WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Dunmunkle Creek Waterway Action Plan

Wimmera Catchment Management Authority

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CONTENTS

APPENDICES

1 INTRODUCTION

Water Technology was commissioned by the Wimmera Catchment Management Authority (CMA) to develop a Waterway Action Plan (WAP) for Dunmunkle Creek in western Victoria.

Waterway Action Plans provide a technical and financial basis for the implementation of works and initiatives on waterways by government and its partners. The waterway action planning process includes a review of environmental, social, cultural and economic values, and threats to these values, along a particular waterway. This information is strengthened by community experience and knowledge gathered through community consultation during the project. Each waterway action plan culminates in a series of prioritised, broadly costed management actions for the CMA and its partners to implement over-time.

1.1 Project Area

The project area incorporates 92 km of Dunmunkle Creek, extending from the Wimmera River offtake approximately six kilometres east of Glenorchy and approximately 20 km north west of Stawell, to Lawler Road in Boolite. It is acknowledged that the Dunmunkle Creek continues north past Boolite however due to the undefined nature of the creek in this northern section and other drainage investigations being undertaken in this area it was decided to limit the project area to Lawler Road in Boolite for this report.

Dunmunkle Creek is approximately 220 km north west of Melbourne. It is situated in the Yarriambiack and Northern Grampians Shires and the creek flows through the township of Rupanyup (Figure 1-1). The creek passes through several categories of public land managed by various public authorities, as well as freehold land.

Dunmunkle Creek is a highly modified distributary of the Wimmera River. Flows within Dunmunkle Creek are primarily received from the Wimmera River during high flow events. However, the waterway also drains a narrow, localised catchment.

1.2 Waterway Action Plan Project Objectives

Dunmunkle Creek is a priority waterway for the Wimmera CMA, particularly for its native vegetation, recreational and economic values (Wimmera CMA, 2014). This WAP completes the suite of WAPs commissioned by Wimmera CMA for its priority waterways.

This Waterway Action Plan focuses on identifying the values and threatening processes impacting on stream health within Dunmunkle Creek and identifies actions to address these threats. Specifically, the aims of this Waterway Action Plan are to:

- Provide the Wimmera CMA with an improved understanding of the geographic location, scale and nature of the environmental assets and issues in Dunmunkle Creek.
- Investigate possible areas where naturalisation and channel decommissioning are feasible beyond those recommended in the Dunmunkle Creek Decommissioning Report (RPS, 2018).
- Develop a series of prioritised management actions for the Wimmera CMA and other partners to implement over time, which aim to:
  - mitigate threats to high value assets
  - maintain and improve the condition of Dunmunkle Creek.

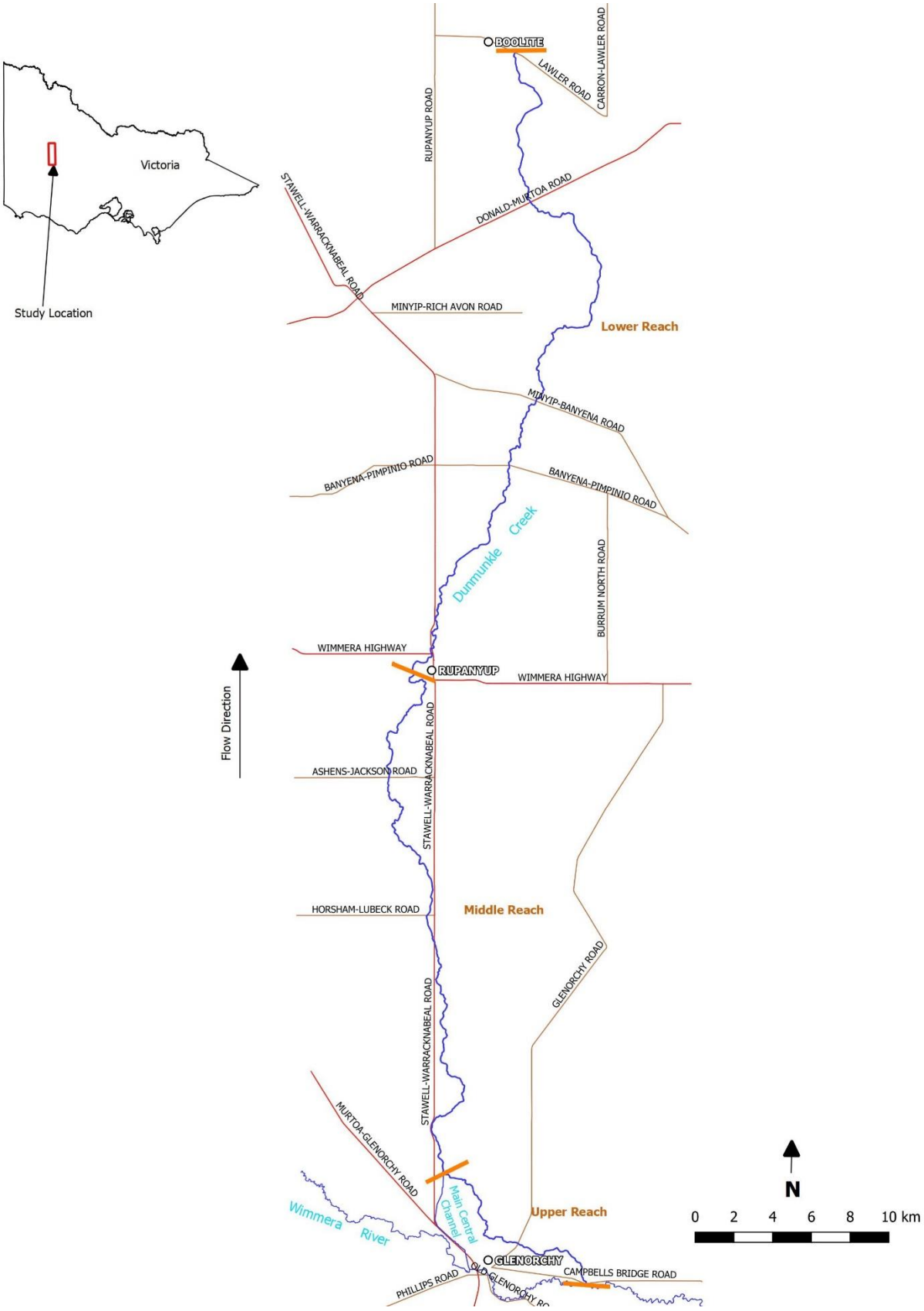

FIGURE 1-1 DUNMUNKLE CREEK WATERWAY ACTION PLAN PROJECT AREA

2 PROJECT APPROACH

The tasks below were undertaken in the development of the Dunmunkle Creek Waterway Action Plan.

2.1 Project Scoping and Initiation

The Waterway Action Plan commenced with an inception meeting and preliminary site visit in December 2019 to confirm the scope and aims of the Waterway Action Plan and requirements of the CMA.

2.2 Desktop Assessment and Field Work Preparation

A review of the available literature and data relevant to the Dunmunkle Creek project area was undertaken at the beginning of the project. This focussed on the history, biophysical condition, geomorphology, hydrology, flora, fauna and other environmental, social, cultural and economic values, threats and impacts previously reported in the project area were also investigated.

The review was completed to gain an appreciation of the landscape features, the broad scale management context, catchment condition and ensured that the field work was undertaken on an informed basis.

2.2.1 Aerial photo interpretation (API)

Aerial photo interpretation (API) was undertaken by our field assessors, prior to the site assessments, once all of the desktop and digital information was compiled. This assisted with the identification of areas for targeted field assessment. For instance, areas of obvious high grazing pressure, eroding banks, woody weed infestation or extensive native vegetation were noted for field inspection.

2.2.2 Mapping

ArcCollector was prepared for data collection in the field. This allowed for relatively easy digitisation and mapping of information observed in the field and the development of management actions at particular sites.

As part of this process the Dunmunkle Creek was divided into Segments that were approximately 100 m long (mainly from the Index of Stream Condition network) to which data could be attributed in the field.

During the development of management actions, these Segments were amalgamated to Sections and three Reaches for mapping and reporting purposes. The reaches and sections are further described in Sections 5, 6, and 7.

Prior to the fieldwork, draft objectives for the management of Dunmunkle Creek were also agreed with Wimmera CMA. This allowed for the management actions developed during and after the fieldwork, to be prioritised in terms of the degree to which they contributed to the objective. The objectives are listed in Section 6.1 of this report.

2.2.3 Stakeholder Engagement

Stakeholder engagement was an important component of the project as it gave the project team a broader understanding of the history of the catchment, as well as local issues, perspectives and priorities for management.

A range of stakeholders were involved in the development of the WAP. These included:

- Wimmera CMA
- Traditional Owners – Barengi Gadjin Land Council
- local landholders and community
- Department of Environment, Land, Water and Planning (DELWP)

- Grampians Wimmera Mallee Water (GWMWater)
- Yarriambiack Shire
- Northern Grampians Shire
- community groups.

A stakeholder engagement plan was developed in conjunction with Wimmera CMA which listed key stakeholders, their level of involvement in the project, how stakeholders would be engaged and by whom at various stages of the project.

Stakeholders were engaged at several stages of the project through meetings, workshops, face to face discussions in the field telephone calls, the local press and the CMA's website and social media platforms. Due to COVID-19 restrictions, the draft report was sent to agency stakeholders and made available online for the community for review and comment. This stage of the project was also advertised using the local press and the CMA's social media platforms.

Key stakeholder engagement events were an agency meeting and two community meetings prior to the field inspection in February 2020. The purpose of these meetings was to introduce the project and identify areas to be targeted for further field investigation.

2.3 Field Inspections

Field inspections were undertaken on foot by Water Technology staff Julian Martin (Environmental Engineer and Geomorphologist) and Johanna Slijkerman (Ecologist); and Wimmera CMA staff member Bryana Bisset. The fieldwork was undertaken over five days in February 2020 after the information gathering workshops with agency staff and the community. Some observations were also made in December 2019, following the inception meeting.

The field inspections were undertaken at key accessible locations over the entire project area. Due to the time and budget constraints of the project, the entire 92 km creek length was not to be walked.

The field inspection involved the identification of stream processes, key features, values and threats and their location. The field inspection was also used to gather georeferenced photographs of the reach and collect enough information to develop the prioritised works program.

Sites targeted for inspection included those which supported values or threats identified during the desktop phase of the project such as:

- patches of remnant vegetation with potentially high flora or fauna values; or where opportunities for naturalisation/channel decommissioning might be feasible
- areas of bed or bank instability, or areas that may be impacted by these instabilities in future
- weed infestations or areas where weed infestations are likely to expand if unmanaged
- any other documented high value assets or risks identified through stakeholder consultation.

2.3.1 Attributes collected

During the field inspections, the following information about project area was collected:

- fluvial geomorphology and stream processes
- riparian condition, including weeds, stock pressure, pest animals and fencing status
- instream features
- cultural heritage

- opportunities for naturalisation and channel decommissioning
- other all high value assets e.g. social, environmental, cultural, economic
- other threats to high value assets.

These attributes and their definitions are discussed in more detail in Section 5.

2.3.2 Landholder meetings

During the field inspections we met with a small number of landholders. This meeting allowed for the transfer of information pertaining to the Waterway Action Plan between landholders, the project team and the CMA. Specifically, the meeting was used to:

- communicate the Waterway Action Plan objectives and process
- gain an appreciation of the catchment wide and property level issues perceived by landholders
- gain an appreciation of individual landholders willingness to undertake activities to improve stream health (e.g. fencing and revegetation).

2.3.3 Waterway Action Plan Development

The development of the Waterway Action Plan drew upon the desktop assessment and the condition of the project area gained through the field inspection process. A summary of the key physical and ecological features, values and threats identified within the Waterway Action Plan project area is provided in Sections 4 and 5.

Drawing upon this information, a prioritised works plan was developed in an Excel spreadsheet for each waterway section where it was considered that stream health improvement works (such as fencing, revegetation, weed control or pest animal control) were warranted. This spreadsheet, provided to Wimmera CMA was used as a tool to identify priority works areas using a cost benefit analysis. The prioritisation of works was based on objectives determined by the Wimmera CMA and summarised in Section 6.1.

2.4 Project Outputs

In addition to this report, the following outputs were developed as part of this Waterway Action Plan process:

- GIS layers summarising the digitised information collected during the field inspection
- photographs collected during the field inspection
- an Excel spreadsheet presenting the prioritised works plan
- a series of stakeholder engagement events.

3 POLICY AND MANAGEMENT CONTEXT

The following section summarises the state and regional policies, strategies and plans that are relevant to the development and implementation of the Dunmunkle Creek Waterway Action Plan.

3.1 Water for Victoria: Water Plan (2016)

Water for Victoria: Water Plan (Water Plan) (DELWP, 2016a) is the Victorian Government's strategic plan for management of water resources. It aims to manage Victoria's water to support a healthy environment, a prosperous economy and thriving communities. It particularly recognises:

- The role that that water plays in communities, and seeks to make the most of water, including for agriculture, the environment, Aboriginal communities and recreation.

Water Plan includes an implementation plan and 69 actions. The following actions are relevant to the WAP:

- Action 3.3 Invest in integrated catchment management
- Action 3.4 Provide long-term investment to improve waterway health
- Action 3.8 Support community partnerships and citizen science
- Action 3.9 Improve knowledge and information about waterways and catchments
- Action 6.1 Recognise Aboriginal values and objectives of water
- Action 7.1 Include recreational values in water and waterway planning (DELWP, 2016).

3.2 Regional Riparian Action Plan (2015)

The Regional Riparian Action Plan is the Victorian Government's five-year plan to accelerate on-ground riparian management works to improve the health of riparian land along Victoria's regional rivers, estuaries and wetlands. Works include fencing to manage stock, revegetation programs, weed management and construction of off-stream stock watering systems.

Dunmunkle Creek is listed as a priority waterway, particularly for native vegetation values (DELWP, 2015).

3.3 Protecting Victoria's Environment – Biodiversity 2037

Protecting Victoria's Environment – Biodiversity 2037 (Biodiversity Plan) is the Victorian Government's plan to stop the decline of native plants and animals and improve the natural environment. Launched in 2017, the plan presents a long-term vision for Victoria's biodiversity supported by two overarching goals:

- Victorians value nature
- Victoria's natural environment is healthy.

Coupled with reviews of the *Flora and Fauna Guarantee Act 1988* and native vegetation clearing regulations, the plan brings an updated approach to protecting and managing the natural environment (DELWP, 2017).

The Plan promotes collaboration and improved alignment across government, business, communities, Traditional Owners, Aboriginal Victorians and private land managers, to restore biodiversity and strengthen the economy. It also promotes community participation in caring for biodiversity and encourages Victorians to enjoy the natural environment. The plan assists in recognising the multiple values of biodiversity, and identifies the tools, tasks and roles needed to ensure that Victoria's natural environment is healthy and positioned to cope with the effects of future population growth and climate change (DELWP, 2017). The plan lists 20 key priorities. The following priorities are directly relevant to the Dunmunkle Creek WAP:

- Priority 13. Support and enable community groups, Traditional Owners, nongovernment organisations and sections of government to participate in biodiversity response planning
- Priority 14. Engage with Traditional Owners and Aboriginal Victorians to include Aboriginal values and traditional ecological knowledge in biodiversity planning and management
- Priority 17. Deliver excellence in management of all land and waters
  - A key target of the plan is to achieve a net gain of the overall extent and condition of habitats across terrestrial, waterway and marine environments.
- Priority 18. Maintain and enhance a world class system of protected areas (DELWP, 2017).

3.4 Strategic Management Prospects

Strategic Management Prospects (SMP) is the Victorian Department of Environment, Land, Water and Planning's (DELWP's) modelling tool that is designed to help biodiversity managers consider and compare which actions are appropriate and where. Along the Dunmunkle Creek, priority actions are identified for rabbit, fox and cat control, weed control, permanent protection and domestic stock grazing control. Rabbit control and weed control are the highest ranked cost-effective actions along the creek. Key areas for this work to occur are adjacent to already vegetated areas such as Glenorchy, Bryntirion State Forest, south and north of Rupanyup and between Lallat and Dunmunkle East (DELWP, 2020d).

3.5 Biodiversity Response Planning

During DELWP's 2019-20 Biodiversity Response Planning workshop for the Wimmera, the Dunmunkle Creek was identified as a priority landscape by stakeholders. The creek was identified as an important biolink through an agriculturally dominated landscape. Revegetation along the creek would help mobile species to move through the area. Records of threatened species indicate that this was a high-quality landscape and is a good candidate for restoration works (DELWP, 2020d).

3.6 The Wimmera Regional Catchment Strategy (2013)

The *Wimmera Regional Catchment Strategy* (RCS) aims to provide focused, integrated and coordinated direction for all natural resource management (NRM) activities in the region. Catchment Management Authorities (CMAs) in Victoria are required to develop a RCS, under the *Catchment and Land Protection Act 1994*. The RCS is an umbrella strategy that encompasses several other regional strategies (Wimmera CMA, 2013).

The RCS sets twenty-year objectives and six-year management measures. Groups and individuals are encouraged to use the strategy to assist in developing funding proposals and guiding NRM activities in the region.

The following objectives and actions are relevant to the Dunmunkle Creek WAP:

- 20-year high level objectives for rivers and streams:
  - Improvements in the condition of rivers and streams classified as poor to *moderate* in the 2004 Index of Stream Condition.
  - Net gain in extent and quality of floodplain Ecological Vegetation Class (Wimmera CMA, 2013).
- 20-year high level objectives for native vegetation:
  - Strategically revegetate with indigenous species.

  - Bring 30,000 ha (45 percent) of endangered vegetation on private land under ongoing and recognised best practice management standards (including Buloke Woodlands of the Riverina and Murray–Darling Depression Bioregions).
- 20-year high level objectives for threatened plants and animals:
  - Improve community awareness of local threatened species (Wimmera CMA, 2013).

3.7 Wimmera Waterway Strategy (2014)

The *Wimmera Waterway Strategy* (the Strategy) sets a vision for the management of waterways across the Wimmera region until 2022 (Wimmera CMA, 2014). The Strategy is integrated with the Wimmera Regional Catchment Strategy and works on an asset-based approach. This approach identifies areas with significant values and threats to those values. This allows for priority setting to target investment (Wimmera CMA, 2014).

The goals for the Wimmera Waterway Strategy are as follows:

- maintaining and improving the values and condition of waterways that have formally recognised significance
- improved connectivity and condition along priority wetland systems and riparian corridors
- improved water quality in priority areas for; water supply, environmental condition and recreation
- waterways with high social, cultural and economic values are maintained in a state that continues to support those values in line with climatic conditions (Wimmera CMA, 2014).

Dunmunkle Creek is listed as having environmental, social and economic values. The creek is valued for:

- rare or threatened species/communities
- recreation (such as fishing at the Jack Emmett Billabong on the Dunmunkle Creek)
- economic - other resources (Wimmera CMA, 2014)

The Strategy identifies threats across the system as including:

- habitat fragmentation
- the spread of weeds into high value parts of the riparian zone
- physical changes to the geomorphology of the creek system, including loss of diversity (e.g. deep pools and shallow, seasonal wetlands)
- surrounding land-use, including grazing and cropping

The development of a management plan for Dunmunkle Creek is a priority (Wimmera CMA, 2014).

3.8 Growing What Is Good Country Plan: Voices of the Wotjobaluk Nations (2017)

The *Growing What Is Good Country Plan: Voices of the Wotjobaluk Nations* (2017) outlines the history of Aboriginal occupation in the Wimmera and sets out a vision, goals, priorities and actions for Wotjobaluk Country. The priorities are:

- more time on Wotjobaluk Country
- strengthening Wotjobaluk culture and language
- education and rewarding jobs for Wotjobaluk people
- stronger partnerships
- caring for our country (Barengi Gadjin Land Council, 2017).

4 CATCHMENT OVERVIEW

This section provides an overview of the Dunmunkle Creek project area, informed through both the desktop review and field inspection.

4.1 Indigenous heritage and management

The Dunmunkle Creek area was originally inhabited by the Wotjobaluk peoples (BGLC, 2017). In the Wimmera region, the availability of different foods encouraged people to move across the landscape from season to season. Water was essential and the Wimmera River and associated waterways provided abundant resources. Plants were used for food, medicine and for trade; and supplemented a diet of birds, fish and mammals. Fire was traditionally used as a tool to manage and look after Country. It assisted with hunting, gathering edible tubers and eased movement through densely vegetated areas.

Many scarred trees and middens are present along the Dunmunkle Creek, evidence of the importance of this area to Aboriginal people. Cultural heritage sites were identified as part of the Cultural Heritage Management Plan summarised in the Dunmunkle Creek Decommissioning Report (RPS, 2018). A total of 105 Indigenous heritage sites were identified through the Cultural Heritage Management Plan including 82 scarred trees, 19 isolated artefact sites and four artefact scatter sites. The Dunmunkle Creek Decommissioning Report (RPS, 2018) assessed the Main Central Channel section between Glenorchy and the Dunmunkle Creek – Main Central Channel confluence. The Cultural Heritage Management Plan did not include an assessment of the Upper Reach of the Dunmunkle Creek (defined as being from the Wimmera River offtake, approximately six kilometres east of Glenorchy through to the confluence with Main Central Channel), which is included within the project area of this Waterway Action Plan.

Pastoralism brought rapid and devastating change to Wotjobaluk peoples such as the loss of land, resources and sacred sites along waterways (Context, 2012).

The first inhabitants of the area and their rich culture are now embodied by the Barengi Gadjin Land Council (BGLC). BGLC represents Traditional Owners from the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk peoples, who were recognised in a 2005 Native Title Consent Determination, the first in south-eastern Australia. BGLC is the Federally recognised authority to speak on behalf of the Wotjobaluk peoples. They are the only body in the region with the legislative authority to make legal decisions about cultural heritage and are the Prescribed Body Corporate for the Wotjobaluk claim area, as outlined in the Native Title Act, giving legal authority and obligation to work on behalf of Traditional Owners. BGLC is a Registered Aboriginal Party, as appointed by the Victorian Aboriginal Heritage Council, under the Aboriginal Heritage Act 2006 (BGLC, 2020).

4.2 Post European history

4.2.1.1 Settlement

The first Europeans in the Wimmera were Major Mitchell's team who passed south of the project area in 1836. Mitchell described the 'open land' northwards from Mount Zero to the Wimmera River (Context, 2012).

The Wimmera was one of the later areas of Victoria to be settled. However, from the 1840s and 50s the area was occupied by pastoral squatters (Wimmera Place Names, nd). Access to water was an important consideration in locating pastoral runs, and their extent followed natural water flows and catchments. 'Ashens', 'Longerenong' and 'Warranooke' pastoral stations were some of the first runs taken by squatters in and around the Dunmunkle Creek (Context, 2012). Pastoralists brought livestock, mainly sheep, across Bass Strait from Van Diemen's Land; or overland from the Riverina District, following Major Thomas Mitchell's exploration of new pastures south of the Murray River.

A succession of Land Acts from 1869 subdivided pastoral claims with the aim of achieving closer settlement. This was partly in response to the need to resettle huge influxes of population from the Gold Rushes (Context, 2012). Townships in the Wimmera were surveyed and established in the 1870s as part of this process. In 1873, the first survey of 24 township allotments was conducted on the Dunmunkle Creek. This town was originally known as Karkarooc, then Lallat and finally (by 1876) Rupanyup. The surrounding area was previously part of two pastoral stations – 'Longerenong' in the west and 'Warranooke' in the east (Context, 2012).

Droughts and a succession of dry years between 1877 and 1881 drove local and government interest in finding a solution to the problem of water supply (Context, 2012).

4.2.1.2 Wimmera-Mallee Stock and Domestic Supply System

The Dunmunkle Creek was heavily modified in the 1880s and early 1900s to deliver regulated stock and domestic water to landholders in the area. This involved the installation of concrete regulating structures, bridges, culverts and channel banks (Figure 4-1). Extensive levelling and snag removal were undertaken to improve the efficiency of water delivery. These changes resulted in the loss of fluvial geomorphic diversity in many locations, particularly the loss of deeper pools and shallow, seasonal wetlands (Wimmera CMA, 2014).

FIGURE 4-1 DUNMUNKLE CHANNEL, GLENORCHY WEIR IN 1892 (SOURCE: TROVE 2019)

These early works by local water and irrigation trusts formed the basis of the Wimmera-Mallee Stock and Domestic Supply System. The purpose of the system was to supply water for stock and domestic use, but it

was extended to include some irrigation (Context, 2012). The construction of the Rocklands and Toolondo reservoirs in 1953 made it possible, by 1962, to draw water from Grampians reservoirs instead of the Waranga Channel.

Upon completion, the Wimmera-Mallee Stock and Domestic Supply System was one of the largest schemes of its kind in the world and represented a major technical and logistic achievement - it supplied water by gravity in open channels to about 22,000 farm storages on over 15,000 rural properties and to some 50 towns spread over 28,500 square kilometres (Context, 2012).

Dunmunkle Creek continued to operate as a regulated water supply system until 2010 when was made redundant by the construction of the Wimmera Mallee Pipeline (WMP). Many local landholders recall 'The Delver', a large pointed grader-blade towed by a tractor, coming through the project area in the early 21st century to keep the channel open and push sediment up onto, and beyond the banks.

4.2.1.3 The Wimmera-Mallee Pipeline

The Wimmera Mallee Pipeline was opened in 2010. It involved the construction of almost 8,800 kilometres of reticulated pipeline to replace 17,000 kilometres of open channels, for an anticipated saving around 103 billion litres of water a year. The pipeline supplies stock and domestic water to approximately 9,000 farms and 34 townships across almost 10 per cent of Victoria, from the Grampians to the Murray River, and is managed by GWMWater (Context, 2012).

FIGURE 4-2 DUNMUNKLE CHANNEL, GLENORCHY WEIR IN 2019

4.2.1.4 Dunmunkle Creek Channel Decommissioning (GWMWater)

With stock and domestic water demands now supplied by the Wimmera Mallee Pipeline, the water regulating structures and channel banks along Dunmunkle Creek are no longer required (Figure 4-2). GWMWater is preparing to decommission these structures and banks to return a more natural flow regime to the creek (as much as practicable). The works will assist in slowing flood flows and make use of natural storage sites along the creek (i.e. wetlands, swamps, etc.). A consultant has made preliminary recommendations to GWMWater using a 'traffic light' system to indicate areas to consider works as part of the decommissioning (e.g. removal of levee banks and redundant structures). Community consultation is likely to follow in due course.

4.3 Current Land Use and Tenure

The majority of the Dunmunkle Creek is situated within narrow Crown land parcels throughout the length of the project area. Occasionally, the Crown land parcels extend to wider areas, incorporating broader vegetated reserves, including:

- Hunts Bushland Reserve and the Glenorchy Streamside Reserve, adjacent to Campbells Bridge Road at the upstream end of the project area
- Ridds Bushland Reserve, adjacent to the Stawell – Warracknabeal Road
- Paynes Pool Bushland Reserve, adjacent to the Stawell – Warracknabeal Road
- Bryntirion State Forest, adjacent to the Stawell – Warracknabeal Road
- Rupanyup Memorial Park at Rupanyup.

The land use adjacent to the Dunmunkle Creek is dominated by Farming Zone (FZ1). A review of available 2017 land use data and the site assessment indicated that the land use is dominated by general cropping followed by mixed farming and grazing (mainly sheep) (Figure 4-3 and Figure 4-4). The general cropping areas are more prominent, particularly north of Rupanyup. The mixed farming and grazing areas are more concentrated upstream of the Main Central Channel confluence, however, are scattered throughout the entire project area. Residential housing and commercial properties are present through Rupanyup. However, the creek is situated to the west of the town itself and largely bypasses the majority of the developed areas.

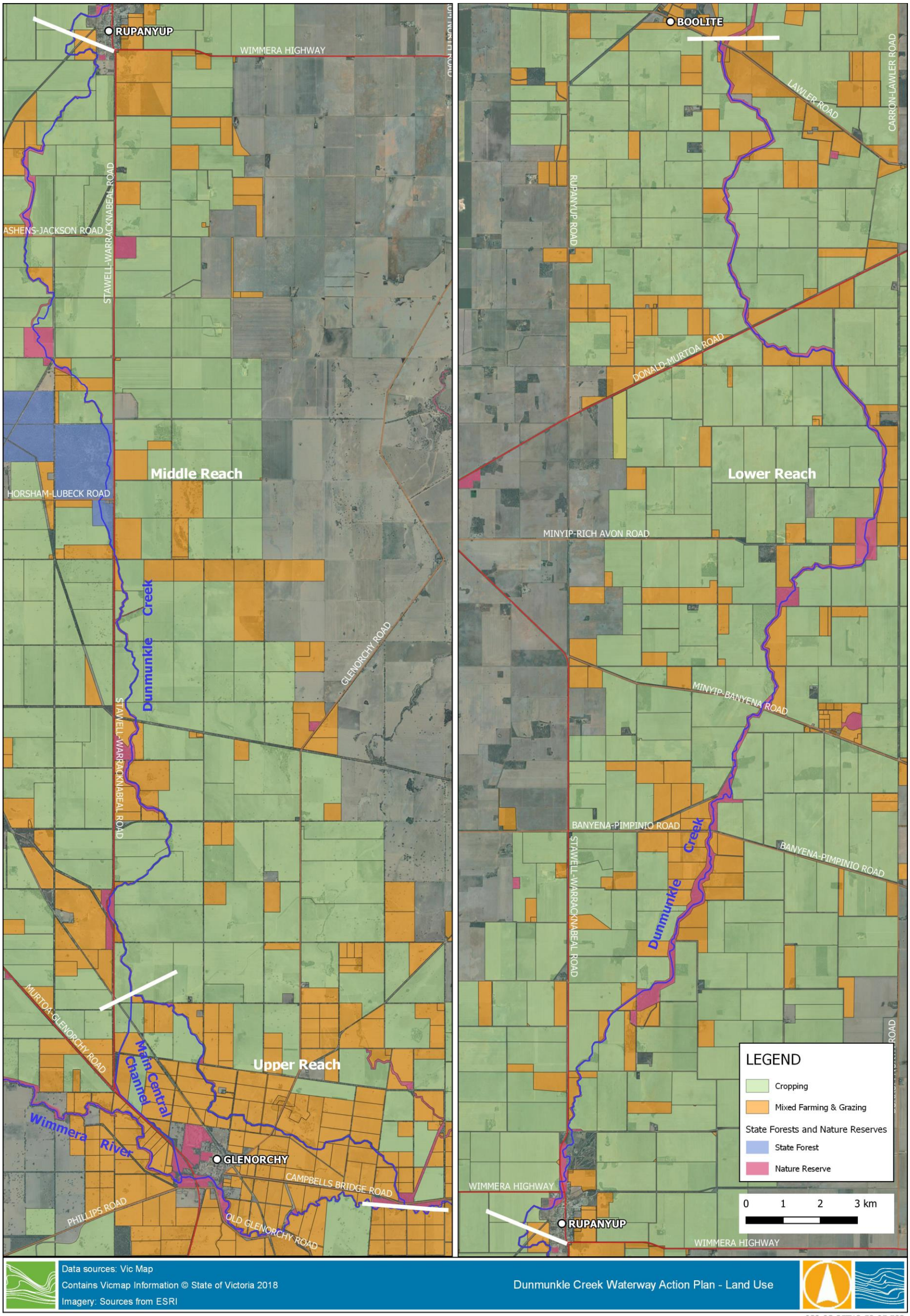

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FIGURE 4-3 LAND USE

FIGURE 4-4 SHEEP GRAZING A PREVIOUSLY CROPPED PADDOCK UPSTREAM OF THE CONFLUENCE WITH THE MAIN CENTRAL CHANNEL

4.4 Fluvial Geomorphology

Dunmunkle Creek is commonly referred to as a distributary of the Wimmera River. That is, the creek branches off and flows away from the Wimmera River in a northerly direction. The creek broadly terminates at Lake Carron in the southern Mallee, downstream of the current project area boundary. Earth Tech (2003) notes that both Dunmunkle Creek and the neighbouring Yarriambiack Creeks are rare hydrological systems within south-eastern Australia to the fact that they are distributary systems.

Dunmunkle Creek primarily receives flows during high flow events within the Wimmera River, although the creek also drains a narrow-localised catchment area. Consequently, the creek can remain dry for extended periods between flow events. Additionally, the northern portion of the creek only receives flows in progressively larger high flow events. The January 2011 high flow event provides the most recent example of a widespread flow event within Dunmunkle Creek, however a smaller flow event occurred in 2016. There are two streamflow gauges on the Wimmera River which can provide an indication on the likely streamflow distribution to Dunmunkle Creek; Wimmera River at Glynwylln (415206) and Wimmera River at Glenorchy (Tail Gauge - 415201). The January 2011 event recorded the highest peak flow on record at both gauging stations, 38,970 ML/d (451 m3 /s) and 55,420 ML/d (641 m3 /s) at Glynwylln and Glenorchy respectively. In both cases the January 2011 event was far greater than the second largest flood on record (Water Technology, 2018).

Dunmunkle Creek is situated within the Wimmera Bioregion. Earth Tech (2003) describe that 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, which all flow within the northern alignment of these troughs. The Parilla Sands became the supply of sediment for the Quaternary Aeolian (windblown landscapes) forms, which now dominate the Wimmera landscape.

Dunmunkle Creek can be broadly categorised as a low energy, alluvial continuous system. Key characteristics of the creek system include:

- The creek comprises a single channel of low sinuosity and low longitudinal gradient.
- Continuous floodplains are present on both sides of the channel.
- There are low rates of channel migration.
- Both the channel and floodplain comprise fine grained sediments.
- Both the floodplain and channel are gradually accumulating fine grained sediments.

Dunmunkle Creek has been highly modified by its progressive adaptation for well over a century into a stock and domestic water supply channel delivering water to the Mallee. Works have included channelisation, channel realignment, large woody debris removal and progressive enlargement. As a consequence of the historic works and in combination with the gradual accumulation of fine-grained sediments, the character of Dunmunkle Creek now largely comprises:

- A straight channel planform with a homogenous stream bed. That is, the in-channel geomorphic diversity is extremely poor (Figure 4-5).
- Levees are immediately adjacent to the channel throughout much of the creek length, formed by the spoil deposits associated with the progressive channel enlargement (Figure 4-5).

In addition to the channel modifications, in excess of 100 water regulation and impoundment structures are present within Dunmunkle Creek (Figure 4-6, Figure 4-7 and Figure 4-8). The majority of these structures are currently owned by Grampians Wimmera Mallee Water (GWMWater). The Dunmunkle Creek Decommissioning Report (RPS, 2018) summarises these assets as including:

- waterway crossings, which included boarded weirs
- grade control structures
- offtake diversion structures
- regulators
- syphons.

Many of these structures are now considered redundant as the stock and domestic water supply operation has ceased and been replaced by the Wimmera Mallee Pipeline. The potential decommissioning of these structures is being investigated as part of a separate project. Farm dams commonly adjoin Dunmunkle Creek throughout the project area. Small diversion channels facilitated flow into the dams and back into Dunmunkle Creek during flow events. Only two observed dams had been constructed on/within Dunmunkle Creek itself, with the remaining dams located adjacent to the creek channel.

The substantial channel modifications, in combination with the redundant structures and natural topography has resulted in a complex flood behaviour arrangement that has been investigated within the Dunmunkle Creek Flood Study (Water Technology, 2018).

FIGURE 4-5 DOWNSTREAM VIEW OF DUNMUNKLE CREEK, SHOWING A MAN-MADE CHANNEL, UNIFORM BED PROFILE AND SPOIL HEAPS ADJOINING THE CHANNEL, FORMED THROUGH THE PROGRESSIVE CHANNEL ENLARGEMENT WORKS.

FIGURE 4-6 VIEW OF A REDUNDANT WATERWAY CROSSING OVER A ROAD ON DUNMUNKLE CREEK. THE CROSSING INCORPORATED TIMBER BOARDS TO IMPOUND WATER UPSTREAM.

FIGURE 4-7 UPSTREAM VIEW OF A REDUNDANT WEIR STRUCTURE IN DUNMUNKLE CREEK WITHIN THE BRYNTIRION STATE FOREST.

FIGURE 4-8 A SYPHON ON DUNMUNKLE CREEK IMMEDIATELY WHICH FACILITATES FLOW PAST THE ROCKLANDS OUTLET CHANNEL.

Minimal erosion is evident throughout the length of Dunmunkle Creek. This is generally due to the flat longitudinal gradient, the low and irregular flows and the relatively wide distribution of flood flows, forming a low energy flow environment. In addition, the intensity of stock grazing throughout the project area is low and is generally not impacting upon channel stability. Isolated instances of observed erosion include:

- At road crossings, associated with poor roadside drainage arrangements entering Dunmunkle Creek. The most severe erosion associated with this process is located on the northern side of Campbells Bridge Road (Figure 5-10).
- Knickpoints, propagating away from Dunmunkle Creek, associated with floodplain flow re-entry points. These features are restricted to the section of creek between Campbells Bridge Road and Glenorchy Road.
- Sub-aerial erosion on the bank face associated with wind-blown and/or localised water erosion processes.
- Historic bed deepening and associated channel widening (erosion on both banks) processes at the confluence of Dunmunkle Creek and the Main Central Channel. The bed deepening at this location is no longer active.
- Minor scour pools formed on the downstream side of culverts.

4.5 Flora and fauna

4.5.1 Vegetation communities

Remnant native vegetation is present along the majority of the length of Dunmunkle Creek, with a transition in vegetation type occurring near Rupanyup.

South of Rupanyup, the dominant Ecological Vegetation Classes (EVCs)[1] are EVC 679 Drainage Line Woodland, with EVC 803 Plains Woodland further off-stream (DELWP, 2020a). The Drainage Line Woodland EVC is characterised by River Red Gum (*Eucalyptus camaldulensis)* along the waterway, with occasional Grey Box (*Eucalyptus micrpocarpa)* on rises or slightly off stream. The understorey is dominated by sedges, rushes, grasses and herbs rather than shrubs. The Plains Woodland EVC also has a grassy or sedgy understorey but the canopy is more likely to include Yellow Gum *(Eucalyptus leucoxylon),* Yellow Box *(Eucalyptus melliodora),* Grey Box or Buloke *(Allocasuarina luehmannii)* (DELWP, 2020b). Full EVC benchmarks are presented in Appendix A.

North of Rupanyup the remnant vegetation along the Dunmunkle Creek changes to EVC 103 Riverine Chenopod Woodland, with EVC 826 Plains Savannah further off-stream (DELWP, 2020a). The Riverine Chenopod Woodland EVC is dominated by a Black Box (*Eucalyptus largiflorens*) canopy with lignum, saltbushes, copperburrs, bluebushes and scattered daisies in the understorey. The Plains Savannah EVC vegetation typically lacks Eucalypts and the canopy is dominated by Buloke or Slender Cypress-pine (*Callitris gracilis* spp. *murrayensis*). The understorey includes small shrubs and lots of herbs and grasses (DELWP, 2020a). Full EVC benchmarks are presented in Appendix A.

These EVCs are all endangered in the Wimmera Bioregion. The distribution of EVCs and remnant vegetation in the project area is shown in Figure 4.9.

In this largely cleared part of Victoria, the remnant patches of vegetation along creeks and roadsides provide important habitat, refuge and connectivity for native species, including threatened species. These will become increasingly important refuges under climate change scenarios, as existing habitats reduce in size due to reduced rainfall, increased fires, droughts or other climate variability. Threats to these patches of remnant vegetation along the Dunmunkle Creek include weed incursion, stock access and fragmentation. The vegetation along Dunmunkle Creek is discussed in more detail in the Condition Assessment in Section 5.

[1] EVCs are the standard unit for classifying vegetation types in Victoria. They are described through a combination of floristics, lifeforms, ecological characteristics and environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating (DELWP 2019b).

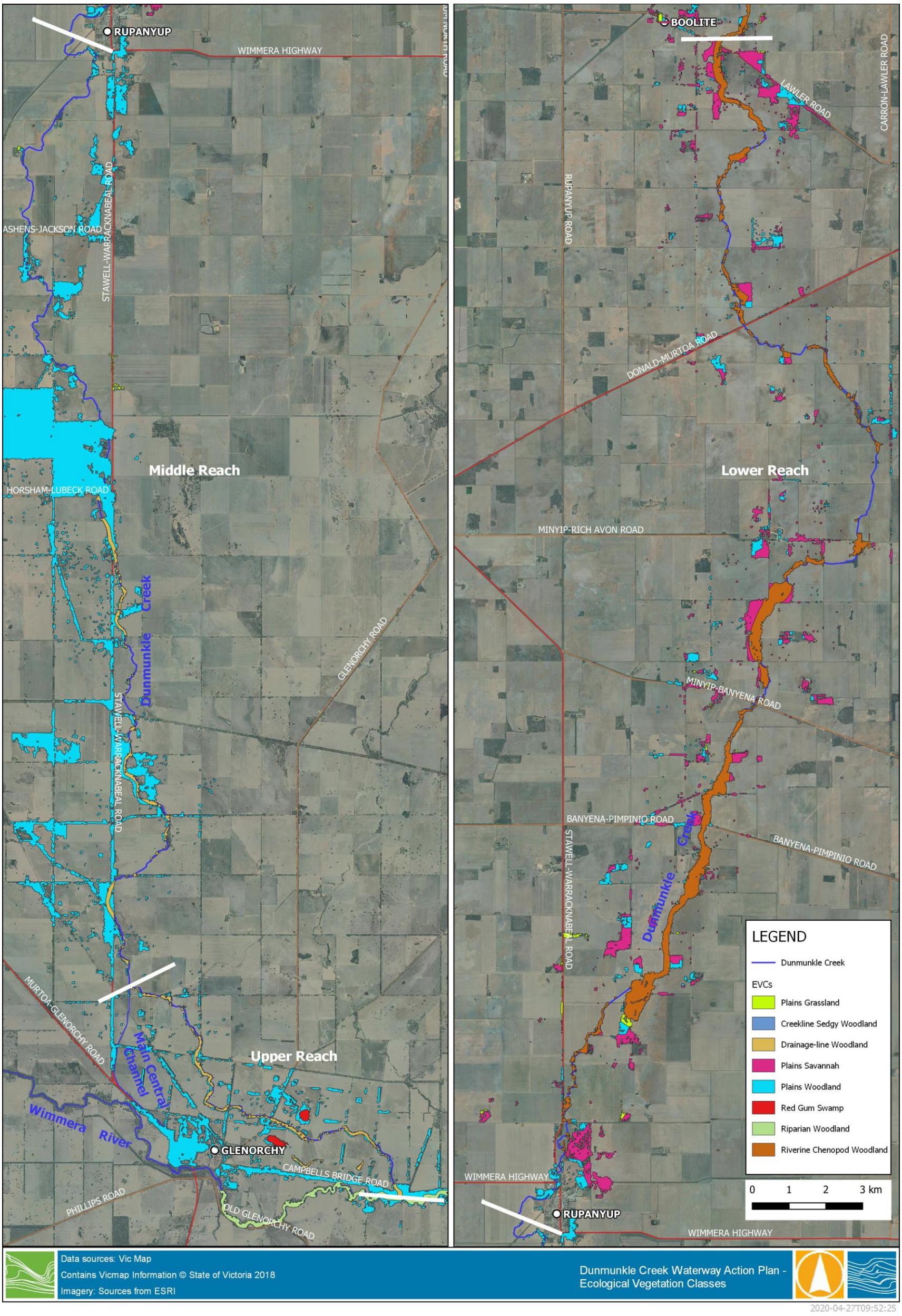

FIGURE 4-9 EVCS IN THE STUDY AREA

4.5.2 Threatened species

Several threatened species have previously been recorded in surveys along the Dunmunkle Creek and registered in Victoria's Biodiversity Atlas (VBA) (DELWP, 2020a). Species recorded within a 200-metre buffer of the creek and their status are listed below.

- flora
  - Turnip Copperburr (*Sclerolaena napiformis*)
    - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) - Endangered
    - Victorian *Flora and Fauna Guarantee Act 1998* (*FFG Act*) - Listed
    - *Advisory list of rare or threatened plants in Victoria 2014* - Endangered
  - Buloke (*Allocasuarina luehmannii*)
    - Victorian *FFG 1998* – Listed
    - *Advisory list of rare or threatened plants in Victoria 2014* - Endangered
  - Slender Bindweed (*Convolvulus angustissimus* subsp. *omnigracilis*)
    - *Advisory list of rare or threatened plants in Victoria 2014* - Poorly known[2]
  - Pin Sida (*Sida fibulifera*)
    - *Advisory list of rare or threatened plants in Victoria 2014* - Vulnerable
  - Long Eryngium (*Eryngium paludosum*)
    - *Advisory list of rare or threatened plants in Victoria 2014* - Vulnerable
- fauna
  - Growling Grass Frog (*Litoria raniformis*)
    - Commonwealth *EPBC Act 1999* - Vulnerable
    - Victorian *FFG Act 1998* - Listed
    - *Advisory List of Threatened Vertebrate Fauna in Victoria 2013* - Endangered
  - Bush Stone-curlew (*Burhinus grallarius*)
    - Victorian *FFG Act 1998* - Listed
    - *Advisory List of Threatened Vertebrate Fauna in Victoria 2013* - Endangered.

4.5.3 Weeds

Weeds are also present along the length of the Dunmunkle Creek, as expected in a highly modified environment. The dominant species are ubiquitous annual grasses such as Wild Oat (*Avena fatua*) and bromes (*Bromus* sp.). Some declared weeds which are on the Victorian noxious weeds list (20 July 2017) are also present such as African Boxthorn (*Lycium ferocissimum*), Bathurst Burr (*Xanthium spinosum*), Horehound

[2] Poorly Known in Victoria: poorly known and suspected, but not definitely known, to belong to one of the above categories (x- extinct, e- endangered, v- vulnerable or r- rare) within Victoria. At present, accurate distribution information is inadequate.

(*Marrubium vulgare*) and Prickly Pear (*Opuntia stricta*). These are all Regionally Controlled Weeds[3] in the Wimmera region. Tortured Willow (*Salix matsudana* 'Tortuosa') was is also present near Rupanyup and some Spear Thistles (*Cirsium vulgare*) were observed in the project area. These are Restricted Weeds[4] in Victoria.

4.6 Waterway condition

4.6.1 Index of Stream Condition

The Index of Stream Condition (ISC) indicates that the Dunmunkle Creek is generally in moderate condition (Figure 4-10). The ISC provides a snapshot of river health for major rivers and streams in Victoria using data collected over a six-year period from 2004 to 2010. It measures the Hydrology, Physical form (geomorphology), Streamside zone (riparian vegetation), Water quality and Aquatic life (macroinvertebrates) of a reach within a waterway.

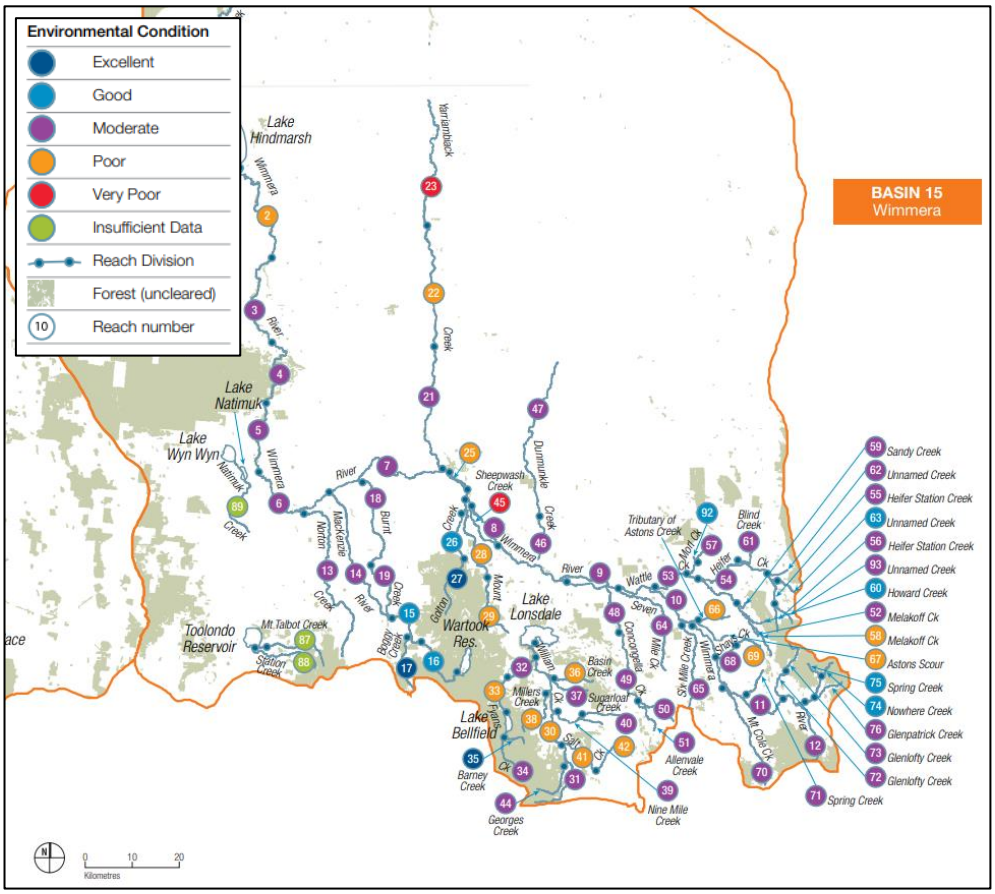

FIGURE 4-10 INDEX OF STREAM CONDITION REACHES AND SCORES IN THE CATCHMENT (DEPI, 2013)

[3] Regionally Controlled Weeds - These invasive plants are usually widespread in a region. To prevent their spread, ongoing control measures are required. Land-owners have the responsibility to take all reasonable steps to prevent the growth and spread of Regionally controlled weeds on their land.

[4] Restricted weeds - This category includes plants that pose an unacceptable risk of spreading in this State and are a serious threat to another State or Territory of Australia. Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited.

The two reaches sampled along Dunmunkle Creek (note the downstream end of the project area near Boolite is not part of the Index of Stream Condition Stream network) are both in moderate condition. The reach scores are presented in Table 4-1. Water Quality and Aquatic Life are not assessed in the Dunmunkle Creek due to the variability of flow.

TABLE 4-1 INDEX OF STREAM CONDITION RESULTS FOR REACHES IN THE CATCHMENT (DEPI, 2013)

Waterway	Reach	Length (km)	Hydrology	Phys. form	Streamside zone	Water quality	Aquatic life	ISC score	Condition
Dunmunkle Creek	46	11.7	6/10	7/10	6/10	-	-	30	Moderate
Dunmunkle Creek	47	44.4	6/10	7/10	4/10	-	-	27	Moderate

4.6.2 Index of Wetland Condition

The IWC is a rapid method used to assess the condition of Victoria's high value wetlands. DELWP administers the data collected from Index of Wetland Condition (IWC) assessments.

Five registered wetlands[5] are present along the Dunmunkle Creek or in close vicinity to the waterway (DELWP, 2020c). However, no IWC assessments are recorded in DELWP's system for the wetlands in the project area (Katie Jackson, DELWP *pers comm.* 16 March 2020).

[5] Wetland numbers 19700, 19684, 19699, 19683, 19697

5 CONDITION ASSESSMENT

5.1 Overview

This section details the physical condition, existing vegetation characteristics, trajectory and management implications of Dunmunkle Creek within the project area. The condition assessment draws on observations from the site inspections, discussions with land managers and review of aerial imagery and background information.

For the purpose of this Waterway Action Plan, Dunmunkle Creek has been split into three broad reaches, based on its geomorphic and ecological characteristics. These reaches are outlined below.

- The **Upper Reach** – Extending from the Wimmera River offtake through to the confluence with Main Central Channel. This reach is characterised as comprising a channel form that is inclusive of palaeochannels associated with the abandonment of the Wimmera River. These palaeochannels are of a similar geometry to the contemporary Wimmera River channel.
  - This reach comprises six Sections[6].
- The **Middle Reach** – Extending from the confluence with the Main Central Channel through to the Wimmera Highway at Rupanyup. This reach is characterised by man-made channel sections in combination with natural channels that have been progressively enlarged.
  - This reach comprises 18 Sections.
- The **Lower Reach** – Extending from the Wimmera Highway at Rupanyup through to Lawler Road at Boolite. This reach is characterised by a completely man-made channel form, where naturally a channel is unlikely to have existed. Prior to intervention, it is likely that the majority of this reach comprised a series of poorly defined depressions or discontinuous minor channel networks.
  - This reach comprises 19 Sections.

5.2 Data Collection

The field inspection process collected information on the physical condition and existing vegetation characteristics within the project area. The data, summarised in this section, has been digitised and has been provided as a geodatabase as part of the project deliverables.

5.2.1 Physical Condition Variables

The physical (or geomorphic condition) variables collected during the field inspection are listed below.

- waterway and catchment erosion sites, including the nature and scale of the erosion
- the geomorphic process causing the erosion (e.g. fluvial scour, knickpoint migration, bank slumping etc.)
- refuge pools
- instream structures and barriers.

5.2.2 Vegetation Condition Variables

The vegetation condition variables collected during the field inspection included:

- remnant vegetation type (e.g. EVC affinity)

[6] Sections are an amalgamation of creek 'Segments' to which data was attributed in the field. Management actions in Section 6 are reported at the Section scale.

- remnant vegetation quality
  - Low – Little to no native remnant overstorey or understorey vegetation, dominated by exotic species, may be cropped.
  - Medium – Scattered native remnant overstorey trees (as appropriate for EVC), native understorey species may occasionally be present but ground layer is generally dominated by exotic species e.g. annual grasses.
  - High – Remnant overstorey with good connectivity and continuity along the waterway, some native species in understorey (as appropriate for EVC e.g. native grasses, saltbushes, other herbs) but ground layer generally includes moderate cover of exotic species e.g. annual grasses.
  - Very High – Remnant overstorey with good connectivity and continuity along the waterway, high diversity of native species (as appropriate for EVC) and low cover of exotic species in the understorey[7].
- threatened species
- declared weeds
- weed cover (e.g. non-pasture species, agricultural weeds)[8]
  - Low - < 5% cover of weeds
  - Medium - 5 - 20% cover of weeds
  - High - >20% cover of weeds (DSE, 2004).

5.2.3 Existing Fencing Status

The extent and condition of fencing was collected for both sides of all of the assessed waterway (i.e. left and right bank). The fencing condition was classified as either absent, effective or ineffective.

The categories used were:

- absent
- absent, not required
  - This was used if the area was not agricultural land e.g. a public park, a Nature Conservation Reserve etc.
- likely present, effective
  - This was used when the area was not able to be easily accessed.
- present effective
  - A functional fence capable of excluding stock (i.e. sheep).
- present, ineffective
  - fence incapable of restricting stock access to the waterway due to insufficient or missing wires or tree limbs having fallen on the fence (Figure 5-1).

[7] Note: Due to the timing of the field inspections (February) some species e.g. native grasses were not able to be identified to species level due to the lack of fertile material on the plants at this time of the year.
[8] Note: Weed cover, as defined above, was Low across the whole project area. This has not been mapped and supplied to Wimmera CMA with the other GIS layers. However, georeferenced information about Declared Weeds has been supplied.

The fencing status for each reach is described in the reach condition descriptions below. Fencing has been mapped and GIS layer shows fencing on the waterway. Note: this is the indicative location of the fencing, it does not represent the exact position of the existing fence lines.

FIGURE 5-1 AN EXAMPLE OF INEFFECTIVE FENCING.

5.2.4 Stock Grazing Pressure

The impact of stock grazing was noted on all of the assessed segments and rated as having either low/no impact, moderate impact or high impact. The rating considered damage to vegetation (both native and non-native species, including pasture species), physical damage including pugging and tracks and manure presence (Figure 5-2). The definitions used are as follows:

- low – bare ground attributed to stock < 5% (as appropriate for EVC), limited pugging, tracks, manure
- medium – bare ground 5 - 20%, moderate pugging, tracks, manure
- high – bare ground >20% (under non-drought or other post-disturbance conditions) (Kaye and Peters, 2014). Lots of tracks, manure, pugging.

Stock grazing pressure is described in the reach condition descriptions below. Broadly, the intensity of stock grazing throughout the project area is low. Through both observations and consultation during the site assessment process, it was noted that sheep are the dominant livestock present within both the general cropping and mixed farming and grazing areas. Commonly, sheep are introduced to the cropping areas

subsequent to harvesting for a short period of time (Figure 4-4). It was also noted by several landholders during the consultation process that livestock numbers have decreased across the project area over the last decade.

FIGURE 5-2 STOCK PRESSURE WAS ASSESSED THROUGHOUT THE PROJECT AREA.

5.2.5 Pest Animals

Observations or evidence of pest animals was recorded in the project area. The key pest animals were rabbits, hares and foxes. Evidence of pest animals included warrens, manure etc. Pest animal pressure was also recorded. In general, pest animal pressure was low. The definitions used are as follows:

- low – no evidence of pest animals e.g. no vegetation damage, warrens, scats
- medium – some evidence of pest animals e.g. occasional manure/scats, minor vegetation damage, possibly old warrens
- high – extensive evidence of pest animals e.g. active warrens, lots of manure/scats, individuals observed, more extensive vegetation damage, resting areas (Kaye and Peters, 2014)

5.2.6 Cultural Heritage

The location of possible aboriginal scar trees were opportunistically recorded throughout the project area (Figure 5-3). This information supplements the Cultural Heritage assessment undertaken as a component of the Decommissioning Report completed GWMWater (RPS, 2018), summarised in Section 4.1. This data has been supplied to Wimmera CMA as a GIS layer.

FIGURE 5-3 POSSIBLE SCAR TREE ON A BLACK BOX ADJACENT DUNMUNKLE CREEK WITHIN THE PROJECT AREA.

5.2.7 Opportunities for naturalisation/channel decommissioning

The Dunmunkle Creek Decommissioning Report (RPS, 2018) developed a works plan in context of the constraints associated with the engineering, ecology and heritage assessments. The Wimmera CMA wishes to build upon this work and identify potentially feasible locations where strategic decommissioning works may occur to benefit environmental values adjoining Dunmunkle Creek through the distribution of water during flow events.

During the field inspections opportunities for naturalisation or channel decommissioning, in addition to that already recommended by RPS (2018), were recorded. In order to identify suitable locations, a series of criteria were established. These criteria used for identifying these sites were:

- high value vegetation areas, where environmental watering has the potential to maintain/improve the vegetation quality
- relatively wide Crown land parcels, positioned in the landscape so that flooding would not extend to agricultural land
- waterway sections with limited channel capacity where decommissioning works would not be onerous, e.g. the existing channel bed is relatively close in height to the surrounding floodplain, and the banks of the channel would be easy to breach or remove.

These sites were further examined at the desktop using API and LiDAR to determine that they met the criteria listed above.

5.2.8 Miscellaneous Values and Threats

In addition to the aforementioned information, miscellaneous values and threats were identified where they were observed. This information included:

- Crown water frontages in good condition where existing grazing licences could be considered for amendment to riparian management licences
- threatening land management practices (dumping of rubbish in a waterway).

5.3 Reach Condition

5.3.1 Upper Reach

The Upper Reach of Dunmunkle Creek extends from the Wimmera River offtake through to the confluence with Main Central Channel. The reach incorporates approximately 12 km of Dunmunkle Creek. The creek is intersected by several road crossings within this reach, namely Campbells Bridge Road, Glenorchy Road, Cemetery Road and Glenbrook Road.

The Main Central Channel offtake, which flows into Dunmunkle Creek at the downstream extent of this reach, bifurcates from the Wimmera River approximately six kilometres to the west at Glenorchy. Swedes Cutting (Creek), situated less than 200 m to the east of Dunmunkle Creek is a constructed channel designed to convey water from the Wimmera River to the Richardson River.

5.3.1.1 Physical Overview

The Dunmunkle Creek offtake is situated on the southern side of Campbells Bridge Road. The offtake is comprised of a man-made channel, constructed through an alluvial ridge of the Wimmera River, incorporating a culvert crossing beneath Campbells Bridge Road. The Dunmunkle Creek invert is situated approximately 5 m above the Wimmera River invert at the offtake. The culvert arrangement beneath Campbells Bridge Road exists in the form of a 300 mm pipe culvert and a butterfly value (Figure 5-6), understood to have been constructed by a local landholder. Historically, the valve was used to allow transfer of flow along Dunmunkle Creek, filling several large pools within the creek, after which point it would be turned off. However, the valve has not been operated in several years. Operation of the valve has been hindered by vandalism, however it is understood the valve could be operated in its current state (Water Technology, 2018).

The Upper Reach is characterised as comprising a channel form that is inclusive of palaeochannels associated with the abandonment of the Wimmera River (Figure 5-7). These palaeochannels are of similar geometry to the contemporary Wimmera River, typically comprising a channel width of 40 – 60 m and a depth of approximately 3 to 4 m (Figure 5-4). Comparatively, the remaining sections of channel are much narrower, typically being 10 – 15 m wide and approximately 2 – 4 m deep (Figure 5-5). It is likely that the narrower channel sections have been subject to historic channel enlargement works.

The majority of the observed refuge pools observed within Dunmunkle Creek are contained within the Upper Reach of the creek system (Figure 5-8). Given the last observed flow within Dunmunkle Creek was in 2016, the presence of water within these refuge pool suggests that creek receives localised inflows within this reach.

A series of in-channel weirs are present within the Upper Reach. The weirs are primarily fixed crest concrete weirs, however two earthen weirs were also observed (Figure 5-9). The weirs commonly take advantage of the wider palaeochannel sections to impound water. All of the observed weirs were in good condition.

There are several isolated instances of erosion within the Upper Reach. These include:

- A poor roadside drainage arrangement entering Dunmunkle Creek, situated on the northern side of Campbells Bridge Road which has resulted in the formation of a knickpoint within the roadside drain (Figure 5-10). Building waste has been placed over the knickpoint. However, this has been ineffective in managing the erosion.
- Several knickpoints, propagating away from Dunmunkle Creek, associated with floodplain flow re-entry points (Figure 5-11). These features are restricted to the section of creek between Campbells Bridge Road and Glenorchy Road.
- Several instances of sub-aerial erosion on the bank face associated with wind-blown and/or localised water erosion processes (Figure 5-12).

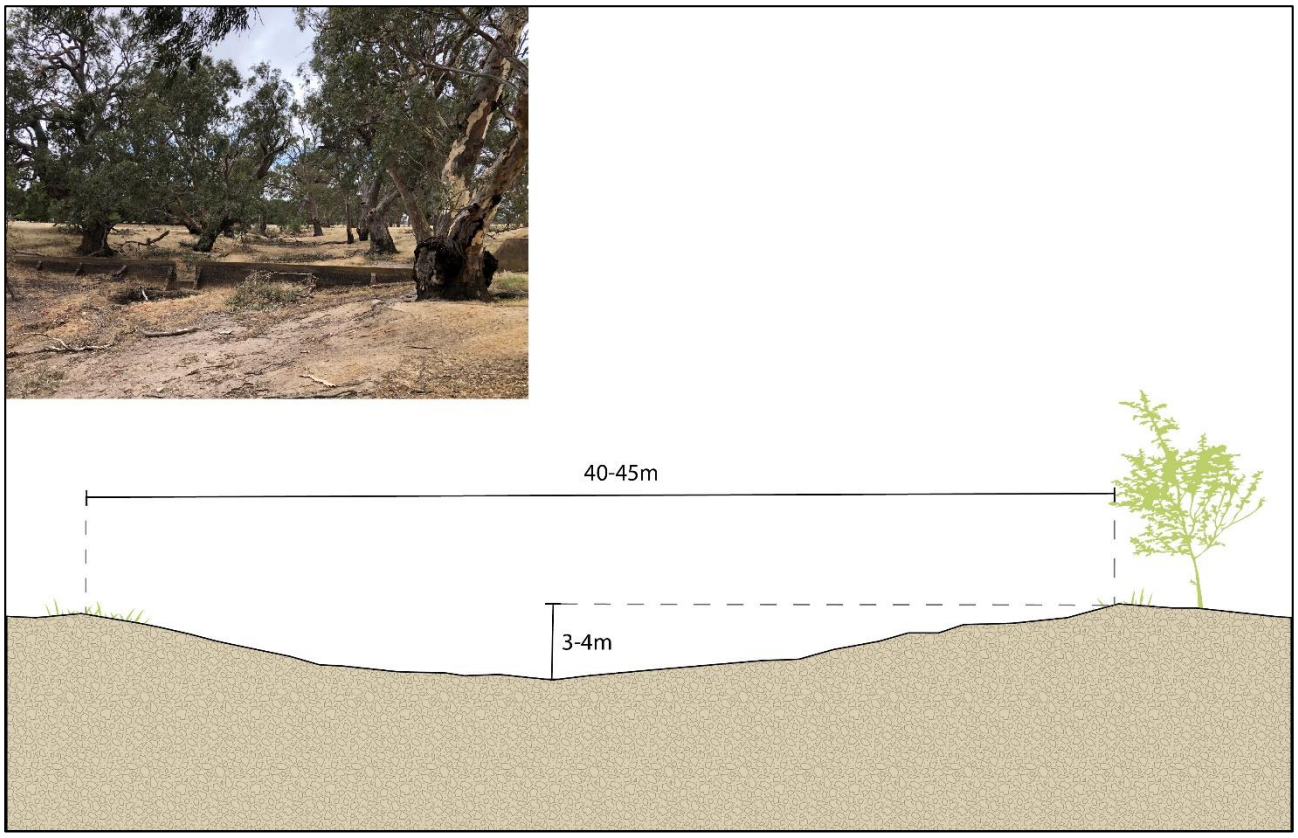

FIGURE 5-4 TYPICAL CHANNEL DIMENSIONS OF DUNMUNKLE CREEK WHERE THE CHANNEL INHERITS PALAEOCHANNELS OF THE WIMMERA RIVER.

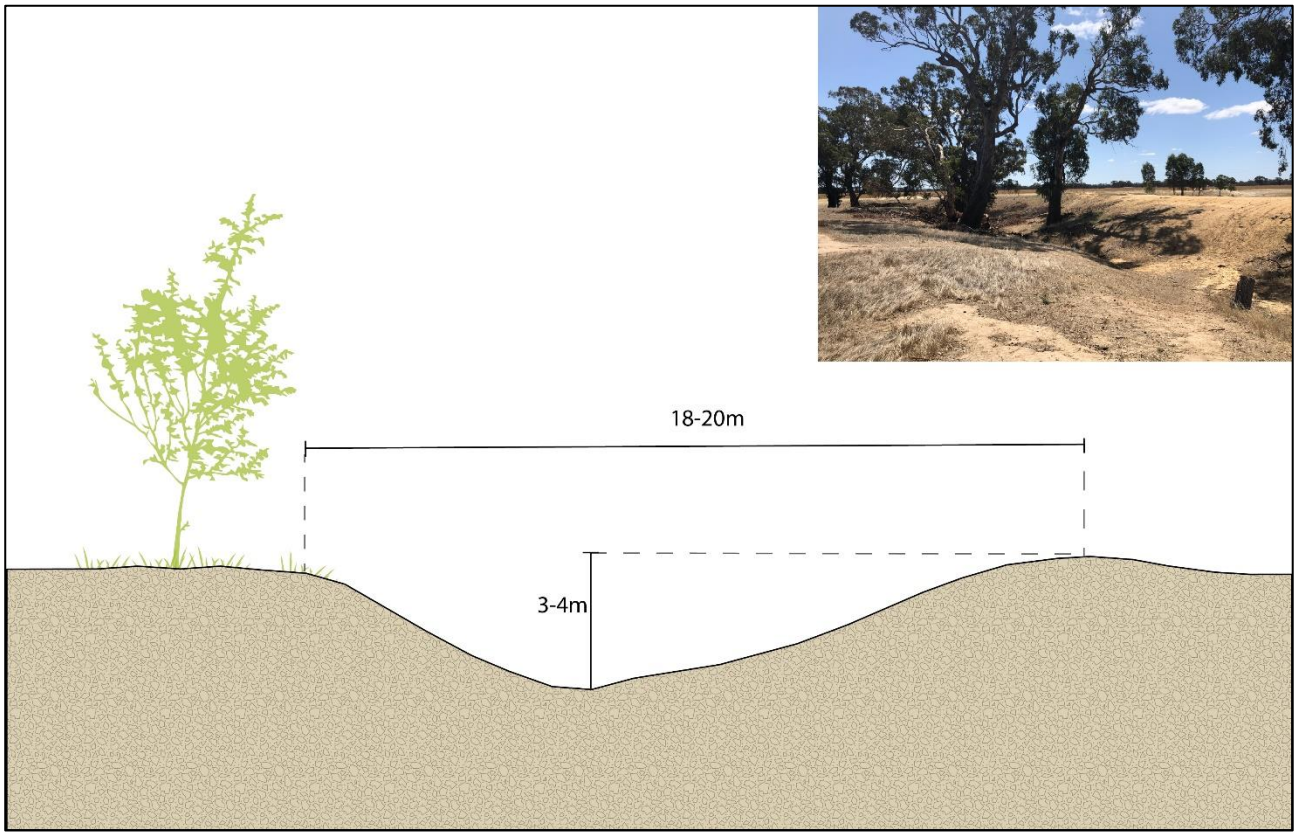

FIGURE 5-5 TYPICAL CHANNEL DIMENSIONS IN THE UPPER REACH EXCLUDING WHERE THE CHANNEL INHERITS PALAEOCHANNELS OF THE WIMMERA RIVER.

FIGURE 5-6 THE UPSTREAM SIDE OF THE CULVERT ARRANGEMENT BENEATH CAMPBELLS BRIDGE ROAD.

FIGURE 5-7 UPSTREAM VIEW OF A PALAEOCHANNEL SECTION OF DUNMUNKLE CREEK. THE UPPER REACH COMMONLY INHERITS THESE PALAEOCHANNEL FEATURES.

FIGURE 5-8 LOOKING UPSTREAM AT A REFUGE POOL. THESE POOLS ARE MORE COMMON WITHIN THE UPPER REACH THAN ANY OTHER REACH OF DUNMUNKLE CREEK.

FIGURE 5-9 AN UPSTREAM VIEW OF A CONCRETE WEIR.

FIGURE 5-10 LOOKING AT THE KNICKPOINT, FORMED THROUGH POOR ROADSIDE DRAINAGE ARRANGEMENTS ENTERING DUNMUNKLE CREEK ON THE CAMPBELLS BRIDGE ROAD.

FIGURE 5-11 A FLOODPLAIN KNICKPOINT, LOCATED AT A FLOOD FLOW RE-ENTRY POINT.

FIGURE 5-12 VIEW OF SUB-AERIAL BANK EROSION IN THE UPPER REACH.

5.3.1.2 Vegetation type and condition

The vegetation along this reach of the Dunmunkle Creek has affinities with the Drainage Line Woodland EVC, due to the River Red Gum (*Eucalyptus camaldulensis)* overstorey along the waterway and, where present, a native understorey of native grasses and herbs, rather than shrubs.

The quality of the vegetation the reach is generally high, punctuated by two scattered areas of low and one of medium quality vegetation. The vegetation in Hunts Bushland Reserve at the upstream extent of the reach has been classified as very high.

Hunts Bushland Reserve supports a relatively intact multi-aged remnant overstorey of River Red Gums over a relatively high diversity of native species in the understorey such as Wattles (*Acacia sp.),* wallaby grasses (*Rytidosperma* spp.), spear grasses (*Austrostipa spp.),* Black-anther Flax-lily (*Dianella revoluta*), Mat Rush (*Lomandra* sp.), herbs and natural recruitment. Weeds in this area included annual grasses such as Wild Oat, particularly on the edge of the reserve near Campbells Bridge Road, but they were less abundant in the centre of the reserve and further downstream.

FIGURE 5-13 HUNTS BUSHLAND RESERVE WHERE VEGETATION QUALITY WAS VERY HIGH

FIGURE 5-14 DUNMUNKLE CREEK CHANNEL IN HUNTS BUSHLAND RESERVE

Moving from Hunts Bushland Reserve downstream, Dunmunkle Creek passes through mixed farming land (sheep and cropping). Streamside vegetation to the end of the reach is generally characterised by large River Red Gums (some of which are very large e.g. 295 cm diameter at breast height), often with connected canopies (Figure 5-9). The understorey contains some native grasses (wallaby grasses and spear grasses) but is generally dominated by exotic annual grasses and pasture species. The degree and effectiveness of fencing is variable, and recruitment of native woody species is low due to low to medium stock pressure.

Two areas of low-quality vegetation in this reach were to the east of Callawadda Road and Cemetery Road where remnant trees had been cleared and very little remnant understorey vegetation was present due to high stock pressure. The single area of medium quality vegetation to the west of Dead Horse Lane did support remnant overstorey trees but stock pressure was also medium and the understorey was dominated by exotic annual grasses.

No threatened species or declared weeds were observed in this reach. However, evidence of rabbits and hares were observed. Rubbish dumping was evident on the corner of Glenbrook Road and Dead Horse Lane. Refer to maps in Appendix B.

FIGURE 5-15 RUBBISH DUMPING ON THE CORNER OF GLENBROOK ROAD AND DEAD HORSE LANE

5.3.1.3 Reach summary and management implications

Key values:

- refuge pools
- channel is likely to be a palaeochannel which was once an abandoned course of the Wimmera River
- large and very large River Red Gums
- continuity of vegetated corridor, and habitat along the majority of the reach
- very high vegetation quality in Hunts Bushland Reserve
- remnant vegetation EVCs are endangered.

Key threats:

- isolated instances of erosion
- rabbits in Hunts Bushland Reserve and further downstream
- two breaks in vegetation continuity (fragmentation) east of Callawadda Road and Cemetery Road
- rubbish dumping on the corner of Glenbrook Road and Dead Horse Lane.

Trajectory and management implications:

- Without intervention in the medium term (5-15 years) condition is likely to decline due to stock pressure.
- Key issues for management are riparian vegetation protection and enhancement, stock pressure and pest animals.

5.3.2 Middle Reach

The Middle Reach of Dunmunkle Creek extends from the confluence with the Main Central Channel through to the Wimmera Highway at the Rupanyup Memorial Park, extending approximately 36 km in length. The majority of the creek channel is situated within narrow Crown land parcels and incorporates wider Crown land reserves, including:

- Ridds Bushland Reserve, adjacent the Stawell – Warracknabeal Road
- Paynes Pool Bushland Reserve, adjacent the Stawell – Warracknabeal Road
- Bryntirion State Forest, adjacent the Stawell – Warracknabeal Road
- Rupanyup Memorial Park at Rupanyup.

5.3.2.1 Physical Overview

The Middle Reach is characterised by man-made channel sections in combination with natural channels that have been progressively enlarged (Figure 5-16). The in-channel geomorphic channel form is primarily uniform and flat, influenced by the progressive channel enlargement works, absence of large woody debris and progressive infilling (subsequent to the channel enlargement works). Shallow and small refuge pools were only occasionally observed. The remaining water in these pools is likely associated with local run-off. The channel is typically 8 – 10 m wide and approximately 1 – 2 m deep in this reach (Figure 5-17).

The Middle Reach commences at the confluence of Dunmunkle Creek and the Main Central Channel. A large concrete drop structure exists on the Main Central Channel, immediately upstream of the confluence (Figure 5-18). The concrete structure also incorporates provision for timber drop boards across the crest to impound flows on the upstream side. Whilst the flow impoundment element of the structure is redundant, the drop structure also provides a stable transition from a high bed elevation on the upstream side, to a lower bed elevation on the downstream side. Hence, this structure still provides an important role in channel bed stability at this location.

Evidence of historic bed deepening and associated channel widening was observed within Dunmunkle Creek within the section of creek both downstream and upstream of the Main Central Channel confluence (Figure 5-19). Whilst minor active bank erosion was still evident (Figure 5-20), the bed deepening processes no longer appear active.

The reach is also characterised by the presence of multiple GWMWater water regulation and impoundment structures. These structures are most common at road crossings and within the Bryntirion State Forest. The offtake arrangement with the Main Central Channel in the Bryntirion State Forest has been decommissioned through the placement of fill at the offtake channel. The flow regulating structures remain, however the gates/boards are open.

FIGURE 5-16 TYPICAL VIEW OF THE CREEK IN THE THIS REACH. THE CHANNEL HAS BEEN PROGRESSIVELY ENLARGED.

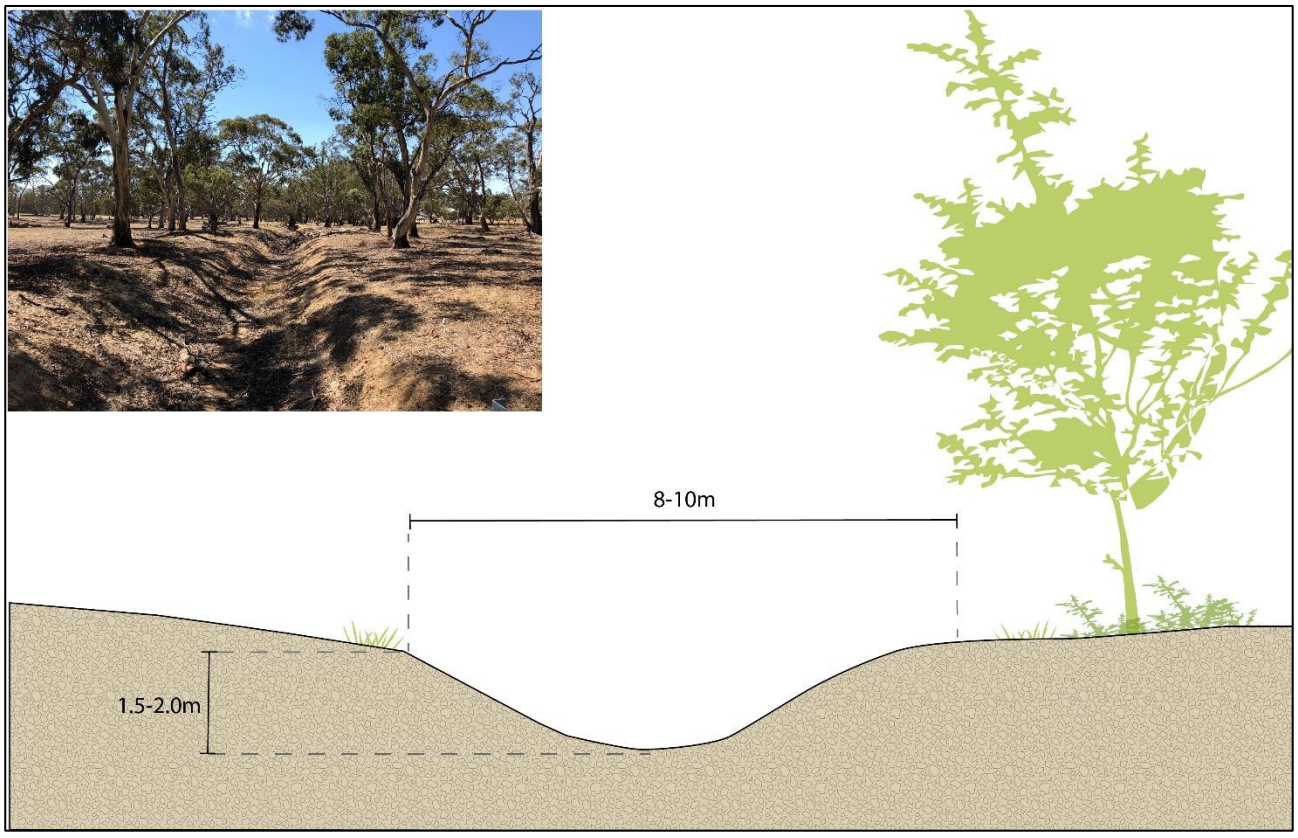

FIGURE 5-17 TYPICAL CHANNEL DIMENSIONS OF DUNMUNKLE CREEK IN THE MIDDLE REACH.

FIGURE 5-18 CONCRETE DROP STRUCTURE IMMEDIATELY UPSTREAM OF THE DUNMUNKLE CREEK–MAIN CENTRAL CHANNEL CONFLUENCE. THE STRUCTURE CONTROLS A CHANGE IN BED ELEVATION.

FIGURE 5-19 LOOKING UPSTREAM INTO DUNMUNKLE CREEK IMMEDIATELY UPSTREAM OF THE DUNMUNKLE CREEK – MAIN CENTRAL CHANNEL CONFLUENCE. THIS SECTION OF THE CHANNEL HAS BEEN SUBJECT TO HISTORIC BED DEEPENING.

FIGURE 5-20 ISOLATED BANK EROSION DOWNSTREAM OF THE DUNMUNKLE CREEK – MAIN CENTRAL CHANNEL CONFLUENCE.

5.3.2.2 Vegetation type and condition

The type and quality of the vegetation along this reach of Dunmunkle Creek is variable. The streamside vegetation in the upstream section of the reach has affinities with the Drainage Line Woodland EVC, due to the River Red Gum (*Eucalyptus camaldulensis)* scattered along the waterway. Where native understorey exists, it is dominated by native grasses and herbs.

In the Bryntirion State Forest and further downstream, the remnant vegetation changes to be more aligned with the Plains Woodland EVC. River Red Gum, along with Yellow Box, Grey Box and Buloke trees are present in the overstorey and the native understorey, where present, generally comprises native grasses such as wallaby grasses or spear grasses.

The condition of the remnant vegetation in this reach is generally higher at the upstream end near the Main Central Channel, where some areas of very high-quality vegetation were recorded in scattered bushland reserves and state forest. Areas of very-high quality vegetation were in the Ridds Bushland Reserve, Paynes Pool Bushland Reserve, the Dunmunkle Creek Water Frontage and Bryntirion State Forest. Two threatened species, Buloke and Slender Bindweed have been previously recorded in Ridds Bushland Reserve and registered with the VBA. In Dunmunkle Creek Water Frontage, particularly south of the Wattles Road, understorey diversity was high and included species such as Gold-dust Wattle (*Acacia acinacea*), Black-anther Flax-lily, Mat Rush (*Lomandra* sp.), wallaby grasses (*Rytidosperma* spp.), Common Wheat-grass (*Anthosachne scabra*) and spear grasses (*Austrostipa spp.).* Weed cover and stock pressure in this area were low.

FIGURE 5-21 VERY HIGH QUALITY VEGETATION IN THE DUNMUNKLE CREEK WATER FRONTAGE, SOUTH OF THE WATTLES ROAD

FIGURE 5-22 FLAX LILY AND GOLD DUST WATTLE (SMALL SHRUB, TOP RIGHT), DUNMUNKLE CREEK WATER FRONTAGE

The Bryntirion State Forest also supports some areas of high and very high-quality vegetation including herbs such as Lemon Beauty Heads (*Calocephalus citreus*) and Blue Devil (*Eryngium ovinum*). A previous survey in 1992 recorded the Bush Stone-curlew in remnant vegetation just south of the State Forest.

FIGURE 5-23 LEMON BEAUTY HEADS IN THE BRYNTIRION STATE FOREST (DECEMBER 2019)

FIGURE 5-24 BLUE DEVIL IN THE BRYNTIRION STATE FOREST (DECEMBER 2019)

High quality vegetation often extends from some of the reserves and state forest into mixed farming land (sheep and cropping) or exists where large River Red Gums or other canopy species provide good continuity and corridors along the waterway. In these areas, particularly where there have been no stock in recent years, native understorey species are common such as Flax Lily, Bindweed (*Convolvulus angustissimus*), Daisies (*Vittadinia* sp.), wallaby grasses, spear grasses and copperburrs, inter-mingled with exotic annual grasses. An example of this is the area of High-quality vegetation between Tinsley Road and the Bismark-Lubeck Road.

FIGURE 5-25 SPEAR GRASS, DAISIES AND OTHER NATIVE SPECIES BETWEEN TINSLEY ROAD AND THE BISMARK-LUBECK ROAD

Medium to low quality vegetation is scattered throughout the upstream half of the reach but then dominates the downstream end of the reach, particularly in cleared areas where cropping is the dominant land use.

Fencing was absent in a large proportion of the reach, particularly in the downstream cropped areas. Stock pressure was generally only low to medium. However, one area of high pressure was recorded north of Ashens-Jackson Road. Rubbish dumping was observed on the southern side of Minnieboro Road while rabbit damage was noted south of The Wattles Road. A fox was observed on C Readings Road. Declared weeds (Horehound, Bathurst Burr and African Boxthorn) were clustered at the downstream end of the reach, between Ashen-Jacksons Road and Rupanyup. Refer to maps in Appendix B.

FIGURE 5-26 HOREHOUND IN THE ROADSIDE SOUTH OF MCINTYRES ROAD

5.3.2.3 Reach summary and management implications

Key values:

- shallow and small refuge pools
- very high vegetation quality in Ridds Bushland Reserve, Paynes Pool Bushland Reserve, the Dunmunkle Creek Water Frontage and Bryntirion State Forest
- remnant vegetation EVCs are endangered
- threatened species – Buloke, Slender Bindweed; Bush Stone Curlew in remnant vegetation patches.

Key threats:

- minor active bank erosion
- high stock pressure north of Ashens-Jackson Road
- rubbish dumping on the southern side of Minnieboro Road
- rabbit damage
- fox.

Trajectory and management implications:

- Without intervention in the medium term (i.e. 5-15 years) condition is likely to decline due to stock pressure and weeds.
- Key issues for management are riparian vegetation protection and enhancement, stock pressure and pest animals.

5.3.3 Lower Reach

The lower reach of Dunmunkle Creek extends from the Wimmera Highway at Rupanyup through to Lawler Road at Boolite, extending approximately 43 km in length.

5.3.3.1 Physical Overview

The Lower Reach is characterised by a completely man-made channel form, where naturally a channel is unlikely to have existed. Prior to intervention, it is likely that the majority of this reach comprised a series of poorly defined depressions or discontinuous minor channel networks. In its current form, the channel is straight, incorporating a uniform and flat in-channel profile (Figure 5-27 and Figure 5-28). Levees, formed by the spoil deposits associated with the progressive channel enlargement commonly adjoin the channel on both sides (Figure 5-27 and Figure 5-28). The levees are most pronounced at the downstream end of the project area. Whilst these levee features were not constructed to manage over bank flows, in their current form they do influence flows, by confining flow in-channel. The channel dimensions within this reach are variable (Figure 5-28 and Figure 5-29).

Each of the road crossings that intersect Dunmunkle Creek within this reach incorporate redundant weirs on the upstream side of the road crossing. The weirs facilitated the installation of timber boards to impound flows when the stock and domestic water supply channel was operational. Some timber boards remain installed (Figure 5-30).

Minimal erosion is evident throughout the Lower Reach of Dunmunkle Creek. This is generally due to the low energy flow environment. In addition, the intensity of stock grazing throughout the project area is low and is generally not impacting upon channel stability. Isolated erosion was observed at the Gorman Road crossing, associated with poor roadside drainage arrangements entering Dunmunkle Creek (Figure 5-31).

FIGURE 5-27 TYPICAL VIEW OF DUNMUNKLE CREEK SHOWING THE LEVEES ON BOTH SIDES OF THE CHANNEL.

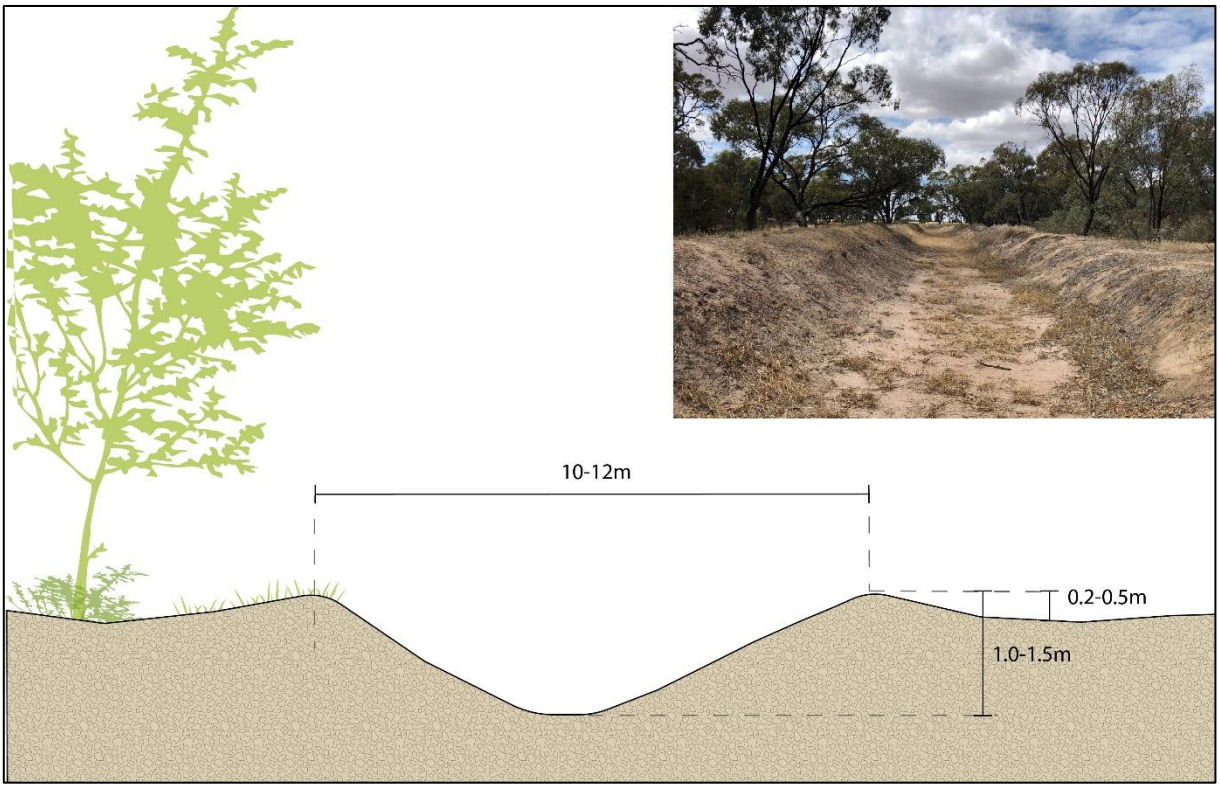

FIGURE 5-28 TYPICAL CHANNEL DIMENSIONS IN THE LOWER REACH OF DUNMUNKLE CREEK, SHOWING THE SPOIL MOUNDS THAT HAVE FORMED LEVEES.

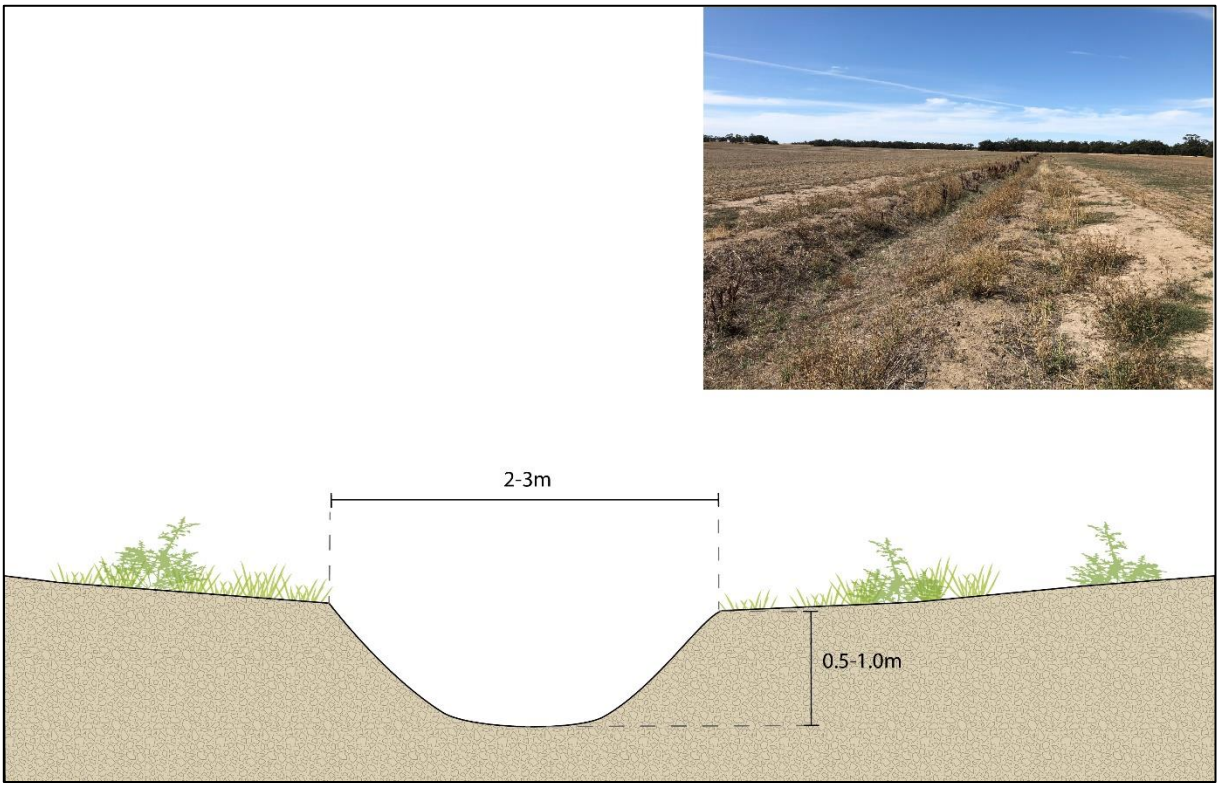

FIGURE 5-29 DUNMUNKLE CREEK CHANNEL DIMENSIONS IN THE LOWER REACH, WHERE AN OBVIOUS SPOIL MOUND IS NOT PRESENT.

FIGURE 5-30 A REDUNDANT WEIR, SITUATED ON THE UPSTREAM SIDE OF A ROAD CROSSING THAT INTERSECTS DUNMUNKLE CREEK.

FIGURE 5-31 UPSTREAM VIEW OF THE EROSION AT GORMAN ROAD CROSSING, ASSOCIATED WITH POOR ROADSIDE DRAINAGE ARRANGEMENTS.

5.3.3.2 Vegetation type and condition

The vegetation along the Lower Reach of Dunmunkle Creek, from Rupanyup to Boolite shows affinities with the Riparian Chenopod Woodland EVC, while the Plains Savanah EVC occurs slightly off stream. Overstorey vegetation in this reach is dominated by Black Box along the waterway and Buloke on rises or further off stream. Where present (i.e. in very high or very-high quality vegetation), the native understorey is dominated by lignum, saltbushes, copperburrs, wallaby grasses and herbs.

This reach is characterised by several linear Crown reserves which run along the waterway and support remnant vegetation. There is one area of 'very high' vegetation north of the Banyena Pimpinio Road, and several areas of 'high' quality riparian vegetation, particularly in the middle and northern sections of the reach. These areas were classified as very high or high quality as they provide continuous corridors of riparian vegetation along the creek. They also generally support a canopy of Black Box in the overstorey, associated with Buloke slightly off stream, and numerous understorey species. Species commonly observed in this layer include Tangled Lignum (*Duma florulenta*), Ruby Saltbush (*Enchylaena tomentosa* var. *tomentosa*), Roly-poly (*Sclerolaena muricata* var. *villosa*), Black Cotton Bush (*Maireana decalvans*), Grey Cooperburr (*Sclerolaena diacantha*), wallaby grasses and spear grasses. Other species observed at scatted locations include Blue Devil, Grey Germander (*Teucrium racemosum*), Quena (*Solanum esturiale*), Variable Sida (*Sida* corrugata), Pale Goodenia (*Goodenia glauca),* Bluebell (*Wahlenbergia* sp.), Nardoo (*Marsilea* sp.) and Wattle Mat Rush (*Lomandra filiformis*).

FIGURE 5-32 TYPICAL PHOTO OF HIGH QUALITY VEGETATION BESIDE THE CHANNEL (STH OF LAWLER ROD)

The VBA indicates that the Growling Grass Frog was observed near the intersection of the creek and the Banyena-Pimpinio Road in 2005 and that Turnip Copperburr, Slender Bindweed and Long Eryngium have been observed in Crown reserves between Rupanyup and the Banyena-Pimpinio Road. Bulokes are also located along the reach.

FIGURE 5-33 BULOKES NEAR THE CORNER OF MCLAUGHLIN LANE AND DUNMUNMKLE CREEK ROAD

FIGURE 5-34 BULOKE MISTLETOE, NORTH OF PYRES ROAD

Low to medium quality vegetation is present north of Rupanyup, either side of the Minyip-Banyena Road and the Donald-Murtoa Road. These areas are generally in cropped agricultural land with no remnant vegetation (low quality) or scattered overstorey trees and very occasional native understorey species only (medium quality). They are dominated by exotic annual species e.g. grasses such as wild oat and bromes.

FIGURE 5-35 TYPICAL PHOTO OF CROPPED LAND, LOW – MEDIUM QUALITY REMNANT VEGETATION, SOUTH OF PYRES ROAD

Fencing was absent in approximately half of the reach and stock pressure was low throughout. Rabbit damage e.g. burrows, scratchings and manure, was observed, in greater density than in the upper or middle reaches. Hares and foxes were not observed at the time of the field survey. Some Bathurst Burr plants were observed along the waterway between Rupanyup and the Banyena-Pimpinio Road and Horehound was also generally located in this area. African Boxthorn shrubs were scattered throughout the reach. Tortured willow was observed in the reserve north of the Wimmera Highway in Rupanyup. Prickly Pear was also observed on the Crown – freehold boundary on the left bank, south of Lawler Road. Refer to maps in Appendix B.

FIGURE 5-36 TORTURED WILLOWS NORTH OF THE WIMMERA HIGHWAY IN RUPANYUP

FIGURE 5-37 RABBIT BURROWS, NEAR GORMANS ROAD

FIGURE 5-38 BATHURST BURR ON THE CREEK, OPPOSITE ISBELS ROAD

FIGURE 5-39 AFRICAN BOXTHORN BETWEEN MINYIP-BANYENA ROAD AND BANYENA-PIMPINIO ROAD

5.3.3.3 Reach summary and management implications

Key values:

- very high-quality remnant vegetation north of the Banyena Pimpinio Road
- several areas of 'high' quality remnant vegetation in the middle and northern sections of the reach.
- remnant vegetation EVCs are endangered
- threatened species – Buloke, Turnip Copperburr, Slender Bindweed, Long Eryngium; Growling Grass Frog in remnant vegetation patches.

Key threats:

- declared weeds – Horehound, Bathurst Burr, African Boxthorn, Tortured Willow, Prickly Pear
- rabbit damage.

Trajectory and management implications:

- Without intervention in the medium term (i.e. 5-15 years) condition is likely to decline due to weeds and pest animal pressure.
- Key issues for management are riparian vegetation protection and enhancement, weeds management and pest animals.

6 MANAGEMENT OBJECTIVES AND ACTIONS

6.1 Objectives for the management of Dunmunkle Creek

Objectives for the future management of the Dunmunkle Creek were developed with Wimmera CMA as part of the project. The actions recommended by the WAP were prioritised in terms of their contribution to these objectives. The objectives are:

1. Improvement in river health (e.g. Index of Stream condition) of the Dunmunkle Creek
2. Protection of remnant vegetation (including Endangered EVCs and threatened species)
3. Improvement in landscape connectivity of vegetation (e.g. along the waterway or linking off-stream vegetation with the waterway corridor)
4. Improvement in flow connectivity to ecological assets (e.g. to enable environmental watering)
5. Protection of drought refuge for plants and animals
6. Maintenance of Social, Cultural or Economic values.

6.2 Key Management Principles, Tools and Recommendations

These management principles will assist the Wimmera CMA to plan and implement river health projects, mitigate risks and improve the environmental condition of the Dunmunkle Creek. It is important to acknowledge that most on-ground projects will involve a combination of management strategies to manage a particular threat(s) and to achieve a desired outcome.

The following on ground management techniques are considered most appropriate to achieve the objectives detailed in Section 6.1.

6.2.1 Vegetation Establishment

Healthy riparian zones are essential for maintaining healthy ecosystems and economic productivity along rivers. Vegetation establishment is a key technique for meeting the vision and objectives for waterway management within the Dunmunkle Creek project area. The benefits of vegetation within context of the Dunmunkle Creek Waterway Action Plan include:

- improving vegetation and habitat connectivity
- improving aquatic and terrestrial ecology values of a waterway
- improving in-channel geomorphic diversity.

In context of waterway health more broadly, the benefits of vegetation include:

- assisting channel stability and reducing rates of channel change
- increasing stream roughness and reducing instream velocities
- reducing sediment transport capacity throughout the stream network.

6.2.1.1 Revegetation

Revegetation is used to improve waterway health where the riparian corridor lacks remnant vegetation and seed bank may be absent. In time, revegetation will also provide a source of instream logs and branches, which in turn provides complex habitat such as pools, positively influencing aquatic biodiversity. Revegetation works are typically complemented by stock exclusion (or controlled grazing) and weed management.

Strategic revegetation programs are recommended throughout the Dunmunkle Creek project area to improve:

- the waterway health of Dunmunkle Creek, including surrounding refuge pools
- vegetation quality
- landscape connectivity.

The revegetation should comprise a suitable mixture of species with consideration of the relevant EVCs, namely:

- Drainage Line Woodland
- Plains Woodland
- Riparian Chenopod Woodland
- Plains Savannah.

A comprehensive revegetation program should aim to plant native species on the bank face, top of bank and beyond the top of bank for as wide as can be accommodated. The revegetation area should extend as far off stream as practical, **typically a minimum of ten metres** beyond top of bank.

Denser plantings are generally encouraged on the bank face and on outside bends. Additional revegetation recommendations include:

- A vegetation survey in an adjoining or nearby stream system with riparian vegetation will assist identification of the most appropriate native species. Take note of where particular species occur in relation to the river channel (e.g. lower bank, mid bank, upper bank or floodplain).
- Preferably a range of species should be used, including trees, shrubs and ground covers (as appropriate for the EVC and climate change predictions).
- If overstorey trees are already present, reduce or eliminate the number of trees planted.
- Utilise and protect natural recruitment of native species wherever present. These plants will have the greatest prospect for survival.
- Prior to planting seedlings, reduce weed cover as much as possible from the planting area. Ideally, one full year of weed control should occur before planting.
- Avoid ripping soils in riparian areas that may be subject to flooding.
- Soil preparation, the aim is to create good tilth (loose friable soil) in which to plant your seedlings.
- Newly planted seedlings may need protection from browsing or trampling from domestic or native animals.
- Gently water new plants with a few litres of water over the first year of their life.

The Wimmera CMA website contains further information, including relevant links to determine appropriate species selection (https://wcma.vic.gov.au/native-vegetation).

Riparian vegetation widths should be determined on an individual property/works site basis as part of the appropriate planning process taking into consideration:

- the works type proposed for the site
- ongoing management issues (e.g. weed spraying access)
- interaction of floodplain and channel landforms
- property size and layout
- estimated meander migration direction and rate
- estimated erosion rate

- ecological benefits
- existing infrastructure
- land planning issues
- stock access and watering
- existing remnant vegetation
- riparian corridor links.

6.2.2 Fencing (Stock Exclusion)

Fencing is the most common approach to control stock in the riparian zone. Fencing may be employed where stock exclusion will protect and/or enhance the riparian zone. This approach applies to numerous sections of waterway within the Dunmunkle Creek project area, where a healthy riparian zone (including remnant vegetation) is already present and a seed source for future natural recruitment is available. Stock exclusion can improve a riparian zone through natural regeneration and stream bank stability. Fencing also has the potential to improve the riparian zone in areas where existing vegetation is grazed and the density is declining. Complementary revegetation may be beneficial several years after the installation of fencing, targeting any species or structural and poor density areas not filled by natural recruitment.

Guidelines for the riparian vegetation in flood-prone areas have been prepared by the Victorian Department of Environment, Land, Water and Planning.

6.2.3 Weed management

Weed management involves the management (control or eradication) of all weeds deemed to have a negative influence on environmental health. As previously stated, Horehound and Boxthorn are the most prevalent weeds throughout the riparian zone within the project area. Without intervention these invasive weed species will continue to colonise the Dunmunkle Creek riparian zone. Hence a weed management program targeting the highly invasive and noxious weeds is strongly recommended.

6.2.4 Structural Intervention

Structural intervention works are generally not necessary or considered a priority for works within the context of this WAP due to the stable nature of the creek system. However, occasionally structural works may be required to address specific threats to stream health or other environmental/social or economic assets. In these instances, specialist design advice should be sought to ensure the intended works consider the relevant waterway processes and account for the necessary design considerations.

In the planning stage of a project aimed at managing erosion, it is important to assess the implications associated with not undertaking structural works. In many circumstances, erosion processes are most effectively managed in the long term through vegetation establishment and stock exclusion.

6.2.5 Decommissioning Works

A small number of the water regulation and impoundment structures present within Dunmunkle Creek currently contribute to stream bed stability (e.g. the large concrete drop structure on the Main Central Channel, immediately upstream of the confluence) (Figure 5-18). It is strongly recommended that the decommissioning project consider the role these structures are providing in regard to stream bed stability in the decommissioning process.

6.2.6 Crown Land Management

The majority of the Dunmunkle Creek channel is situated within narrow Crown land parcels throughout the length of the project area. Many of these parcels are licensed by DELWP to nearby landholders for grazing. It is recommended that these Grazing Licences be considered for amendment to Riparian Management Licences. This would result in a reduced cost to the landholder and the addition of special conditions to the licence schedule which could assist in protecting the high and very-high quality remnant vegetation in these areas.

All affected public land should be managed in accordance with DELWP policies and legislation. The affected land may also be subject to agreements or other tenures, as well as the Land Conservation Council final land use recommendations for public land in the Wimmera. These must be considered in the future management of these areas.

6.2.7 Rubbish Dumping

Rubbish dumping was occasionally observed during the field assessment. It is recommended that land management practices/improvement opportunities are discussed with the relevant land manager/authority to remove and avoid rubbish dumping close to the waterway.

6.3 Prioritisation process

A cost-benefit analysis was used to prioritise the recommended management actions in each Section of the Dunmunkle Creek. The method is described below.

6.3.1 Management Actions

The following management actions were considered in the prioritisation process:

- fencing
- fencing and revegetation
- weed management
- pest animal management
- structural erosion control works.

Management actions were determined on a site by site basis, for each section of the creek.

6.3.2 Method

The following steps describe the prioritisation process applied in the Excel spreadsheet supplied to Wimmera CMA.

- The project area was divided into a series of sections within each of the defined reaches (The Upper, Middle and Lower Reach) (Figure 6-1). The sections were divided according to road intersections or other physical or condition attributes.
- For each section of the creek, appropriate management actions were identified based on the values and threats recoded e.g. if a declared weed was recorded, weed management would apply.
- For each section, the relative benefit of each management option that applies was assessed in terms of its contribution to achieving the management objectives for Dunmunkle Creek (Objectives are listed in Section 6.1).

- The relative benefit of each management option towards achieving the objectives was rated using a Benefit Score between 1 and 5. For instance, the contribution of fencing and revegetation to the Objective 'improvement in landscape connectivity' is very high, so would achieve a Benefit Score of 5.
- In the Excel spreadsheet, Priority Scores for every Section were then calculated for the selected management options, to determine which action would provide the most beneficial return on investment. This process took the following information into account:
  - The Benefit Score
  - The Stream Length Protected (metres)
  - The Costs associated with the management option.

The priority works option for each Section was deemed to be the option with the highest Priority Score.

Across the project area, or in different Sections, the Priority Scores can be ranked and used to determine the highest priority actions for implementation.

The Excel spreadsheet supplied to Wimmera CMA is set up to allow the CMA to analyse and manipulate input data such as benefit scores and costs if required in future.

TABLE 6-1 BENEFIT SCORES

Benefit Score	Description
5	Very high
4	High
3	Moderate
2	Low
1	Very low

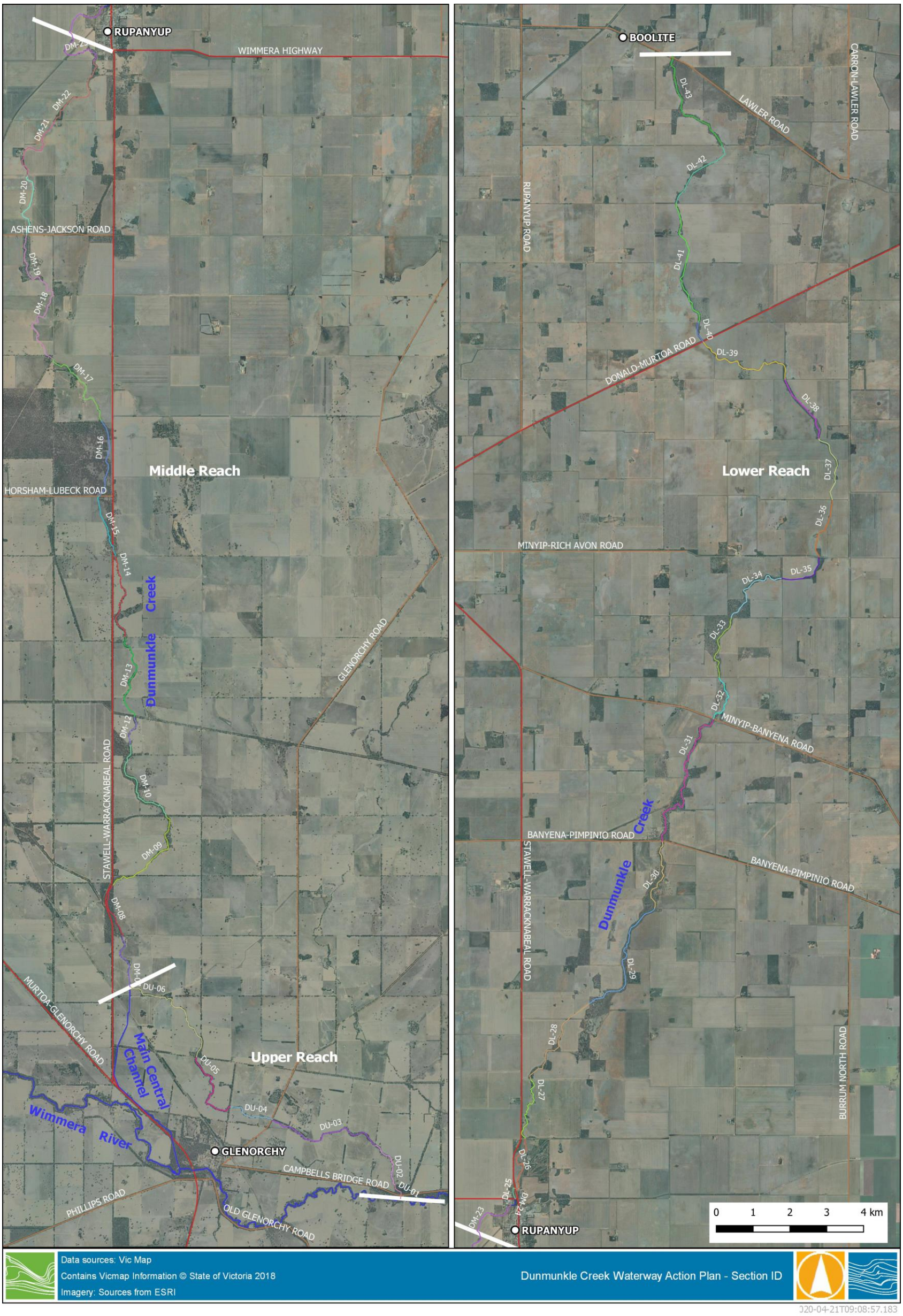

FIGURE 6-1 DEFINED SECTIONS USED IN THE PRIORITISATION PROCESS AND EXCEL SPREADSHEET.

TABLE 6-2 SECTION ID AND LOCATION DESCRIPTION (REFER FIGURE 6.1)

ID	Section Description	ID	Section Description
DU-01	Wimmera River offtake to downstream end of Hunts Bushland Reserve	DM-22	C Readings Road to McIntyres Road.
DU-02	Hunts Bushland Reserve to property boundary near weir.	DM-23	McIntyres Road to Rupanyup Memorial Park.
DU-03	Property boundary near weir to Glenorchy Road	DM-24	Upstream end of Rupanyup Memorial Park to Wimmera Highway.
DU-04	Glenorchy Road to Cemetery Road	DL-25	Wimmera Highway to Stawell - Warracknabeal Road.
DU-05	Cemetery Road to Glenbrook Road	DL-26	Stawell - Warracknabeal Road to Ballantines Road.
DU-06	Glenbrook Road to Main Central Channel confluence.	DL-27	Ballantines Road to Lallat North Road.
DM-07	Main Central Channel confluence to Ridd Road.	DL-28	Lallat North Road to unnamed road reserve.
DM-08	Ridd Road to downstream end of Ridds Bushland Reserve.	DL-29	Unnamed road reserve to Ryan Lane.
DM-09	Downstream end of Ridds Bushland Reserve to Riachella Tramline Road	DL-30	Ryan Lane to Banyena - Pimpinio Road.
DM-10	Riachella Tramline Road to Paynes Pool Bushland Reserve.	DL-31	Banyena - Pimpinio Road to Minyip - Banyena Road.
DM-11	Paynes Pool Bushland Reserve.	DL-32	Minyip - Banyena Road to Gun Club Rad.
DM-12	Downstream end of Paynes Pool Bushland Reserve to Minnieboro Road	DL-33	Gun Club Road to unnamed road.
DM-13	Minnieboro Road to Tinsley Road.	DL-34	Unnamed road to Gorman Road.
DM-14	Tinsley Road to Bismark - Lubeck Road.	DL-35	Gorman Road to Minyip - Rich Avon Road.
DM-15	Bismark - Lubeck Road to Horsham - Lubeck Road.	DL-36	Minyip - Banyena Road to Switchback Road.
DM-16	Bryntirion State Forest	DL-37	Switchback Road to Dunmunkle Estate Road.
DM-17	Bryntirion State Forest to Bryntirion Road	DL-38	Dunmunkle Estate Road to Delavedovas Road.
DM-18	Bryntirion Road to Len Matthews Road.	DL-39	Delavedovas Road to Donald - Murtoa Road.
DM-19	Len Matthews Road to Ashens - Jackson Road.	DL-40	Donald - Murtoa Road to McLachlans Road.
DM-20	Ashens-Jackson Road to Hopefield Road.	DL-41	McLachlans Road to Walkers Road.
DM-21	Hopefields Road to C Readings Road.	DL-42	Walkers Road to Pyres Road.

6.4 Prioritised Management Actions

The recommended management actions for each section of the project area have been presented to Wimmera CMA in MS Excel format

6.5 Complementary Measures

The following complementary actions which have not been included in the prioritisation process as costs are negligible or variable, are also recommended.

6.5.1 Opportunities for naturalisation/decommissioning

During the field inspections opportunities for naturalisation or channel decommissioning, in addition to that already recommended by RPS (2018), were recorded. The criteria used for identifying these sites were:

- High value vegetation areas, where environmental watering has the potential to maintain/improve the vegetation quality.
- Relatively wide Crown land parcels, positioned in the landscape so that flooding would not extend to agricultural land
- Waterway sections with limited channel capacity where decommissioning works would not be onerous, e.g. the existing channel bed is relatively close in height to the surrounding floodplain, and the banks of the channel would be easy to breach or remove.

The sites selected are all situated within the Lower Reach (downstream of Rupanyup) and identified in Figure 6-2. The relevant sections include:

- DL-28 to DL-31.
- DL-33 to DL-34.

The watering considerations for specific vegetation communities differ. Specific management recommendations for the Riparian Chenopod Woodland EVC are provided in Frood and Papas (2016) and include:

- The ecological context in which this EVC occurs is variable and not all examples are flood-prone.
- If Tangled Lignum (*Duma florulenta*) is present, the vegetation is potentially subject to infrequent inundation (shallow and short duration) during higher level flooding events.
- Sustained flooding can cause serious damage to this EVC.
- Inundation should be less than 3 years in every 10.
- Duration of waterlogging – 1 to 6 months.
- Duration of inundation – less than 1 month.
- Water depth – very shallow, less than 30 cm.
- Critical assessment of the associated flora should precede any decision to deliver environmental water. Any requirement for associated engineering works to deliver water should raise concerns, and extreme caution is required to avoid unintended associated ecological damage. If environmental water is delivered, it should be supplied during cooler months and artificial water retention should be avoided.

Any potential impacts to land, water, biodiversity and cultural heritage caused by changes to water regimes or ground disturbing works, must be discussed with the relevant stakeholders, including the community, the Barengi Gadjin Land Council and DELWP, prior to implementation. A cultural heritage management plan may be required for ground disturbing works. This should be developed and implemented in partnership with the

Barengi Gadjin Land Council. Potential impacts to vegetation will also need to be discussed with DELWP and considered in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017a) and the *Flora and Fauna Guarantee Act 1988* (FFG Act). For all on-ground works on public land within DELWP's portfolio responsibilities, including for earthworks, tree removal, lopping or planting, as well as revegetation works, the written consent of DELWP must be obtained prior to any proposed works or activities being undertaken (DELWP, 2020d).

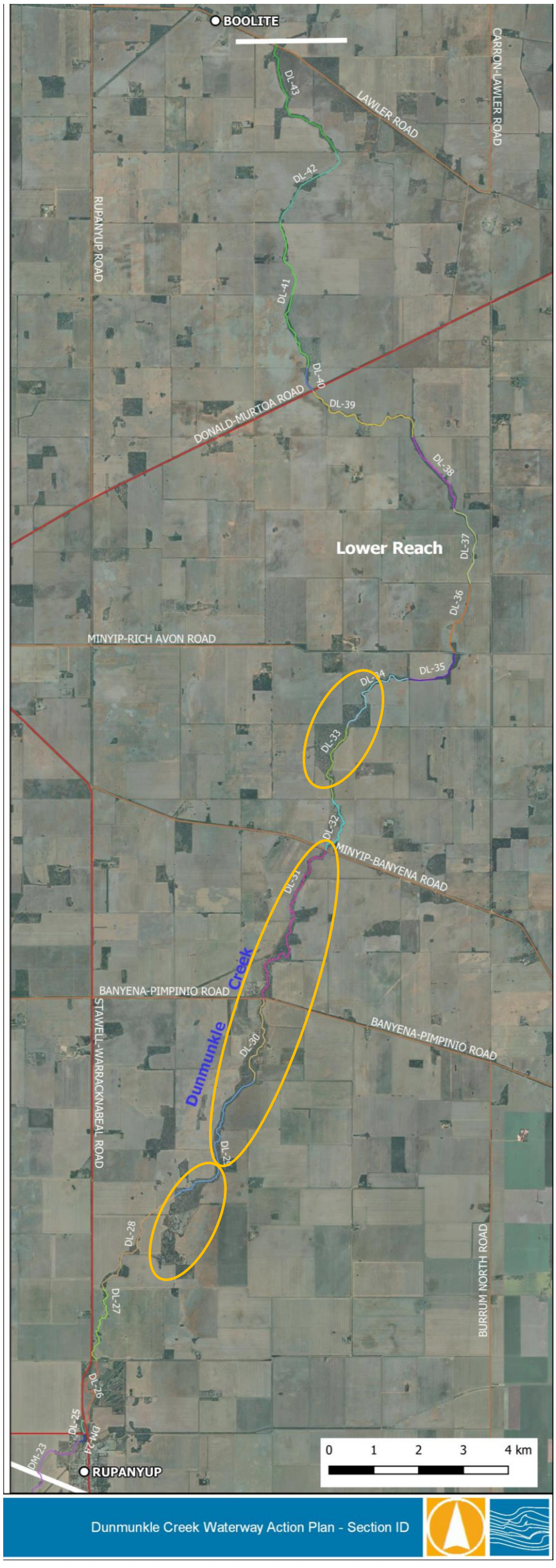

FIGURE 6-2 DEFINED SECTIONS WHERE DECOMMISSIONING OPPORTUNITIES EXIST TO IMPROVE HIGH VALUE VEGETATION AREAS.

6.5.2 Crown water frontages

It is recommended that the Grazing Licences in the Crown reserve, particularly those which support wide areas of remnant vegetation, be considered for amendment to riparian management licences. This would result in a reduced cost to the licensee (and it appears that these areas are not heavily grazed at the moment) and would allow for the addition of special conditions on the licence schedule that would preserve the remnant vegetation in the area.

6.5.3 Rubbish dumping

- Rubbish dumping was observed in the project area. It is recommended that two isolated instances be followed up with the relevant authorities to be addressed. These include: a large assortment of hard rubbish e.g. fridge, metal etc over approximately a 50 x 50 metre area on what is likely to be Crown land.
- a small area of household rubbish e.g. a pram, car battery etc in a roadside reserve.

Further location details are in the MS Excel Actions spreadsheet provided to Wimmera CMA.

7 MONITORING AND EVALUATION

The effectiveness and relevance of the Dunmunkle Creek WAP should be reviewed and monitored over-time. This review will enable the incorporation of new data and information, to check whether values, threats and management actions remain current and allow for adaptive management. This is particularly important given the release of new Regional Catchment and Waterway Strategies over the next few years.

Monitoring and evaluation may be on several levels, ranging from the monitoring of the implementation of individual actions, to changes in environmental condition in key areas, through to the effectiveness of the WAP itself.

The Wimmera CMA could decide on key evaluation questions, at different levels, that are linked to the management objectives of the WAP. Monitoring and reporting should be output and outcome based, independent and objective. It should include an assessment of what was done, what has been achieved, what else is necessary (follow up actions) and what had changed since the development of the WAP.

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

APPENDIX A
EVC BENCHMARKS

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Wimmera bioregion

EVC 679: Drainage-line Woodland

Description:
Sedge and rush-dominated eucalypt woodland to 15 m tall occurring along intermittent creeks in areas where annual rainfall is less than 500 mm.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	*Eucalyptus camaldulensis*	River Red Gum
	Eucalyptus microcarpa	Grey Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Large Herb	2	5%	LH
Medium Herb	5	10%	MH
Small or Prostrate Herb	1	1%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	6	20%	MTG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		**60%**	

LF Code	Character Species	Common Name
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Acaena echinata*	Sheep's Burr
LTG	*Carex appressa*	Tall Sedge
LTG	*Carex tereticaulis*	Sedge Rush
MTG	*Cyperus gunnii* ssp. *gunnii*	Flecked Flat-sedge
MTG	*Elymus scaber* var. *scaber*	Common Wheat-grass
MTG	*Lachnagrostis filiformis*	Common Blown-grass

Recruitment:
Continuous

Organic Litter:
40% cover

Logs:
20m/0.1 ha

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Cirsium vulgare*	Spear Thistle	high	low
LH	*Plantago lanceolata*	Ribwort	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Anagallis arvensis*	Pimpernel	high	low
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
MNG	*Briza maxima*	Large Quaking-grass	high	low
MNG	*Romulea rosea*	Onion Grass	high	low
MNG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MNG	*Briza minor*	Lesser Quaking-grass	high	low
MNG	*Aira elegantissima*	Delicate Hair-grass	high	low

EVC 679: Drainage-line Woodland - Wimmera bioregion

Published by the Victorian Government Department of Sustainability and Environment May 2004

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Wimmera bioregion

EVC 803: Plains Woodland

Description:
Grassy or sedgy woodland to 15 m tall with large inter-tussock spaces potentially supporting a range of annual or geophytic herbs adapted to low summer rainfall, with low overall biomass. Mostly occurs on terrain of low relief in areas receiving <600 mm rainfall per annum. Fertile, sometimes seasonally waterlogged, mostly silty, loamy or clay topsoils, with heavy subsoils, derived largely from former Quaternary swamp deposits.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	15 / ha
Allocasuarina luehmannii	40 cm	

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	*Eucalyptus leucoxylon*	Yellow Gum
	Allocasuarina luehmannii	Buloke
	Eucalyptus microcarpa	Grey Box
	Eucalyptus melliodora	Yellow Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	2	5%	MS
Small Shrub	2	5%	SS
Prostrate Shrub	1	1%	PS
Large Herb	1	1%	LH
Medium Herb	20	25%	MH
Small or Prostrate Herb	4	10%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	16	30%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C

Recruitment:
Continuous

Organic Litter:
10 % cover

Logs:
10 m/0.1 ha.

EVC 803: Plains Woodland - Wimmera bioregion

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Acacia pycnantha*	Golden Wattle
MS	*Acacia acinacea* s.l.	Gold-dust Wattle
SS	*Eutaxia microphylla* var. *microphylla*	Common Eutaxia
PS	*Astroloma humifusum*	Cranberry Heath
LH	*Senecio quadridentatus*	Cotton Fireweed
MH	*Acaena echinata*	Sheep's Burr
MH	*Plantago gaudichaudii*	Narrow Plantain
MH	*Maireana enchylaenoides*	Wingless Bluebush
MH	*Calocephalus citreus*	Lemon Beauty-heads
SH	*Solenogyne dominii*	Smooth Solenogyne
SH	*Oxalis perennans*	Grassland Wood-sorrel
SH	*Daucus glochidiatus*	Austral Carrot
SH	*Goodenia pinnatifida*	Cut-leaf Goodenia
LTG	*Austrostipa mollis*	Supple Spear-grass
MTG	*Austrostipa scabra*	Rough Spear-grass
MTG	*Austrodanthonia setacea*	Bristly Wallaby-grass
MTG	*Dianella revoluta* s.s.	Black-anther Flax-lily
MTG	*Austrodanthonia caespitosa*	Common Wallaby-grass
MNG	*Wurmbea dioica*	Common Early Nancy
TTG	*Centrolepis strigosa* ssp. *strigosa*	Hairy Centrolepis
TTG	*Centrolepis aristata*	Pointed Centrolepis
EP	*Amyema miquelii*	Box Mistletoe
SC	*Thysanotus patersonii*	Twining Fringe-lily
SC	*Convolvulus erubescens* spp. agg.	Pink Bindweed

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Trifolium angustifolium* var. *angustifolium*	Narrow-leaf Clover	high	low
MH	*Hypochoeris glabra*	Smooth Cat's-ear	high	low
MH	*Arctotheca calendula*	Cape Weed	high	low
MH	*Petrorhagia velutina*	Velvety Pink	high	low
MH	*Trifolium dubium*	Suckling Clover	high	low
MH	*Anagallis arvensis*	Pimpernel	high	low
SH	*Trifolium glomeratum*	Cluster Clover	high	low
LNG	*Avena fatua*	Wild Oat	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Briza minor*	Lesser Quaking-grass	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low
MTG	*Lolium rigidum*	Wimmera Rye-grass	high	low
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MNG	*Vulpia myuros*	Rat's-tail Fescue	high	low
MNG	*Juncus capitatus*	Capitate Rush	high	low
MNG	*Bromus rubens*	Red Brome	high	low

Published by the Victorian Government Department of Sustainability and Environment May 2004

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Wimmera bioregion

EVC 103_62: *Northern Wimmera* Riverine Chenopod Woodland

Description:
Eucalypt woodland to 15 m tall with a diverse shrubby and grassy understorey occurring on most elevated riverine terraces. Confined to heavy clay soils on higher level terraces within or on the margins of riverine floodplains (or former floodplains), naturally subject to only extremely infrequent incidental shallow flooding from major events if at all flooded. Occurs in areas with <500 mm annual rainfall.

Large trees:

Species	DBH(cm)	# / ha
Eucalyptus largiflorens	40 cm	5/ha

Tree Canopy Cover:

% cover	Character Species	Common Name
10%	*Eucalyptus largiflorens*	Black Box

Understorey:

Life form	# Spp	% Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	3	30%	MS
Small Shrub	5	25%	SS
Prostrate Shrub	1	1%	PS
Medium Herb	5	5%	MH
Small or Prostrate Herb*	5	10%	SH
Medium to Small Tufted Graminoid	2	5%	MTG
Soil Crust	na	10%	S/C
* Largely seasonal life form			
Total understorey projective foliage cover		**65%**	

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia stenophylla*	River Coobah
MS	*Atriplex nummularia*	Old-man Saltbush
MS	*Chenopodium nitrariaceum*	Nitre Goosefoot
MS	*Eremophila divaricata* ssp. *divaricata*	Spreading Emu-bush
SS	*Sclerolaena tricuspis*	Streaked Copperburr
SS	*Enchylaena tomentosa* var. *tomentosa*	Ruby Saltbush
SS	*Atriplex lindleyi*	Flat-top Saltbush
SS	*Rhagodia spinescens*	Hedge Saltbush
PS	*Sclerochlamys brachyptera*	Short-wing Saltbush
MH	*Einadia nutans* ssp. *nutans*	Nodding Saltbush
MH	*Calocephalus sonderi*	Pale Beauty-heads
MH	*Senecio glossanthus*	Slender Groundsel
MH	*Brachyscome lineariloba*	Hard-head Daisy
SH	*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
SH	*Maireana pentagona*	Hairy Bluebush

Recruitment:
Continuous

Organic Litter:
5% cover

Logs:
5m/0.1 ha.

Victoria The Place To Be

EVC 103_62: *Northern Wimmera* Riverine Chenopod Woodland - Wimmera bioregion

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	*Olea europaea* subsp. *europaea*	Olive	high	high
MS	*Lycium ferocissimum*	Boxthorn	high	high
LH	*Sisymbrium erysimoides*	Smooth Mustard	high	high
LH	*Critesion* spp.	Barley-grass	high	low
LH	*Gazania linearis*	Gazania	high	high
LH	*Opuntia* spp.	Cactus	high	high
LH	*Sisymbrium irio*	London Mustard	high	high
LH	*Psilocaulon granulicaule*	Noon-flower	high	high
MH	*Limonium sinuatum*	Notch-leaf Sea-lavender	high	high
MH	*Limonium lobatum*	Winged Sea-lavender	high	high
MH	*Trifolium arvense* var. *arvense*	Hare's-foot Clover	high	low
MH	*Mesembryanthemum nodiflora*	Ice-plant	high	high
MH	*Carrichtera annua*	Ward's Weed	high	high
MH	*Marrubium vulgare*	Horehound	high	high
MH	*Carpobrotus aequilaterus*	Angled Pigface	high	high
MH	*Silene apetala* var. *apetala*	Sand Catchfly	high	low
MH	*Medicago* spp.	Medic	high	low
MH	*Oxalis pes-caprae*	Soursob	high	high
MH	*Silene gallica*	French Catchfly	high	low
MH	*Silene nocturna*	Mediterranean Catchfly	high	low
SH	*Mesembryanthemum crystallinum*	Common Ice-plant	high	high
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	high
MTG	*Lolium rigidum*	Wimmera Rye-grass	high	low
MTG	*Asphodelus fistulosus*	Onion Weed	high	high
MNG	*Bromus rubens*	Red Brome	high	high
MNG	*Vulpia myuros*	Rat's-tail Fescue	high	low
MNG	*Bromus* spp.	Brome	high	high
MNG	*Schismus barbatus*	Arabian Grass	high	low
SC	*Asparagus asparagoides*	Bridal Creeper	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Wimmera bioregion

EVC 826: Plains Savannah

Description:
A structurally diverse vegetation unit which includes 'grassy openings' of a few to many hundreds of hectares, with a variable tree density ranging from a very sparse savanna to woodland. The relative absence of eucalypts is particularly characteristic, with *Allocasuarina luehmannii* and perhaps *Callitris gracilis* subsp. *murrayensis* to 10 m tall being the dominant trees.

[+] woodland only components (ignore when assessing grassland areas and standardise final score as appropriate)

Large trees[+]:

Species	DBH(cm)	#/ha
Allocasuarina luehmannii	40 cm	5/ha
Callitris gracilis subsp. *murrayensis*		

Tree Canopy Cover[+]:

% cover	Character Species	Common Name
10%	*Allocasuarina luehmannii*	Buloke
	Callitris gracilis ssp. *murrayensis*	Slender Cypress-pine

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree[+]		5%	IT
Small Shrub	2	5%	SS
Large Herb	3	5%	LH
Medium Herb*	6	20%	MH
Small or Prostrate Herb*	3	10%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	5	35%	MTG
Medium to Tiny Non-tufted Graminoid*	2	5%	MNG
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	25%	S/C

* Largely seasonal life form

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia pendula*	Boree
MS	*Acacia oswaldii*	Umbrella Wattle
SS	*Sclerolaena napiformis*	Turnip Copperburr
SS	*Sclerolaena diacantha*	Grey Copperburr
SS	*Maireana decalvans*	Black Cotton-bush
SS	*Pimelea curviflora* s.s.	Curved Rice-flower
LH	*Ptilotus exaltatus*	Mulla Mulla
LH	*Eryngium ovinum*	Blue Devil
LH	*Calocephalus citreus*	Lemon Beauty-heads
LH	*Arthropodium fimbriatum*	Nodding Chocolate-lily
MH	*Calotis scabiosifolia*	Rough Burr-daisy
MH	*Goodenia pinnatifida*	Cut-leaf Goodenia
MH	*Sida corrugata*	Variable Sida
MH	*Ptilotus macrocephalus*	Feather Heads
SH	*Maireana pentagona*	Hairy Bluebush
SH	*Chamaesyce drummondii*	Flat Spurge
SH	*Pogonolepis muelleriana*	Stiff Cup-flower
SH	*Convolvulus erubescens* spp. agg.	Pink Bindweed
LTG	*Austrostipa blackii*	Crested Spear-grass
LTG	*Austrostipa gibbosa*	Spurred Spear-grass
LTG	*Austrostipa aristiglumis*	Plump Spear-grass
MTG	*Austrostipa scabra*	Rough Spear-grass
MTG	*Austrostipa nodosa*	Knotty Spear-grass
MTG	*Whalleya proluta*	Rigid Panic
MTG	*Austrodanthonia duttoniana*	Brown-back Wallaby-grass

EVC 826: Plains Savannah - Wimmera bioregion

Recruitment:
Continuous

Organic Litter:
5% cover

Logs+:
5 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Lycium ferocissimum*	Boxthorn	high	high
LH	*Helminthotheca echioides*	Ox-tongue	high	low
LH	*Lepidium africanum*	Common Peppercress	high	low
LH	*Salvia verbenaca*	Wild Sage	high	high
LH	*Echium plantagineum*	Patterson's curse	high	high
LH	*Sisymbrium irio*	London Rocket	high	high
LH	*Marrubium vulgare*	Horehound	high	high
LNG	*Avena fatua*	Wild Oat	high	high
MH	*Limonium sinuatum*	Notch-leaf Sea-lavender	high	high
MH	*Arctotheca calendula*	Cape Weed	high	high
MH	*Hypochoeris glabra*	Smooth Cat's-ear	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Oxalis pes-caprae*	Soursob	high	high
MH	*Plantago coronopus*	Buck's-horn Plantain	high	high
MH	*Spergularia rubra* s.l.	Red Sand-spurrey	high	low
MH	*Trifolium angustifolium* var. *angustifolium*	Narrow-leaf Clover	high	high
MH	*Trifolium arvense* var. *arvense*	Hare's-foot Clover	high	high
MH	*Trifolium campestre* var. *campestre*	Hop Clover	high	high
MH	*Trifolium striatum*	Knotted Clover	high	low
MH	*Trifolium subterraneum*	Subterranean Clover	high	low
MH	*Hedypnois cretica*	Cretan Hedypnois	high	high
MNG	*Aira cupaniana*	Quicksilver Grass	high	low
MNG	*Avena barbata*	Bearded Oat	high	high
MNG	*Brachypodium distachyon*	False Brome	high	high
MNG	*Juncus capitatus*	Capitate Rush	high	high
MNG	*Vulpia muralis*	Wall Fescue	high	high
MNG	*Vulpia myuros*	Rat's-tail Fescue	high	high
MTG	*Bromus diandrus*	Great Brome	high	high
MTG	*Critesion hystrix*	Mediterranean Barley-grass	high	high
MTG	*Critesion murinum*	Barley-grass	high	high
MTG	*Lolium rigidum*	Wimmera Rye-grass	high	high
MTG	*Pentaschistis airoides* ssp. *airoides*	False Hair-grass	high	low
MTG	*Poa bulbosa*	Bulbous Meadow-grass	high	high
MTG	*Romulea minutiflora*	Small-flower Onion-grass	high	high
MTG	*Romulea rosea*	Onion Grass	high	high
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	high
SH	*Medicago minima*	Little Medic	high	high
SH	*Medicago polymorpha*	Burr Medic	high	high
SH	*Trifolium glomeratum*	Cluster Clover	high	low

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WATER TECHNOLOGY
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APPENDIX B
MAPS
1. REMNANT VEGETATION QUALITY
2. THREATENED SPECIES
3. PEST PLANTS AND ANIMALS
4. FENCING STATUS
5. STOCK GRAZING PRESSURE

RUPANYUP
WIMMERA HIGHWAY
STAWELL-WARRACKNABEAL ROAD
ASHENS-JACKSON ROAD
HORSHAM-LUBECK ROAD
Middle Reach
Dunmunkle Creek
GLENORCHY ROAD
MURTOA-GLENORCHY ROAD
Main Central Channel
Upper Reach
Wimmera River
GLENORCHY
CAMPBELLS BRIDGE ROAD
PHILLIPS ROAD
OLD GLENORCHY ROAD
BOOLITE
LAWLER ROAD
CARRON-LAWLER ROAD
RUPANYUP ROAD
DONALD-MURTOA ROAD
Lower Reach
MINYIP-RICH AVON ROAD
MINYIP-BANYENA ROAD
BANYENA-PIMPINIO ROAD
STAWELL-WARRACKNABEAL ROAD
Dunmunkle Creek
WIMMERA HIGHWAY
RUPANYUP
WIMMERA HIGHWAY

LEGEND

Riparian Condition

- Very High
- High
- Medium
- Low

0 1 2 3 km

Data sources: Vic Map

Contains Vicmap Information © State of Victoria 2018

Imagery: Sources from ESRI

Dunmunkle Creek Waterway Action Plan - Riparian Vegetation Condition

020-03-25T13:23:36.285

RUPANYUP
WIMMERA HIGHWAY
ASHENS-JACKSON ROAD
HORSHAM-LUBECK ROAD
Middle Reach
Dunmunkle Creek
GLENORCHY ROAD
STAWELL-WARRACKNABEAL ROAD
MURTOA-GLENORCHY ROAD
Main Central Channel
Upper Reach
Wimmera River
GLENORCHY
CAMPBELLS BRIDGE ROAD
PHILLIPS ROAD
OLD GLENORCHY ROAD
BOOLITE
LAWLER ROAD
CARRON-LAWLER ROAD
RUPANYUP ROAD
DONALD-MURTOA ROAD
Lower Reach
MINYIP-RICH AVON ROAD
MINYIP-BANYENA ROAD
BANYENA-PIMPINIO ROAD
Dunmunkle Creek
STAWELL-WARRACKNABEAL ROAD
BANYENA-PIMPINIO ROAD
WIMMERA HIGHWAY
RUPANYUP
WIMMERA HIGHWAY

LEGEND

Threat Flora (VBA Record)
- Buloke
- Long Eryngium
- Pin Sida
- Slender Bindweed
- Turnip Copperburr

Threated Fauna (VBA Record)
- Bush Stone-curlew
- Growling Grass Frog

Threatend Species (Field Observation)
- Buloke

0 1 2 3 km

Dunmunkle Creek Waterway Action Plan - Threatened Flora and Fauna

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RUPANYUP
WIMMERA HIGHWAY
STAWELL-WARRACKNABEAL ROAD
ASHENS-JACKSON ROAD
HORSHAM-LUBECK ROAD
Middle Reach
Dunmunkle Creek
GLENORCHY ROAD
MURTOA-GLENORCHY ROAD
Main Central Channel
Wimmera River
GLENORCHY
CAMPBELLS BRIDGE ROAD
PHILLIPS ROAD
OLD GLENORCHY ROAD
Upper Reach
BOOLITE
LAWLER ROAD
CARRON-LAWLER ROAD
RUPANYUP ROAD
DONALD-MURTOA ROAD
Lower Reach
MINYIP-RICH AVON ROAD
MINYIP-BANYENA ROAD
BANYENA-PIMPINIO ROAD
BURRUM NORTH ROAD
WIMMERA HIGHWAY
RUPANYUP
WIMMERA HIGHWAY

LEGEND

Pest Animals
- Foxes
- Hares
- Rabbits

Pest Plants
- African Boxthorn
- Bathurst Burr
- Horehound
- Tortured Willow
- Prickly Pear
- Spear Thistle

0 1 2 3 km

Data sources: Vic Map
Contains Vicmap Information © State of Victoria 2018
Imagery: Sources from ESRI

Dunmunkle Creek Waterway Action Plan - Pest plants and Animals

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RUPANYUP
WIMMERA HIGHWAY
STAWELL-WARRACKNABEAL ROAD
ASHENS-JACKSON ROAD
HORSHAM-LUBECK ROAD
Middle Reach
Dunmunkle Creek
GLENORCHY ROAD
MURTOA-GLENORCHY ROAD
Main Central Channel
Upper Reach
Wimmera River
GLENORCHY
CAMPBELLS BRIDGE ROAD
PHILLIPS ROAD
OLD GLENORCHY ROAD
BOOLITE
LAWLER ROAD
CARRON-LAWLER ROAD
RUPANYUP ROAD
DONALD-MURTOA ROAD
Lower Reach
MINYIP-RICH AVON ROAD
MINYIP-BANYENA ROAD
BANYENA-PIMPINIO ROAD
BANYENA-PIMPINIO ROAD
STAWELL-WARRACKNABEAL ROAD
Dunmunkle Creek
WIMMERA HIGHWAY
RUPANYUP
WIMMERA HIGHWAY

LEGEND

Dunmunkle Creek

Riparian Fencing Condition

Absent

Absent, Not Required

Likely Present, Effective

Present, Effective

Present, Ineffective

*Left and Right Bank are orientated in a downstream direction

0 1 2 3 km

Data sources: Vic Map

Imagery: Sources from ESRI

Dunmunkle Creek Waterway Action Plan - Left and Right Bank Existing Fence Status

RUPANYUP
WIMMERA HIGHWAY
STAWELL-WARRACKNABEAL ROAD
ASHENS-JACKSON ROAD
HORSHAM-LUBECK ROAD
Middle Reach
Dunmunkle Creek
GLENORCHY ROAD
MURTOA-GLENORCHY ROAD
Main Central Channel
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DONALD-MURTOA ROAD
Lower Reach
MINYIP-RICH AVON ROAD
MINYIP-BANYENA ROAD
BANYENA-PIMPINIO ROAD
BURRUM NORTH ROAD
RUPANYUP
WIMMERA HIGHWAY

LEGEND

Stock Pressure

- High
- Medium
- Low

0 1 2 3 km

Data sources: Vic Map

Imagery: Sources from ESRI

Dunmunkle Creek Waterway Action Plan - Stock Pressure

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

APPENDIX C
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