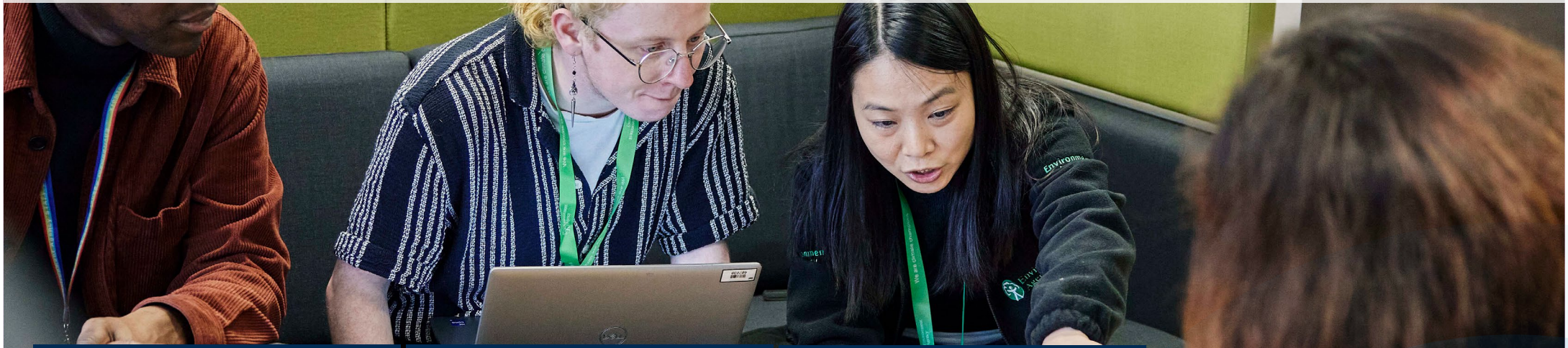
Oxford to Cambridge
Integrated Water Management Programme

Water Balance Visualiser

Environment Agency



Introduction

Balancing water in our rivers and aquifers, while accounting for abstractions and discharges, is a core component of water management. Across the Oxford to Cambridge Corridor (OxCam) and beyond, this is becoming more challenging. Stakeholders told us they need simpler tools to understand how changes to abstractions and discharges could affect river systems and water availability.

The challenge

There are two core pressures on water availability:

- increased demand from a growing population
- the impacts of climate change, particularly hotter, drier summers

Addressing these challenges will require new tools, data, and evidence to support effective planning and decision-making.

Our project ambition

To develop a highly visual tool with an interface that allows users to quickly explore and test changes to abstractions and discharges, understand their impacts on the river system and water availability, and compare different scenarios.

Project Aims

To explore

How to support users to understand how different abstraction and discharge scenarios affect river flows, water availability, and environmental flow compliance.

Develop an interactive, map-based tool that will test potential changes and visualise their impacts on the wider water system.

To create

A user-friendly screening tool that:

- **helps users understand system interactions and supports scenario testing, option comparison, and understanding of system interactions allowing water planners to quickly compare options and identify potential impacts.**
- **complements, rather than replaces, existing abstraction licensing and discharge consenting processes.**

To learn

Support early-stage planning and optioneering, ahead of more detailed assessment and modelling.

Understand the value, usability, and uptake of a non-regulatory visual decision-support tool among water planners and other stakeholders.

Challenges and facts

<u>Environmental Destination:</u> potential future abstraction reduction needed to maintain a healthy environment as the climate changes.

There are significant water supply pressures across the OxCam Corridor.



Increasing population means that more flows from sewerage works is expected over the coming years.

Natural flows, abstractions and discharges all determine the flow of water in rivers.

Background information

What is the Water Balance Visualiser?

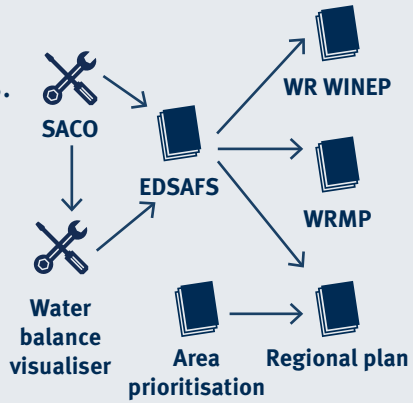
The Water Balance Visualiser is a user-friendly tool that provides a visual interface for Environment Agency water resource data. It enables users to test scenarios by modifying key abstraction and discharge parameters and quickly assess the impacts on river flows, water availability, and compliance with environmental flow targets.

While not required for any statutory process, the tool has been developed to support water resource planning and decision-making. It provides an accessible way for users across the water sector to explore the potential impacts of changes to abstraction and discharge volumes, supporting informed discussions on balancing environmental, societal, and economic needs.

Relationship with the Sustainable Abstraction Calulator and Optimiser (SACO) tool

The Water Balance Visualiser is closely linked to the Environment Agency's SACO tool, using the same data, calculations, and methodology to ensure consistent outputs. However, the tools serve different purposes. SACO assesses and optimises sustainable abstraction reductions, including potential license changes, while the Water Balance Visualiser supports option development and appraisal. Its visual interface makes it easier to explore, compare, and understand abstraction and discharge scenarios but does not recommend licence changes.

Users can also import optimised SACO outputs to review and compare scenarios through maps, schematics, and other visual outputs.



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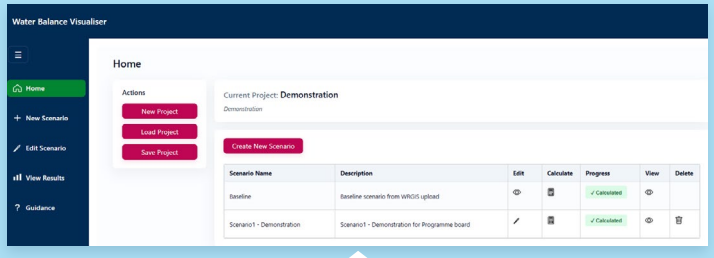
Environment Agency

Supporting the planning of water resources

Project scoping

Visualiser development

Water Balance Visualiser



Who is the tool for?

Access the tool

Why use the tool?

Required data

Engagement

Who we worked with

The idea for the Water Balance Visualiser emerged from discussions with stakeholders across the water sector, who identified a need for better tools to support thinking and visualise how changes in abstractions and discharges, particularly those linked to population growth, could affect river flows and water availability.

The Environment Agency OxCam team worked closely with stakeholders from across the OxCam Corridor and the Environment Agency to scope the project, develop and test the tool, including:

- Water Resources East
- Water Resources South East
- Anglian Water
- Cambridge Water
- Local Environment Agency teams
- Environment Agency National Water Resources team

How can we make best use of all the data and information already at our disposal?

What did we do?

We undertook a series of stakeholder engagement sessions to understand user needs and define the tool's requirements. Stakeholders were involved in:

- user story workshops to shape the design and functionality of the tool
- user acceptance testing sessions to evaluate usability and performance
- ongoing feedback and refinement activities to ensure the tool met user needs

Working collaboratively with stakeholders

To ensure the Water Balance Visualiser met real planning needs, we explored:

- who would use the tool?
- how it could support water resource planning?
- what types of scenarios and analysis users would want to undertake?
- how to deliver intuitive, accessible outputs through a user-friendly interface?

PDF

Water Balance Visualiser briefing note and FAQ

Demonstration of the tool

Supporting the planning of water resources

Project scoping

The project was initially conceived as a proof of concept focused on a single river catchment, to be developed and tested within the OxCam Corridor.

During the pre-development phase, an opportunity was identified to expand from a proof of concept to a national tool. This was made possible through the automated pulling of data from live datasets to map river networks and catchments across England.

As part of the scoping process, a number of approaches to calculating river flows were reviewed. The project team chose to utilise the Environment Agency's existing water balance calculator, which is part of the SACO tool. This ensured consistency with established Environment Agency tools and methodologies, making future updates and enhancements easier to manage.

Visualiser development

Agile project management

The development work was delivered using an agile approach, with work organised into 2-week sprints.

A sprint is a short, fixed period during which a team focuses on delivering a prioritised set of tasks and features.

At the end of each sprint, progress was reviewed, lessons were captured, and priorities were refined for the next development cycle. This iterative approach enabled the tool to evolve quickly in response to feedback and emerging requirements.

2 weeks

Shaped by users

During the requirements workshop, stakeholders highlighted the importance of understanding influences and interactions across river catchments, particularly where groundwater abstractions can influence river flows over large areas or across multiple catchments.

User testing also informed several refinements to the tool. For example, compliance colour scales within the visualisations were adjusted to provide a clearer distinction between compliant and non-compliant flow conditions.

An extended testing period was built into the project to identify bugs, validate functionality, and gather feedback to inform future development.



The Visualiser

The tool

PDF

Instruction manual

Demonstration video

PDF

Briefing note and FAQ

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Supporting the planning of water resources

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Visualiser development

Initial requirement

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Stakeholder scoping

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Commercial engagement

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User stories / requirements workshop

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3 development sprints

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User acceptance testing

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2 finalisation sprints

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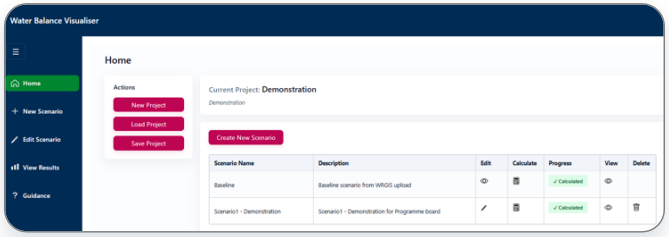
6-month user testing

The Water Balance Visualiser

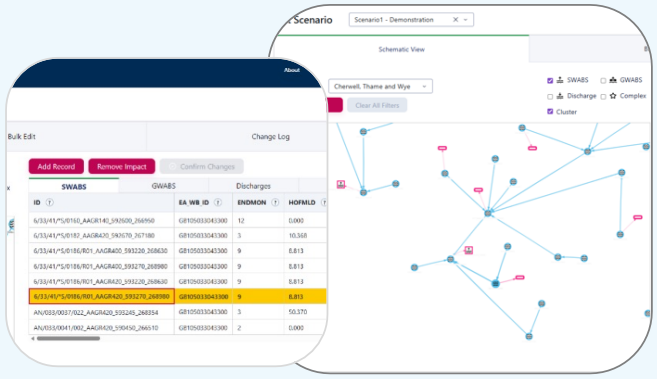


Key capabilities of the tool

- Upload and explore water resource datasets
- Edit abstraction and discharge data
- Create and compare multiple abstraction and discharge scenarios with each other and against the baseline
- Identify water bodies moving into or out of deficit
- Run the river-flow calculator and visualise outputs

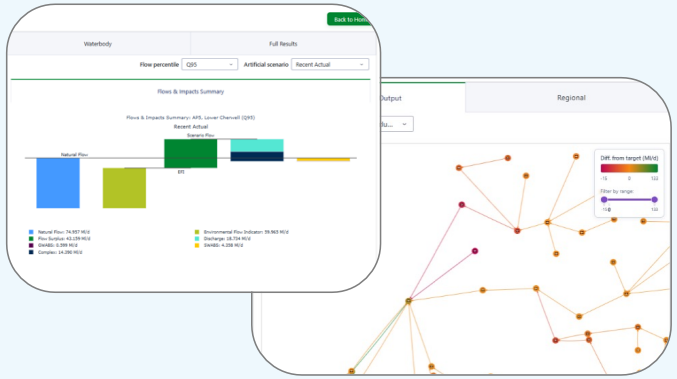
Editing scenarios

- View river catchments in a schematic format
- Modify, add, or remove abstractions and discharges
- Track changes through an audit log



Viewing outputs

- Results can be seen and analysed at individual water body level
- Aggregated results can be viewed at catchment or river basin scale



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What's next?

Who is the tool for?

Environment Agency users

Regional water planners

Water companies

Consultants

Wider partners, including non-governmental organisations and academia (subject to licensing)

Access the tool

External users

- access the open-source code via GitHub and host the tool locally

Defra group users

- access the tool through an internally hosted platform

Throughout the project, we sought to keep the tool open source to promote transparency, collaboration, and trust across the water planning community.

Required data

The tool relies on the Environment Agency's WRGIS dataset, which is available on request. To obtain the dataset users or their organisation must demonstrate they hold a valid 'Qube licence', for which a fee applies.

Our ambition was to make the tool accessible to all water planners. However, we decided the use of the WRGIS dataset was necessary to ensure consistency with other water planning tools. As a result, user access to the dataset is dependent on a valid Qube licence.

Why use the tool?

The main strength of the tool is that its interface allows users to quickly define and visualise different scenarios, making it particularly valuable during early-stage option development and planning.

Examples of how the tool can support users include:

- assessing the impact of discharge reductions, for example from proposed treated effluent reuse schemes
- understanding how population growth may affect dry weather flows through increased discharge volumes
- exploring water availability across different points of the flow duration curve
- identifying catchment-wide impacts of changes occurring outside an immediate area of interest
- quickly identifying significant abstractors or specific abstraction categories using the filtering functions

The tool's change log supports transparency, collaboration, and clear discussion on scenarios and outputs.

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