

Case Study: Marne Catchment

A study of low flow bypass devices found that the devices restored more natural flows without disadvantaging the landholders who depend on farm dams to store water for agriculture.¹³

Dam storage capacity in the catchment has exceeded sustainable limits, delaying the onset of winter flow and increasing the duration of zero-flow.

In the study, bypasses were installed on three farm dams. The bypasses prevented low flows from entering the dams, instead diverting them around the dams and sending them downstream. The flow rate bypassed differed at each dam depending on the size of the Marne catchment above and rainfall in the area.

To assess whether the bypasses worked, each of the bypassed dams was paired to a similar 'control' dam. Water quality parameters such as pH (how acidic or basic the water is) were measured, and macroinvertebrates (organisms without backbones, which are visible to the eye) were collected upstream and downstream of each dam. The observations at the bypassed dams were compared with observations at the control dams.

Noticeable changes

- A more natural flow regime downstream of bypassed dams
- A reduced period of zero flow downstream of bypassed dams
- More flow-loving macroinvertebrates (including Ephemeroptera and Plecoptera) downstream of bypassed dams
- Fewer still-water macroinvertebrates (including several Coleoptera, Hemiptera and Diptera) downstream of bypassed dams
- In most years, there was no noticeable drop in water supply across the board.

How reduced flows of water affect catchment health

in the Eastern Mount Lofty Ranges



Dams and watercourse diversions provide water security for sustainable agriculture, tourism and rural lifestyles. Recent research in the Eastern Mount Lofty Ranges (EMLR), however, shows that dams and watercourse diversions contribute to the long-term degradation of water catchments.

Unless we act, poor catchment conditions are expected to continue. To reverse the decline, a more natural flow pattern must be returned in areas affected by dams and watercourse diversions. In order to improve the flow pattern, devices can be installed in strategic locations to allow low flows to bypass or be returned from dams and diversions.

When low flows are passed, the length of the flow season in the EMLR is expected to be extended. Also, with devices, low flows will be allowed to pass through the catchment at any time of the year – whenever there is a rainfall event. This will provide much needed water to the catchment more frequently.

Passing low flows with devices does not mean that a constant flow of water will seep out of dams. The low volumes only pass around or from a dam when there is flow into the catchment. This means shifting the timing of water capture to higher flow events.

This brochure provides a summary of the evidence-based science that demonstrates how reduced flows have affected catchment health in the EMLR and how low flow devices on dams and watercourse diversions will help reverse the problem.

Want to know more about Flows for the Future?

Call **8204 1673**, email **F4f@sa.gov.au** or visit **www.naturalresources.sa.gov.au/flows-for-future**

References

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more than
8000
dams
have
been
built¹

Dam capacity more than doubled in the Marne catchment in the 1990s²



90%
of pre-European
vegetation
cleared³

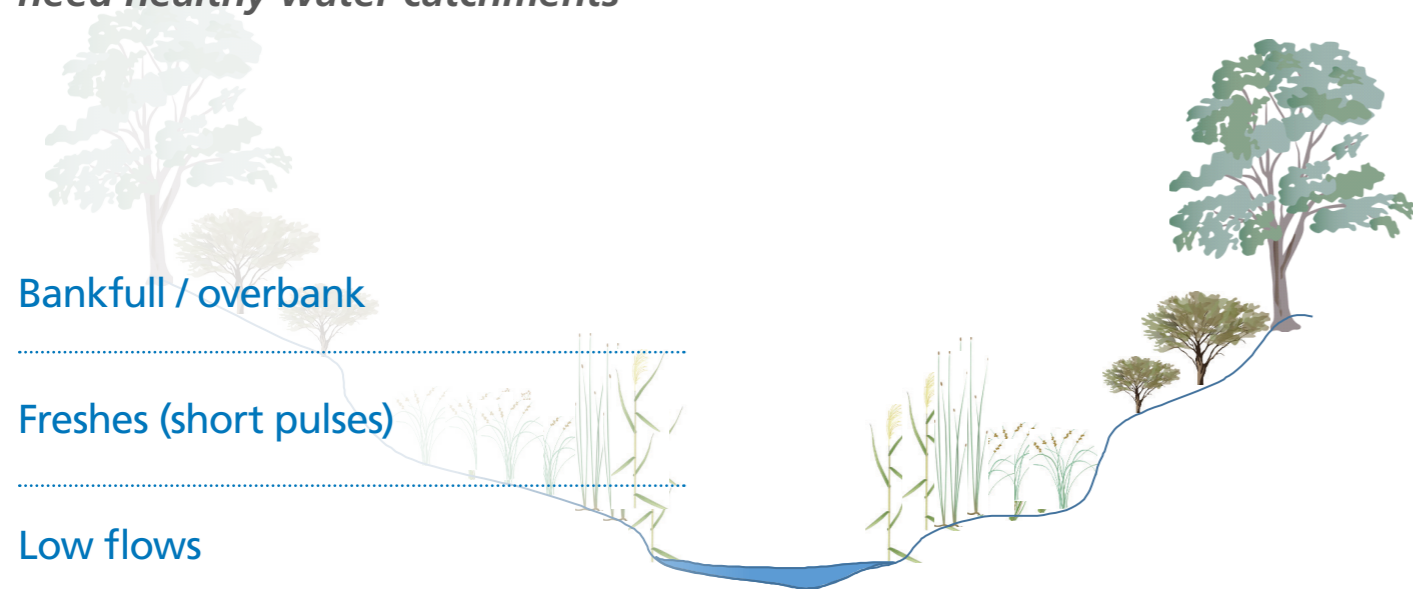


77% of the
region
used for
grazing &
cropping³



Why are natural flow patterns important?

Productive and sustainable businesses need healthy water catchments



Bankfull / overbank

- Waters the floodplain
- Moves materials and organisms
- Forms the channel

Freshes (short pulses)

- Refreshes water quality and scours pools
- Moves material and organisms locally
- Wets higher bank habitats

Low flows

- Maintains pools as aquatic refuges for plants and animals
- Supports fish breeding and survival to adulthood
- Wets edges and creates shallow flowing habitat needed by some plants and animals
- Low flows come from surface flow and groundwater inflow

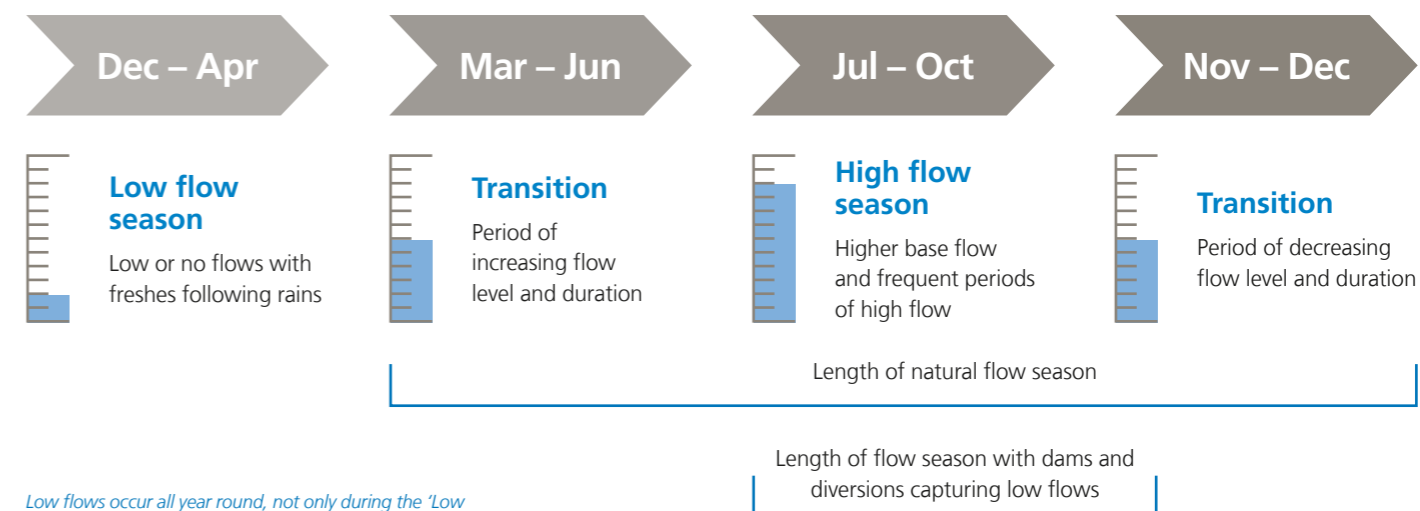
The flow regime of many streams has changed

A 'flow regime' describes the pattern of water in a stream – such as the quantity, timing and variability of flow - over time. An important part of the flow regime is the different flow components like no flow, low flow, freshes (short pulse flows), and high flow. These flow components play different roles in supporting plants and animals that live in and around streams, as shown in the stream diagram (left).

The flow regime can be described in terms of when, how often and how long these different flow components occur. 'Flow seasons'

are part of this, with a general example of the natural flow seasons in the Mount Lofty Ranges shown below.

There are eleven low flow trial sites in the Mount Lofty Ranges. Recent monitoring at these sites shows that data from hydrological models that are used to estimate catchment run-off and flow rates closely match actual flows observed passing into and out of the dams. The data also show that the landholders were able to continue their normal water use – the security of their supply and ability to access water was not impacted.



Low flows occur all year round, not only during the 'Low flow season'. The above flow season lengths are indicative.

Catchment health in the Eastern Mount Lofty Ranges is deteriorating due to changes in flow. Here's how we know.

The Environment Protection Authority's assessment of aquatic ecosystem health at 14 sites across the EMLR in 2015 showed 43% of sites to be in poor conditions.⁶ Native fish populations have also declined. 29 native fish species have been found in the EMLR, of which 3 are now regionally extinct, 3 are critically endangered, 5 are endangered, and 3 are vulnerable.^{4,5}

Several studies show that changes to the flow pattern as a result of dams and diversions in the EMLR are one of the most significant drivers of deteriorating ecosystem health.^{7,8,9} Dams intercept flows until they fill and spill, which changes the pattern of flows over the year.

In ecosystems that depend on water, changes in flow are linked to:

- Decline of aquatic plants and animals
- Decline in water quality
- Loss of permanent pools and refuges



Improved catchment health ensures sustainable water resources for generations to come.

Dams and watercourse diversions have changed natural flow patterns

In 2009, researchers assessed the impact of dams on the flow regime at 135 sites in the whole Mount Lofty Ranges⁸ and found that:

- Low flow 'events' throughout the year are now smaller (fewer events, lower volume and shorter duration)
- Small pulse flows are shorter and happen less often; the negative impacts of this are strongest in the Low Flow Season
- High flow events that occur throughout the year have been less affected
- The high flow season starts later (at almost 75% of sites) and ends sooner (at almost 50% of sites).

Native plants, animals and ecosystems have been impacted

Flows are critical to the survival of aquatic plants and animals. Flows regulate how much habitat and food is available and the important connection between habitats and populations. Flows determine

how aquatic plants and animals grow, reproduce and move across the ecosystem.

- Changes in macroinvertebrate and fish communities are strongly linked to the pattern of flows, with an increase in zero flow days having a particularly significant negative impact on native animals.^{10,11,12}
- Dams lengthen the naturally stressful time that pools of water (used as refuges by animals) are disconnected. For much of the year, these pools now rely on dams filling and spilling to pass low flows to the catchment. Water quality in pools is now poorer, and many pools dry up altogether.
- As seen in the case study on the back page, improving flow patterns leads to an increase in the number and types of flow-loving macroinvertebrates in a catchment. Macroinvertebrates provide food for other native animals.

