

# **Environmental Flow Determination for the Little Yarra and Don Rivers**



## **Site Paper**

Prepared by

**The Little Yarra and Don Rivers  
Environmental Flow Technical Panel  
(LYDEFTP)**

June 2004

## The Little Yarra and Don Rivers Environmental Flow Technical Panel

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### Acknowledgements

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### Abbreviations used in this report

DSE	Department of Sustainability and Environment
EPA	Environment protection Authority
LYDEFTP	Little Yarra and Don Rivers Environmental Flow Technical Panel
mg/l	Milligrams per litre
ML	Megalitres (1,000,000 litres)
MWC	Melbourne Water Corporation
NRE	Department of Natural Resources and Environment
SFMP	Streamflow Management Plans
WoV	Waters of Victoria

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Cover Photo: Little Yarra River – photo from Coleman and Armanata (2002)

## Conclusions

The overall study area for this project covers the Little Yarra River catchment, and the Don River catchment, two small tributaries of the Yarra River that flow north and south into the Yarra River around Launching Place and Yarra Junction.

Environmental flow recommendations will only be required for a smaller part of each of the two catchments. Each catchment has an upstream forested section – upstream of Powelltown on the Little Yarra River, and upstream of Malleson Glen on the Don River. Environmental flow recommendations are not required for these sections of each catchment.

It is recommended that the lower end of the study area in each catchment also be restricted in this study, to upstream of the influence of high flows in the Yarra River. This is particularly because the selection of further study sites are likely to be located at compliance points for environmental flow monitoring. Locating these sites within the influence of the Yarra River will result in inadequate monitoring of environmental flow compliance for any higher flows recommended or adopted.

### The Little Yarra River

The Little Yarra River downstream of Powelltown and upstream of the Yarra River influence can be considered as a number of different reaches (between 1 and 4), depending on the environmental characteristics utilised.

	Yarra River – Britannia Creek	Britannia Creek – Black Sand Creek	Black Sand Creek – Hackett Creek	Hackett Creek - Powelltown
Geology	1	1	1	2
Geomorphology	1	2	3	3
Hydrology	1	2 <sup>1</sup>	3	3
Fish	1	1	2	2
Vertebrates (other)	1	1	1	1
Macroinvertebrates	1	1	1	1
Vegetation	1	1	2	2

In the opinion of the Technical Panel, a logical split for examining environmental flow recommendations would be at the inflow of Black Sand Creek. The geomorphology changes from a narrow valley to a widening valley with a distinct natural constriction of the valley at this point, and the fish fauna shows a distinct disjunction at this point based on the presence of migratory fish species. There is some (but not convincing) evidence of an upstream and downstream difference in the macroinvertebrate community. Vegetation communities also show this split, with Riparian Forest upstream, and Riparian Forest associated with rarer Riparian Scrub (typically dominated by *Melaleuca squarrosa*), Swampy Riparian Complex and Damp Heathy Woodland.

About half of the diversions occur above and half below this point, but with winterfill licences much more common downstream of Black Sand Creek.

The division of the Little Yarra River into two reaches for environmental flow determinations presents a number of management difficulties. There is no streamflow gauge upstream of Black Sand Creek so

<sup>1</sup> While a further hydrology reach of Black Sand Creek to Slaty Creek is suggested, this is very short and has been ignored in these conclusions.

monitoring compliance with any environmental flow recommendations cannot be done. Either a gauge will need to be established, or rules-based compliance measures will need to be developed (i.e. a set of diversion rules that, if implemented, will guarantee the recommended flows are delivered).

The division may also mean that diversions in the two halves of the catchment may need to be managed differently. It may turn out that flow conditions (such as cease-to-divert flows) could be different in the two parts of the catchment. This will produce extra management work and may introduce perceptions of inequity within the catchment (where one half of the catchment cannot divert and the other may still divert).

### **The Don River**

The Don River downstream of the forested areas and upstream of the Yarra River influence can be considered as a single reach. There are no indications that this reach has significant geomorphological, hydrological or in-stream biological discontinuities that would require different sites to be assessed. The terrestrial vegetation suggests two separate reaches, but it would not appear feasible or desirable to split the river in two for management purposes (particularly in such a small catchment). It is therefore recommended that a single site be chosen for further examination, probably near the bottom of the catchment, but upstream of the influence of the Yarra River.

These reach discriminations are based on current available information and may need to be revised in the light of the field inspection to be conducted in mid June 2004, or any further information that comes to light during more detailed research in preparation of the Issues Paper.

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# 1. Introduction

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Melbourne Water Corporation is currently in the process of developing Streamflow Management Plans (SFMPs) for a number of unregulated tributaries of the Yarra River system. SFMPs will provide a framework of rules to operate a specific river system that aims to ensure the long term sustainability of river system health by reaching a balance between environmental requirements and consumptive uses of water.

The main aim of the SFMP process is to devise rules related to water sharing in the catchment. Part of any water sharing arrangements is to provide water for environmental uses. However, without an understanding of the environmental water requirements of the catchment, defensible and equitable decisions on water allocation between consumptive and environmental uses cannot be made.

The aim of this project is to develop environmental flow recommendations for the Little Yarra River and the Don River, two small sub-catchments of the Yarra River, as part of the input into the SFMP process.

The method for determining environmental flow recommendations is to be the FLOWS method. FLOWS is the standardised Statewide Method For Determining Environmental Water Requirements in Victoria (SKM *et al.*, 2002). FLOWS was specifically developed to be used for environmental components of SFMPs (and small to mid sized Bulk Entitlement BE projects) and so is the most appropriate method for this project.

## The FLOWS Site Paper

This Site Paper represents the first output from the FLOWS project to develop environmental flow recommendations for the Little Yarra and Don River catchments. Its purpose is to present summary ecological information that can be used to delineate discrete reaches within the two catchments. This is done to identify different areas where environmental flow recommendations may need to be determined. Given that different reaches will have different ecological characteristics, there may be a need for different specific flow regimes, and thus, different environmental flow recommendations.

Natural discontinuities in hydrology (including tributary inflows and major diversion points), geology and geomorphology, and biodiversity values (fish, other vertebrates, macroinvertebrates and vegetation) are identified. These are examined to determine overlaps between areas with similar attributes of biodiversity, hydrology, geology and geomorphology.

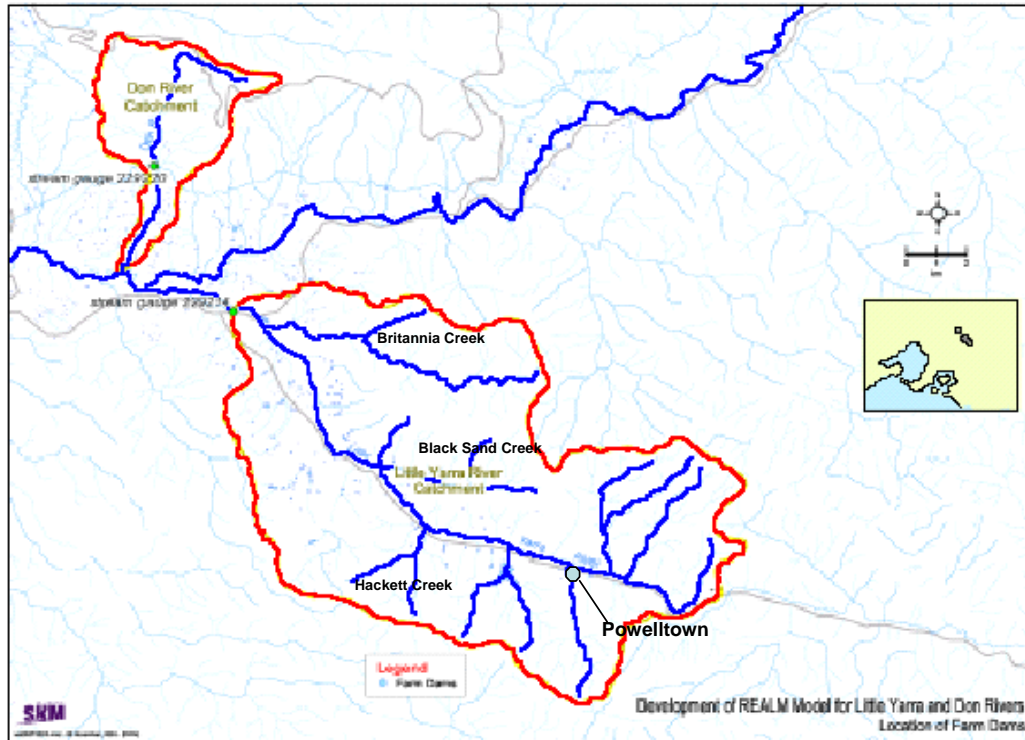
The Site Paper is based on available information that can be gathered rapidly in the early stages of the study. During the preparation of the more detailed Issues Paper, further information (usually unpublished or difficult to obtain) may come to light that causes a revision of the conclusions of this paper.

## The Study Area

The study area for this project covers the Little Yarra River to its confluence with the Yarra River near Launching Place, and the Don River to its confluence with the Yarra River near Launching Place (Figure 1.1).

The Little Yarra River rises to the east of Powelltown in the Yarra Ranges. The stream flows generally north-west through the townships of Powelltown, Three Bridges, Gladysdale, and Yarra Junction, before joining the Yarra River near Don Road in Launching Place. The total catchment area of the Little Yarra River is approximately 154km<sup>2</sup>.

The Don River rises near Panton Gap on Mt Toole-Be-Wong. The river flows south and joins the Yarra River near Don Road in Launching Place. The Don River catchment is approximately 22km<sup>2</sup>.



**Figure 1.1** Map of the study area (adapted from SKM, 2004).

Much of the catchments of the Little Yarra and Don Rivers are characterised by moderate to steep slope gradients and high rainfall (1000-1400 mm per annum). As a consequence, a large proportion of both catchments could not be selected for agriculture and remains in a comparatively unmodified condition. Only 13% of the Don catchment and 23% Little Yarra catchment have been cleared and most of the balance remains in public ownership and is used for timber extraction, recreation and nature conservation.

The uncleared upper regions of the catchments are characterised by the predominance of tall Eucalypt forests – Ecological Vegetation Classes<sup>2</sup> present include Wet Forest, Damp Forest and Montane Wet Forest, with Riparian Forest along the larger watercourses. Here both rivers are confined to narrow valleys with little or no valley development. In restricted fire protected valleys, Cool Temperate rainforest may also occur in association with these tall forests. As with most catchments in south-eastern Australia the upland forest types – while often subject to modifications associated with timber harvesting – are either naturally rare (eg. Cool Temperate Rainforest) or are relatively well represented on public land.

<sup>2</sup> In Victoria, the principal unit for vegetation circumscription and mapping for land use planning and management is the Ecological Vegetation Class (EVC). EVC's represent aggregations of floristic communities with structural, physiognomic and floristic affinities that exist under a common regime of ecological processes within a particular environment.

Clearing for intensive agricultural pursuits have taken place where slope gradients are moderate to low in the middle and lower reaches of both rivers. The cleared areas of both valleys are closely settled with a preponderance of small holdings and 'hobby farms'.

In the Little Yarra catchment, there is a relatively narrow strip of cleared land along the river between Powelltown and Three Bridges. Below Three Bridges, the wider valley is mostly cleared for a variety of agricultural uses, including orchards, vineyards, vegetables, tree farms and grazing.

The lower section of the Don River valley has also been cleared for a variety of agricultural uses (similar to those in the Little Yarra catchment).

Both catchments are unregulated and as such do not have any major irrigation or urban water supply reservoirs located on the rivers.

However, environmental flow recommendations are not required for the forested reaches upstream of Powelltown on the Little Yarra River or for the forested reaches of the Don River upstream of the Don Road crossing. Thus, these forested upstream areas of each catchment are not included in this study.

## 2. Information

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### 2.1 Geology and Geomorphology

Geology, and particularly fluvial geomorphology, have been investigated for the Little Yarra River catchment by Brizga *et al.* (2000). The geology of the Little Yarra and Don Rivers is presented on the Warburton 1:250,000 Geological Map Series (Department of Natural Resources and Environment, 1997). Catchment topography, and in particular channel slope, was identified from the Digital Elevation Data at 10m contour intervals (Geoscience Australia, 2004) through the GIS package ArcView. In the absence of a study on the Don River, information has been garnered from the geological and topographic maps and other minor sources as identified.

#### 2.1.1 Little Yarra River

The geology of the Little Yarra River is dominated by granites. Upstream of the Hackett Creek confluence at Three Bridges Road, the geology is mostly intrusive Upper Devonian Warburton Grandiorite (fine grained) and Tynong Granite (medium grained – DNRE, 1997), with associated alluvium/colluvium (Brizga *et al.*, 2000). The geology is more diverse downstream of Hackett Creek with, in addition to the granites, metamorphic hornfels and Devonian Humevale Siltstones as well as Quaternary alluvium and colluvium consisting of ‘gully alluvium’, gravels, sands and silts (Brizga *et al.*, 2000; DNRE, 1997).

The geology of the Little Yarra River therefore suggests two main reaches – up- and downstream of Hackett Creek.

Topographically, the Little Yarra valley is narrow in the headwaters and widens downstream to an alluvial fill valley. The headwaters are contained in a steep confined valley until Learmonth Creek (near Powelltown). Downstream of Powelltown, the grade decreases significantly to the confluence with Black Sand Creek. While still within hilly to mountainous terrain, the alluvial valley floor is wider along this reach, but is still within a confined to partially confined valley.

Downstream of Hackett Creek, the valley begins to contract again, and the channel sinuosity decreases. Immediately upstream of the confluence with Black Sand Creek, there is a significant valley constriction.

Downstream of Black Sand Creek, the valley broadens into a partially confined valley, which further significantly broadens downstream of Britannia Creek. Downstream of Britannia Creek, the Little Yarra maintains its own valley, until coalescing with the Yarra River valley just upstream of Yarra Junction. From there, the Little Yarra River follows the southern margin of the unconfined Yarra River Valley to its confluence with the Yarra River.

The geomorphic condition of the Little Yarra River - the amount to which the channel alignment and form have undergone physical intervention due to human activity – increases in a downstream direction. Based on interpretation of works programs and field inspection Brizga *et al.* (2000) found the reach upstream of Powelltown to be in a ‘relatively natural geomorphic condition’. Evidence of modification was found between Powelltown and the Black Sand Creek confluence, with mostly desnagging, levee construction and riparian vegetation clearing. Modifications are greater downstream of Black Sand Creek with artificial straightening and desnagging. Recent desnagging at Tarrango Road downstream of Black Sand Creek has been put forward as the reason for incision and the oversize channel capacity Brizga *et al.* (2000). In the lower section downstream of Britannia Creek numerous rock chutes are present and channel straightening is considered to be significant (Brizga *et al.*, 1998).

Based on geology, geomorphology and topography, the suggested reach delineation in the Little Yarra River downstream of Powelltown follows the selection of Brizga *et al.* (2000) as follows:

- Powelltown to Black Sand Creek (with the potential for the Hackett Creek inflow to be a further delineation due to the change in geological type – this will be further examined on the field inspection);
- Black Sand Creek to Britannia Creek; and
- Britannia Creek to the Yarra River Confluence.

### **2.1.2 The Don River**

The headwaters of the Don River catchment is in a Donna Buang Rhyodacite extrusive with an intrusive felsic dyke section extending east from Wallaby Road. Humevale siltstone dominates the lower section of the catchment downstream of Road Eighteen. The Don River channel is almost entirely within Quaternary colluvium and alluvium for its full length.

Topographically, the headwaters of the Don River are relatively steep to the edge of the forested area, beyond which the grade decreases and the valley widens significantly. From this point the Don River flows through a relatively unconfined valley to the confluence with the Yarra River.

Based on geologic, geomorphic and topographic information no delineation can be recommended for the Don River downstream of the forested area. An assessment of bed material, geomorphic condition and levels of modification for the Don River may further clarify if delineation is required.

## **2.2 Hydrology and Diversions**

### **2.2.1 Little Yarra River**

The Little Yarra River downstream of Powelltown has five main tributary inflows: Saxton Creek – which joins the river just downstream of Powelltown; Hackett Creek – which joins at Three Bridges; Black Sand Creek – which joins just upstream of Gladysdale, Slaty Creek – which joins just at Gladysdale; and Britannia Creek – which joins the river just upstream of Yarra Junction. Numerous other smaller tributaries also flow into the Little Yarra River.

Of the main tributaries, Britannia Creek is the largest, with a catchment area of around 27 km<sup>2</sup> (17% of the Little Yarra River catchment). The others are smaller tributaries of around 10 km<sup>2</sup> (about 6% each). Hence, hydrologically, the Little Yarra River downstream of Powelltown could be divided into:

- 5 main reaches based on the major tributaries – Saxton Creek to Hackett Creek, Hackett Creek to Black Sand Creek, Black Sand Creek to Slaty Creek (a very short reach), Slaty Creek to Britannia Creek, and downstream of Britannia Creek to the Yarra River; or
- 2 main reaches based on the largest tributary – upstream of Britannia Creek and downstream of Britannia Creek.

The 5 reach option has some similarity with the reaches selected for the purposes of REALM modelling (SKM, 2004). SKM divided the catchment into four reaches: upstream of Powelltown (F1); Powelltown to the inflow of Black Sand Creek (F2); Black Sand Creek to the confluence of Britannia Creek (F3); and from Britannia Creek to the Little Yarra River stream flow gauge 229214 (F5).

Hence, F1 corresponds to the hydrological reach upstream of Saxton Creek (outside of our area of interest); F2 corresponds to the two hydrological reaches between Saxton Creek and Hackett Creek, and from Hackett Creek to Black Sand Creek; F3 corresponds to the combination of the Black Sand Creek to Slaty Creek, and the Slaty Creek to Britannia Creek hydrological reaches, The Realm reach

F4 only includes the river below Britannia Creek to the stream flow gauge in Yarra Junction, omitting the river further downstream to the Yarra River.

The first three reaches (F1, F2 and F3) have areas of 37.5, 48.8 and 60.3 km<sup>2</sup> respectively, while the area below Britannia Creek (F4) is only 1.8 km<sup>2</sup>.

The natural flow data generated by the REALM model (1963-2003) for the larger 3 reaches suggest that inflows into each reach are evenly distributed (an average of 0.85 ML/d/km<sup>2</sup> for both F1 and F2 and 0.87 ML/d/km<sup>2</sup> for F3). While this may be an artefact of the modelling procedure, it would suggest that SKM considers there are no significant hydrological discontinuities (with one tributary contributing proportionally more of the flow than others).

Licensed diversions are widely spread throughout the catchment (Table 2.1). The higher diversion licence volumes, and diversion volumes per catchment area, are upstream of Saxton Creek (F1) and between Black Sand Creek and Britannia Creek (F3).

**Table 2.1 Diversion licences in the Little Yarra River (from SKM, 2002).**

Reach	No. of diverters	Licenced Volumes (ML/year)				Total	Total/km <sup>2</sup>
		D&S	Winterfill	Irrigation	Industrial		
F1	8	171	0	4	100	275	7.3
F2	30	42	24	93	0	159	3.3
F3	50	54	187	80	94	415	6.9
F4	2	4	0	0	0	4	2.2

Similarly, farm dams are spread throughout the catchment, with 11 ML in F1, 84 ML in F2, 488 ML in F3 and 38 ML in F4.

Hence, the greatest diversions of water occur in the stretch between Black Sand Creek and Britannia Creek.

In the absence of any further hydrological information, it seems reasonable to divide the Little Yarra River downstream of Powelltown into three hydrological reaches – Saxton Creek to Black Sand Creek; Black Sand Creek to Britannia Creek and Britannia Creek to the Yarra River (F2, F3 and an extended F4 reaches in the REALM model).

### 2.2.2 Don River

Downstream of the forested areas in the Don River, there are no significant tributaries to the main river. In their REALM study, SKM (2004) considered the Don River as a single sub-catchment. There is no evidence that licenced diversions (Table 2.2) or farm dams (38 ML) are concentrated in any particular area of the reach downstream of the forested area. Hence, hydrologically, the Don River study area should be considered as a single reach.

**Table 2.2 Diversion licences in the Don River (from SKM, 2002).**

Reach	No. of diverters	Licenced Volumes (ML/year)				Total	Total/km <sup>2</sup>
		D&S	Winterfill	Irrigation	Industrial		
Don	17	36	0	111	1	148	6.9

## 2.3 Fish

### 2.3.1 Little Yarra River

The fish fauna of the Little Yarra River was recently surveyed as part of a study commissioned by Melbourne Water Corporation (MWC) and conducted by the Arthur Rylah Institute (Coleman and Amenta, 2002; MWC, unpubl. data). Surveys were conducted in 2001 and 2003 and consisted of two-pass backpack electrofishing samples.

Seven species of native fish, and three introduced fish species, were recorded from the Little Yarra River in the surveys (Table 2.3). In addition to the native species recorded in these surveys, it is also likely that Australian grayling *Prototroctes maraena* occur in the lower reaches of the river. This species is rare and is difficult to detect without intensive and sustained survey effort. However, there are confirmed recent records of the species in the Yarra River upstream of its junction with the Little Yarra River (T. Raadik, DSE, pers. comm.) and there is suitable habitat available in the lower reaches of the Little Yarra River. Surveys of the tributary streams suggest that they have a less diverse fish fauna than the main stem, with only three native fish and three introduced fish recorded from Britannia Creek, Black Sand Creek, Hackett Creek and Saxon Creek (Table 2.3).

**Table 2.3 Presence of fish species recorded in the Little Yarra River and tributary streams in 2001 and 2003 (modified from Coleman and Amenta 2002). Sites LY01, LY02 and LY03 are located downstream of Black Sand Creek and sites LY04 and LY05 are upstream. Tributary samples are from Britannia (BT06 and BT07), Black Sand (BS08), Hackett (HC09) and Saxon (SC10) Creeks.**

Common Name	Scientific Name	Little Yarra River					Tributaries				
		LY01	LY02	LY03	LY04	LY05	BT06	BT07	BS08	HC09	SC10
<i>Native Fish</i>											
Australian Smelt	<i>Retropinna semoni</i>	✓	✓	✓							
Short-finned Eel	<i>Anguilla australis</i>	✓	✓	✓		✓	✓		✓	✓	
Mountain Galaxias	<i>Galaxias olidus</i>	✓	✓	✓		✓	✓	✓		✓	
Pouched Lamprey	<i>Geotria australis</i>		✓	✓							
River Blackfish	<i>Gadopsis marmoratus</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Short-headed Lamprey	<i>Mordacia mordax</i>		✓	✓							
Southern Pygmy Perch	<i>Nannoperca australis</i>		✓		✓						
<i>Introduced Fish</i>											
Brown Trout	<i>Salmo trutta</i>	✓	✓		✓		✓			✓	
Rainbow Trout	<i>Oncorhynchus mykiss</i>		✓				✓				
Roach	<i>Rutilus rutilus</i>		✓		✓						

The fish distribution data suggest that it may be appropriate to divide the Little Yarra River into two sections – above and below Black Sand Creek. Pouched lamprey, short-headed lamprey and Australian smelt were recorded in the three sites below the Black Sand Creek inflow, but were absent upstream and in the tributaries. Both species of lamprey exhibit a form of migration known as anadromy, where the adults live in the sea and migrate into freshwater to spawn. Although it is currently unknown whether Australian smelt in coastal river systems migrate between freshwater and the sea, the species has been reported to undertake upstream migrations at certain times of the year.

These two sections may have different environmental flow recommendations, as certain flows will be required to trigger and facilitate movement of the migratory fish species, flows which would not be required upstream.

### **2.3.2 Don River**

Information regarding the fish fauna of the Don River is much less comprehensive than for the Little Yarra River, although several limited surveys of fish have been conducted on an *ad hoc* basis between 1983 and 2001 (DSE Fauna database). Three native fish species (Short-finned eel, Mountain galaxias, and River blackfish) and three introduced species (Brown trout, Weatherloach, and Roach) have been recorded in the Don River in these surveys. As for the lower reaches of the Little Yarra River, it is likely that Australian grayling may also occur in the lower reaches of the Don River. Given that environmental flow recommendations are not required for the forested upstream region of the Don River, it is considered appropriate to treat the river as a single site requiring consideration of the requirements both migratory and non-migratory fish.

## **2.4 Other vertebrates**

### **2.4.1 Little Yarra River**

Coleman and Armenta (2002) presented data for water-dependent<sup>3</sup> vertebrates (platypus and frogs) and other vertebrates that occur in the Little Yarra catchment. Platypus have been recorded throughout the study area, from Yarra Junction to Guilderoy, and therefore show no pattern that would suggest any reach discrimination.

Nine species of frogs have been recorded, or presumed to occur within the Little Yarra catchment. These are presumed to be distributed throughout the study area downstream of Powelltown and therefore show no pattern that would suggest any reach discrimination.

Coleman and Armenta (2002) list a number of significant bird and mammal species present in the Little Yarra catchment. However, they note that “it is acknowledged that these species may not be closely associated with the stream environment” (p. iii). It is unlikely that environmental flow recommendations will be needed for these species.

None of the vertebrate data suggests that dividing the Little Yarra River into reaches for environmental flow recommendations would be justified.

### **2.4.2 Don River**

No information on water dependent vertebrates has been found for the Don River.

## **2.5 Aquatic macroinvertebrates**

### **2.5.1 Little Yarra River**

A considerable amount of data are available for aquatic macroinvertebrates from the Little Yarra River.

The EPA (Bessell-Browne, 2000) sampled two sites in the Little Yarra River catchment as part of a Yarra Basin survey in 1994-1995 – the Little Yarra River at Lowes Road just upstream of Yarra Junction (Site RZ, Altitude 110 m) and the Little Yarra River at Powelltown (Site SA, Altitude 180 m).

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<sup>3</sup> “Water-dependant” refers to strictly aquatic species, or those dependant on river water for primary habitat, food source or part of their life cycle.

Only edge samples can be compared between the sites. The site at Powelltown was considered to be at reference condition (all expected species were present) while the site at Lowes Road was considered to be below references (some expected species were not present).

When compared to other sites in the upper Yarra catchment, the samples from each site were classified differently – the Powelltown site was more aligned with a group of upper tributaries in largely undisturbed condition (including Armstrong, Stavation, McMahons and Cement Creek), and the Lowes Road site grouped with nearby Yarra River Woori Yallock Creek and Olinda Creek sites. The main difference between the sites were that the Lowes Road site supported macroinvertebrate communities more commonly found in streams at lower altitudes and with slower currents.

While this may suggest a natural disjunction in the macroinvertebrate fauna, Bessell-Browne (2000) notes that:

*The Little Yarra at Lowes Road site is not far upstream of Yarra Junction. Riparian vegetation is somewhat degraded at the site and surrounding land use is largely dominated by agriculture. The below reference score for this site reflects the effects of anthropogenic impacts, such as agricultural runoff and riparian habitat degradation. (p. 33).*

More recently, Coleman and Armenta (2002) reported on macroinvertebrate sampling at 10 sites in the catchment, conducted by AWT in 1998-1999 (Hardwick and Waller, 1999). Six sites were located on the Little Yarra River, and one site each on four major tributaries (Table 2.4).

Only four of the sites were located in the Little Yarra River study area between Powelltown and upstream of the Yarra River confluence (LLR03-06).

**Table 2.4 Macroinvertebrate sampling sites in 1998-1999 (adapted from Coleman and Armenta, 2002)**

Site No.	Sampling Locality	General location
LRR01	Little Yarra River at Monett Road	Upstream of Powelltown
LRR02	Little Yarra River at Yarra Junction-Noojee Road	Upstream of Powelltown
LRR03	Little Yarra River at Coles (Black Sand Creek) Road	Saxton Creek to Black Sand Creek
LRR04	Little Yarra River at Tarrango Road	Black Sand Creek to Britannia Creek
LRR05	Little Yarra River at Lowes Road	Britannia Creek to the Yarra River
LRR06	Little Yarra River at Corduroy Road	Britannia Creek to the Yarra River
BTC01	Britannia Creek at Tarrango Road	n.a. <sup>4</sup>
BSC01	Black Sand Creek at Black Sand Creek Road	n.a
HCC01	Hackett Creek at Yarra Junction-Noojee Road	n.a
SXC01	Saxons Creek at Yarra Junction-Noojee Road	n.a

The majority of mayfly, stonefly and caddisfly families were found at all four of these sites (Table 2.5). Three caddisfly families were located exclusively downstream of Britannia Creek (Ecnomidae, Calocidae and Calamoceratidae) and one was located exclusively upstream of Black Sand Creek (Philopotamidae).

However, this may be due to a gradual deterioration in the physical habitat with distance downstream, rather than a natural variation with altitude. Hence, there is no convincing evidence of any major upstream-downstream gradation in the major macroinvertebrate fauna in the study area, so the entire study area can be considered as a single reach.

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<sup>4</sup> n.a. tributary sites are not included in this assessment.

**Table 2.5 Presence of mayfly, stonefly and caddisfly families at four sites within the Little Yarra River study area (from Coleman and Armenta, 2002)**

Site	Ephemeroptera				Plecoptera				Trichoptera											
	Baetidae	Oniscigastriidae	Coloburiscidae	Leptophlebiidae	Caenidae	Austroperlidae	Eustheniidae	Notonemouridae	Gripopterygidae	Atriplectidae	Hydrobiosidae	Ecnomidae	Philopotamidae	Hydropsychidae	Conoesucidae	Calocidae	Philotheiridae	Calamoceratidae	Linniphilidae	Leptoceridae
LLR03	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓				✓
LLR04	✓	✓	✓	✓		✓		✓		✓			✓	✓			✓			✓
LLR05	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓					✓
LLR06	✓	✓	✓	✓		✓		✓		✓	✓		✓	✓	✓	✓	✓			✓

### 2.5.2 Don River

Macroinvertebrate sampling has been conducted in the Don River catchment at 4 sites (Crowther *et al.*, 2001). Three sites were located on the Don River and one on Myrtle Creek, a named upper branch of the river (Table 2.6). Riffle habitats were sampled at each site.

**Table 2.6 Macroinvertebrate sampling sites in the Don River 1998-1999 (adapted from Crowther *et al.*, 2001)**

Site No.	Sampling Locality	General location
DON01	Don River upstream of Dalry Road	Lower catchment
DON02	Don River upstream of Ewatts Road	Mid catchment
DON03	Don River downstream of Don Road	Edge of forested area
MYR04	Myrtle Creek upstream of Donna Buang Road	Forested area

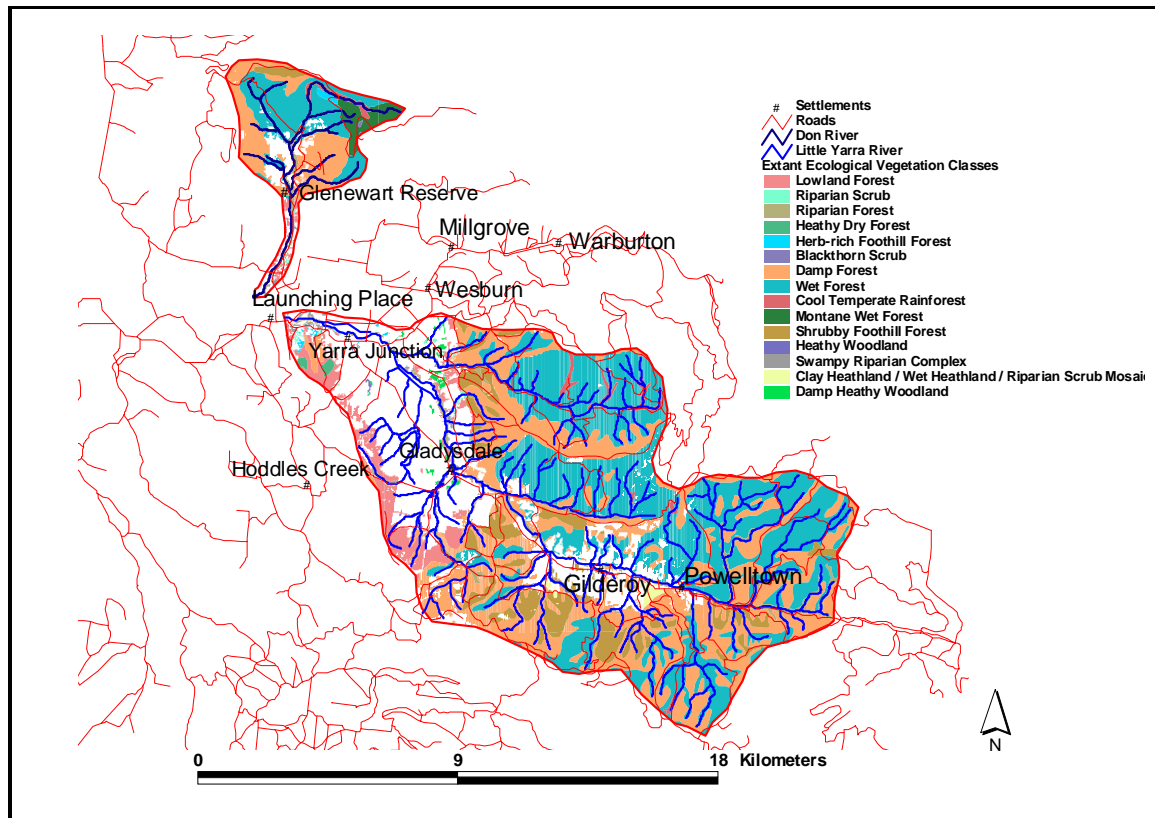
The distribution of major taxa shows a distinct difference between the two upstream sites (in the forested area) and the two downstream sites (Table 2.7). Within the downstream area, only two families (Ecnomidae and Conoesucidae) show any disjunct distribution, suggesting the area downstream of the forest can be considered as a single reach.

**Table 2.7 Presence of mayfly, stonefly and caddisfly families at four sites within the Little Yarra River study area (from Crowther *et al.*, 2001)**

Site	Ephemeroptera				Plecoptera				Trichoptera									
	Baetidae	Caenidae	Coloburiscidae	Leptophlebiidae	Austroperlidae	Eustheniidae	Notonemouridae	Gripopterygidae	Glossosomatidae	Helicophidae	Hydrobiosidae	Ecnomidae	Philopotamidae	Hydropsychidae	Conoesucidae	Calocidae	Philotheiridae	Leptoceridae
DON01	✓	✓	✓	✓				✓	✓		✓	✓		✓		✓	✓	✓
DON02	✓	✓	✓	✓				✓	✓		✓			✓	✓	✓	✓	✓
DON03	✓			✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓	✓
MYR04	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓

## 2.6 Vegetation

The vegetation of the catchments of these two rivers is relatively well documented (VicRFASC, 1997). Ecological Vegetation Classes have been mapped and described at 1:100,000 scale or better (Figure 2.1).



**Figure 2.1 Ecological Vegetation Classes in the catchments of the Don and Little Yarra Rivers. Cleared areas within the catchments are shown as white background.**

### 2.6.1 Little Yarra River

Between Powelltown and Gladysdale on the Little Yarra River, the river banks and immediate slopes have been subjected to significant clearing. In this reach, the river remains quite swift-flowing and only minor alluvial terraces have developed. Where uncleared, these fertile terraces and the river banks support tall Riparian Forest, typically dominated by *Eucalyptus viminalis*. Riparian Forest is tolerant and potentially dependent on seasonal, short duration flooding. Environmental weeds are a common component of Riparian Forest particularly in fragmented and disturbed areas – such as this reach. Riparian forest is greatly depleted regionally and much of what remains is in a highly degraded state.

Away from the influence of the river, the eucalypt forests of the footslopes (in response to altitude and aspect) is typically drier and of lower stature that is found in the upper catchment. The most widespread EVC is Lowland Forest.

Just downstream Gladysdale, to the confluence with the Yarra, the nature of the river and associated vegetation changes gradually. Minor floodplains are now prevalent. In addition, clearing of the native vegetation on the adjoining slopes is extensive.

Several flood and/or groundwater seepage dependant EVC's have been recorded in this section of the river. Riparian Forest typically remains along the river bank levees and higher terraces. The extensive

and increasingly poorly drained floodplains support a range of EVC's associated with these conditions – including Riparian Scrub (typically dominated by *Melaleuca squarrosa*), Swampy Riparian Complex and Damp Heathy Woodland. Across most of southern Victoria these EVC's have been extensively cleared and the land subsequently drained for agricultural development. Significant remnants (each of these EVC's would be considered threatened in a regional and State context) persist in the lower reach of the Little Yarra River.

The restoration of the drainage characteristics of the floodplain areas and overbank flow regimes from the respective rivers will be required prior to any attempts to reconstruct these rare EVC's in the catchment.

### **2.6.2 Don River**

The vegetation in the Don River follows the same pattern as for the Little Yarra River. Between Malleson Glen and Glenewart Reserve, narrow fertile alluvial terraces and the river banks support tall Riparian Forest typically dominated by *Eucalyptus viminalis*. Below Glenewart Reserve to the confluence with the Yarra, Riparian Forest typically remains along the river bank levees and higher terraces, with Riparian Scrub, Swampy Riparian Complex and Damp Heathy Woodland on poorly drained parts of the floodplains.

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