E A R T H T E C H

Wimmera Catchment Management Authority

Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment

Section One – Introduction

Job 2901049.008 & 2901049.009

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Contents

Figures

Tables

List of Abbreviations

Acronym	Definition
CMA	Catchment Management Authority
GIS	Geographical Information System
LWD	Large Woody Debris
Ma	Million years

Geological Time Scales

Table 1.1: Geological time scale used in this report

Era	Period	Epoch	Age
Cainozoic	Quaternary	Holocene	0.01 Ma
		Pleistocene	1.8 Ma
	Tertiary	Pliocene	5 Ma
		Miocene	22.5 Ma
		Oligocene	38 Ma
		Eocene	54 Ma
		Palaeocene	65 Ma
	Cretaceous		144 Ma
Mesozoic	Jurassic		208 Ma
	Triassic		245 Ma
	Permian		286 Ma
Palaeozoic	Carboniferous		360 Ma
	Devonian		408 Ma
	Silurian		438 Ma
	Ordovician		505 Ma
	Cambrian		570 Ma
Proterozoic			2500 Ma

Background to the Investigation

The Wimmera River Geomorphic Investigation, Sediment Sources, Transport and Fate (2001) identified major sediment sources within the Wimmera River catchment and defined priority areas for management. The study identified a number of different stream types and associated processes along the main stem but did not include detailed review of stream types throughout the whole catchment.

The Wimmera River Geomorphic Categorisation and Stream Condition Assessment identifies the stream types throughout the Wimmera River catchment and provides information to assist in determining management regimes for stream types based on the geomorphic characteristics and condition of the stream. The project identifies reference sites for stream types and benchmarks stream condition at those sites. The reference sites provide a template for rehabilitation of similar stream types elsewhere throughout the catchment.

Scope of the Investigation

This project has comprised stream ordering, categorisation and condition assessment of streams within the Wimmera River catchment. The project has been limited to streams of 3rd order and greater. The project has not included the Millicent coast region. For the purpose of this investigation, the Wimmera River was considered to terminate at Lake Hindmarsh. Therefore, the overflow system of Outlet Creek and Lake Albacutya were not assessed with regards to geomorphic condition or stream condition.

Figure 1.1 shows the area of investigation. The hashed area to the west of the Wimmera Catchment is the Millicent Coast catchment, which is part of the Wimmera CMA district but not part of this investigation.

Resources utilised

The following resources were directly relevant to the investigation:

- Wimmera River Geomorphic Investigation (ID&A, 2001).
- Index of Stream Condition data, 1999.
- Aerial photography of the upper catchment at a scale of 1:25,000 in a digital form for the majority of the upper catchment and contact prints in the lower catchment.

GIS information of catchment boundaries and waterways sourced through the Wimmera CMA's existing GIS database.

Location of the Investigation

The investigation was located in the Wimmera River catchment in western Victoria. The Wimmera River is presently a terminal system in the northwest of Victoria. To the north is the Mallee, west is the region known as the Millicent Coast and to the east are the Avon Richardson and Avoca River catchments. In the southern section of the Wimmera River catchment lies the Grampians, the most southern extent of the Great Dividing Range.

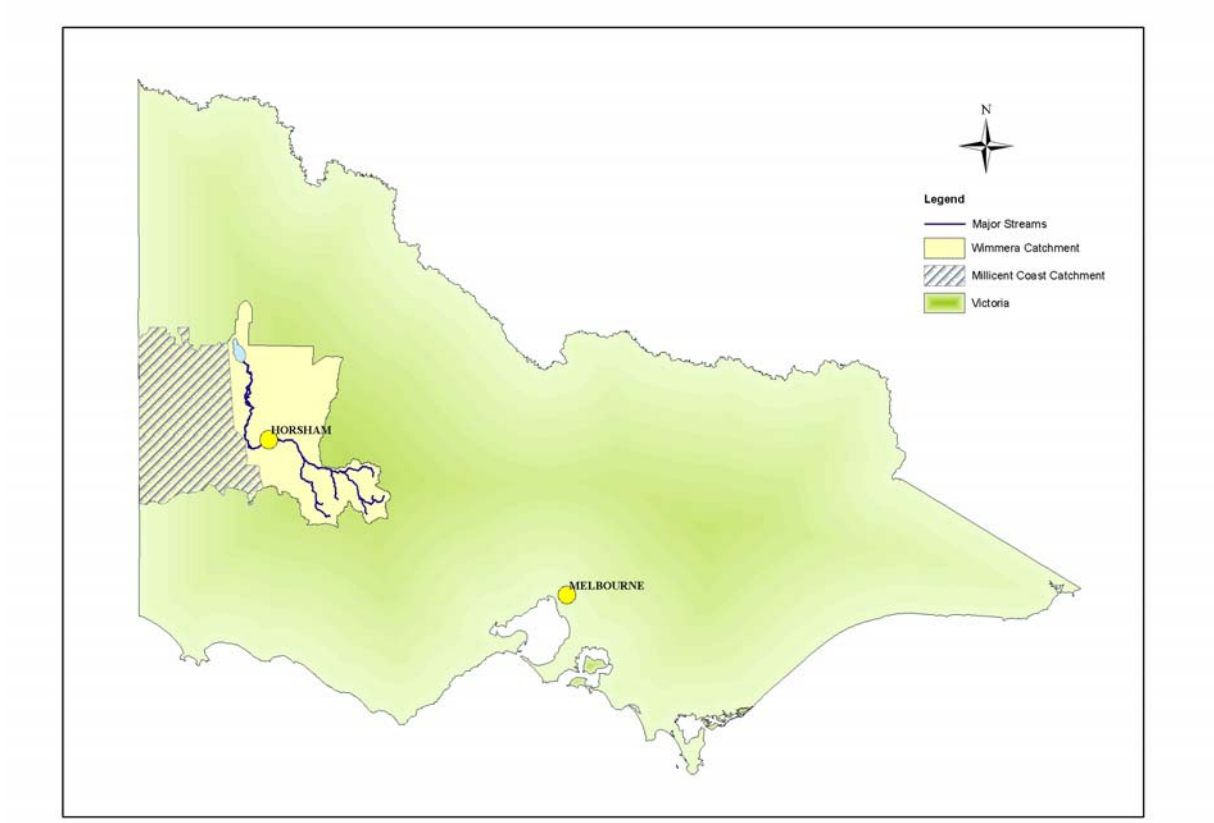

Figure 1.1: Location of the Wimmera Catchment within Victoria

Background to the Wimmera River Region

The Wimmera River catchment rises in the Grampian and Pyrenees ranges of central and western Victoria. The river flows in a northwesterly direction towards Horsham and is joined by several major tributaries that drain the northern slopes of the Grampians. No significant tributaries join after the McKenzie River west of Horsham where the river turns north and flows to Lake Hindmarsh. When Lake Hindmarsh fills, it spills through Outlet Creek to Lake Albacutya. In exceptionally wet periods Lake Albacutya overflows to Wirrengren Plain. The Wimmera River has two major distributaries. The Yarriambiack Creek flows north from Longerenong to beyond Hopetoun. Dunmunkle Creek flows north from Glenorchy and dissipates in the southern Mallee.

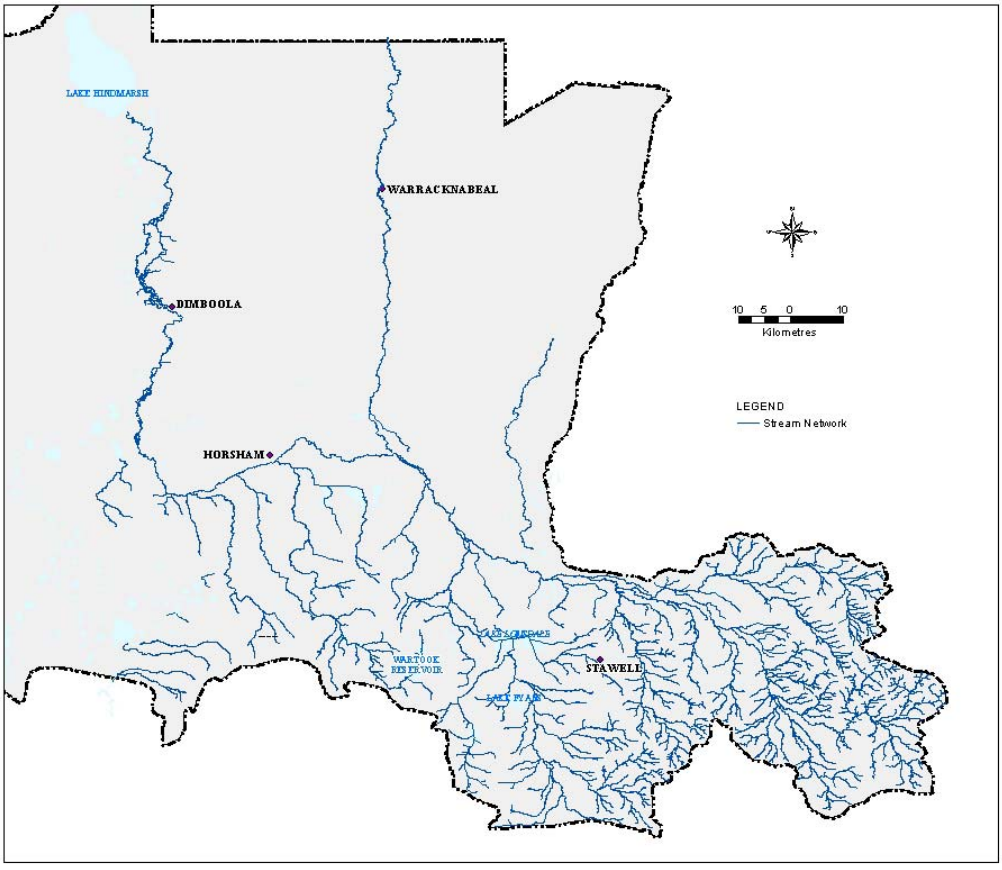

Figure 1.2: Stream Network of the Wimmera River Catchment

Heritage River

In 1991, the Land Conservation Council released their final recommendations for the *'Rivers and Streams Special Investigation'*. The Wimmera River was listed as a Heritage River from Polkemmet Bridge, through Lakes Hindmarsh and Albacutya to Wirrengren Plain.

Hydrology Conditions

The contrasting rainfall and run-off across the Wimmera catchment, being high in the Grampians and Pyrenees ranges and very low on the lowlands, has had a significant impact on the development of the fluvial systems of the catchment. The limited summer run-off means that many smaller streams in the upper catchment are subjected to intermittent flows. In dry periods many of the large streams throughout the catchment are reduced to a series of pools with only tenuous surface links.

The upper catchment of the Wimmera is steeper and the streams generally more confined, though the limited rainfall and runoff has a major effect on the formation of different types of streams. The limited overland flow allows the formation of disconnected channels and other discontinuous fluvial systems, such as intact valley fills and chain of ponds.

The runoff of the Wimmera catchment and the large plains have led to the formation of a single main drainage feature; the Wimmera River. With a dominance of alluvial material in the lower catchment and low relief, the river and the lower reaches of its' tributaries are unconfined. Whilst flows in the Wimmera River may be intermittent during dry periods, the channel system is continuous. Further the low relief has also lead to parts of the Wimmera River being a multi-channel or anabranching system.

The Wimmera-Mallee Stock and Domestic Supply System acts to supply water to the north-west of the catchment over an area of 28 500 square kilometres. The system has had a significant impact on the hydrology of waterways in the catchment.

Streamside Zone Conditions

The Wimmera River and Environs Action Program – Action Plan (Thomson Hay & Associates 1997) and Assessment and Review of Crown Water Frontages in the Wimmera Region (SKM 1998) found that streams in the upper catchment were generally in worse condition than in most other parts of the region. Many of the lower and middle reaches were in good condition as were most streams derived from catchments in the Grampians.

Where present, the riparian zone acts as a wildlife habitat and migration corridor (LCC, 1991). Of particular note within the Wimmera is:

- Widespread native vegetation surrounds the river immediately south from Dimboola and north from Lake Hindmarsh (LCC, 1991).
- There is a site of floristic significance at Dorington Point in Lake Albacutya. The seeds of the river red gums are in international demand due to having a salt tolerance that is higher than usual.
- South from Dimboola, there are six species of flora in the Wimmera River riparian zone which are extremely rare and four species which are endangered or have localised occurrences (LCC, 1991).

- Between Antwerp and Dimboola the vulnerable bottle bluebush (Maireana excavata) is part of an intact understorey.

Geology

The Wimmera catchment can be divided into three major geological areas (Figure 1.3)

1. The Silurian/Devonian sediments of the Grampians in the upper catchment;
2. The Palaeozoic turbidites of the St Arnaud Beds that form the Pyrenees Ranges, and
3. The Tertiary/Quaternary sediments of the Middle and Lower Wimmera.

During the Tertiary period a series of marine transgressions occupied much of the lower Murray Basin. Extensive marine sands, known as the Parilla Sands, were laid down on the Wimmera Plain. The marine transgressions left a series of north - south trending strandline ridges (representing former shorelines). These ridges and associated troughs are now a major influence on catchment behaviour with the Wimmera River, Yarriambiack Creek and Dunmunkle Creek all flowing north in the alignmnet of these troughs. The Parilla Sands became the supply of sediment for the Quaternary Aeolian (windblown landscapes) forms, which now dominate the Wimmera landscape.

A series of global glacial events during the Quaternary period, over the last 50 000 years, have had a significant effect on hydraulic regimes. Alternating periods of wet and dry have played a significant role in the production of the landforms which now dominate the landscape of the south-eastern Australian.

Periods of dry have been influential in the formation of the aeolian forms that cover much of the Wimmera's catchment. These formations include:

1. The Lowan Formation, which makes up the large dune field lobe of the Little Desert National Park;
2. The reddish brown dunes of the Woorinen Formation, which cover much of the Wimmera and Mallee; and
3. The Lunette Lake Basins.

There are also two fluvial formations from the Quaternary.

1. The Shepparton Formation, consisting of fluvial silts and sands which may form erosion resistant terraces along the Wimmera River, and
2. The Coonambigdal Formation, consisting of alluvial units associated with the active channel belt of the Wimmera River. The alluvials are mobile sediments and are currently being reworked by the river within the channel belt.

The sedimentary rocks of the Grampians form a thick sequence of quartzose sandstone, red siltstone and mudstone with occasional lenses and layers of conglomerate. The sediments are predominantly of freshwater origin with occasional thin layers that contain fossils with marine associations. These sediments usually overlie basal acid lavas and pyroclastics.

The Pyrenees Ranges, which are comprised of the St Arnaud beds, generally consist of green mudstones interbedded with graded turbite sandstones and are generally quartz rich. The Grampians and Pyrenees Ranges have been deformed

by a series of northwesterly trending high angle faults and *en echelon* folds. The folding and faulting has been attributed to the Tabberabberan Orogeny. The Stawell Granite and the Ararat Granodiorite that postdate the original deformation have also intruded the Grampians and Pyrenees (Douglas and Ferguson, 1988) (see Appendix A).

As the granitic rocks and the sandstones of the Grampians are exposed to weathering there is the development of quartz sands that may form a significant bed load in streams draining these areas, as well as allowing the formation of stream categories such as gorges. This bed load of sand may have a significant influence on the geomorphic form of these streams.

The mudstones and siltstones of the St Arnaud Beds are more prone to weathering and have tended to form confined and partly confined streams (see Geomorphic Categorisation section for a description of stream categorises).

For a more complete description of the Lower Wimmera Geology see Wimmera CMA – Wimmera River Geomorphic Investigation.

Figure 1.3 is a schematic of the different geological zones of the Wimmera catchment. The Lowland Alluvials consist of the Quaternary aeolian sediments and the Tertiary Marine Sands. The Grampians consist of the Silurian Devonian freshwater sandstone and siltstones. The Pyrenees consists of Palaeozoic siltstones and sandstones (turbites).

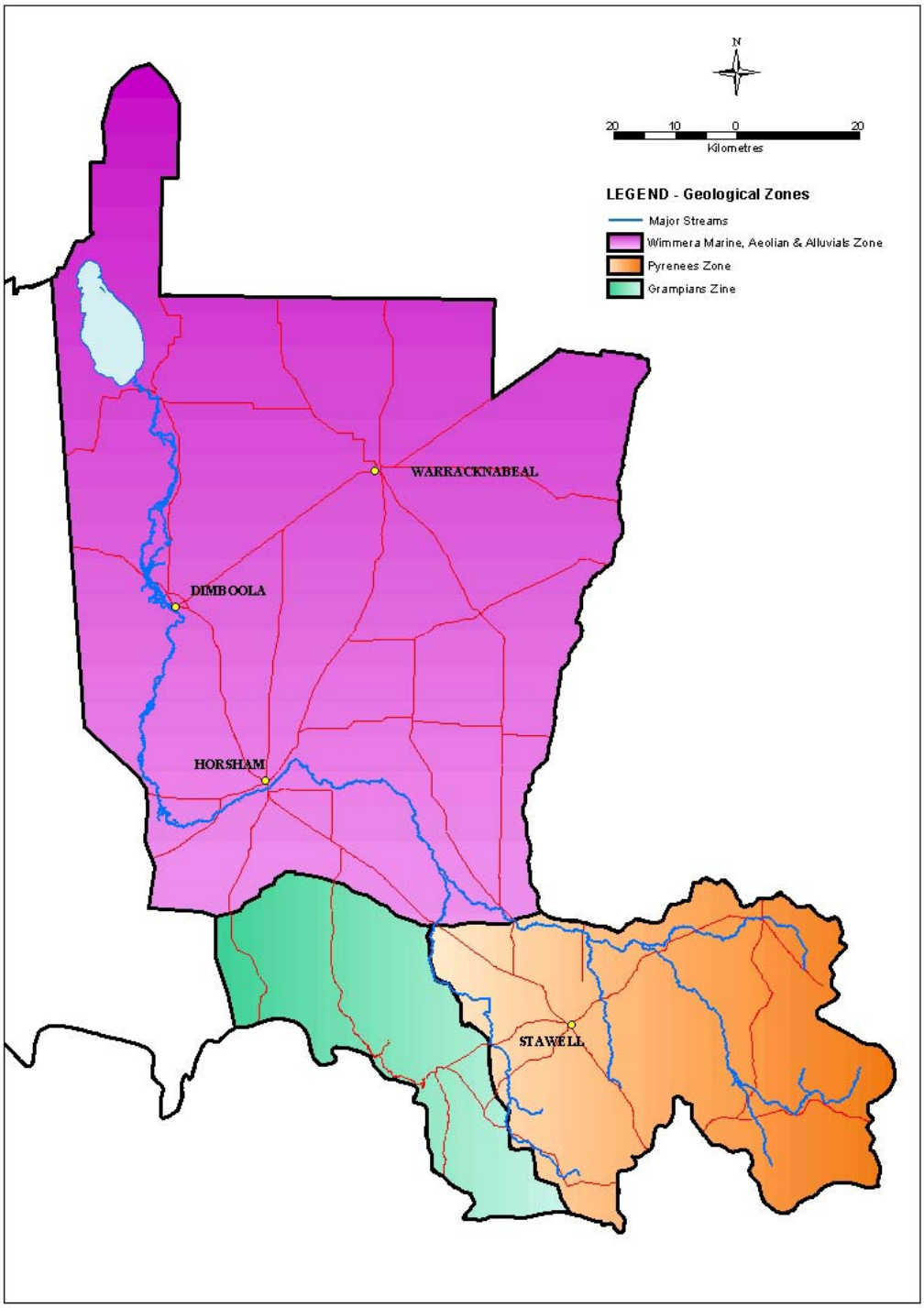

Figure 1.3: Geological zones of the Wimmera River catchment

Topography

The Wimmera catchment is dominated by the western plains of Victoria, which are of very subtle relief. Tertiary marine strandline ridges and Quaternary aeolian dunes and lunettes dominate the topographic features of the plains. The headwaters of the catchment are the western end of the Great Dividing Range and comprise the Grampians and Pyrenees ranges.

The topography of the catchment produces three distinct zones:

1. The highlands of the upper catchment;
2. The transition zone, which occurs between the highlands to lowland plain. This change leads to a drop in stream power and the deposition of most bed material sediment being transported; and
3. The lowland plains, which result in the formation of sinuous channels and multi-channel systems. The channel systems are often complex and vary in activity at differing flow levels.

Structure of the investigation

The project was divided into three distinct phases:

- Phase 1 – Geomorphic Categorisation.
- Phase 2 – Stream Condition Assessment.
- Phase 3 – Management Implications & Recommendations.

Geomorphic Categorisation

The geomorphic categorisation involved:

- Identification of tributaries within the Wimmera River catchment to a third order stream level.
- Categorisation of stream types within the Wimmera River catchment using an approach based on the River StyleTM method.
- Identification of the geomorphic attributes of the stream types to enable categorisation and monitoring, identification of the natural assets of the catchment, and setting of target conditions.
- Providing information on underlying geomorphic processes to assist in developing catchment management strategies.

Stream Condition Assessment

The stream condition assessment involved:

- Use of the previous Index of Stream Condition (ISC) assessments conducted in 1999 to identify the condition of the tributaries within the Wimmera River catchment.
- ISC assessments of an additional 52 sites to increase the number of sites to 89.
- Vegetation cover assessment of all waterways of third order or greater, using aerial photographs and GIS.
- Presentation of the information in a GIS format linked to the geomorphic categorisation information.

Management Implications & Recommendations

The priority stream sections identification involved:

- Identification of representative sections of stream for each stream type for use as a template.
- Corresponding of each stream type with respective condition assessment.
- Determination of priority listing for further study on geomorphically and ecologically significant stream types.
- Identification of objectives for river management.
- Identification of the relative value of conservation and rehabilitation efforts for each stream type and for the overall management of the catchment.