# *Goulburn–Broken region*

## Lower Goulburn River Floodplain

The Lower Goulburn River Floodplain hydrologic indicator site (see Figure B4.1) extends from the Goulburn River's junction with the River Murray upstream toward Shepparton, covering an area of about 13,000 ha. It is listed as a wetland of national importance (Department of the Environment, Water, Heritage and the Arts 2009h) and is set within the broader Lower Goulburn floodplain.

The floodplain consists of a river red gum (*Eucalyptus camaldulensis*) open forest woodland with smaller areas of grey box (*E. moluccana*) open forest woodland having associated yellow box (*E. melliodora*), white box (*E. albens*) and black box (*E. largiflorens*) on higher ground (Department of the Environment, Water, Heritage and the Arts 2009h). The site includes a network of 'flood runner' watercourses and 70 separate wetland sites (Victorian Department of Natural Resources and Environment 1995).

A variety of permanent and temporary wetlands are found within the floodplain, including billabongs, sloughs, marginal swamps, potholes, scroll swales, anabranches and cut-off loops (Department of the Environment, Water, Heritage and the Arts 2009h). Key wetlands include Gemmills Swamp and Reedy Swamp state wildlife reserves and Loch Garry Wildlife Management Cooperative Area (Department of the Environment, Water, Heritage and the Arts 2009h).

The boundary and extent of the Lower Goulburn River Floodplain hydrologic indicator site has been defined using the Collaborative Australian Protected Areas database and data from *A directory of important wetlands in Australia* (Department of the Environment, Water, Heritage and the Arts 2001). Spatial data used in this map is listed in Table B1.3.

### Values

The Lower Goulburn River Floodplain has been identified as a hydrologic indicator site in the Murray–Darling Basin by meeting three of the Murray–Darling Basin Authority's (MDBA's) key environmental asset criteria (Table B4.1).

The assessment of key environmental asset criteria is largely informed by the Australian Wetlands database (Department of the Environment, Water, Heritage and the Arts 2009a). Less data is available on the Lower Goulburn River Floodplain compared to nearby key environmental assets on the River Murray (such as Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest). Given the similarity in habitats and hydrology, it is likely that the Lower Goulburn River Floodplain shares some attributes and values of these other hydrologic indicator sites.

**Table B4.1 MDBA key environmental asset criteria: Lower Goulburn River Floodplain**

| Criterion | Explanation |
|---|---|
| 1. Formally recognised in, and/or is capable of supporting species listed in, international agreements | The Lower Goulburn River Floodplain is formally recognised in, or is capable of supporting species listed in the Japan–Australia Migratory Bird Agreement, the China–Australia Migratory Bird Agreement or the Republic of Korea–Australia Migratory Bird Agreement. For a full list of species listed under Commonwealth legislation that have been recorded at the Lower Goulburn River Floodplain refer to Table B4.6. |
| 3. Provides vital habitat | The Lower Goulburn River Floodplain's ecological features make it a high-value wetland system. The floodplain consists of a large area of habitat for fauna such as waterbirds and fish (Department of the Environment, Water, Heritage and the Arts 2009h).<br><br>A total of 34 bird species have been recorded breeding at Gemmills Swamp, including Australian white ibis (Threskiornis molucca), royal spoonbill (Platalea regia), yellow-billed spoonbill (P. flavipes), black swan (Cygnus atratus), Pacific black duck (Anas superciliosa), grey teal (Anas gracilis), musk duck (Biziura lobata), dusky moorhen (Gallinula tenebrosa), purple swamphen (Porphyrio porphyrio), Eurasian coot (Fulica atra), and masked lapwing (Vanellus miles) (Department of the Environment, Water, Heritage and the Arts 2009h). |
| 4. Supports Commonwealth-, state- or territory-listed threatened species and/or ecological communities | The Lower Goulburn River Floodplain meets this criterion because it supports species listed as threatened under Commonwealth or state legislation. For a full list of species that have been recorded refer to Table B4.6. |

## Hydrology

The hydrology of the Lower Goulburn River Floodplain is driven by flows in the Goulburn River, via Goulburn Weir diversions as well as a number of effluent channels (CSIRO 2008f). Compared to the adjacent River Murray, flows are much 'flashier', with large flows often persisting for only a few days or weeks, compared to weeks or months in adjacent reaches of the River Murray. As the Goulburn River is ecologically and hydrologically linked to the River Murray, integrated management of both rivers is a highly desirable outcome (Water Technology 2010). The Living Murray program recognises that flooding of Gunbower Forest, in particular, could be highly dependent on flows from the Goulburn River, given the limited ability to move water from the upper Murray through the Barmah Choke (Water Technology 2010).

Flows in the Goulburn River are significantly affected by the operation of Lake Eildon and Goulburn Weir for irrigation supply (Davies et al. 2008). Lake Eildon is the main water storage within the catchment with a capacity of about 3,400 GL. It captures winter and spring flows and regulates them for irrigation use, mainly in summer. The operation of Lake Eildon has reversed the natural seasonal flow patterns along much of the Goulburn River, from winter–spring dominant to summer–autumn dominant.

Goulburn Weir is used to divert water from the Goulburn River into irrigation channels and infrastructure associated with the Shepparton irrigation district. The weir, in combination with the channels, has the capacity to divert nearly 10,000 ML/d from the Goulburn River. Mean annual streamflow for the Goulburn Basin is approximately 3,040 GL, with an average flow of approximately 1,340 GL in the Goulburn River below Goulburn Weir (Cottingham et al. 2003a).

The flooding behaviour and inundation characteristics of the Goulburn River were assessed by Water Technology (2010). This assessment found that the reach between Kialla to Bunbartha is characterised by flows of 20,000 ML/d, generally confined to the river channel. Flows in excess of 30,000 ML/d result in extensive areas of overbank floodplain inundation in adjacent riparian areas, including complete inundation of Gemmills Swamp. Anecdotal reports indicate that volumes exceeding 24,000 ML/d result in out-of-channel flows, as analysed by Cottingham et al. (2007).

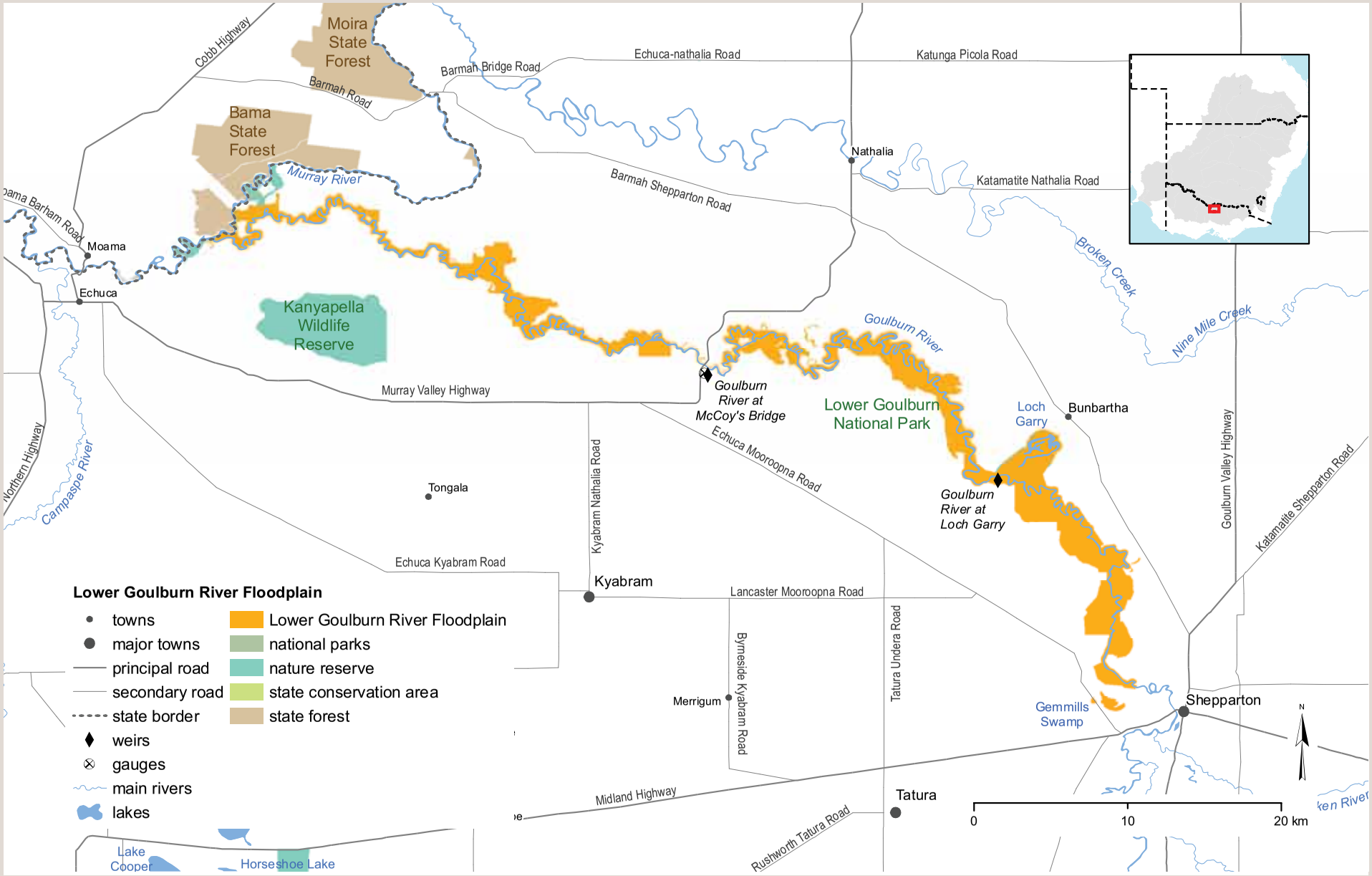


**Figure B4.1 Location and extent of hydrologic indicator site: Lower Goulburn River Floodplain**

With flows of 20,000 ML/d, the Lower Goulburn River between Bunbartha and the River Murray confluence is characterised by limited floodplain inundation and anabranch flow adjacent to Loch Garry (Water Technology 2010). However, when flows exceed 30,000 ML/d, extensive areas of floodplain within the levees are inundated, with limited outflow to Deep, Wakiti and Hancocks creeks (Water Technology 2010).

While diversions at Goulburn Weir mean that flows are significantly reduced in the Lower Goulburn River compared to other reaches of the river, the seasonal pattern of flow is unchanged (Chee et al. 2009) (Figure B4.2). One of the major impacts of flow regulation on the Goulburn River has been to alter the frequency and duration of regular flooding.

The CSIRO Sustainable Yields Project reported that flooding in the Lower Goulburn River has been significantly reduced, which is largely due to water resource development in the Goulburn River. Under without-development conditions, flows that inundated the Lower Goulburn River floodplain were relatively common — occurring every 2.5 years on average and never more than about a decade between events (CSIRO 2008f). However, there is now an average of 11 years between flooding events, and the maximum period between events is 37 years (CSIRO 2008f).

This is likely to have changed the filling and drying pattern of floodplain billabongs and anabranches, clearly important habitats associated with the Goulburn River (Cottingham et al. 2003a). Similarly, Chee et al. (2009) report that block banks and levee construction along the length of the Goulburn River reduce connectivity between the channel and its floodplain. This, combined with flow regulation and flood control works, has resulted in a substantial reduction in the frequency and area of floodplain and wetland inundated.

## Environmental objectives and targets

Environmental objectives have been determined for the Lower Goulburn River Floodplain using MDBA's key environmental asset criteria.

Targets to achieve these objectives have been specified for flood-dependent vegetation communities considered essential to support wetland processes and to provide crucial habitat for identified flora and fauna species (Table B4.2).

For the Lower Goulburn River Floodplain, these objectives relate predominantly to bird and fish species listed under international agreements or threatened species legislation (see list of species relevant to criteria 1 and 4 in Table B4.6 at the conclusion of this section). Targets have been developed for the habitats these species require for survival and recruitment. There are many species and their habitat requirements cover the full breadth of habitat types available in the asset. For the purpose of developing targets, the habitat types have been grouped into a smaller number of broad classes.

The Lower Goulburn River Floodplain has been impacted by development for agriculture with parts of the floodplain cleared and/or disconnected from the river by levees. The targets for the indicator site are for the remaining intact floodplain, comprising state forest, other public land reserves and private land. The specified flow regime reflects that the remaining floodplain is closest to the river and easiest to inundate.

It is assumed that most box tree communities have been cleared or isolated by the levees, so targets are not specified for these communities.

Few existing management plans set objectives and targets for the Lower Goulburn River Floodplain. Cottingham et al. (2003b) recommends that an annual wetting and drying cycle be reinstated for the Goulburn River floodplain downstream of Lake Eildon.

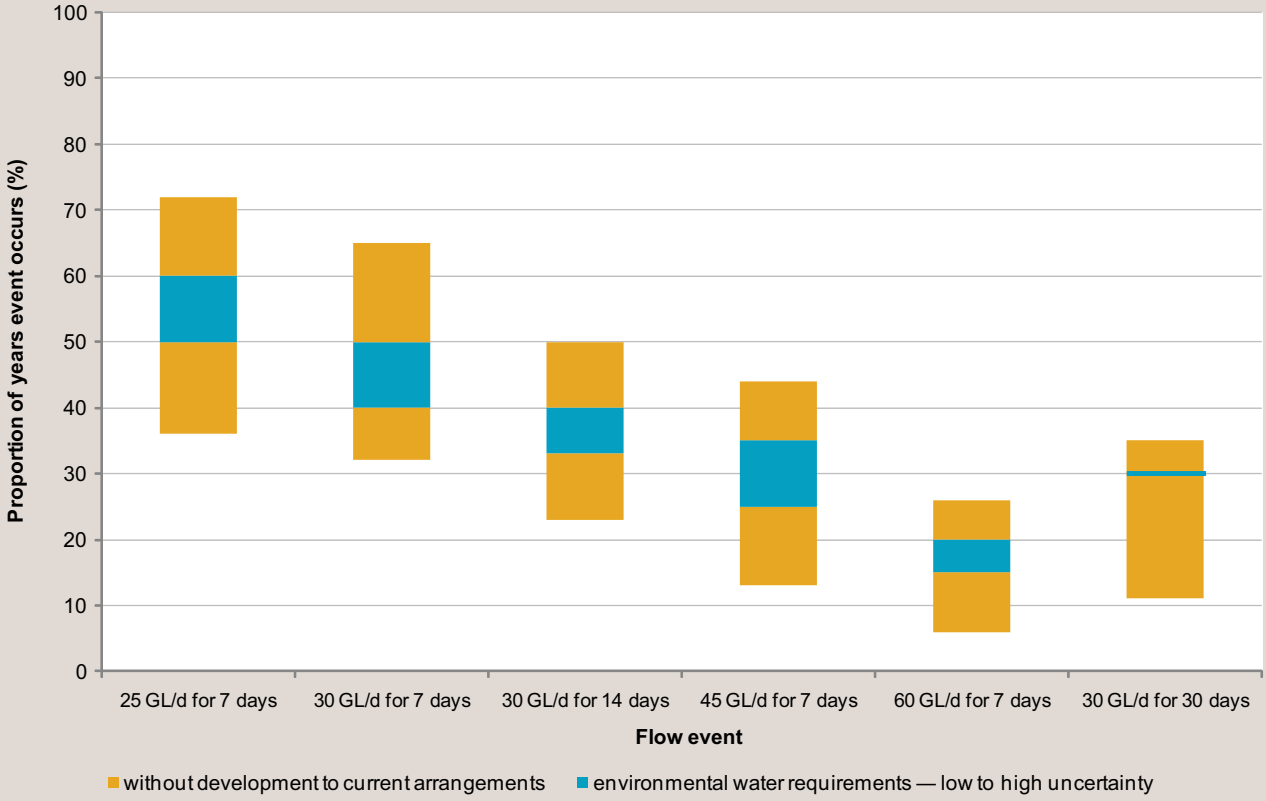


**Figure B4.2 Median monthly flow at McCoys Bridge, Lower Goulburn River: Lower Goulburn River Floodplain**

Source: based on MDBA analysis

**Table B4.2 |Environmental objectives and targets: Lower Goulburn River Floodplain**

| Objectives | Justification of targets | Targets |
|---|---|---|
| 1. To protect and restore water-dependent ecosystems that support migratory birds listed under international agreements (Criterion 1)<br>2. To protect and restore water-dependent ecosystems that provide vital habitat (Criterion 3)<br>3. To protect and restore water-dependent ecosystems that support Commonwealth-, state- or territory-listed threatened species and/or ecological communities (Criterion 4) | As for Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest, any decrease in the current area of wetlands would signal a change in ecological character. | Maintain 100% of current extent of wetlands in good condition |
| Objectives 1 to 3 | As for Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest, any change in the current area or health of vegetation communities would signal a change in ecological character. | Maintain 100% of current extent of red gum forest in good condition<br>Maintain 100% of current extent of red gum woodland in good condition |
| Objectives 1 to 3 | As for Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest, any reduction in the recorded frequency and abundance of bird breeding or number of bird species would signal a change in ecological character.<br>This is also an interim ecological objective under The Living Murray program. | Provide conditions conducive to successful breeding of waterbirds |

In the absence of existing management plans, including specified targets, the targets specified have been adopted from nearby key environmental assets, Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest. This approach has been used because these hydrologic indicator sites are similar in their hydrology, ecology and values. The assumption is that these similarities support adoption of similar targets (see Table B4.2).

## Environmental water requirements

### *Floodplain – wetland and vegetation inundation relationship with flow*

To prescribe an environmental water requirement for the Lower Goulburn River Floodplain and achieve floodplain – wetland inundation, information is needed on the relationship between flow and inundation at various points along the river. Unfortunately, very little work has been done for flows between 10,000 and 60,000 ML/d, particularly for those around and just above bankfull. Therefore understanding of flow – inundation relationships are not as well developed for flows in this range compared to either extreme, for which flood studies and irrigation supply have provided more information (Earl 2009).

Recent hydraulic modelling has improved knowledge of what areas of floodplain are inundated at flows between 20,000 and 60,000 ML/d in different reaches of river (Water Technology 2010). Figure B4.3 shows this relationship for the Lower Goulburn River, from upstream of Shepparton to the River Murray junction. This modelling indicates that environmental flows up to 40,000 ML/d, rather than the 60,000 ML/d recommended in Cottingham et al. (2003b), may provide most environmental benefit in terms of floodplain – wetland inundation, at least economic cost. While only small increases in floodplain inundation occur between flows of 40,000 to 60,000 ML/d for the lower Goulburn River reaches, a higher flow in the downstream reaches may be appropriate due to the variable flow capacity along the length of the river (Water Technology 2010).

To inform environmental water requirements, MDBA has used floodplain inundation data provided by Water Technology (2010) in conjunction with previously reported commence-to-flow levels for 'flood runner' watercourses and effluents, and floodplain – wetland inundation relationships for the lower Goulburn River (see Table B4.3 and Figure B4.4). Type 2 wetlands presented in Figure B4.4 correspond to freshwater meadows in the Victorian Department of Sustainability and Environment wetland database (Cottingham et al. 2003b). The percentage of floodplain and wetland inundated against flow magnitude is presented as a proportion of natural floodplain extent. However, this is not particularly useful for determining environmental water requirements, given the modified extent of the floodplain due to levees and agricultural development.

**Table B4.3 Commence-to-flow levels of flood runners: Lower Goulburn River Floodplain**

| Flood runner | Commence-to-flow level (ML/d) |
|---|---|
| Loch Garry | 55,000 |
| Deep Creek | 26,000 |
| Wakiti Creek | 21,000 |
| Hancocks Creek | 23,000 |

Source: Cottingham et al. (2003b)

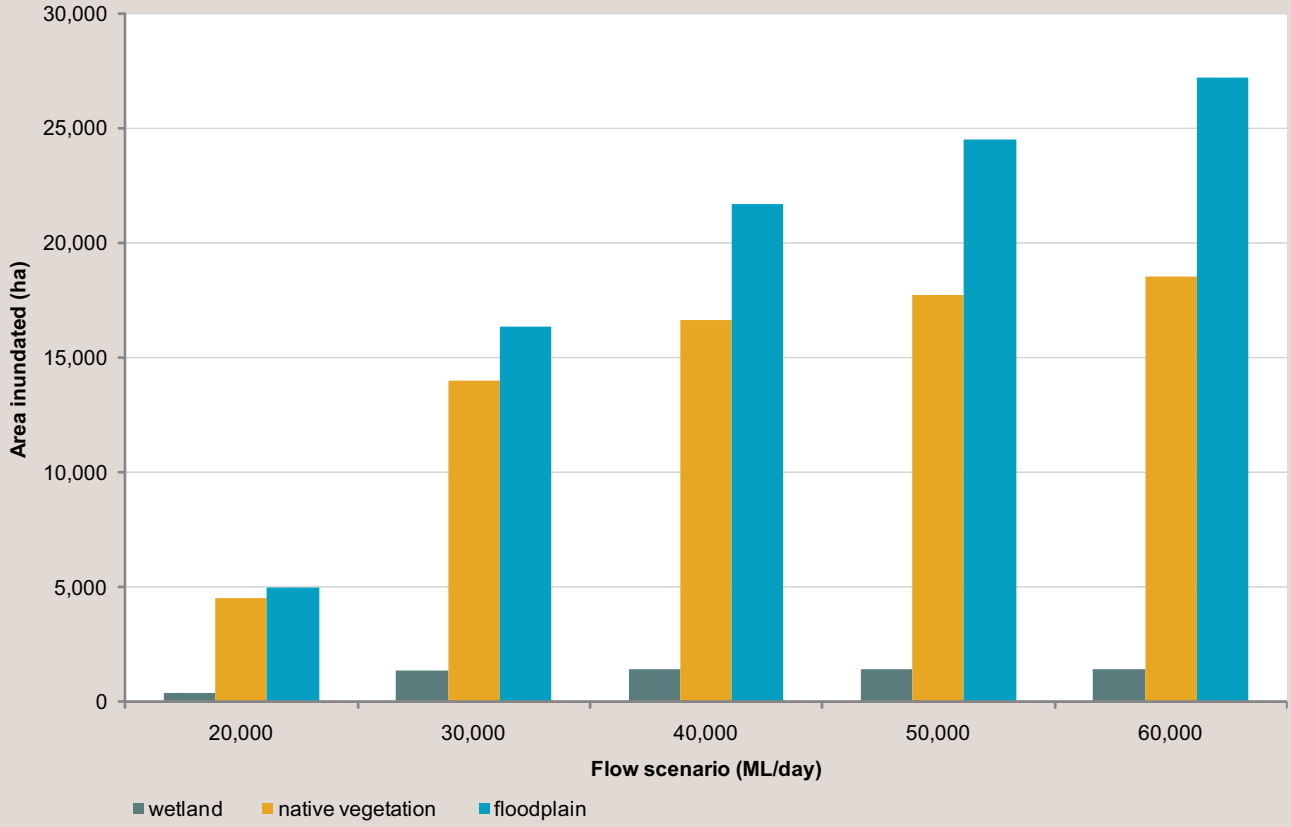


**Figure B4.3 Relationship between different flow scenarios and floodplain vegetation inundation: Lower Goulburn River Floodplain**

Note: wetland inundation is not determined for the reach between Bunbartha to River Murray junction
Source: MDBA analysis of data in Water Technology (2010)

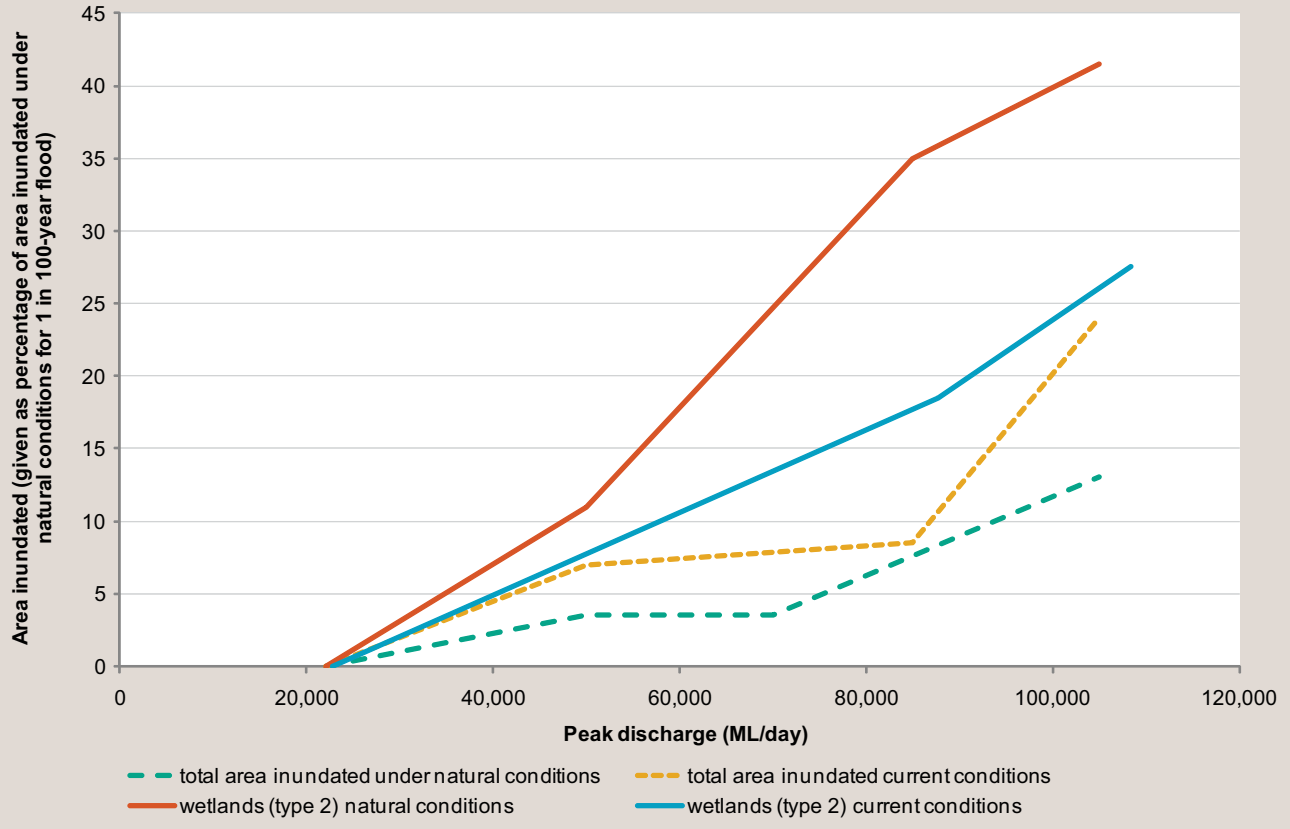


**Figure B4.4 Relationship between flow and inundation of wetlands (freshwater meadows): Lower Goulburn River Floodplain**

Source: Cottingham et al. (2003b)

**Table B4.4 Water requirements of selected vegetation communities: Barmah–Millewa and Gunbower–Koondrook–Perricoota forests**

| Vegetation community/habitat type | Flood frequency (percentage of years with inundation) | Inundation duration | Season |
|---|---|---|---|
| Permanent wetlands | 100 | 7–12 months | winter/spring, persisting for 12 months in nearly all years |
| Semipermanent wetlands | 60–90 | 5–8 months | winter–spring to early summer |
| River red gum forest with flood-dependent understorey | 40–92 | 4 months (range of 1–8 months) | winter–spring |
| River red gum woodland with flood-tolerant understorey | 10–40 | 1–2 months (range of 1–4 months) | spring |
| River red gum and black box woodland | 10–40 | 1 month (range of 1–4 months) | winter–spring |

Sources: MDBC (2006b); MDBC (2006e) & Ecological Associates (2006a)

Information on the relationship between flows and inundation of habitat types and vegetation communities of the Lower Goulburn River Floodplain is also limited. In the absence of specific information for the Lower Goulburn, data on the water needs of selected vegetation communities from nearby key environmental assets (Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest) has been used to inform water requirements for the Lower Goulburn River Floodplain (Table B4.4).

Modelled without-development flow data at McCoys Bridge was used as a reference to determine if recommended frequencies and durations are achievable in the lower Goulburn River. This showed a discrepancy between the inundation regime recommended by Cottingham et al. (2003b), modelled without-development hydrology data for the Goulburn River, and flood frequencies and durations recommended for selected vegetation communities. Consequently, flood durations recommended for selected vegetation communities have been modified due to the 'flashier' hydrology of the Goulburn River compared to the River Murray.

### *Waterbird breeding*

The Australian Wetlands database (Department of the Environment, Water, Heritage and the Arts 2009h) identifies the Lower Goulburn River Floodplain as an important breeding area for waterbirds, including many colonial nesting species. Analysis of water requirements for colonial nesting waterbirds (ibis, spoonbills, herons and egret) within Barmah–Millewa Forest suggests that for successful fledging (nursing of a young bird until it is able to fly), colonial nesters require four to five months of flooding (Overton et al. 2009).

The 'flashy' nature of Goulburn River flows means that events of long duration required for colonial nesting waterbird recruitment rarely occur. Therefore successful breeding may depend on retaining water in wetlands, as well as inundation of foraging and nesting habitats after floods have receded. This will be limited to specific areas, such as Gemmills Swamp, where breeding of colonial nesting species has been recorded. Waterfowl typically require floods of shorter duration to breed successfully, so conditions suitable for their breeding are more likely to be generally provided across the Lower Goulburn River Floodplain hydrologic indicator site.

### *Water requirements of Lower Goulburn River Floodplain*

Flow recommendations for five reaches of the Goulburn River — as well as some limited data describing wetland and floodplain inundation thresholds — have been developed previously (Cottingham et al. 2003b). The flow recommendation for the Goulburn River floodplain from Cottingham et al. (2003b) is to reinstate an annual floodplain – wetland inundation regime of variable magnitude, from 15,000 to 60,000 ML/d, in the reach downstream of Lake Eildon to support the wetland and floodplain ecosystems.

Presumably the magnitude would be greater in the Lower Goulburn River Floodplain (due to flow contributions from additional catchment and tributaries), although no specific recommendations are made. This is supported by flood frequency analysis that shows a 60,000 ML/d flow is a small flood event at Shepparton, with an average recurrence interval of three to four years (Water Technology 2010).

In contrast, 60,000 ML/d represents a large flood event downstream of Eildon (45-year average recurrence interval) and reduces to a medium flood event at Trawool (10-year average recurrence interval). In the absence of specific information on an optimal inundation frequency for events of various magnitudes, Cottingham et al. (2003b) recommend restoring flooding frequency to about half of its natural frequency. Guidance is also provided on the maximum desirable duration between events. An annual floodplain inundation event is suggested, except in drought years when wetland and floodplain inundation would not have occurred naturally. Analysis undertaken by Cottingham et al. (2003b) indicates that a wetland and floodplain inundation event would be absent every 13–15 years, due to natural drought.

Environmental water requirements set out in Table B4.5 have been based primarily on the work of Cottingham et al. (2003b). However, this document does not set out water requirements completely, so Table B4.5 represents an amalgam of information from existing literature and hydraulic modelling inundation data. Where a discrepancy exists between the literature and modelled data, analysis of modelled without-development flows has been used to help determine environmental water requirements, particularly to ensure that the recommended flows are achievable and not greater than without-development flows.

It should be noted that Table B4.5 should be read in its entirety to understand the environmental water requirements of the Lower Goulburn River Floodplain. Although targets and flow rules are separated, multiple flow rules will in fact contribute to achieving each target. This approach has been used as it not possible to define a single flow threshold for the vegetation community targets. The species cover a wide range of flows and a single indicator would be misleading (MDBC 2006c). Therefore, while particular flow thresholds and durations may have been specified for particular targets, these should be read in combination with other recommendations as part of a broader flow regime.

Figure B4.5 provides a graphical summary of the flows recommended for the Lower Goulburn River Floodplain hydrologic indicator site. The proportion of years a flow event occurs is shown for each flow threshold and duration recommended to sustain the indicator site. These include the modelled without-development, current arrangements, and low or high uncertainty proportion of years. Proportions are shown for the entire model period (1895–2009). This shows that recommended environmental watering requirements are, to varying degrees, within the without-development to current arrangements proportions over the historical record.

Environmental water requirements for the Lower Goulburn River Floodplain hydrologic indicator site have been specified as daily targets. Hydrological modelling undertaken by MDBA to determine long-term average sustainable diversion limits for the Murray–Darling Basin required these daily water requirements to be aggregated to monthly demand volumes, in order to allow this demand to be incorporated into the monthly Goulburn simulation model.

## *Risks*

### Potential socioeconomic impacts

Prioritising water to sustain key environmental assets within the Murray–Darling Basin brings with it the potential to increase the frequency of flooding of agricultural, commercial and residential property. The environmental water requirements for the key environmental assets generally recommend floods up to the 5- to 10-year average recurrence interval, corresponding with the extent of flood-dependent vegetation and ecosystems.

Urban development in this zone of flooding is limited and tightly controlled by planning authorities, and major infrastructure such as main roads and bridges are generally designed to accommodate much larger floods. Most flood-prone towns are protected by levees, and contemporary flood protection design standards provide for much larger floods. The likelihood of environmental flows associated with the Basin Plan contributing to significant impacts on urban flooding are therefore low.

### Current condition and impact on targets

The ability of the Lower Goulburn River Floodplain to recover from the recent drought and modifications for agricultural production (including levee construction) is a risk. The Sustainable Rivers Audit, which assessed the current condition of rivers in the Basin, found the Goulburn Valley to be in very poor health (Davies et al 2008). Fish communities in the Goulburn Valley were particularly assessed as being in extremely poor condition. Fish abundance and biomass was found to be dominated by alien species, representing the equal lowest condition across all Murray–Darling Basin valleys (Davies et al. 2008).

However, tree and understorey vegetation has shown positive responses to relatively small-scale watering activities, and a greater variety of fauna species, including waterbirds, frogs and fish, have been observed. These water activities occurred as part of The Living Murray program at Chowilla Floodplain, Hattah Lakes, Barmah–Millewa Forest and Gunbower–Koondrook–Perricoota Forest (MDBC 2007; McCarthy et al. 2009; Newall et al. 2009). While the watering activities have been localised, they indicate the likelihood of wider asset recovery in response to broader actions. For this reason, objective targets have not been modified in response to current conditions.

**Table B4.5 Environmental water requirements: Lower Goulburn River Floodplain**

| Target | Event | | | Proportion of years event required to achieve target (% of years) | | Proportion of years event occurred under modelled without-development conditions (%) | Proportion of years event occurred under modelled current arrangements (%) |
|---|---|---|---|---|---|---|---|
| | Flow required (measured at McCoys Bridge) | Duration[a] | Timing | Low uncertainty | High uncertainty | | |
| Maintain 100% of current extent of wetlands in good condition | 25,000 ML/d | 7 days total (with 1 day minimum) | June to November | 60 | 50 | 72 | 36 |
| | 30,000 ML/d | | | 50 | 40 | 65 | 32 |
| Maintain 100% of current extent of red gum forest and red gum woodland in good condition | 30,000 ML/d | 14 days total (with 1 day minimum) | June to November | 40 | 33 | 50 | 23 |
| | 45,000 ML/d | 7 days total (with 1 day minimum) | Preferably winter/ spring, but timing not constrained to reflect that high flows are dependent on heavy rainfall and will be largely unregulated events | 35 | 25 | 44 | 13 |
| | 60,000 ML/d | | | 20 | 15 | 26 | 6 |
| Provide conditions conducive to successful breeding of waterbirds[b] | 30,000 ML/d | 30 days total (with 1 day minimum) | June to November | 30 | 30 | 35 | 11 |

a Duration is expressed both as a total and minimum duration, allowing multiple smaller flow events that meet the minimum duration criteria to comprise a successful event. Minimum durations are therefore a subset of total duration and should not be read independently. MDBA analysis showed that if a minimum duration is not specified and individual events must meet the total duration criteria, this resulted in a significantly reduced proportion of years.

b See text regarding breeding of colonial nesting waterbird species

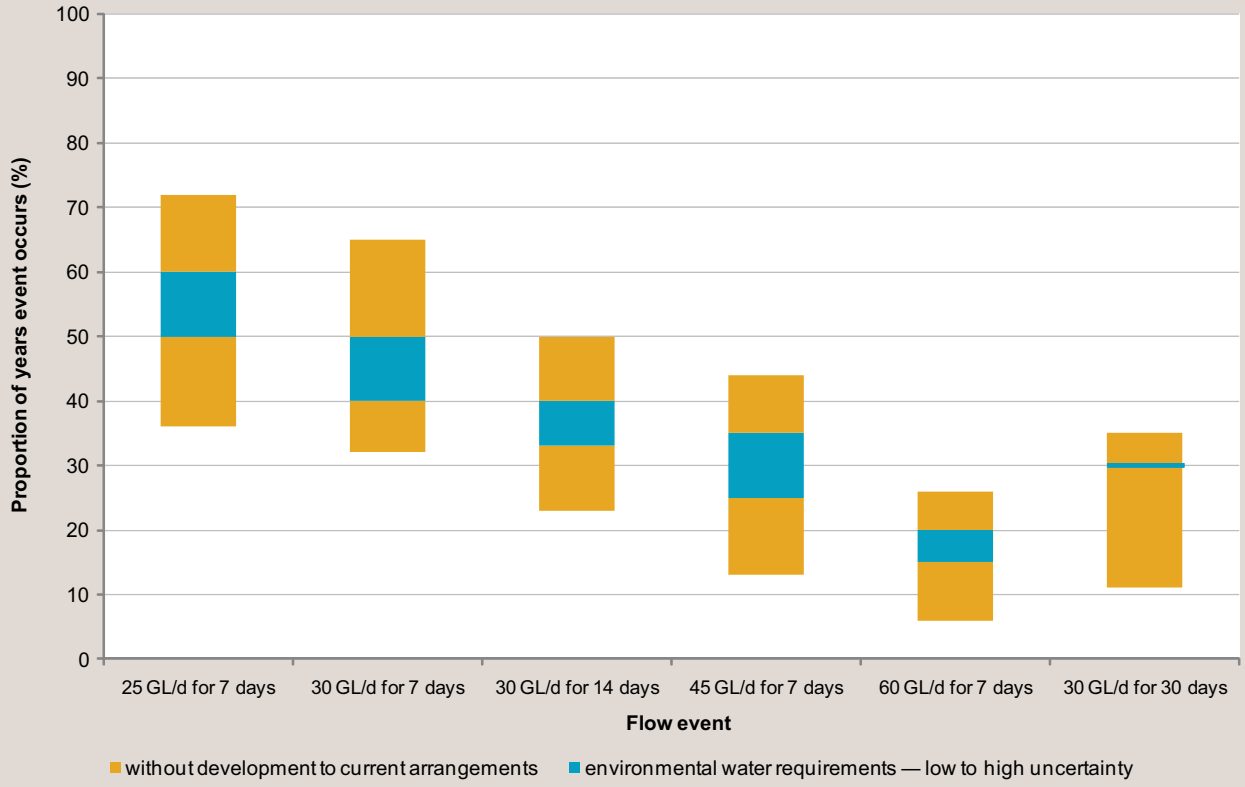


**Figure B4.5 Recommended environmental water requirements and the proportion of their occurrence under without-development flows and current arrangements, 1895–2009: Lower Goulburn River Floodplain**

**Table B4.6 Species relevant to criteria 1 and 4: Lower Goulburn River Floodplain**

| Species | Recognised in international agreement(s)1 | *Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth) | *Flora and Fauna Guarantee Act 1998* (VIC) |
|---|---|---|---|
| Amphibians and reptiles | | | |
| Lace goanna (*Varanus varius*)[4] | | | V |
| Brown toadlet (*Pseudophryne bibronii*)[4] | | | E |
| Southern bell or growling grass frog (*Litoria raniformis*)[4] | | | E |
| Birds | | | |
| Australasian bittern (*Botaurus poiciloptilus*)[2, 3] | | | E |
| Australasian shoveler (*Anas rhynchotis*)[4] | | | V |
| Baillon's crake (*Porzana pusilla*)[2, 3] | | | V |
| Barking owl (*Ninox connivens*)[2, 3] | | | E |
| Bush stone-curlew (*Burhinus grallarius*)[2, 3] | | | E |
| Diamond firetail (*Stagonopleura guttata*)[4] | | | NT |
| Eastern great egret (*Ardea modesta*)[2, 3] | ✓ | | V |
| Freckled duck (*Stictonetta naevosa*)[4] | | | E |
| Grey-crown babbler (*Pomatostomus temporalis temporalis*)[2, 3] | | | E |
| Ground cuckoo-shrike (*Coracina maxima*)[2, 3] | | | V |
| Intermediate egret (*Ardea intermedia*)[4] | | | CE |
| Latham's snipe (*Gallinago hardwickii*)[2, 3] | ✓ | | |
| Lewin's rail (*Lewinia pectoralis*)[2, 3] | | | V |
| Little bittern (*Ixobrychus dubius*)[2, 3] | | | E |
| Magpie goose (*Anseranas semipalmata*)[2, 3] | | | NT |
| Musk duck (*Biziura lobata*)[4] | | | V |
| Painted honeyeater (*Grantiella picta*)[2, 3] | | | V |
| Royal spoonbill (*Platalea regia*)[4] | | | V |
| Superb parrot (*Polytelis swainsonii*)[2, 3] | | V | E |
| Swift parrot (*Lathamus discolor*)[2, 3] | | E | E |
| Turquoise parrot (*Neophema pulchella*)[2, 3] | | | NT |
| White-bellied sea-eagle (*Haliaeetus leucogaster*)[2, 3] | ✓ | | V |
| Fish | | | |
| Barred galaxias (*Galaxias fuscus*)[2, 3] | | E | CE |
| Flat-headed galaxias (*Galaxias rostratus*)[4] | | | V |
| Freshwater catfish (*Tandanus tandanus*)[2, 3] | | | E |
| Hardhead (*Aythya australis*)[4] | | | V |
| Macquarie perch (*Macquaria australasica*)[2, 3] | | E | E |
| Murray cod (*Maccullochella peelii peelii*)[2, 3] | | V | E |
| Murray–Darling rainbowfish (*Melanotaenia fluviatilis*)[2, 3] | | | DD |
| Silver perch (Bidyanus bidyanus)[2, 3] | | | CE |
| Trout cod (*Maccullochella macquariensis*)[2, 3] | | E | CE |
| Unspecked hardyhead (*Craterocephalus stercusmuscarum fulvus*)[2, 3] | | | DD |

*... continued*

**Table B4.6 Species relevant to criteria 1 and 4: Lower Goulburn River Floodplain (continued)**

| Species | Recognised in international agreement(s)1 | *Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth) | *Flora and Fauna Guarantee Act 1998* (VIC) |
|---|---|---|---|
| Mammals | | | |
| Squirrel glider (*Petaurus norfolcensis*)[2, 3] | | | E |
| Brush-tailed phascogale (*Phascogale tapoatafa*)[2, 3] | | | V |
| Plants | | | |
| Grey billy-buttons (*Craspedia canens*)[4] | | | E |
| Jericho wire-grass (*Aristida jerichoensis* var. *subspinulifera*)[4] | | | E |
| Western water-starwort (*Callitriche cyclocarpa*)[4] | | | V |
| Communities | | | |
| Lowland Riverine fish community of the southern Murray–Darling Basin[2] | | | L |

CE = critically endangered DD = data deficient E = endangered L = listed NT = near threatened V = vulnerable

1 Japan–Australia Migratory Bird Agreement, China–Australia Migratory Bird Agreement, or Republic of Korea – Australia Migratory Bird Agreement

2 Victorian Department of Primary Industries (2010)

3 Department of the Environment, Water, Heritage and the Arts (2009)

4 Victorian Department of Sustainability and Environment (2009)