

## How modelling helps us understand changes to low flows

*This fact sheet explains low flows, how changing harvestable rights limits could affect them and what further analysis of modelling results tells us.*

The Coastal Harvestable Rights Review uses hydrological modelling to help us understand how river flows could change if we increase harvestable rights limits. See the [Coastal Harvestable Rights Review—Discussion paper<sup>1</sup>](#) for more details.

The modelling estimates how changes in the size, number and location of harvestable rights dams could affect daily river flow volumes at the end of each case study catchment. Each model run estimates more than 15,000 daily flow values over a 42-year period. We interpret and compare the different modelled scenarios by measuring aspects of different flow types (e.g. low flows, freshes, annual volumes) that are made up of a series of daily flow values. Looking at changes to the pattern, timing and volume of different flow types or events can help us answer questions about how increasing harvestable rights could affect downstream water users and environments.

This fact sheet looks at the modelling results for low-flows in more detail to better explain the changes that may occur.

## What low flows are

Low flows are regular, small flow events. These lower flows keep the riverbed and lower banks of the river wet. They keep the river connected during dry periods, maintaining water quality by the movement of oxygenated water, and help to maintain the salinity balance between fresh upstream water and salty estuarine water.

## Why we look at low flows

Changes to low-flow periods are likely to be of interest to users who have permission to access low flows, as it is during these times when competition for access to water is greatest. This competition is not just between water users, but also with the environment and its needs. Therefore, we also need to consider changes to low flows from an environmental perspective. This is because in most unregulated rivers, it is during dry periods when flows are naturally low that there is generally greatest concern for the health of the river. This is when pools contract, water quality deteriorates rapidly, algal blooms occur, oxygen levels decline and animals compete for reduced food supplies.

## How the modelling defined low flows

In the modelling report, low flows are flows on the driest 20% of days. This means these flows are exceeded by higher flows 80% of the time.

The modelling looked at low flows in the low-flow season separately to low flows in the high-flow season.

## How the frequency of low flows changes

Further analysis of the low-flows modelling allows us to better understand the effects on how often low flows would occur if we increase harvestable rights. The analysis uses the low-flow condition as it would exist if there was no dam development in the catchment as a baseline. The results

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<sup>1</sup> Available at [www.dpie.nsw.gov.au/coastal-harvestable-rights-review](http://www.dpie.nsw.gov.au/coastal-harvestable-rights-review)

show the upper limit of changes that would occur if we increased harvestable rights limits. This fact sheet focuses on the Wyong River catchment, which contains many spring-fed streams, as a case study. However, we acknowledge that the modelling shows that the scale of flow changes can differ considerably between catchments.

Figure 1 shows that low flows in the Wyong River catchment occur more frequently as both the uptake of harvestable rights and the percentage of allowable harvestable rights increase. The current level of uptake in this catchment has been modelled at 51% of the existing 10% harvestable right.

In a scenario where there are no harvestable rights dams, the low-flow condition occurs 20% of the time. However, under full uptake of a 10% harvestable right, low flows would occur 27% of the time. And under full uptake of a 20% harvestable right, low flows would occur 31% of the time.

This means that compared with a no-farm-dam development scenario, the low-flow condition occurs 7% more frequently under full uptake of a 10% harvestable right, and 11% more frequently under the full uptake of a 20% harvestable right.

In a one-year period, a 10% increase in the occurrence of low flows would mean an extra 25 days of low-flow conditions. It would mean an extra 40 days of low-flow conditions if we increased harvestable rights to 20% and it was fully taken up.

**Figure 1. Changes to the frequency of low-flow conditions in the Wyong River catchment as harvestable rights uptake and percentage are increased with dams on first- and second-order streams only**

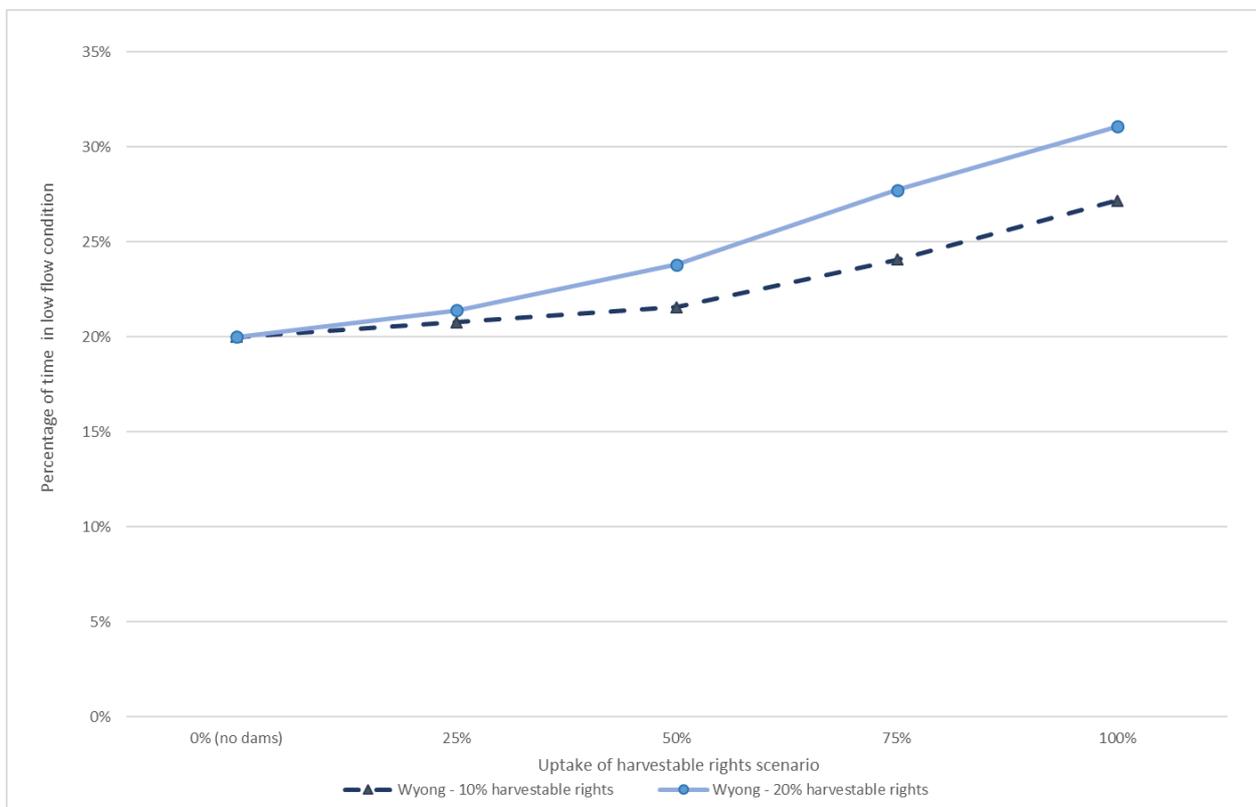


Figure 2 shows the number of days the Wyong River catchment experiences low-flow conditions under three scenarios:

- where there are no harvestable rights dams

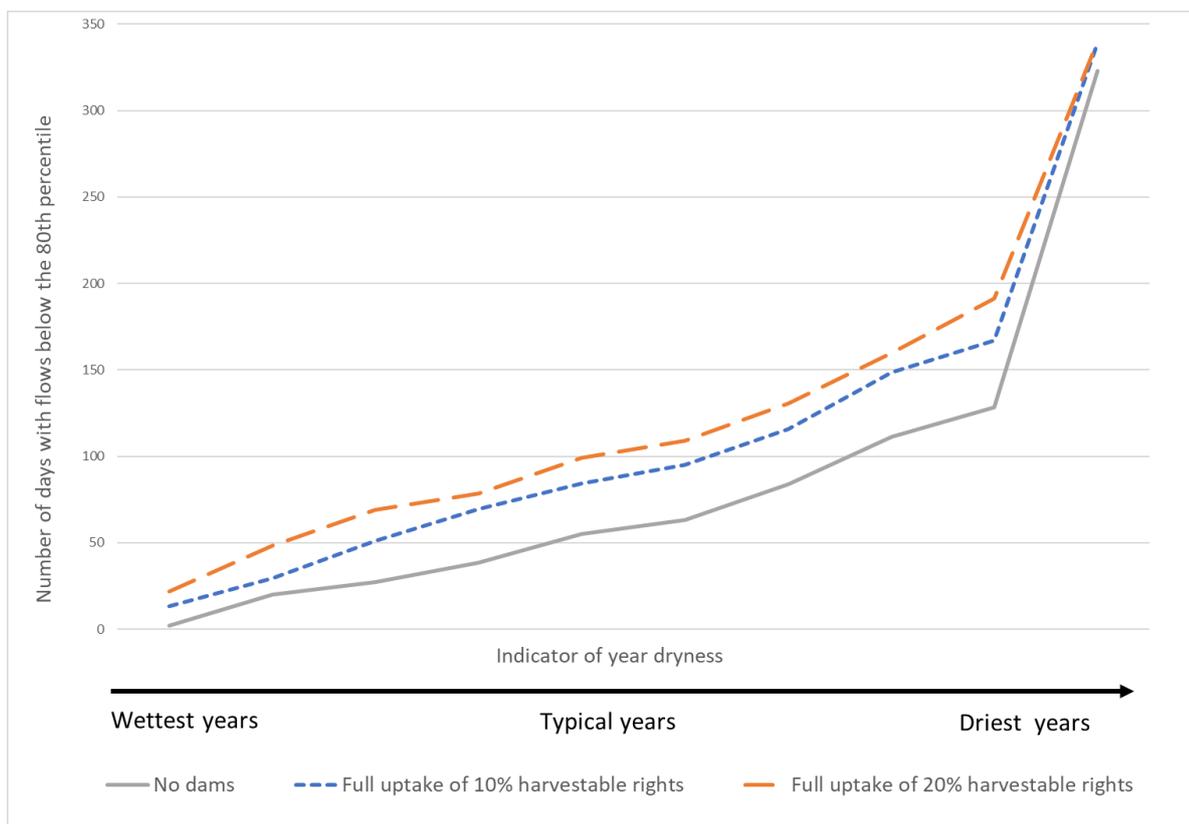
- the full uptake of the current 10% harvestable right
- the full uptake of a 20% harvestable right.

Changes to low-flow conditions will vary depending on whether the catchment is experiencing a dry year or a wet year, which Figure 2 also shows.

In very dry or very wet years, the number of days the system experiences low-flow conditions changes a small amount when introducing additional dams into the catchment compared with changes in more ‘typical’ years.

For example, in one of these more typical years, under full uptake of the 10% harvestable right, the low-flow conditions in the catchment may persist for an extra 30 to 40 days compared with when there are no harvestable rights dams in the catchment. This increases to an extra 40 to 50 days under full uptake of a 20% harvestable right.

**Figure 2. Number of days per year in low-flow conditions in the Wyong River catchment for the no-dams scenario and full uptake of a 10% and 20% harvestable right with dams on first- and second-order streams only**



## Summary

Changing harvestable rights limits can affect how often river systems experience low-flow conditions. The modelling analysis in this fact sheet explores the concept that low-flow conditions occur more frequently as dam development increases in a specific catchment.

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