Towards the operationalization of water sharing for irrigation in England

Authors: Dolores Rey Vicario, Ian Holman, Jerry Knox

Department: Cranfield Water Science Institute

Date: July 2021

Executive summary

In the context of ongoing water abstraction reforms[1], water sharing between abstractors is gaining increasing attention among stakeholders and agribusinesses. However, the rules and the application process regarding water sharing are still unclear. This study aimed to fill this gap by providing (i) a formal definition of water sharing (and how it is different from trading), (ii) a set of realistic water sharing scenarios, and the factors that would make a proposed water share 'likely' or 'unlikely' to be approved by the Environment Agency (EA), and (iii) an overview of the anticipated application process. This study focussed on water sharing scenarios involving agricultural irrigation abstractors and considered only surface water abstraction. It was targeted to irrigators and other stakeholders interested in identifying more flexible ways to make more efficient use of available water.

Water sharing versus trading: The terms water sharing and trading are sometimes used interchangeably. The key difference between sharing and trading is that the latter implies a change in the abstraction licenses involved. Any temporary physical exchange of water that does not require any licence alterations would be considered a water share.

Water sharing scenarios: There are a wide range of water sharing options, from simple and informal to more complex. This study co-developed a set of realistic water sharing scenarios covering this spectrum and outlined the factors that would determine whether an application would be likely to be accepted or rejected by the EA. In general terms, sharing surface water downstream with a neighbouring farm when the licence conditions (e.g., Hands off Flows) and pumping rates of both parties are similar would be much easier to approve.

Application process: Once two businesses agree on sharing water, in most instances they will need to contact the EA for approval – two examples are provided in the scenarios in which EA approval would not be required. The level of information required for the application and the review time are likely to be less than in a water trade, making water sharing a more appealing option for abstractors. The review process is likely to lead to permissions via Local Enforcement Positions (LEPs) rather than licence variations, whilst the farming community should be encouraged to pro-actively develop sharing requests early in the season (e.g. using the February and April EA Irrigation Prospects as a trigger for action) rather than making emergency requests for licence flexibility when water resources availability is already constrained.

[1] https://www.gov.uk/government/publications/water-abstraction-plan-2017/water-abstraction-plan

Introduction

Many catchments in England are over-abstracted and/or over-licensed and have no spare summer water that can be allocated to support business expansion, meaning that access to water is increasingly becoming a constraint on economic growth. This situation is particularly acute in eastern England. The legislation for managing water abstraction was introduced in the 1960s and is currently under review. A key limitation is its inflexible approach which limits the capacity to cope with the changing environmental pressures of increasing demand for water, or to allow abstractors access to additional water when available (e.g. peak flows). To address these and other water regulatory limitations, the government is implementing a raft of reforms to the abstraction licensing regime in England.

While water trading can support more efficient water allocation, high transaction costs and delays in approvals have often limited abstractor uptake. Water sharing is an alternative approach to formal water trading that is gaining more attention in the so-called Priority Catchments[2], where the development and testing of innovative abstraction management approaches is underway. However, there remains a widespread lack of understanding of what water sharing means from hydrological and regulatory perspectives - what are the available sharing options along the spectrum from informal to formal arrangements? What are the different scales at which sharing might be feasible (neighbouring businesses to catchment scale) and how might the approval process for authorising and monitoring sharing be operationalized by the Environment Agency (EA)?

The aim of this short study was to explore these unresolved issues through the development of a range of realistic water sharing 'scenarios' between agricultural abstractors coupled with a mock evaluation process led by the Environment Agency.

Water sharing versus water trading

Both water sharing and trading have the same aim, namely, to make a more efficient and flexible use of available water resources. These two terms are sometimes used interchangeably but they are quite different in practice. The EA recognizes the difference between the two terms might not be clear and could lead to confusion, so are updating these definitions as part of the abstraction reform.

For the purpose of this study, we used the following definitions: When two abstractors want to physically share the water but there is no need for the water abstraction licenses to be altered in any way, then we will be talking about **water sharing**. In those cases when the licence of the donor or recipient needs to be changed, then this will be called a **water trade**.

[2] https://consult.environment-agency.gov.uk/water-resources/water-resources-priority-catchments/

Abstractors can only share water with someone using it for the same purpose (e.g., two farming businesses using the water for direct spray irrigation), otherwise the donor would not be complying with their license – moving water between purposes would be considered a trade and hence needs to go through the formal water trading application process already in place.

Water trading requires a formal application process and growers have been reluctant to rely on trading due to the long assessment period and high transaction costs associated with it. Both the right or the licence quantity can be traded, and the trade can be permanent or temporary.

Water sharing is more informal (not requiring the involvement of the EA in some cases) and it tries to solve some of the issues associated with trading identified above. Water sharing should be a faster and more flexible option to share water between abstractors on a temporary basis. The share could also be pre-approved before the start of the irrigation season.

A recent study in the River Lark by the River Lark Catchment Partnership (RLCP) and Cranfield University found that abstractors were more interested in sharing rather than trading water. A summary of that work is provided below.

Case study: potential benefits of water sharing in the Lark catchment

A recent study in the River Lark catchment (part of the Cam and Ely Ouse Priority Catchment) by Cranfield University, in collaboration with the Lark Abstractor Group and the River Lark Catchment Partnership, found that abstractors were more interested in sharing rather than trading water (Ref). Subsequent work by Chengot et al. (2020[3] used the freely available online D-Risk webtool (www.d-risk.eu) to explore how different scales of water sharing could reduce aggregate annual irrigation deficits across nine businesses with the constraints of existing licence allocations and Hands Off Flow restrictions. These scales ranged from water sharing between (i) businesses on the same tributary or reach; (ii) businesses in the same sub-catchment and (iii) all nine businesses, irrespective of their location within the catchment.

As an example, Figure 1 shows the annual exceedance probability or annual risk of a certain level of irrigation deficit across the nine businesses. With a 50% annual exceedance probability or 1 in 2 annual risk, the nine businesses have a modelled annual irrigation deficit of *c*100,000 m^3. However, this increased to over 1,000,000 m^3 in a 'design' dry year (20% annual exceedance probability) and 2,500,000 m^3 in the driest year. Water sharing at all scales reduces the 'design' dry year irrigation deficit to around zero, although it has limited effect in the driest year, due to the over-riding control

[3] Chengot R, Knox JW, Holman IP (2021). Evaluating the Feasibility of Water Sharing as a Drought Risk Management Tool for Irrigated Agriculture. Sustainability, 13, 1456. [Open Access: https://doi.org/10.3390/su13031456

of Hands Off Flows and volumetric licence limits. Nevertheless, the study showed the significant benefits that can potentially be achieved through water sharing at the local (tributary / reach) scale.

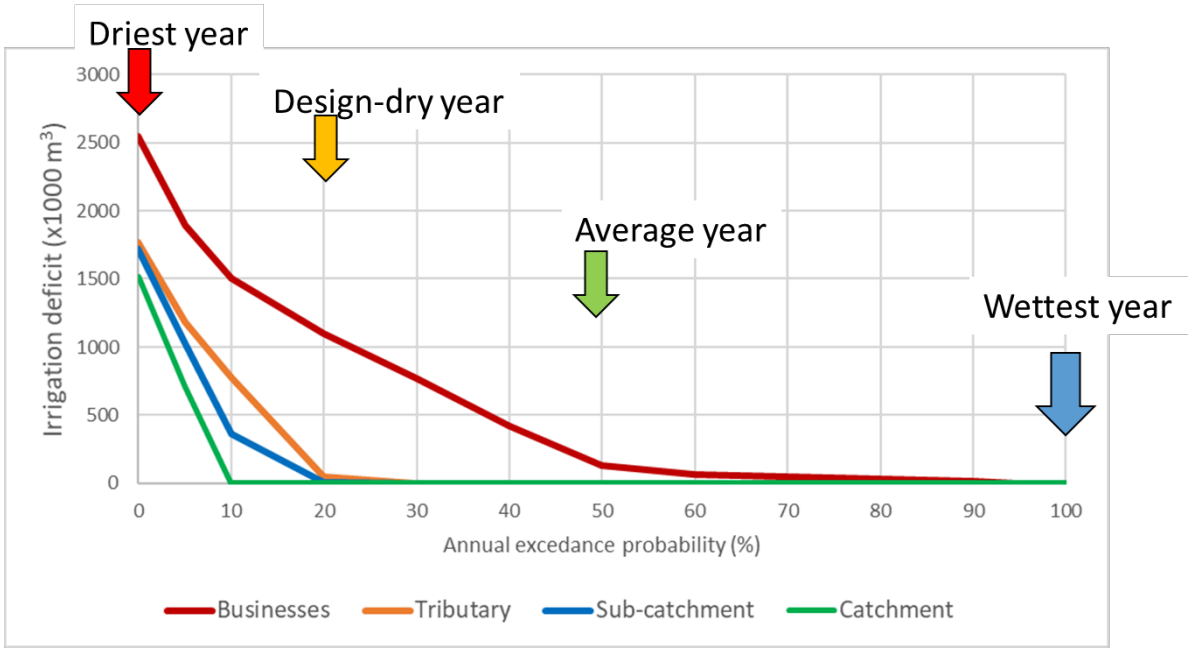

Figure 1. Annual probability distribution of aggregated irrigation deficits for different scales of water-sharing groups within the Lark catchment.

Approach

A set of realistic water sharing scenarios that covered the spectrum of informal-formal arrangements were developed. The water sharing scenarios were defined to reflect a combination of the following water resource attributes or conditions:

1. Same or different abstraction point
2. Water shared either upstream or downstream
3. Water shared from the same reach/tributary or not
4. HoF conditions of the donor being more/less strict than recipient
5. Pumping rates similar or different between donor and recipient

Based on these five different conditions, the following scenarios were defined for surface water abstractors:

1. Farm A sharing water from **own abstraction point** with neighbouring Farm B
2. Farm A sharing stored winter **water from on-farm reservoir** with Farm B in summer

3. Farm A sharing direct abstraction water (licence quantity) during the summer with Farm B on **same reach/tributary**

4. Farm A sharing direct abstraction (licence quantity) water during the summer with Farm B on **different reach/tributary**

These 4 scenarios were then shared with the Environment Agency so they could undertake a mock assessment to define (i) the conditions that would make the scenario likely to be approved, (ii) the conditions that would make a water share application likely to be rejected, and (iii) the issues that would need further assessment. The results were presented as a traffic-light system to help abstractors visually understand what to expect under a given set of circumstances.

Traffic-light system for water sharing for irrigation in England

Table 1 contains the results of the mock assessment of the scenarios shared with the EA. For each scenario, the factors that will make it more or less likely to be approved, and the situation that will add uncertainty to the outcome, are listed. The aim was to help abstractors understand the key factors that need to be taken into consideration when looking for a water sharing partner and what to expect when applying for permission to the EA.

However, it is important to emphasise that each water share will be unique, depending on the licence conditions of the donor and the recipient, where they are geographically located within the catchment, and the water resources situation in the area. Consequently, the information in Table 1 should be used as only as a guiding principle and does not reflect or commit the Agency to any particular decision.

Table 1. Water sharing scenarios using the traffic-light system approach, ordered by level of complexity (from low to high).

Scenario	Likely to be approved if…	Uncertain outcome	Likely to be rejected if…
Farm A sharing water from **own abstraction point** with neighbouring Farm B	• The abstraction point location remains unchanged then the neighbouring Farm B can pump/pipe the water wherever they need. All licence conditions need to be adhered to. • The legal licence owner (Farm A) would be responsible for any breach of conditions. EA approval not necessary.	• N/A	• The donor licence still has a licence condition that stipulates the land on which the irrigated water can be used. • **Different purposes** between donor and recipient (water can only be shared with other farm using the water for the same purpose). • **Sharing between surface and groundwater.**
Farm A sharing **stored winter water** from on-farm reservoir with Farm B in summer	• **With pipe infrastructure** - Farm A pipes the water they can share directly to Farm B. No compensation discharge will be required as there is no loss in the system. EA approval not necessary. • **Discharged into the river** - Shared winter stored water is discharged into river in summer and abstracted by Farm B prior to location of downstream flow gauges and/or any other abstractors. The closer the two points are the better. The discharge would also need to contain 10% compensation • **Discharged into local drain/ditches** - Farm A discharges into local drains/ditches, a compensation discharge of 10% greater than the abstraction would need to be made to cover evaporative and seepage losses.	• **Distance between the two -** When discharging into drains/ditches or a flowing river the distance between the discharge and the abstraction would need to be taken into account. Hydraulic connectivity would need to be shown. • **Sharing from multiple reservoirs** – This would add a level of complexity that may be difficult to monitor/enforce.	• **No connectivity -** There is no connectivity between the discharge and abstraction. • **Sharing downstream of flow gauges used for HoFs -** Shared winter stored water is discharged into river and abstracted by Farm B downstream of the location of EA flow gauges used for HoFs and/or other summer direct abstractors with no/lower HoFs • **Sharing upstream -** The abstraction takes place far enough upstream of the discharge to create a depleted reach. This situation applies primarily to flowing rivers. • **Different purposes** between donor and recipient • **Sharing between surface and groundwater.**

Farm A sharing **direct abstraction water (licence quantity)** during the summer with Farm B **on same reach/ tributary**	• **Downstream and close distance -** Farm B is downstream of Farm A. Ideally the distance between the two would be small, neighbouring farms would be the best situation. • **Recipient keeps pump and abstraction rates the same -** Farm B would stick with their instantaneous pump rates and their hourly and daily rates. They would only be sharing annual quantity with Farm A. • **Above HoFs -** Both farms would have to be above their respective HoFs.	• **Longer distance –** Significant distance between the two farms. • **Very different HoFs -** HoF conditions on recipient and donor are widely different. • **Permanent licence without HoFs** – these would need a HOF equivalent to the 95th percentile of the Environmental Flow Indicator (EFI q95) for that catchment to avoid risk of deterioration during sharing • **Impact on others -** Number of other abstraction licences between Farm A and B.	• **Upstream share -** Farm B is far enough upstream of Farm A to create a depleted reach. • **Higher pumping rate of recipient -** Pumping rate of recipient is higher than donor • **Less restrictive HoFs -** Upstream recipient has no or less stringent HoF than donor • **Different purposes** between donor and recipient • **Sharing between surface and groundwater**
Farm A sharing **direct abstraction (licence quantity)** water during the summer with Farm B **on a different reach/ tributary**	• Only annual quantities can be shared. • **Connected and downstream -** Farm B must be hydraulically connected to and downstream of Farm A • **Above HoFs -** Both farms would have to be above their respective HoFs at the time. • **Pumping rate of recipient same or lower than donor**	• **Longer distance -** Significant distance between the two farms • **Very different HoFs -** HoF conditions on recipient and donor are widely different • **Permanent licence without HoFs** – these would need a HOF equivalent to the 95th percentile of the Environmental Flow Indicator (EFI q95) for that catchment to avoid risk of deterioration during sharing • **Impact on others -** Number of other abstraction licences between Farm A and B.	• **No hydraulic connection** • **Unmet flow targets -** Water body that the recipient abstraction affects is failing or at risk of failing its ecological flow targets (EFI or alternative flow objective). • **Upstream -** Farm B is far enough upstream of Farm A to create a depleted reach • **Different purposes** between donor and recipient • **Sharing between surface and groundwater**

Water sharing in practice – the process

From the four water sharing scenarios presented above, only two situations were identified which would not require the parties to contact the EA for approval. In these two cases, the shared water continues to be abstracted from the same abstraction point and is shared to the recipient farm via existing inter-connected irrigation distribution networks without the water being discharged to the environment. In the remainder of the cases, the donor and recipient would need to contact the EA before the share could proceed. The parties involved share would need to confirm to the EA:

- The licenses involved (so the EA can check their licence conditions and water sources);
- The abstraction point/s;
- The rate and volume of water they would like to share, and;
- For how long (duration) the water share will last for.

The farming community should be encouraged to pro-actively develop sharing requests early in season (e.g. using the February and April EA Irrigation Prospects as a trigger for action) rather than making emergency requests later in the year for licence flexibility. Although water sharing should entail a simpler application and review process than water trading, it is likely that the review process will still take up to two weeks (but could be longer). It is anticipated that the review process will, in the case of successful applications, lead to permissions via Local Enforcement Positions (LEPs) rather than licence variations.

Water sharing – A way forward

The abstraction reform and the Priority Catchments Initiative bring the opportunity to test more innovative ways to make use of available water resources. Water sharing is being discussed within this framework as a tool to provide more flexibility in how water is used in a catchment and that could help abstractors to access additional licensed water when they need it, subject to avoiding environmental degradation or derogation of neighbouring licenses.

As highlighted by the mock application process undertaken as part of this study, in most cases the water sharing parties would still need to engage with the EA for prior approval, preferably before the start of the irrigation season. It is now hoped that the operationalisation of this water sharing process can be tested within a Priority Catchment, which will enable the EA to publish guidance, similar to the recently updated water trading guidance, to ensure future consistency in application across the country.

Acknowledgements

We thank the Environment Agency, particularly Andrew Chapman and Iain Page, for their time and support during this project, for the mock assessment of the water sharing scenarios and in providing constructive feedback.

Towards the operationalization of water sharing for irrigation in England

Rey Vicario, Dolores

2021-07