THE HEALTH OF STREAMS IN THE WESTERN PORT CATCHMENT

Publication 601 **February 1998**

Introduction

Careful management of our waterways and catchments is crucial to maintain and improve river health. Good decision making requires detailed information on the environmental condition of our rivers.

The Monitoring River Health Initiative (MRHI) – a biological monitoring program across Australia – was introduced as part of the National River Health Program funded by the Commonwealth. The main aim of the MRHI was to develop a standardised biological assessment scheme for evaluating river health. This was to be achieved by sampling reference sites and using the information collected to build models to predict which macroinvertebrate families would be expected to occur under specified environmental conditions. In Victoria the program was conducted by the Environment Protection Authority (EPA) and Water EcoScience (formerly the State Water Laboratory).

Currently the First National Assessment of River Health (FNARH) is underway to assess the health of Australia's rivers. EPA is sampling approximately 600 test sites in Victoria and evaluating these against the MRHI models.

Having undertaken biological monitoring in Victoria since 1983, EPA has a great deal of experience in the field. The results of previous studies will be combined with those of the current program, providing a solid background of data. This will be used to determine long-term trends in the health of our rivers and will help the protection of water quality and the beneficial uses of our water courses.

Monitoring water quality

Traditional water quality monitoring involves measuring physical and chemical aspects of the water. Common measurements include pH, salinity, turbidity, nutrient levels, toxic substances and the amount of oxygen dissolved in the water. These measures provide a 'snapshot' of environmental conditions at the moment samples are taken. Water quality conditions are variable, so such monitoring can fail to detect occasional changes or intermittent pulses of pollution.

In contrast, the biological monitoring program involves sampling aquatic animals, which gives an indication of the health of the river as a whole. Because they live at the site for some time, animals reflect the build-up of impacts of environmental change on the river ecosystem – such as the influence of surrounding land use or the effects of pollution.

Biological monitoring techniques

Aquatic macroinvertebrates (such as insects, snails and worms) are very useful indicators in biological monitoring. They are visible to the naked eye and are commonly found in rivers and streams. They are an important source of food for fish and many are well known to anglers – such as yabbies, mudeyes, stoneflies and mayflies. They are widespread, easy to collect, relatively immobile and provide good information about the environment.

The presence or absence of specific species provides information about water quality. Some species are known to have particular tolerances to environmental factors such as temperature or levels of dissolved oxygen. Other information can be obtained from the number of species found at a site (biological diversity), the number of animals found at a site (abundance) and the relationship between all animals present (community structure).

Sites with a high level of species diversity generally have good water quality. Sites which have low diversity are less healthy – often due to the impacts of pollution. In polluted habitats, sensitive species are eliminated and less sensitive species show an increase in numbers.

Reporting results

With the end of the initial three year biological monitoring program, a base of assessment has been completed for all the major river basins in Victoria. The test sites from these basins are now being trialed against the MRHI models.

The River Health Bulletin series provides a summary of the health of streams in each basin as it becomes available. Comprehensive catchment assessments will be published following completion of the FNARH program.

Study site selection and assessment

Monitoring sites are selected to include a variety of sites believed to be representative of the river basin's waterways – including sites that are relatively unimpacted and sites which are subject to the impact of pollution, although most of these are situated away from any obvious point source of pollution.

Sites are sampled twice a year (autumn and spring) using the rapid bioassessment technique. This involves collecting two types of biological samples where possible.

- ***Kick samples***
  To conduct kick samples, the stream bed is disturbed by the sampler's feet to dislodge animals which are swept into a net by the current. Samples are taken from shallow areas with stony or rocky substrates in medium to fast currents. This type of habitat is called a riffle and is usually associated with upland streams.

- ***Sweep samples***
  Sweep samples are collected by sweeping a net along banks and around snags in backwaters and pools which have slow currents. Aquatic plants (macrophytes) – which provide additional habitat for aquatic animals – are often found in these edge habitats and are included in the sweep sample. These habitats can be found in both the upland and lowland reaches of rivers.

Water quality measurements – including dissolved oxygen, pH, temperature and electrical conductivity – are made at each site and water samples are taken for laboratory analysis of nitrogen and phosphorus levels and turbidity. The vegetation along the river banks (the riparian zone) and the aquatic habitat are also assessed. The aquatic habitat is those parts of the river environment which animals use to make a home. It can be strongly affected by the riparian zone as well as the environment and land use of surrounding and upstream regions.

For example, if fertiliser runoff is causing an excess of nutrient to enter the river, there may be excess growth of algae attached to rocks and snags in the river, affecting these important habitats. It can also result in blooms of toxic blue-green algae which are potentially hazardous to humans, animals and birds contacting or consuming the water. Thus different factors can influence many parts of the river environment. Biological monitoring can be a valuable tool to measure the overall effect of all these influences.

Invertebrate analysis techniques

Biological data can be analysed in a number of ways – from using simple biotic indices through to more complex statistical and modelling procedures.

Number of families

The number of invertebrate families found in streams can give a reasonable representation of the health of a stream, though it is too great a simplification of data to be adequate on its own. Lack of suitable habitat or the presence of various pollutants can cause a reduction in the number of families present. This assessment method complements SIGNAL (see below) which tends to underestimate toxic effects.

SIGNAL

This biotic index uses families of aquatic invertebrates that have been awarded sensitivity scores according to their tolerance or intolerance to various pollutants. The index is calculated by totalling these scores and dividing by the number of families present. A single value between 1 and 10 is produced, reflecting the degree of water pollution – high quality sites have high SIGNAL scores (Chessman, 1995) (Table1). While SIGNAL is particularly good for assessing salinisation and organic pollution, its usefulness for toxic impacts and other types of disturbance is uncertain.

Table 1: Key to SIGNAL scores

SIGNAL score	*Water quality*
>7	Excellent
6-7	Clean water
5-6	Doubtful, mild pollution
4-5	Moderate pollution
<4	Severe pollution

Ordination

A pattern analysis technique (ordination) can be used to "map" relationships that might be present between groups of macroinvertebrates found at different sites. The distance between sites on the map indicates their degree of similarity – the closer the sites are to each other, the more alike they are (Clarke, 1993).

AusRivAS

One of the main aims of the National River Health Program was the development of predictive models which could be used to assess river health. As a result, the Co-operative Research Centre for Freshwater Ecology has developed the Australian Rivers Assessment System (AusRivAS) which consists of several mathematical models.

Each model uses reference data collected under the MRHI from a single aquatic habitat from either a single season (autumn or spring) or from the two seasons combined (Simpson *et al.*, 1997).

AusRivAS predicts the macroinvertebrates which should be present in specific stream habitats under reference conditions. It does this by comparing a test site with a group of reference sites which are as free as possible of environmental impacts but have similar physical and chemical characteristics to those found at the test site.

One of the products of AusRivAS is a list of the aquatic macroinvertebrate families and the probability of each family being found at a test site if there were no environmental impacts. By comparing the totalled probabilities of predicted families and the number of families actually found, a ratio can be calculated for each test site. This ratio is expressed as the observed number of families/ expected number of families (the O/E index).

The value of the O/E index can range from a minimum of zero (none of the expected families were found at the site) to around one (all of the families which were expected were found). It is also possible to derive a score of greater than one, if more families were found at the site than were predicted by the model. A site with a score greater than one might be an unexpectedly diverse location, or the score may indicate mild nutrient enrichment by organic pollution, allowing additional macroinvertebrates to colonise.

Table 2: AusRivAS O/E family score categories

Band label	*O/E scores*	*Band name*	*Comments*
X	>1.15	richer than reference	◆ more families found than expected ◆ potential biodiversity "hot spot" ◆ possible mild organic enrichment
A	0.85-1.14	reference	◆ index value within range of the central 80% of reference sites
B	0.55-0.84	below reference	◆ fewer families than expected ◆ potential mild impact on water quality, habitat or both, resulting in loss of families
C	0.25-0.54	well below reference	◆ considerably fewer families than expected ◆ loss of families due to moderate to severe impact on water and/or habitat quality
D	<0.25	impoverished	◆ very few families collected ◆ highly degraded ◆ very poor water and/or habitat quality

The O/E scores derived from the model can then be compared to bands representing different levels of biological condition, as recommended under the MRHI (Table 2). This allows an assessment of the level of impact on the site to be made and characterisation of the general health of the part of the river that was sampled.

THE HEALTH OF STREAMS IN THE WESTERN PORT CATCHMENT

The Western Port catchment drains an area of approximately 3,200 square kilometres south-east of the city of Melbourne in Victoria. With very productive farmland and a beautiful coastline – especially around Phillip Island and the Mornington Peninsula – which makes it an attractive tourist destination, the catchment is an important resource for the people of Victoria. Because of its close proximity to Melbourne, the Western Port catchment is an important centre of urban growth, particularly around Berwick and Cranbourne.

Located approximately 40 kilometres to the south-east of Melbourne, the catchment is bounded by Flinders on the Mornington Peninsula in the south-west, Emerald in the north-west, Gembrook in the north-east, Drouin in the east, Bass in the south-east, and also includes French, Quail and Phillip Islands. The catchment also includes the area that was once the Koo-Wee-Rup Swamp. In the late 1800s, European settlers drained and dug channels through the swamp for drainage and irrigation purposes.

Rivers and streams in the catchment

A total of 38 streams contribute approximately 1,100 ML of freshwater to Western Port each day – a relatively small quantity compared to the volume of the bay ($2.9x10^6$ ML at high tide). Three of these streams (Bunyip River, Lang Lang River and Bass River) contribute around 75% of the total freshwater discharge into the bay.

The Bunyip River (including the Yallock Creek system in the southern segment) rises in the Bunyip State Forest in the north-eastern part of the catchment and flows south to Longwarry North, where it is joined by the Tarago River. It then continues south-west to Bunyip where it becomes a straightened channel and flows through the Koo-Wee-Rup Swamp and into the north of the bay.

The Lang Lang River rises in a predominantly dairy farming area of the catchment, in the foothills east of Poowong East. It then flows north to Athlone where it starts to flow west. At the South Gippsland Highway it becomes a straightened channel and empties into the north-east of the bay.

The Bass River rises in a dairy farming area in the south-eastern foothills area of the catchment, south of Poowong. It flows south-west past the towns of Loch and Glen Forbes and into the south-east of the bay near San Remo.

Another important set of streams in the catchment is the Cardinia, Deep and Toomuc Creeks. These drain the northern part of the catchment – including Berwick – and come together in parallel channels that run through the Koo-Wee-Rup Swamp and into the bay at Moody's Inlet.

Land use in the catchment

Land use in the catchment is dominated by agriculture. Grazing occupies approximately 97% of the available farming land. Dairy farming is the most significant grazing industry, followed by beef and a small sheep industry.

The remaining farming land comprises 70% of Victoria's broiler chicken industry (chiefly located around the urban fringe areas) and 40% of market gardening (including 25% of the State's potatoes), mainly around the Koo-Wee-Rup area.

There is a developing vineyard precinct on the Mornington Peninsula that is closely linked to tourism in the area.

In the north-east, there is a forested area that comprises less than 5% of the total catchment. Of this, 14,000 hectares of the State forest is managed for water production (Bunyip and Tarago Rivers). There are also small logging operations in the Tarago State forest.

Another important and emerging land use in the catchment is the rapidly growing urban development around Berwick, Pakenham and Cranbourne.

Macroinvertebrate assessment

Thirty-four sites in the catchment were selected for biological assessment – including forested sites in the north-east of the catchment, a variety of rural sites, sections of streams that are essentially irrigation drains and some semi-urban locations. These sites are shown in Figure 1.

Caddis fly larva

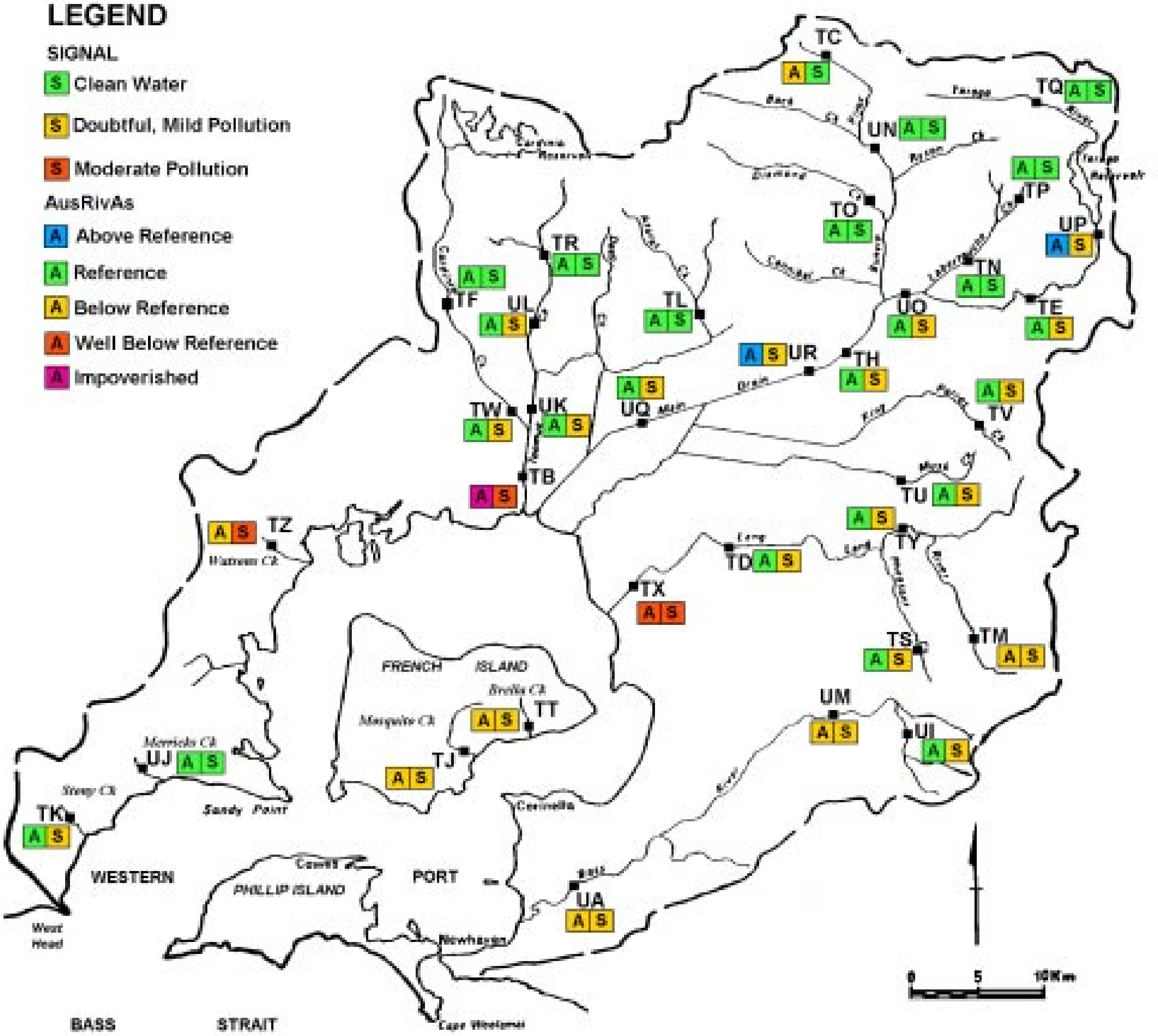

Figure 1: AusRivAS O/E and SIGNAL family scores (edge habitat combined seasons) for the Western Port catchment.

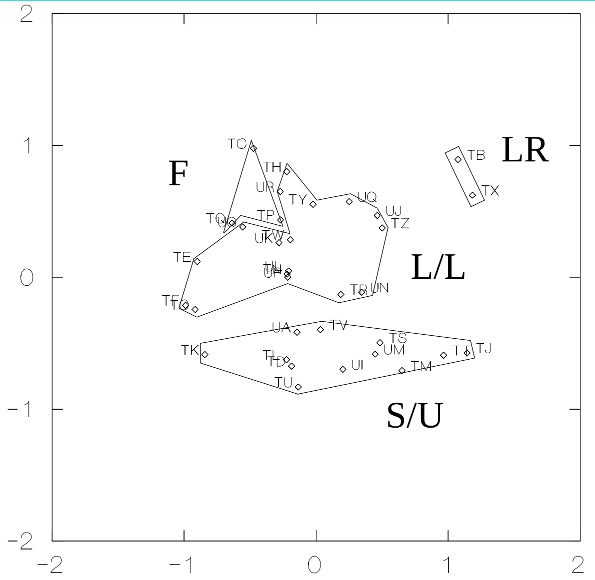

Figure 2: Ordination of the edge habitat macroinvertebrate data (lower reaches = LR; forested = F; smaller and/or more upland = S/U; larger and/or more lowland = L/L)

Classification of macroinvertebrate community structure from edge habitat data indicated that sites in the catchment fall into four broad groups. These groups are graphically represented in Figure 2 and can be identified as lower reaches (LR), forested (F), smaller and/or more upland (S/U), and larger and/or more lowland (L/L).

Lower reaches

The lower reaches group comprises only two sites – both located at the bottom ends of their respective catchments. Cardinia Creek at Manks Road (TB) is a straight clay-bottomed channel with unstable banks lacking any riparian zone, located in a paddock with direct cattle access at the site. The other site is the Lang Lang River at the South Gippsland Highway (TX), downstream of Lang Lang. This stream is similar to the Cardinia Creek site but is slightly larger and has a healthier riparian zone.

Forested

Three sites fall into the forested group. These sites are small, sandy bottomed streams in natural State forest, with one site located in the closed water supply catchment. Although there have been some logging activities upstream of these sites, all have extensive, healthy riparian zones and surrounding forest with minimal human impact.

Smaller and/or more upland

The group of smaller and/or more upland group comprises 13 sites. The greatest concentration of sites belonging to this group occurs in the south-eastern portion of the catchment around the Bass River, the upper Lang Lang River catchment, King Parrot Creek, Musk Creek and French Island. These sites can generally be characterised as having high nutrient concentrations and low dissolved oxygen levels, generally limited riparian zones, but relatively healthy macrophyte communities.

Larger and/or more lowland

The remaining 16 sites formed the larger and/or more lowland grouping. These are generally located in the northern area of the catchment, with the exception of two sites located in the southern part of the Mornington Peninsula. Streams in this group are generally quite wide, with many sites in straightened channel sections of Bunyip River, Cardinia Creek and Deep Creek. The sites which are not in straightened channels generally had stable substrates with relatively good quality riparian zones.

Graphing the average number of macroinvertebrate families in each group (Figure 3) shows that communities at sites in the lower reaches are the most impoverished with a very low number families, which are mainly pollution tolerant.

The forested sites are the next least diverse group. This is surprising, given that it is generally expected that a rich and diverse community would live in relatively undisturbed environments. Nevertheless, the amount of habitat available is a crucial factor in determining community structure. The sites in the upper forested area of the catchment are in very small, sandy bottomed streams with no

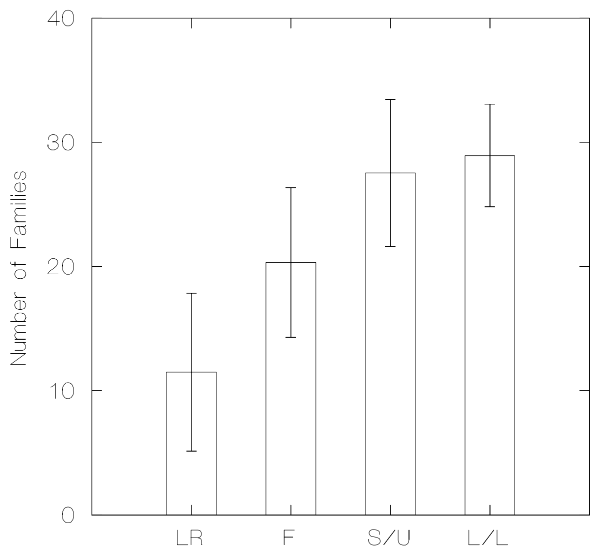

Figure 3: Mean number of families for groupings (lower reaches =LR, forested =F, smaller and/or more upland =S/U, larger and/or more lowland =L/L).

macrophytes, so there is little habitat in which macroinvertebrates can live. However, the types of macroinvertebrates present are equally important in assessing a stream's ecological health. The three forested sites may not have many types of macroinvertebrates, but those that are present are families which have many pollution sensitive species, indicating streams of high aquatic value.

The two other groups (smaller and/or more upland and larger and/or more lowland) include well more than three quarters of the sites in the catchment. These have similar numbers of families, but each group has a slightly different complement of families, reflecting changed habitat availability and water quality.

Physico-chemical water quality

Only three sites have salinities that exceed the recommended guideline values (ANZECC 1992), beyond which the stream biota may suffer. These sites (Watsons Creek, Merricks Creek and Mosquito Creek located on the Mornington Peninsula and French Island) are small coastal streams. In general, their salinities are not excessively high.

Of more concern are the 10 sites that have dissolved oxygen levels that do not comply with the recommended guidelines (ANZECC 1992, EPA 1979). Most of these sites are in the eastern part of the catchment where there are intensive dairy farming activities, particularly around the Lang Lang and Bass Rivers. Four out of the five Lang Lang system sites have low dissolved oxygen levels, all three Bass River sites have very low values (around 3 mg/L), and Musk Creek has one of the lowest levels of dissolved oxygen in the catchment (2.7 mg/L). Deep Creek at Ballarto Road and Watsons Creek on the Mornington Peninsula also have low levels of dissolved oxygen at 5.4 mg/L and 2.5 mg/L respectively.

When organic matter such as sewage effluent, dairy effluent and septic tank seepage enters a waterway it begins to break down. This process requires oxygen. When large amounts of organic waste enters a system the rotting process can use up most of the available dissolved oxygen, causing a drop to levels that may be harmful to aquatic life.

Another factor that causes low dissolved oxygen is a slow flow regime. In fast-flowing streams the tumbling of the water acts to aerate it, while in slow or non-flowing systems the deeper water may become deoxygenated. In addition, the presence of elevated turbidity in streams limits oxygen production in aquatic plants. This may also be an important contributor to the low dissolved oxygen levels found, particularly in the streams around the Poowong area in the east of the catchment.

The macroinvertebrate communities at these sites do not lack species richness. However, when the actual families present are examined, it is clear that communities at these sites – particularly Watsons Creek and Bass River at Bena Road – generally have more macroinvertebrates such as beetles and true bugs, many of which are air breathers, rather than gilled animals dependant on dissolved oxygen in the water.

No sites in the catchment comply with EPA's *Preliminary Nutrient Guidelines* (EPA Publication 478). At some sites – particularly in the east of the catchment and at Watsons Creek – where the dissolved oxygen levels are low, nutrient levels exceed the recommended limits by more than five times. Substantially elevated levels of phosphorus may reflect the severe erosion problems in the surrounding catchment, depositing sediment and carrying phosphorus into streams. Nitrogen was also recorded at very high levels. This may indicate a variety of stream inputs such as dairy-shed effluent, septic seepage, sewage treatment plant effluent or direct cattle access.

These chemical measures of water quality highlight the eastern part of the catchment around Poowong as having low water quality – high nutrient levels and low levels of dissolved oxygen. Measures of water quality also highlight the poor aquatic value of Watsons Creek which failed the recommended guidelines for dissolved oxygen and greatly exceeded the nutrient guidelines. The site's already degraded water quality is further exacerbated by elevated salinity levels.

AusRivAS and SIGNAL

Physical, chemical and macroinvertebrate edge habitat data from sites in the Western Port catchment were analysed using the AusRivAS model. Macroinvetebrate data were also used to calculate SIGNAL scores.

Table 3 shows the AusRivAS O/E score and SIGNAL score for each site (colours indicate band

Site code	Site description	AusRivAS O/E	Signal
Forested, upland, good quality streams			
TC	Bunyip River, upstream of weir	0.64	6.93
TP	Labertouche Creek at Main Race Track	0.87	6.90
TQ	Tarago River Upper	1.05	6.72
Foothills and plains agricultural sites			
TO	Diamond Creek at Jolley Road	0.93	6.41
UJ	Merricks Creek at Frankston-Flinders Road	0.96	6.39
TN	Labertouche Creek at Fisher Road	1.00	6.28
UN	Bunyip River at Labertouche Road North	0.93	6.18
TR	Toomuc Creek at Shelton Road	0.96	6.15
TF	Cardinia Creek at Beaconsfield	0.93	6.04
TL	Ararat River at Princes Highway	1.00	6.03
TV	King Parrot Creek at Drouin South	1.02	5.87
TE	Tarago River at Neerim Road	0.86	5.86
TY	Lang Lang River at Drouin-Poowong Road	1.10	5.84
UL	Toomuc Creek at Princes Highway	1.11	5.82
UO	Tarago River at Morrisons Road	0.98	5.80
UP	Tarago River downstream Reservoir	1.19	5.76
UM	Bass River at Ferriers Road, Loch	0.81	5.73
UI	Bass River at Poowong Road	0.88	5.72
TK	Stony Creek at Shoreham	0.86	5.71
TH	Bunyip River at Evans Road	1.09	5.69
TM	Lang Lang River at Main South Rd	0.68	5.63
TU	Musk Creek at Ripplebrook	0.92	5.59
UA	Bass River at McGraths Road	0.79	5.59
TW	Cardinia Creek at Ballarto Road	1.10	5.48
UQ	Bunyip River at Ballarto Road	1.01	5.43
TS	Pheasant Creek at Timms Road	0.95	5.42
TJ	Mosquito Creek at French Island	0.61	5.39
TD	Lang Lang River at Heads Road	0.98	5.34
UR	Bunyip River at Iona	1.17	5.32
UK	Deep Creek at Ballarto Road	0.87	5.29
TT	Brella Creek at French Island	0.61	5.28
Lowland, severely impacted streams			
TX	Lang Lang River at South Gippsland Highway	0.45	4.94
TZ	Watson Creek at Hasting-Dandenong Road	0.57	4.90
TB	Cardinia Creek at Manks Road	0.16	4.33

AusRivAS O/E

- *Above reference*
- *Reference*
- *Below reference*
- *Well below reference*
- *Impoverished*

Signal

- *Clean water*
- *Doubtful mild pollution*
- *Moderate pollution*

Table 3: AusRivAS O/E Family and SIGNAL scores for sites in the Western Port catchment

membership). The O/E and SIGNAL scores are also illustrated in Figure 1, indicating the biological health of sites throughout the catchment.

Initially, SIGNAL scores make more intuitive sense than AusRivAS. SIGNAL ranks sites in the upland areas of the catchment as good quality, while low SIGNAL scores occur at sites in the lower reaches.

The generation of AusRivAS O/E scores involves the use of a broader range of data than SIGNAL and are, therefore, a little more complex. Overall most of the catchment scores as 'reference' using the O/E system. However, there is a general trend of decreasing O/E values from upland sites to lower reaches, with some exceptions.

Tarago River downstream of the reservoir (UP) and Bunyip River at Iona (UR) score as 'richer than reference' – that is, having more macroinvertebrate families than would be expected at a site of reference quality.

The Tarago River site (UP) is subject to releases from the reservoir and on both sampling occasions was covered in thick mats of filamentous algae indicating mild nutrient enrichment. At this point the Tarago River is a wide shallow pool with a sandy substrate; plenty of light and a weir downstream creates a large area of slow-flowing water. There is also a variety of macrophytes at the site. The combination of these factors may make this site particularly suitable for a variety of macroinvertebrate families.

The Bunyip River site (UR) is located in a section of the river that is a series of slow-flowing pools created by a number of small weirs in a deeply incised irrigation drain. The presence of areas of slow-flowing water distinguishes this site from the other two sites in the main drain section of the Bunyip River which are straight channels with no backwaters. This site may provide the best habitat available to macroinvertebrates in the Bunyip main drain, and this may explain why there are so many macroinvertebrate families living there.

Most sites in the Western Port catchment, particularly those in the upper reaches of their respective systems, fall into the 'reference' band of O/E scores. Nine of the 23 sites in the 'reference' band, are also designated 'clean water' by the SIGNAL index. These are generally upland sites in the north of the catchment. The remaining 'reference' sites have a SIGNAL rating of 'doubtful, mild pollution'.

One site – Bunyip River upstream of the weir (TC) – came out as 'clean water' according to SIGNAL scores and 'below reference' in the AusRivAS assessment. This site is a small sandy-bottomed stream that has poor edge habitat and no macrophytes. The macroinvertebrate community at this site has low species richness and many of the predicted families do not occur at the site, thus giving a low O/E score. However, the invertebrate community at this site comprises a suite of very pollution sensitive species that score highly in the SIGNAL index.

AusRivAS analyses scored six other sites as 'below reference'. These sites are generally located in the southern parts of the catchment and comprise the French Island, lower Bass River, upper Lang Lang River and Watsons Creek sites. The SIGNAL index for five of these sites is 'doubtful, mild pollution'. All are relatively small streams with limited available habitat and sparse riparian zones. Land use around these sites is largely cattle grazing with the exception of Watsons Creek (TZ), which has intensive market gardening upstream of the site.

Watsons Creek received a SIGNAL score of 'moderate pollution'. This fits in with what we know of the creek – high nutrients, low dissolved oxygen, luxuriant growths of filamentous algae, intensive farming upstream – all leading to a depleted variety of macroinvertebrates.

Only one site – Lang Lang River at the South Gippsland Highway (TX) – received an O/E score of 'well below reference' and also falls into the 'moderate pollution' band according to SIGNAL. It has a low dissolved oxygen value and a very low number of families, most of which are known to be pollution tolerant. This site is situated at the start of the channel portion of the Lang Lang River where the clay banks are steep (and were, on one sampling occasion, covered with blue-green algae) and there is a very limited riparian zone. The township of Lang Lang is just upstream.

Riparian habitat

The most degraded site in the catchment is Cardinia Creek at Manks Road (TB). It obtained the lowest O/E (0.16) and SIGNAL scores in the catchment, placing it in the 'impoverished' and 'severe pollution' bands respectively. This site, at the bottom end of the Cardinia Creek system, is located in the drain section of the stream that runs through the Koo-Wee-Rup Swamp area. Here, the stream is entirely straight, has direct cattle access (at the site and for some distance upstream) and has no riparian zone. The sticky clay substrate provides little habitat for the small number of families of pollution tolerant macroinvertebrates that are found there.

The two severely degraded sites (TX and TB) came out as a single group – lower reaches – in the ordinations conducted on the family data. In addition, the three forested sites that obtained the highest SIGNAL scores in the catchment comprise the forested group.

The other two groups – smaller and/or more upland, and larger and/or more lowland – are more difficult to relate to the AusRivAS and SIGNAL assessments of the catchment. Each group (S/U and L/L) contains sites with a variety of SIGNAL and AusRivAS scores. This may indicate that either the streams in the Western Port catchment are largely homogeneous or, alternately, the RBA sweep method used in the assessment of this area is inadequate to detect small differences between groups of sites. While, in general, riffle data have been found to be useful in delineating differences within a catchment, the nature of streams in the Western Port catchment meant that this habitat was rarely available to sample.

The edge habitat in streams has not been widely sampled until now and there is little information as to its nature and the factors influencing it. Edge fauna are much more mobile than macroinvertebrates living in riffle areas of a river, which may account for some of the apparent homogeneity in Western Port streams.

Summary

Streams in the Western Port catchment vary considerably in quality with the better, more pollution sensitive macroinvertebrate communities found in the forested areas of the catchment. As streams drain towards Western Port and water quality deteriorates, the macroinvertebrate communities are composed of a suite of diverse, mainly pollution-tolerant families. In the lower reaches, the macroinvertebrate communities have very low diversity and are composed of a handful of pollution tolerant families.

A number of areas have been identified as being of poor ecological quality. There is an obvious water quality issue in the east of the catchment, with a number of streams in the Poowong area suffering from low dissolved oxygen and very high nutrient levels.

The principal factor causing this situation is most likely the severe erosion problems faced in that area of the catchment, coupled with the dairy farming activities in the region.

Another site with similar ecological problems, but for a different set of reasons, is Watsons Creek on the Mornington Peninsula which is downstream of the growing urban development of Sommerville. This site also exhibits low dissolved oxygen and very high nutrient levels. The land use around Watsons Creek is mainly intensive market gardening and chicken farming. Agricultural runoff is most likely causing the impoverished macroinvertebrate community found at the site.

Two other sites – Lang Lang River at the South Gippsland Highway and Cardinia Creek at Manks Road – were identified as severely degraded. Both sites consist of a straightened channel with steep clay banks and very few macrophytes. A limited riparian zone, dominated by blackberries, is present at the Lang Lang River site and there is no riparian zone other than grass at the Cardinia Creek site.

The edge habitat is closely linked to the riparian zone. Riparian vegetation provides habitat and a food source for many macroinvertebrates by dropping logs, leaves and branches into streams and protecting bank structure. It also acts as a filtering mechanism which reduces the levels of contaminants entering streams.

Habitat is an important factor in determining the composition of a macroinvertebrate community. Without suitable habitat, a stream cannot support a healthy aquatic fauna.

Erosion is a common problem in the eastern part of the catchment, particularly around the Poowong area where land slips are common. Runoff from steep, cleared hills carries large amounts of sediment and leads to loss of habitat and nutrient enrichment in streams. Better management of surrounding land is required to combat erosion and improve bank stability.

Physical degradation of the stream habitat is exacerbated by the input of chemical and organic pollution. Agricultural runoff is a major problem – particularly around Watsons Creek. Intensive farming activities – particularly in urban fringe areas – need to be better managed to combat the effect of nutrient enriched runoff to nearby streams.

Loss of riparian zone is a problem in most areas of the Western Port catchment – particularly in the straightened channel sections of streams such as Cardinia Creek, Deep Creek and Lang Lang River.

Lack of riparian zone, coupled with the common practice in grazing areas of allowing cattle direct access to streams, leads to severely degraded aquatic habitats. It is important that action is taken to rehabilitate and protect riparian zones and exclude cattle from waterways.

A more detailed discussion of the results of this study will be published later this year in an EPA report *Environmental Health of Streams in the Western Port Catchment*.

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Further information

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