Flat marshland at South Walsham, Norfolk

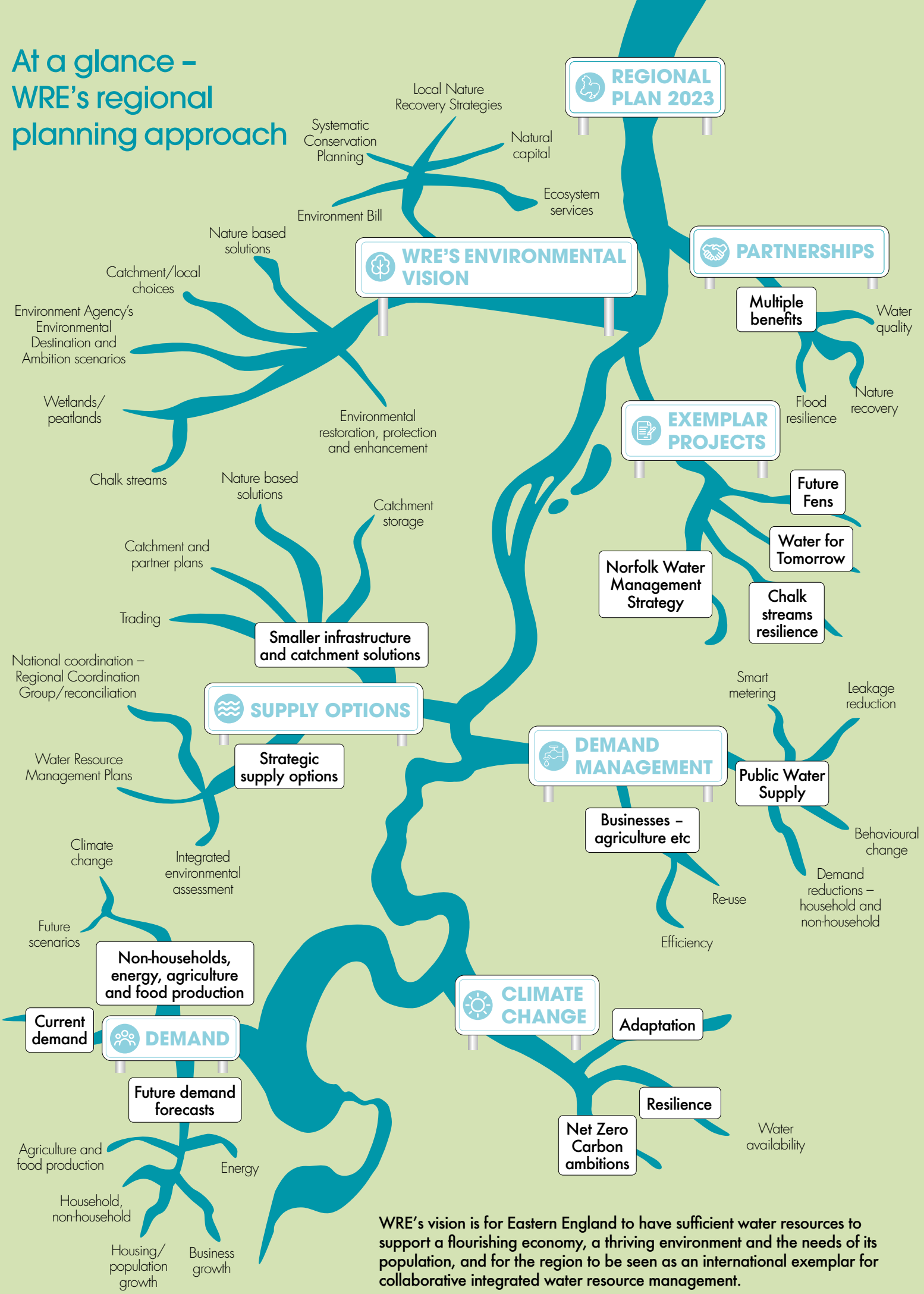
WRE

WATER RESOURCES EAST

The Emerging Water Resources Regional Plan for Eastern England

January 2022

At a glance – WRE's regional planning approach



WRE's vision is for Eastern England to have sufficient water resources to support a flourishing economy, a thriving environment and the needs of its population, and for the region to be seen as an international exemplar for collaborative integrated water resource management.

Hinchingbrooke Country Park, Huntingdon

This plan is one of five regional plans, being developed to meet England's future water needs.

In 2020 the Environment Agency (EA) published the first National Framework for Water Resources to transform how we plan. It requires water companies and other large water users to collaborate across boundaries and, through regional groups, to develop plans that consider their region's water needs, and for those plans to fit together to provide a joined up national solution.

The plans will make our water supplies more resilient to severe droughts, leave more water in the environment and plan ahead for population growth and climate change.

Regional groups are made up of groups of water companies and a wide range of other water users, along with local authorities, environmental groups, regulators and wider interested parties. Together, these groups are working to understand how much water is needed in each region and which combination of options will best secure our future water supplies – and deliver wider economic and environmental benefits.

The options are designed to serve the needs of people, business, power, agriculture and the environment. They include improving water efficiency by reducing leakage from public water supply and helping individuals and organisations to use less water, developing new sources, increasing the opportunity to store more water, identifying ways to move water around to meet the needs of multiple users, and using nature-based solutions to protect, restore and enhance the water environment.

This emerging regional plan, which we are now widely consulting on, will inform the individual statutory water companies' draft Water Resources Management Plans (WRMPs), which they'll be publishing and consulting on later in 2022, together with water management plans for other sectors and organisations. Together, these plans will deliver the investment needed across England and Wales to deliver more sustainable and resilient water supplies for the future.

Jean Spencer

Chair,
The National Framework

River Bure

It is already clear that water resources and water quality should not be taken for granted in general, and in Eastern England in particular.

People, agriculture and other businesses depend upon ready access to clean water. The water environment also provides many recreational and health and wellbeing benefits. However, Eastern England has been designated as a water stressed area and future pressures include climate change, economic and housing development.

It is in this context that Water Resources East (WRE) has been given the important task of developing a resilient and adaptive water resources plan. The plan is not a one-off, it forms part of an ongoing process. It will be be reviewed periodically and modified if required as time progresses, and circumstances change or become clearer.

WRE is further along the path in developing a multi-sector water resource plan, compared with the other regional water groups. We are engaging with a wide range of water users on current and future needs all in the context of protecting and improving the water resource aspects of the natural environment. We are also identifying opportunities to contribute to the wider environmental agenda such as achieving net environment gain, net biodiversity gain and carbon net zero objectives.

The diversity of users, interests and environments in Eastern England means that WRE provides an exciting opportunity to find new approaches including breaking down existing silo-based approaches to find shared solutions.

The water resources plan we are consulting on is at an early stage of development. It provides an outline of the main water resource issues and potential strategic solutions. Work has also been carried out with the other regional water groups to ensure a coherent approach is being taken across England. The comments received via this consultation together with any further development work will then inform a second consultation in autumn 2022. This will be used to shape the WRE Water Resource Plan 2023 and will mark the culmination of this phase of WRE activity.

The current focus is on identifying the no or low regret actions which are sensible to progress now. These will include the initial planning and development aspects of strategic options. It will be many years before they are providing additional water supplies, but work needs to start on them now.

However, the actions will not be taken by WRE. It will be for other sectors to incorporate the issues and solutions identified within their planning processes. The WRE plan and process will provide a context and a means by which interested parties can have more confidence in making their choices.

Along the way there will be difficult choices and trade-offs to address, including challenges with the current policy, regulatory and funding approaches.

WRE will have an important role to play in their identification and resolution.

Please contribute to this consultation. We need your views and ideas as we address this most critical of issues, the current and future water resources of Eastern England.

Dr Paul Leinster CBE

Independent Chair,
Water Resources East

"When the well's dry, we know the worth of water"

Benjamin Franklin, 1746, Poor Richard's Almanac.

How to respond to this informal consultation

Right: A watermill in Flatford, Suffolk

In summary, with reference to the position nationally agreed across other regions and regulators, this January 2022 publication is:

- Signalling early sight of big issues and candidate solutions (including strategic water resource solutions included in the RAPID programme[1]) to get initial feedback from stakeholders.
- Reporting outputs from inter-regional reconciliation and best value selection.
- A public document that regional groups are seeking views on.
- A step in an ongoing process of plan development. The revised plans expected in the autumn will inform whether individual strategic water resource solutions included in the RAPID programme will progress.

This January 2022 report is not:

- A statutory water resource management plan with associated data tables.
- A formal preferred plan.

We welcome your comments on this emerging regional plan. In particular, we would welcome your responses to the questions summarised below.

Question 1:
Have we gained a clear initial view of the problem of future water deficits across all sectors and the environment?

Question 2:
Are we taking the right approach to identify potential solutions to mitigate the challenge?

Question 3:
Does our emerging adaptive plan, including the immediate low-regret options such as reservoirs, look like it will help address the problem?

Question 4:
Are the technical methodologies, processes and decision support tools which we have used robust and appropriate for the task?

Question 5:
Has our emerging regional plan been co-created in a fair, open and transparent process involving the right stakeholders and organisations?

Question 6:
Are there any areas which you feel WRE should be considering which are not currently reflected in our plan? What have we missed?

We would welcome your responses by no later than 28 February 2022.

Please email your responses to contact@wre.org.uk

Alternatively, you can post your responses to Rachel Dyson at the following address:

Water Resources East
The Enterprise Centre Research Park,
University of East Anglia,
University Drive,
Norwich,
NR4 7TJ.

[1] *RAPID has been introduced as part of the National Framework to develop Strategic Resource Options (SROs). RAPID is an alliance of Ofwat, the Drinking Water Inspectorate (DWI) and the EA and aims to accelerate the development of new water infrastructure to ensure restrictions are avoided in the near future.*

CONTENTS

EXECUTIVE SUMMARY


The Broads

The whole of Eastern England is now classified as 'seriously water stressed'. It is short of water now and if nothing changes that shortage will get worse. There is not enough water to go round now reliably nor to meet new demand for homes, for food or for energy or be resilient to the impact of climate change as it bites further and society adapts to it. **Together with the now well recognised climate and biodiversity crisis, there is also a water crisis today.**

Water Resources East (WRE) is tackling this challenge head on. We aim to produce a long-term water resource plan for the region covering public water supply, environmental protection and restoration, for agriculture and energy and for other sectors reliant on water.

WRE operates as a not-for-profit, independent, membership organisation. Currently, more than 200 organisations from the across the region and beyond are members or advisory stakeholders of WRE and many have been actively engaged in co-creating the Regional Plan, sending a clear message that water is not an issue which can, or should be, solved by one group of water users alone. **Water is a regional challenge, and one which will only be met through strong and enduring regional collaboration.** It is not going to be easy to solve, so all water-dependent sectors and all of us as citizens need to come together in a way in that we never have before.

We are predicting that by 2050, the region could require around double the amount of water currently used. This arises from the need to restore, protect and enhance the environment at the same time as increasing demands for public water supply and for the agri-food and the energy sectors, alongside an increasing allocation to the natural environment, and mitigating or adapting to the effects of climate change.

While future water demand drivers from population and housing growth are significant, these could be largely offset through demand management measures such as leakage reduction and a focus on household and non-household water efficiency, enabled by an increase in measures such as smart metering. However, water demand management alone is not going to provide sufficient water to enable the region's environmental vision to be realised while also aiming to support water-dependent economic activity.

Significant new infrastructure will be required, and our planning includes processes for identifying an appropriate mix of new strategic water supply options to develop such as reservoirs, transfers, desalination plants and water reuse.

Our plan also includes processes for identifying more local catchment-based options, seeking to reduce flood risk, improving water quality, increasing carbon capture and providing more resilient water sources within catchments, with an increasing focus on a contribution from the use of nature-based solutions at scale.

This emerging regional plan is the culmination of seven years' work by WRE members from initial thought leadership events to the development of tools and creation of new data and scientific research to better inform and enable future long-term water planning. We have engaged and listened to members concerns, thoughts and suggestions through our initial co-creation events. We now have a better understanding of the issues and concerns affecting our cross-sector membership on which to base the foundations of our water resource planning which we will continue to build on to the draft plan stage in autumn 2022 and final plan in 2023.

We would like to express our sincere thanks to everyone who has enabled us to reach this very important moment. This emerging regional plan marks a notable stage in the National Framework process. With just under two years to go before we publish our 'final' Regional Plan, this is a good time to pause and reflect with you all, and to invite you to read through and provide feedback on the emerging draft of the first-ever Regional Plan for integrated water resource management for Eastern England.

1. WHAT IS A REGIONAL PLAN?

Bedford River

1.1 What is the purpose of the Regional Plan?

The aim of our Regional Plan is to ensure sustainable and resilient water resources to 2050 and beyond. Current predictions estimate that by 2050 there will be a water deficit in Eastern England of between 703 million litres a day (or megalitres – Ml/d) and 2,267 Ml/d. Based on the current regional rate of water consumption (2,311 Ml/d in 2020/21), these predictions range from 30% to 98% higher than the region's current water use. This is because of population growth, climate change and the need to restore, protect and enhance the natural environment.

The regional planning process is inter-generational and iterative, with the first 'final' version being published in 2023. It is expected that the plan will then be updated and modified as required periodically to 2050 and beyond, as is the case with water company Water Resources Management Plans (WRMPs) and River Basin Management Plans (RBMPs).

The WRE regional planning process is also, most importantly, a co-creation process with our 200+ members and stakeholders. This form of highly collaborative regional, multi-sector water resource planning has never been undertaken before in England, and the overall aim is to create a best value plan, based on economic, social, and environmental costs and benefits, involving as many people and organisations as possible who have a stake in the future of water and of the region. Our truly collaborative approach to developing our plan will facilitate efficient and effective integrated water resources management.

The focus of our regional plan is on the following key components:

1) **Recovery, enhancement and protection** of the natural water environment through an overarching water resources related environment vision for the region, based on catchment defined bespoke environmental destination scenarios.

2) **Demand management –** reducing leakage and individual water use (known as per capita consumption, or PCC, and measured in litres per person per day, or l/p/d), with multi-sector water efficiency measures. Ultimately reducing the overall amount of water needed to be sourced from the environment and put into distribution or used in homes and businesses.

3) **Large infrastructure options delivering more than 10 Ml/d** that have a regional or national significance (for example, reservoirs, transfers, desalination, water re-use).

4) **'Local' non-water company and smaller (less than 10 Ml/d) water company infrastructure projects** and schemes that require the specialist, local knowledge of WRE members.

5) Identifying, supporting, facilitating and encouraging **water innovations and exemplars in Eastern England** which highlight the 'art of the possible'.

Our regional plan will contribute to the strategic context for the region, and will help existing and future PWS and non-PWS water users to better understand issues relating to future water security. This will allow investment decisions on market-facing water dependent activity and associated long-life assets to be made with improved confidence in the next few years.

River Welland, Lincolnshire

1.2 An iterative process

Central to our planning is the challenge of assessing uncertain future water resource needs and, when water resource is scarce, its allocation between potential users. Using existing and new strategic supply options can help manage some of this uncertainty through increased water storage, water transfers and/or the development of new resource options. Water efficiency, demand management and leakage reduction, and improved mechanisms for sharing available resources can help to better manage scarcity when it occurs. All these possibilities can occur at national, regional and local levels, and each come with costs, benefits and wider consequences that need to be taken into account.

We presented our new large supply options at our recent Regional Planning Conferences in October 2021, and throughout the regional planning process our members have been able to express views on which large infrastructure options will go forward into the draft and final Regional Plan. These options are discussed in more detail in Section 7. In addition, initial Local Focus Catchment Workshops were run during October and November to start to identify (amongst other things) what the smaller local water supply and demand option opportunities there may be. These workshops will continue during 2022.

Our regional plan will reflect best available data and information at the time of each publication. Developing the Regional Plan will require many discussions around trade-offs and compromises and will be an iterative and adaptive process. We discuss these trade-offs in more detail in Chapter 7 of this document.

A best value, multi-sector plan

In Autumn 2023, we will publish a single, multi-sector, best value adaptive regional water resources plan for Eastern England.

As well as setting out a broad vision for water resources related environment aspects over the period to 2050 and beyond, this will describe how water supply systems and potentially water resource allocations to restore, protect and enhance the environment, for water companies, the energy sector, agri-food sector and others, will need to change to meet growth in demand and become more resilient to the effects of drought and climate change.

Given that the Regional Plan will inform the development of individual water company WRMPs for the current planning cycle, there is an intrinsic need for alignment across a number of varying plans (see Figure 1.1) to drive shared objectives at a strategic level, while meeting the numerous legal requirements and policy expectations already required of water companies. A core objective of WRMPs to date has been to deliver service while keeping cost and impact on customer bills as low as possible, as promoted through the economics of balancing supply and demand (EBSD) method[2] for a plan that is optimised based on least cost.

[2] *The Economics of Balancing Supply and Demand (EBSD) Guidelines. UKWIR, 2002. Document ref. 02/WR/27/4.*

Figure 1.1: Diagram showing multiple inter-related plan complexities (dates subject to change)

Notable relevant other law/strategy/policy

- UK GHG Net Zero 2050
- Food Security and Affordability
- Marine Spatial Plans, Marine Environmental Protection
- Freshwater Aquatic Environment Legislation

Other relevant strategies/plans

- National Infrastructure Commission National infrastructure assessment 2023
- Water Industry National Environment Programme (WINEP) obligations
- Water company PR24 business plan submissions
- RAPID gated process for strategic resource options

River Deben, Waldringfield, Suffolk

Water companies have traditionally adopted the least cost approach to benchmark supply and demand options. However, it is widely recognised that WRMPs could deliver additional value and that this should be considered alongside cost. This could result in a plan being developed that is not necessarily the cheapest, but is one which delivers wider benefits to customers, society and the environment – otherwise known as a 'best value' plan. There is more detailed industry guidance available for this planning cycle, promoting the best value planning of water resources[3].

Generally, the assessments underpinning WRMPs to date have been restricted in scope to the interests of water bill payers in relation to provision of PWS service and environmental impact. A requirement of and opportunity for regional water resource planning is to widen the scope of the assessments to include non-PWS interests. Therefore, establishing an appropriate framework leading to a best value regional plan distinct from a best value water company plan is an important part of our process. It is also a major challenge in itself. Sectors such as agri-food and power/energy comprise many individuals or companies competing with each other. Water users and licence holders in sectors other than PWS do not have formal plans at a sector level, neither statutory nor otherwise, and their representative bodies such as trade associations are not empowered to make sector-level agreements that are binding on their members. Where a sector participates in competitive markets, the law prevents some forms of collaboration.

WRE is working with representatives from these sectors through focused working groups so that these very different needs can be factored into the regional plan. We will also seek to explore any gaps in funding to ensure the deliverability of the multi-sector aspects outlined in our plan.

Member voices...

In our Regional Planning Conferences the most used words to describe what Regional Planning is trying to achieve were **ambitious**, **challenging**, and **impossible**. Water resources planning has never been undertaken before on this scale or as a co-creation process so at this stage, these words are not a surprise. **Essential**, **urgent**, **crucial**, **vital**, **logical**, and **useful** were also commonly used by our members and stakeholders, giving clues as to how timely and time sensitive Regional Planning is.

"Our interests are being recognised by WRE and others, but we need greater specificity about exactly what will be done when and how. More action is needed earlier to reconfigure abstraction. People are saying the right things - but this needs to be translated into meaningful action."

"There is recognition that making water available for abstraction to be used to produce food is necessary however there seems little currently in the regional planning proposals that contributes to this. The minimum daily contribution is not reflecting that the agri-food does not have the financial capacity to involve itself in such large schemes."

Extracts of stakeholder feedback received through the planning conferences and local focus catchment workshops held with our members are provided in Appendix A. We are further analysing the feedback and will produce a detailed account of member and stakeholder feedback using this information and the consultation responses to this emerging regional plan.

[3] *Deriving a best value water resources management plan. UKWIR, 2020. Document ref. 20/WR/02/14.*

1.3 Alignment with other plans

The emerging regional plan will take its place among other plans, policies and guidelines that together will provide the backdrop which decision-makers will consider in exercising their powers and delivering their legal responsibilities in relation to water resource matters. The National Framework for Water Resources and the Water Resource Planning Guidelines 2021 deal with how WRE's plan is to align with certain other plans. In particular, WRE planning:

- **MUST**
  - Be reflected in water company WRMPs.
  - Be compatible with the other regions' water resources plans in respect of inter-regional and national considerations.
  - Be informed by the objectives set out in RBMPs, with the expectation that work in WRE on long term environmental destination will inform subsequent RBMP planning rounds.
- **SHOULD**
  - Join up with Drainage and Wastewater Management Plans (DWMPs) (which are now a statutory requirement for water and sewerage companies under the Environment Act 2021).
  - Set out how the region will respond to drought, implying a relationship with other parties' drought plans.

The degree of alignment or compatibility with other plans and policies which can be expected in this WRE planning round will vary since other plans and policies have their own cycles. In some cases, alignment may only be achieved in the longer term as other activities take the emerging regional plan into account, as illustrated in Figure 1.2. The EA's water resources planning guidelines makes it clear that WRE's planning need not be constrained by 'previous decisions' (although the context for those decisions must be understood). It is therefore not to be expected that WRE planning fully aligns with relevant elements of previous related planning.

The guidelines also require WRE to agree certain aspects of the Regional Plan with regulators – in particular, the 'long-term environmental destination' (see Chapter 5 for the definition). This agreement process will ensure some consistency between WRE member water companies WRMPs which are currently in development for 2024. Water companies would then require 'clear justification' for any departures from the Regional Plan in their individual WRMPs. The second round of RBMPs is currently in force. The third round of plans has concluded its first two statutory consultation phases ('Working Together' and 'Challenges and Choices'), and the consultation on the draft RBMPs is open until 22 April 2022. The third round of RBMPs are expected to be published in December 2022 and will contain statutory status targets with timescales for all water bodies.

In establishing these targets, the EA will take into account technical feasibility, as well as the balance and distribution of costs and benefits that would result from the programme of measures required to meet those targets. This is clearly relevant to some aspects of WRE planning – particularly when considering the environmental destination within regional planning. For example, pending the consultation ending in April 2022, we will need to take account of no-deterioration guidance and its implications for further accelerated abstraction reductions in some water bodies. We are likely to need further review of our environmental destination and ambition scenarios and re-run the analyses accordingly to explore what this means for the selection of supply options and their timings. We will also need to take account of future risks to the delivery of RBMP objectives such as climate change and growth scenarios in both our regional modelling and catchment level work

At a regional, strategic resource option and catchment level, we will need to identify schemes that contribute to measures that help natural assets cope with or recover from damaging impacts, such as those from climate change or other damaging impacts.We note that extensive work has already been undertaken by catchment partnerships in the region through implementation of their catchment plans, which is a valuable knowledge base to draw on throughout our catchment scale planning activities.

This will be an iterative process as we move into more catchment work in 2022 for the draft WRE draft regional plan, and likely updates post-consultation where further work is still underway through 2022 and beyond to refine water body objectives and programmes of measures. A theme which has clearly emerged in our interactions with our members and stakeholders at strategic and local levels has been the scope to regard 'excess water', such as storm water that is pumped by internal drainage board assets out to sea to prevent land and communities from flooding, as an opportunity rather than a risk to be managed. It is therefore important to note that the next round of draft Flood Risk Management Plans (FRMPs) are open for consultation until 22 January 2022.

In the following sections, we set out some detail on the 'alignment' of WRE planning with water company WRMPs and the regional reconciliation for achieving alignment between the other four regional plans.

Every six years, the EA publishes its catchment-scale abstraction licensing strategies. These set out water resource availability for licensing, including reliability (for example, hands off flows and hands off levels), the approach to restoring sustainable abstraction (RSA) and opportunities for trading. Different catchments within WRE are at different phases within their six-year review cycle. Over time, we anticipate some alignment of the water company WRMPs with the EA's abstraction licensing strategies.

Water Resources Management Plans (WRMPs)

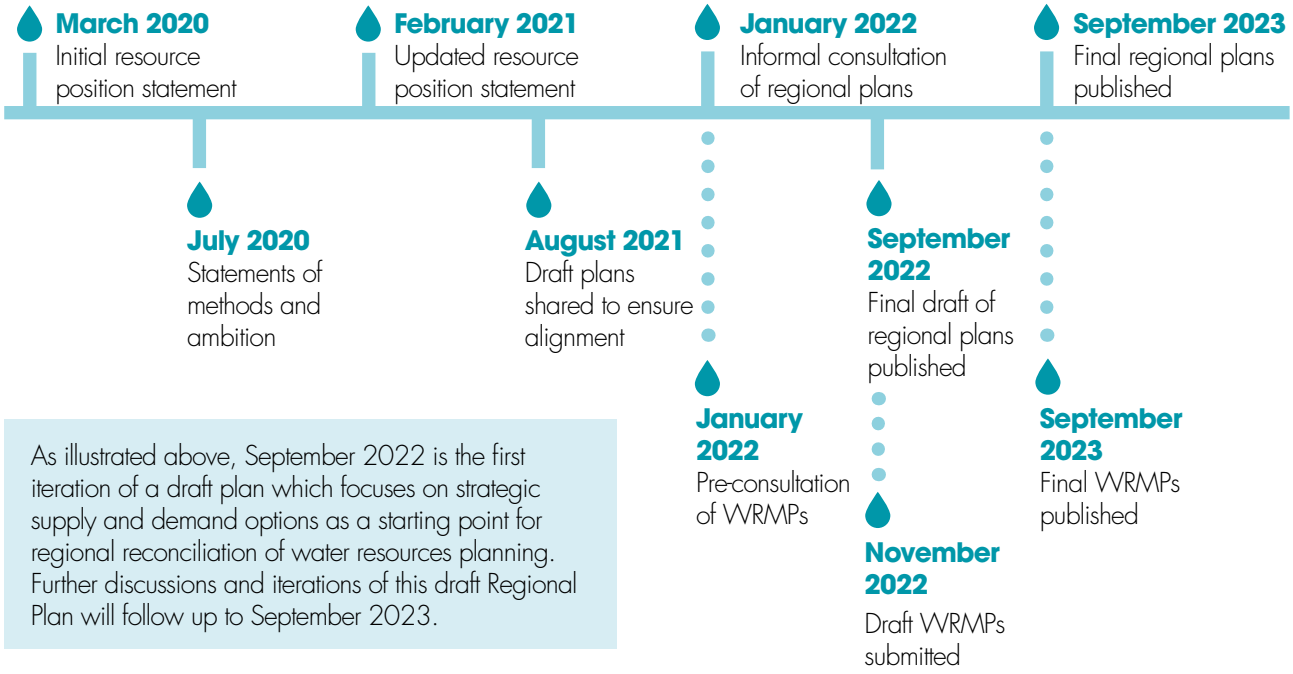
Alignment between the Regional Plan and water company WRMPs is critical to our success. This is because changes to PWS arrangements, including physical assets, leakage and demand management, will be required to be delivered through the statutory WRMPs rather than the Regional Plan. To manage the related risks and issues, WRE water companies have formed an Alignment Task & Finish Group (T&FG). Supported by the WRE Technical Directors and senior water resource planners from each water company, this group determines how outputs from the regional planning process will be taken up and used in their WRMPs, as well as the related business plans produced as part of Ofwat's next periodic review of price controls in 2024 (known as PR24). Alignment T&FG workstreams include:

- Preparing the draft WRMP water resource planning tables.
- Consistency of supply and demand forecasting data and assumptions.
- Iterative water supply/demand options development.
- Collective approaches to the following:
  - Demand management, and the reductions in leakage and PCC.
  - Environmental destination and ambition.
  - Drought resilience.
  - Maximising the efficient use of the available resources through the development and testing of appropriate supply-side options.

The overall purpose of the Alignment T&FG is to ensure that WRMPs form a coherent group of plans that support our wider planning objectives. To achieve this objective, the Alignment T&FG works closely with the Planning T&FG. The Planning T&FG comprises a small group of WRE members whose focus is on providing input into the wider engagement programme. Both groups report through to a newly re-purposed Technical Delivery Group (TDG). See Figure 6.1 in Chapter 6.

As illustrated in Figure 1.2 below, we developed the first iteration of the emerging regional plan in August 2021. This iteration focused on strategic supply and demand options as a starting point for regional reconciliation between the five regional groups for water resource planning. Further discussions with the other regional groups and stakeholders will continue through to September 2023, with incremental refinements through iterations of the draft Regional Plan.

Figure 1.2: Timeline of Regional Plan and WRMP24 alignment (dates subject to change)



As illustrated above, September 2022 is the first iteration of a draft plan which focuses on strategic supply and demand options as a starting point for regional reconciliation of water resources planning. Further discussions and iterations of this draft Regional Plan will follow up to September 2023.

River Wensum, Norwich

Other Regional Plans

A key element of the regional planning process is the flexibility of each region to develop a plan that best meets its own individual needs. At the same time, the Regional Plans, once aggregated, need to form a coherent national plan that, when required, is capable of meeting national needs as outlined in the National Framework.

Through the Regional Co-ordination Group (RCG), we have been working with the EA, Ofwat, the Regulators' Alliance for Progressing Infrastructure Development (RAPID), and the other regional planning groups to ensure the Regional Plans meet these criteria. Several projects have been completed in support of this process including, most recently, an evaluation of the criteria in the National Framework to determine which are critical to inter-regional alignment.

This showed that inter-regional transfers ('Look beyond regional boundaries'), environmental destination and ambition ('Deliver enhanced environmental outcomes') and co-ordinated sign-off of Regional Plans and WRMPs are all likely to be critical to alignment success as outlined in the asks of the National Framework. Success was defined in terms of:

- Keeping the alignment process as simple as possible and focused on the key inter-regional decision-making issues.
- Showing that the strategic schemes being selected through each region's best value planning process form part of a coherent and evidence-based national picture of cross-boundary solutions to future challenges.

The findings from the alignment project work have been tested by the regional planning groups through the national RCG. The results of this activity have been evaluated and used to guide the regional reconciliation process, to ensure that we have a nationally coherent set of plans.

The regional reconciliation process

The regional planning groups convened in September 2021 to start the process of narrowing down the key solutions being considered to gain a better understanding of the risks, issues, and choices of the different inter-regional solutions. This involved an iterative process of alignment where each region discussed its supply/demand balance, level of environmental ambition, and options that could aid each other. The primary stage of regional discussions was around the need for inter-regional water transfers and the infrastructure schemes that would be needed to support them.

A summary of the regional reconciliation process and its findings can be found in this **Method Statement**.

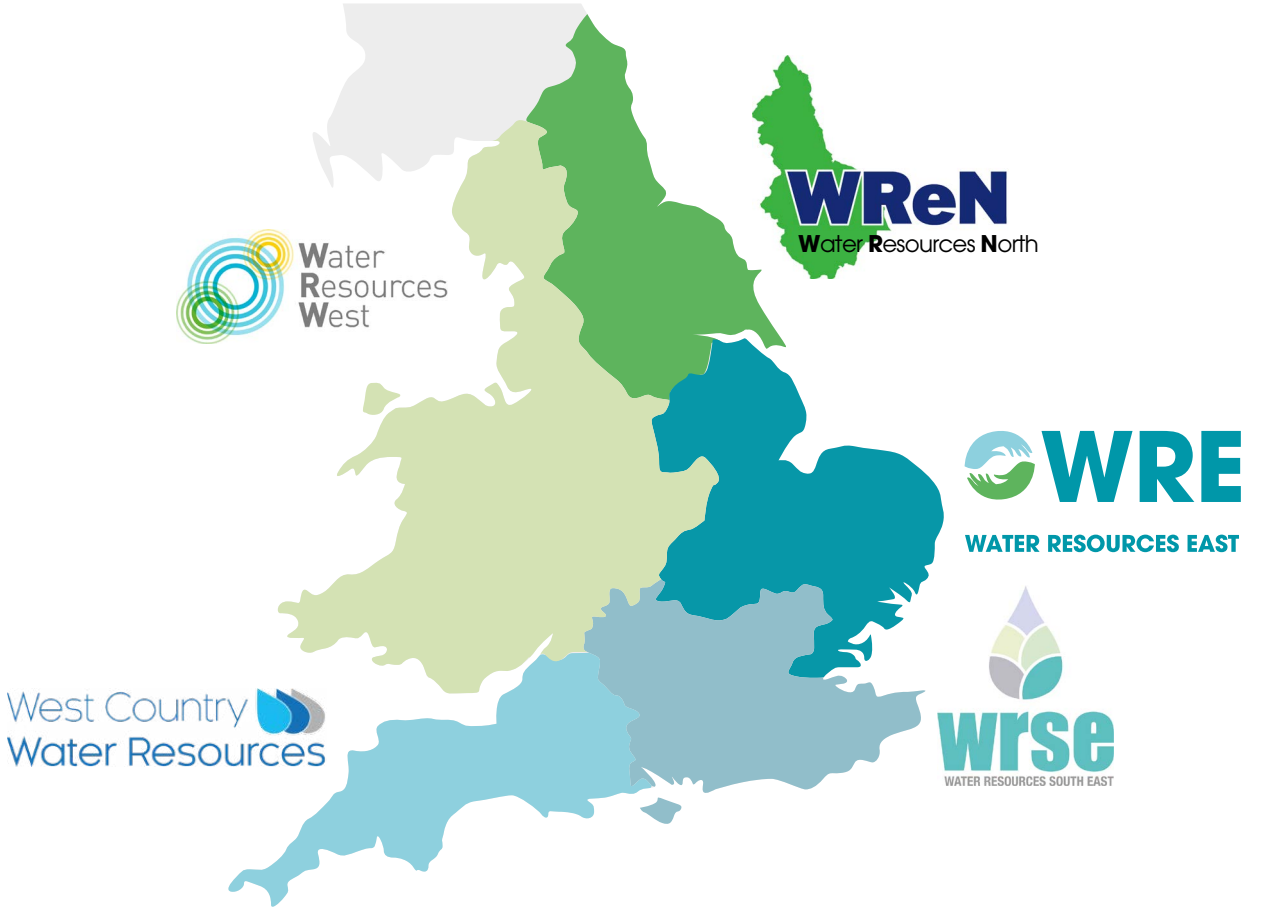
1.4 What is a regional planning group?

A regional approach to integrated water management is required because of the number of immediate and future water security challenges that each region faces, and Eastern England is no exception. You can read more about the current water resources challenges in the region now and in the future in our **Water Resource Position Statement 2021**. Water Resources East (WRE) is one of five distinct regional planning groups in England tasked with regional water resources planning, as illustrated in Figure 1.3. In 2020, the EA formalised the roles of these regional planning groups to deliver the **National Framework for Water Resources**.

This outlines a multi-sector, collaborative, and regional based approach to water resource management that sits alongside the Environment Agency's river basin management. In developing this plan, we have followed the Environment Agency's framework and guidance, as well as taking account of the UK Government's long-term vision and ambitions for the environment. Throughout this process, the Environment Agency has acted as an expert participant and is required to 'agree' certain aspects of the final plan.

Since WRE's formation as an independent, cross-sector, not-for-profit, membership entity in 2019, we have been working with members and stakeholders to co-create our first Regional Plan. Between now and 2023 we will develop, consult on and publish our plan.

Figure 1.3: Regional groups



Key messages...

There has been a step-change in water resource planning requirements over the past few years. This is to build an integrated picture of cross-boundary, multi-sector needs for water resources through regional planning and improve the wider resilience of water systems. The National Framework and abstraction licensing policies present very real challenges across all sectors, not just public water supply, and everyone has a part to play in ensuring they are met.

The Regional Planning process and National Framework exists in a complex landscape of other plans, legislation and strategies. Creating co-ordination or alignment with those most applicable is another challenge.

2. POLICY AND NATIONAL FRAMEWORK

The Regional Plan must meet the requirements of the National Framework (including its clear multi-sector expectations), support RAPID's approach for strategic resource option development, work with the other regional planning groups through the regional reconciliation process and inform water companies' WRMPs. It should also be guided by the EA's Water Resource Planning Guidelines, in so far as they apply to regional planning.

WRE also acknowledges the 10 asks of regional plans in the Blueprint for Water and the Chalk Stream Restoration Strategy, and are reviewing how we can contribute to their ambitions. Our future work programme will build further understanding of the implications of the EA's enhanced environmental destination scenario on the region's chalk streams. Further discussion on the environmental destination scenarios is provided in Chapter 5.

2.1 The National Framework for Water Resources

The National Framework established regional planning groups with the aim of developing Regional Plans that must, should and could meet a number of requirements, as illustrated in Table 2.1.

River Cam, Cambridge

Table 2.1: National Framework Regional Plan requirements

Action type	Action/Plan requirement	How WRE is addressing this	Reference
Must	Take account of the national framework and set out its contribution to the national need	**Water efficiency and reducing leakage** All the participating water companies support the National Framework which has set ambitious targets for both leakage (a 50% reduction by 2050) and 110l/h/d for PCC. Consideration is still being given as to how these targets should be implemented at a national, regional and individual company level, given the differing starting and end positions of water companies with respect to these metrics and the implications for costs and benefits. WRE recognises that significantly reducing PCC and mitigating demand growth, will need to be a collaborative effort, supported by consumers, water companies and the government over the long term. We hope to engage further with non-household users and water retailers as the plan iterates through to 2023 and beyond to exchange information, improve monitoring and planning for non-household demand. Collaboration between WRE's member water companies has increased, and through our Alignment Task & Finish Group we hope to become increasingly coordinated. Our planning assumptions do not involve a more frequent use of Temporary Use Bans (TUBs) and Non-essential use bans (NEUBs). Levels of service are assumed to remain the same.	Chapter 5, 7 & Appendix B
		Increasing supplies and transferring water We support the view presented in the National Framework that supply and transfer infrastructure is required even with the most ambitious demand savings. Our options identification and development process ensured that a diverse portfolio of supply options is being explored. Based on our understanding of how long each supply option would take to implement, we are carrying out modelling to inform the scheduling of options to address emerging deficits over time, focusing initially on "low-regret" options that should be developed early in the planning period. At the core of the emerging plan are a number of strategic options that are being promoted through Ofwat's gated process. WRE is working to ensure that these schemes are designed with multi-sector beneficiaries in mind. Providing a level of drought resilience so that emergency drought restrictions on mains supplies are expected to be implemented no more than once in 500 years on average are built into our planning assumptions from 2039. WRE's member water companies are committed to working with the EA to ensure that there is no increased use of drought measures where they might be environmentally damaging. We have begun exploring challenges and solutions at a more local level and we will build on this through 2022 to support the catchment-based approach in developing cross-sector options that provide benefits to society and the environment. Between August and December 2021, WRE joined the four other regional groups in a regional reconciliation of emerging plans. This has allowed us to stress test the plans and explore the strengths and limitations of new and existing inter-regional transfers, in particular with WRSE.	Chapter 6, 7 & 8

Action type	Action/Plan requirement	How WRE is addressing this	Reference
Must	Be reflected in WRMPs	WRE's approaches and close working with member water companies (especially through the Alignment Task & Finish Group) ensure that the regional plan will feed directly into water company WRMPs and that option development and refinement through the WRMP process feeds back up into the regional plan.	Chapter 6 & Appendix B
	Forecast supply and demand over at least 25 years and set out solutions to any deficits	The emerging regional plan is focused on the period 2025-2050. WRE's forecasts (which have been updated here since the initial and revised Resource Position Statements) include the impacts of climate change, enhanced demand management, enhanced environmental improvements, future housing and economic growth and growth ambitions of other sectors.	Chapter 5, Appendix B & C
	Be a single plan with one preferred adaptive solution and set of options	Our emerging plan is based on the principle of deriving an adaptive programme of investments and initiatives, including alternative options and timings if needed. This deals with both supply and demand uncertainty affected by climate change, population growth and the need for environmental adaptation and enhancement. At the core of what we present in this emerging plan is a focus on solutions that are robust to a range of future scenarios and that can be delivered to ensure flexibility to adapt to change. As the plan develops, we will refine our understanding of key decision points in our adaptive pathways to inform choices between different pathways as time progresses.	Chapter 6 & 7
	Take a multi-sector approach – Include the water needs of other sectors	WRE's organisational model has put us in an excellent position to be able to engage widely across sectors throughout the development of our emerging plan and continues to help us shape our approaches as we begin to explore cross-sector opportunities in more detail at a variety of scales. We recognise the importance of ensuring water is used efficiently across all water-using sectors, including those who independently abstract for their business needs, ahead of investment in further supply schemes. We will continue to work with the sectors represented across our membership to identify appropriate actions or policies that will demonstrate a commitment to reduced demand where possible.	Chapter 3, 5 & 8
	Look beyond regional boundaries and use technical approaches and scenarios compatible with other regions	WRE has been actively involved in the Regional Coordination Group, in particular through the regional reconciliation process as well as coordinating across regional boundaries on the developing SRO schemes. We have also worked closely with WRSE on growth scenarios associated with housing developments in Oxford to Cambridge.	Chapter 6 & 7

Action type	Action/Plan requirement	How WRE is addressing this	Reference
Must	Consider enhanced environmental improvements and demand management	We have explored the implications of the full range of EA environmental destination scenarios and estimated their impact on abstraction licences. Our approach to modelling and portfolio search means that whichever scenario is chosen, it is hard-wired into the overall plan providing a basis from which further demand management and supply options are considered. Our core planning assumption informing this emerging plan has been the EA's BAU+ scenario, but we continue to work on this and will review at a more local level to ensure that sustainable levels of abstraction are achieved where relevant to freshwater and wetland habitats, particularly chalk rivers and other sites identified as priority habitats for restoration. It is also important to note that abstraction reductions will be needed across sectors. There is more work to be done to refine our collective understanding of this. In addition WRE has taken a step further in our Strategic Conservation Planning (SCP) exercise. We plan to draw on the outputs of the SCP to inform our approach to the planning of sustainable water resources solutions, particularly as we begin to work in smaller geographies through 2022. At the scheme level, our Integrated Environmental Assessment approach has allowed us to track positive and negative environmental effects of options, along with biodiversity units requiring replacement as metrics within our portfolio optimisation. Work will continue on this through to 2023 as the plan develops as part of the creation of a best value plan. We intend for the regional plan to build on the water industry Routemap 2030 towards Net Zero. Capital and operating carbon of supply options has been estimated to inform decision making. At this point, for the emerging plan (January 2022), this is not yet integrated into the simulator, but our work on this will continue in order to influence our selection of portfolios of options that minimise and reduce total carbon emissions. Building on our work on the SCP and by working partners at a sub-regional scale on integrated water management and land management solutions we also hope to identify and promote actions that complement the strategic supply and demand side option portfolio and further a cross-sector movements towards lower total carbon futures (e.g. working with the Lowland Agricultural Peat Taskforce).	Chapter 6 & 8
	Take a catchment based approach	In line with the expectations of the National Framework WRE has been actively working with stakeholders and catchment groups and other partners to build resilience in catchments and enhance our natural capital. Strategic water storage systems feature as an important part of our set of "low-regret" options to be promoted via Ofwat's gated process, but we will also explore options for storage at different scales. WRE has also co-funded a study exploring the financing options for multi-beneficiary reservoir systems. Our work on the Norfolk Water Strategy Programme is examining the benefits of and possible funding mechanisms for the implementation of Nature Based Solutions at scale with a view that approaches developed in Norfolk can be rolled out across other geographies.	Chapter 6 & 8

Action type	Action/Plan requirement	How WRE is addressing this	Reference
Must	Consider resilience benefits, including reducing flood risk, when developing options	WRE's work with our member water companies promoting the SROs seeks to ensure that they are designed in the context of the wider system and that they very much provide benefits beyond public water supply. At the scheme level, our Integrated Environmental Assessment approach has allowed us to track positive and negative environmental effects of options, including flood risk and water following statutory environmental assessment methods. Work will continue on this through to 2023 as the plan develops as part of the creation of a best value plan. As our work in smaller geographies (be that county, catchment or sub-catchment) develops in 2022, we hope to explore opportunities to align actions aimed at delivering against various water security challenges including flood risk, water quality and water supply.	Chapter 6 & 8
	Be open to market mechanisms	We have been open through direct engagement and through our options screening process to third party solutions in support of strategic supply options, and we will continue to work with those promoting such schemes. WRE is a partner in research on financing mechanisms to multi-beneficiary schemes. WRE also recognises that actions identified and supported by the regional plan and future iterations may need to be owned and delivered by other parties subject to their own funding approaches.	Chapter 7 & 8
	Take into account growth ambition	Our forecasts out to 2050 include a range of plausible scenarios for population and economic growth in the region. Our forecasts for growth in other water using sectors include those for agriculture and energy and we plan to update these forecasts to improve our view of the future through 2022 and 2023.	Chapter 5 & Appendix B
	Comply with Strategic Environmental Assessment and Habitats Regulation Assessment legislation.	WRE is undertaking an Integrated Environmental Assessment (IEA) of regional supply options, which complies with this legislation.	Chapter 6

Action type	Action/Plan requirement	How WRE is addressing this	Reference
Should	Engage widely with interested groups	Through WRE's Strategic Advisory Group (SAG) and other mechanisms – for example, website, podcasts, partner-led citizen workshops (to be held in 2022), regional planning conferences and local focus catchment workshops, Technical Delivery Group and sub-groups, water company customer engagement groups and through public consultation of the plan.	Chapter 4 & Appendix A
	Set out how the region will respond to drought and agree common scenarios for drought actions	Enhancing this approach will be an area for further consideration by WRE in the next round of regional planning.	Not applicable
	Join up with water companies' Drainage Wastewater Management Plans (DWMPs)	This is a longer-term ambition and is being explored by water companies (for example, Anglian Water's Future Fens Resources Strategy) and in particular locations, and we support the goal presented in the National Framework for a consideration of building a case for broadening the scope of regional plans beyond water resources to ensure systems and networks are robust and resilient to future pressures.	Chapter 8
	Seek to improve resilience to events other than drought, particularly floods	WRE is actively seeking to build in flood resilience solutions to reservoir system design as part of the strategic resource options and in the work of our Norfolk Water Management Strategy and Future Fens exemplar projects.	Chapter 8
	Look ahead 50 years or more	Our draft and final regional plan will consider the 25 and 50 year planning horizon.	Not applicable
Could	Contain all the detailed information required for WRMPs	WRE member water companies do not believe this is the best approach at present. There would be a number of issues to resolve, such as the approach to companies with Water Resource Zones (WRZs) that fall outside of the regional boundaries and the alignment of metering policy. Instead, companies are aiming to achieve vertical alignment with the WRE strategic plan, as well as horizontal alignment between WRMPs as far as possible; this process is managed in the WRE Alignment Task & Finish Group.	Not applicable
	Contain all the detailed information required for Drought Plans	WRE member water companies do not believe this is the best approach at present. There would be a number of issues to resolve, such as the approach to companies with extra-regional WRZs and the alignment of levels of service across companies. More fundamentally, the new regulatory expectation that drought plans are tactical, operational manuals, means that they are more appropriately managed at company level. However, WRE companies have worked alongside WRSE companies in addressing common issues and aligning approaches where appropriate.	Not applicable

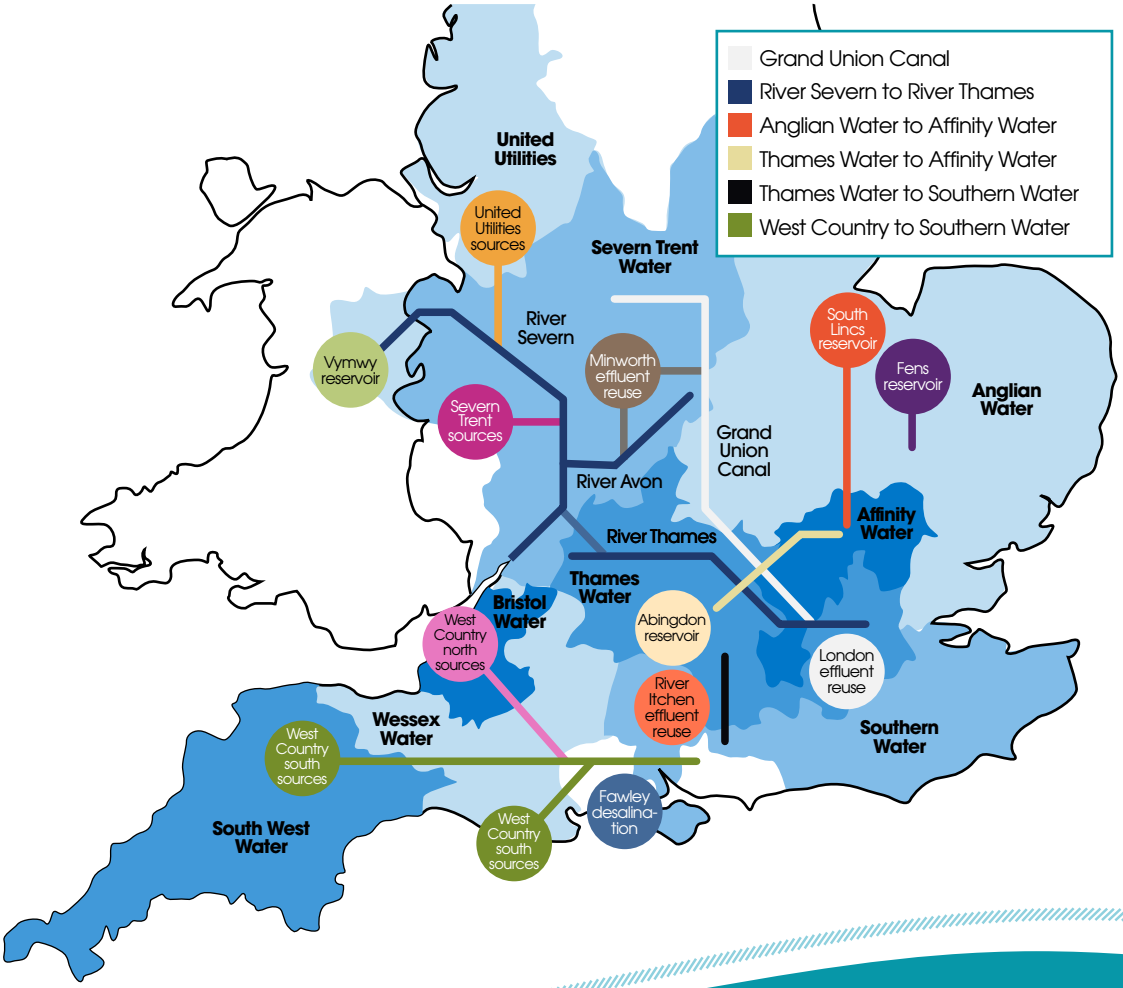
Regulators' Alliance for Progressing Infrastructure Development (RAPID)

RAPID has been introduced as part of the National Framework to develop Strategic Resource Options (SROs). RAPID is an alliance of Ofwat, the Drinking Water Inspectorate (DWI) and the EA and aims to accelerate the development of new water infrastructure to ensure restrictions are avoided in the near future. This process is administered through a 'gated' process where certain criteria must be met by defined dates. The Gate 2 milestone requires a detailed feasibility of the SRO solutions to be progressed providing a suitably progressed concept design and accompanying assessments of environmental impact, carbon and scheme cost by 31 October 2022.

Several schemes are currently working towards the Gate 2 milestone, with Affinity Water and Anglian Water jointly developing the South Lincolnshire Reservoir and the Anglian to Affinity Water transfer. Anglian Water and Cambridge Water are progressing the Fens Reservoir as a third SRO in the WRE region. With RAPID's guidance, it is expected that these large regional options will be 'shovel ready' sooner if they are selected as suitable options through regional reconciliation and through RAPID's gateways. It is expected that these solutions will feature in our final Regional Plan in September 2023.

Above: Abotts Ripton Lake
Left: Hanningfield Reservoir Nature Discovery Centre, Billericay, Essex

Figure 2.1: Current RAPID Strategic Resource Options (SRO) schemes



2.2 Water Resources Planning Guidelines

In July 2019, the National Framework Senior Steering Group recommended changing the drought resilience criteria from a 1 in 200-year event to a 1 in 500-year event. This reflects the desire to reduce the risk of severe restrictions, underpinned by the economic costs and benefits of drought and flood risk (as recommended in the National Infrastructure Committee's 2018 assessment report). As a result, it expands the scope of resilience measures needed from water companies, regional groups, regulators and wider water management organisations.

Having identified the main pressures on public water supplies in Eastern England, the National Framework explores how much of the need could be met by reducing demand for water in the first instance and matching this with how much additional water is likely to be needed from new infrastructure, such as reservoirs, desalination plants and water transfers.

The Steering Group's analysis, as well as being based on achieving the higher level of drought resilience, also focuses on achieving greater environmental protection than is currently included in water companies' plans. The aim of the Group's work is to set the context of a water resources picture for each regional group rather than to identify the optimum mix of solutions that could address each region's challenges.

Since 2019 we have been exploring the options available to us in more detail and developing a deeper understanding of the specific needs of all water-using sectors across the region.

Looking at demand reduction, the National Framework recognises that there is uncertainty around whether water companies' PCC targets, as outlined in their 2019 WRMPs can be met. This is because they depend on many external factors, such as customer behaviour, technology and weather conditions.

To help understand the role of different infrastructure options in the future, the National Framework considers three levels of individual water use by 2050. These are:

1. **High –** daily water use of 127 l/p/d, no change to non-household consumption and 30% leakage reduction.

2. **Central –** daily water use of 119 l/p/d, no change to non-household consumption and 50% leakage reduction.

3. **Low –** daily water use of 110 l/p/d, 4% reduction in non-household consumption and 50% leakage reduction.

These targets are ambitious given that average household PCC in the region is currently 146 l/p/d, based on a 2019/20 baseline.

Sheringham coast

2.3 Environmental Permitting Regulations

Virtually all abstraction from surface and groundwater must take place under licences issued by the EA in line with the Water Resources Act 1991 (as amended by the Water Act 2003). As part of its 2017 Abstraction Plan, the Department for Environment, Food and Rural Affairs (Defra) announced that the current abstraction licensing regime was to transition into the Environmental Permitting Regulations, with abstraction licences being replaced by abstraction permits. The transition is intended to be 'neutral' regarding existing water rights, with existing licences initially being transitioned as 'a converted permit'. An EA consultation on these proposals closed on 22 December 2021.

There are currently several technical areas of concern for licence holders. Perhaps the most relevant for our purposes is that, ultimately, abstraction permits will not be time limited. Instead, all permits will be subject to periodic review – for example, linked to the EA's Catchment Abstraction Management Strategy (CAMS) /Abstraction Licensing Strategies (ALS) common end dates. It is understood that converted permits will retain an existing time limit, should they have one, avoiding periodic review until they expire, unless the operator triggers a non-trivial permit variation. Guidance setting out the principles of this periodic review process is still to be drafted. Clearly, all permit holders, be they operators of major water dependent infrastructure or individual farm owners will be concerned about the implications of the review for their current operational and future investment risks.

This uncertainty highlights the importance of the relationship between:

- Our Regional Plan.
- EA/Catchment Abstraction Management Strategies/ Abstraction Licence Strategies.
- EA's policy on Restoring Sustainable Abstraction.
- Abstraction permitting law and guidance within the Environmental Permitting Regulations (in relation to determining abstraction permit applications).

Key messages

There has been a step-change in water resource planning requirements over the past few years to build an integrated picture of cross-boundary, multi-sector needs for water resources through regional planning and improving the wider resilience of water systems, including through resilience planning for more severe droughts. The National Framework and abstraction licensing policies present very real challenges across all sectors, not just public water supply, and everyone has a part to play in ensuring they are met.

3. THE REGION AT A GLANCE

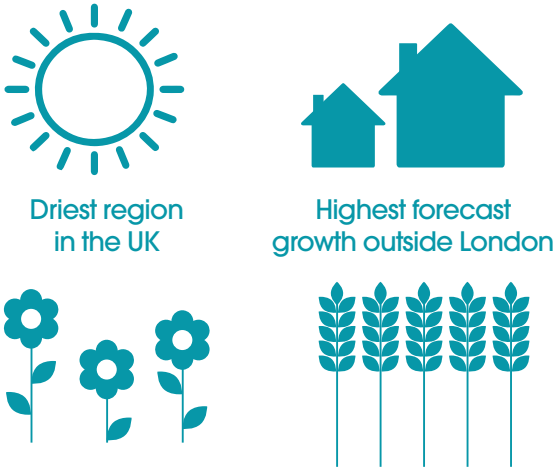
Barley field, Carlby, Lincolnshire

Barley

3.1 Regional overview

Eastern England is home to some of the UK's most successful businesses, internationally recognised landscapes and habitats, very fertile agricultural land and some of the most prestigious academic institutions – and it is set to grow rapidly over the coming decades. Three of the UK's five fastest-growing cities, (Cambridge, Milton Keynes and Peterborough), the potential growth areas centred along the M1, A1 and M11 strategic roads and East West Rail are all in the Eastern region – contributing significantly to growth nationally.

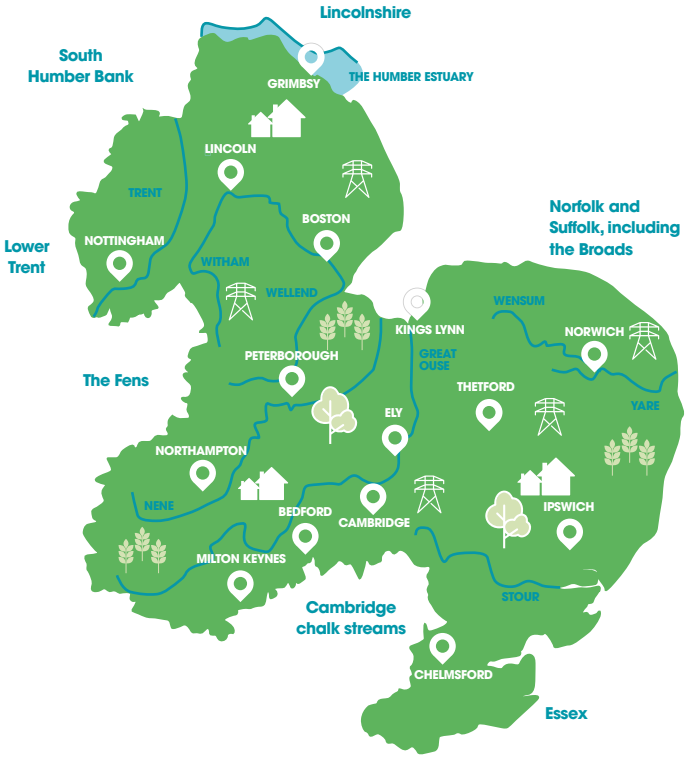
Figure 3.1: Eastern England attributes



But Eastern England has other attributes that make it uniquely vulnerable to water security and severe weather events. Nearly 30% of the land is below sea level, a large proportion of the area of the East of England (75%) is used for agricultural production, it is the driest region in the UK and has one of the longest coastlines of any region. The EA has classified the whole of Eastern England as being in 'in serious water stress'.

With the increasing risk of drought and the surge in demand for food, energy and growing local economies that is likely in future, there is a very real risk that a lack of collaborative water management could limit development in the region. The WRE region is predicted to face a significant gap between supply and demand unless there is a change in approach.

Figure 3.2: Map of Eastern England



3.2 Key water users in the region

Agri-food sector

Farmers manage over

75%

of the land in Eastern England

The agricultural and horticultural sector in the WRE region benefits from drier, warmer weather patterns combined with some of the most fertile and productive soils in the UK. Farmers in Eastern England are major growers of crops such as wheat and barley and produce a significant proportion of the nation's fruit and vegetable crops, potatoes and sugar beet, as well as poultry and pig production. Agricultural produce is delivered into a food processing industry that is the UK's largest manufacturing sector. Many of the crops grown here need access to clean and plentiful supplies of water for irrigation and food processing.

Farmers rely on local water resources that lie beneath, stored on their farm or flow past their farm. Water treated to human drinking standard is rarely needed, so energy costs for water distribution and treatment are low compared to PWS. More than 60% of England's abstraction licences for irrigation are located in the region.

Staythorpe power station, Newark, Lincolnshire
Image courtesy of RWE

Water use for irrigated crops is seasonal, with the peak irrigation season being from May to September. It also varies considerably depending on weather – for example, less irrigation is needed during wet summers. Although the aggregate volumes of water abstracted in agriculture are relatively small, farmers hold the overwhelming majority of abstraction licences, so the impact of regulation is very site-specific. Aggregate volumes of groundwater and surface water abstracted for use in agriculture and horticulture are broadly similar across the region; groundwater tends to be more reliable and of higher quality, but its use is becoming more constrained by regulatory pressure. Access to surface water for direct summer irrigation is becoming more erratic because of variable river flows and regulatory restrictions (irrigation is subject to regulatory restrictions or bans, although these are used as a last resort).

Food security in a post-Brexit era may require addditional and potentially different demands on water usage in addition to the increase in wet farming practices as farmers adapt to changes in weather patterns.

Energy sector

Energy plants across the region are major users of freshwater, particularly from the River Trent and River Great Ouse. Thermal power stations provide reliable energy and secure electricity supplies, as well as on-demand services to the National Grid to complement and support intermittent renewable energy sources. Power stations currently hold abstraction licences to draw water from rivers, which is used mainly for cooling. This use provides increased thermal and resource efficiency compared with air cooling, resulting in societal benefits of reduced emissions to air and affordability of power.

As the UK moves towards the UK Government target of net zero greenhouse gas emission by 2050, the demand for electricity – for example, in homes and transport networks – will increase. However, the mix and locations of future power generation plans that may evolve in response to market signals is highly uncertain as there is currently no energy sector plan. It is acknowledged that much of the increased electricity demand will be provided by renewables.

Meeting the national statutory net zero target with a secure, stable and affordable electricity supply will require the development of reliable low, zero or net negative carbon power generation capacity, including nuclear power, thermal power with carbon capture utilisation and storage (CCUS) and hydrogen combustion. Flexible thermal plant will have an important role in being able to respond to the increasing proportion of intermittent renewables production. In addition, new types of energy infrastructure producing alternative fuels such as hydrogen are likely to

be developed. The exact mix of future plant, their locations and time at which they will come on stream are all uncertain and will evolve as developers respond to market signals. However, a wide range of scenarios developed by the Committee for Climate Change, Department for Business, Enterprise and Industrial Strategy (BEIS) and National Grid Future Energy Scenarios show the same essential features. While some considerations would attract hydrogen production installations to the coast, others, including access to hydrogen storage and proximity to clusters of hydrogen users, would attract them to freshwater locations. This would then drive an additional demand for water compared with today, with some projections suggesting a return to historic levels of water use by the sector. The location of these production installations may attract hydrogen consuming activity, which may itself impact on water demand. Energy UK has provided a quantitative illustration of the potential consequences for water demand of many of the available scenarios.

Many energy plants are located near to coasts and estuaries, again for cooling purposes primarily. Both thermal and renewable power generation siting may offer co-location opportunities for other activities such as desalination.

The environment

Eastern England is a diverse part of the UK. The Broads National Park and wetlands of the East coast are internationally recognised and have more than a quarter of Britain's rarest wildlife, including Norfolk hawker dragonfly, swallowtail butterfly, Fen orchid and marsh harrier in Sites of Special Scientific Interest (SSSIs) and United Nations Ramsar Convention sites. Only 200 chalk rivers are known globally and 85% of these are found in the UK in southern and eastern England. The East Anglian Fens contain 23% of the area of lowland peat in England and Wales, which is estimated to store 37 million tonnes of carbon. The peat in the Broads has lost a million tonnes of carbon in the last 40 years of drainage, but every 10 centimetre increase in water table depth could reduce the net warming impact of CO_2 and CH_4 (methane) emissions by the equivalent of at least 3 tonnes of CO_2 per hectare per year. In addition, Eastern England has 125 miles of navigable waterways that are integral to many current and future water management strategies.

A simple definition of 'environment' is "the air, water and land in or on which people, animals and plants live"[4]. The environment of the region contains many areas where habitats, communities and species are designated for particular care and maintenance purposes at local, regional, national and international level. The natural environment also provides services, directly or indirectly, upon which people and the economy are dependent. Depending on how and in what quantity those services are obtained, the natural environment may be maintained, degraded or restored affecting the ability of the environment to continue to provide those services into the future. WRE, along with the other regional groups, has been established to plan the allocation of water resources. They are required to focus primarily on the aquatic environment, specifically freshwater, and in particular on river flows and levels and on groundwaters (and in some areas, lakes and wetlands). We will work with others in their development of Local Nature Strategies and Nature Recovery Networks including through the sharing of the outputs from the work we co-sponsored on Systematic Conservation Planning.

However, the choices we may make will have environmental implications well beyond the consideration of freshwater resources alone. There will be implications for the chemical, physical and biological quality of freshwater, for saltwater and for the environment in general, such as the emissions released into the atmosphere, changes in land use resulting from the locations of new infrastructure assets and the way in which they interact with the environment, and from fundamental changes in land use. In addition, these choices will have implications for the extent to and manner in which would-be users of the aquatic environment may use it in future. This will affect the choices those users will make about their future assets and activities leading to changes in the size and make-up of the future economy of the region, the extent to which it will support people locally and nationally, and the ways in which that economy will affect the aquatic and wider environment differently to historic and current activity.

Current state of the aquatic environment in the WRE region

Quantitative information on the state of the aquatic environment at a water body level can be accessed through the EA's Catchment Data Explorer[5]. Interpretative information on water resource availability can be found in relevant EA CAMS and ALS reports[6]. Descriptions of the issues affecting the aquatic environment, the challenges and choices society faces in relation to the aquatic environment are set out in the RBMP consultation summary[7].

There are many water bodies not achieving their current target status set out in the RBMPs and many designated sites not achieving their target condition status. For some, water resource (flow or level) is or may be a contributory factor.

[4] https://dictionary.cambridge.org/dictionary/english/environment

[5] environment.data.gov.uk/catchment-planning

[6] https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process

[7] http://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/954201/Challenges_and_Choices_consultation_summary_reponse_210125.pdf

In the future:

- Climate change will affect the occurrence (both timing and intensity) of rainfall.
- Air and temperature distributions will change.
- Sea levels will rise.
- Flood risk will increase.
- Population growth could result in changing demand for services provided directly and indirectly from the aquatic environment.
- Society will undertake many activities in response to climate change adaptation measures and in response to development in regulation.
- Regional economic activity will evolve in response to the local, regional, national and global threats and opportunities.
- Land use may change.

All of these can be expected to have consequences for the aquatic environment. The challenge of providing for society's future water needs and delivering appropriate environmental restoration, protection and enhancement is central to our planning activity.

Environmental plans, strategies and policies of relevance to the Regional Plan

There are a wide range of water resources and environmental plans, strategies and policies that are already influencing our decision making, including:

- Defra's 25-year environment plan.[8]
- RBMPs (with the 2021 plans in preparation, principally Anglian and Humber).
- Marine spatial plans (principally East Inshore, South East Inshore).
- Restoring sustainable abstraction, CAMS/ALS and Water Industry National Environment Programme (WINEP), and its planned reform.
- Catchment plans.

[8] http://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

Environmental choices in regional water resource planning

It is a given that legal minimum environmental standards will be adhered to and delivered. However, in many cases there may be a degree of choice available in how those legal standards will be met. The Regional Plan provides a platform to consider alternative approaches, taking into account a wide range of environmental and socio-economic considerations. This includes for existing longstanding activity such as agri-food, tourism and recreation, power and energy and navigation, as well as the implications for potential future activity (including, potentially, that associated with carbon capture and hydrogen production and use).

For example, if it is established that there is insufficient river flow at a location to meet a statutory target status, it could be that reduction in actual or licensed abstraction affecting that location is appropriate and there is potentially a choice of which abstractors and over what time scale reductions could be imposed. Alternatively, when other factors are explored or further catchment investigations and/or related WRE projects highlight alternative interventions it may be found preferable that appropriate environmental status be secured by means other than imposing abstraction reductions (for example, through a water transfer, use of storage or land management changes).

Both the National Framework and the Water Resource Planning Guidelines encourage regional planning to consider 'going beyond' minimum legal standards in relation to the (aquatic) environment. Exploring the wider environmental and socio-economic consequences of this potential choice of 'destination' for the aquatic environment is an integral part of the regional planning process. This exploration will be an ongoing and iterative process playing out at strategic, regional, catchment and more local levels.

Public water supply

Eastern England is home to an estimated 10.5 million people. Many live in towns and cities such as Milton Keynes, Chelmsford, Southend-on-Sea, Cambridge, Ipswich, Norwich and Peterborough, which are growing fast as the region as a whole attracts more economic development and – as a result – more people who need drinking water and water recycling services.

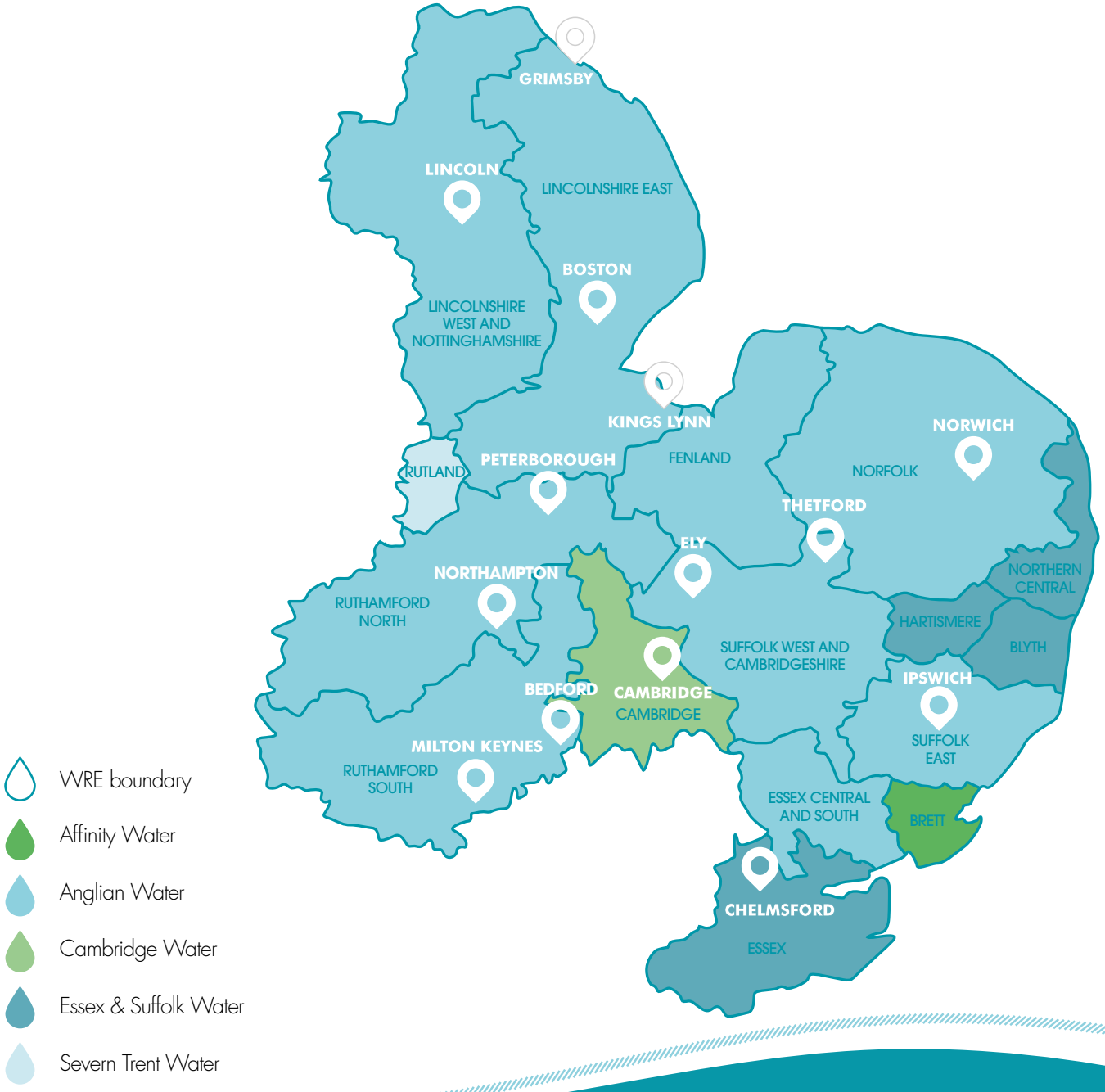
In England, water supply and sewerage services are provided to customers by privately owned water companies. Water companies' regulatory duties are primarily laid down in the Water Industry Act 1991. These include the duties to supply wholesome potable water, treat wastewater and protect the environment. Water company operations are regulated by the Drinking Water Inspectorate (DWI) for drinking water quality, the

EA for environmental matters and the Water Services Regulation Authority (Ofwat) for economic regulation. Ofwat sets price controls for water and sewerage services to retail household and non-household customers, as well as wholesale water and sewerage services. Consumer Council for Water (CCW) is a statutory consumer body for the water sector in England and Wales. In addition, Natural England is responsible for ensuring that England's natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved.

Given the geographic distribution of the water companies and their assets, there is limited competition between suppliers and with that a risk that the companies will not deliver the services customers want. For this reason, the water sector undergoes a five-yearly review of price, investment and the service customers receive. The last price review took place in 2019 (PR19), covering the five years from 2020 to 2025. The following water companies operate in the region, as illustrated in Figure 3.3:

- Affinity Water (water only company).
- Anglian Water (water and sewerage company).
- Cambridge Water (water only company).
- Northumbrian Water Limited trading as Essex & Suffolk Water (water only company).
- Severn Trent Water (water and sewerage company).

Figure 3.3: The water companies operating in the WRE region and their Water Resource zones



Cley Marshes, Norfolk

The EA issues abstraction licences for water bodies where water is considered to be available. This follows the consideration of ecological sensitivity as represented by the EA's application of Abstraction Sensitivity Bands (ASB) to water bodies. The ASB then allows the EA to define the Environmental Flow Indicator (EFI) for a water body (whether this is defined through nationally applied screening methods, or via local investigation), and it is this that is then considered to be the flow required to support aquatic life and so allows the EA to determine the amount of water available.

Headroom between water already licensed and the EFI is considered for, although water availability needs to be reviewed regularly based on improvements in understanding on what the system can sustainably support.

Water companies assess their future water resource needs every five years through their WRMPs. These are statutory plans that set out how the companies will reduce any forecast deficit between supply and demand to meet the needs of customers.

Challenges and pressures regionally

Some of the key challenges facing PWS include the following:

- **Sustainability reductions** applied to existing abstraction licences, reducing abstraction volumes to reduce potential environmental impacts on waterbodies. The EA has already determined these, in consultation with the water companies. The reductions will come into force by 2025. View our **Glossary of Terms here**.
- **Drought resilience** of the water supply system to a 1 in 500-year event by 2039. This is a step change from previous planning cycles (1 in 200-year).
- **Climate change** impacts, particularly on precipitation and evaporation rates. This will affect the ability to store this water for supply, as well as resilience of water supply assets to sea level rise and flood risk.
- **Achieving net zero** carbon operational emissions by 2030 – a target committed to by the water sector to stretch the UK Government's existing commitment of net zero by 2050. However, a number of water companies are on track to achieve this target ahead of 2030 – for example, Northumbrian Water, which operates as Essex & Suffolk Water in the region, plans to achieve this target by 2027.

Future water demands

Demand forecasts for the region are required to consider the following:

- Population growth could present a significant issue for household demand forecasts, particularly with the uncertainties around large-scale development in the region.
- Eastern England is the driest region in the UK, with all water company supply areas now classified by Defra and the EA as '**seriously water stressed**' requiring an assessment of compulsory metering demand management options.
- Due to the COVID-19 pandemic and the implications of a re-distributed population, many people have chosen to relocate from towns and cities to rural areas and many are now working from home, shifting their water consumption to their own water company area rather than out of region – this has particularly affected the Essex & Suffolk Water operating area. This has a knock-on effect for the requirements of water infrastructure to serve potentially smaller, decentralised demand centres.

These water resource challenges and uncertainties are explored further in Chapters 4 and 5.

Key messages...

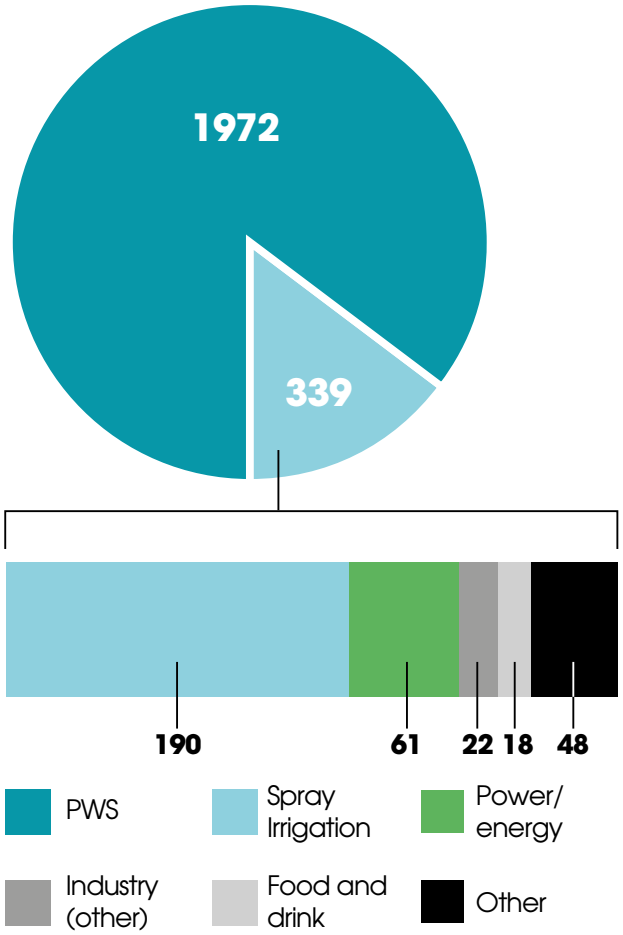
Eastern England is a unique landscape which makes it especially vulnerable to water insecurity. By looking at some of the region's most integral water use sectors we can start to understand what Regional Planning needs to address. Agri-food, energy, the environment and public water supply have been looked at to explore how they can work together out of traditional silos and create acceptable trade-offs where there is a mutual understanding for each sectors' challenges and pressures.

4. CURRENT POSITION

4.1 Current water needs

In February 2021, we updated our Resource Position Statement, which outlined current water consumption rates in the region. On an average day, in a dry year, the total demand for water across the region is equivalent to 2,311Ml/d, based on a 2020/21 baseline year. Most of this water (85%) is used for PWS purposes. The rest is used to irrigate crops (8%), generate power (3%) and in the manufacturing, food and drink sectors (2%), as illustrated in Figure 4.1.

Figure 4.1: Average daily regional consumptive water use – 2020/21 (in a dry year)



Current regional average daily water used per person, or PCC, is around 146 l/p/d. All the water companies in the region have reported higher rates of consumption in 2020/21 than forecast in their WRMPs. This is because of the impacts of the COVID-19 pandemic.

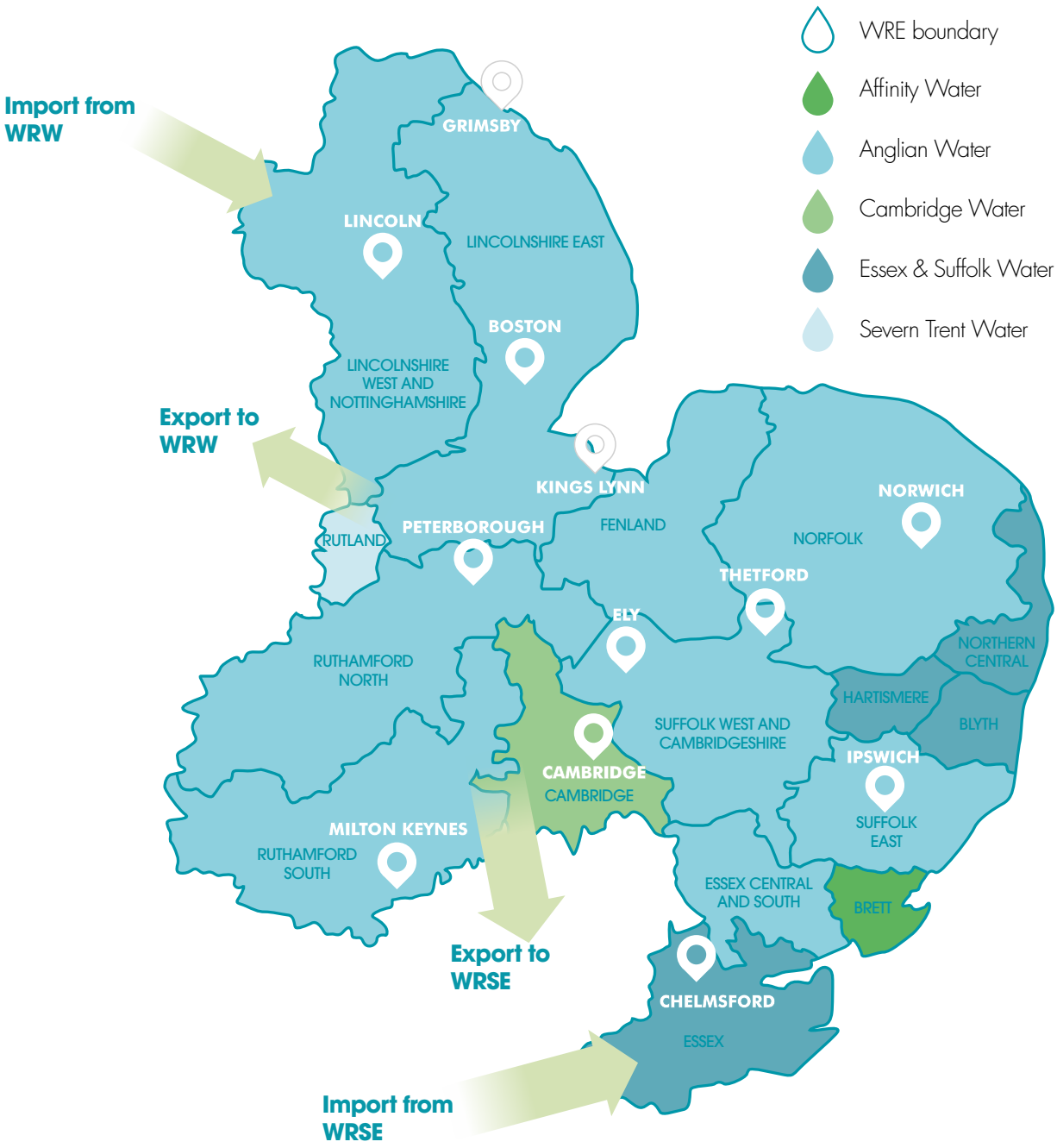
To help meet current PWS needs, some pipelines are used to transfer water within and/or across water company boundaries through imports and exports. However, the result of these water transfers is that almost the same water balance is achieved. To illustrate this point, the WRE region currently imports 71 Ml/d net from Thames Water (WRSE region) into Essex & Suffolk Water and exports up to 85 Ml/d from Grafham reservoir, owned by Anglian Water, into Affinity Water. Resulting in a marginal net export from the WRE region to WRSE at peak times.

The main water transfer with WRW is the export to Severn Trent Water, from Anglian Water's Rutland water resources zone in the WRE region of up to 18 Ml/d.

Average daily water consumption in our region is currently estimated at

2,311 million litres

Figure 4.2: Current inter-regional transfers in use for public water supply



Through the EA's 2017 Water Abstraction Plan, a number of existing abstraction licences have been identified which require reduction by 2025, in order to minimise impacts on the environment through unsustainable abstraction. These licence reductions largely relate to capping of groundwater abstractions to manage any deterioration of waterbodies, affecting PWS through the water industry national environment programme (WINEP), as well as agricultural and industrial users. This imparts an urgent and imminent requirement to find alternative options to manage short-term risk to water needs by 2025. The energy sector is not currently affected by these licence reductions.

For non-household demand, some water companies in the region are unable to meet requests for additional water from businesses they supply, which could hinder economic growth.

4.2 Customer preferences

During summer 2021, Blue Marble, a customer research company, carried out qualitative research for the water companies in the WRE region into household and non-household business customer awareness of regional water resource planning issues and preferences for bridging the gap in resource deficit. The research found that there is an overall lack of understanding of the water security issues facing Eastern England. These research findings illustrate a clear impact of the COVID-19 pandemic on the need for long-term planning to meet future challenges and the sensitivities of social inequality to the ability for customers to pay their bills in the context of funding major investments to ensure a reliable supply of clean water in the future.

Further insights demonstrate that:

- Drought risk is not a conscious concern of customers.
- No customers were aware of the risk of water supply shortages in the near future, with a genuine surprise that there is an immediate risk in their region.
- There is little to no awareness of specific, local, environmentally sensitive features such as chalk streams.
- Linkage between water supply and river environments was not well understood.

In exploring the challenges water companies in Eastern England face, the general public (customers and non-bill payers) and stakeholder organisations have highlighted the principles on which they want to see future water resource plans developed, see Figure 4.3.

Critical focus area:

Investigation of alternative options to address imminent abstraction licence caps.

Critical focus area:

Improve public awareness of water-related issues and promote responsible water use behaviours.

Figure 4.3: Customer findings

1. The principle of a 'best value plan' (not the cheapest but the best for society and the environment) wins approval

- However consumers want water companies to prioritise the core business activities (which includes protection of the environment, managing flood risk and drought resilience) over the 'added value' elements (boosting the local economy, consulting customers and creating public amenities etc.).

2. Consulting and collaborating is good – but only up to a point

- Consumers, non-household and stakeholders point out they are not experts at e.g. optioneering, deciding who should pay – and defer decisions to experts.
- Stakeholders believe the size of the challenge requires actions from beyond the water companies. Collaboration means being part of the delivery too – and they want to see (and be part of) more creative solutions to addressing the problem.

3. Empower customers to help by reducing their water use: consumers and stakeholders agree that communication is vital

- The public do not know there is a problem. There is little to motivate them to reduce demand. Potential for restrictions in a drought does not appear to trouble people (who approach the prospect with new post-pandemic resilience).
- The water sector's silence on the risk of supply shortages suggests that the problem is not real/immediate.

4. Drought resilience should focus first on making the most of what there is

- Demand-side options are favoured above new supply options – with leakage the number one issue that water companies should address (unaware that customers have a part to play here too).
- Other options involving customer behaviour change and universal metering are secondary.
- Businesses, always with an eye on cost, are interested in recycling their water and want water companies to prioritise this.

5. Options should meet three criteria: financially viable; low carbon; and effective in the long term

- Options that appear short term stop gaps and/or poor environmentally are largely rejected (including drought permits).
- Recycling water and (low carbon) desalination are the most acceptable of the 'new' supply options.
- Water transfer and tankering from other countries have least appeal.

6. Environmental ambition is important- but for the general public and non-household, not at any cost

- Restoring past damage is supported but cost implications of improving environments means few support the highest 'destination'.
- Stakeholders with an environmental remit support the highest destination.

7. Affordability is heightened post-COVID-19: plans should be fair and affordable for all

- Everyone is worried about rising costs.
- Inequalities highlighted by the pandemic create a more 'citizen' mentality: important to protect lower income/poorer households.
- However, stakeholders (and some non-household) believe water is (too) cheap and under-valued.
- The need to protect the economically vulnerable is undisputed.

8. Urgency is key for stakeholders but less so for the general public/non-household

- Consumers do not see the argument for exceeding statutory timeframes.
- Stakeholders are much more urgent about the need for action – but there is no consensus on the optimum timeframes.

9. Develop a holistic approach to all aspects of water supply and waste management

- Stakeholders want to see a joined up approach – and this could help consumers appreciate what appear to be contradictions (higher awareness of flooding undermines the drought message).

10. Think outside of the established (regulatory) confines

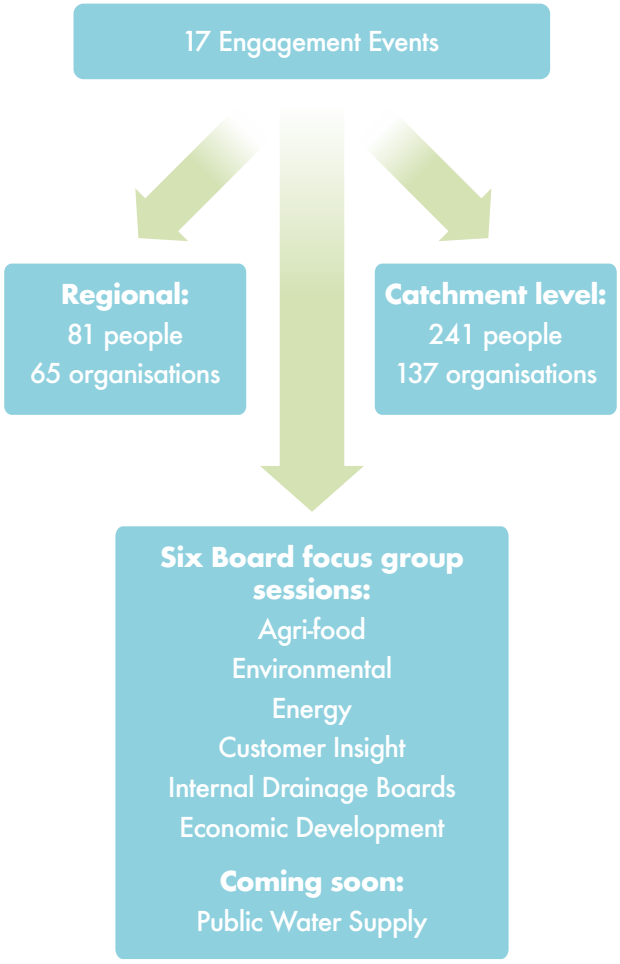
- Stakeholders challenge the regulatory approach: 5 year cycles promote short-termism; pressure on bills hampers the ability to do the 'right' thing.
- Challenge the fundamental idea that water is a limitless resource for all.
- Change the focus from consulting to informing.

4.3 Member and stakeholder views

Between January and November 2021, we conducted a broad stakeholder engagement programme. This covered all members' sectors, focusing on the Regional Plan from different scales, and specialising in different aspects. These stakeholder engagement activities included:

- Two WRE Board/Technical Delivery Group Planning Conferences.
- Two Strategic Advisory Group member training sessions.
- Three Regional Planning Conferences (two in person and one online).
- Four Local Focus Catchment Workshops (online).
- New agriculture and energy technical focus groups formed.
- Six Board Focus Group sessions.

Figure 4.4: Member and stakeholder engagement activities



The feedback from the Regional Planning conferences and Local Focus Catchment Workshops has been summarised to provide insights as follows:

As mentioned earlier, the most used words to describe what regional planning is trying to achieve are ambitious, challenging, and impossible. Nevertheless, regional planning has never been done before on this scale or as a co-creation process so at this stage, it is no surprise. Essential, urgent, crucial, vital, logical, and useful were also used giving clues as to how timely and time sensitive Regional Planning is.

We were keen to use our engagement to address incorrect assumptions and misinformation about our members and their sectors. This is something we will continue to do throughout the planning process.

We asked what our members consider are the biggest challenges facing Regional Planning. Costs, focus, regulation, funding, political will, and scale of the challenge were the most commonly expressed themes. This echoes a broader question of whether the ambitions of the Regional Plan will be met with the appropriate policy landscape to support them. It also highlights questions on the operation of possible checks and balances on our ambition, reflecting the considerable uncertainty around costs, benefits, distributional effects, funding, and technical and regulatory feasibility.

There is also increasing concern around the reductions in existing abstraction licences by 2025 through the EA's RSA programme. This is especially true for those in the agri-food sector that need these licences to support food production.

There are some incorrect assumptions existing in society concerning the energy sector, mainly around the role renewables will play and the idea that the energy sector will not require freshwater because of this, or that all energy needs will be met from plants located at or near the coast.

One message that came through clearly from WRE members during our engagement is that the uncertain effects of climate change, the need to restore, protect and enhance the environment and increased demand are the biggest challenges for current and future water resources.

When asked in what ways the needs of specific sectors are not being recognised, some stakeholders expressed concern about the lack of specific detail in current plans.

There is also a feeling that the trade-offs in regional planning at this point are not fully understood and there is a lack of knowledge of how conflicts that will occur will be resolved. There is dissatisfaction with both historic

and current regulation and governance from a national perspective.

A view voiced by many concerns the water sector's and customers' perceived 'failure' of managing a water service by imposing non-essential use bans (NEUBs) or temporary use bans (TUBs) for non-essential potable water uses such as those for watering the garden, washing the car and filling paddling pools. Stakeholders felt that a societal shift was needed so that using NEUBs, and TUBs is seen as 'everyone doing their bit' to protect precious water resources.

On leakage, a few people made the comment that allowing a certain level of leakage from water companies is like accepting leakage as a water user in its own right, and therefore potentially depriving other water abstractors (for example, farmers) of a license or imposing an unnecessary reduction in license.

At a catchment level the questions were more focused on WRE as a regional planning group. The emerging themes were that WRE needs a "louder voice and stronger messaging in the public sphere". This ties in with the feedback that WRE needs greater engagement with the farming and landowning community about the projects/ missions that would directly affect them with WRE needing a bigger presence "on the ground". However, at this stage of water resources planning, our primary focus is on a planning role and the purpose of our flagship projects such as the Norfolk Water Management Strategy and Water for Tomorrow, is to inform the planning aspects and highlight the need for policy interventions and delivery by others.

There was also a desire that WRE continues to work through members to tighten links and build bridges between catchment work and regional links.

Lastly, stakeholders believe that WRE needs to further facilitate innovation to ensure the water that is available in Eastern England now is used first – before larger or more intrusive options are developed.

Key messages...

A number of sources have been used to build our understanding of the water resource availability in the region, however, uncertainties remain which are being explored through our existing technical workstreams and new technical working groups (e.g., for the agri-food and energy sectors) and provide greater certainty to the water security situation in the region.

Sunset over wetlands

5. WHAT THE FUTURE LOOKS LIKE

5.1 Possible future water resource needs

Since we updated our **Regional Resource Position Statement** earlier in 2021, we have further refined the scale of the planning problem facing Eastern England in 2050 and beyond.

Since then, we have further refined our forecasts specifically to update the possible range of sustainability reductions which could affect existing abstraction licences in the region. Looking forward to the 2050s, we have estimated that up to an additional 2,267 Ml/d of water could be needed. Based on current water consumption rates of some 2,311 Ml/d in 2020/21, this represents up to 98% increase in demand. The largest drivers of this increase are abstraction reductions required to drive environmental restoration and enhancement (1,325 Ml/d), housing growth (273 Ml/d) and additional water for irrigation (220 Ml/d). This current view is summarised in Table 5.1.

Table 5.1: Regional water resource challenge to 2050

Sector	Pressure	Dry year annual average estimated impact (Ml/d)		Comment
		Lower	Upper	
Public water supply	Climate change	54	180	Includes range of possible high/low climate change impacts mostly on reservoir yields.
	Sustainability reductions	790	1,325	Includes cross-sector abstraction licence reductions resulting from a range of environmental destination scenarios outlined by the EA. The lower limit represents the business as usual (BAU) scenario, with the upper limit accounting for the enhanced scenario. Current values apply to all existing licences except the energy sector. Further refinement will be made through discussion with the EA and Natural England.
	Growth (population)	-250	273	Upper limit accounts for growth targets in local plans and some consideration of strategic growth and limited progress with planned demand management measures. Lower end represents lower population forecasts and high uptake of water efficiency measures.
	Drought resilience	88	88	Methodological uncertainties subject to work in progress.
	Regional exports	0	0	Not considered at this stage, although 100 Ml/d export to WRSE is currently assumed for the South Lincolnshire Reservoir SRO development.
Energy	Decarbonisation	-38	181	Updated forecast based on research commissioned by the Joint Environmental Programme, Energy UK[9] on a baseline of 61Ml/d.
Agriculture	Growth (irrigation)	59	220	Updated forecast based on uplift factors from research commissioned by WRE[10] on a baseline of 190Ml/d.
Total		**703**	**2,267**	

The scale of the water resource challenge facing the region has been developed using several key assumptions to represent the range of relevant pressures as discussed below.

[9] *Gasparino, U. & Edwards, N.A. 2021. Projections of Water Use in Electricity and Hydrogen Production to 2050, under the 2020 Future Energy and CCC Scenarios including BEIS 2020 lowest system cost analysis – with a focus on the East of England. RWE Generation UK, ENV/675/2021, for the Joint Environmental Programme, Energy UK.*

[10] *Knox, J., Haro, D. & Hess, T. 2018. Task 2 Agricultural demand forecasts (Part II): future demand. Final Technical Report. Cranfield University for WRE.*

5.2 Climate change and water scarcity

Climate change has the potential to alter dramatically the resource availability in the environment. Therefore, to ensure that our Regional Plan reflects this uncertainly adequately, the latest developments in climate science have been applied through the UK climate projections 2018 (UKCP18). Regionally appropriate climate change factors have been used to sensitivity test hydrological time series, this uses a range of different representative concentration pathways (RCPs) across a number of different regional climate models (RCMs) to represent possible climate change impacts. This provides a view of the region's water resource availability to 2050 and has been modelled for both surface water and groundwater resources.

For PWS purposes, the latest water resources planning guidelines require water companies to provide resilience to more extreme droughts by 2039 (1 in 500-year events instead of the 1 in 200-year events currently expected). This assumption has been used to assess available headroom within existing water company systems.

Above: Earith, Cambridgeshire
Left: A new housing development under construction

5.3 Growth in water demand

Eastern England has the potential for considerable growth in water demand from a variety of different, multi-sector pressures, including:

- **Public water supply demand –** this is through housing growth and non-household industrial growth. Housing growth estimates are embedded in local government plans across the region, which could see up to 1.2 million new homes by 2050, as well as supporting other economic and strategic growth plans such as the Norfolk and Suffolk Economic Renewal Plan.
- **Agri-food demand –** in an already highly productive region the agri-food sector will be required to adapt to numerous challenges, including diversification and a post-Brexit consumer landscape, including the need for the agri-food sector to support the UK's food security in the face of climate change impacts and a pandemic era. A significant increase in demand from spray irrigation is anticipated over the coming years, although predicted increases in the amount of glasshouse operations in the region offer, through careful design, an opportunity for more rainwater capture and use.
- **Energy demand –** with the drive to net zero carbon emissions, the energy sector is likely to need up to 181 Ml/d more freshwater to facilitate the potential switch to greener technologies such as carbon capture and storage, and hydrogen generation through the electrolysis of water. This is in combination with renewable technologies.

Further detail on the various demands forecasts is provided below.

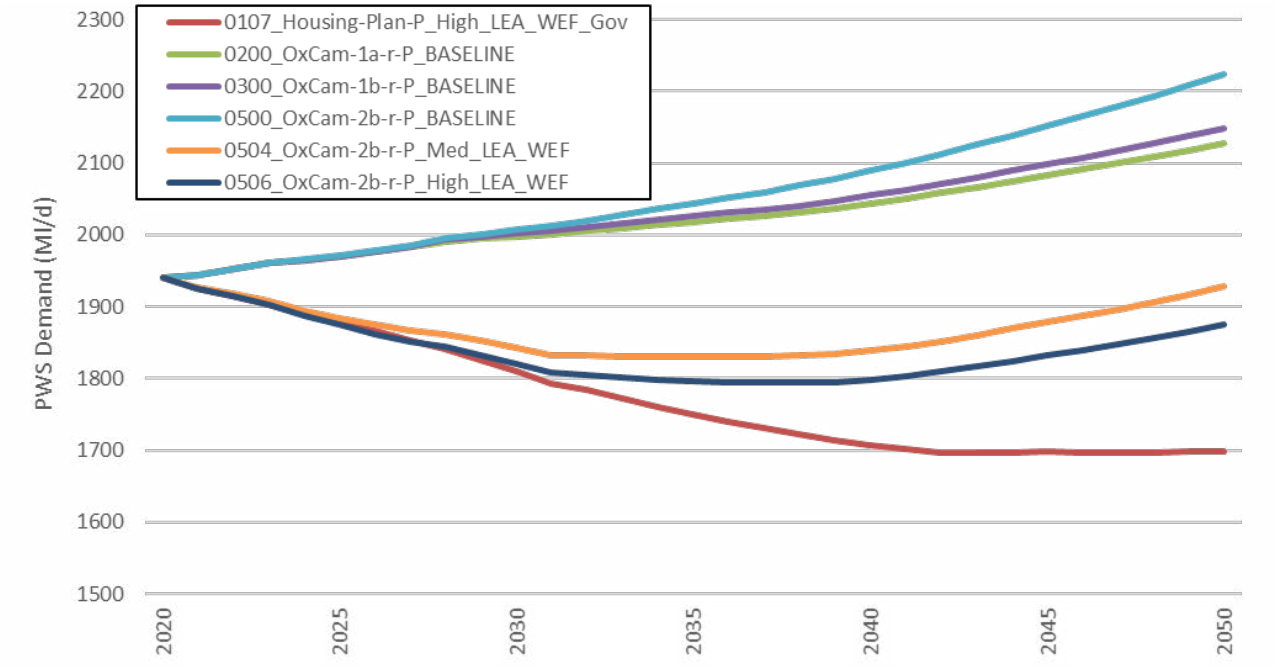
Public water supply (PWS) demand

Housing growth and new development is likely to change demand in PWS across the region by between –250 Ml/d and 273 Ml/d by 2050. Strategic development within the area from Oxford to Cambridge is the dominant growth feature within the region, although we recognise that there are also other potentially high housing targets in counties such as Essex, Norfolk and Lincolnshire.

Growth in the area between Oxford and Cambridge is a cross-water company issue within WRE and, with WRSE, an inter-regional issue. Since we published our Regional Resource Position Statement, we have carried out further work to refine the plausible demands on the PWS system. This includes some scenarios, with demand management portfolios, that indicate levels of demand reducing, as illustrated in Figure 5.1.

We have developed 70 different demand scenarios to assess vulnerability for PWS, with six used as growth parameters to ensure we incorporate a reasonable range in the search for strategic supply options (discussed in Chapter 6), as shown in Figure 5.1. These account for a range of different growth forecasts and uptake rates of demand management options, such as leakage reduction and installing smart meters in customers' homes. We use a range of demand scenarios because of the uncertainty in forecasting future growth – for example, PCC actually increased in 2020/21 rather than decreased, being significantly impacted by the COVID-19 pandemic.

Figure 5.1: Demand scenarios for Public Water Supply to 2050



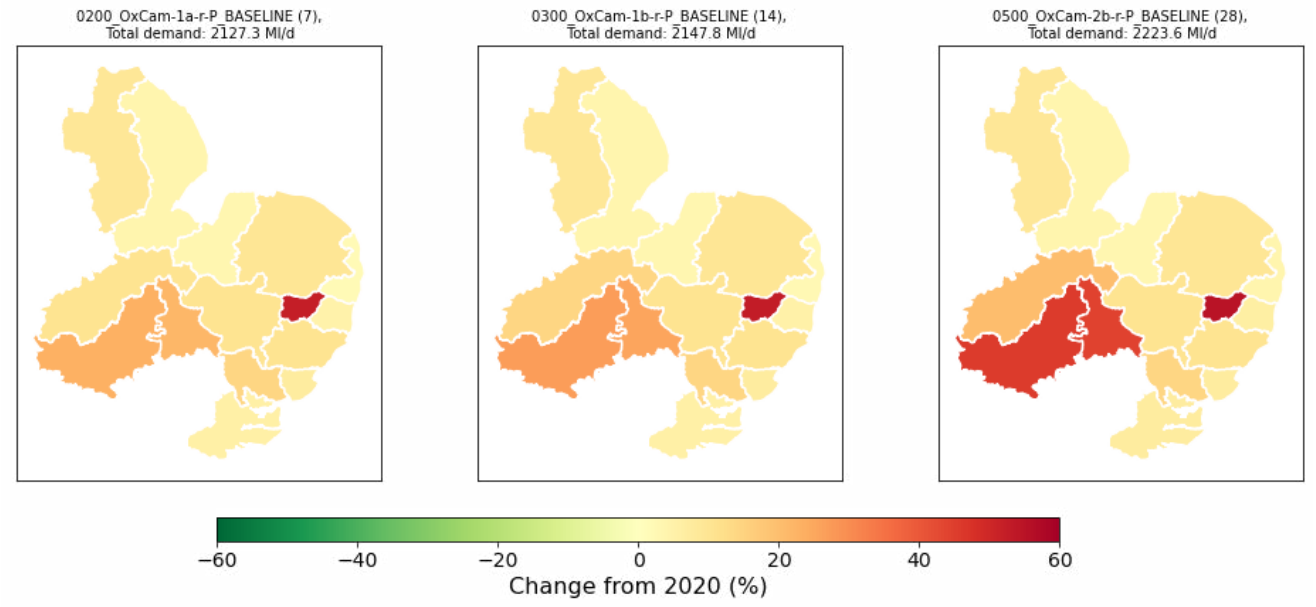
To reduce water consumption to the industry target of 110 l/p/d, a collaborative approach will be required among many different players, alongside Government-led policies (for example, water efficiency labelling for white goods, building regulations requirements for new homes and encouraging behavioural change among water consumers).

Further details of the development of our PWS demand forecasts are provided in Appendix B.

A new housing development under construction

Figure 5.2 represents the spatial distribution of the six demand scenarios across the regional water resource zones. The top three Oxford to Cambridge baseline scenarios show the impacts of strategic growth with no demand management options, ranging from a total demand of between 2,127.3 Ml/d and 2,223.6 Ml/d by 2050. The bottom three scenarios demonstrate the beneficial impacts of demand management measures despite growth, with total demand ranging from 1,698.6 Ml/d to 1,927.9 Ml/d by 2050, which suggests that with effective uptake of demand management options, increased demand from growth can be mitigated.

Figure 5.2: Public water demand scenarios to 2050 (% change from 2020)



Further work is under way to refine this significant forecast uncertainty in public water demand for the region. For the purposes of this initial planning round, we have assumed no additional demand from non-household PWS users, with further increases in demand offset by water efficiency savings – for example, through smart metering of non-household premises. Further detailed work is under way to refine the assumptions used through the development of water company WRMPs.

There are also plans to link household and non-household demand forecasts to the new Met Office weather generator that is being used to determine climate change impacts on our supply systems. Once this is complete, we will have the capacity to produce time consistent weather and climate change adjusted supply and demand forecasts for the whole of the region, both for the Regional Plan and to inform water companies' WRMP forecasts.

Agri-food sector growth

There is the potential for large growth in agri-food demand, as the sector adjusts to climate change, the UK's exit from the European Union, the 25-year Environment Plan, diversification and the need for widespread productivity gains. From a baseline position of peak demand in a dry year of approximately 190 Ml/d, it has been estimated that demand could increase by between 59 Ml/d and 220 Ml/d to 2050[11]. These estimates have been updated following our Resource Position Statement in early 2021.

The combined impacts of the COVID-19 pandemic and the UK's exit from the European Union have highlighted the vulnerability of the global food chain to supply disruption, which could lead to increasing consumer demand for more locally produced food, potentially increasing the water used to meet this demand. The Government's recently published **Path to Sustainable Farming: Agricultural Transition Plan** makes its objectives for the sector clear:

Above: Snape Maltings, Suffolk

- A renewed agricultural sector, producing healthy food for consumption at home and abroad, where farms can be profitable and economically sustainable without subsidy.

- Farming and the countryside contributing significantly to environmental goals, including addressing climate change (for example, through wetland habitat creation or restoration and associated transition to wet farming practices or paludiculture as it is also known). For example, **The Water Works project** is testing new crops that could suit a future UK climate, when weather events are expected to be more extreme and rain arrives in a deluge. Using plants that thrive in saturated soil and showing the commercial benefits of re-wetting these peatlands, a process that will also lock carbon into the ground.

In the highly productive areas of Eastern England, where spray irrigation in the UK is concentrated, matching productivity growth with enhanced environmental outcomes means that the way that water is abstracted and used is going to change. Growth in water demand for economic sustainability will need to be matched to changing patterns of availability, including the hotter, drier summers and warmer, wetter winters that are projected to occur as a result of climate change. This will drive a more integrated approach to drought and flood management, which is based on an increase in storage – either single or multi-sector.

The demand projections for the agri-food sector are currently based on estimates made by Cranfield University in 2018 but will be reviewed as part of our work programme in early 2022.

Energy sector growth

The potential growth in water demand for the energy sector has been estimated at up to 181 Ml/d on existing demand within the region to 2050[12]. This growth compared with today is linked to statutory targets for achieving net zero carbon emissions and the need to decarbonise energy systems and transport. As a result of this target, new types of plant will need to be developed from the mid-2020s onwards to complement the expected growth in renewables generation. The potential use of carbon capture and storage (CCUS) and the transition to a hydrogen economy are among the main drivers for the increase in consumptive water demand.

This forecast is based on Joint Environmental Programme (JEP) studies, using energy scenarios created by National Grid, the Committee for Climate Change (CCC) and BEIS. Based on the most recent and best data available, the forecast water demand from the energy sector is likely to show:

- An initial decline as the older coal-fired power stations are decommissioned.

[11] *Knox, J., Haro, D. & Hess, T. 2018. Task 2 Agricultural demand forecasts (Part II): future demand. Final Technical Report. Cranfield University for WRE.*

[12] *Gasparino, U. & Edwards, N.A. 2021. Projections of Water Use in Electricity and Hydrogen Production to 2050, under the 2020 Future Energy and CCC Scenarios including BEIS 2020 lowest system cost analysis – with a focus on the East of England. RWE Generation UK, ENV/675/2021, for the Joint Environmental Programme, Energy UK.*

- As energy systems then adjust to the requirements of net zero carbon strategies with increased electrification, introduction of hydrogen production and hydrogen-using technologies, there will follow a dramatic increase in water demand resulting from the cooling and process water needs of the new power plant and hydrogen production plant.

At a national scale and over the period to 2050, the increase in demand has been estimated to be in the order of 1,000 Ml/d. In the WRE region, we expect that the South Humber Bank and the Lower Trent Valley will be a focus for this new demand. The potential exists for significant hydrogen generation and CCUS in other areas of the region, and Hydrogen East has now formed to focus on opportunities in eastern counties including Norfolk, Suffolk and Essex.

There is significant uncertainty around the size and distribution of future demand and when the growth will occur. This will be influenced by national strategy around whether we will move to large-scale hydrogen powered transport (which will potentially require smaller, more local hydrogen systems) before we move to mass replacement of domestic gas systems (which will be focused on large hubs).

Further significant research is required to understand the future dynamic relationship that will be required between energy and water systems as the region and nation decarbonises, particularly in a water-stressed region such as Eastern England.

Environmental restoration and enhancement

As well as the reduction in abstractions as detailed below in the environmental destination section, there is an urgent need for water for environmental restoration and enhancement across Eastern England. We are exploring what this means for our region through consideration of a natural capital approach using SCP to help identify priority areas for conservation actions related to water resources.

This includes peatlands as set out in the Government's Peatland Action Plan. This is of particular significance in the East Anglian Fens, which contain 23% of the area of lowland peat in England and Wales and are estimated to store 37 million tonnes of carbon. There is a need to raise water levels in peat soils above current levels to minimise the release of stored carbon into the atmosphere. Higher water tables may require a whole-scale change of use to some of the land, such as a shift to paludiculture (wet farming).

Further environmental restoration could include wetland development. This includes those being created in the Broads National Park at Horsey and other locations in Thurne, Yare and the Waveney in partnership with the EA, Natural England, Norfolk Wildlife Trust, the Broads Internal Drainage Board and Broadland Environmental Services Limited.

Solar panels

The Broads Authority has provided very initial figures for the amount of water required for farming with higher water tables, paludiculture and wetland restoration. We will work with colleagues from the National Defra Lowland Agricultural Peat Task Force to explore if estimates of water volumes required for the region can be quantified, as we have yet to quantify the amount of water required from such environmental restoration and enhancement schemes to feed into our forecasts.

This is needed to achieve the Government's ambitious target to restore 280,000 ha of peatland by 2050, with new responsible management regimes for an estimated 158,000 ha of lowland peat. This might include wetter modes of farming, including paludiculture, and more responsible modes of conventional farming. These peat related initiatives will all require water.

Environmental vision:
A broad, long-term vision for the environment in the WRE region that considers water and land-management holistically.

Environmental destination:
The reductions needed to ensure abstraction is sustainable, now and in the future (2050).

Environmental ambition:
The rate at which the reductions in abstraction (defined by the environmental destination) will be delivered.

5.4 Environmental destination

Environmental destination and ambition are terms defined by the EA in the National Framework for Water Resources. The environmental destination for Eastern England details the scale of abstraction licence reductions required across most sectors for application throughout the planning horizon. The scope of this activity and its application at catchment and sub-catchment level is the subject of ongoing detailed conversations with our members, stakeholders and regulators through the regional planning process. Depending on the level of environmental destination applied, using the EA's scenarios, a range of possible reductions to existing abstraction licences could be adopted, which would limit abstraction by seeking to achieve Environmental Flow Indicators and improve water availability in the environment.

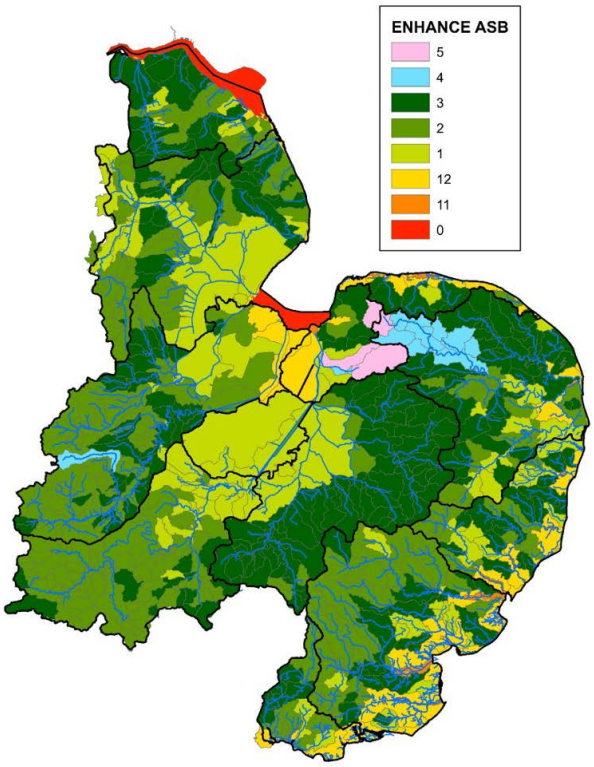
We have modelled the EA's scenarios, as well as two additional versions of the ADAPT scenario, to assess the scale of impact on a number of existing abstraction licences, not just PWS, and regional water resources. The scenarios comprise the following:

- **BAU –** continue to protect the same percentage of natural flows for the environment as today.
- **BAU+ –** same approach as BAU but also includes waterbodies that were deemed 'non-economic' in RMBPs to achieve statutory targets by 2027.
- **ADAPT –** starting from BAU+, accepts that full recovery to the environmental flow indicator (EFI) might not be achievable in some heavily modified waterbodies (75% recovery).
    - Two additional scenarios produced by WRE reflect further variation in consideration of abstraction sensitivity bands (ASBs):
        - **ASB-1 ADAPT –** starting with ADAPT, adding further waterbodies (least sensitive) where full recovery has not been achieved (75% recovery)
        - **ASB-2 ADAPT –** starting with ADAPT, adding further waterbodies (least sensitive – in addition to ASB-1 ADAPT) where full recovery has not been achieved (75% recovery).
- **ENHANCE –** sees greater environmental protection for Protected Areas and Sites of Special Scientific Interest (SSSI) rivers and wetlands, principal salmon and chalk rivers. This is achieved by applying the most sensitive flow constraints.
- **COMBINE –** balances greater protection for rivers, wetlands and principal chalk and salmon rivers with a view that good status (as defined under the Water Framework Directive) cannot be achieved everywhere in a shifting climate. For WRE, this was found to be very similar to BAU+.

The potential reduction in abstraction licences across the three most ambitious environmental destination scenarios (BAU+, ADAPT and ENHANCE) are estimated between 1,207 Ml/d and 1,325 Ml/d. For some areas of the region, this could mean significant reductions in water available for use (up to 50%).

Figure 5.3 illustrates the abstraction sensitivity bands (ASBs) the EA used to identify the sensitivity of catchments to abstraction (with band 5 being the most sensitive on this figure, and 0 the least sensitive). Appendix C outlines the approach taken to quantify these licence reductions for the region and will be the subject of further discussions in early 2022.

Figure 5.3: Abstraction sensitivity bands



In general, PWS licences comprise 70% of the total potential reductions in the region, with other sectors including agri-food, representing the remainder of the potential reductions

The scale of environmental destination and the pace of that ambition, will be the subject of ongoing discussions with our members, stakeholders and regulators through our local catchment focus workshops being held in early 2022. These workshops will provide an opportunity to explore the outcomes of different levels of environmental destination to inform a bottom-up view of catchment level water needs in addition to the existing regulatory process.

It is expected that the Cam and Ely Ouse, Broadland Rivers and Norfolk catchments may be prioritised and tested for investigation of possible licence reductions given the sensitivity of the systems but the test catchments will be confirmed through our work programme in early 2022.

Members voices...

We asked – "In your sector, what do you think is the biggest challenge for current and future water resources?"

Climate Change

" Lack of understanding from the public of the perceived water shortage resulting from climate change. "

" The uncertainty of climate change. In terms of water resources planning, uncertainty re: per capita consumption. "

" Ensuring enough water is available so as not to compromise the most efficient and reliable pathway to net zero. "

" Drought risk, and the capital investment needed to tackle it. "

Environmental health

" Ecology and quantity of water/accessing chalk streams. "

" Reconfiguring abstraction from the chalk aquifer so that chalk springs and headwaters run freely, as they would under natural conditions, every year, whatever the weather. "

" Lack of water in the environment now let alone in the future with an expanded population and climate change impacts. "

" The cost of arable land for development competing with woodland creation. "

" Achieving an acceptable level of ecosystem/ environmental well-being without much greater spending. "

" Implementing the changes needed for truly sustainable use and environment. "

Increased demand

" The funding and delivery of additional water capacity to support housing and economic development in growth locations. "

" That supply needs and the impacts of not meeting them are not properly understood. "

" Enough capacity for the demand coming with all the new homeowners. "

" Difficult to predict future usage and growth. Increasing efficiency of use. "

" Growth – supporting development while protecting environment. "

Beaver dam, Spains Hall Estate, Essex

" Population growth and not limiting it. "

" Climate change and its effect on demand forecasting demand and scarcity – uncontrolled use and growth understanding how higher temperatures and public drinking water affect groundwater and water demand. "

Water for energy

" Securing water rights for future power/hydrogen plant, without knowing where these plants will be and who will own them. "

Key messages...

Through the WRE planning process there has been further refinement of supply and demand estimates to meet future needs. Looking to 2050, we have estimated that up to an additional 2,267 Ml/d of water could be needed – up to a 98% increase in current demand. Several key assumptions have been made to estimate the possible impacts of climate change, water scarcity, demand growth (from population increase, agri-food, and energy), and enhanced environmental need. In-depth engagement with members and stakeholders has supported our view of the scale of future resource pressures, with one clear agreement: continuing with the status quo is not an option and better management of water is needed now.

6. OUR APPROACH

6.1 WRE delivery process

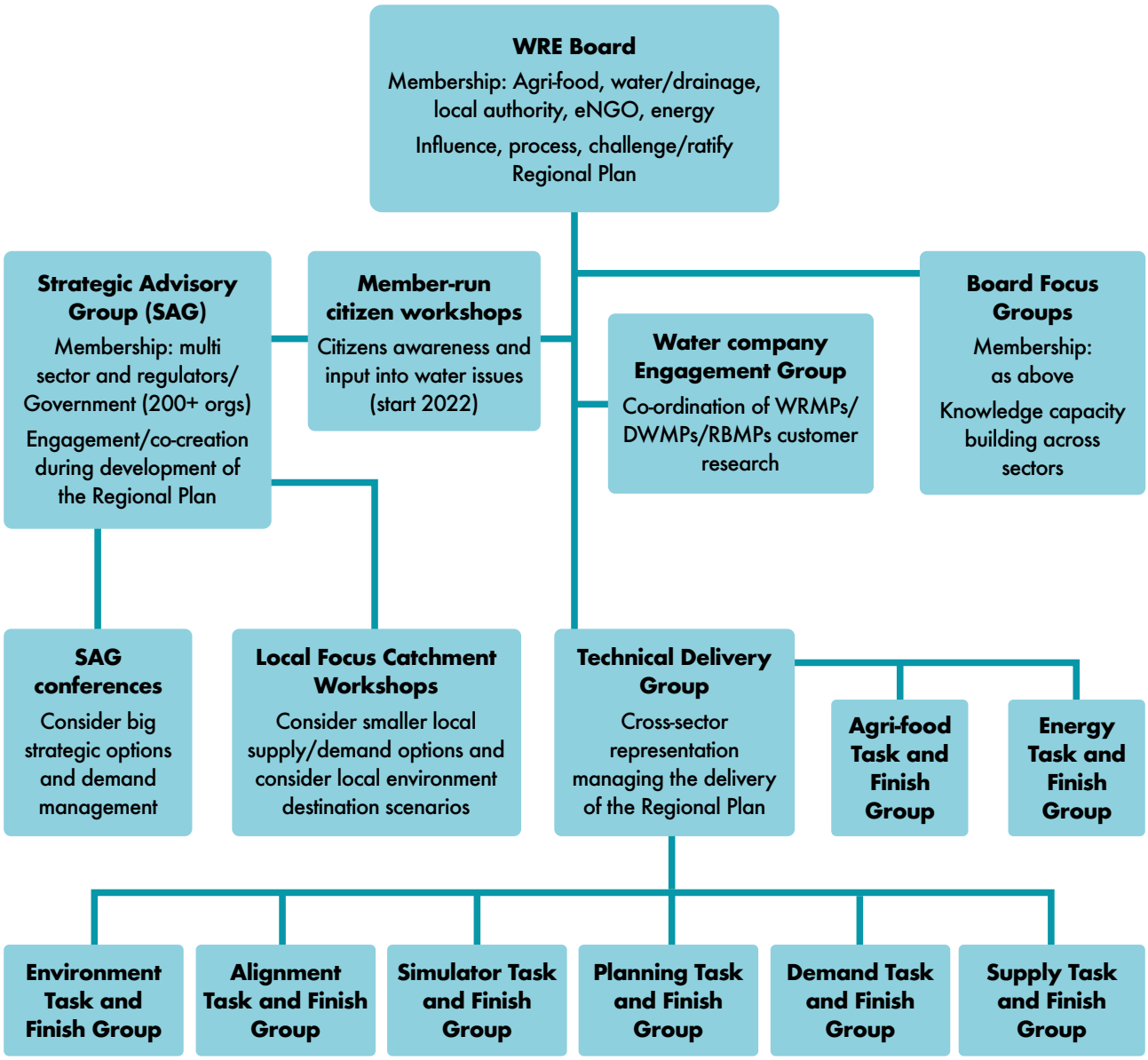
To enable us to respond to the water security challenges the region faces, we require best value investment decisions on strategic water resource solutions using a tailored set of tools to outline the planning problem and explore the potential trade-offs. To this end, a regional water resource model or 'simulator' has been created to replicate water management across the region, understand the problem under different scenarios, and test how future options perform. Our regional planning process has been designed around co-creation and collaborative decision making, by embedding stakeholders in the process and capturing their preferences throughout.

WRE is governed as a regional group to deliver our overall 'ethos' for the development of our Regional Plan as one of co-creation, engagement, and collective decision-making, rather than more traditional creation and consultation.

We are different to other regional groups and operate as a Company Limited by Guarantee and a not-for-profit membership organisation. Currently, more than 180 organisations from across the region and beyond are members of WRE (200+ organisations are involved in WRE including regulators and other Government organisations). Many of these members and stakeholders have been actively engaged in the process of co-creating the Regional Plan, sending a clear message that water is not an issue which can, or should be, solved by one group of water users alone. This is a regional issue, and one which will only be solved through strong and enduring regional collaboration.

WRE planning conference

Figure 6.1: WRE Governance



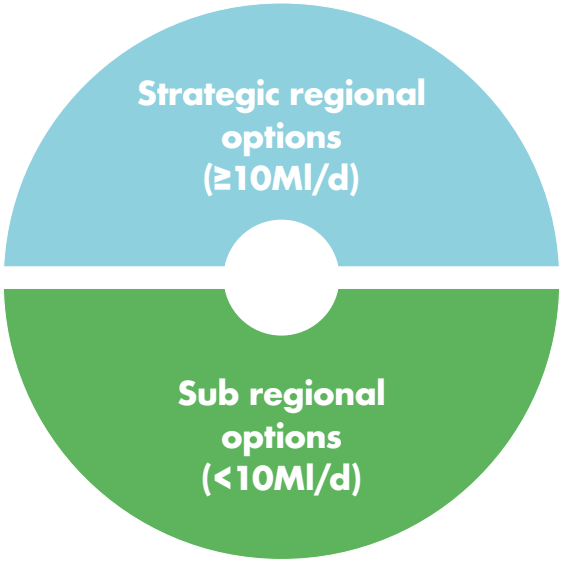
To date, we have co-ordinated the outputs of the sub-regional planning processes and the associated working groups through a series of Planning Conferences and local catchment focus workshops for stakeholders in each area. This has enabled us to discuss a range of proposed solutions, understand challenges and opportunities and seek consensus on the portfolio of strategic options and local catchment-based opportunities, which will go forward in our Regional Plan. We will continue to engage in this manner with stakeholders and members alike.

Technical workstreams have been scoped, developed and delivered through Task & Finish Groups, with oversight from the Technical Delivery Group (TDG).

Detailed methodologies for each workstream contributing to our Regional Plan are outlined in our **Method Statement**, which we published in August 2020.

Our approach to developing options in response to the regional planning challenges we face to 2050 is to separate them by scale of opportunity:

- **Strategic regional scale options**, with a water resource benefit greater than 10 Ml/d. These options would most likely be delivered by water companies through their statutory WRMP or SRO delivery mechanisms. These options have undergone cost, carbon and environmental appraisal through our integrated environmental assessment (IEA) approach (outlined in Section 6.3) designed to identify any statutory issues early in the planning process
- **Sub-regional scale options**, with a water resource benefit less than 10 Ml/d. These options require local knowledge and will be developed in discussion with members and stakeholders through local catchment focus workshops. Water companies will be developing PWS sub-regional options to include in their own WRMPs, which reinforces the need for alignment at a regional scale.



6.2 Addressing the planning challenge

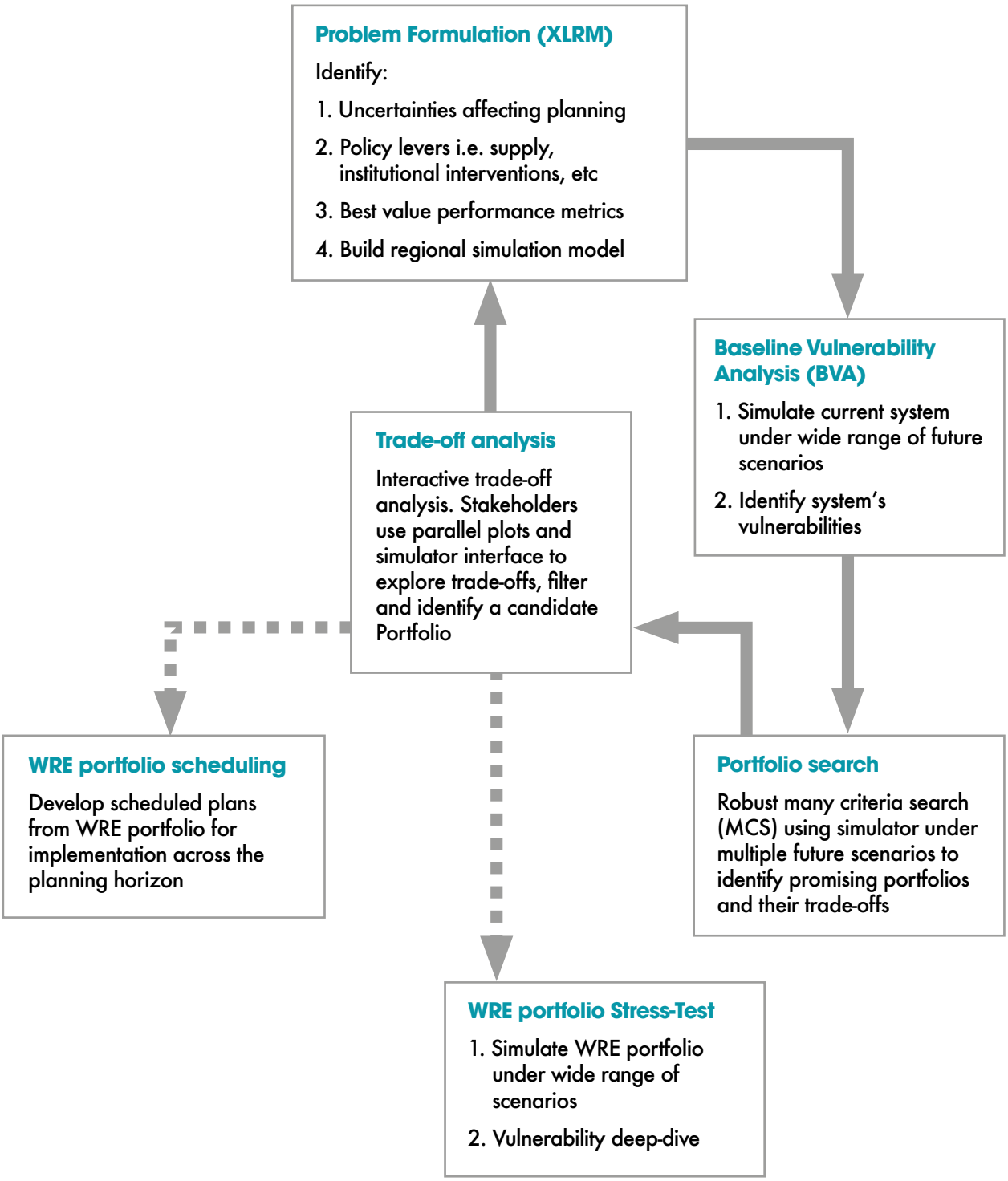
Our best value Regional Plan aims to drive towards a water resource position that balances the economic growth, PWS need and environmental requirements in a holistic way.

Our approach has been to explore the complex planning challenge we face through use of a decision making under uncertainty framework known as Multi-Objective Robust Decision Making (MO-RDM). This framework involves using a bespoke regional simulator model driven by a variety of planning scenarios to build a regional representation of what the future could look like for WRE from a supply and demand perspective.

The conceptual approach is illustrated in Figure 6.2. Fundamental to this approach is the need to identify:

- Sets of key properties describing the future state that affects the water 'system performance' such as climate change impacts on water availability.
- Characterisation of 'system performance' – that is, identifying the sets of metrics that allow stakeholders to decide how well 'the system' is performing (in other words, measures of interest to stakeholders).

Figure 6.2: Our decision-making under uncertainty framework



For a 'system' that includes a given set of active supply options, relevant properties such as population growth, the results of leakage and demand management policies and interventions, weather (as affected by climate change) and choice of 'environmental destination' are taken into account. Further detail is provided in Chapter 5.

Planning scenarios applied

Combinations of these possible future states are linked together to construct 12 core planning scenarios covering a 'medium' climate change scenario (reflected in RCP 8.5)[13] with two distinct hydrological scenarios (each with some 400 individual sets of river flows), six demand scenarios (covering a range of possible demand profiles, including local authority planned growth with different levels of demand management) and three environmental destination scenarios (BAU+, ADAPT and ENHANCE). It is important to note that in our approach, leakage and demand management is built into the planning scenarios to reflect integrated PWS demand scenarios.

System response

For a given set of active supply options a regional simulator is used to derive the system response in the various planning scenarios. A search tool, developed through WRE by the University of Manchester called 'Polyvis', then uses these planning scenarios to optimise and select a number of strategic regional scale supply option portfolios (a range of supply options developed to address supply and -demand deficits) and, using the regional simulator, evaluate their performance against the series of metrics.

Best value performance metrics

To achieve the optimisation, a subset of the metrics ('search' metrics) has been selected to represent key aspects of system performance. These search metrics have been developed to help us solve the planning challenge. Polyvis then identifies sets of candidate optimal portfolios. They are 'candidate optimal' in the sense that it is not possible within a given portfolio to improve the performance in one of these 'search' metrics without degrading the performance in another metric, thus presenting a compromise or trade-off. Those metrics currently used for optimisation in the regional simulator include the following:

- Supply and supply deficits for energy and agricultural abstraction licence holders
- Export capacity to WRSE region
- Capital and operating cost of supply options
- Levels of service and reliability of public water supply

A number of metrics are also tracked, but not optimised, in the regional simulator. Tracked metrics help us to identify a best value plan and need to be explored in early 2022 with our stakeholders and members. Metrics tracked at catchment level will also allow us to draw links from the strategic, regionally optimised portfolio, to catchment solutions and include:

- Capital and operating carbon footprint of supply options
- Environmental flow indicators at a catchment level
- Environmental effects of construction and operation of the strategic supply options – positive and negative scores against strategic environmental assessment (SEA) objectives
- Natural environment derived services and benefits (Natural Capital approach)
- Biodiversity units requiring replacement (through Biodiversity Net Gain)

We discuss how our planning process makes use of the candidate optimal portfolios in Section 6.4.

[13] *A high-emissions scenario frequently referred to as "business as usual", suggesting that this is a likely outcome if society does not make concerted efforts to cut greenhouse gas emissions.*

Below: River West Glen

6.3 Strategic options

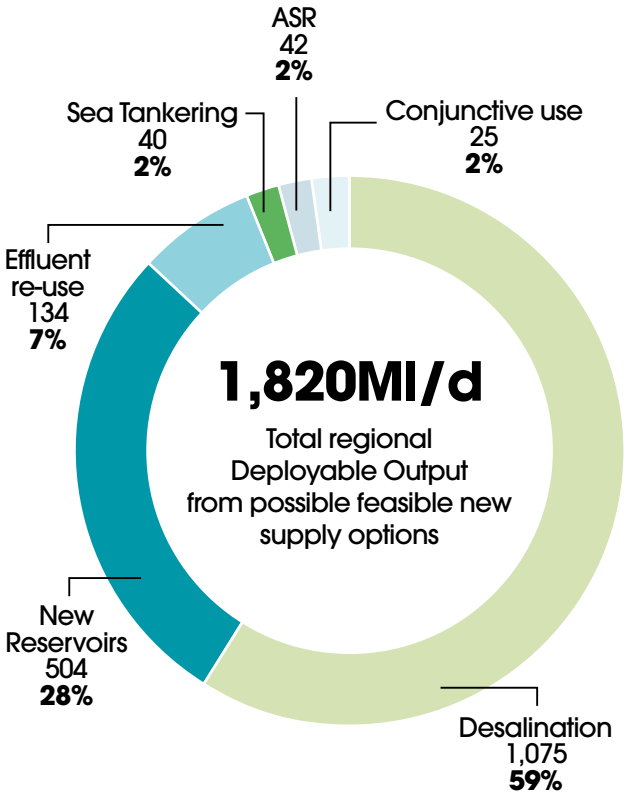
A number of strategic supply options have been identified and developed to a sufficient level of detail to be considered 'feasible' options for the purposes of water resources planning. Further detail on the development of these options can be found in the **Planning Conference Briefing Pack**. Demand-side management options have been built into the six demand scenarios adopted in the regional simulator; three represent variations of possible growth, leakage and demand measure implementation (high, medium and low), one reflects a high level of water efficiency, and two are variations of the above.

Several different supply option types were identified as feasible through a screening process to help address the regional deficits in supply-demand balance. These include three SROs with the potential to contribute around 250 Ml/d of new water resource benefit[14] currently in development by Anglian Water, Affinity Water and Cambridge Water.

Involvement in Water Partnerships
WRE is involved in the collaborative, multi-sector design and development of the SROs through the South Lincolnshire Water Partnership (SLWP) and Fens Water Partnership (FWP). These partnership groups comprise the water company project sponsors, the EA, Natural England, Lead Local Flood Authorities, Internal Drainage Boards, National Farmers Union and other water-related local interest groups.

A total of 38 feasible strategic supply options, each with the capacity to contribute more than 10 Ml/d to supply, have been integrated into the regional simulator for optimisation using the multi-criteria search algorithm. From these, the simulator will select candidate optimal portfolios of supply options which have been optimised against the search metrics to address the regional planning problem, as described in Section 6.2.

Figure 6.3: Feasible strategic supply options



The capital and operating costs of each supply option have been estimated to inform the selection of supply option portfolios in the regional simulator, represented as total cost each year. Capital and operating carbon has also been estimated to inform decision making, but is not yet integrated in the simulator.

In addition to estimating the capital and operating costs and carbon of the feasible strategic options, they have also been assessed using our Integrated Environmental Assessment (IEA) approach, which was developed specifically for our Regional Plan. Our **Method Statement** outlines this approach in more detail.

[14] *250 Ml/d represents the deployable output of the schemes as put forward to RAPID at Gate 1.*

Woodbridge, Suffolk

Integrated environmental assessment (IEA)

The IEA provides information on the likely positive and negative environmental consequences of implementing alternative options. It is designed to provide relevant environmental information at key steps of the plan development process, enabling better decision-making.

The IEA approach has been developed to deliver an effective, consistent, and efficient process across the six environmental assessment processes, set out across the EA's National Planning Policy Framework and Water Resource Planning Guidelines. The IEA workstream is responsible for delivering the findings – and other compliance requirements – related to the:

- Strategic Environmental Assessment (SEA).
- Habitats Regulations Assessment (HRA).
- Water Framework Directive (WFD) assessment.
- Invasive Non-Native Species (INNS) risk assessment.
- Biodiversity Net Gain (BNG) assessment.
- Natural Capital Assessment via Ecosystem Services (NCA via ESS) assessment.

The IEA has already influenced the regional plan development process through a high-level environmental screening of the unconstrained regional supply options. This removed some options – because of unacceptable environmental risks – and provided advice in developing the alternativce supply options available in the simulator. The remaining feasible options were put through a detailed assessment with the findings available to Planning Conference delegates in both August and October, alongside initial assessments of the environmental consequences of the environmental destination scenarios and a selection of demand management options.

IEA metrics have been developed so they could be tracked in the simulator, presenting the predicted environmental consequences of each portfolio of supply options. These metrics include:

1. **Positive environmental effects of constructing** the portfolio's supply options (using the SEA).
2. **Negative environmental effects of constructing** the portfolio's supply options (using the SEA).
3. **Positive environmental effects of operating** the portfolio's supply options (using the SEA).
4. **Negative environmental effects of operating** the portfolio's supply options (using the SEA).
5. **Biodiversity units requiring replacement**, indicating the scale of habitat replacement activity that could be needed if the selected supply options were constructed (using the Defra Biodiversity Net Gain Tool).
6. **Monetised Ecosystem Services (£/year)**, indicating the scale of total annual costs associated with each portfolio of supply options, related to positive/negative impacts across: carbon sequestration, natural hazard management, air pollution management, recreation and amenity, and food production (using the IEA's Natural Capital Approach).

Tracking environmental performance as metrics enables the environment to influence our decision-making, helping us to track performance and compare alternatives supply options at a strategic, regional level and contribute to a best environmental plan.

6.4 Decision-making process

The choices and trade-offs relating to portfolios and their performance under scenarios are presented to our members and stakeholders through parallel plots on the Polyvis platform as illustrated in Figure 6.4. Polyvis simplifies the multi-dimensional trade-off space to provide a useful tool to support the decision-making of supply option portfolios, through the presentation of option performance against our key search and tracked metrics. Further information on this tool and how it facilitates decision making under uncertainty is available in Section 8 and 9 of the **Planning Conference Briefing Pack** and an **introductory video**.

Figure 6.4: Portfolio performance against metrics as parallel plots to support decision making

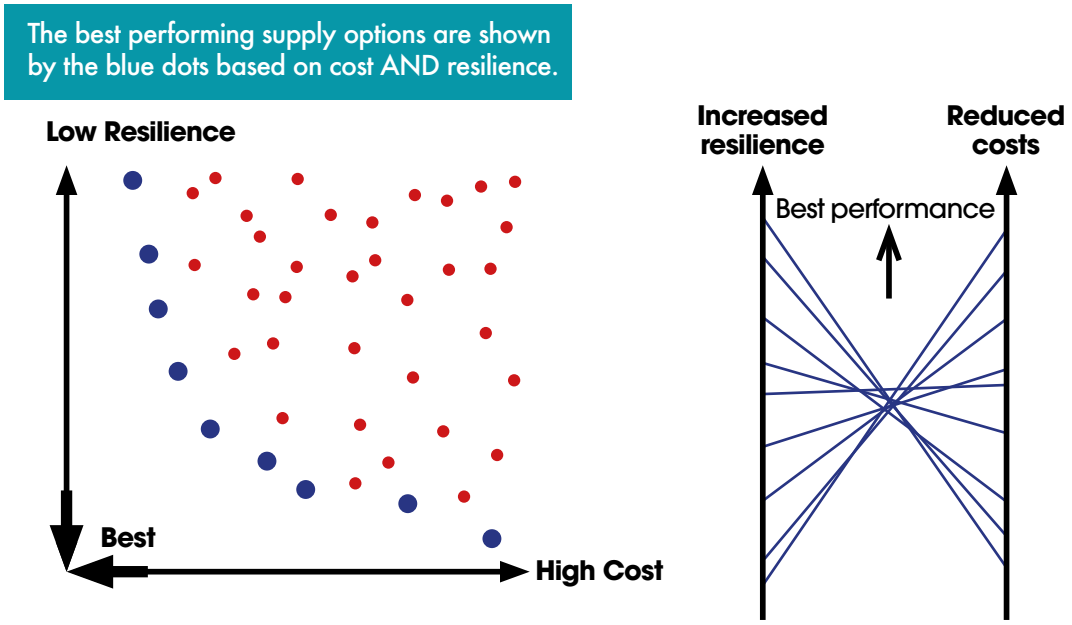
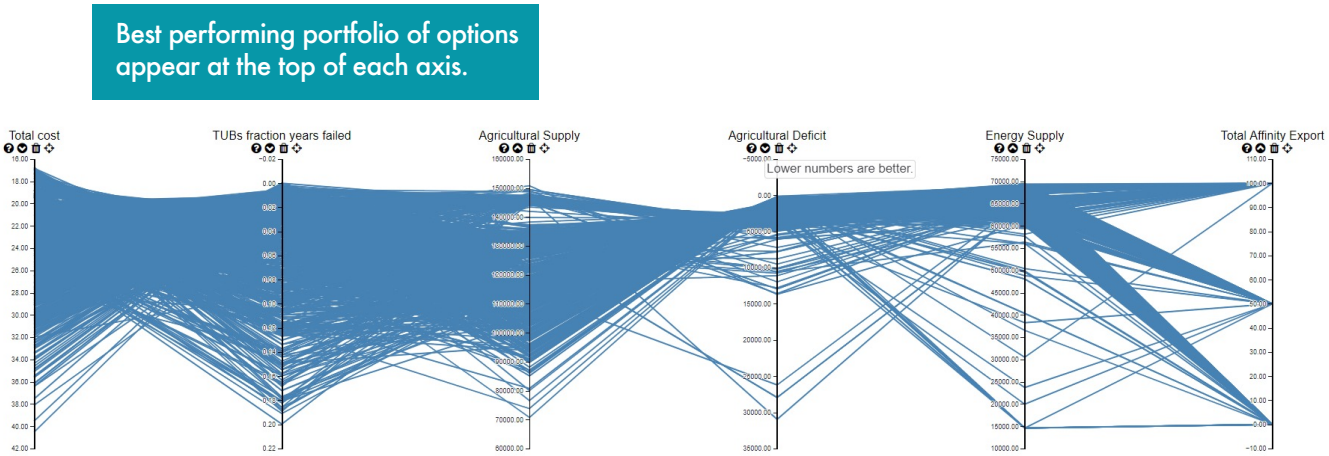


Figure 6.5: Screenshot of Polyvis showing different metrics (total cost, agricultural supply, etc.).



Source: University of Manchester, 2021

Our decision support tool, brought to life through Polyvis, consolidates numerous complex analytical outputs against our best value search and tracked metrics, to illustrate performance and inform discussions.

We have used our Polyvis support tool to make preliminary decisions since August 2021 and inform the regional reconciliation process with the four other regional groups. These preliminary decisions have served the purpose of testing possible outcomes from each region, to enable discussion around regional self-sufficiency of water and the possible need for inter-regional water transfers.

Scheduling option delivery

The regional simulator provides a view of the planning problem in 2050 only. In order to build a more granular understanding of the regional supply-demand balance across the planning horizon, we have developed a regional Economics of Balancing Supply and Demand (EBSD) model (as historically used by individual water companies to develop their WRMPs). The EBSD model complements the regional simulator by providing the scheduling requirements of options. EBSD takes into account the timing of option availability, utilisation capacity of each option and ability for combinations of options to address the deficit.

To date, we have used the regional EBSD model to validate and schedule the strategic supply options being most frequently selected in the simulator, also known as 'low-regret options'. Further detail on these options is provided in Chapter 7.

The EBSD scheduling also exposes where there are deficits which cannot be met by the strategic supply options, which will help identify sub-regional, local catchment options (less than 10Ml/d) to plug the short- and medium-term gaps in supply. This local level option development will commence in early 2022 in discussion with our stakeholders and members.

Working at different scales

Regional scale modelling, and our associated decision support tools are providing greater clarity around the need for large strategic supply solutions and widespread approaches to demand management. However, as the EBSD scheduling reveals, these strategic schemes are only part of the overall solution. Water demand hotspots and availability, and the specific needs of the environment can be hyper-local. As we begin to explore trade-offs at a more local level we are likely to see where smaller and varied schemes and innovations will be needed to fill the existing and emerging gaps in the planning challenge that large strategic schemes cannot fill.

More local challenges may relate to critical peak water demands supporting food and energy security, specific flow or groundwater regimes needed to protect the region's most important rivers and water-dependent habitats, or drought resilience for businesses and aquatic ecosystems. As WRE starts to focus on smaller geographies there is also a need to understand local water-related planning challenges beyond just water availability, and therefore beyond the thematic coverage of the regional simulator. These might include water quality challenges, flood risk, and land use change alongside developing nature recovery strategies.

In addition, there is a recognised gap between the timescales on which strategic infrastructure can be delivered and the need in the coming few years, and now, for measures to support those localities within the region which are already experiencing water security challenges. It is intended that WRE's more local focus will enable us to work closely with our partners to identify other measures and solutions which could bridge this gap and add to the benefits delivered by the longer term actions promoted in the regional plan. WRE can play a role in facilitating the generation of evidence and promotion of actions at an appropriate scale that leads to improved deliverability and longer term sustainability. For example, shared storage systems, sub-catchment level investigations and monitoring programmes, integration of evidence to address wider challenges beyond those faced by any one group or individual.

The scale of our work in smaller geographies already varies depending on the problem being addressed and the partners we collaborate with. The Norfolk Water Strategy programme is operating at a county level, examining the benefits of and possible funding mechanisms for the implementation of Nature based solutions at scale; as a partner in the Future Fens: Integrated Adaptation programme WRE is supporting adaptation to climate change through transformational change in the way water is managed at a landscape scale; the Water for Tomorrow project is essentially trialling the approaches and tools used at the regional level to develop catchment level plans; our work supporting the development of strategic reservoir systems seeks to ensure work at the scheme level results in multi-sector beneficiaries; and of course we continue to seek out and support business or site-level exemplar projects in integrated water management that demonstrate the art of the possible.

We know that we're not starting from scratch and we have been collating examples of local catchment work ongoing and planned from amongst WRE's many members and stakeholders. These will all contribute in some way – whether to solving supply and demand issues directly, or supporting the delivery of an overarching regional

Sunrise over the River Orwell near Ipswich, Suffolk

environmental vision. The independence and regional viewpoint of WRE allows us to identify where developing plans could be adapted so that they contribute to wider strategies, and act as a facilitator where opportunities for collaboration in a locality cannot be missed. It's in this area that the benefits of working across sectors including energy, agriculture and land management and public water supply can be realised.

WRE's focus will be to ensure that work in smaller geographies takes place in the context of the regional plan and the developing strategic schemes. As our understanding of catchment challenges and solutions builds, our regional level modelling and decision-making will be improved. We will seek to create a line of sight between local and regional actions so that WRE promotes both a top down and bottom up contribution to developing and delivering shared goals.

It is important to recognise however, that WRE cannot fully develop plans or implement solutions at any scale alone. While smaller supply and demand schemes (<10Ml/d) of direct relevance to public water supply have a clear planning and delivery mechanism via WRMPs and water company business plans, there is no direct equivalent for developing solutions required by other water using sectors and the environment over longer timeframes. WRE's members, stakeholders and relevant businesses and individuals will need to take ownership of actions and their delivery within their own plans, but with support from WRE via the regional plan as it iterates to 2023 and beyond.

6.5 Other approaches/supporting projects

The WRE vision is supported by key projects that will hopefully have an influence on, and are influenced by, the overall Regional Plan. These projects are fundamental in pioneering innovative water management approaches, trialling new ways of working, and forging new partnerships. For information on these projects, please refer to Section 8.3.

Key messages...

Our approach attempts to put complex technical workstreams into a transparent decision support tool to aid discussions with our members and stakeholders over likely trade-offs to meet the likely water needs of the region.

7. EMERGING REGIONAL PLAN

7.1 Emerging strategic option preferences

Over the past 12 months, we have engaged with our members through Technical Delivery Group (TDG), Task and Finish Groups and Stakeholder Advisory Group (SAG) forums, workshops, Planning Conferences and Board meetings to establish an appropriate basis for formulating the planning problem. This included assumptions on leakage and PCC, and gauging insights and initial views on the emerging preferences shaping this emerging regional plan. Details of our planning problem formulation approach can be found in our **Method Statement** and **Planning Conference Briefing Pack**.

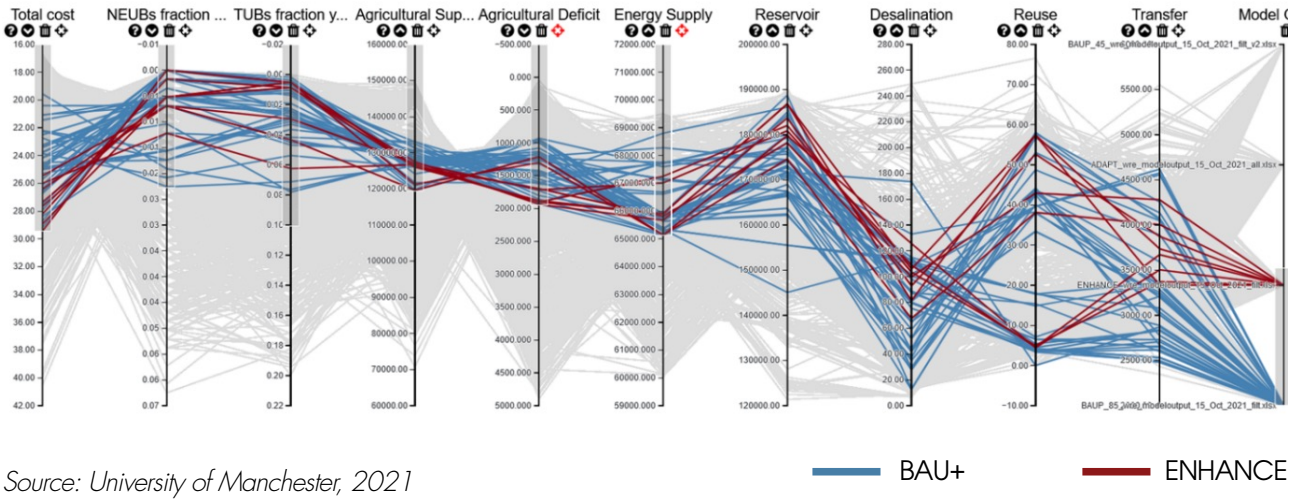
Key discussions have included:

- Our approach to the EA's environmental destination scenarios and the trade-offs associated with the development of a regionally appropriate WRE scenario.
- Preferences for the types and portfolios of options required to address the regional supply-demand deficit including the level of demand-side options.
- The appetite and capacity to export water outside of our region (existing and additional).

In August 2021, we were required to provide starting positions for each of these to participate in the regional reconciliation process with the four other regional groups. To provide this, we undertook an initial interpretation within the WRE region of the EA's environmental destination scenarios. This allowed a strategic exploration, informed in part by the Polyvis tool, of candidate optimal portfolios and export/import positions for each of several alternative environmental destination futures. Polyvis provides a simple means to visualise the trade-offs in 'search metrics' for the performance of the candidate portfolios and the consequences for 'tracked metrics' (see Figure 7.1).

In the example of the polyvis tool illustrated in Figure 7.1, the BAU+ and ENHANCE environmental destination scenarios have been selected as model outputs. The tracked metrics on the left hand side have been filtered along their axes to demonstrate the impact of this filtering on the selection of supply option types on the right hand side. In this example, to meet all six of the tracked metric filter selections, larger capacity reservoirs are selected more frequently to meet ENHANCE environmental destination requirements than for BAU+.

Figure 7.1: Example Polyvis parallel plot



Source: University of Manchester, 2021

Figure 7.1 illustrates a parallel plot filtering of candidate optimal portfolios using search metrics. The tracked metrics displayed show the extent of use of supply options (for example, reservoirs, 'next generation' desalination plants, water re-use schemes and water transfers).

Following discussion with our TDG and with the agreement of our Board, we submitted the following initial positions for regional reconciliation:

- **Environmental destination:** Business as usual plus (BAU+), as outlined in Section 5.4.
- **Strategic option types:** A portfolio of options comprising reservoirs, 'next generation' desalination, effluent re-use and aquifer storage and recovery schemes.
- **Water export from the region:** No additional export to outside the WRE region.

Along with the other regional groups, we have explored this initial position since September to stress-test the outcomes. Stress-testing provides confidence in the plan by understanding how changing assumptions impact the portfolio of options. It also provides valuable information about the key sensitivities and the impacts of changing scenarios.

The latest stage of the regional reconciliation process has explored the potential benefits and issues associated with a lower export from Grafham Water to Affinity Water. This is currently up to 85 Ml/d and a scenario of reducing this by 40 Ml/d was assessed.

There are considerable benefits to the WRE region in lowering this export in terms of reduced costs for additional supply options, as well as in several best value planning metrics, including environmental impacts.

Essentially, Grafham Water is ideally placed to serve expected growth in the Oxford to Cambridge area and using this within the region would avoid the need to bring water in from elsewhere, ultimately potentially supported by 'next generation' desalination. By this we mean desalination plabnts run off 100% renewable energy with brine water re-use.

Overall, however, reducing the export to Affinity Water creates a number of negative impacts for WRSE, and the costs of replacing the water depends on the final scheme selection within WRSE and ultimately the marginal cost of the development of new sources within the combined Thames and Affinity Water system in the 2040-2050 period.

In addition, there are legislative and contractual implications of altering the export that would need to be resolved.

Therefore, at this point the regional reconciliation process has concluded that for the longer term (post 2040) needs, it is prudent to assume that the existing export to the WRSE region to continue. This will be reviewed in the next regional reconciliation process.

A further iteration of this process was completed in December 2021, with sign off from each of the regional planning group's Boards or equivalent governance group. The next step is the first round of consultation on each region's emerging regional plan.

It is possible that our planning may need adjusting depending on future outcomes within the regional reconciliation process as the five regional plans are developed further. A further, final reconciliation stage is expected in April 2022.

The early position was further developed and explored to inform discussions at our Planning Conferences. Key strategic positions and findings established through this engagement include:

- Introducing the reverse trade from Grafham Water to Affinity Water (by which WRE retains 40 Ml/d of the existing trade lowering net export to Affinity to 45 Ml/d) reduces portfolio option costs.
- Planning for more ambitious environmental destination scenarios such as ENHANCE increases portfolio costs, although good multi-sector performance can nonetheless be achieved.
- Under all scenarios, storage is increased.
- All portfolios include desalination.
- Increased desalination (and re-use) compensates for more exports and adopting more ambitious environmental destination scenarios.

Together, these have led to the emerging regional plan, including the following strategic option components:

- Demand management.
- Supply side options found in most portfolio selections with strong performance against our search metrics.
    - New reservoirs.
    - Desalination.
    - Aquifer Storage and Recovery (ASR).
    - Effluent re-use.

River Brett, Hadleigh, Suffolk

7.2 Low-regret option development

The primary focus of the portfolio assessment has been identifying portfolios that perform well under a wide range of scenarios for 2050. It is also necessary to consider how best to develop from the current position towards the selected 2050 position. The different supply options have differing lead times for design, planning and implementation – many years in some cases. The timescale for developing and implementing an option is an important consideration within adaptive planning. Therefore, we have assessed the optimal scheduling of supply options and demand measures using a regional economics of balancing supply and demand (EBSD) modelling approach to inform the trajectory of supply options and expose any deficits along the way.

To date, the regional EBSD model has been used to schedule the low-regret, strategic supply options and evaluate their performance for the three selected environmental destination scenarios (BAU+, ADAPT, ENHANCE). The modelling exercise highlights that these options go some way to solving the regional deficit, although transfers to improve regional connectivity would be required, but do not address the whole planning problem. It also highlights the criticality in the regional supply-demand balance for the phasing of options to help address the deficits caused by sustainability reductions on abstraction licences.

Given the evident pressing need and lead times involved in developing strategic options, there is an emphasis on progressing design feasibility work on options which feature in the majority of portfolios selected by the regional simulator and perform well against our search metrics. The optimisation of option portfolios in the regional simulator allows us to identify a sub-set of the many possible portfolios that solve the planning problem, and focus on those that are most frequently selected against our best value metrics to build confidence in their capacity to solve part or all of the planning problem.

7.3 Scheduling of our adaptive plan

To address the varied and uncertain water resource challenges, WRE's plan is adaptive and envisaged as being revisited periodically. There is much higher confidence in the changing physical, economic and social circumstances likely to be found in the early years of the plan than those in its later years. In addition, in later years the results of investigations, pilots and innovative development carried out in the early years will be known. Over the course of the remaining period of this planning cycle, we expect to identify key adaptation triggers for instigating the interventions informed by the EBSD, environmental ambition and non-PWS demand trajectory workstreams. Our current expectation is that the emerging plan will include intervention phasing as follows.

Demand-side strategy:

Now to 2025	2025 to 2030	2030 onwards
• Water company delivery (e.g. demand management such as PCC, leakage reduction) • Identification of multi-sector, non-household exemplars, and development of a collaborative strategy	• Significant focus on household and non-household water efficiency and demand management, particularly smart metering, leakage reduction • Innovation around tariffs • Focus on water sharing/trading opportunities using international learning • Delivery of multi-sector, non-household water efficiency approaches • Delivery of a long-term approach and trajectory	• Continued focus on water efficiency and delivery of a long-term approach

Supply-side strategy:

Now to 2025	2025 to 2030	2030 onwards
• Focus on immediate abstraction hotspots around chalk streams and the Broads • 'Next generation' desalination research and development • Strategic reservoir design and planning • Local infrastructure studies	• Strategic reservoir system construction • Intermediate solutions e.g. Anglian Water to Cambridge Water transfers • First re-use schemes and next generation desalination, linked to green hydrogen pilots • Aquifer storage and recover (ASR) pilot (Sherwood sandstone) • Local multi-sector infrastructure delivery (equal mix of green and grey?)* • Catchment investigations and planning (linked to environmental vision) • Development of further strategic storage options and potential transfers through Regional and National planning	• Strategic reservoir systems into supply • Wider re-use and next generation desalination options, including for public water supply? • ASR implementation • Wider green hydrogen implementation • Significant delivery of further multi-sector local infrastructure (more green than grey?) linked to catchment plans

** Green infrastructure refers to natural systems including forests, floodplains, wetlands and soils that provide additional benefits for human well-being, such as flood protection and climate regulation.*
Grey infrastructure refers to structures such as dams, seawalls, roads, pipes or water treatment plants.

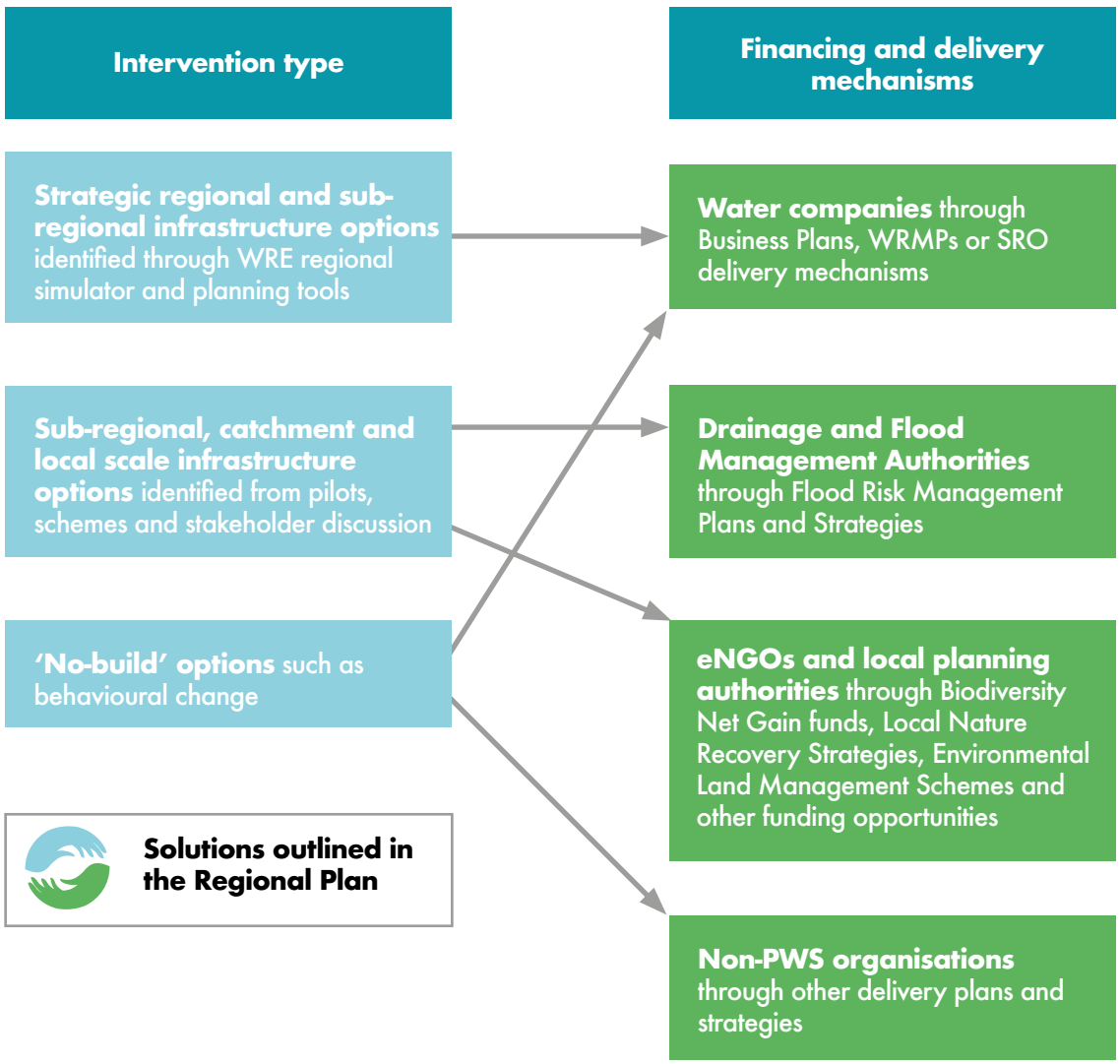
7.4 Financing the plan

The interventions identified in our emerging plan will require a collaborative effort to ensure they are financed and deliverable. Interventions with a core PWS benefit will need to be driven by water companies through their WRMPs, with other multi-sector water resource benefits requiring support from the EA, local planning authorities and other key players as indicated in Figure 7.2.

Further work is planned in 2022 to identify opportunities for cross-sector funding of catchment and local scale options as they are identified and developed.

River Bure in the Broads

Figure 7.2: Financing and delivering the regional plan



Cambridge Water/Anglian Water interim supply option collaboration case study

The additional demand generated through the further growth proposed in the Greater Cambridge Local Plan can be delivered through Cambridge Water's demand management plans in the short term; by lowering demand through reducing leakage and improving water efficiency in existing and new communities. Cambridge Water can ensure delivery with no additional environmental impact. However, Cambridge Water is facing reductions in their licenced capacity through the review of licences being proposed by the EA, to drive important environmental improvements across the region. This will mean that alternative supply options must be developed to continue to deliver the forecasted demand. Cambridge Water is currently developing short, mid and long-term options to address this.

Cambridge Water is progressing a significant strategic regional supply option with Anglian Water, which would supply both areas - the Fens Reservoir - which could be available by the mid-2030s. This is obviously a long term option, and in the short and mid-term Cambridge Water are working closely with Anglian Water to identify opportunities for transfers through their grid network or from Grafham Water. These opportunities could be available between 2025 and 2030, and hence the timing of licence reductions is of critical importance.

River Cam, Cambridge

Key messages...

Key discussions have been had over the past year including environmental destination, strategic option types (both supply and demand management), and the level of need for inter-regional water exporting/importing. The focus has been on identifying options that are "low regret" and able to be adaptive through a wide range of possible futures. All have their their strengths and weaknesses, but by focusing on 'best value' planning, options are emerging for various timescales including reservoir schemes, demand management, tariff reform, desalination, reuse, and leakage reductions.

River Cam, Cambridge

8. NEXT STEPS

Sheringham Coast

8.1 Informal consultation response on our emerging regional plan

In summary, with reference to the position nationally agreed across other regions and regulators, this January 2022 publication is:

- Signalling early sight of big issues and candidate solutions (including strategic water resource solutions included in the RAPID programme) to get initial feedback from stakeholders.
- Reporting outputs from inter-regional reconciliation and best value selection.
- A public document that regional groups are seeking views on.
- A step in an ongoing process of plan development. The revised plans expected in the autumn will inform whether individual strategic water resource solutions included in the RAPID programme will progress.

This January 2022 report is not:

- A statutory water resource management plan with associated data tables.
- A formal preferred plan.

We have adopted an iterative, co-creation process to develop our emerging regional plan involving all our members and wider stakeholders. The next stage in the process is for us to consult with those who have been involved to date, and to broaden this consultation out to a wider audience, including the general public.

Therefore, we would very much welcome your comments on this emerging regional plan. In particular, we would welcome your responses to the questions summarised below.

Question 1:
Have we gained a clear initial view of the problem of future water deficits across all sectors and the environment?

Question 2:
Are we taking the right approach to identify potential solutions to mitigate the challenge?

Question 3:
Does our emerging adaptive plan, including the immediate low-regret options such as reservoirs, look like it will help address the problem?

Question 4:
Are the technical methodologies, processes and decision support tools we have used robust and appropriate for the task?

Question 5:
Has our emerging regional plan been co-created in a fair, open and transparent process involving the right stakeholders and organisations?

Question 6:
Are there any areas where you feel WRE should be considering which are not currently reflected in our plan? What have we missed?

We would welcome your responses by no later than 28 Februrary 2022. Please use the contact details on page 6 of this document to submit your responses.

Consolidating the responses

We will consider all the responses to this consultation, which will feed into our Regional Plan. We will aim to publish a response to the comments we receive in April 2022, and also share this with the other regional planning groups to determine if there are common concerns for the members of all these groups to consider in the round.

In addition, we will use feedback from the most recent and future Planning Conferences and local catchment focus workshops to consider a range of smaller resource options, such as flood storage reservoirs, recreation lakes, canal and waterway restoration projects, and a wide range of nature-based solutions as well as considering some of the innovative demand side options eg water sequestration products. This will enable us to start work on a more detailed assessment process to understand how these options might be included in our Regional Plan.

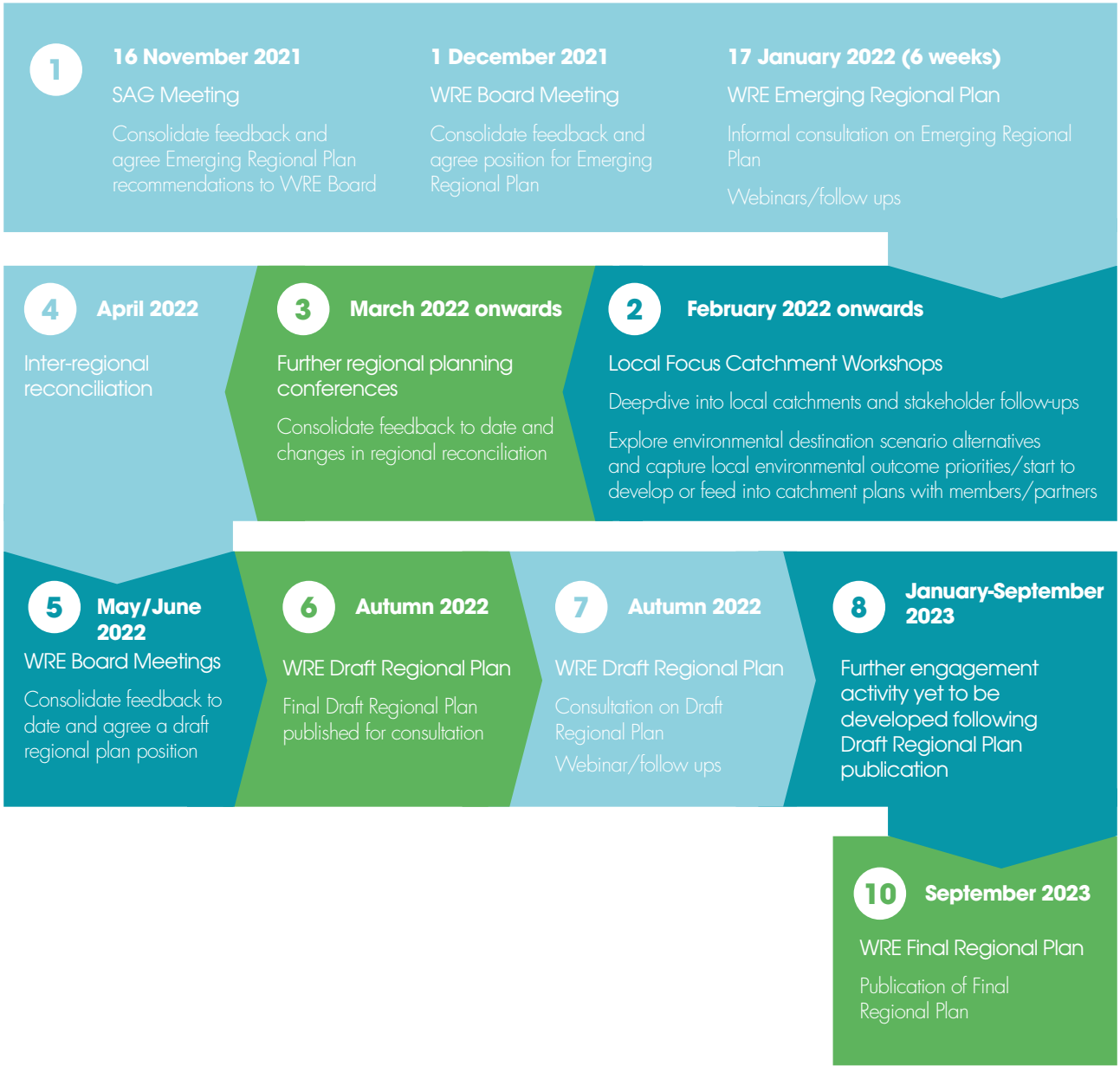
We believe that some of these smaller options will help to deliver a number of benefits to the agricultural sector, while also delivering local environmental restoration and enhancement.

We will continue to engage with stakeholders as we refine our regional plan, with the aim of publishing a draft for formal consultation in Autumn 2022.

8.2 Roadmap to our final plan in 2023

Our proposed next steps to develop our final plan in September 2023, include a number of key milestones over the coming months as illustrated in Figure 8.1 below.

Figure 8.1: Roadmap to our final plan (dates subject to change)



Once we have consolidated responses to this informal consultation, we will feedback both publicly and through engagement with our stakeholders and members at planning conferences and local focus workshops.

This will enable us to further challenge our proposals, address any gaps and build on local knowledge as we drill into the potential for local scale options. Our plan for immediate implementation over the next three months is outlined below.

Confirm confidence in 'low-regret' options through further simulator updates.

Scope further investigations to assess impacts of environmental destination scenarios.

Identify priority local catchment options and develop framework for catchment level planning.

Continue developing regional exemplars and pilots to illustrate the art of the possible.

Communicate policy issues that could hinder or aid water resources management.

Strategic regional options

Our initial draft Regional Plan uses an adaptive approach to progress the development of both supply and demand-side strategic options. In preparing for our draft plan in Autumn 2022, we propose that all options identified in Chapter 7 are further progressed to build confidence in their feasibility and deliverability within the required timeframes. WRE will be focusing on promoting the multi-sector aspects and opportunities of the reservoirs already discussed and is also active in the newly created Water Farmers group to bolster this.

Anglian Water, Affinity Water and Cambridge Water will continue to develop the Fens and South Lincolnshire Reservoir SROs and the Anglian to Affinity Transfer (A2AT) through RAPID's gated process in preparation for the next key milestone, Gate 2, in October 2022. This should provide greater confidence that three of the main supply options currently deemed as 'low regret' in our plan are deliverable.

Through WRE's involvement in the water partnerships involved in the ongoing development of the SRO schemes (the SLWP and FWP), we are able to help collaboratively shape and support the multi-sector outcomes and benefits of the schemes alongside other partnership organisations.

Sub-regional options

Over the next two years, water companies in the WRE region will continue to develop options at a sub-regional scale for delivery through their committed and emerging WRMPs. These options will predominantly comprise supply options providing less than 10 Ml/d of water resource benefit and further refinements to demand-side management options.

Catchment level planning

To supplement the water company developed supply options, in early 2022, we will look to hold the next stage of our local focus catchment workshops with stakeholders. In these sessions, we will look at the alternative environmental destination scenarios for each specific catchment, understand the direct impacts and opportunities, and then understand the implications of different levels of abstraction reduction for that catchment. We will also look to capture a set of prioritised environmental outcomes ranging from flow-based outcomes or other environmental considerations to protect and enhance the natural environment, enhance the natural environment. How the next state of catchment level planning fits into existing or developing plans will be a key question that we will address.

For the environmental destination, it is necessary ultimately to define the appropriate level of abstraction reduction required at appropriate spatial and temporal scales to deliver the chosen destination. This is with the aim to understand the various water demands (and their uncertainties), the challenges, opportunities, (such as local storage or supply options, improved trading or water sharing), costs and benefits. The potential socioeconomic consequences associated with the choice of geographically nuanced environmental destination and trajectory to achieve that at sub-regional level must also be understood. It is possible that some policy level changes beyond the scope of WRE may be identified which could contribute to improved water resource management. In some cases, there may be considerable uncertainty in the level of abstraction reductions needed to achieve an environmental outcome. In such cases, it may be appropriate to carry out investigations to reduce uncertainty (for example, within water companies' future WINEP programmes or conduct pilot trials of approaches or techniques).

A more detailed set of catchment workshops will allow our members and wider stakeholders to explore the vital trade-offs at the appropriate spatial scale and with a strategic backdrop in place. It will involve taking into account the projects and schemes already being progressed, along with potential additional interventions aimed at achieving alternative environmental outcomes. The objective of this work-stream will be to either produce or feed into existing or new catchment plans, in collaboration with existing catchment partnerships or other parties.

8.3 Other approaches/supporting projects

The supporting projects with which WRE is involved will continue to deliver over the next year and beyond. These projects will transfer knowledge and exemplar project examples into the regional planning process for wider regional dissemination and inspiration. A selection of these projects and their next steps are summarised below.

Water for Tomorrow (WfT)

Interreg funded: WRE is leading the development of a technical model and decision-making tools to:

- Understand water availability under different levels of climate change and growth.
- Identify the options to address water scarcity in the catchment: for example, if and where new agricultural reservoirs could be built.
- Understand the trade-offs that would need to be made for each set of options, for example, cost vs reliability.
- Develop and trial a catchment management system to better manage water within a catchment.

The key focus of WfT is on the Broadlands Rivers and its sub-catchments. Once the WfT project reaches its conclusion in March 2023 it is hoped that the novel catchment management systems are rolled out in catchments across the WRE region.

Systematic Conservation Planning (SCP)

Natural capital planning: The final output from the SCP process has been released, identifying priority areas across the WRE region where actions can take place to achieve natural capital objectives outlined by our members and stakeholders. This output is designed to inform on-the-ground action delivered by government bodies, environmental organisations, farmers, local communities, volunteer groups, the private sector and any other person or organisation that feels they can contribute.

It is important to note the output is not statutory and has no legal status.

The output can be used as a tool to help target natural capital actions.

Thetford Forest

Norfolk Water Strategy Programme

Nature based solutions (NBS): This work aims to create a long-term investable programme of NBS, delivered at scale, that can attract large scale funding to help address water security challenges. This will support the regional plan technically by investigating:

- Where, which and by how much NBS can enable increases in aquifer storage, flows and/or storage in the landscape.
- The quantum of NBS interventions needed to make a difference on a catchment scale.
- Whether NBS could be used as a local or large scale catchment alternative to some traditional solutions in Norfolk.
- Where the use of NBS can complement, support or mitigate the trade-offs with traditional infrastructure.

Next steps are a consultation on the programme as a whole to follow in the first few months of 2022.

Chalk Streams Protection

Intervention research: We are reviewing approaches to improve the resilience of chalk stream catchments, taking a wider view than "simply" reducing abstraction. Joining with others to form a land and water planning management partnership in the River Granta catchment in Cambridge, we are considering opportunities for alternative land stewardship and land-use change.

We are looking to understand the impact of different interventions on flow and quality in the river, including the provision of further storage higher up in catchments (for example, through floodplain reconnection, the creation of wetlands or recharge basins) changing agricultural practice and nature-based solutions. This work could directly inform the types of interventions which could qualify for payment under the Defra's Environmental Land Management (ELM) schemes, so we are considering an application for a test and trial grant.

Future Fens

Integrated adaptation: A Taskforce has been set up and knowledge pooled through a series of visioning and mapping workshops. The Taskforce's origins lie in close collaboration with Fenland District Council and the local community to consider options for the regeneration of the Fenland town of Wisbech, including the potential for a new climate resilient Garden Town. A knowledge sharing field trip to the Netherlands took place following the application of Defra's award-winning approach to flood-risk modelling (TRICO). This is a step-change in innovative modelling, long-term integrated planning, and a wider learning opportunity to incorporate into the Future Fens Direct funding from the Dutch Government followed for a pilot scheme. This work concluded that a technical solution could be provided to ensure future resilience to climate change.

Financing multi-sector infrastructure

New funding models: CEPA and Agilia were challenged with producing research and evidence (both quantitative and qualitative) for how a multi-sector financing approach could but implemented as the policy arguments are already well known and supported. A report was produced in December 2021 that:

- Identifies relevant aspects and demonstrates understanding of the existing legal and regulatory frameworks related to multi-sector investments, including water companies' statutory functions and the water regulators' statutory duties, and explains their implications for a multi-sector investment.
- Includes a recommendation for a viable commercial and legal model for a multi-stakeholder reservoir systems.
- Identifies barriers and risks and proposes any policy or regulatory changes that would be needed to enable the model to operate successfully.

Cost benefit analysis

Supporting decision making: Water Resources East has commissioned HR Wallingford, Wood consultants, and PJM Economics to develop a Cost Benefit Analysis (CBA) framework to support decision making in water resource planning. This is to achieve WRE's environmental ambition and support decisions on sustainable abstraction scenarios for incorporation into the Regional Plan.

The CBA framework considers monetary, non-monetary, and qualitative metrics and will capture the performance of different interventions against these metrics. Overall, the intention of the CBA is to avoid unintended consequences and maximise opportunities by, for example, developing strategic options that may allow companies to substantially reduce abstractions in more environmentally sensitive areas.

Energy Project

Water/Energy nexus: The University of Manchester, WRE, and the Joint Environmental Programme have commissioned a study to determine the significance of future power sector water use in the UK and the regulatory and planning changes needed to secure a more efficient, resilient, and adaptable water and energy resource system. This is against the backdrop of nation-wide Net Zero commitments, a push for decarbonisation, and the projected water resource deficits in England.

The study aims to provide the evidence needed for water regulators and policy makers in the UK to alter the current water regulations and planning frameworks to consider future energy-water linkages. This report is intended to motivate future work in this area and to identify the eventual scope of future work.

Report aims:

1. Discuss issues and opportunities for accommodating potentially higher future UK power sector water demands.
2. Identify potential future water deficits in the East of England under selected high power sector water use scenarios.
3. Propose a new integrated water-energy model and discuss its ability to help estimate, in more detail than the current study, the potential impacts on the water and energy sectors of higher future power sector water demands.

We will continue to work through our members' exemplar projects to learn and progress innovative ways of working to manage water to provide multiple benefits with a particular focus on nature-based solutions.

Golf / sporting venue demand management project

Environmental Solutions International has been working with the 17 English and Welsh water companies to identify irrigation consumption in the turf grass sector, engage with the National Associations, and create the framework to help leisure facility operators reduce water consumption and transition towards sustainable sources.

Outcomes:

1. The Leisure Association Water Charter

A public commitment from the leisure association representative bodies to engage with the water sector to find ways to improve sustainability and reduce demand of water for grass irrigation.

2. A case study portal

To highlight water efficiency and sustainability projects that have/have not worked and highlighting mistakes made during the implementation process.

3. The Leisure Sector Water Working Group

A platform to allow discussions between the leisure associations, water companies, The EA, Natural England, Cranfield university and others, to identify the needs of facility operators and to help transition away from mains or unsustainable irrigation sources.

The leisure sector has significant landholding across England and Wales and there are opportunities for that land to be used for surface water attenuation to reduce flooding, combined sewer overflows/ discharges, retaining flows from urban drainage systems, and to improve river water quality.

Rendlesham Forest

Securing water for peatlands

Reducing emissions: WRE is working with the independent Lowland Agricultural Peat Task Force; a group established by Defra to explore ways of reducing greenhouse gas emissions from England's farmed lowland peatlands to support the Government's Net Zero goal. We support the initial evidence gathered by the Taskforce, particularly the fact that peatlands in good health contain more than 90% water. We acknowledge that the science is clear that for peatlands well irrigated or under higher water table management regimes, we can expect less greenhouse gas emissions than from peatlands which are intensively drained.

The Task Force have set a goal of securing a place for peatlands in every regional water resource plan, including Water Resources East. We are grateful for the commitment to develop baseline assumptions for how much water may be required to support different management regimes, not withstanding the significant interplay of climate change. The task force has offered support to WRE to make our own assessment of peat coverage, and how much water may be required to see each regional group contribute to the Government's overall target.

We recognise that there is further work to do around peat, and we build on the dialogue and engagement we have already had, particularly with colleagues involved in the paludiculture trials in the Great Fen Project in Cambridgeshire and by the Broads Authority in Norfolk. We look forward to gaining a clearer picture around the water requirements for peat landscapes which we can then include in the next iteration of our Regional Plan later in 2022.

8.4 Other key considerations

A number of issues have been identified that need to be addressed if the overall water resource needs and ambitions of the region are to be met. These include:

- The targeted environmental destination adopted up to 2050 and its rate of achievement.
- Different levels of environmental destination based on local catchment needs and priorities to better suit local catchments.
- The close links between agricultural and environmental needs and the dangers of segregating them.
- The risk of focusing solely on supporting flows in main river and neglecting flows in ordinary watercourses that could lead to net environmental loss.
- The need for significant additional water for agriculture (in peatlands particularly) to reduce CO_2 emissions.
- The need to supply water for food security purposes.
- Transparency in the trade-offs between demand management options and the policy and operational choices at national and local levels for example, the irrigation of crops or watering gardens, golf courses or other sporting venues in droughts.
- Raising awareness of the existing water resource situation to local and national policy makers and the public.
- Agreed growth projections for scenario planning purposes.
- The energy sector's requirement for access to water now and in the future to ensure security of energy supply and decarbonisation in a resilient and cost-effective way.
- Deliverability of the Regional Plan particularly for sectors that currently lack a formal water resource planning process and funding mechanism.

Some issues specifically relate to the water company WRMP process which is running in parallel to our regional planning process, including:

- The rate at which measures are implemented to achieve resilience to a1 in 500-year drought by 2039.
- Are current levels of resilience or water use restrictions such as a temporary use bans (TUBs) and non-essential use bans (NEUBs) considered acceptable?
- Other measures and rates of adoption to drive down demand through leakage and PCC reduction.
- Behavioural change to reduce reduce business water use.

We will explore these further in 2022 as we expand our member and stakeholder engagement activity through our supporting projects, local catchment focus workshops and engagement in water company WRMP development.

8.5 Areas of clarification and policy asks

A number of gaps exist in our current understanding, which we will explore in more detail in the next 12 months. These include:

Gaps in understanding:

- Short-term water resource deficits in agricultural supply.
- Agri-food and energy sector water resource need forecasts.
- Housing growth scenarios in a number of areas.
- Emerging risks and challenges arising from abstraction licence strategies and reform.

Joint working and integrated planning:

- Work with Government departments and Defra to better integrate at a local level the implementation of the various policies and funding streams on issues such as water quality and resources, energy, food, the natural environment, trees, land management, flood risk, carbon, local planning, housing and economic development to achieve greater outcomes for people and the environment.
- Wider emphasis on integrated water management planning to pull together the various water-related plans, schemes and strategies e.g., River Basin Management Plans, Water Resource Management Plans, Drainage Wastewater Management Plans, Flood Risk Management Plans, Catchment Management Plans and Net Zero to break down the siloed working these separate plans engender. See Figure 1.1 that illustrates the current complexity of aligning the inter-related plans.
- Household demand management:
  - A date by which white good manufacturers have to meet mandatory water efficiency labelling requirements.
  - How best to support to support local authorities in adopting the optional minimum building standard of 110 litres per person per day in all new builds.
  - How best to encourage the retrofitting of existing housing stock with water efficiency measures such as taps, cisterns and rainwater/reuse systems.
  - Explore the use of skills academies to support the implementation of household water efficiency measures building on the experience in Essex of their energy efficiency skills academies.
- Non-household demand management:
  - Explore opportunities to work with the water retail sector through water smart business programmes to share best practice in water efficiency measures and incentivise demand management.

Key messages...

Significant progress has been made over the last 12 months to understand the risks and uncertainties faced by the region's water users and water dependent environment, but further work is required to refine our evidence base.

Our proposed next steps will help to reduce the level of uncertainty and refine our view of possible solutions in preparation for our draft Regional Plan in Autumn 2022, culminating in our Final Regional Plan in 2023.

GLOSSARY OF TERMS

Bullfinch

A full list of terms can be found here.

Hanningfield Reservoir

APPENDIX A: STAKEHOLDER FEEDBACK

Regional Planning

Between July and November 2021, we conducted a broad member and stakeholder engagement programme. This covered all members' sectors, focusing on regional planning and local catchments – specialising in different aspects of both.

These member and stakeholder engagement activities included:

- Two WRE Board/Technical Delivery Group Planning Conferences
- Two Strategic Advisory Group member training sessions
- Three Regional Planning Conferences (two in person and one online)
- Four Local Focus Catchment Workshops (online)
- New agriculture and energy technical focus groups formed

Overall, we engaged 322 people from 202 organisations. Our members and stakeholders are incredibly important to us and for us. Engaging them consistently through the planning process ensures we are creating a regional plan which is answering real need, is robust and credible, and represents all voices with a stake in water resources in the East of England.

Regional Planning Conferences

These conferences focused on strategic resource options which have an influence on how water is managed across the entire region and nationally. For example, possible new infrastructure options or schemes which include the involvement of multiple sectors.

Local Focus Catchment Workshops

These workshops focused on what opportunities and challenges existed in specific catchment areas. This was to start the process of evidence gathering, learning, and knowledge building. National plans and catchment plans will inevitably influence each other, and they will need to work in harmony. WRE are very aware that there is a lot happening at a catchment level that isn't known, therefore, this process will continue into 2022.

Technical focus groups

Two sector specific focus groups have been formed to answer the challenge that the voices of the agriculture and energy sectors have been lost and/or misunderstood or underrepresented historically in water planning. Yet, these are sectors which have some of the biggest water vulnerabilities for the future. Focus groups are working to eliminate these challenges to ensure they are correctly represented and included in regional planning.

This appendix is summary of all feedback that was received from questions asked during the regional planning conferences and local focus catchment workshops. Feedback was given anonymously to create a safe and open environment where individuals felt they could answer honestly without risk of judgement or consequence.

Cam & Ely Ouse, Welland & Nene, Old Bedford, Upper & Bedford Ouse

What our members say

5th October 2021

Summary

More work needs to be done on educating stakeholders on Environmental Destination as **39%** of participants had no knowledge of it.

Only **47%** of people knew a little about Systematic Conservation Planning (SCP) which is very surprising but again efforts must be made to educate stakeholders about this.

44% know enough about Regional Planning which is good but **39%** still only know a little. No surprises, "abstraction", "chalk steams", "individual water companies", and "local plans" were the strongest words appearing throughout the workshop.

Recommendations for the future

There is a clear lack of knowledge for key initiatives feeding into the Regional Plan, including the Regional Planning Process itself. However, it is recognised this is the first time we have delved down to catchment level – knowledge gaps are expected.

We have the resources readily available to plug these gaps but they need to be further circulated. Maybe stakeholders engaged at this level are experiencing WRE for the first time even if their organisations are members.

To help build knowledge amongst WRE members, timely emails and updates will be circulated for members to explore and self-educate further.

There is a risk of stakeholder fatigue, as with any multi-facitated engagement process. Keeping the same questions throughout the process to gauge changes will be needed.

Further workshops

Questions, comments, and themes arising here are a big indication of what topics to expect in early 2022. We will use these outputs to prepare for further workshops and manage stakeholder expectations.

Do you have any suggestions for how we can further engage organisations in catchments?

"Maybe do a summary of the feedback provided from the workshop for each catchment that stakeholders can add too – eg: RSPB has interests in all of the catchments dealt with today, but could only field input into two of them."

"I like the idea of finding ways to match private funding to projects, which would be better done at CamEO or WRE level than by individual project officers."

"Via a clear comms strategy and dedicated website."

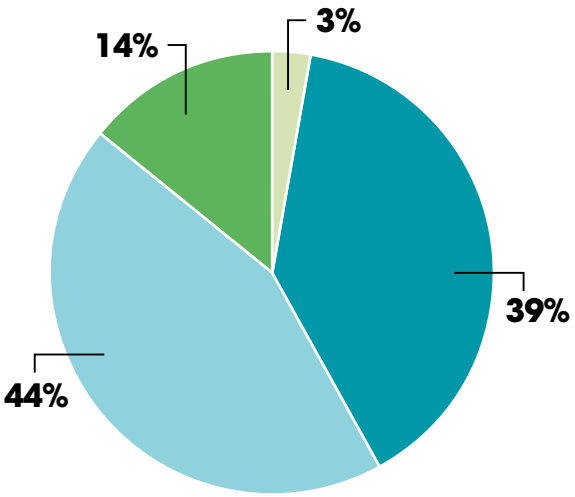
"Focus the WRE message on how to better utilise water when it is actually available; encourage local innovation."

"Smaller scale examination of projects or developments to come up with more specific details of what needs to be delivered. Making partners aware that discussions to set the local scenes is starting."

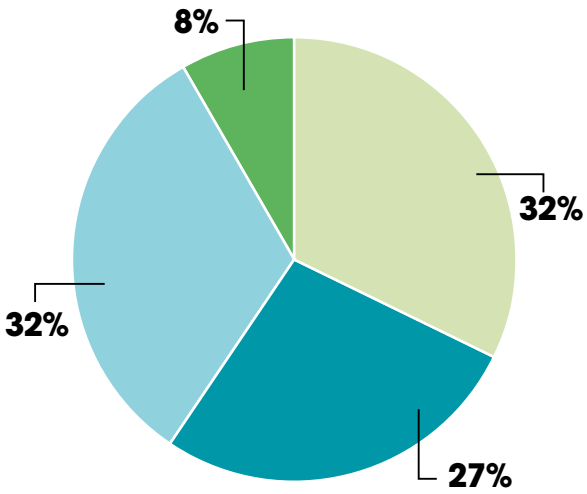
"Create a sector specific info graphic and then make it shareable – explicitly showing how developers, food producers, aquatic recreation, etc could improve their future by having a say and its not too late."

"Get a slot on local TV news to ask organisations to come forward and get involved."

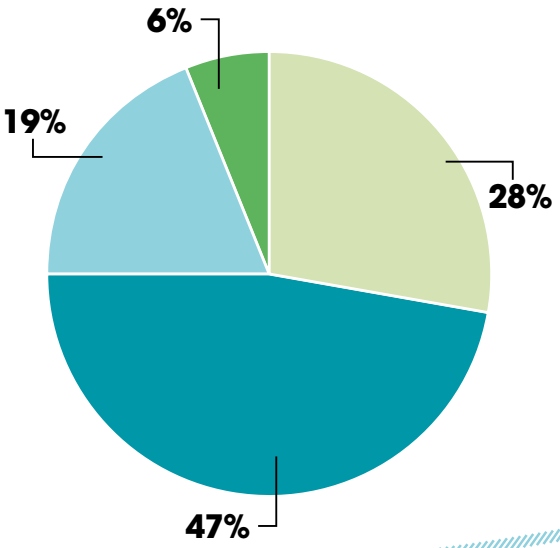
How much do you know about Regional Planning?



How much do you know about Environmental Destination?



How much do you know about Systematic Conservation Planning?



Key

- None
- A little
- Enough but I need more information
- A lot

Popular questions and topics

Anonymous
Why weren't wetlands on the introductory slide showing concerns in WRE area? Large number of groundwater dependent sites – it isn't all just Chalk Streams!

Anonymous
Water resource is a big issue in South Cambs. The emerging planning Local Plan describes considerable restraints on development. Will you be covering this?

Anonymous
... without factoring in CC, growth etc. If you want to restore flows along all Chalk Streams, reductions would need to be even more.

Anonymous
Is 1,458 Ml of new capacity enough? Do planning assumptions include the need to RESTORE habitats (e.g.Chalk streams) as well as to meet water supply needs?

Combined Essex, Roding, Beam and Ingrebourne

What our members say

2nd November 2021

Summary

"Water supply", "Innovation", "Access", "Greater transparency", "Priming funding", "Specialist technical expertise", "Facilitation", "People" were the most prominent words used during the workshop.

50%

knew enough but needed more information about Regional Planning compared to **6%** knew nothing, **31%** knew a little and **13%** knew a lot.

44%

knew enough about Environmental Destination but need more information compared to **6%** that knew a lot and **25%** each that knew nothing or a little. More work needs to be done to spread education about regional planning within and outside our membership.

31%

each knew a little or enough but needed more information about SCP. **19%** each knew a lot or nothing. The latter should lower once it becomes further integrated with the Regional Plan and SCP starts seeing practical application in the WRE Regional Plan.

What role do you think WRE should play at catchment level and/or what do you want us to do collectively?

WRE should focus on catchment level solutions working with organisations that already promote best practice. Information WRE already has could help further inform catchment partnerships to understand how local work helps towards regional targets. WRE should work on learning more from partners about catchment level detail and incorporate these issues into region planning.

WRE need to strengthen their messaging that all users will face supply issues if we don't work together to ensure long terms solutions that are resilient and that don't harm the environment. WRE should bring connectivity that crosses artificial boundaries and focus on engaging, encouraging and inspiring local stakeholders to place water resource planning on their agendas.

WRE should assist on multi-party opportunities and has a major role in bringing together everyone with a stake in local water management. All stakeholders need to be at the table not just significant abstractors, bridging the local and the strategic. There is a view that WRE should be the umbrella organisation that all projects and stakeholders within a given geographical space.

Do you have any suggestions for how we can further engage organisations in catchments?

"WRE needs to work with CaBa and Catchment Partnerships to interact more with catchment organisations."

"To identify gaps and understand what work is already happening, and to engage farmers."

"WRE need to get on the ground talking to individuals and help show/demonstrate best practice to give others the confidence to invest in options and solutions now, moving beyond modelling which individuals find difficult to engage with."

"WRE need to use the local planning authority to engage with spatial partners and developers to highlight the importance of catchment measures."

"WRE face the same problems as other projects in how to effectively engage local individual organisations or stakeholders who really need to make the changes. There is an acknowledgement that the struggle to engage down into organisations is tough."

East Suffolk, Broadland, Northwest Norfolk & North Norfolk

What our members say

4th November 2021

Summary

45%

of participants each knew a little or enough but needed more information about Regional Planning. **3%** knew nothing and **6%** knew a lot. More work needs to be done to spread education about regional planning within and outside our membership.

39%

knew enough but needed more information about environmental destination, **6%** knew a lot. **29%** knew a little and **26%** knew nothing. More work needs to be done from WRE to spread education about environmental destination within and outside our membership.

42%

knew a little about SCP with **26%** needing more detail and **13%** knowing a lot. **19%** still knew nothing about SCP but this number should lower once it becomes further integrated within the Regional Plan and SCP starts seeing practical application in the WRE region.

The most popular words used were "water today", "water needs", "flood risk", "project", "data", "significant step change", "barriers", and "farmland values".

What role do you think WRE should play at catchment level and/or what do you want us to do collectively?

There was a comment that there is a disconnect between the WRE vision and it being recognised as a "thing" at catchment level.

"What WRE would call a 'a project' to a farmer could/should/would be basic on farm maintenance. Unsustainable systems of the past 30/40 years have encouraged bad practices to the point where intervention on farming practices are 'projects' rather than good practice."

Many believe WRE needs to play the role as a forum to discuss and solve catchment issues, to help coordinate projects, programmes, partnerships, focus and action to avoid duplication and to make the picture of water resources management clearer for all; to bring international, regional and technical knowledge to catchments; enhance but not replicate initiatives & projects; WRE needs to be the inclusive, honest, and realistic player.

Do you have any suggestions for how we can further engage organisations in catchments?

WRE has been heavily criticised for not involving (during the workshops and in general) landowners and individual farmers but only by lobbying organisations:

> *"The lack of the biggest landowners, farmers and estates owners is troubling..... WRE seems to listen to those organisations that lobby not the people on the ground who understand how catchments functions.....I don't think I've ever seen or heard WRE been mentioned at any farmers meetings that must be a real concern for WRE staff."*

WRE know this isn't entirely true given the large estates and landowners/farmers we have engaged and have in our membership but there is a valid point here and there is clearly a gap in engagement.

Nevertheless, while WRE may have gap in engagement there is still a lack of knowledge of where WRE is at and some expectation management to be had:

> *"The great hope from WRE was that there would be a water resources solution for the Broadland and East Suffolk, from the comments today, WRE are unlikely to deliver on that front. So you start to realise why farmers are not connecting with WRE, there is no reason to. I strongly believe that farmers and landowners hold all the solutions to water resources issues but WRE are doing an excellent job in isolating farmers and landowners with the consequence that they are not interested. So WRE will fail in its aims."*

To enhance engagement, WRE needs to project/use their voice more to highlight the potential future water shortage if actions are not taken now. Our message is something the public needs to hear and will help us understand demand management, value of water, etc. WRE must also work with members to ensure early engagement on desalination (noted especially in the fishing industry).

People and the public need to be engaged now, not just our members and key sectors. It was commented it would be beneficial for our membership to hear from the general public to provide more diversity of thought/perspectives.

WRE need to further engage through the relative CaBA catchment partnerships that meet quarterly to also help join up with regional information across Eastern England.

Louth, Grimsby& River Ancholme, Witham, Steeping, Great Eau & Long Eau

What our members say

9th November 2021

Summary

Slido (the tool we used to conduct poll surveys and capture questions and comments) was limited (only 14/45 used it) nevertheless, dynamic conversations were had which were picked up in the breakout rooms and Miro boards.

"Energy intensive" and "expensive" were the two most used words of the workshop.

50%

of participants understood enough but needed more information about Regional Planning. **30%** knew little, **20%** a lot and **0%** none which is the only catchment area where there was a least some knowledge of Regional Planning.

40%

each knew a little to enough but needed more information about Environmental Destination, with **20%** knowing a lot. **0%** knew nothing which again is a positive sign initially or it could be a reflection of the users that interacted with Slido rather than a snapshot of the delegates as a whole.

30%

of people knew nothing about SCP, **20%** knew either a little or a lot and **30%** knew enough but needed more detail.

What role do you think WRE should play at catchment level and/or what do you want us to do collectively?

"WRE should or could fulfil an overarching function bringing projects together and facilitating the creation of a water system that sustainably delivers water resources/ management in the area that all stakeholders/partners can fit into."

"WRE should ensure the maintenance of existing infrastructure before any new projects are undertaken." Again, this echoes the overarching theme of fixing/using what we have at our disposal first before focusing on new initiatives.

Lastly, there is a view that WRE should support landowners' application on future projects (this possibly refers to reservoir applications and Environmental Land Management schemes (ELMs) applications)).

Do you have any suggestions for how we can further engage organisations in catchments?

Three suggestions included engaging the Lincolnshire Wolds Countryside; sharing regular updates through a newsletter; and a TV documentary explaining the water cycle and who does what and how things need to change to be resilient to a future climate.

Regional Planning

What our members say

7th, 18th, 21st October 2021

Summary

Ambitious, **challenging**, and **impossible** are the three most used words to describe what WRE is trying to achieve.

Nevertheless, this is perhaps not surprising as regional planning has never been done before. **Essential**, **urgent**, **crucial**, **vital**, **logical**, and **useful** give clues as to how timely and time sensitive regional planning is.

Costs, **focus**, **regulation**, **funding**, **political will**, and **scale of the challenge** are marked as the biggest challenges we face.

What are the biggest incorrect assumptions is a question WRE hasn't asked before. Assumption logging will continue throughout the planning process as we go into consultation to ensure we're not making any obvious assumptions about sectors.

Some assumptions are no surprise: "farmers waste water and use it unnecessarily", "there is no connection with agriculture and environment". Others are more concerning, such as the assumption that "there is no limit to growth", that "nature will recover" and "that demand is reducing over time, there is plenty of water available already" with the incorrect assumption "that we know how much freshwater we will need in the future and that we have budget available now" are interesting.

We know this isn't true, is work needed to change this narrative?

A further assumption noted concerned the energy sector "the future energy sector will not require freshwater as renewables will provide all our electricity or it can all be produced at the coast".

Our members say that climate change, environmental health, and increased demand are our biggest challenges for current and future water resources.

With all this uncertainty, members are telling us that managing what we have now first is a priority to ensure future demand challenges are easier to respond to.

When asked in what ways the needs of your sector are not being recognised, some responded that there is a lack of recognition due to a lack of specific detail about plans and the specifics of "what does this mean for me?" "How will this benefit me?" etc.

There is a feeling that the trade-offs at this point are not fully understood and knowing how we will resolve the obvious conflicts that we know will occur.

Lastly, there is dissatisfaction with both historic and current regulation and governance, which is no surprise.

Verbatim stakeholder comments

1. In one word, what do you think about what WRE is trying to achieve?

2. In three words or less, what do you think is the biggest challenge facing Regional Planning?

3. For your sector, what is the biggest incorrect assumption often made in regard to water resources?

Agriculture

- That farmers waste water and use it unnecessarily.
- Agriculture and the environment are separate sectors without significant overlap.
- Misconception is agriculture uses large amounts as when people see spray irrigation the assumption is we use a lot. In percentage terms we are of course only a few %.
- That its ok to import food if we don't have enough water to grow it here.

Energy

- The future energy sector will not require freshwater as renewables will provide all our electricity or it can all be produced at the coast.

Environment/Nature

- Nature will recover.
- Risk of false narrative of env vs X.
- That securing water supplies is more important than safeguarding the environment. The environment needs to be prioritised.
- Historic degradation of rivers doesn't need to be addressed.
- Green spaces are 'free'.
- The incorrect assumption that new woodlands do not sequester significant amounts of carbon. They do; both the growing trees and even more carbon is captured as the woodland soil develops.

Growth/Demand

- That there are no limits to growth.
- Failure to recognise that there are limits to growth will lead to deeply irresponsible actions and disbenefits to people.
- There is insufficient capacity to support growth, and that it is not possible to address this.
- That constraints are not an issue for the development industry.
- That current levels of growth are sustainable.
- That demand is reducing over time there is plenty of water available already.

Internal Drainage Boards

- That Internal Drainage Boards only "drain" water.

Public water supply

- Open water transfer isn't practical.
- That there is a mythical giant tap which we can switch off water company abstraction.
- That every customer has a water meter.
- The ability of the water companies to meet all of the water demands given the regulatory restrictions.
- Cleanliness of water transfer.

Rivers

- Only rivers matter and water flowing out to sea is a waste.

Regulation/Governance

- That the EA are regulating the situation.

Water availability

- Water is a free and finite resource (It falls from the sky syndrome).
- There is plenty.
- There is no shortage.
- That we know how much freshwater we will need in the future and that we have budget available now.
- Taking fresh water for granted as we're surrounded by water people do take liberties.

Water value

- Water is cheap!
- People often comment that water is too cheap. However, the cost of water is relative and household water poverty in this country is real.

4. In your sector, what do you think is the biggest challenge for current and future water resources?

Climate change

- Climate change and lack by the public of a perceived shortage (of water).
- From a purely resource perspective, the uncertainty of climate change. In terms of water resources planning, uncertainty re: per capita consumption.
- Climate change.
- Also the weather events from very dry spells to downfalls.
- Ensuring enough water is available so as not to compromise the most efficient and reliable pathway to net zero.
- Drought risk, and the capital investment needed to tackle it.

Environmental health

- Saving the water environment.
- Ecology and quantity of water/accessing chalk streams.
- Reconfiguring abstraction from the chalk aquifer so that chalk springs and headwaters run freely, as they would under natural conditions, every year, whatever the weather.
- Lack of water in the environment now let alone in the future with an expanded population and climate change impacts.
- The cost of land both arable land for development competing with woodland creation.
- Reducing reliance on groundwater abstraction from the chalk aquifer.
- Achieving an acceptable level of ecosystem/ environmental wellbeing without much greater spending.
- Implementing the changes needed for truly sustainable use and environment.
- 2–10-year growth impact of the environment.
- Environmental need.

Increased demand

- The funding and delivery of additional water capacity to support housing and economic development in growth locations such as Cambridge and South Cambridgeshire for example.
- That supply needs and the impacts of not meeting them are not properly understood.
- Shared use.
- Enough capacity for the demand coming with all the new homeowners.
- Difficult to predict future usage and growth. Increasing efficiency of use.
- Growth – supporting development while protecting environment.
- Population growth and not limiting it.
- Climate change and its effect on demand forecasting demand and scarcity – uncontrolled use and growth understanding how higher temperatures and PDW affect groundwater and water demand.

Regulation/Governance

- Bureaucracy, risk aversion and time to deliver a solution through a very complex system of processes and procedures.
- The ability of the regulatory framework to support development of water.
- Changes to supply systems.
- Costs and timings of solutions.

Saving water/water availability/future security

- Uncertainty.
- Can we capture the water and use it more productively?
- Less waste.
- Access to enough water.
- Availability of resource.

Water for energy

- Securing water rights for future power/hydrogen plant, without knowing where these plants will be and who will own them.

Other

- Access to sufficient water to maintain long established and viable businesses.
- Changing old ideas.
- Getting started.
- Enabling sustainable growth, food security and protecting the environment before the strategic options are available.

5. In what ways are the needs of your sector not being recognised? Either by the Regional Planning process or in general.

Agri-food sector

- There is recognition that making water available for abstraction to be used to produce food is necessary however there seems little currently in the regional planning proposals that contributes this. The minimum daily contribution is not reflecting that the agri-food does not have the financial capacity to involve itself in such large schemes. In the Eastern Region agri-food business is a huge contributor to the economy and the environment but currently there is very little benefit being shown from any of the development plans.
- Agricultural need and food security.

Demand increase

- Failure to honour the precautionary principle in regional H.M. Government planning for 30% population increase when we are facing major climate change in a water stressed area.

Environmental health

- Enduring over abstraction causing low flows; the massive threat that low flows and pollution are to chalk stream survival.
- The seemingly increasing insoluble pollution pressures (nitrates, ammonia, phosphate, coliforms and enterococci, pharmaceuticals, pesticides and microplastics) without adequate investment in remediation.
- True holistic catchment approach based on water cycle (quality, quantity, landscape).
- Historically lack of water for wetlands and rivers has been accepted as the baseline position, rather than being treated as a result of an unsustainable water supply and river management systems.
- Woodlands for water either for natural flood management or to improve water quality does not require a large land take.
- Resource availability, quality and environmental impact.

Growth/development

- Major infrastructure solutions and long-term planning may need to say 'no' in some sub regions. Environment or cost impact is too great without reducing demand.
- Building on flood plains is a concern as this moves the water on also materials used in new homes.

Lack of detail

- Regional lack of awareness of the issues – lack of data and previously losing the detail by average and mean consolidation of historic data.
- Our interests are being recognised by WRE and others but we need greater specificity about exactly what will be done when and how. More action is needed earlier to reconfigure abstraction. People are saying the right things – but this needs to be translated into meaningful action. For the Cam Valley this is critical – three water companies abstract from the Chalk (Cambridge 64%, Affinity 22% and Anglian 14% on 2019 actual totals). The three companies need to work together to deliver a coordinated plan of action.
- Need more water management ideas in the plans.

Public water supply

- With respect to environmental well-being a depressing expectation from the public that water companies will not or cannot better their performance.

Regulation/Governance

- Failure to honour the precautionary principle in regional H.M. Government planning for 30% population increase when we are facing major climate change in a water stressed area.
- A supine government has effectively destroyed the capacity of the EA to uphold its remit.
- Costs of putting it right as years of under investment.
- Not convinced that DEFRA takes agriculture seriously.
- Pleased with the engagement we are having. The competitive nature of the energy sector does not lend itself to the regulated asset base water resources planning process. It is currently not possible to know who will build future power assets requiring freshwater and exactly where they will be located.
- Cost of water.
- Education of what is (or may be) possible... Ignorance is bliss!

Trade offs

- Trade off is a big worry.
- Apparent 'conflict' of environment versus sector.

WRE

- I feel we are able to feed needs into WRE and these are recognised.
- I believe our needs are being recognised, however I'm not sure that the difficulties in overcoming some of the barriers that exist for our sector are recognised.
- I believe they are recognised now finally, but the solutions are huge.
- I think that work to properly understand them is underway, but further work is needed.
- Face to face discussions on all options and integrating recreational needs in the financial cost/benefit analysis.
- Our needs are verbally recognised, we are waiting for the action to start.

APPENDIX B: DEMAND FORECAST ASSUMPTIONS FOR PUBLIC WATER SUPPLY

Water companies have been developing their demand forecast scenarios to inform their next WRMP to be published in 2024 as part of the statutory WRMP process. These scenarios are still in development as information is gathered on cost and customer acceptance of the demand management options proposed. For the purposes of the Regional Plan, the following assumptions are represented in the demand forecast for public water supply:

- Baseline demand is based on the 2019/20 water balance which only included a minor reflection of the higher demand and per capita consumption (PCC) levels experienced during the COVID-19 pandemic. However, COVID-19 factors have now been included, to reflect the marked increase in household consumption (and PCC) observed through 2021, and account for higher forecast demand due to the potential new 'normal' that might endure, as more consumers work from home.

- Property and Population forecasts are aligned with WRPG guidance for households to reflect Local Authority plans except for the Anglian Water and Cambridge Water WRZs within the area of Oxford to Cambridge growth. These forecasts are further uplifted to reflect an increase in local housing completions to 30,000 per annum, apportioning the Oxford to Cambridge growth to the WRE region at a rate of 75% based upon an expansion model of settlement growth (OxCam-2b-r 30k dpa, Town Expansion), as illustrated in Figure B.1.

- Household consumption has been derived at sub-resource zone level, where appropriate to facilitate alignment between water company level planning and the Regional Plan. Customer groups have been determined, based upon relevant consumption criteria (measured/unmeasured) and meter uptake has been derived using industry wide assumptions and a baseline level of water efficiency from technology change. Scenarios have been developed to reflect both water company metering changes (including the installation of advanced metering infrastructure (AMI) and automatic meter reading meters) and potential water efficiency savings from government-led interventions.

- Demand management options have originally been developed for the Regional Plan based upon the National Framework targets of a 50% reduction in leakage by 2050 (from a 2017/18 baseline) and a reduction in PCC to 110l/h/d by 2050. However, it should be noted that demand management portfolios for water company WRMPs are being developed by individual water companies, whilst recognising the differing starting positions that contextual potential cost benefit analysis (i.e. for a particular company at the frontier of current leakage reduction, prohibitive cost might be encountered in achieving a 50% target individually, whilst overall national savings might still achieve the same target).

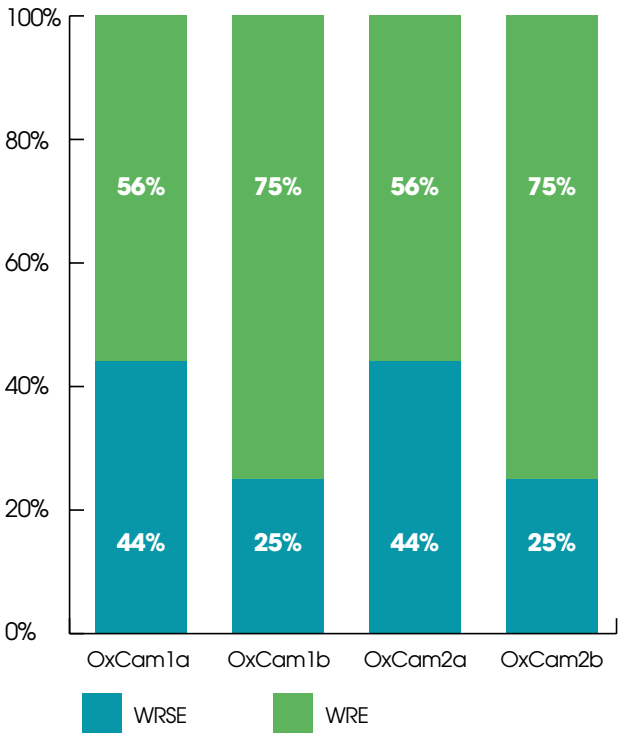
  Additionally, for PCC, many factors both within the control of water companies and externally, will need to be considered in assessing final out-turns applied in their WRMPs, including government-led interventions to ensure more water efficient white good products and the potential for mandatory standards with respect to building regulations. All these factors will need to be considered by each company in developing their preferred demand management plans informing their WRMPs.

- Non-household consumption has been characterised by non-household customers per geographical area and industrial sector. Historical regression modelling has been applied to each sector's consumption. Forecasts have then been based upon the appropriate selection of explanatory variables, such as numbers in employment or the level of economic activity (GVA), which most appropriately account for historical trends and variations in demand.

Non-household demand forecasts have been aligned with the selected household growth projection (Oxcam_2b_r_P). Both Household and Non-Household growth have been modified to reflect potential changes due to the COVID-19 pandemic[15].

- Non-household forecasts have been developed in line with household projections.

Figure B.1: Regional share of Oxford to Cambridge growth uplift



OxCam-1a-r 23k dpa, New Settlements

OxCam-1b-r 23k dpa, Town Expansion

OxCam-2a-r 30k dpa, New Settlements

OxCam-2b-r 30k dpa, Town Expansion

Note: 'Town Expansion' based upon cities – Milton Keynes, Luton, Bedford, Cambridge, Northampton, Peterborough.

'New Settlement' includes areas in Cherwell / Aylesbury Vale, Central Bedfordshire, South Cambridgeshire.

- Leakage assumes minor changes across the forecast owing to measured versus unmeasured as customers switch to metered supply.

- Baseline meter penetration has been based upon the WRMP19 forecast assumptions.

[15] *Observed data from Anglian Water and findings from Water UK Pathways to Long-term PCC reduction report. Artesia, 2019.*

National Framework for Water Resources:

All the participating water companies support the National Framework strategy which has set ambitious targets for both leakage (a 50% reduction by 2050) and 110l/h/d for PCC. Consideration is still being given as to how these targets should be implemented at a national, regional and individual company level, given the differing starting and end positions of water companies with respect to these metrics and the implications for costs and benefits.

Government-led interventions to reduce PCC

The Artesia (2019) report identified a number of demand management scenarios based on the potential impact of Government-led interventions on PCC. In particular they found that the introduction of water labelling and the slow change to more efficient white goods, along with a set of government lead mandatory standards for new-build and retrofit properties might lead to very significant savings in the long-term (up to 27 l/h/d by 2050).

Given that the Government has signalled that they will introduce legislation to bring in white good labelling and promote more water efficient white goods, we have felt that we should include a reduction in the baseline demand profile to reflect this. Significantly reducing PCC and mitigating demand growth, will need to be a collaborative effort, supported by consumers, water companies and the government over the long term.

Table B.1 provides details of the growth, leakage and water efficiency measures included in the six demand scenarios we have embedded in our decision making under uncertainty framework and modelled in our regional simulator.

Table B.1: PWS demand scenario descriptions

PWS Demand Scenario	Package description	Growth scenario description	Leakage option	Water Efficiency (WEF) Option	Government-led interventions
0107_Housing-Plan-P_High_LEA_WEF_Gov	Housing-Plan-P, Non-HH growth aligned/ High DMO, HH-LEA Higher, HH-Higher WEF, including Government Standards	Local Authority Housing Plan projections	**Leakage High Demand Reduction Scenario** High – greater than WRMP Reference: National Framework 2019/20 Central/Low demand scenario (50% reduction) **Leakage Target:** By 2050: 50% reduction (from 2017/18) 2050 - 2100: >2% reduction each AMP from 2049/50 level (20-40% further reduction)	**High Water Efficiency Package + Government led interventions** High 1 (water company led) – reduce consumption by up to 15% by 2050 from Household + Non-Household options **WEF Target:** By 2050: reduction in projected demand by an equivalent of 10-15% of 2017/18 baseline. 2050 - 2100: >1% reduction each AMP from 2049/50 level – (>10% further reduction) Includes High Non-HH DMO savings – approx. 15% by 2050 – flat-lined to 2100	High 2 (with Government-led interventions in addition to water company led). Higher than High 1 Strategy – based upon Artesia assumptions.
0200_OxCam-1a-r-P_BASELINE	OxCam-1a-r-P, Non-HH growth aligned/No DMO, HH-LEA No Investment, HH-No WEF – Baseline, Dumb metering only	Oxcam 1a-r-P 23k dwellings per annum (dpa) New Settlements	**Leakage No Investment Scenario** Base-line Low (Baseline) – No leakage change from 2024/25 **Leakage Target:** No further reductions in leakage from 2024/25	**No Water Efficiency Options** Extreme Low DMO – (Baseline) No impact from DMOs (Potential for increased PCC – includes meter installation only) **WEF Target:** By 2050: No further DMO driven reductions in consumption (Potential for PCC to increase) 2050 - 2100: No further DMO driven reductions in consumption (Potential for PCC to increase) Includes No Non-HH DMO savings	No Government-led interventions
0300_OxCam-1b-r-P_BASELINE	OxCam-1b-r-P, Non-HH growth aligned/NoDMO, HH-LEA No Investment, HH-No WEF – Baseline, Dumb metering only	Oxcam 1b-r-P 23k dpa Town Expansion	**Leakage No Investment Scenario** Base-line Low (Baseline) No leakage change from 2024/25 **Leakage Target:** No further reductions in leakage from 2024/25	**No Water Efficiency Options** Extreme Low DMO – (Baseline) No impact from DMOs (Potential for increased PCC – includes meter installation only) **WEF Target:** By 2050: No further DMO driven reductions in consumption (Potential for PCC to increase) 2050 - 2100: No further DMO driven reductions in consumption (Potential for PCC to increase) Includes No Non-HH DMO savings	No Government-led interventions

PWS Demand Scenario	Package description	Growth scenario description	Leakage option	Water Efficiency (WEF) Option	Government-led interventions
0500_OxCam-2b-r-P_BASELINE	OxCam-2b-r-P, Non-HH growth aligned/No DMO, HH-LEA No Investment, HH-No WEF – Baseline, Dumb metering only	Oxcam 2b-r-P 30K scenario Town Expansion	**Leakage No Investment Scenario** Base-line Low (Baseline) No leakage change from 2024/25 **Leakage Target:** No further reductions in leakage from 2024/25	**No Water Efficiency Options** Extreme Low DMO – (Baseline) No impact from DMOs (Potential for increased PCC – includes meter installation only) **WEF Target:** By 2050: No further DMO driven reductions in consumption (Potential for PCC to increase) 2050 - 2100: No further DMO driven reductions in consumption (Potential for PCC to increase) Includes No Non-HH DMO savings – approx. 7.5% by 2050 – flat-lined to 2100	No Government-led interventions
0504_OxCam-2b-r-P_Med_LEA_WEF	OxCam-2b-r-P, Non-HH growth aligned/MedDMO, HH-LEA Middle, HH-Med WEF	Oxcam 2b-r-P 30K dpa Town Expansion	**Leakage High Demand Reduction Scenario** High – greater than WRMP Reference: NF 2019/20 Central/Low demand scenario (50% reduction) **Leakage Target:** By 2050: 50% reduction (from 2017/18) 2050 - 2100: >2% reduction each AMP from 2049/50 level (20-40% further reduction)	**High Water Efficiency Package + Government led interventions** High 1 (water company led) – reduce consumption by up to 15% by 2050 from Household + Non-Household options **WEF Target:** By 2050: reduction in projected demand by an equivalent of 10-15% of 2017/18 baseline. 2050 - 2100: >1% reduction each AMP from 2049/50 level – (>10% further reduction) Includes High Non-HH DMO savings – approx. 15% by 2050 – flat-lined to 2100	No Government-led interventions
0506_OxCam-2b-r-P_High_LEA_WEF	OxCam-2b-r-P, Non-HH growth aligned/HighDMO, HH-LEA Higher, HH-Higher WEF	Oxcam 2b-r-P 30K dpa Town Expansion	**Leakage High Demand Reduction Scenario** High – greater than WRMP Reference: NF 2019/20 Central/Low demand scenario (50% reduction) **Leakage Target:** By 2050: 50% reduction (from 2017/18) 2050 - 2100: >2% reduction each AMP from 2049/50 level (20-40% further reduction)	**High Water Efficiency Package + Government led interventions** High 1 (water company led) - reduce consumption by up to 15% by 2050 from Household + Non-Household options **WEF Target:** By 2050: reduction in projected demand by an equivalent of 10-15% of 2017/18 baseline. 2050 - 2100: >1% reduction each AMP from 2049/50 level – (>10% further reduction) Includes High Non-HH DMO savings – approx. 15% by 2050 – flat-lined to 2100	No Government-led interventions

Note: DMO – Demand management option, dpa – dwellings per annum, HH – household, Non-HH – non household, PCC - per capita consumption, WEF – Water efficiency

APPENDIX C: ENVIRONMENTAL DESTINATION SCENARIOS

The **National Framework for Water Resources** presents a range of environmental destination scenarios developed by the EA to outline the potential changes which may result from sustainability reductions to existing abstraction licences. In 2021, WRE commissioned Mott MacDonald to assess the scale of possible licence reductions for each of the EA scenarios[16], and has used this information as the basis of ongoing discussions with stakeholders and members.

More detailed discussions are planned for early 2022 to build understanding of the water requirements of specific catchments, principally through a series of detailed Local Focus Catchment Workshops.

Overview

The EA has recently completed a long-term environmental water needs assessment as part of the National Framework, establishing the potential licence reductions required by 2050 to meet the Environmental Flow Indicators (EFI) so that good ecological status is achieved or maintained under the Water Framework Directive (WFD). The EFI is defined by an Abstraction Sensitivity Band (ASB) allocated to each waterbody.

The following scenarios were assessed, alongside two variations of the Adapt scenario:

1. **Business as usual (BAU):** the same percentage of natural flows for the environment that currently applies continues for the future. Uneconomic waterbodies, where reducing abstraction would imply a significant investment, were initially discarded. However, an additional scenario (BAU+) including them has subsequently been incorporated.

2. **Enhance:** greater environmental protection for protected areas and Sites of Special Scientific Interest (SSSI) rivers and wetlands, principal salmon and chalk rivers is achieved by applying the most restrictive ASB.

3. **Adapt:** same ASB as BAU+ but a recovery to a lower standard in some heavily modified waterbodies is assumed.

   Two additional scenarios produced by WRE reflect further variation in consideration of abstraction sensitivity bands (ASBs):

   - ASB-1 ADAPT – starting with ADAPT, adding further waterbodies (least sensitive) where full recovery has not been achieved (75% recovery)

   - ASB-2 ADAPT – starting with ADAPT, adding further waterbodies (least sensitive – in addition to ASB-1 ADAPT) where full recovery has not been achieved (75% recovery).

4. **Combine:** balances greater environmental protection for protected areas, SSSI rivers and wetlands and principal salmon and chalk rivers with a view that good status (as defined under the Water Framework Directive) cannot be achieved everywhere in a shifting climate. Hence, adopts the Enhance ASB with a lower recovery to the EFI in some heavily modified waterbodies.

This appendix summarises the technical findings for three of the scenarios taken forward for further analysis in the WRE Regional Simulator; business as usual plus (BAU+), adapt and enhance.

The Lower Trent and Erewash and the Idle and Torne management catchments are excluded from this assessment as they are considered as part of the Water Resources West (WRW) region.

[16] *Mott MacDonald, 2021. WRE Environmental Ambition: Sustainability reductions required to fulfil EA environmental destination, Technical Note for WRE, August 2021.*

Assessment Approach

In the National Framework for Water Resources (2020), the EA utilised a bespoke spreadsheet tool (Waterbody Abstraction Tool) to estimate the deficits in 2050 for each waterbody per scenario. The tool calculates the water balance at the outlet of each waterbody for four quantiles (Q30, Q50, Q70 and Q95) using the following approach (as illustrated in Figure C.1):

1. Starting with the predicted natural flow in 2050 based on ensemble AFIXK of the Future Flows Hydrology project extrapolated to the outflow point of the integrated waterbodies in the WRGIS.

2. Adding the future predicted discharge to each waterbody modifying the recent actual value with a growth factor based on water company demand projections.

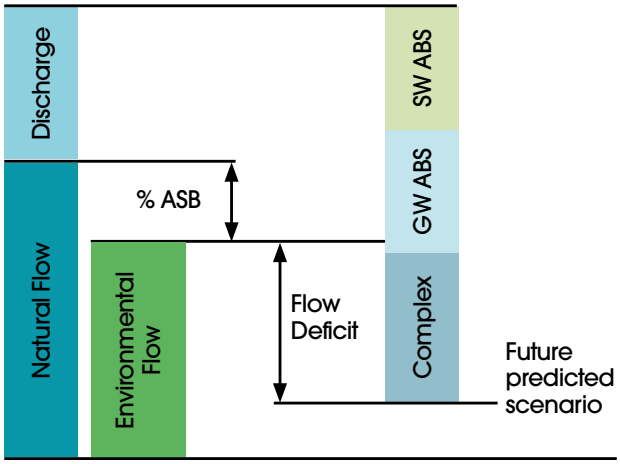
3. Subtracting the future predicted surface water abstractions based on the recent actual value with growth factors according to the sector.

4. Subtracting the future predicted impact of groundwater abstractions based on the recent actual value with growth factors according to the sector, and the spatial and temporal impact factors included in WRGIS which have been calculated using regional groundwater models.

5. Incorporating complex impacts associated with reservoirs, transfers or augmentation schemes.

6. Comparing the resulting future predicted flow in the river with the EFI, the latter calculated by applying the maximum allowable abstraction as indicated in Table C.1 with ASBs varying per scenario (see Figure C.2 showing how abstraction would be more restricted in the upper parts of the catchments).

Figure C.1: Process to derive flow deficit for a certain quantile



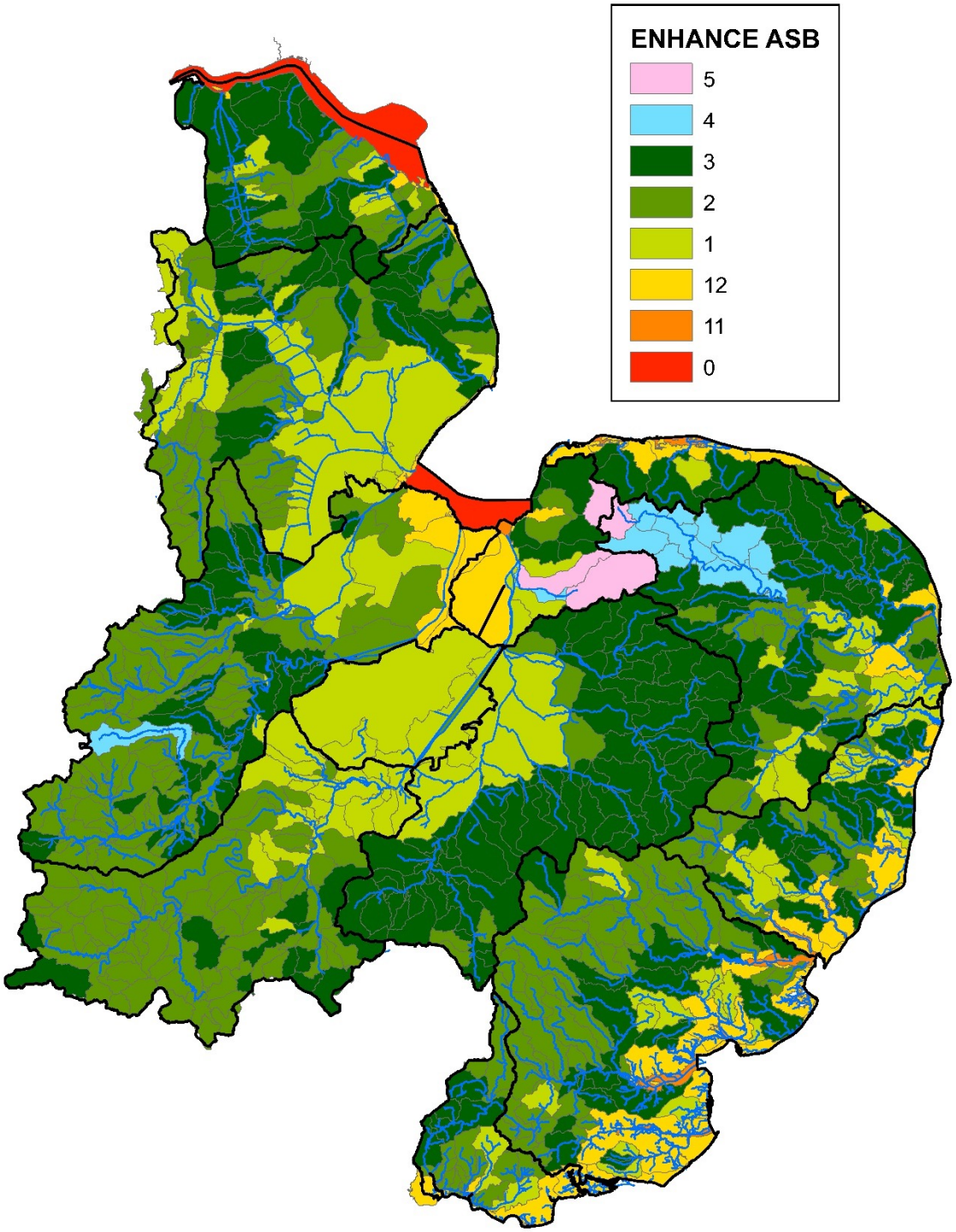
Source: Mott MacDonald, 2021

Table C.1: Maximum allowable abstraction as a function of Abstraction Sensitivity Band

Flow quantile	Abstraction Sensitivity Band									
	0	11	12	13	1	2	3	4	5	6
Q30	100%	45%	40%	35%	30%	26%	24%	10%	15%	10%
Q50	100%	41%	36%	31%	26%	24%	20%	20%	15%	10%
Q70	100%	39%	34%	29%	24%	20%	15%	15%	10%	10%
Q95	100%	35%	30%	25%	20%	15%	10%	10%	5%	5%

Increasing flow sensitivity

Figure C.2: Abstraction Sensitivity Bands for ENHANCE scenario



Source: Environment Agency, 2020.

Data from the Waterbody Abstraction Tool was used to derive the required sustainability reductions to remove the deficit at Q95 in 2050 in all waterbodies within the WRE region. The logic for establishing the reductions needed has aimed to minimise the abstraction loss and hence the impact on deployable output (DO), as follows:

- Reductions are applied from the top to bottom of each catchment so that upstream benefits (i.e. increases in river flows due to licence reductions) are considered downstream before applying the required reductions.
- Licences are reduced first to their future predicted abstraction rates as this would imply no loss of DO.
- Surface water licences are then reduced further, if existing, as they would impact DO less than reductions in groundwater licences given that availability of water for abstraction in rivers during a drought is not as guaranteed as in the case of aquifers. This reduction of abstraction from rivers during droughts is already accounted for in planning assumptions.
- Groundwater licences are subsequently reduced below future predicted abstraction rates starting from the ones that impact the deficit the most, because of either the spatial or temporal allocation of their impact.
- Licences with high consumptiveness are reduced next (licences with consumptiveness lower than 10% not adjusted).
- Licences impacting the waterbody of analysis are considered for reduction before others located upstream as reducing the latter would impact DO more. Thus, if for example two abstractions are causing a deficit in a certain waterbody X, one located in that waterbody X and another upstream in a different waterbody Y, and the upstream abstraction is not provoking a deficit in the waterbody Y it is located in, the reduction will be first applied to the abstraction in the waterbody X. Reducing the abstraction in waterbody Y would solve the problem in waterbody X as well, but it would imply a surplus in waterbody Y.
- In equal conditions, smaller licences are reduced/ removed first as they would be less economical to maintain.
- Sustainability reductions are applied at 5% steps and uniformly across the flow duration curve.

It is noted that in order to avoid PWS sustainability reductions impacting other sectors, the portion of the Q95 deficit attributed to PWS abstractions was estimated and then used to derive PWS licence reductions first. Hence, for each waterbody the future predicted deficit in flow was calculated considering both all sources and PWS ones. The difference between the two (i.e. deficit attributed to other sectors) was not resolved while identifying the PWS reductions. Once they were defined, sustainability reductions for other sectors were calculated so as to remove all deficit.

Results

Table C.2 and Table C.3 present the modelled reductions required in licences, and the effect they would have on future predicted abstractions, to fulfil the objectives of the different EA and WRE scenarios. The largest reduction in abstraction corresponds to PWS followed by other potable uses. Moving from the Adapt to the Enhance scenario would be more than double the estimated future abstraction reduction.

Table C.2: Required licence reductions per sector and scenario (in Ml/d)

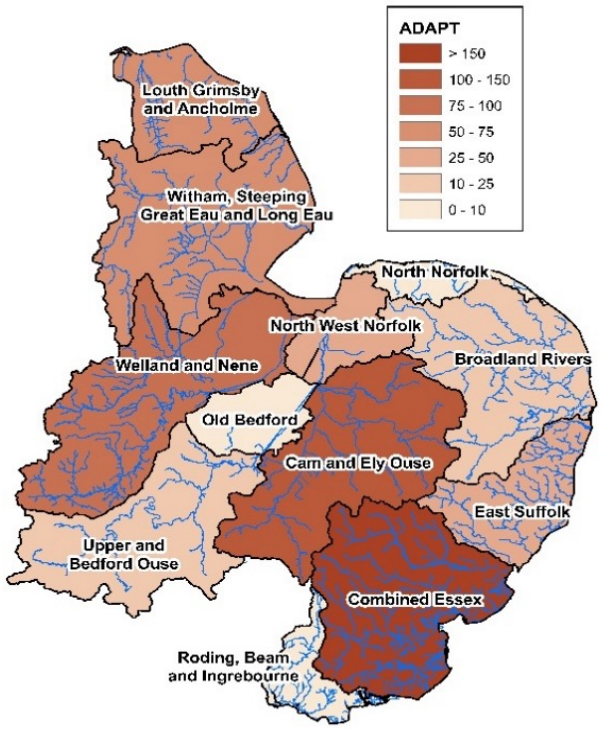
Sector	ADAPT	BAU+	ENHANCE
Public water supply	-865	-899	-941
Agriculture	-217	-204	-247
Industry	-64	-62	-76
Amenity/ environmental	-31	-25	-30
Other	-29	-25	-31
Power generation	0	0	0
Total	-1,207	-1,216	-1,325

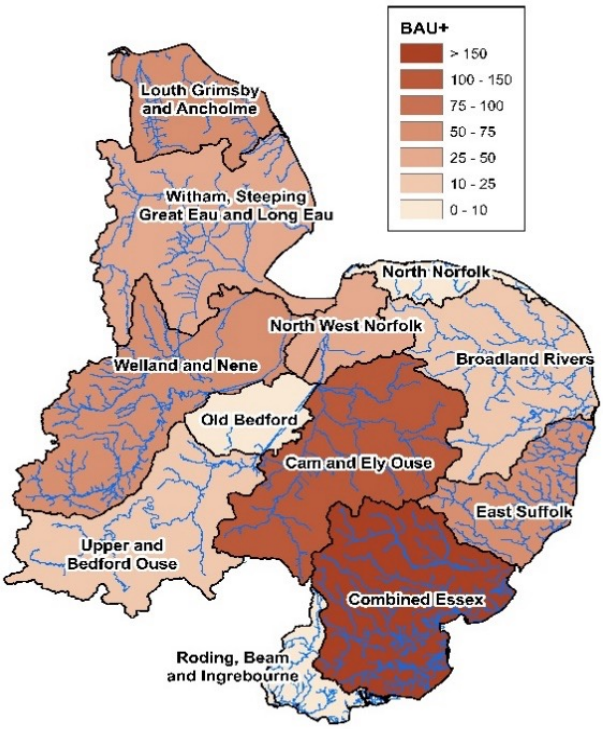
Table C.3: Estimated future abstraction reductions per sector and scenario (in Ml/d)

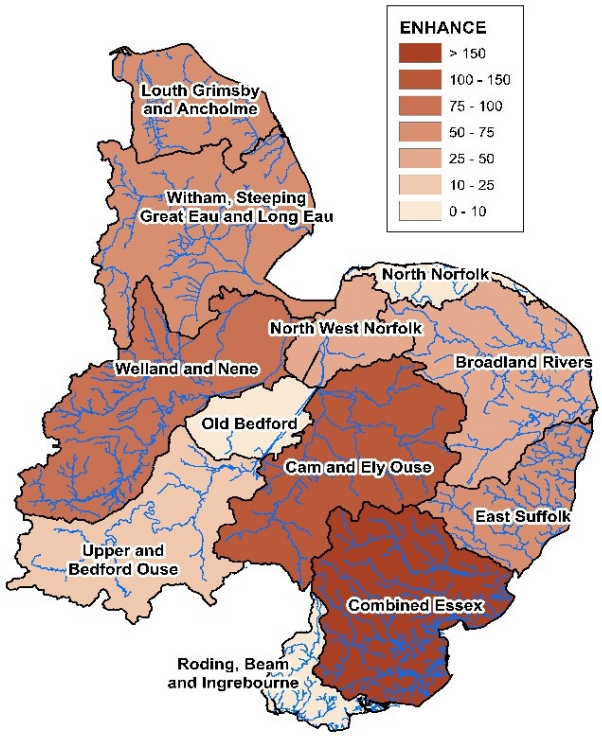
Sector	ADAPT	BAU+	ENHANCE
Public water supply	-475	-500	-562
Agriculture	-60	-55	-83
Industry	-18	-16	-25
Amenity/ environmental	-6	-2	-5
Other	-17	-14	-20
Power generation	0	0	0
Total	-575	-587	-695

As shown in Figure C.3, the largest reductions would be concentrated in the Combined Essex, Cam and Ely-Ouse, and Welland and Nene CAMS areas.

Figure C.3: Spatial distribution of abstraction licence reductions per scenario (in Ml/d)







Source: Adapted by Mott MacDonald based on EA data.

Conclusions

The sustainability reductions derived for the different environmental destination scenarios will increase the future supply-demand deficit in the region with new supply and demand side options required to address the gap. WRE is using a supply-demand system simulation to establish the benefit associated with different options, and a multi-objective optimisation to define the preferred regional portfolio of options, considering cost, the level of service for different sectors and the impact on river flows using the EFI. This Regional Simulator explicitly incorporates licence constraints allowing abstraction to vary within those to meet the demand of water. Given this, and the way the simulator is structured, the following information has been provided to reflect the environmental scenarios:

- Reductions in annual licences for individual modelled PWS river intakes;
- Updated limits to yield curves of Lumped Parameter Models (LPMs) to reflect caps to PWS groundwater sources;
- Reductions in surface water and groundwater agricultural licences aggregated per CAMS area;
- All scenarios were supplied.

While searching the preferred portfolio of options for these scenarios, the EFI metric which penalises in monetary terms flows below the EFI is deactivated to avoid double counting and potential inconsistencies.

It is noted that the methodology applied here to define the required sustainability reductions constitutes a preliminary analysis to understand the magnitude of the changes. It relies on simplified assumptions about the evolution of river flows and abstraction rates, as well as the impact of abstractions on the hydrological regime. More detailed investigations are needed before adopting the modelled reductions to confirm their effect on river flows.

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NORFOLK FWAG
Norfolk Rivers Drainage Board
NORFOLK RIVERS TRUST
North Lincolnshire Council
North Kesteven DISTRICT COUNCIL
NORTH NORFOLK DISTRICT COUNCIL
NORWICH City Council
npower An RWE company
Ofwat
Osberton Grange Farm
Pier Consultants
PROCTOR BROS
RAPID
RCCE
empowering local communities
REVIVEL
Representing the Wildlife and Countryside Link
Royal Horticultural Society
rspb giving nature a home
RWE
RT FARMS
RWC Tittleshall Ltd
SANDRINGHAM
SEVERN TRENT WATER
SEMLEP
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South Cambridgeshire District Council
South Holland Drainage Board
South Norfolk COUNCIL
SOMELCO
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