The Goulburn River - natural features and changes overtime

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Abstract

Australian rivers are the most striking feature on our landscape. They are home to an array of flora and fauna. The water they contain is vital for our community.
Australian streams are unique (different from any others in the world) in terms of their morphology, sedimentology, their flora and fauna.
The flow regimes of our inland rivers are amongst the most highly variable in the world and the ecosystems within had adapted to these extremes over extended periods of time.
This paper presents a summary of the key features of the Goulburn River and the changes which have occurred over recent times. It summarises a presentation to the Teacher PD sessions of the RiverConnect initiative.

The Goulburn River (Catchment)

The Goulburn River system (Figure 1) is a significant environmental, social and economic asset to the local community, the region and the State. The environment is valued for contributing to the resilience and uniqueness of natural ecosystems, while social aspects are valued for many life-fulfilling experiences they provide to communities[1]. Economic aspects are valued for the goods and services they provide that enable people to prosper financially. These environmental, social and economic values and their importance to local communities and the wider population are well recognised.

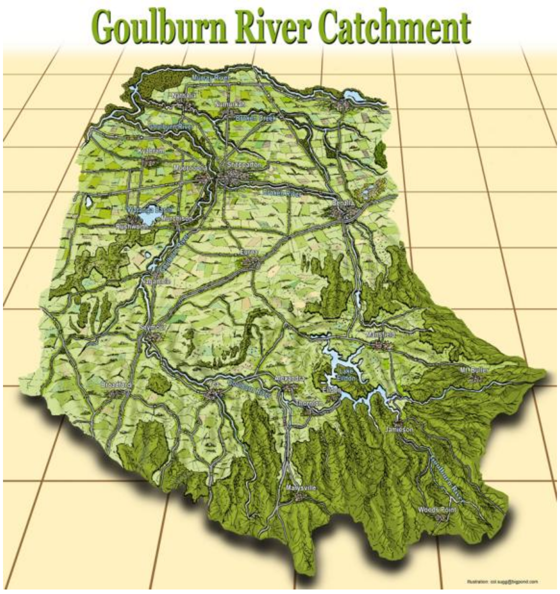

Figure 1 – The Goulburn Catchment

The Goulburn River basin is Victoria's largest, covering over 1.6 million hectares or 7.1% of the state's total area.

The terrain varies significantly across the catchment, from the high ranges and mountains of the Great Dividing Range in the south, to the flat country of the Murray Plain to the north. The high country in the south east experiences cold winters with persistent snow and an average annual rainfall greater than 1,600 mm. Rainfall decreases northward, and in the far north of the catchment is less than 450 mm per year, only one third of the annual evaporation in that area. With the higher rainfall, a number of the Goulburn River's major tributaries rise on the northern slopes of the Great Dividing Range. These include the Big, Delatite, Howqua and Jamieson rivers.

Native vegetation has been retained over much of the mountainous south of the catchment, where slopes are steepest.

[1] GBCMA 2002 - RCS

However clearing for agriculture has been extensive in the valleys and plains.

The Goulburn River itself is 570 km long, flowing from upstream of Woods Point to Echuca. The river has a mean annual water discharge of 3,040 GL (1.8 ML/ha), representing 13.7% of the total state discharge. Streamflow along the Goulburn River has been modified by two major features, Eildon Reservoir and the Goulburn Weir.

Values of Our River Systems

Rivers and streams provide significant environmental, social and economic asset to our local communities.

The environment is valued for contributing to the resilience and uniqueness of natural ecosystems.

Social aspects are valued for many life-fulfilling experiences they provide to communities.

Economic aspects are valued for the goods and services they provide that enable people and our communities to prosper financially.

These environmental, social and economic values, and their importance to local communities and the wider population is the reason we establish river management (river health and water quality) programs.

Rivers need to be protected or maintained in a state of good ecological health for the well-being of the environment, for the protection of economic and social values. This is why we have managed and need to care for our rivers as they provide us with the very values we see as important.

The Project Area (River Connect)

This project refers specifically to the reaches of Goulburn and Broken Rivers within the Shepparton-Mooroopna urban area.

The project area for RiverConnect is bounded to the north by McCracken Road and south by Raftery Road.

Broken River area is bounded to the east to Doyles Road. (Figure 2)

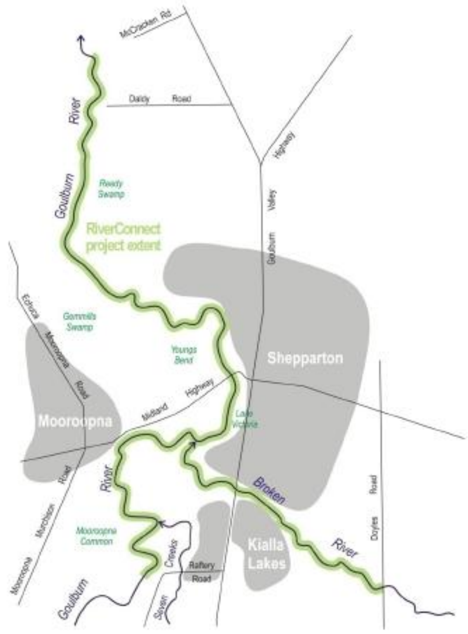

Figure 2 – The RiverConnect Area

Shepparton – Mooroopna

The townships[2] developed adjacent to the Goulburn River, at a crossing point for miners travelling from the Bendigo goldfields to the Beechworth area. As there was no bridge to link rich pastures on either sides of the Goulburn River, a punt was quickly established and the settlement became known as "McGuire's Punt".

The name Shepparton comes from a squatter called Sherbourne Sheppard who held the Tallygaroopna Station. From about 1855 it appears in various documents as a dual name "Shepparton or McGuire's Punt". The initial spelling was Sheppardtown or Sheppardton,

The name Mooroopna was used by the Traditional Owners living in the area and meant 'deep water hole'. This refers to a very deep part of the Goulburn River behind the old Mooroopna Hall.

[2]http://www.filmnortheastvictoria.com.au/region/index.php?town=shepparton

Shepparton Mooroopna is central to the Greater Shepparton urban area, which includes the surrounding suburbs/townships of Tatura, Merrigum, Mooroopna, Murchison and Dookie.

Geology and Soils

Geology: Quaternary[3] alluvial sediments, with the more recent deposits along the main streambeds of the Broken and Goulburn Rivers.

The land system along the course of the Goulburn is categorised as floodplain, with ox bows (see Plate 1), meander scrolls and occasional source bordering dunes.

The surrounding riverine plain land system is well-drained, and flat to gently undulating in the north of the zone, but with increasing evidence of levied prior streams in the landscapes further south (LCC 1983).

Plate 1 – Meander cutoffs / ox bows on the lower Goulburn River

Water Features – Introduction

Stream flow along the Goulburn River has been modified by two major features: Eildon Reservoir and Goulburn Weir.

Operation of Eildon Reservoir for irrigation supply has reduced winter/spring flows downstream and increased summer/autumn flows so that the flow regime is reversed from the natural regime. (Figure 3)

The Goulburn Weir near Nagambie diverts irrigation water to north-western Victoria, and has reduced the average annual downstream to less than half the pre-regulated flow.

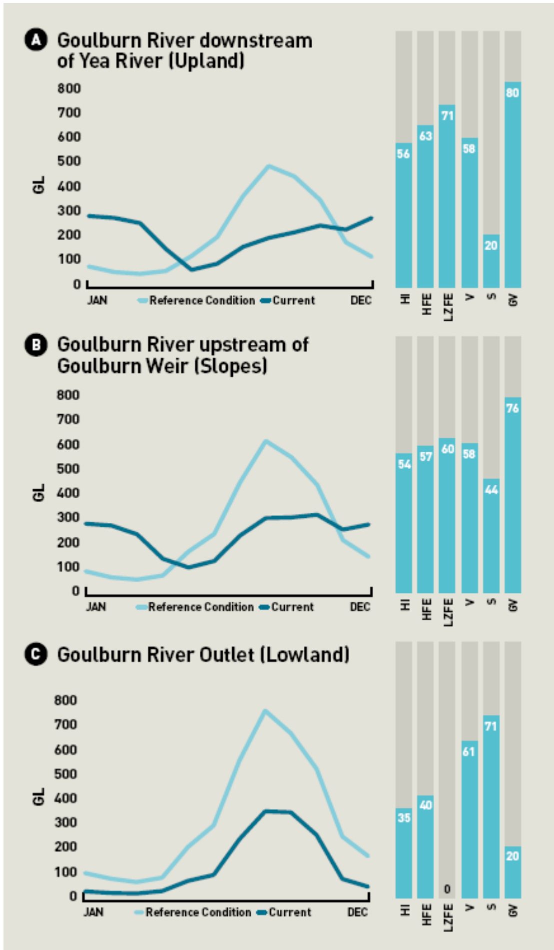

Figure 3 – Flow regimes Goulburn River (natural and modified)

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[3] The Quaternary Period is the geologic time period after the Neogene

Water Features – Lake Eildon

Location[4] Lake Eildon (Plate 2) is located on the Goulburn River in its upper catchment, immediately below the junction with the Delatite River.

Plate 2 – Eildon Reservoir

Harnessing the river catchments in the vicinity of the present Lake Eildon began in the early 1900s. Development of this water resource was undertaken by the State Rivers and Water Supply Commission (SR&WSC) to provide irrigation water for what was a vast uncultivated area on Victoria's northern plains. This region has since developed into the largest area of irrigated farmland in Australia and is known as the Goulburn-Murray Irrigation District (GMID).
Construction of the original storage, which was known as Sugarloaf Reservoir, took place between 1915 and 1929. It was modified in 1929, and again in 1935 to increase the storage capacity to 377,000 ML. However, this reservoir was still limited in its capacity to meet the growing demand for water in the Goulburn Valley and to protect farmers during drought years. Following a detailed feasibility study of all possible storage sites on the Goulburn River, it was decided that the existing dam site was the most suitable for construction of a larger dam.

Facts & Figures

Name	Lake Eildon
Stream	Goulburn and Delatite Rivers
Year of Completion	1956
Construction	Earth and Rockfill
Full Supply Level	288.9 m AHD
Capacity	3,334,158 ML
Area Submerged	13,832 ha
Main Embankment Length	1,085 m
Main Embankment Height	84.5 m
Hydro-electric Generation	135 MW

In 1951, work began to enlarge the storage to its present capacity (3,334,158 ML) which is six times the size of Sydney Harbour. The enlargement was completed in 1955 and the storage was renamed Lake Eildon.
The enlargement plans also considered Victoria's electricity needs. The original 15 MW hydro-electric generation capacity at the Sugarloaf Reservoir was increased to 120 MW through the installation of two 60 MW turbines. The oldest turbines were renovated in 2001 to provide a generation capacity of 135 MW.

Water Features – Goulburn Weir

Location [5]

Goulburn Weir is located on the Goulburn River, approximately 8 km north of Nagambie. The construction of a weir on the Goulburn River began in 1887, and was completed in 1891. The Goulburn Weir was the first major diversion structure built for irrigation in Australia and was considered very advanced for the time. Such was the regard for the structure, it appeared on the reverse of Australian half sovereign and ten shilling banknotes from 1913 until 1933.

[4] www.g-mwater.com.au

[5] www.g-mwater.com.au

Goulburn Weir raises the level of the Goulburn River so that water can be diverted by gravity along the Stuart Murray Canal, Cattanach Canal and the East Goulburn Main Channel.

Diversions to the East Goulburn Main Channel supply the Shepparton Irrigation Area. The Stuart Murray Canal supplies part of the Central Goulburn Irrigation Area. Both the Stuart Murray Canal and the Cattanach Canals are used to divert water to Waranga Basin for further supplies to the Goulburn irrigation system.

The weir also forms Lake Nagambie around which recreation, farming and housing developments have grown.

Flora

The vegetation[6] of the Southern Goulburn zone was a mixture of native grasslands, open woodlands and wetlands. Woodland communities on the plains were dominated by Grey Box (Eucalyptus microcarpa) and Yellow Box (Eucalyptus melliodora), White Cypress Pine (Callitris glaucophylla) and Buloke (Allocasuarina leuhmannii).

Ground cover in these woodlands comprised grasses and chenopods with peas and wattles providing an understorey.

The stream sides supported an overstorey of River Red Gum (Plate 3).

Fauna[7]

There are 52 threatened fauna species recorded. Examples of threatened woodland species recorded in the Southern Goulburn Landscape Zone include:

- Bush Stone-curlew (Burhinus grallarius) (Threatened in Australia, endangered in Victoria),
- Superb Parrot (Polytelis swainsonii) (Vulnerable in Australia, endangered in Victoria),
- Grey-crowned Babbler (Pomatostomus temporalis) (endangered in Victoria, listed under FFG Act 1988) and
- Diamond Firetail (Stagonopleura guttata) (Threatened Australia, vulnerable Victoria) (Ahern et al 2003).

Plate 3 - River Red Gum

Examples of threatened species recorded associated with wetlands include:

- Hardhead (Aythya australis) (vulnerable in Victoria),
- Australasian Shoveller (Anas rhynchotis) (vulnerable in Victoria),
- Musk Duck (Biziura lobata) (vulnerable in Victoria),
- Freckled Duck (Stictonetta naevosa) (endangered in Victoria).

Other notable species are, Tree Goanna (Varanus varius) (vulnerable in Victoria), Growling Grass Frog (Litoria raniformis) (Vulnerable across Australia and endangered in Victoria) and Squirrel Glider (Petaurus norfolcensis) (endangered in Victoria).

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[6] Biodiversity Action Planning, GBCMA.
[7] BAP, GBCMA.

Aquatic Species

The river connect area is home to an array of native fish. Species present include: Trout Cod - *Maccullochella macquariensis,* Murray Cod - *Maccullochella peelii peelii,* Platypus - *Ornithorhynchus anatinus,* Eel Tailed Catfish - *Tandanus tandanus,* Water Rat - *Rakali* , Silver Perch - *Bidyanus bidyanus* *and* Golden Perch - *Macquaria ambigua*

Wetlands (eg Reedy Swamp)

Before European settlement, the site was dominated by River Red Gum (see Plate 3 and 4).

The area would have flooded nearly every year in Winter & Spring, and dried during most Summer & Autumns.

Selective logging, grazing and fires from the 1860s have modified the wetland.

Irrigation drainage water from 1920s and a sewer drain commencing in 1932 (no longer present) created constant high water levels and caused the death of many Red Gums and allowed rush and water-couch to dominate.

Plate 4 - Ibis at Reedy Swamp
Photo by Keith Ward

Changes to these features overtime

Since European settlement a number of changes have occurred within the catchment. The most significant change being developed land use, clearing, urbanisation, vegetation fragmentation, harnessing and diversion of water, channelisation, levee banking and removal of instream wood.

The condition of the waterways have modified significantly. Figure 4(from DSE 2002) represents the suggested decline in health of our waterways due to a range of impacts throughout the catchment

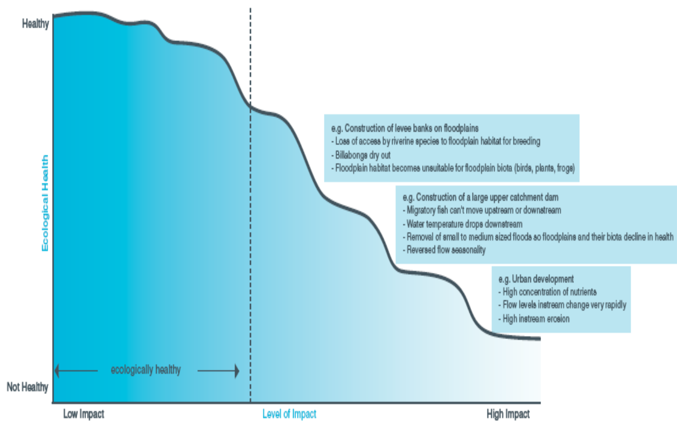


Figure 4 – trends in river health

Figure 5, 6 and 7 highlights the activities and key impacts which have occurred within the catchment, the riparian zone and within the channel.

Activities	Some Key Impacts
Catchment management	
Catchment clearing including urbanisation	• Changed stream flows - peakier, less base flow, can increase instream erosion and sedimentation • Increased catchment erosion hence sedimentation of streambed, smothering biota • Poor quality runoff causing deterioration in instream habitat • Increased salinity levels • Loss of wetland habitat
Poor land management	• Increased input of contaminants such as sediment, salt or nutrients, depending on the land use • Rabbit infestation which can damage riparian vegetation, increase erosion and hence increase sediment input • Loss of wetland habitat
Disposal of poor quality effluents	• Reduced habitat quality from poor water quality • Changed species composition • Algal blooms

(Fig 5)

Management of riparian land	
Grazing banks	• Changed vegetation structure and species composition, especially understorey • Reduced regeneration • Weed invasion • Bank instability hence erosion and sediment deposition in waterways
Clearing banks	• Complete loss of vegetation structure and diversity, so loss of plant and animal species • Weed invasion • Reduced/no input of organic matter and snags to rivers • Reduced quality of bank habitat for aquatic animals • Bank erosion and sedimentation leading to changed channel shape
Promotion of exotics	• Doubtful to negligible habitat quality • Willows: changed channel morphology and hence habitat • Changed input of energy and snags • Decline in suitability of riparian habitat
Levees and floodplain development	• Reduction or loss of linkages • Decline in quality and area of floodplain habitat, reduction in quality of riverine environment • Changed river and floodplain morphology
Recreation: camping	• Loss of understorey, especially ground layer and wood debris, so impact on plants and also animals (lizards, invertebrates, insectivorous birds) • Reduced snag input to rivers

(Fig 6)

Activities	Some Key Impacts
Management in the river channel	
Snag removal	• Loss of habitat and food source • Changed channel shape
Culverts and regulators	• Disrupted longitudinal and lateral linkages, reduced access to habitat
On stream storages	• Disrupted and degraded longitudinal linkages, reduced fish movement, sediment and organic matter transport, recolonisation • Changed flow patterns changing occurrence of ecological triggers
Low level releases on storages	• Disruption of life cycles from reduced temperature – reduction/prevention of breeding, hatching, growth, germination • Reduced primary productivity
Recreation (e.g. boating, fossicking)	• Removal of 'unsafe' snags • Bank erosion, sedimentation
Weed removal	• Loss of plant species, loss of animal habitat • Release of sediment
Flow diversion and management (note: this is described more fully in Table 6.2)	• Disruption of longitudinal and lateral linkages including changed frequency of estuarine closure • Changed channel shape • Loss of habitats and species • Changes in flow patterns, leading to loss of biological cues, reduced linkages, changes to habitat availability and changed geomorphic processes • Changed temperature and seasonality of flows

(Adapted from Thoms et al. 2000)

(Fig 7)

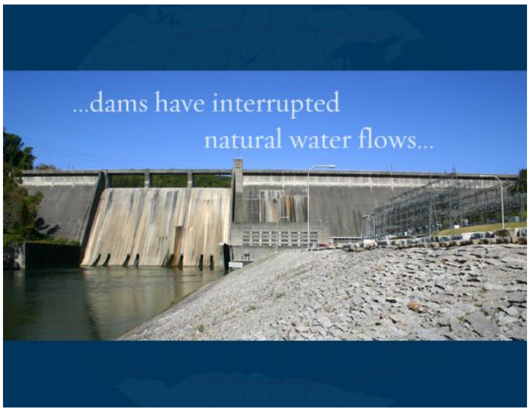
Observations Globally [8]

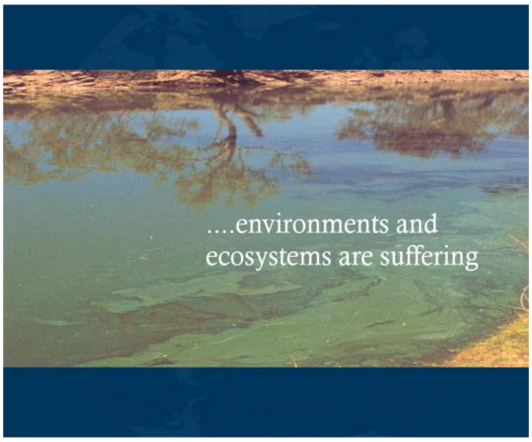
….Our rivers are showing signs of stress…………

Rivers are running dry from overuse

Dams have interrupted natural flow regimes.

A growing population seeks and demands safe, clean fresh water.





[8] The Nature Conservancy

Our Local Rivers are showing signs of stress, with fish deaths, reduced stream flow, poor water quality and rubbish.

Conservation Threats

- Land Clearance – (removal of native vegetation),
- Habitat Fragmentation – (isolation of remnants and species due to land clearance),
- Elevated competition by introduced species,
- Changes in hydrology (inappropriate wetting/drying/flow regimes),
- Inappropriate management of grazing (by introduced animals),
- Removal of habitat (e.g. firewood collection, 'cleaning' up),
- Pest Plants,
- Pest Animals (including soil disturbance),
- Salinity (high watertable), and
- Adjacent Land Use Practices (e.g. Urbanisation, irrigation, laser grading).

The value of Rivers

Our rivers are highly valued. The river connect area presents our community with an array of values, including:

- Significant areas of intact riparian and floodplain vegetation;
- Wetlands of State significance;
- Significant habitat for vulnerable or threatened wildlife;
- Native fish;
- Fishing opportunities;
- A wide range of recreational activities;
- Aboriginal heritage, Cultural heritage and Scenic landscapes sites;
- Tourism activity; and
- Supports one of Australia's pre-eminent agricultural regions.

Their condition cannot be taken as granted. Major changes have occurred to the natural features they contain and without protection they could be further diminished.

Riverconnect provides an incredible opportunity for us to participate in the protection of our most valued assets – the river and the water they contain.

By acting locally we can preserve the natural features and contribute to the protection of the systems as a whole.