



Government of South Australia



Australian Government

MURRAY FUTURE
Riverine Recovery

WEIR POOL MANIPULATION

Management to mimic more natural water levels

The feasibility of using weirs to introduce water level fluctuations that wetlands and floodplains are dependent upon, is being investigated under the *Riverine Recovery Project* (RRP).

The \$100 million RRP, part of South Australia's \$610 million *Murray Futures* program, will take steps to improve the long-term ecological health and resilience of the river, floodplains and wetlands along the River Murray from the South Australian-Victorian border to Wellington.

Part of the RRP funding secured is for investigations into changing the way in which weirs are operated to better mimic more natural, historically variable flows.

What are locks and weirs and why were they built?

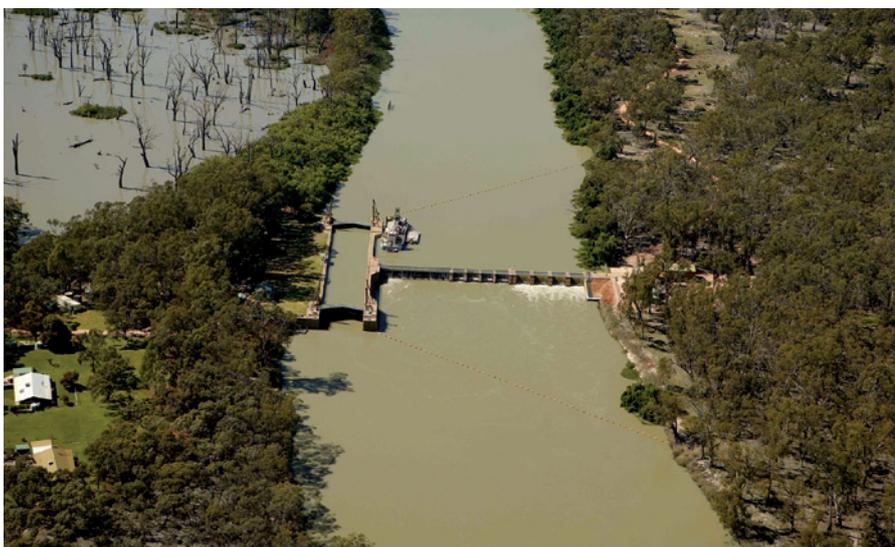
Weirs are structures built along rivers to maintain water levels. Locks enable boats to pass through weirs. During the first half of the 20th century the River Murray was utilised extensively for commercial navigation, carrying agricultural products to markets. At this time the waters of the River Murray also began to be developed for consumptive uses such as irrigation, industry and urban supply. The variable nature of flows in the River Murray made navigation difficult and water supply unreliable. To overcome these problems, schemes to regulate the river were developed. The Commonwealth Government and the states of New South Wales, Victoria and South Australia signed the River Murray Waters Agreement in 1915. This agreement led to the construction of a series of locks, weirs and barrages along the River Murray.

The *Riverine Recovery Project* (RRP) is a key component of South Australia's \$610 million *Murray Futures* program which is funded by the Australian Government's *Water for the Future* initiative.

RRP aims to improve the river's health and the resilience of its wetlands and floodplains from the South Australian-Victorian border to Wellington.

The project will improve the long-term prospects of floodplains and wetlands by more efficient use of environmental water and deliver up to 15 gegalitres of environmental water savings to the Commonwealth.

The variable nature of flows in the River Murray provided difficulties for navigation and water supply and consequently schemes to regulate the river were developed.



Lock and weir 6 on the River Murray.

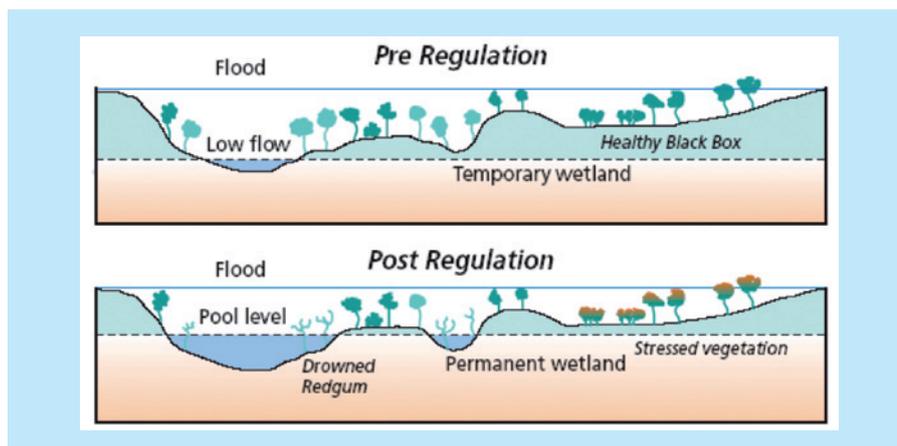


Figure 1: River Murray Levels Pre and Post Regulation.

Construction commenced in 1922 at Blanchetown, South Australia, and was completed at Euston, Victoria in 1937. Today there are 14 weirs on the River Murray between Yarrowonga and Blanchetown. Weirs 1 to 6 are located in South Australia, as are the five barrages near the Murray Mouth. They are particularly important for ensuring a secure water supply for water diverters.

What are the environmental impacts of locks and weirs?

In South Australia, flow in the River Murray was naturally highly variable. Flows increased through late winter, peaked in spring and reduced over summer. Lowest flows commonly occurred over autumn and early winter. The river experienced large seasonal and annual variations in flow and water level. Flows above 150,000 megalitres per day (ML/day) and below 2,000 ML/day were common. River levels changed as a result of these changes in flow, with variations of greater than five metres in the majority of years (Figure 1).

The wide variation in flow and water level was fundamental to the healthy functioning of the river, wetland and floodplain ecosystems. In many years, spring and early summer high flows were sufficient to inundate over half of the floodplain providing the river and wetlands with nutrients and organic matter.

Floods are particularly important for the breeding cycles of fish and water birds, regeneration and maintenance of floodplain vegetation such as river red gums and black box, and flushing salt from the landscape.

The periods of low flow between floods were also important. During these periods the wetlands and backwaters dried out, oxygenating the sediments, aiding nutrient exchange and decomposition of organic matter, as well as providing habitat for terrestrial plants and animals. These periods of low flow also reduced groundwater levels beneath the floodplain, reducing floodplain salinisation and its impact on vegetation health.



River Murray Lock 5 weir pool raising 2005.

The river in South Australia is now operated as a series of stable pools, which experience very little water level variation. As a result 70 percent of wetlands that were once seasonally inundated are now permanently connected to the river at pool level.

The impacts of current river operations include:

- unseasonal and prolonged wetting in low level wetlands and floodplains
- storage of large volumes of salt on the floodplain and maintenance of high saline groundwater levels under the floodplain
- reduced frequency and duration of small to medium floods
- stress and death of floodplain vegetation
- increased sedimentation and higher risk of algal blooms
- reduced opportunities and cues that trigger breeding cycles of birds, fish and invertebrates
- conditions that favour exotic species such as European carp and willows.

How can river health be improved using locks and weirs?

Weirs can be used to raise and lower water levels in a weir pool to mimic more natural water level variability. Fully restoring the pre-regulation ecology via water level manipulation is not a realistic goal. However, improving aspects of the ecology is possible, especially in localised areas of the River Murray. Changing how weirs are managed has been shown to deliver real benefits to the river channel, ephemeral wetlands and anabranch creeks and low lying parts of the floodplain.

The benefits from weir pool raising and lowering include:

- improved vegetation cover and recruitment
- reduced water stress in floodplain vegetation
- improved water level variability for waterbirds, fish and invertebrates
- improved biofilm (algae, micro-organisms) value as a food source
- drying of inundated sediments to consolidate them
- providing positive impacts in the river channel including flowing water habitats.

Future weir management will aim to replicate aspects of the historic water level variability in the river. This means that lowering will occur when water levels in the river would naturally be low – during autumn and winter. Raising weir levels will occur when flooding would have naturally occurred during spring and early summer. This is shown in Figure 2. The light blue line shows a drawdown in the winter months when the river flow is low and an increase in levels in spring when flows naturally increase.

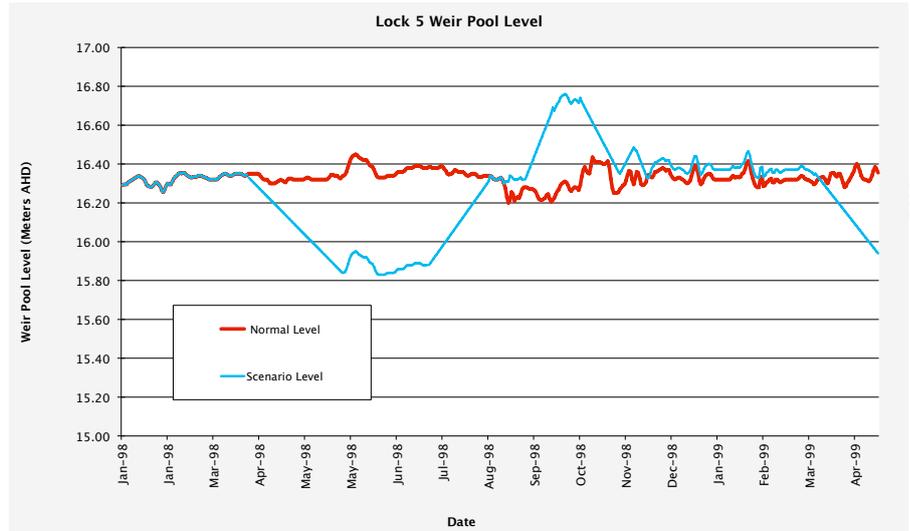


Figure 2: Scenario for changing weir management to vary water levels in the river from relatively constant (normal levels) to variation in levels (scenario level).

Any lowering of water levels would therefore occur at a time when diversions for irrigation are at their lowest.

The extent to which any weir pool can be raised or lowered is constrained by a number of factors. These include limitations on raising due to the capacity of the lock and weir infrastructure. Lowering limitations include pumping infrastructure, salinity and navigation.

Weir pool manipulation

Weir pool raising for environmental benefit was first undertaken in South Australia in October 2000 at Lock 5. A flow of approximately 32,000 ML/day was increased with discharge from Lake Victoria to provide a peak flow of about 42,000 ML/day. The Lock 5 weir pool was raised 50 cm and the resulting inundation of hundreds of hectares of floodplain and wetlands was similar to that normally experienced during a flow of 70,000 ML/day.

From mid March to early April 2005, the Lock 6 weir pool was slowly raised to 15 cm above normal pool level for a period of about four weeks.

The Lock 5 weir pool was also raised a small amount at this time to reduce the hydraulic pressure on Lock 6. These levels were maintained until early May when the level was slowly lowered back to normal. Raising the levels increased the amount of water flowing through the Chowilla anabranch, pushing water into creeks and inundating low-lying areas of the floodplain and wetlands. About 50 hectares of floodplain and wetlands were watered in addition to many kilometres of creeks.



Floodplain inundation: Pike floodplain during 2005 weir pool raising.

Further weir pool raisings were undertaken at Locks 6 (+15 cm), Lock 5 (+50 cm), Lock 4 (+30 cm) and Lock 1 (+10 cm) between October 2005 and January 2006. These weir pool raisings inundated areas along the river channel; pushed water into anabranch creek systems; and allowed the flooding of a number of wetlands.

While weir pool lowering has occurred in association with river management and maintenance activities, lowering for environmental benefit has not been undertaken in South Australia. Initial weir pool lowerings would be relatively conservative (e.g. less than 30 cm below normal pool level). Physically, weir pools can be lowered from between two and three metres. The exact amount depends on which weir is being managed. The lowered water level during a weir management trial will depend on a number of factors including:

- the location and capacity of pumps on the river and backwaters to tolerate changes in water level
- the ability to navigate the river at different levels
- salinity impacts
- the structural stability of the weir and associated infrastructure.

Information on these factors is being collected and analysed, and will be carefully considered prior to any changes in weir management to ensure minimum impacts on river users.



Pump and pipes on adjustable slide to accommodate changes in water level.

The maximum possible lowering of the pool levels would provide the greatest environmental benefits. We are building our knowledge through investigating the likely impacts of weir pool lowering. When there is confidence that any impacts on river users can be effectively managed, the extent of lowering will likely be increased.

The weir pool manipulation program is a continuation of previous Government of South Australia weir operation investigations and trials aimed at improving the River Murray environment.

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