At a glance

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Part 1. Introduction: Victoria implementing the Murray-Darling Basin Plan

The Murray-Darling Basin ('The Basin') is Australia's largest river system. It reaches into Queensland, New South Wales, the Australian Capital Territory, South Australia and covers half of Victoria, including, for the purposes of the Murray-Darling Basin Authority and the Wimmera-Mallee water resource plan area.

The Basin holds important social, cultural, economic and environmental values, supporting strong rural communities and economies, and generating about 40 per cent of the nation's agricultural income. It includes diverse ecosystems, including internationally recognised Ramsar wetlands, and significant floodplains and river red gum forests.

The Murray-Darling Basin requires a unique management approach. In the past, cooperation between the Commonwealth, Victorian, New South Wales and South Australian governments has been determined under the *River Murray Waters Agreement (1915)*, and the *Murray-Darling Basin Agreement (1987)*, which included the Australian Capital Territory and Queensland.

1.1 Objectives of the Basin Plan

In 2007, the Commonwealth Government assumed a greater role in Basin water management when it passed the Commonwealth Water Act. The Commonwealth Water Act integrated the management of Basin water resources, including new limits on how much water can be taken from the Basin's surface and groundwater systems. It established the independent Murray-Darling Basin Authority (MDBA), which was charged with preparing a Basin Plan.

The 2012 Basin Plan sets out how the Basin's water resources will be managed and shared between all water users, including the environment. The Basin Plan sets limits on the volume of water that can be taken for use from the Basin. These limits are known as sustainable diversion limits (SDLs), which come into effect in 2019. Basin-wide, SDLs are set to recover 2,750 gigalitres (GL or billion litres) of water for the environment. Victoria has agreed to deliver 1,075 GL as its share.

The Basin Plan requires all Murray-Darling Basin states, including Victoria, to prepare water resource plans by 30 June 2019. This Wimmera-Mallee Water Resource Plan demonstrates how Victoria will meet the requirements identified in the Basin Plan. It has been prepared by the Department of Environment, Land, Water and Planning (see **Part 1.2**).

The Wimmera-Mallee Water Resource Plan is Victoria's plan to outline how Victoria will meet the Basin Plan requirements to demonstrate compliance with the new SDLs for surface water and groundwater from 1 July 2019. Another plan has been developed to cover northern Victoria, including the River Murray.

5.02 Objectives and outcomes for the Basin Plan as a whole

1. The objectives for the Basin Plan as a whole are:
   a. to give effect to relevant international agreements through the integrated management of Basin water resources; and
   b. to establish a sustainable and long-term adaptive management framework for the Basin water resources, that takes into account the broader management of natural resources in the Murray-Darling Basin; and
   c. to optimise social, economic and environmental outcomes arising from the use of Basin water resources in the national interest; and
   d. to improve water security for all uses of Basin water resources.
2. The outcome for the Basin Plan as a whole is a healthy and working Murray-Darling Basin that includes:
   a. communities with sufficient and reliable water supplies that are fit for a range of intended purposes, including domestic, recreational and cultural use; and
   b. productive and resilient water-dependent industries, and communities with confidence in their long-term future; and
   c. healthy and resilient ecosystems with rivers and creeks regularly connected to their floodplains and, ultimately, the ocean.

1.2 Victoria's approach to this water resource plan

The Murray-Darling Basin Plan outlines a series of requirements for states to cover in their water resource plans (see Chapter 10 of the Basin Plan). These include:

- setting out the quantity of held environmental water and planned environmental water, and incorporating the rules and management arrangements associated with this water
- ensuring that environmental watering is consistent with the Basin-wide environmental watering strategy and Basin Plan objectives
- setting out how much water can be taken annually for consumptive use in a way that meets the long-term sustainable diversion limit
- a plan to manage water quality standards
- setting out the circumstances when trade is allowed within and between groundwater SDL units, and trade from groundwater to surface water SDL units
- outlining how water will be managed during extreme events
- showing how Aboriginal values and uses of water have been considered
- setting out how interception activities will be managed and monitored, including runoff dams, commercial plantations, mining activities and floodplain harvesting
- outlining the risks to water resources and strategies to address these risks.

Victoria has undertaken a comprehensive analysis of the requirements under Chapter 10 of the Basin Plan and has determined that it is meeting most of its obligations through its existing water management framework. The Wimmera-Mallee Water Resource Plan makes no changes to Victoria's water management framework.

The plan proposes that some existing instruments are revised and improved to address high or medium risks identified in developing this water resource plan. Any necessary changes to individual instruments will be made under Victoria's legislative framework following stakeholder consultation.

The Wimmera-Mallee Water Resource Plan will have little to no immediate effect on water users in the region and Victoria will not rely on the plan for enforcement purposes, but will continue to use the compliance and enforcement provisions under Victorian legislation.

The Wimmera-Mallee Water Resource Plan Comprehensive Report focuses on explaining the current water legislation and management arrangements in Victoria, acknowledging the work done in implementing the Basin Plan and the organisations and people who contribute to its delivery. It also provides an opportunity to continue building water literacy in the broader community.

The Basin Plan however, poses two new challenges to Victoria:

1. To show how Victoria will comply with how much water can be taken for consumption from the state's share of the Murray-Darling Basin when the new limits come into place from July 2019.
2. To recognise and manage for Aboriginal values and uses of water.

The Wimmera-Mallee Water Resource Plan Comprehensive Report explains how Victoria will meet these challenges (see **Part 8** and **Part 11** respectively).

1.2.1 A 'water source' basis

Victoria is taking a 'source-based' approach to water resource plans. This means that although some towns, irrigation areas and environmental assets such as wetlands may be located within the boundaries of the surface and/or groundwater water resource plan areas, if their water is sourced from outside the water resource plan area – for example, from the River Murray – they are not included in this water resource plan. Conversely, if a water user is located outside the Wimmera-Mallee water resource plan area but sources their water from a waterbody within the water resource plan area, it is included in the water resource plan.

1.2.2 Victoria's core obligation under the Basin Plan

Victoria's core obligation under the Basin Plan in the Wimmera-Mallee water resource plan area was to recover an average 23 GL of surface water (Basin Plan Schedule 2, item 24) per year for the environment to meet the area's sustainable diversion limit. This water has been recovered through the sale of 28 GL of Wimmera irrigator entitlements (including losses) to the Commonwealth Environmental Water Holder as part of the closure of the Wimmera Irrigation District (see **Part 4.7.3**).

The major usable groundwater resources in the Wimmera-Mallee water resource plan area are excluded from the plan area (West Wimmera Groundwater Management Area (GMA)) or managed under existing arrangements (Border Groundwaters Agreement – South Australia-Victoria and Murrayville Groundwater Management Area Local Management Plan 2017).

1.2.3 Context and purpose

The purpose of the Wimmera-Mallee Water Resource Plan is to set out how Victoria responds to each requirment of Chapter 10 of the Basin Plan.

Victoria has prepared four documents related to the Wimmera-Mallee Water Resource Plan:

1. The draft Wimmera-Mallee Water Resource Plan Comprehensive Report was developed to facilitate discussion and consultation with Wimmera-Mallee stakeholders and community members.
2. A Summary Report of the draft Wimmera-Mallee Water Resource Plan Comprehensive Report was developed to provide a simple (non-legalistic) description of Victoria's water resource management arrangements in the Wimmera-Mallee water resource plan area and how these arrangements relate to Basin Plan requirements.
3. This (final) Wimmera-Mallee Water Resource Plan Comprehensive Report (this document) incorporates learnings from consultation and policy advances, especially the Victorian Government's Aboriginal water policy. It includes accreditation text from the Basin Plan where relevant and provides context and background information to support the descriptions of how Victoria meets Basin Plan requirements.
4. An Index Table, which constitutes the legal documentation to be accredited by the Commonwealth Minister for Water as the Water Resource Plan and sets out how Victoria meets each of the clauses in Chapter 10 of the Basin Plan.

Victoria has chosen to prepare a single Wimmera-Mallee Water Resource Plan rather than a separate plan for surface water and groundwater because both are managed under Victoria's water entitlement framework and cover similar, although not identical, areas. Where the response to Chapter 10 requirements is different between surface water and groundwater, the Index Table clearly identifies the water resource plan area and water resources to which the response for accreditation applies.

Drafting water resource plans

Victoria has attempted where possible to prepare this water resource plan's terms so that they do not exceed Commonwealth legislative powers.

To the extent that the Basin Plan or the Commonwealth Water Act is required to 'read down' this water resource plan, see: section 15A and section 46 of the *Acts Interpretation Act 1901* (Cth), section 13 of the *Legislative Instruments Act 2003* (Cth) and section 11 of the Commonwealth Water Act.

If:

(a) this water resource plan imposes an obligation on the state or a state agency; and

(b) the imposition of that obligation would contravene a constitutional doctrine restricting the obligations that the Commonwealth may impose on a state

this water resource plan is taken, instead of imposing the obligation, to confer discretion on the state or state agency to do the thing.

This means that if the water resource plan seeks to require the Victorian Water Minister or a water corporation to do something not permitted because of constitutional limitations, that requirement will change from being an obligation to being at the discretion of the Minister or water corporation.

Victoria has made best efforts to draft obligations in this water resource plan to avoid the application of the above clause.

Many terms used in this water resource plan are used in the Basin Plan or the Commonwealth Water Act. Where such terms are defined in the Basin Plan or the Commonwealth Water Act, they have the same meaning in this water resource plan, unless otherwise stated or the context indicates otherwise.

1.3 Accreditation and compliance

The Wimmera-Mallee Water Resource Plan was prepared in accordance with the requirements of Chapter 10 of the Basin Plan.

10.49(1) The Wimmera–Mallee Water Resource Plan was prepared using the best available information for each component of the Plan that was available at the time of submission for accreditation.

10.49(2) Significant sources of information are:

a. recent resource assessments conducted in Victoria

b. current legislative and non-legislative information

c. a specifically designed risk assessment

d. REALM modelling results of Baseline Diversion Limit

e. Sustainable Diversion Limit assessments

f. information gathered from consultation with the community and industry.

The Reference section contained in the Wimmera-Mallee Comprehensive Report contains a list of the key sources of information used to develop the Wimmera-Mallee Water Resource Plan.

10.50 The significant methods, models and tools that have been used to develop the Wimmera-Mallee Water Resource Plan are:

- Environmental Water - FLOWS2
- REALM modelling results of Baseline Diversion Limit
- Permitted Take - Draft MDB Groundwater Permitted Take Methodology Report
- SDL Determination - SDL derived from RRAM and the proposed Basin Plan groundwater SDL
- Commercial Plantations - SoilFlux (Jacobs (2016), HARC (2016))
- Runoff Dams - STEDI (Spatial Tool for Estimating the Impact of Dams) version 1.2 (Sinclair Knight Merz 2011, STEDI: Estimating the impact of farm dams on streamflow (User Manual), Prepared for Victorian Department of Sustainability and Environment, July 2011)
- risk assessment method outlined in **Part 2** of the Wimmera-Mallee Risk Assessment Report at **Appendix B**
- Take under basic rights - model results for domestic and stock use (RMCG, 2011)
- Wimmera-Mallee Surface Water BDL Re-estimates document, prepared February 2019

The Wimmera-Mallee Water Resource Plan is an enforceable instrument under the Commonwealth Water Act and Basin Plan. It will be used by the Commonwealth Government and the MDBA to enforce the following provisions in the Basin Plan:

- *10.08(2) A water resource plan must require a holder of a water access right to comply with the conditions of that right.*
- *10.13(1) Subject to this section, a water resource plan must require that the long-term annual average quantity of water that can be taken from a surface water SDL resource unit for consumptive use by:*
  a. *take under basic rights; or*
  b. *take by runoff dams; or*
  c. *net take by commercial plantations; or*
  does not exceed the level specified in column 2 of Schedule 3 for that form of take.
- *10.26 Planning for environmental watering:*
  A water resource plan must provide for environmental watering to occur in a way that (a) is consistent with the environmental watering plan and the Basin-wide environmental watering strategy; and (b) contributes to the achievement of objectives in Part 2 of Chapter 8.
- *10.28 No net reduction in the protection of planned environmental water:*
  A water resource plan must ensure that there is no net reduction in the protection of planned environmental water from the protection provided for under state water management law immediately before the commencement of the Basin Plan.
- *10.47 Review of water resource plans:*
  A water resource plan must require that if a review of the plan (or part of the plan) is undertaken, the report of the review must be given to the Authority within 30 days after the report is completed.
- *10.48 Amendment of water resource plan:*
  A water resource plan must require a Basin state that proposes an amendment to the plan arising from a review to give the reasons for the amendment to the Authority.

MDBA enforcement powers are contained in Part 8 of the Commonwealth Water Act while the obligation to comply with the requirements of an accredited water resource plan (e.g. the Wimmera-Mallee Water Resource Plan) is contained in sections 58 and 59 of the Commonwealth Water Act. This means that where an obligation is expressed in the Wimmera-Mallee Water Resource Plan (the pale blue accredited text in this document), the person on whom the obligation is imposed may be subject to enforcement under the Commonwealth Water Act for non-compliance with that obligation. These obligations operate separately from any similar obligations under the Victorian Water Act. Action taken by Victorian statutory bodies for non-compliance with obligations reflected in the Wimmera-Mallee Water Resource Plan does not prevent the MDBA from taking action under the Commonwealth Water Act.

The Wimmera-Mallee Water Resource Plan is valid for the following periods (whichever occurs first):

- when the water resource plan ceases to have effect (see section 64 of the Commonwealth Water Act); or
- until three years after an amendment of the Basin Plan requires changes to water resource plan accreditation requirements; or
- until Victoria proposes amendments to state water resource management arrangements that materially affect the Plan.

10.04(4)(c) The Wimmera-Mallee Water Resource Plan, as constituted by Columns 1, 2, 3, and 4 of the Wimmera-Mallee Index Table, will cease to have effect at the end of the accreditation period in accordance with section 64 of the *Water Act 2007* (Cth).

The Wimmera-Mallee Water Resource Plan will be reviewed if, at any time during its accreditation period, changes to the Victorian legislative or water resource management framework which, in DELWP's view, are relevant to whether the water resource plan is consistent with the Basin Plan.

1.4 Consultation

Many Victorian instruments that informed the Wimmera-Mallee Water Resource Plan are subject to legislated consultation requirements to ensure Victoria's water entitlement framework and management are aligned with community expectations. The Victorian Government's view is that most of Victoria's Basin Plan obligations are met by these existing instruments and tools. Victoria's approach to consultation with stakeholders and broader communities on its water entitlement framework, management, and policy development is designed to accommodate local, regional and statewide priorities and views, and has helped inform the preparation of the Wimmera-Mallee Water Resource Plan.

The development process for water resource plans provided a forum to discuss opportunities for improvements to the way Victoria manages water, while detailed consultation regarding improvements and changes to state-based instruments is more appropriately managed through the independent processes for the relevant instruments, strategies or policies.

Consultation on the amendment of existing and new Victorian instruments, strategies and policies relevant to meeting Basin Plan requirements will continue during the life of the Wimmera-Mallee Water Resource Plan.

1.4.1 Who else is involved?

At the local level, water corporations and catchment management authorities (CMAs) have significant responsibility to engage with their communities. In addition to standing customer or community consultative committees, many processes require or benefit from groups or committees that provide advice on implementation, policy, community expectations and local knowledge.

The Victorian Government provided $22 million to implement *Our Catchments, Our Communities* from 2016–17 to 2019–20. The strategy requires stronger community engagement in catchment management. A key feature of CMA waterway management is their regional waterway strategies. These strategies, required under the Victorian Water Act, provide a pathway for river and wetland management for the Wimmera, Mallee and North Central CMAs represented in the Wimmera-Mallee Water Resource Plan. The strategies identify high-value waterways and priority management activities over eight years and are developed in close consultation with key partners, including regional agencies and boards, Traditional Owners and the regional community.

As service providers, water corporations prioritise customer communication. These corporations have a significant role in community consultation beyond customer service and pricing. They seek stakeholder and community input when changing instruments or tools such as groundwater local management plans, or constructing infrastructure such as pipelines, and developing urban water strategies every five years, including being prepared for drought.

1.4.2 Water security and risk analysis

Victoria has several planning tools to provide water security for communities, agriculture, the environment, business and industry, with associated consultation to improve access to information, increase transparency and guide decision making, consistent with stakeholder and community expectations.

Victoria undertakes long-term water resource assessments every 15 years as prescribed by the Victorian Water Act. Every 10 years, regional sustainable water strategies are conducted to set out long-term plans to secure the water future of Victoria's regions. The strategies identify threats to water availability in each region and identify policies and actions to help water users, water corporations and CMAs manage and respond to those threats over the next 50 years.

The Victorian Water Act details consultation processes that must be followed when regional sustainable water strategies are prepared. For example, the Western Region Sustainable Water Strategy, released in November 2011, had an extensive consultation process and was a 'temperature check' into the water issues community members and stakeholders felt were most pressing. Every eight years, the Victorian waterway management strategy is conducted, providing the policy direction for managing waterways to maintain or improve their condition and support their economic, environmental, social and cultural values. This strategy is developed with an associated stakeholder and public consultation process.

In the early 1990s, Victoria created bulk entitlements to provide clearly defined property rights to water, and a basis for sharing water resources across entitlement holders, including the environment. All bulk entitlement orders describe the rights to water, financial obligations, passing flow/environmental obligations and water accounting requirements. Bulk entitlements have provided more surety, particularly in times of increasing water scarcity and increased demand. Any changes to bulk entitlements have to follow the process detailed in **Figure 18**.

Major policy documents, such as *Water for Victoria* and *Our Water, Our Future* (DSE 2004), are subject to stakeholder and community input and review. Feedback, policy decisions, implementation and actions have been considered in the preparation of the Wimmera-Mallee Water Resource Plan.

In 2016, Victoria conducted a robust risk analysis for this water resource plan area. Stakeholder consultation included representation from water corporations, CMAs, the Victorian Environmental Water Holder (VEWH), Murray Lower Darling Rivers Indigenous Nations (MLDRIN) and the Victorian Farmers Federation. Assessment of the risk analysis was conducted at the technical level, and again at executive level. The preliminary risk report was made available when the draft Wimmera-Mallee Water Resource Plan was released for stakeholder and community feedback, and changes as a result of this consultation are reflected in this (final) Wimmera-Mallee Water Resource Plan.

The Wimmera-Mallee Water Resource Plan was guided by a Technical Advisory Group established to inform and review content during its development. The Technical Advisory Group members were invited to participate based on their diverse experience, expertise and perspectives in water management in the Wimmera-Mallee water resource plan area (members outlined in **Table 1**).

Table 1: Wimmera-Mallee Water Resource Plan Technical Advisory Group[1]

Organisation	Representative	Position
Coliban Water	Steven Healy	Manager, Raw Water Supply
Grampians Wimmera Mallee Water	Kym Wilson	Manager, Water Resources
Wimmera CMA	Tony Baker	Statutory & Strategy Manager
Mallee CMA	Jenny Collins	Chief Executive
North Central CMA	Tim Shanahan	Executive Manager, Program Delivery
Victorian Environmental Water Holder	Caitlin Davis	Acting Manager, Planning & Delivery (delegate of Denis Flett)
Murray Lower Darling Rivers Indigenous Nations	Bruce Lindsay	Environmental Justice Australia (delegate of Will Mooney)
Victorian Farmers Federation	Richard Anderson	Chair, Water Council
Wimmera Development Association	Ralph Kenyon	Executive Director (representing five shire councils)

Given that the water resource plan is largely a descriptive document that explains how Victoria's management of surface and groundwater resources meets Basin Plan requirements, it was important that Victoria tested the accuracy of this description, and any instruments/policy documents referred to, with the responsible government agencies. Key external stakeholder representatives were included in the Technical Advisory Group to ensure the information in this water resource plan clearly and accurately reflects the state's water management arrangements as understood by the groups they represent:

Consultation on the draft Wimmera-Mallee Water Resource Plan was conducted through stakeholder briefings, public meetings and a public submissions process. Submissions to the draft Wimmera-Mallee Water Resource Plan are available.

Details on consultation undertaken in the preparation of the final Wimmera-Mallee Water Resource Plan are contained in the final Consultation Report (see **Appendix D**).

1 Environment Victoria was invited to be a part of the Technical Advisory Group but was unable to participate at the time.

1.5 Water resource plan review process

Part or all of this Wimmera-Mallee Water Resource Plan will be reviewed where the following have a material effect on the accredited water resource plan:

- legislative changes to the Victorian Water Act
- changes to policy or the Victorian framework to respond to emerging water management issues
- development of a new water resource plan.

10.47 If a review of the Wimmera-Mallee Water Resource Plan is undertaken, the report of that review must be given to the Murray-Darling Basin Authority within 30 days after the report is completed.

10.48 If a review of the Wimmera-Mallee Water Resource Plan results in a proposed amendment to the Plan, the reasons for the amendment must be provided to the Murray-Darling Basin Authority.

If the review requires amendments to the water resource plan, the responsible Minister must undertake the following consultation in developing the changes:

- for small or technical changes (for example, updating references or correcting errors), the Minister (or Department of Environment, Land, Water and Planning) will consult key water industry stakeholders and publish notification of the changes on the DELWP and water authority websites.
- where changes are made to instruments made under Victorian law that are identified in the water resource plan, the statutory processes for consultation under the Victorian Water Act or the *Subordinate Legislation Act 1994* will be complied with.
- where substantive (not small or technical) changes are made to the text of the water resource plan, at least 28 days of public consultation will occur, where the Minister considers that there has not been sufficient consultation on a matter to which the amendment relates. This public consultation will allow for submissions to be made on the changes before seeking accreditation from the Commonwealth Minister for Water for the proposed amendments.

The accreditation process under section 65 of the Commonwealth Water Act applies to changes to the water resource plan except those identified in regulations made under section 66 of that Act.

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2. Wimmera-Mallee water resource plan area

Part 2. Wimmera-Mallee water resource plan area

The Basin Plan establishes long-term average sustainable diversion limits (SDLs) for 110 surface and groundwater SDL resource units that are located within water resource plan areas.

10.02(1) This Wimmera-Mallee Water Resource Plan applies to the following water resource plan areas and water resources:

- Wimmera-Mallee (surface water) water resource plan area and all surface water resources in that area as described under section 3.05(n) of the Basin Plan; and
- Wimmera-Mallee (groundwater) water resource plan area and all groundwater resources beneath the area as described by 3.06(p) of the Basin Plan.

Reference to Wimmera-Mallee Water Resource Plan is reference to the plan to be accredited under section 63 of the Commonwealth Water Act.

The surface water and groundwater plan areas differ slightly. The groundwater area extends to the River Murray in the north while the surface water area excludes the irrigation districts and wetlands supplied from the River Murray and a strip of land along the Victorian side of River Murray. The Wimmera-Mallee water resource plan surface and groundwater areas are shown in **Figure 1** and **Figure 2** respectively.

2.1 Surface water boundaries

The surface water component of the Wimmera-Mallee water resource plan area includes parts of three basins[2] as shown in **Figure 1**:

- Basin 15 – Wimmera-Avon
- Basin 8 – Avoca
- Basin 14 – Mallee.

The Wimmera-Avon rivers' surface water basin is not connected to the River Murray. The Avoca basin is infrequently connected to the River Murray via the Avoca floodway that connects with the Kerang Lakes during floods. The Mallee basin is a semi-arid zone that has no perennial streams, localised runoff during exceptionally wet conditions and no surface water diversions.

The Wimmera-Mallee (surface water) water resource plan area benefits from inter-basin water transfers from the Glenelg basin in the south, the River Murray in the north and the Goulburn system in the east. It also transfers water south to the Hopkins basin to supply towns such as Ararat.

2 In Division IV, Murray-Darling Basin, of the Australian Water Resources Council (AWRC) Drainage Basins (Auslig 2001).

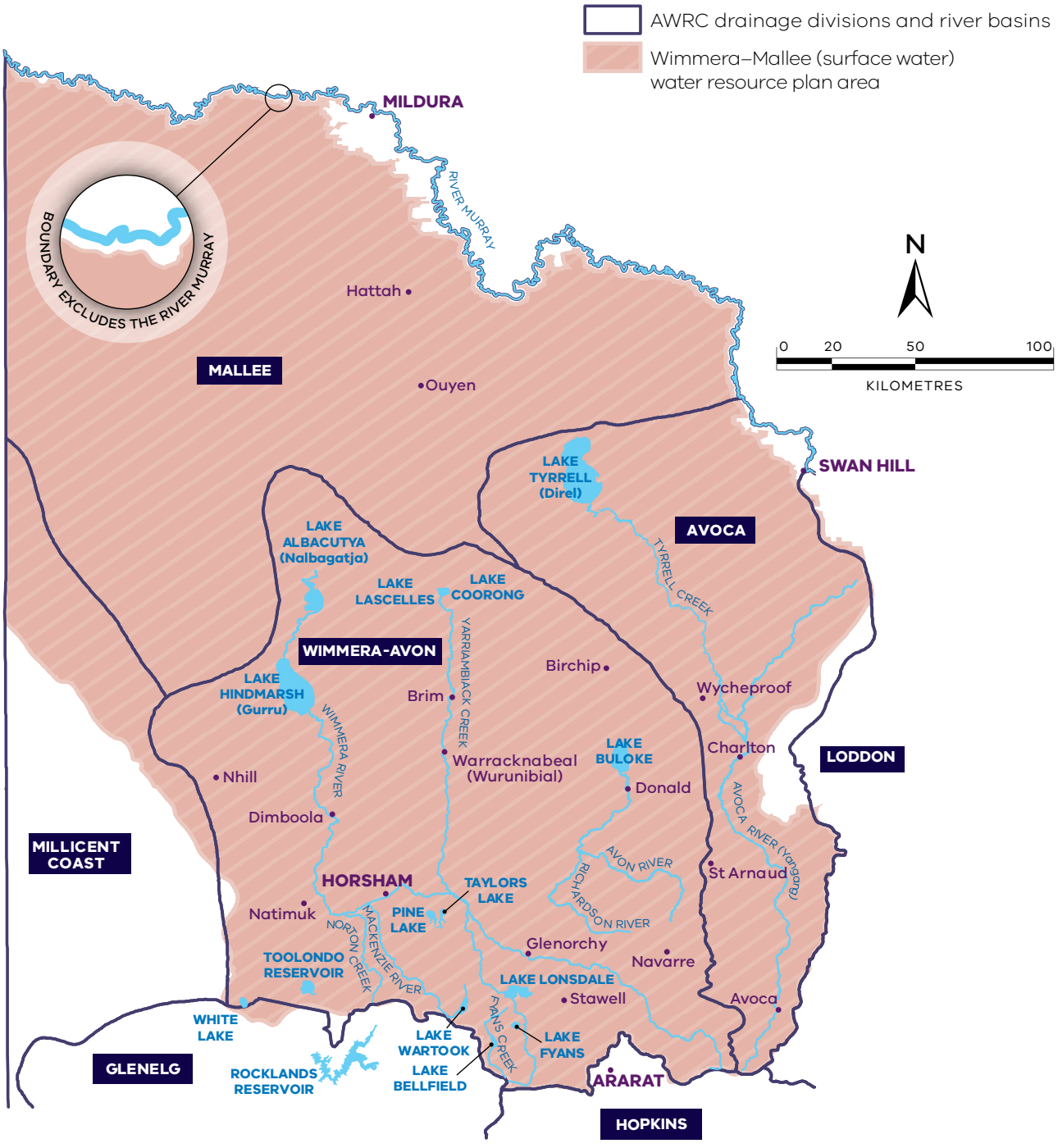

Figure 1: Wimmera–Mallee (surface water) water resource plan area

2.2 Groundwater boundaries

Under the Murray-Darling Basin Plan, groundwater resources in the Wimmera-Mallee water resource plan area (**Figure 2**) are divided into three SDL resource units:

- Wimmera-Mallee Sedimentary Plain SDL resource unit – all groundwater from the land surface to 200 metres below the surface or 50 metres below the base of the Tertiary sediments, whichever is deeper
- Wimmera-Mallee deep SDL resource unit – all groundwater excluding groundwater in the Wimmera-Mallee Highlands and Wimmera-Mallee Sedimentary Plain SDL units
- Wimmera-Mallee Highlands SDL resource unit – all groundwater in the outcropping Paleozoic rocks (or the *in situ* weathered horizon within five metres of the surface) from the land surface to 200 metres below the surface.

The Victorian Groundwater Management Framework consists of groundwater catchments, groundwater management areas and water supply protection areas (collectively known as groundwater management units). The Victorian section of the Murray-Darling Basin is divided into the Wimmera-Mallee catchment and Avoca catchment managed by Grampians Wimmera Mallee Water, and the Goulburn-Murray catchment managed by Goulburn–Murray Water.

The Wimmera-Mallee water resource plan area consists of the Wimmera-Mallee groundwater catchment and Avoca groundwater catchment as shown in **Figure 2**. These groundwater catchments represent regions of connected groundwater resources and are based on groundwater flow systems (DSE, 2012). The groundwater resources in both catchments, which are mostly saline, are located from the northern Grampians (*Gariwerd*) to the River Murray. Each groundwater catchment includes portions of the three SDL units within the Wimmera-Mallee water resource plan area. The groundwater SDL does not include groundwater take within the West Wimmera GMA because the groundwater resources in the West Wimmera Groundwater Management Area (GMA) have been excluded from the water resources of the Murray-Darling Basin under the *Water Regulations 2008* (Cth). This is because the groundwater resources within the West Wimmera GMA are only remotely hydrologically connected to the River Murray and disconnected from surface ecosystems in the Murray-Darling Basin.

10.03(1) The following water resources are within each SDL resource unit in the Wimmera-Mallee (groundwater) water resource plan area in accordance with section 6.03 and Schedule 4 of the Basin Plan:

a. Wimmera-Mallee: Highlands (GS9) all groundwater in the outcropping Palaeozoic rocks (or the in situ weathered horizon where it is within 5 metres of the surface) from the land surface to 200 metres below the surface that lies beneath the area

b. Wimmera-Mallee: Sedimentary Plain (GS9): all groundwater resources from the land surface to 200 metres below the surface or 50 metres below the base of the Tertiary sediments, whichever is the deeper

c. Wimmera-Mallee: deep (GS9): all groundwater, excluding groundwater in Wimmera-Mallee Highlands and Wimmera-Mallee Sedimentary Plain, that lies beneath the area.

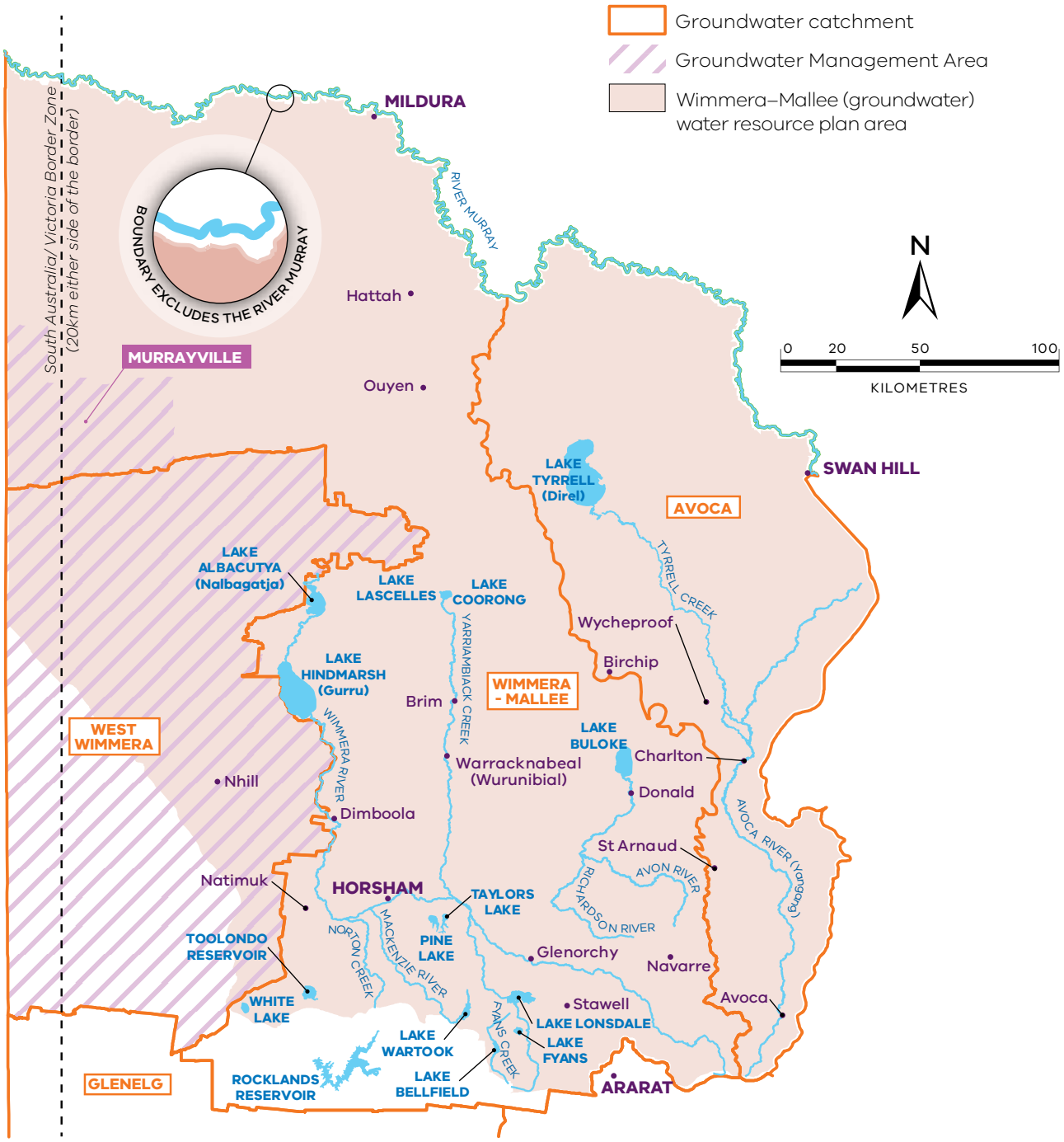

Figure 2: Wimmera–Mallee (groundwater) water resource plan area

Figure 3 shows a simplified stratigraphy of the Wimmera-Mallee: Sedimentary Plain SDL resource unit in the northern part of the Wimmera-Mallee water resource plan area (Mallee CMA, 2013). In this SDL, there are three main aquifers (which are extensive and continue north and west into South Australia):

- Pliocene Sands Aquifer (also referred to as the Parilla Sands Aquifer)
- Tertiary Limestone Aquifer (also referred to as the Murray Group Limestone Aquifer)
- Renmark Group Aquifer.

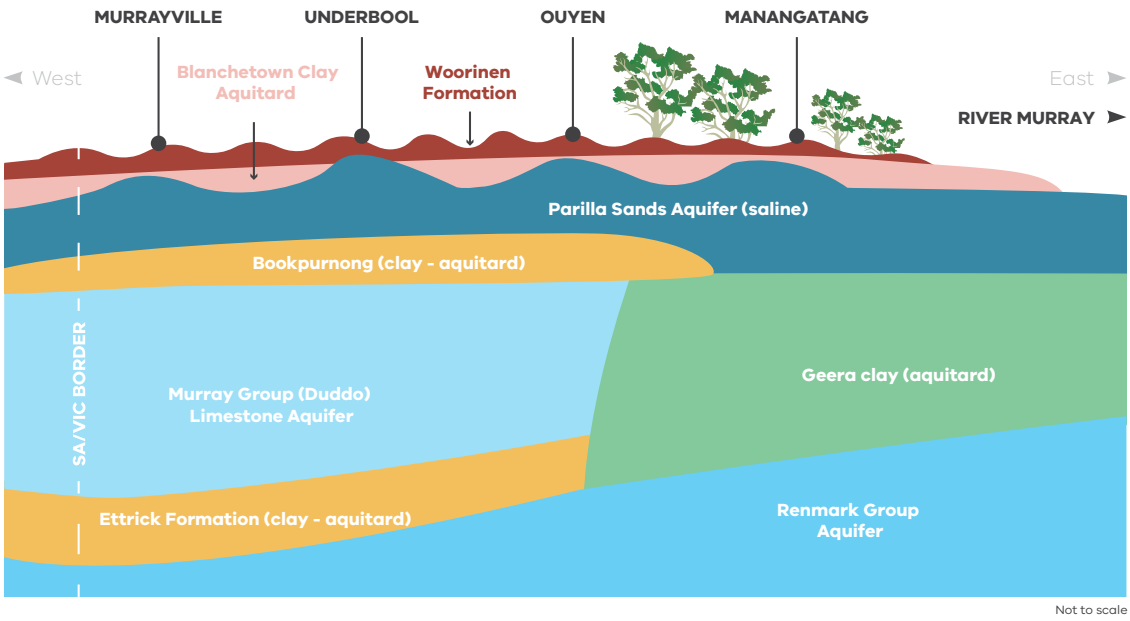

Figure 3: Simplified stratigraphy of the Wimmera-Mallee: Sedimentary Plain SDL in northern part of the Wimmera-Mallee water resource plan area

Groundwater in this part of the Wimmera-Mallee: Sedimentary Plain SDL resource unit is predominantly saline and unsuitable for agriculture or human use. The exception to this is the Murray Group Limestone Aquifer, a confined aquifer found in the western part of the Wimmera-Mallee. However, usable groundwater is limited to the confined resources along the Victoria–South Australia border.

The Wimmera-Mallee: Highlands SDL resource unit comprises the fractured rock aquifers and shallow alluvial deposits along waterways.

Border Groundwaters Agreement – South Australia–Victoria (DEWNR, 2016)

Along the South Australia–Victoria border, groundwater is the only reliable water source and there is increasing demand for this resource. It is used for irrigation, and for industrial, domestic and stock supplies. Many towns near the border also rely on groundwater for their public water supply.

The resource is shared between both states and, in recognition of the need to cooperatively manage these resources, the two states entered into the Border Groundwaters Agreement 1985. The agreement was updated in 2005 and is currently under review.

It provides that available groundwater shall be shared equitably between the two states and applies to all existing and future bores. It does not cover bores that extract groundwater for domestic and stock purposes.

The agreement covers an area that extends 20 km either side of the border from the coast to the River Murray. This is known as the Designated Area, which is divided into 22 management zones with 11 zones in each state.

Water allocation is the responsibility of the licensing authorities in each state in accordance with the relevant groundwater management plan or water allocation plan prepared under the respective state legislation. The agreement provides for management prescriptions to set:

- the permissible annual volume of groundwater allocation from each aquifer for each zone
- the permissible distance from the border for each aquifer within a zone where an application for a water licence or permit to drill a bore must be referred to the Border Groundwaters Agreement Review Committee for decision
- the permissible level of salinity
- the permissible rate of groundwater level lowering.

Implementation of the agreement is overseen by the Review Committee, with membership from both states. The agreement requires that all decisions made by the Review Committee are by consensus. The Review Committee is required to review the management prescriptions at least every five years.

3. Landscape, people and economy

Part 3. Landscape, people and economy

Wimmera-Mallee Water Resource Plan applies to surface water and groundwater resources in Wimmera-Mallee water resource plan area. This chapter provides a brief description of the landscape, people and economic drivers in this water resource plan area.

3.1 Climate and landscape

The Wimmera-Mallee region is part of Victoria's north-western plains. The Wimmera-Mallee landscape is dominated by the Grampians Ranges to the south, the broad floodplains of the Wimmera, Avon-Richardson and Avoca River systems, the aeolian (windblown/dune) areas of the Little Desert, Wyperfield and Murray Sunset national parks, and the large terminal lakes including the Ramsar-listed Lake Albacutya, Lake Hindmarsh, Lake Tyrrell and Kerang Lakes.

The highest point in the Grampians (*Gariwerd*) is Mount William (1,167 m AHD), with the surrounding south-eastern area about 500 m AHD. This quickly drops into the lowland areas of the terminal lakes and Mallee, which are less than 100 m AHD (ABS, 2012). **Figure 4** shows the (relative) topography in the Wimmera-Mallee.

The region is comparatively flat and sits on the geologically stable north-western plains of Victoria. The geology includes alluvium and dune deposits in the vast floodplain areas, signifying windblown aeolian landscapes over the Woorinen Formation to the north and Cambrian rock of the Grampians (*Gariwerd*) and St Arnaud groups in the south-east.

The remarkable feature of the landscape is its flatness which, along with the soil and geology, supports numerous lakes. The flat topography was plainly evident in 2011 when the floods that originated in the Grampians (*Gariwerd*) and Pyrenees resulted in inundation for several weeks.

The climate of the Wimmera-Mallee is the hottest and driest in Victoria owing to its inland location.

Temperatures are hot in summer and extremes can be as high as 46°C. In winter, mean maximums are 15°C, but mornings can be cool, with mean minimums of 4°C at Horsham.

The average annual rainfall for the region ranges from up to 700 mm in the Grampians (*Gariwerd*) to less than 300 mm near Mildura. The region's rainfall is lowest in early autumn, and highest in winter (Bureau of Meteorology, 2016).

The central and northern parts of the Wimmera-Mallee have very unreliable surface water flows and groundwater is generally brackish to saline. It was recognised in the 19th century that a reliable water supply was needed to meet the demands of the extensive livestock and cropping activities in the region and the industries, communities and towns that depended on these activities. The water supply system in the Wimmera-Mallee has evolved since then to meet these needs.

A reliable water supply supports the region's economy, people and many social activities. Towns supplied with water from within the Wimmera-Mallee water resource plan area are listed in **Table 2**, while **Table 3** shows towns within the Wimmera-Mallee water resource plan area that source their water from outside the area.

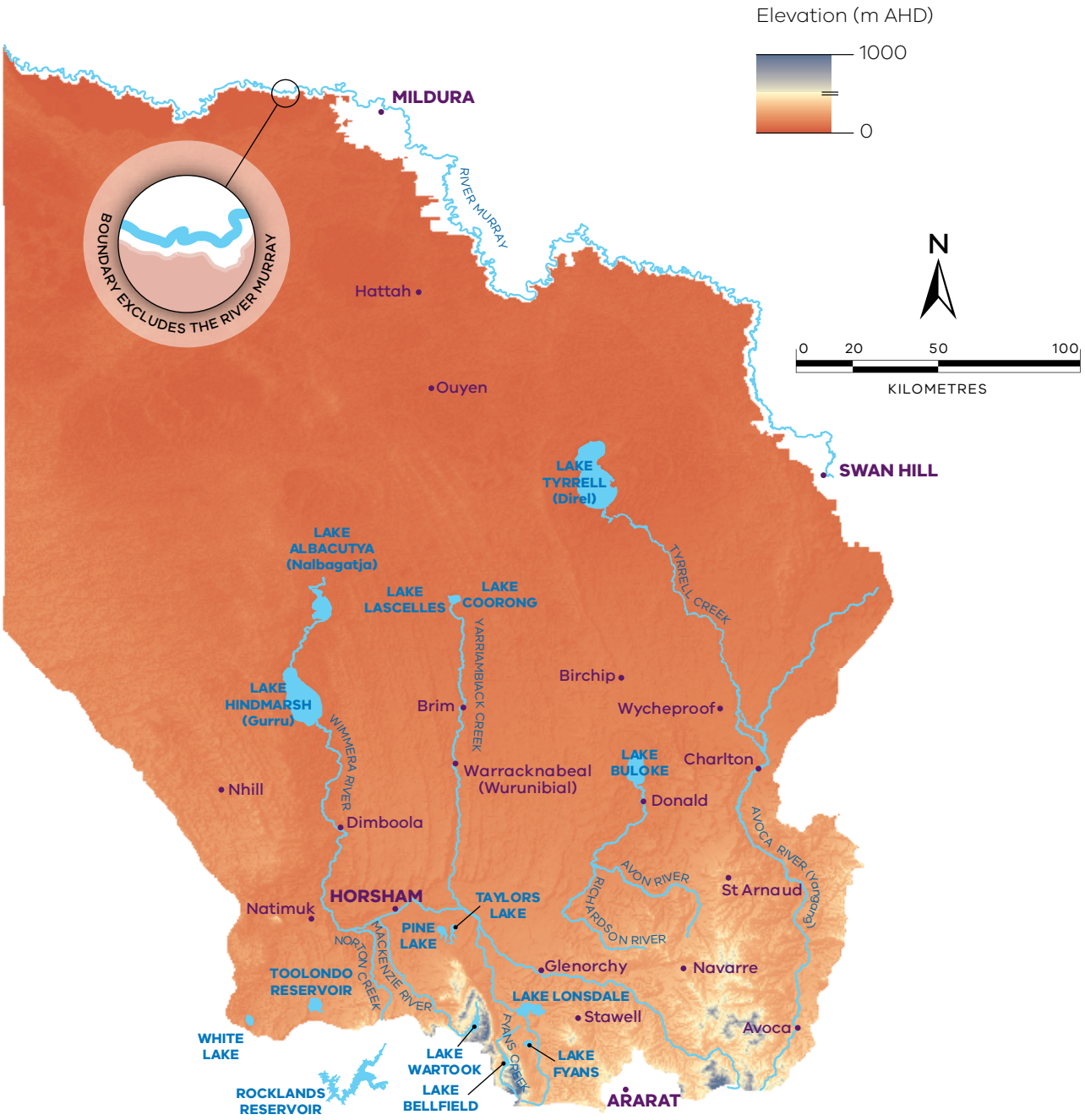

Figure 4: Topography of the Wimmera-Mallee water resource plan area

3.2 Traditional Owners

Water holds a significant place in Aboriginal culture and identity. Water is intimately linked to the health of Country and life. Many Aboriginal cultural sites in the Wimmera-Mallee water resource plan area are on or near waterways, and streams and waterbodies are still important sources of food and medicine. Water also holds a significant connection to Aboriginal women and a special meaning for women's business, although it is not widely documented. Women hold a sacred relationship to land and water, connected to healing, medicines and birthing practices.

Aboriginal communities also hold knowledge of the region's water resources, which are important for many cultural practices and values (See **Part 11**).

3.3 Population and towns

The population of the Wimmera-Mallee is about 60,000[3]. The gross regional product is $6.24 billion and the regional economy provides more than 58,700 jobs. The local government boundaries of the region can be seen in **Figure 5**.

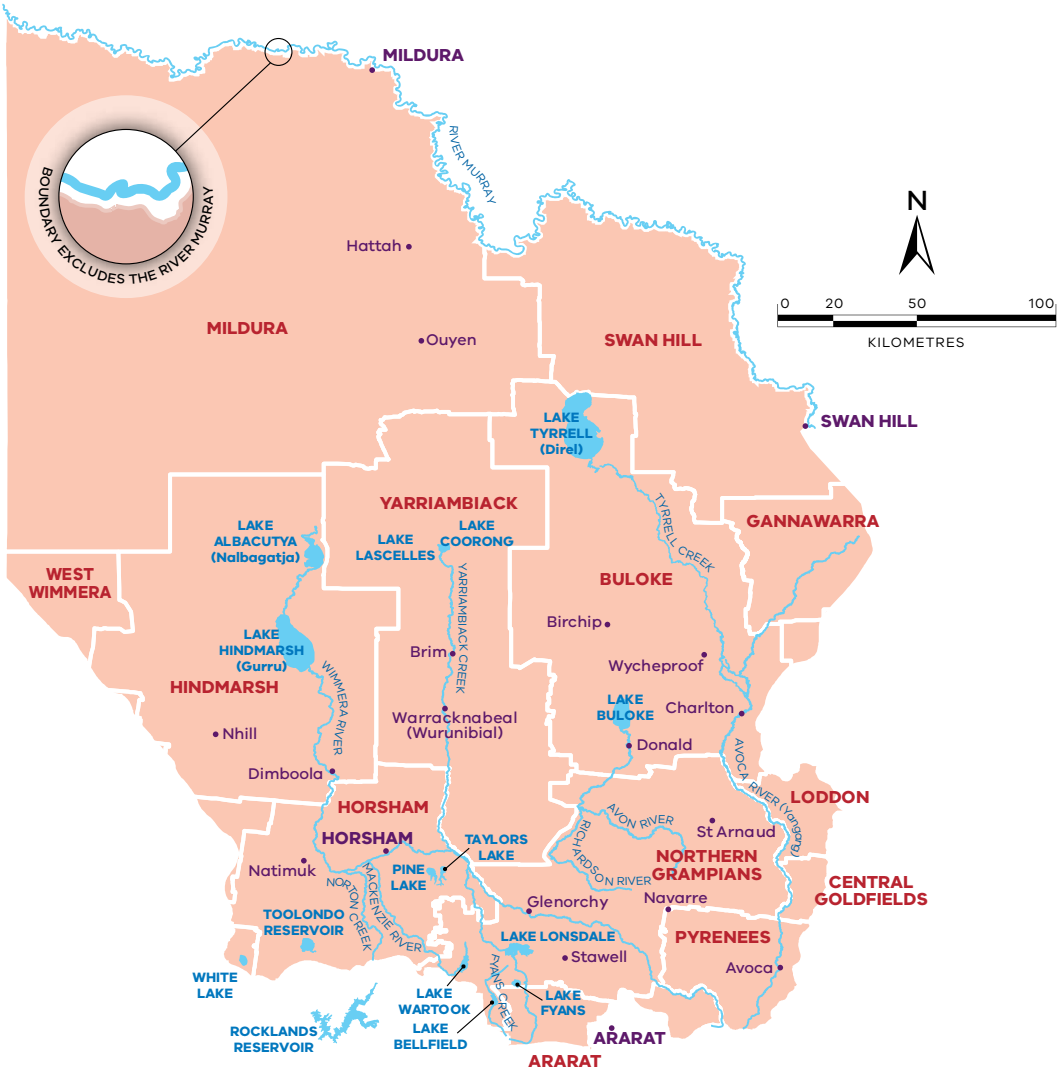

Figure 5: Local government boundaries

3 This figure is based on estimates from municipal councils located wholly within the Wimmera-Mallee water resource plan area.

Table 2: Towns that source their water supply from within the Wimmera-Mallee water resource plan area

Water supply system	Water source	Towns		
Wimmera-Glenelg system headworks	Wimmera and Glenelg basins	Antwerp	Great Western	Rainbow
		Ararat	Hopetoun	Rupanyup
		Beulah	Horsham[1]	St Arnaud
		Birchip	Jeparit	Stawell
		Borung[2]	Jung	Tarranyurk
		Brim	Korong Vale[2]	Warracknabeal
		Charlton	Lascelles	Watchem
		Clear Lake	Marnoo	Wedderburn[2]
		Dimboola	Minyip	Woomelang
		Donald	Murtoa	Wycheproof
		Dooen	Natimuk	Wychitella[2]
		Noradjuha	Yaapeet	Glenorchy
		Pimpinio		
Pyrenees Water Supply system	Hickmans Creek and McLeods Creek	Buangor	Elmhurst	
East Grampians Supply system	Mount William Creek, Masons Creek, Stoney Creek and groundwater	Lake Bolac	Moyston	Willaura
		Glenthompson	Wickliffe	
West Wimmera GMA[3]	Local groundwater	Apsley	Kaniva	Miram
		Edenhope	Kiata	
		Goroke	Lillimur	Serviceton
		Harrow		
Murrayville GMU	Local groundwater	Cowangie	Murrayville	Westmere
		Streatham		
Avoca River	Avoca basin	Amphitheatre	Avoca	Redbank
Unregulated surface water (Franks Gully)	Wimmera basin	Navarre	Landsborough	

1. Supplemented by Mt Zero groundwater.
2. Bulk water supplied to Coliban Water. Supplies to Borung and Wychitella are untreated (not a drinking water supply).
3. These townships are in the West Wimmera GMA but outside the water resource plan area

Table 3: Towns and their water supply systems which are sourced outside the Wimmera-Mallee water resource plan area

Water supply system	Water source	Towns		
Northern Mallee system	Murray system	Chillingollah	Nullawil	Tempy
		Chinkapook	Ouyen	Underbool
		Lalbert	Patchewollock	Ultima
		Manangatang	Sea Lake	Waitchie
		Nandaly	Speed	Walpeup
Wimmera-Mallee Pipeline system	Murray basin	Berriwillock	Culgoa	Nhill
Waranga Western Channel	Goulburn basin	Quambatook		

Dryland grazing and cropping are the dominant land uses and drivers of the regional economy. Private farm water supply systems are not feasible in much of the Wimmera-Mallee water resource plan area because of low and unreliable rainfall and lack of suitable groundwater. These areas depend on the Northern and Wimmera-Mallee pipeline systems, which were built to provide reliable domestic and stock water supplies to farms and towns.

These supply systems were not designed to have the capacity to meet irrigation demand; however, they do meet town, domestic and stock, nominated recreational lakes (e.g. Walkers Lake), mining and environmental (e.g. waterways and wetlands) demands.

Small patches of irrigation exist in the more temperate southern parts of the Wimmera-Mallee water resource plan area. These are supplied mainly from small farm dams, although there are some diversion licences from the upper catchment streams and the Wimmera River, but these are often restricted due to low flow. Groundwater is also used for irrigation mainly around Murrayville.

3.4 Recreation and community values

Rivers, weir pools, storages and lakes are an integral part of community life throughout the

Wimmera-Mallee water resource plan area. They provide social, recreational and environmental benefits for the community and attract tourists. They are also valued as a source of water for firefighting.

Much has been done in the Wimmera-Mallee water resource plan area to improve access to water for recreation. The Wimmera-Mallee is the only region in Victoria with a dedicated recreational water entitlement – a portion of the bulk entitlement held by Grampians Wimmera Mallee Water (GWMWater).

Headworks storages (see **Part 4.7**) are highly valued for recreation as are the nominated recreational lakes, which can receive water under GWMWater's recreational entitlement (see **Figure 41**). Headworks storages with recreational facilities are Lakes Bellfield, Fyans, Lonsdale, Taylors, Green and Wartook, Moora Moora, Toolondo and Rocklands reservoirs. Information such as storages and water levels that are open to the public for recreational activities can be found on the GWMWater website.

An operational review of Wimmera-Mallee system bulk and environmental entitlements by GWMWater in 2013–14 secured additional water for recreation including for Walkers Lake between St Arnaud and Donald (GWMWater, 2014).

4. Water resources

Part 4.
Water resources

This part outlines the key water resources and features in the Wimmera-Mallee Water Resource Plan's surface water area: Wimmera-Avon, Avoca and Mallee, as well as the Wimmera-Mallee Water Resource Plan's groundwater area resources.

4.1 Managing water resources: types of water resource supply systems

Rivers in the Wimmera-Mallee water resource plan area vary from unregulated, like the Avon and Avoca rivers, to regulated like the Wimmera River. All rivers in the Wimmera-Mallee water resource plan area are undeclared.

4.1.1 Unregulated surface water systems

An unregulated catchment is one that does not contain a storage such as a dam or weir, which significantly alters and regulates the flow of the river downstream. An unregulated catchment may contain rivers, creeks and small waterways, and in the case of several unregulated catchments in Victoria, can extend well over 1,000 km^2 in area. Unregulated catchments are all undeclared which means that entitlements are bundled. Therefore, an entitlement includes rights to allow both the take and use of water. In unregulated catchments entitlements to water include take and use licences and bulk entitlements (see **Chapter 6**). All water taken for commercial or irrigation purposes from unregulated catchments must be licensed, including water taken from harvesting dams. The licences are called take and use licences or section 51 licences after the relevant section of the Victorian Water Act. The use of water, and trade of licences between users, is managed by Grampians Wimmera Mallee Water (GWMWater) in accordance with Ministerial trading rules (Minister for Water, 2014a). In unregulated surface water systems, the volume of water taken and the impact on the environment is managed by specifying limits on the timing and the rate of take in bulk entitlements and take and use licences. Any water not allocated through entitlements or taken under a statutory right is above cap water. The volume of water which can be extracted by consumptive users is further limited by restricting or banning take by take and use licence holders during times of low flow. When above cap water in an unregulated system flows into a storage it will become regulated and support the needs of the regulated system. Depending on the rules in the bulk entitlement for the regulated system, this water may be stored or released as a passing flow. A range of water management arrangements have been developed for unregulated streams in the Wimmera-Mallee water resource plan area, examples include the Wimmera Catchment Surface Water and Groundwater Local Management Plan and the Avoca Local Management Plan. These have been developed and published by Grampians Wimmera Mallee Water (**https://gwmwater.org.au/our-water-supply/strategies-and-plans**). These communicate how the water corporation intends to manage the resource in an identified area or for a specified

resource.

4.1.2 Regulated surface water systems

A regulated system is controlled or regulated by infrastructure such as water storages or weirs which impede the flow of water and allow the water to be released when it is required. Water storages are created by building a dam wall or embankment to stop water flowing. The water then spreads out, covering the land and forming a body of water. The stored water can be controlled and released to supply urban, industrial, agricultural and environmental needs. Regulated systems can either be declared (under section 6A of the Victorian Water Act) or undeclared. There are no declared systems in the Wimmera-Mallee water resource plan area.

Storages in regulated systems can be either in-stream or off-stream. In-stream storages are fed by a water catchment with a dam built across a river. Off-stream storages receive water transferred from in-stream storages (weirs) or other storages.

Large off-stream regulated storages are used to capture water diverted into the storage using weirs and canals, channels and pipelines. Released water may be returned to the river or diverted from these storages into the supply system and delivered to towns and farms. These storages can be used as mid-catchment harvesting storage to capture unregulated flows that enter the river from tributaries downstream of the headworks storages, or to divert water from storages upstream to reduce the likelihood of the headworks storage spilling. An example of an off-stream storage is Taylors Lake, which is fed from transfers from Lake Bellfield via the Bellfields Taylors Lake Pipeline and from transfers from Rocklands Reservoir and Toolondo Reservoir via pipelines.

4.1.3 Groundwater systems

Groundwater can be taken under licences or in accordance with section 8 or 8A rights, and take is managed in accordance with the Victorian Water Act. Areas of intensive use are incorporated into management plans, these include groundwater management areas for which the Victorian Water Act provides the legislative arrangements for the delegated authority to manage take in these systems, and or water supply protection areas for which a statutory water management plans are prepared to manage take across these systems. For groundwater management areas water corporations prepare local management rules which describe how the authority manages the resources including triggers and rosters and restrictions to manage during dry conditions. Permissible consumptive volumes, which limit the volume of water that may be taken for consumptive use, have been set for all groundwater management areas and water supply protection areas.

4.2 Wimmera-Avon basin

4.2.1 Surface water

The Wimmera-Avon basin is in the south-western part of the Wimmera-Mallee (surface water) SDL resource unit (SS9), as shown in **Figure 1**.

The basin covers 2,401,130 hectares, an area equivalent to 10.3 per cent of Victoria. These rivers enter terminal lake systems rather than discharging to the River Murray. Catchment flows average 316,400 ML per year (DELWP, 2016e).

The headwaters of the Wimmera River originate in the Buangor State Park in the south-east corner of the basin. The Wimmera River drains water from the Pyrenees Ranges and takes in the water of Wattle and Concongella creeks before reaching Glenorchy. Further downstream, Yarriambiack Creek flows directly north to Hopetoun, terminating in Lake Lascelles and Lake Coorong (see **Figure 1**).

After flowing through Horsham, the Wimmera River collects water from Burnt Creek, Norton Creek and Mackenzie River. It flows through Dimboola and Jeparit to Lake Hindmarsh. In very infrequent wet periods, flow continues to Lake Albacutya and about once every 100 years may overflow into Wyperfield National Park.

Flows are extremely variable; for example (see **Figure 6**), the flow in the Wimmera River at Glenorchy varied from zero to 570,000 ML in 1956.

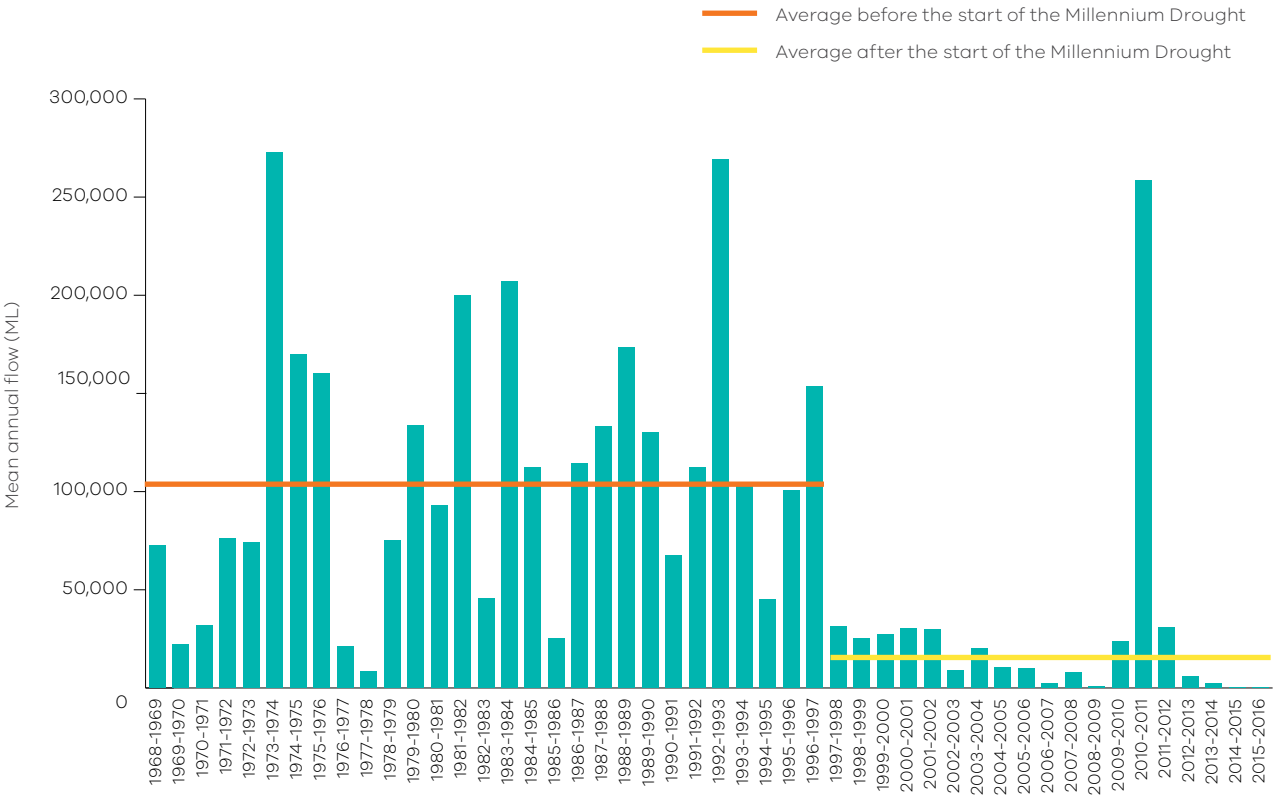

Figure 6: Annual Wimmera River flows 1968–2016 at Glenorchy (site 415201) as at March 2017, with average flow before and after the Millennium Drought

There are three major harvesting storages in the southern part of the Wimmera-Avon basin:

- Wartook Reservoir, built in 1887 on the MacKenzie River
- Lake Lonsdale, built in 1903 on Mt William Creek

- Lake Bellfield, built in 1966 on Fyans Creek.

Three off-stream storages also operate in the Wimmera-Avon:

- Fyans Lake, completed in 1916
- Taylors Lake, completed in 1923
- Toolondo Reservoir, completed in 1952.

The Avon River system is in the central eastern part of the Wimmera basin. It flows north, terminating in Lake Buloke just north of Donald, although water enters the lake only occasionally. There are no major storages on the Avon River system, and so flows are not regulated for water supply purposes. There are some unregulated irrigation licences from the Avon and Richardson rivers.

4.2.2 Groundwater resources

Beneath the surface water catchment of the Wimmera-Avon basin is the Wimmera-Mallee groundwater catchment (see **Figure 2**), which comprises:

- Wimmera-Mallee: Sedimentary Plain SDL resource unit in the north
- Wimmera-Mallee: Highlands SDL resource unit in the south
- Wimmera-Mallee: deep SDL resource unit, which underlies both the Highlands and Sedimentary Plain units.

Some good-quality groundwater is found in paleochannels in the northern Grampians (*Gariwerd*). Elsewhere, the groundwater is generally brackish to saline and therefore of limited usability. The regional groundwater flow path in the Wimmera-Mallee groundwater catchment is north-west.

Most of the usable groundwater is found in parts of the West Wimmera Groundwater Management Area which is excluded from the SDL resource units for the Wimmera-Mallee (groundwater) water resource plan area (see **Part 2**).

The groundwater resources in the Upper Glenelg are excluded from this water resource plan as the groundwater flows south from the Great Divide into the Glenelg groundwater catchment.

4.2.3 Salinity and water quality

Water quality in the Wimmera-Avon basin ranges from good to very poor (DEPI, 2013a). All monitored river reaches have elevated levels of turbidity and generally high levels of phosphorus. These elevated levels are found in cleared parts of the catchment and can be attributed to diffuse sources such as runoff from farms and erosion. High levels of salinity occur in the downstream river reaches where naturally brackish to saline groundwater inflows occur.

The lakes and wetlands in the Wimmera-Avon basin are ephemeral. Water quality in these systems varies widely as they progress through natural wetting and drying cycles. Salinity, temperature and nutrient levels increase during the drying period. In wet periods, inflows can improve water quality by diluting accumulated ions and toxins. Nutrients from soils and organic matter are released, encouraging seed growth in the refilled wetlands.

The quality of groundwater resources in the Wimmera-Avon basin is monitored by catchment management authorities and GWMWater. The 2013–19 Wimmera Regional Catchment Strategy identifies the major areas of concern as the rivers and streams which intersect with the groundwater table.

4.3 Avoca basin

4.3.1 Surface water

The Avoca River drainage basin is in the eastern part of the Wimmera-Mallee (surface water) SDL resource unit (SS9), as shown in **Figure 1**.

The Avoca basin covers 1,235,246 hectares, which is equivalent to 5.3 per cent of Victoria. Average annual catchment streamflows in the basin are about 136,200 ML per year (DELWP, 2016e).

The Avoca River rises on Mt Lonarch, near Amphitheatre, and flows north for about 270 km into Lake Bael Bael. Lake Bael Bael occasionally overflows into the Avoca Marshes, which form part of the Kerang Lakes. During extreme wet periods, such as the 2010–11 floods, the Avoca Marshes overflow and floodwaters flow to the River Murray via the Avoca floodway.

Downstream of Charlton, the river enters a broad alluvial plain where effluent waterways[4] such as Tyrrell and Lalbert creeks carry water respectively to Lake Tyrrell and Lake Lalbert, which are terminal lakes. Lake Tyrrell is a large salt lake and the largest saline groundwater discharge lake in the Murray-Darling Basin.

Flows in the Avoca River at Quambatook are extremely variable, ranging from zero to more than 120,000 ML per year (see **Figure 7**).

There are no major water storages in the Avoca basin, however, there are entitlements for Avoca River itself to take water for irrigation and domestic and stock use.

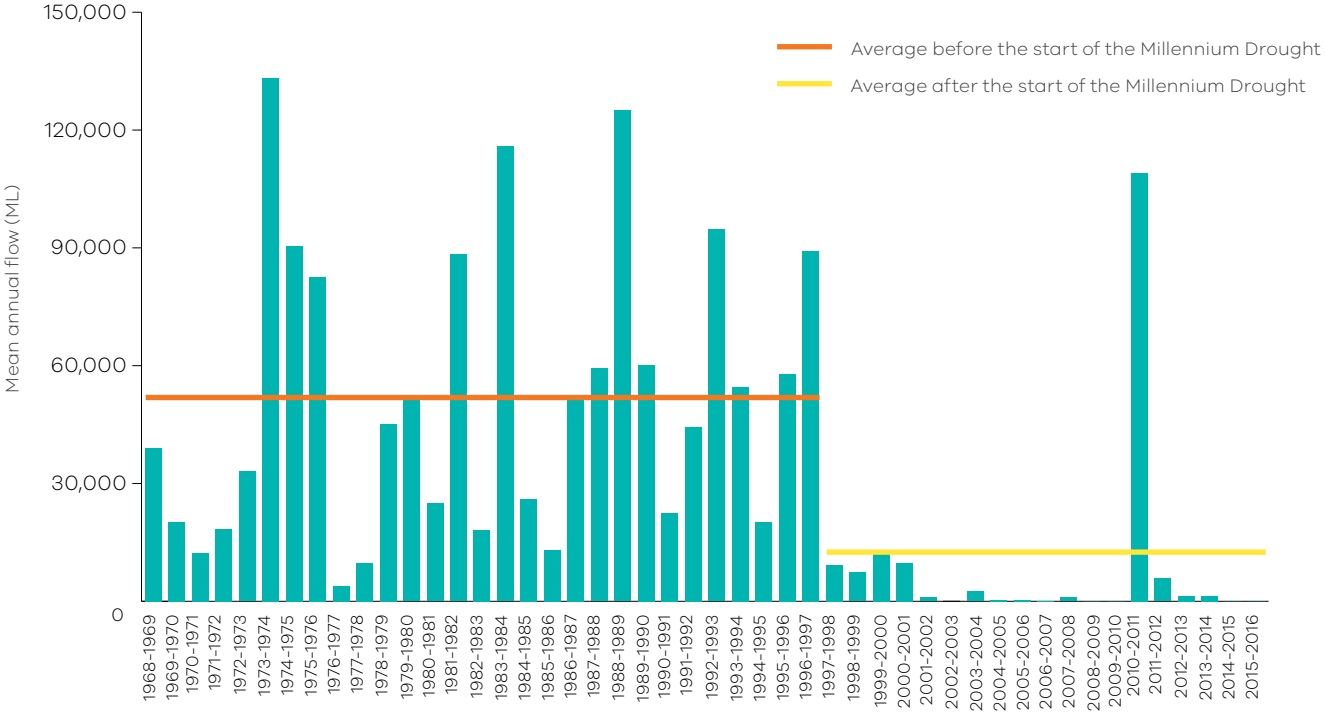

Figure 7: Annual Avoca River flows 1968–2016 at Quambatook (site 408203) as at March 2017, with average flow before and after the Millennium Drought

4 Water flows into these creeks from watercourses rather than them feeding watercourses – the opposite of how tributaries flow into rivers.

4.3.2 Groundwater resources

The groundwater resource located beneath the Avoca basin is the Avoca groundwater catchment, which is part of the Wimmera-Mallee catchment (see **Figure 2**). It includes the:

- Wimmera-Mallee: Sedimentary Plain SDL resource unit in the north
- Wimmera-Mallee: Highlands SDL resource unit in the south
- Wimmera-Mallee: deep SDL resource unit, which underlies both the Highlands and Sedimentary Plain units.

The groundwater resource in the Avoca groundwater catchment is managed by a local management plan (currently being reviewed by GWMWater). This plan also applies to unregulated surface water systems in the Avoca River. In the Avoca catchment, only small volumes of groundwater are used because of poor water quality in the north outside of paleochannels and variable yield of fractured rock in the south.

4.3.3 Salinity and water quality

Water quality in the Avoca catchment has been rated moderate to poor (DEPI, 2013a). Water quality results indicate elevated levels of turbidity and generally high levels of phosphorus. Very high levels of salinity occur in the downstream river reaches where naturally brackish to saline groundwater inflows occur.

The lakes and wetlands in the Avoca basin are ephemeral. Water quality in these systems varies widely as they progress through natural wetting and drying cycles.

Groundwater quality in the Avoca catchment is not regularly monitored because of the small volumes used.

4.4 Mallee basin

4.4.1 Surface water

The Mallee basin is in the north-western part of the Wimmera-Mallee (surface water) SDL resource unit (SS9), as shown in **Figure 1**.

The Mallee basin is a semi-arid zone with sand plains that slope gently to the north-west. It has no perennial streams and the sandy nature of the soils results in very little if any runoff and no surface water diversions. Mallee catchment flows are not estimated in the Victorian Water Accounts (DELWP, 2016c).

There are no major water harvesting storages in the Mallee basin.

Ephemeral wetlands of varying salinity are common throughout the basin.

4.4.2 Groundwater resources

The groundwater resource beneath the Mallee basin is part of the Wimmera-Mallee groundwater catchment (Murray basin) (**Figure 2**). Good-quality groundwater is found in the far west of the Mallee Basin, in the Murray Group Limestone aquifer in the Murrayville Groundwater Management Area (GMA) and part of the border zone defined in the South Australian–Victorian Border Groundwaters Agreement. Elsewhere, the groundwater is generally brackish to saline and therefore of limited usability. The regional groundwater flow path in the Wimmera-Mallee groundwater catchment is north-west.

For more information on the water quality monitoring program undertaken by GWMWater in the Murrayville groundwater management unit (GMU) plan, see GWMWater's website.

In Murrayville, groundwater is the sole source for town supplies, domestic and stock use and irrigated agriculture.

Water quality in the management unit varies, with the freshest water in the south-west and the poorest in the north. Overall aquifer salinity is relatively low – typically less than 10,000 EC and mostly below 3,000 EC.

The Mildura-Merbein salt interception scheme, operated by the MDBA, intercepts saline groundwater before it reaches the River Murray to reduce river salinity levels, and discharges it to inland drainage basins. Groundwater extractions under this scheme are not licensed and not included in the SDL.

4.4.3 Salinity and water quality

There are no surface water quality monitoring sites in the Mallee part of the Wimmera-Mallee water resource plan area. The Mallee Catchment Management Authority and Murrayville GMA monitor groundwater quality.

The quality of groundwater resources in the Wimmera-Avon basin is monitored within the border zone and management plan areas. Some monitoring is also undertaken by catchment management authorities and GWMWater. For more information on the water quality monitoring program undertaken by GWMWater in the Murrayville groundwater management unit (GMU) plan, see GWMWater's website.

4.5 Inter-basin transfers

Figure 8 shows the inter-basin transfers that occur in the Wimmera-Mallee water resource plan area.

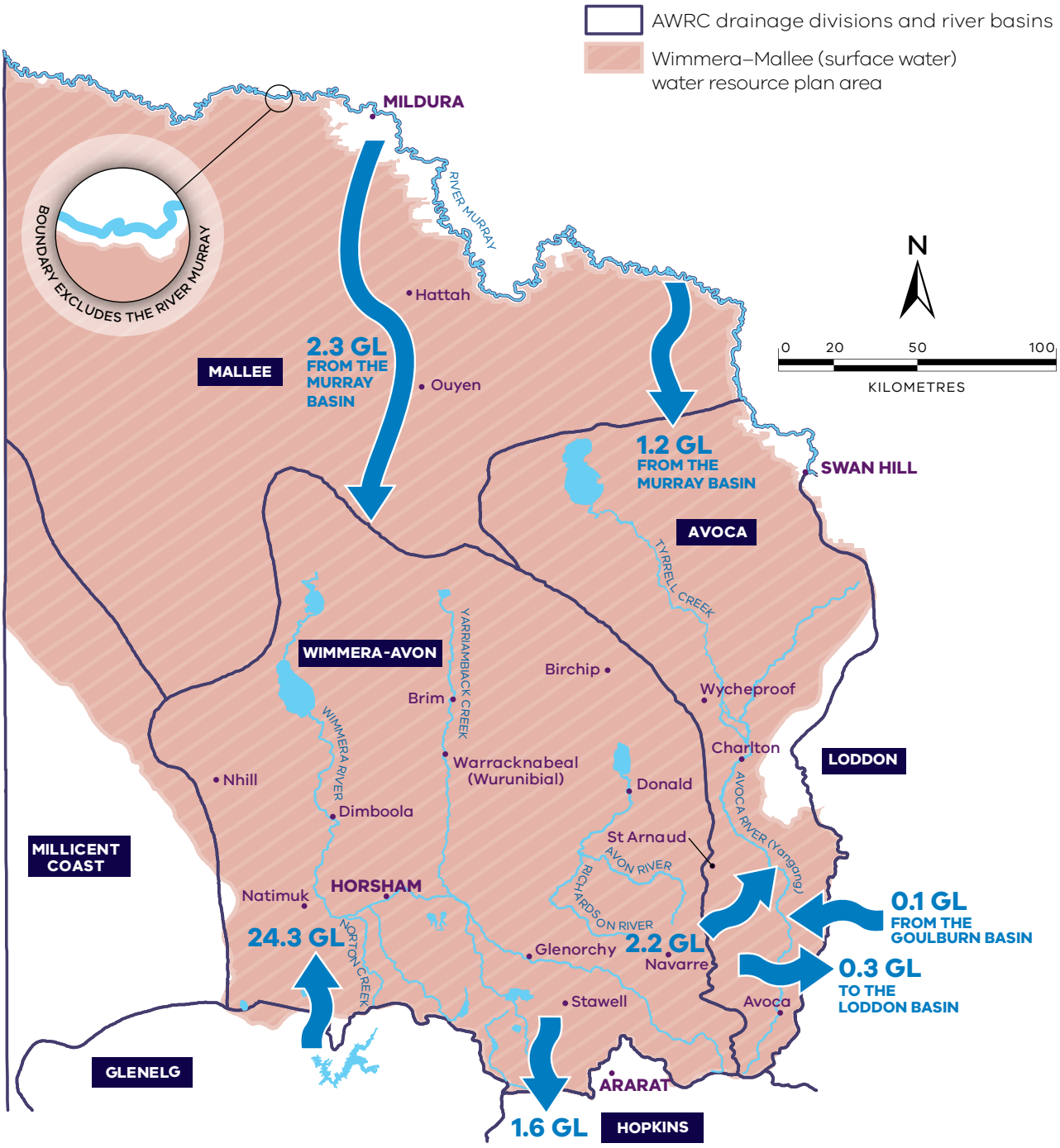

Figure 8: Water transfers into and out of the Wimmera–Mallee (surface water) water resource plan area (average water quantities have been taken from the Victorian Water Account)

4.5.1 Murray system resources

GWMWater diverts water from the River Murray into the Wimmera-Mallee water resource plan area via the Northern Mallee Pipeline and Wimmera-Mallee Pipeline. Diversions are made under the Bulk Entitlement (River Murray – Grampians Wimmera Mallee Water) Conversion Order 1999, which entitles GWMWater to a 3,492 ML high-reliability entitlement from the Murray system. Water available under this entitlement is subject to annual allocations plus any carryover or trade. Use of this entitlement is to be accounted for as a diversion from Victoria's North and Murray water resource plan area.

4.5.2 Goulburn system resources

Goulburn system resources are supplied to Quambatook via the Waranga Western Channel. This water is supplied in accordance with the Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006, which entitles GWMWater to a 100 ML high-reliability entitlement from the Goulburn system. Water available under this entitlement is subject to annual allocations plus any carryover or trade. Use of this entitlement is accounted for as a diversion from the Victoria's North and Murray water resource plan area.

4.5.3 Glenelg basin resources

On average, about 24,300 ML (DELWP, 2015a) per year of water is transferred from the Glenelg basin to the Wimmera-Mallee water resource plan area. The diversions into the Wimmera-Mallee water resource plan area come from:

- Rocklands Reservoir on the Glenelg River. Rocklands is the largest storage supplying the Wimmera-Mallee water resource plan area via the Rocklands–Toolondo Channel.
- Wannon River at the Billy Jack Creek diversion weir. Water is diverted to Fyans Creek in the Wimmera-Mallee water resource plan area and this flows into the Wimmera-Mallee System Headworks.

4.5.4 Inter-basin transfers from the Wimmera-Mallee water resource plan area

Small volumes of surface and groundwater from the Wimmera-Mallee water resource plan area are used to supply towns and rural water needs in the Upper Hopkins basin via the Willaura water supply system. This system supplies the following towns:

- Willaura
- Lake Bolac
- Wickliffe
- Moyston
- Glenthompson.

Ararat in the Hopkins basin is supplied with surface water from Mt Cole and this is supplemented with water from Lake Fyans in the Wimmera-Mallee system headworks.

These are accounted for as a diversion from the Wimmera-Mallee Water Resource Plan.

Wannon Water holds entitlements to the Wimmera-Mallee supply system which it uses for the Hamilton supply system and Balmoral. This water is sourced from Rocklands Reservoir in the Glenelg catchment and is not included as a diversion in the Wimmera-Mallee Water Resource Plan.

10.05(b) The Wimmera–Mallee Water Resource Plan was prepared having regard to the management and use of water resources that have a significant hydrological connection to the water resources in the water resource plan area. For surface water to surface water connections, no natural connections to other areas have been identified. Some

inter-basin transfers occur to support town supply and are managed so that there is no material effect on the water resources and they are accounted for in the method for permitted take under section 10.10 of the Basin Plan. As such, these connections are not considered significant connections for the purposes of the Basin Plan.

4.6 Groundwater connection to other water resource plan areas

The Renmark Group aquifer extends regionally between Victoria, South Australia and New South Wales and is the major connected groundwater resource between the Goulburn-Murray and Wimmera-Mallee (groundwater) water resource plan area. In Victoria it varies from about 30m thick in the Loddon Valley to the east and up to 300m thick around Mildura (Evans, 2012) and variously underlies the Shepparton and Calivil formations, the Parilla Sands aquifer and the Murray Group Limestone aquifer. Clay aquitards separate the Murray Group limestone aquifer from overlying Parilla and underlying Renmark formation and the Murray Group limestone aquifer is not a connected resource.

There is generally very little development of the Renmark Group aquifer in Victoria, and none in the Wimmera-Mallee water resource plan area where it is typically too saline for productive use, or too deep to be economically developed, or both.

The Parilla sands aquifer is contiguous with the Calivil and Shepparton formations in the Goulburn-Murray water resource plan area, however where these aquifers adjoin the groundwater is also saline. The Parilla Sands aquifer is generally unconfined in the Wimmera-Mallee (groundwater) water resource plan area and if it was developed, extraction from an unconfined system is unlikely to extend significantly from the point of extraction.

The generally low level of development in the adjoining aquifers to the water resource plan area means no restrictions have been placed on issuing groundwater licences by setting Permissible Consumptive Volumes. There is little demand for trade in the Sedimentary Plain as licensed entitlement and the BDL is well below the SDL, for further information about BDL and SDL see **Part 8.2**. Current management arrangements via Victoria's water entitlement framework are sufficient to manage impacts from licensing decisions and no additional rules are considered necessary to manage impacts on connected water resources.

10.05(b) The Wimmera-Mallee Water Resource Plan was prepared having regard to the management and use of water resources that have a significant hydrological connection to the water resources in the water resource plan area.

For groundwater to surface water connections:

a. The Wimmera-Mallee: deep SDL resource unit does not connect to surface water.

b. The Wimmera-Mallee: Sedimentary Plain SDL resource unit connects to surface water resources. These connections and how regard was had to them in the preparation of the Wimmera-Mallee Water Resource Plan are described below:

   i. Groundwater connections to the Wimmera and Avoca Rivers contribute saline inflows, and the aquifer may be freshened by flood or river recharge (CSIRO, 2010). The risk assessment considered the risks to the groundwater resources resulting from an increase in farm dams and non-compliance with the *Water Act 1989* (Vic), and these risks informed the Water Quality Management Plan and the responses to the requirements in Part 4 of the Basin Plan.

   ii. Connections occur to some wetlands in the Wimmera-Mallee water resource plan area. The nature of these connections is not well understood, and they are

generally not in areas where consumptive take from surface water resources occurs. As such, the management of the surface water resources is unlikely to have a material impact on the groundwater resources, and therefore these connections are not considered significant for the purposes of the Basin Plan.

c. The Wimmera-Mallee: Highlands SDL resource unit connects to surface water resources in the upper unregulated tributaries of the Wimmera and Avoca Rivers, and are likely to be contributing base flow (CSIRO, 2010). The risk assessment considered the risks to the groundwater resources resulting from an increase in farm dams and non-compliance with the *Water Act 1989* (Vic), and these risks informed the Water Quality Management Plan and the responses to the requirements in Part 4 Chapter 10 of the Basin Plan. Connectivity between the Wimmera-Mallee (surface water) SDL resource unit (SS9) and the Wimmera-Mallee Highlands SDL resource unit (GS9a) is not considered significant because there are only limited areas where groundwater contributes to the surface water resource, and there is currently a low level of actual groundwater take in this area The local scale of groundwater flow paths, the intermittent rainfall and the low yield is insufficient to provide enough baseflow to maintain surface flows over extended dry spells.. Even if the level of groundwater take increases to the upper limit of the SDL, it is not expected that there would be any material impacts to surface water resources.

Connectivity between the Wimmera-Mallee (surface water) SDL resource unit (SS9) and the Wimmera-Mallee Highlands SDL resource unit (GS9a) is not considered significant because there are only limited areas where groundwater contributes to the surface water resource, and there is currently a low level of actual groundwater take in this area. The local scale of groundwater flow paths, the intermittent rainfall and the low yield is insufficient to provide enough baseflow to maintain surface flows over extended dry spells. Even if the level of groundwater take increases to the upper limit of the SDL, it is not expected that there would be any material impacts to surface water resources.

For groundwater to groundwater connections:

a. The Renmark aquifer within the Wimmera-Mallee: Sedimentary Plan SDL resource unit extends into the Goulburn-Murray water resource plan area, and into New South Wales and South Australia. There is generally very little development of this aquifer in Victoria, and none in the Wimmera-Mallee water resource plan area where it is typically too saline for productive use, or too deep to be economically developed, or both. As such, the use of this resource is unlikely to have a material impact on the connected groundwater resources and is therefore not considered a significant connection for the purposes of the Basin Plan.

b. The Tertiary Limestone aquifer within the Wimmera-Mallee: Sedimentary Plain SDL resource unit also extends into South Australia and is managed through the South Australia-Victoria Border Groundwaters Agreement for equitable sharing. The groundwater is generally deep and more than 10 metres below the surface. The Tertiary Limestone aquifer is excluded from the area managed by the Wimmera-Mallee Water Resource Plan.

c. The Parilla Sands aquifer within the Wimmera-Mallee: Sedimentary Plan SDL resource unit also extends into the Goulburn-Murray water resource plan area.

However, where these aquifers adjoin the groundwater is saline. There is no demand for water from the Parilla Sands aquifer due to the high salinity and as it is generally unconfined in the Wimmera-Mallee water resource plan area.

4.7 Wimmera-Mallee water resource plan area water supply systems

4.7.1 History

The Wimmera-Mallee water resource plan area has experienced extremely unreliable local water supplies since European settlement. Governments responded by progressively building a 16,000-km channel system supplied from diversion weirs and reservoirs in the Grampians (*Gariwerd*) to meet the domestic and stock needs of farms and demands of towns that did not have a suitable groundwater supply.

Reservoirs were built to improve the reliability of supplies in response to system failures during droughts. Lake Wartook was built in 1887, Lake Lonsdale in 1903, Rocklands in 1954 and Bellfield in 1966.

The original Wimmera-Mallee Domestic and Stock Channel system was a complex network of open earthen channels that were very inefficient, with losses through seepage and evaporation approaching 90 per cent. The channel system was run once a year during winter to fill domestic and stock dams on farms and town dams for urban supplies. A summer channel run was restricted to topping up town dams.

This system provided sufficient water in average years but could not meet demands during severe droughts and was particularly vulnerable to multi-year droughts. In these years, water shortages exacerbated the hardship caused by widespread destocking and crop failures. Extensive and costly water carting was necessary, worsening community adversity.

The system failed most recently during the Millennium Drought when there was insufficient water available to operate the channel system. Efforts to improve reliability moved from building new storages to pipelining the channel system.

Today, GWMWater owns and operates three surface water supply systems and a large number of groundwater systems to supply water in the Wimmera-Mallee water resource plan area. The surface water systems are:

- Northern Mallee Pipeline
- Wimmera-Mallee Pipeline
- eastern Grampians and Pyrenees supply.

Figure 9 shows the location of the surface water supply systems and the groundwater supply area. Each water supply system is outlined in the following sections.

Figure 9: Water supply systems in the Wimmera-Mallee water resource plan area (Source: GWMWater)

4.7.2 Murray Northern Mallee Pipeline system

Construction of the Northern Mallee Pipeline Project began in 1992 and was completed in 2002. The original open channel system used 50,000 ML of water from the Grampians (*Gariwerd*) catchments to deliver 5,000 ML to 1,700 farms and 12 towns in the areas bordered by Ultima, Sea Lake, Underbool, Wemen and Kooloonong. This inefficient channel system was replaced by a pipe network supplied by four pump stations on the River Murray at Swan Hill, Piangil, Nyah and Liparoo/Wemen.

GWMWater currently has a 3,492 ML entitlement under its Murray bulk entitlement to supply the system, and water used in this system is not part of the Wimmera-Mallee Water Resource Plan SDL.

The pipeline project saved 49,500 ML of water a year by reducing seepage and evaporation losses, and allocated 34,700 ML of water to the environment (but at a lower reliability than consumptive entitlements) and 15,000 ML to improve supply reliability to all water users of the Wimmera-Mallee supply system and for growth.

The project greatly improved the reliability and quality of water supplies in the northern part of the system. It enables water that was previously released from the Wimmera-Glenelg Headworks System to supply the northern Mallee to be stored for use by the rest of the system in dry years and for environmental flows.

The project was funded by the Commonwealth and Victorian governments, which together contributed $38 million through the Natural Heritage Trust, and Wimmera Mallee Water (now part of GWMWater) and its customers, who contributed $13 million for pipeline infrastructure, farm water supply works and filling of redundant channels.

4.7.3 Wimmera-Mallee Pipeline system

Wimmera–Mallee Pipeline Project

On completion of the Northern Mallee Pipeline Project, the un-modernised channel system remaining in the southern areas continued to be very inefficient, with high losses during water delivery.

The system uses an average 120,000 ML of water a year to supply just 17,000 ML to 9,000 rural properties and 29,000 urban water customers in 36 towns across the region. In other words, some 103,000 ML (85 per cent) of water per year was lost in conveyance.

The Wimmera-Mallee Pipeline Project piped the rest of the channel system at a cost of $663 million. The project was funded by the Commonwealth and Victorian governments and GWMWater. Government funding was provided so that some of the water savings could be supplied for environmental flows. GWMWater funding was provided so that some of the water savings could be used for regional development.

The project began in 2006 and was completed in 2010. It resulted in dramatically improved reliability of supply to all water users, including the environment. It returned an annual average of 83,000 ML of water to the Wimmera, Glenelg, Goulburn, Loddon, Avon-Richardson and Avoca rivers to help restore these degraded waterways, and provided increased frequency of flows to the region's nationally significant terminal wetlands – Lake Hindmarsh and Ramsar-listed Lake Albacutya.

Water savings from the project were used to:

- improve the reliability of supply to towns, farms and industry in the piped areas
- establish 20,000 ML of 'growth water' entitlement for regional development

- substantially increase the environment's share of flows in the system (83 GL/year on average based on historical streamflows at that time).

Together with water already available to the environment, this enabled:

- establishment of a 40,650 ML environmental entitlement with a reliability upgraded to that of other pipeline entitlements
- passing flows at storages and weirs
- increased unregulated flows by reducing how much water was diverted, and increasing how much water could be 'spilled' downstream
- improved water quality.

The completion of the pipeline systems has improved the reliability of water supplies in the Wimmera-Mallee water resource plan area. However, during prolonged dry periods, water allocations may be severely restricted (see **Table 4**).

Table 4: Water allocations and entitlements in the Wimmera-Mallee supply system

Entitlement type	Annual allocation (per cent of entitlement)				
	2011-12	2012-13	2013-14	2014-15	2015-16
Pipeline	100	82	81	48	16
Pipeline and balancing storage losses	100	100	100	100	33
Recreation and wetland	100	28	25	0	0
Glenelg compensation flow	100	28	25	1.5	0.5
Commonwealth Environmental Water Holder	N/A	0	0	0	0

Most of the environmental water recovery from the Wimmera-Mallee Pipeline Project is included in the Wimmera-Mallee Water Resource Plan baseline diversion limit (BDL), helping to meet the region's SDL. The exceptions are water savings returned to the Goulburn (1.4 GL long-term cap equivalent) and Loddon (7.4 GL long-term cap equivalent) rivers, which will be considered in the Victoria's North and Murray Water Resource Plan. BDL and SDL are explained in **Part 8.2**.

Closure of the Wimmera irrigation area

The Wimmera-Glenelg headworks system supplied the old channel system and the 3,200-hectare Wimmera Irrigation District (WID) near Horsham. The Wimmera-Mallee Pipeline Project did not include supply to the WID.

The WID had a water entitlement of 19,000 ML and supplied 210 irrigators with an additional 9,000 ML for conveyance losses. Water was supplied only after domestic and stock and town demands were met. As a consequence, irrigation water supplies were less reliable than piped supplies.

During the Millennium Drought from 2004, there was insufficient water to supply the irrigation area. Irrigators, with the support of GWMWater, proposed that the system be closed and the water entitlement be sold to the Commonwealth to increase environmental flows.

The Commonwealth agreed to the proposal and bought all 28,000 ML of irrigation and loss entitlements and conveyance water for $900 per ML ($25 million) to provide environmental water to the Wimmera River for Lake Hindmarsh and Lake Albacutya. An additional $4.75 million, allocated from the Wimmera-Mallee Pipeline Project, funded the decommissioning of the WID channel system, which was closed in 2013.

The irrigation entitlements bought by the Commonwealth deliver 23 GL long-term cap equivalent (LTCE) to the environment. This volume fulfils the requirement of the Basin Plan to reduce the Wimmera-Mallee Water Resource Plan's surface water BDL by 23 GL LTCE.

Wimmera-Glenelg headworks system

The Wimmera-Glenelg headworks system contains a large number of storages and diversion weirs (**Figure 10**). The system's many interconnections enable demands to be supplied from a range of sources. Water can be transferred from Rocklands Reservoir in the Glenelg catchment to the Wimmera catchment, but water cannot be transferred from the Wimmera catchment to the Glenelg catchment. This means that only Rocklands Reservoir can be used to supply Balmoral township, supplement the Hamilton urban supply system and release environmental flows to Glenelg River.

Water-harvesting operations affect flows along Wimmera River and tributaries in the north and Glenelg River and its tributary, Wannon River, in the south. Both these south-flowing rivers have important environmental values.

Several lakes that were previously storages in the channel system were made redundant for recreation by the Wimmera-Mallee Pipeline Project. Many of these storages had high evaporative losses but were also valued by local communities for recreation. Examples include Green Lake near Horsham, Pine Lake, Dock Lake and Lake Batyo Catyo.

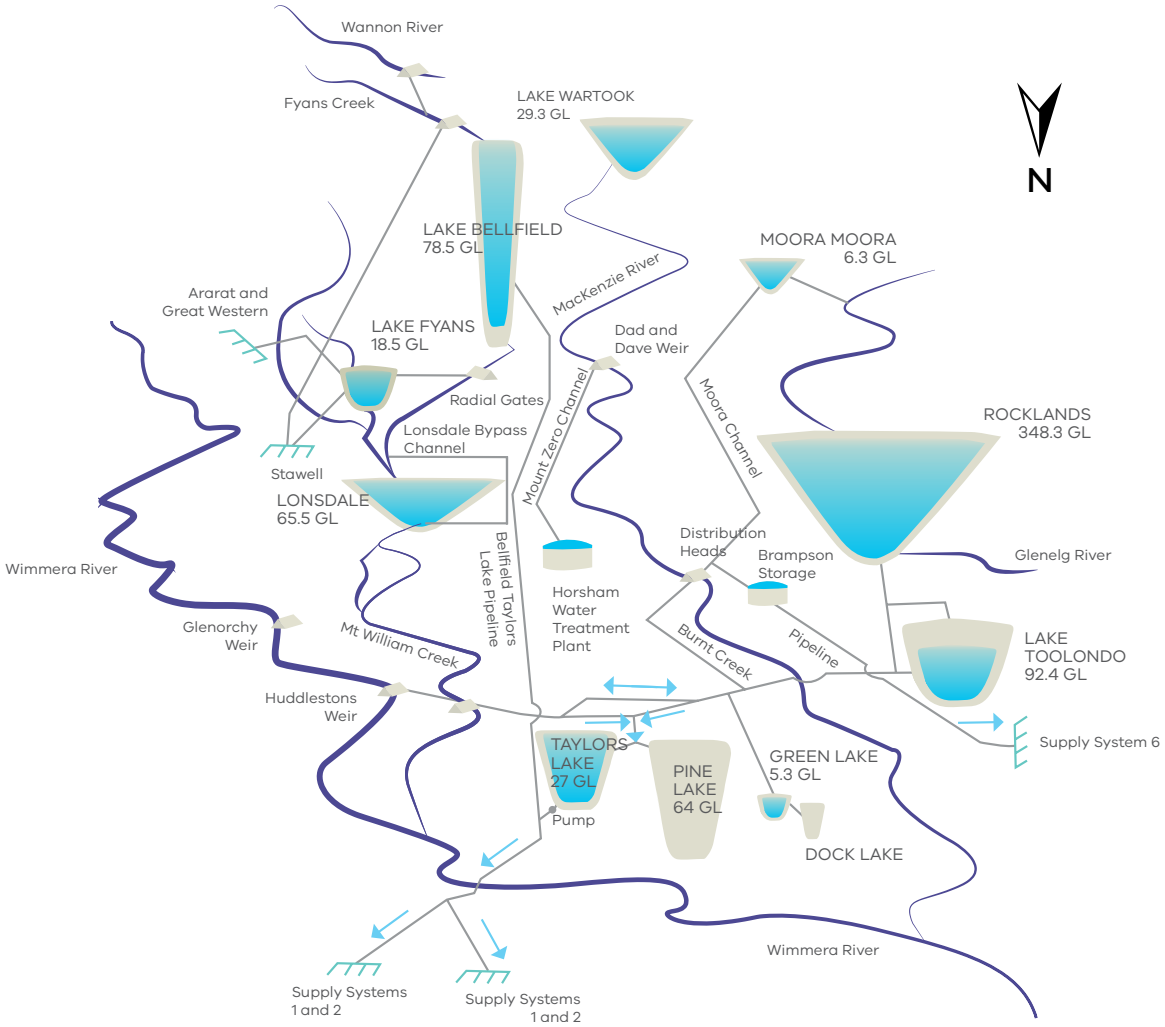

Figure 10: The Wimmera-Glenelg headworks system

4.7.4 Pyrenees and East Grampians supply system

The Bulk Entitlement (Willaura, Elmhurst, and Buangor Systems – GWMWater) Conversion Order regulates water use by the Pyrenees and East Grampians water supply system in the Upper Wimmera catchment. This system supplies the towns of:

- Willaura, Moyston, Lake Bolac and Wickliffe (390 ML) from two weirs located on Stoney Creek and Mt William Creek in the Upper Wimmera basin and two weirs on Masons Creek in the Hopkins basin respectively. This part of the system also provides bulk water to Wannon Water's Willaura system outside the Wimmera basin (58 ML)
- Buangor from a weir that diverts water from McLeod Creek (28 ML) to the Buangor service basin
- Elmhurst from a weir that diverts water from Hickmans Creek (48 ML) to the Elmhurst service basin.

The system services about 1,000 urban customers. It also supplies a number of rural connections that draw water from pipelines between the towns.

The bulk entitlement specifies annual volumetric caps, offtake points and maximum diversion rates. Minimum passing flows are not specified but must consider the time of year (e.g. not in summer/autumn). GWMWater currently has a 220 ML (as at March 2017) groundwater extraction licence for the Mt William borefield that supplements the East Grampians system in drought years or during flood conditions when infrastructure may be damaged.

4.7.5 Groundwater-supplied systems

GWMWater supplies 12 towns from the Murray Group limestone aquifer in the west of the region. Average urban use over the past five years is about 940 ML per year. Groundwater for all these towns except Murrayville is sourced from the West Wimmera groundwater catchment and excluded from the Wimmera-Mallee water resource plan area. Horsham's town supply is supplemented by a paleochannel in the northern Grampians (*Gariwerd*) in the Wimmera-Mallee groundwater catchment. Groundwater use in the Murrayville area is managed under a local management plan, with average urban water use of about 148 ML per year.

5. Victoria's water institutions and functions

Part 5. Victoria's water institutions and functions

This chapter describes the institutional arrangements for the Victorian water sector (see **Figure 11**). The roles and responsibilities of the agencies that must have regard to the Basin Plan are outlined here. These include the Minister, water corporations, catchment management authorities and the Victorian Environmental Water Holder.

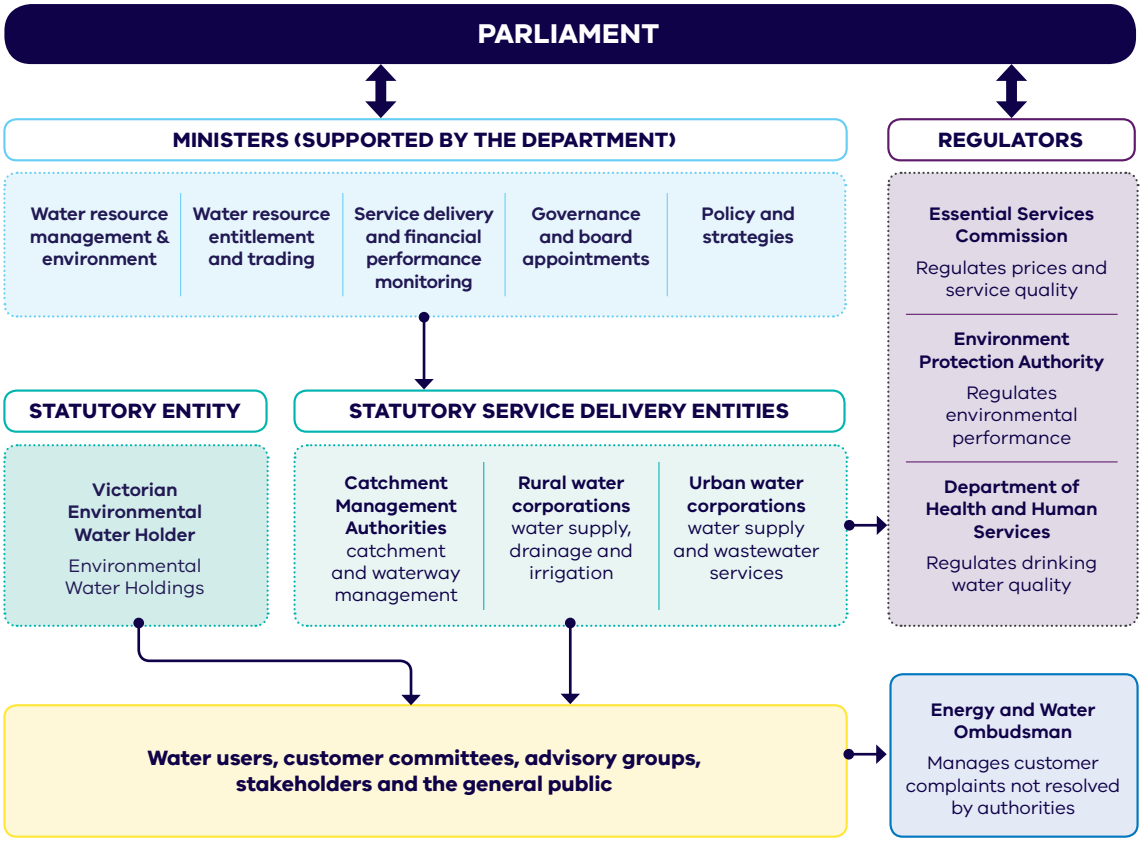

Figure 11: Structure of the Victorian water sector

5.1 The Minister

The Minister for Water is accountable to Parliament and responsible for governance of the water sector under the Victorian Water Act and the *Catchment and Land Protection Act 1994*. The ministers for environment and health and the Treasurer have some responsibilities for elements of the water sector's regulatory framework, but these are not significantly affected by the Basin Plan.

The Minister for Water has specific responsibilities for issuing water entitlements and managing Victoria's water resources and supply, thus is significantly affected by Basin Plan.

The Minister:

- makes and amends bulk and environmental entitlement orders
- appoints the storage manager and sets storage management objectives
- issues water shares
- issues take and use licences in groundwater and unregulated systems - in most cases this function is delegated to rural water corporations
- determines water trading rules and oversees the water market
- declares water shortages and qualifies rights
- establishes metering and reporting requirements
- is responsible for maintaining a register of all entitlements
- oversees the entitlement compliance framework
- ensures a water resource assessment program is in place
- ensures regional water strategies are prepared
- issues statements of obligation that set out the Minister's expectations about the activities carried out by water corporations and catchment management authorities.

5.2 Water corporations

Victoria's water and wastewater services are provided by 19 statutory corporations established under the Victorian Water Act. The Minister for Water and the Treasurer have joint responsibilities for specific governance functions of water corporations. The Minister for Water has portfolio responsibilities for the development of water policy and governance including overseeing performance and appointing directors to the boards of these corporations.

Victoria's water and wastewater services are provided by 19 state-owned corporations established under the Victorian Water Act. The water corporations provide a range of water services to customers within their areas consisting of water supply, sewage and trade waste disposal and treatment, water delivery for irrigation, drainage and salinity mitigation services.

The water corporations are funded by fees and charges they collect from their customers.

The water corporations are subject to the *Financial Management Act 1994* and the *Public Administration Act 2004* and are also affected by:

- independent regulation of prices by the Essential Services Commission
- regulation of water quality by the Department of Health in accordance with the *Safe Drinking Water Act 2003*
- regulation of environmental impacts by the Environment Protection Authority

Water corporation customer complaints that are not resolved directly by the water corporation can be referred to the Energy and Water Ombudsman for consideration.

Water corporations may hold bulk entitlements, water shares and take and use licences to supply or support the supply of water to their customers.

The water corporations are responsible for meeting their customers' water needs and are required to carry out short and long-term planning. They are also required to have emergency management plans to minimise service disruptions.

Water corporations can participate in the water market.

Urban water corporations are responsible for water supply (including recycled water), sewage and trade waste disposal services to their urban customers. Rural water corporations provide services such as water supply, irrigation drainage and salinity mitigation services for irrigation, environmental, recreational and domestic and stock purposes.

Grampians Wimmera Mallee Water (GWMWater) is the main water corporation providing urban and rural water supply and sewerage services for the Wimmera-Mallee water resource plan area. Coliban Water supplies the small towns of Wychitella, Korong Vale, Wedderburn and Borung, and Central Highlands Water supplies Avoca, Redbank, Amphitheater Landsborough and Navarre. **Figure 12** shows the areas managed by the urban water corporations.

GWMWater also provides rural domestic and stock supplies as shown in **Figure 13** and manages take and use licences for surface water from unregulated waterways and groundwater in its management area of the Wimmera-Mallee water resource plan area except for urban supply where it is the Minister who issues these licences in its area of management.

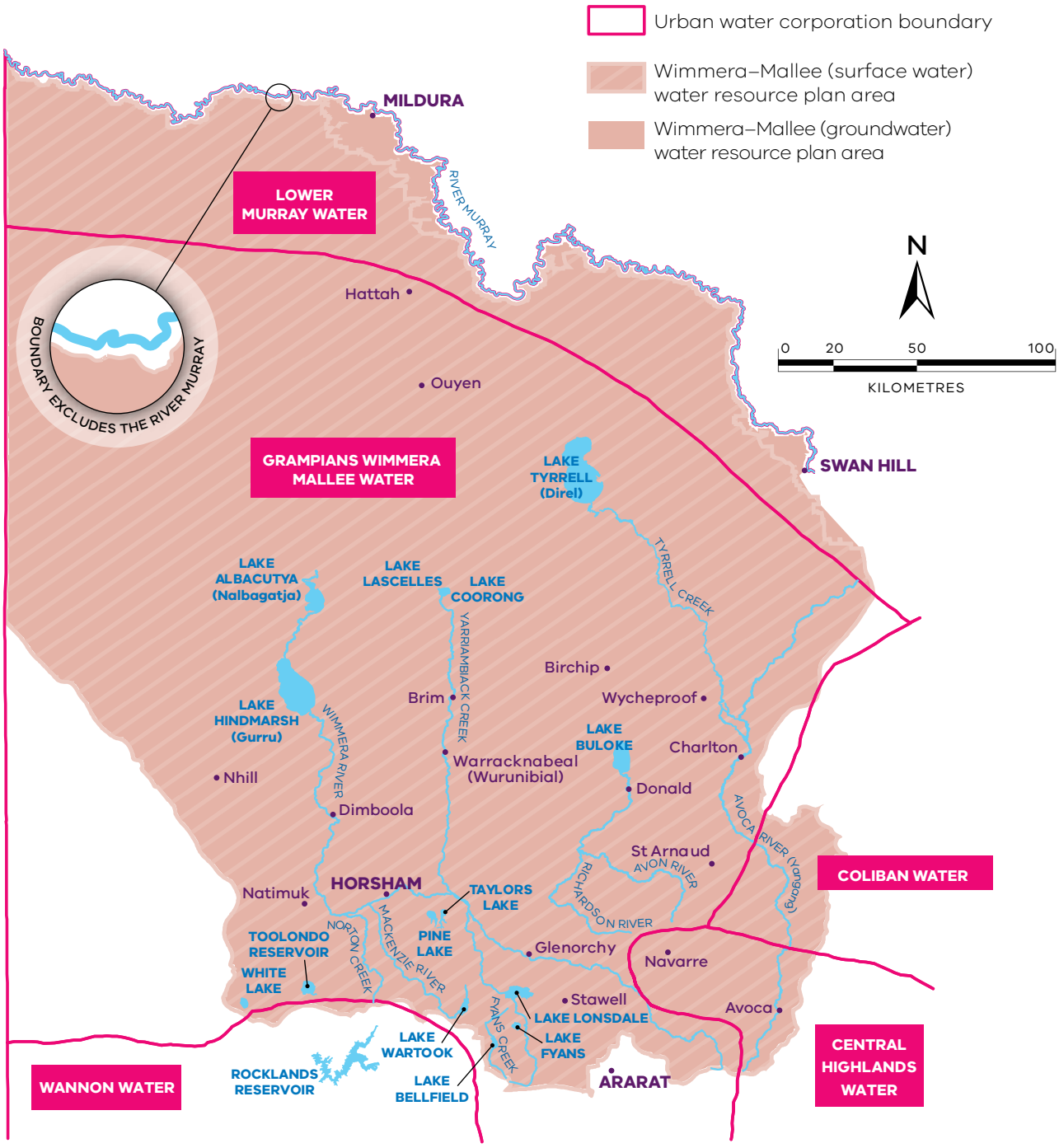

Figure 12: Urban water corporations that provide services in the Wimmera–Mallee water resource plan area

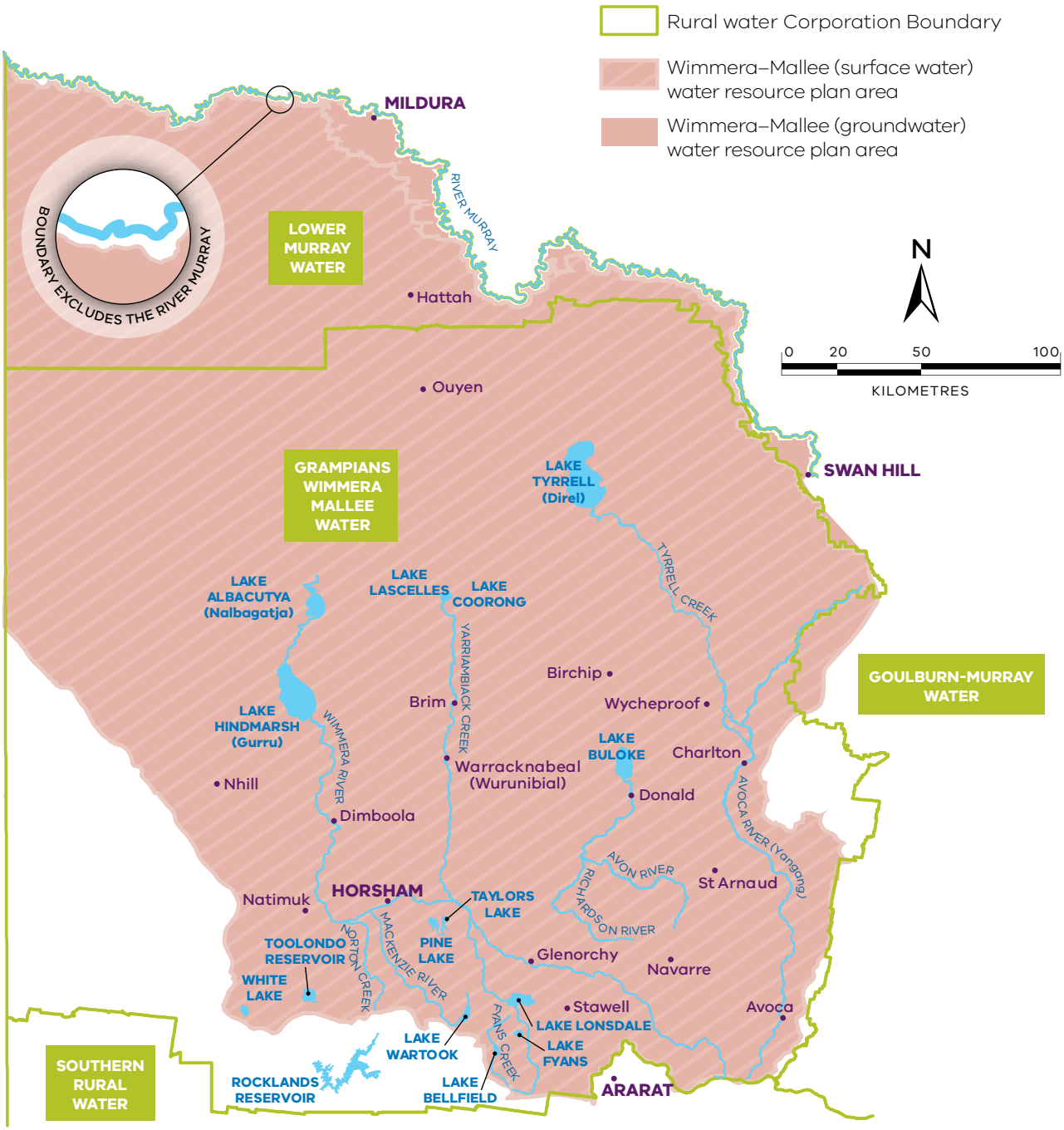

Figure 13: Rural water corporations that provide services in the Wimmera–Mallee water resource plan area

5.3 Catchment management authorities

Victoria's 10 catchment management authorities are statutory bodies established under the *Catchment and Land Protection Act 1994*. They also have functions and powers under Part 10 of the Victorian Water Act. They are administered according to the *Public Administration Act 2004* (that is, they are public entities) and the *Financial Management Act 1994* (that is, they are public bodies).

The Wimmera Catchment Management Authority (CMA), Mallee CMA and North Central CMA operate in the Wimmera-Mallee water resource plan area. **Figure 14** shows their boundaries.

Figure 14: CMAs that deliver services in the Wimmera-Mallee water resource plan area

CMAs are jointly overseen by the Minister for Water and the Minister for Energy, Environment and Climate Change, and rely on funding from the Victorian Government. Their functions relate to the management of land and water resources and include:

- advising the Minister on catchment management issues and priorities
- advising the Department Secretary and municipal councils about flooding issues
- preparing and reviewing regional catchment strategies, sub-strategies and plans about catchment management issues such as:
  - waterway management strategies
  - seasonal watering proposals
  - environmental water management plans
  - land and water management plans (addressing salinity issues)
  - flood management plans
- encouraging cooperation between stakeholders
- promoting community awareness
- undertaking research
- preparing reports on their catchment management activities.

CMAs also have waterway management service delivery functions and powers under Part 10 of the Victorian Water Act. These functions include:

- carrying out works and activities to protect and enhance land, waterways, the environmental water reserve and the environmental values of waterways
- providing, maintaining and operating drainage schemes
- declaring flood levels and developing and implementing plans to minimise flooding.

When undertaking these functions, the CMAs are subject to the general powers and obligations of authorities established under the Victorian Water Act. They also may:

- regulate the connection of drainage works to designated waterways
- regulate drainage diversions into and out of their area
- make by-laws in relation to functions under Part 10 of the Victorian Water Act.

5.4 Victorian Environmental Water Holder

The Victorian Environmental Water Holder (VEWH) is established by Part 3AA of the Victorian Water Act.

The VEWH is responsible for holding and managing water entitlements to improve the environmental values and health of water ecosystems for uses that depend on environmental condition.

The VEWH works closely with CMAs in gathering the most up to date information to prepare a seasonal watering plan each financial year. This scopes where, when, how and why environmental water can be used across Victoria's rivers, wetlands and floodplains. For more information see **Part 12.5**.

The VEWH has no powers to raise revenue through fees and charges, but may buy and sell water where this is consistent with its statutory objectives. It must comply with water trading rules that apply to other entitlement holders. The VEWH's decisions about applying its water holdings are not subject to Ministerial direction.

Each year the Victorian Environmental Water Holder must prepare a corporate plan for the following three years that includes details of:

- strategies and policies
- governance, funding and reporting arrangements
- performance indicators.

5.5 The storage manager

Responsibilities for the management of water systems are assigned by a number of instruments under the Victorian Water Act, including those appointing resource managers (section 43A(1)(b)), and storage managers (section 122ZK), and instruments appointing a water corporation to make seasonal determinations for declared systems (section 64GA)).

The Minister may appoint a storage manager under section 122ZK of the Victorian Water Act on the terms and conditions specified in the instrument of appointment. These are made for bulk water supply systems that supply multiple customers including bulk and environmental water holders and water shares and take and use licence customers.

Additional responsibilities are conferred on storage managers through government policy and legislative instruments, for example *Water for Victoria* and bulk entitlements.

The main responsibility of the storage manager is to operate the headworks system to supply water to meet entitlements. Other functions may include:

- calculating the amount of water available to entitlement holders
- preparing an annual supply system operating plan
- preparing a water resource outlook for the coming water year assuming wet, average, dry and drought scenarios
- reporting on operations to entitlement holders

GWMWater under section 122ZK of the Victorian Water Act is appointed as Storage Manager in respect of the bulk entitlements and environmental entitlements granted for the Wimmera-Mallee system headworks, subject to the terms and conditions as set out in the Storage Manager Instrument of Appointment 2010 documentation.

5.6 Issuing authorisations to take water

The Minister for Water is responsible for issuing entitlements under the Victorian Water Act. Section 7 of the Act provides for the continuation of Crown rights to the use, flow and control of all the water in a waterway and all groundwater in Victoria. From this right, the Minister may authorise individuals to take, use and hold water in Victoria. The types of entitlements and rights to take water (water access rights) available in the Wimmera-Mallee water resource plan area are outlined in **Part 6.2**-**Part 6.4**.

5.6.1 What is an authorisation to take

In Victoria, an entitlement provides for an authorisation to take and use water. In the case of water shares, the authorisation to take and use water are separated across two instruments; however, because there are no water shares in the Wimmera-Mallee water resource plan area, this is not relevant. An authorisation typically has the following key characteristics:

- permits a particular person (or company) to take water from the system
- identifies the water resource or system from which the water can be taken or diverted
- identifies the volume that the person (or company) is authorised to take from the specified resource or system.

An authorisation to take (and use) water is typically subject to conditions including but not limited to:

- the time at which the person is permitted to take the water
- the rate at which the person may take or divert the water
- the place at which the person may take the water
- metering requirements
- reporting requirements.

The standard conditions typically applied to a take and use licence are contained in Schedule 2 of the Ministerial Policies for Take and Use Licences (Minister for Water, 2014b).

For more information on the conditions applied to a bulk entitlement issued to a water corporation or the VEWH, see the Water Register at **www.waterregister.vic.gov.au**.

5.6.2 Limits on issuing new entitlements

The way 'authorisation to take water' complements the concepts of permitted take and actual take under the Basin Plan is explained in **Part 8.5**.

The Victorian Water Act requires the Minister to consider a number of matters when determining whether to issue a new entitlement including:

- every power, discretion, function, authority and duty of the Minister and the Authority must be construed subject to the *Groundwater (Border Agreement) Act 1985*, the *Murray-Darling Basin Act 1993* and the Murray-Darling Basin Agreement under section 6.
- the Crown must not exercise a right conferred by section 7(1) of the Victorian Water Act so as to limit a right to water conferred on any other person by section 8(1)(b), (c), or (d) or section 8(4)(c) of that Act.
- a right must not be conferred on another person under a licence to take and use water unless regard is had to the need to maintain the environmental water reserve in accordance with the environmental water objective.
- where a permissive consumptive volume (PCV) is determined under section 22A, the Minister may not issue a licence to take and use water if the issue of the licence will cause the PCV to be exceeded (see section 55 of the Victorian Water Act).

In addition to the above, the Commonwealth Act requires the Minister and water corporations to act in accordance with a water resource plan. A water resource plan requires Victoria to demonstrates how it will determine permitted take for an accounting period (one year) to meet the SDL prescribed in the Basin Plan. Furthermore, the water resource plan must identify rules that ensure actual take by water users does not exceed permitted take for the accounting period. Determining permitted take is outlined in **Part 8.3** and the rule for ensuring actual take does not exceed permitted take in **Part 8.5**. For more details on permitted and actual take see the Methods Report at **Appendix C**.

This means that in Victoria new entitlements cannot be issued where it would:

- result in exceeding the SDL under the Basin Plan by virtue of the limitation on decision making under section 6 resulting from the requirement in the Basin Plan to ensure actual take does not exceed permitted take
- result in exceeding permissible consumptive volumes as determined under the Victorian Water Act
- impact on other water users including the VEWH.

Practically speaking, in most areas across Victoria new entitlements cannot be issued because the current volume of entitlements is equal to the volume that can be sustainably diverted for the relevant system. There are some areas where groundwater may be available. In the Wimmera-Mallee water resource plan area, for example, the baseline diversion limit, which represents the volume of take as at 2009, is lower than the sustainable diversion limit volumes prescribed for the groundwater.

5.7 Compliance and enforcement

Compliance and enforcement is undertaken by the Minister and authorities ('Authorities') (water corporations and catchment management authorities). Authorities may also be responsible for compliance and enforcement as delegates of the Minister.

Offences under the Victorian Water Act include those relating to:

- authorisations to take and use water
- authorisation to construct works (including but not limited to works on waterways for the take and use of water)
- authorisation to discharge into waterways and aquifers
- connection to the works of an Authority.

In managing compliance with the Victorian Water Act, the Minister and Authorities have the following enforcement tools available under the Act:

- Notice to Repair under section 150, which allows an Authority to require the owner of land to repair works on their land or connect to the works of an Authority so that the Authority can provide a service to that land. Where a person fails to comply with the notice, they may be subject to penalties
- Notice of Contravention under section 151, which allows (where the Authority believes the person has contravened the Act, regulations or other instrument under the Victorian Water Act) the Authority to require, by notice, to take any action to remedy the identified contravention. This notice allows the Authority to identify the breach of Victorian water law and determine action for the person to remedy or address the breach. Where a person fails to comply with the notice, they may be subject to penalties.
- reduce, restrict or discontinue delivery of water under section 231, which allows an Authority to reduce, restrict or discontinue the delivery of water to a serviced property in certain circumstances. These circumstances include where the Authority believes the owner of the serviced property has contravened the Act, regulations or bylaws relating to the taking of water. This power is not relevant, however, to the Wimmera-Mallee water resource plan area because water delivery does not occur in the system. This function is relevant in systems where water shares are issued.
- penalty infringement notices under section 295A where a person contravenes a permanent water saving plan or staged restrictions. These are part of the measures detailed in respect of extreme events in **Part 9**.
- prosecution powers under section 296 under which the Minister or Authority may institute court action to seek penalties for alleged conduct in contravention of the Victorian Water Act. Penalties under the Act are discussed below.
- revoke or suspend a driller's licence under section 313 by the Drillers' Licensing Board[5]. A driller's licence is required for bore construction and does not contain conditions relating to the take and use of water.

5 It should be noted that the Drillers' Licensing Board includes members who are not officers of the DELWP or a water corporation.

In addition to the formal powers under the Victorian Water Act, the Minister and Authorities are able to take administrative action to support compliance including education programs and warning letters. To support enforcement activities, the Minister and Authorities have the following additional powers under the Act to support compliance monitoring:

- powers under section 133 to permit an authorised person and officers of an Authority to enter private land to inspect any works or make any test to find out whether the Act, regulations or bylaws of the Authority are being complied with.
- search and seizure warrant under sections 291E to 291H, which permits an authorised water officer to enter land to inspect any works, make any test and seize any evidence that the Act, regulations or bylaws have not been complied with.

Powers to enter land are subject to conditions. In particular, where the land is used primarily for residential purposes, consent must be obtained and entry must be between 7am and 7pm. There are fewer restrictions on non-residential land to account for the manner in which general water resource management and system management activities are undertaken in addition to general monitoring and compliance on land that is often a significant distance from any residence. Similarly, the time of day for entry restrictions does not apply for non-residential land because water users may take and use their water overnight for a range of reasons including reducing evaporation losses and avoiding high daytime electricity costs associated with pumping water.

5.7.1 Metering and monitoring compliance

Water corporations carry out a monitoring program that includes on-ground inspections and metering of water use.

In Victoria meters are owned, read and maintained by water corporations and read remotely on a continuous basis, or at least yearly in other instances. Victoria's Non-Urban Metering Policy (Minister for Water, 2014c) requires all new extractions for commercial and irrigation purposes to be metered, and for the state to comply with the Australian Standard over time.

Existing licensed extraction sites must be metered if the licensed volume is 10 ML or greater for surface water, and 20 ML or greater for groundwater. Water corporations may choose to meter all commercial and irrigation extractions even where the amounts are smaller than these thresholds. Water corporations maintain asset databases of their meter fleets. Water corporation staff make inspections and spot checks for illegal bores or infrastructure and meter tampering, as well as conducting stream surveys.

Victoria is reviewing its non-urban water metering policy and state-wide implementation plan to make sure they are economically practical and of a suitable standard to meet the requirements of the Basin Compliance Compact. The Basin Compliance Compact can be found at **https://www.mdba.gov.au/publications/independent-reports/basin-compliance-compact**. Victoria's commitment are outlined in the Compliance Compact. DELWP is reporting on how Victoria is implementing the Basin Compliance Compact on **https://www.water.vic.gov.au/mdb/compliance**.

5.7.2 Education programs

Water corporations undertake education and community awareness-raising activities such as:

- publishing newsletters, webpages, media releases, newspaper notices about prosecutions and advisory letters
- holding committee meetings, audits and presentations
- engaging with customers and other stakeholders.

5.7.3 Compliance and enforcement strategy

As part of ensuring that the implementation of national framework activities was embedded as business as usual, in December 2015 the Minister for Water amended water corporations' statements of obligations. These are issued under the *Water Industry Act 1994*, and outline the manner in which the Minister would like water corporations to undertake their functions. The purpose of these statements is to specify the obligations of a water corporation in relation to performing its functions and exercising its powers under the Act. Clause 7.3A of the statements provides that:

> *To manage and prioritise risks associated with non-compliance in enforcement of the Water Act 1989, the Corporation must*
>
> a. *Develop and implement policies, standards and systems based on risk-based regulatory models; and*
>
> b. *Adhere to any guidelines issued by the department.*

Victoria will publish a revised compliance framework in response to the Basin Compliance Compact.

Reporting requirements

Water corporations are required to report annually on how they have met their obligations under the statement of obligations. This reporting includes information on meeting the enforcement of the Victorian Water Act obligations outlined previously as clause 7.3A of the statement of obligations. Reporting against the statement of obligations will support reporting under Schedule 12 of the Basin Plan.

5.7.4 Complementing MDBA enforcement

Water resource plans are designed to demonstrate how Basin states are managing Basin water resources consistently and with a common goal of Basin river and environmental health. This is critical for sustainable water use to support continued agriculture and farming, rural communities and cities and towns without harming the environment or the ability for communities to enjoy and benefit from it.

As a result, Victorian water users will be subject to two regulatory regimes that manage the take of water from Victorian water resources in the Basin (see **Part 1.3**). The Victorian government remains responsible for managing compliance and enforcement with respect to obligations under the Victorian Water Act and any regulations made under that Act. The Commonwealth and Basin states intend that the MBDA will step in as a last resort to enforce compliance with the water resource plans in accordance with the powers under Part 8 of the Commonwealth Water Act. This is reflected in the Basin Plan Implementation Agreement (7 August 2013). This arrangement is supported on the basis that:

- water resource plans reflect state arrangements and Victorian water law contains the same or similar obligations as contained in the relevant water resource plan
- Victorian water corporations are in the best position to manage compliance and enforcement of Victorian water users
- where the Victorian State fails to take appropriate action to manage compliance with an obligation also contained in the relevant water resource plan, the MDBA could exercise its discretion to act
- to manage this relationship and to complement Commonwealth and state compliance and enforcement objectives, Victoria proposes to:
- provide annually, in its reporting under Matter 19 of Schedule 12 of the Basin Plan, information regarding detected non-compliance in water resource plan areas that relates to obligations

under Victoria's North and Murray Water Resource Plan and the action taken to address non-compliance; for example details of auditing, reporting and investigations carried out
- refer to the MDBA for consideration, non-compliance of a serious nature to assess appropriateness of state, Commonwealth or joint action
- use its best endeavours to provide the MDBA with relevant information to support enforcement action regarding non-compliance with a Victorian water resource plan area

Autonomy and referrals

While the MDBA and Victoria will work together to ensure that agencies, companies and individuals comply with the requirements of water resource plans, each party will do so while maintaining its autonomy and exercising its own discretion in relation to enforcement activities.

The Murray-Darling Basin Water Compliance Review (Compliance Review Report) released by the MDBA in November 2017 recommended the development of more structured arrangements relating to the joint enforcement of obligations under water resource plans. Enforcement under water resource plans is considered to be a joint responsibility between the MDBA and Basin states because:

- water resource plans should reflect state-based arrangements that should be enforced by the relevant Basin state
- the Commonwealth Water Act requires state agencies and individuals to comply with the requirements of water resource plans, and this obligation is enforceable under Commonwealth law
- Basin states should use best endeavours to support the MDBA in managing compliance with water resource plans

The Department of Environment, Land, Water and Planning is currently negotiating an enforcement and information sharing protocol with the MDBA. Once finalised this will be published on the DELWP website at **https://www.water.vic.gov.au/mdb/compliance**

While it is anticipated that in some cases the MDBA or Victoria may refer a non-compliance issue to the other party for investigation and prosecution, Victoria considers that such a referral should be done on the following basis:

- the referral is made in confidence to allow proper investigation of the matter
- the referral is done in full, meaning that the party to whom the matter was referred has full ownership of the matter and is responsible for resolving the issue
- the MDBA and Basin states retain prosecutorial discretion over decisions on whether to pursue investigation, settle a matter administratively or investigate at all.

The essence of prosecutorial discretion is that the investigating/prosecuting body can exercise its discretion in relation to its compliance and enforcement strategy and risk assessment for a matter to determine whether that matter should be pursued. Regardless of whether a matter was referred to Victoria by the MDBA, the relevant water corporation will exercise its discretion on whether to investigate and prosecute non-compliance with the Victorian Water Act. This discretion will be exercised free of direction or influence from the MDBA.

The exact nature of arrangements for referral of compliance matters is articulated in the protocol developed between the MDBA and Victoria.

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6. Victoria's water entitlement framework and trade

Part 6.
Victoria's water entitlement framework and trade

The volume of water authorised to be taken in Victoria is specified in a water entitlement or allowed for under a statutory right. The Victorian water entitlement framework is designed to ensure that individual entitlements to water are explicit, enforceable and, in appropriate circumstances, tradable.

A strong regulatory framework is an essential element in the management of water resources. The Victorian Water Act introduced in 1989 represented a fundamental change to the management arrangements for water in Victoria. It set out the framework for water resource management and provided for a secure system of rights and entitlements.

This legislation and a subsequent reform agenda produced major changes to the way water is managed in Victoria, including the conversion of poorly defined rights to bulk entitlements, the process to trade water, the ability to separate water from land titles and the recognition of the needs of the environment.

The Victorian Water Act provides rights to water for domestic and stock use and Traditional Owner use, and water entitlements for both consumptive and environmental purposes. Consumptive uses include the supply of urban drinking water, irrigation, industrial uses and power generation. Environmental uses include delivery of water to environmentally important sites such as wetlands and water flowing in waterways.

Entitlement holders are responsible for managing their own water needs as well as the risks of any water scarcity.

Existing entitlements are protected by the statutory framework which ensures the amount of water that can be taken is capped and makes it an offence to take water without authorisation. It also supports water access by allowing users to trade entitlement and allocation, which gives them the flexibility to manage their individual water needs.

The Victorian Water Act establishes the statutory rights and entitlements that apply in Victoria. These are supported by provisions which make it an offence to take water from a specified water source, including a waterway or aquifer, unless authorised to do so under the Act.

10.08(2) The holder of a water access right must comply with the conditions specified in the water access right instrument.

Note: The types of conditions that may be imposed on a water access right are set out in Tables A and B attached to the Wimmera-Mallee Index Table for surface and groundwater respectively.

6.1 Authorisations to take water

Figure 15 shows the ways water may be used in accordance with the Victorian Water Act in the Wimmera-Mallee water resource plan area. Authorised forms of take are set out in the Act:

- under a right (section 8 or section 8A),
- under an entitlement issued in accordance with the Act, or
- by another authorisation allowed for under the Act.

The type of right or entitlement required to access that water is described in more detail in **Part 6.2** to **Part 6.4**.

10.08(1) Table A, an attachment to the Wimmera-Mallee Index Table, identifies the forms of take, classes of water access right and characteristics of each class of right for the Wimmera-Mallee (surface water) SDL resource unit. The Wimmera-Mallee (surface water) SDL resource unit is the only SDL resource unit in the Wimmera-Mallee (surface water) water resource plan area.

Table B, an attachment to the Wimmera-Mallee Index Table, identifies the forms of take, classes of water access right and characteristics of each class of right for the Wimmera-Mallee (groundwater) water resource plan area. These forms of take, classes of water access rights, and characteristics of each class apply in all three of the groundwater SDL resource units in the water resource plan area.

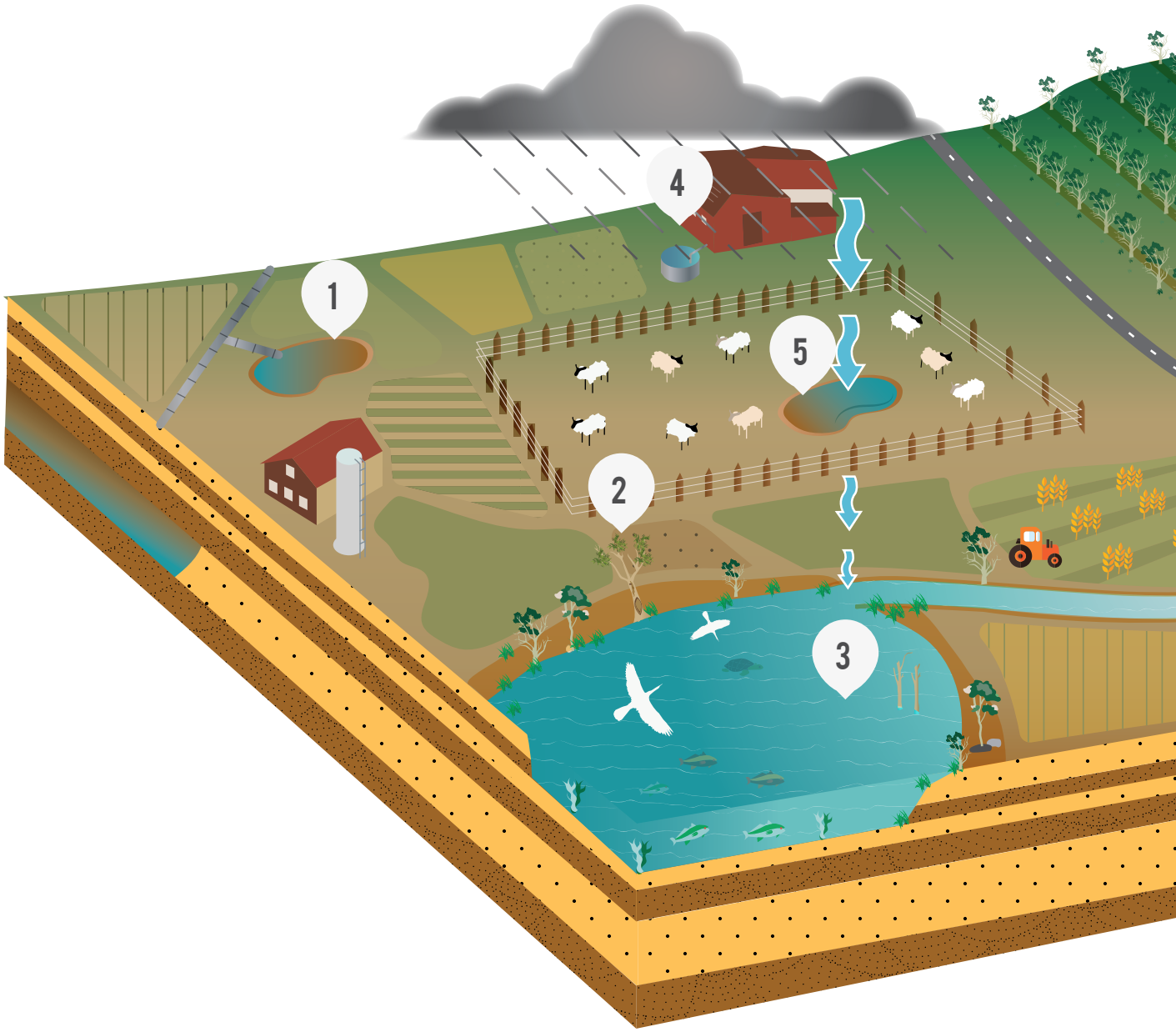

Figure 15: How water is used in the Wimmera-Mallee water resource plan area

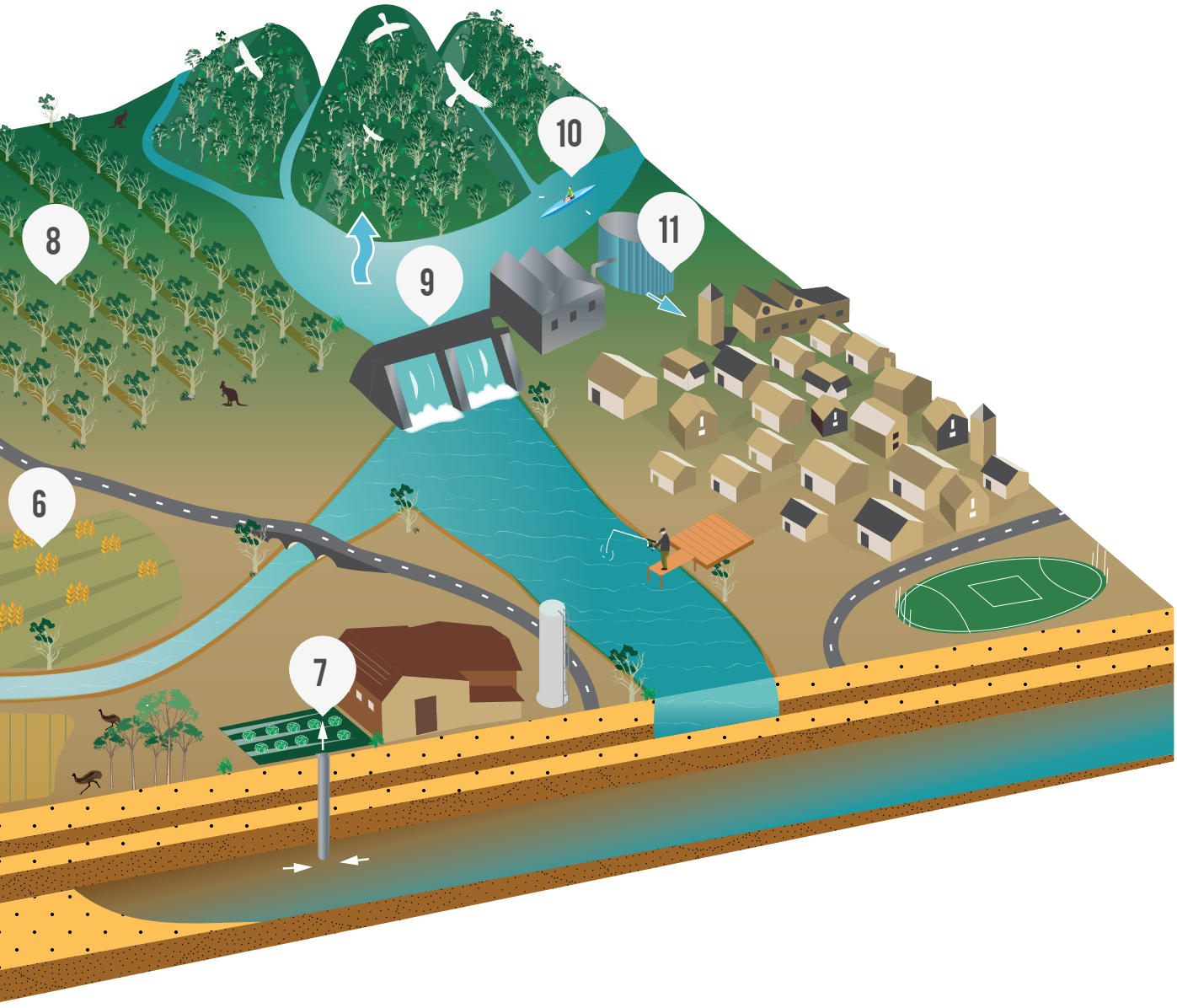
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Table 5: Take and use of water in the Wimmera-Mallee water resource plan area

	Purpose of use	Method of take	Right or entitlement
1	Domestic and stock	Wimmera-Mallee Pipeline, groundwater bore or take from a waterway. In the Wimmera-Mallee, the water user typically takes water from the pipeline and stores it in tank(s)	• Supply by agreement (between water user and water corporation) to take from the pipeline. • Statutory right – section 8 of the Victorian Water Act for domestic and stock purposes.
2	Traditional Owner	Wimmera-Mallee Pipeline, groundwater bore or instream release	• Statutory right – section 8A of the Act for Traditional Owner groups to use water for traditional purposes, where there is an agreement.
3	Environmental	Wimmera-Mallee in-stream release, and Wimmera-Mallee pipeline to wetlands	• Environmental entitlement – environmental outcomes are actively managed with held environmental water under an environmental entitlement and minimum passing flows delivered under bulk entitlements.
4	Any	Rain collected from roofs	• Exempted from entitlement regime. People or businesses may collect and store water that falls on their roof without seeking authorisation to collect, store and use that water.
5	Any	Interception by a farm dam or 'runoff dam'. People or businesses may collect water running over their land and store the water	• Statutory right – right to take and use water under section 8 of the Victorian Water Act for domestic and stock purposes. • A take and use licence issued under section 51 of the Act is required for all other uses.
6	Irrigation or commercial	Wimmera-Mallee Pipeline, interception by farm dams or pump from a waterway	• Take and use licence issued under section 51 of the Act and supply by agreement. This can be from surface water.
7	Any	Groundwater extraction. People or businesses may construct a bore (subject to authorisation under a works licence) to pump groundwater	• Statutory right – right to water under section 8 of the Act for domestic and stock use. • Take and use licence issued under section 51 of the Act for all other uses.

continued

	Purpose of use	Method of take	Right or entitlement
8	Commercial Plantation	Interception	• Currently outside the entitlement framework.
9	Regulating flows	Harvesting inflows and managing losses	• Storage and system losses are effectively shared between the entitlement holders as they are deducted before allocations are made. Grampians Wimmera Mallee Water (GWMWater) holds a bulk entitlement for losses associated with operating the Wimmera-Mallee Pipeline.
10	Recreational	Wimmera-Mallee Pipeline for nominated recreational lakes	• GWMWater holds a bulk entitlement for delivery to nominated lakes via the Wimmera-Mallee Pipeline.
		Headworks storages and waterways	• No specific entitlement for shared benefits.
11	Town water supply	Wimmera-Mallee Pipeline or pump from a waterway	• Bulk entitlement held by water corporation (no right or entitlement required by individual households).

6.2 Statutory rights

Sections 8 and 8A of the Victorian Water Act provide for statutory rights that apply without the need to obtain further authorisation from the Minister. These provide a legal right for a person to take and use water under certain conditions. They are available only in the circumstances and for the specific uses as set out in the Victorian Water Act and there are limitations on who may exercise this right.

These are rights referred to as 'basic rights' in the Basin Plan.

6.2.1 Domestic and stock rights under section 8

Domestic and stock rights, also known as section 8 rights, provide the right in specified circumstances for a person to take water for their personal use for the purposes established in the Victorian Water Act.

Specified circumstances include, for example, where a person has access to the water because they occupy the land adjacent to a waterway and that waterway has remained the property of the Crown, with some exceptions, or they occupy a bore from which the water may be taken.

Water taken for domestic and stock purposes may only be used for:

- household purposes
- pets
- water for cattle or other stock
- on the land around a house and outbuilding, to a maximum of 1.2 hectares for fire prevention purposes with water from a spring or soak or dam
- watering a kitchen garden.

With the exception of water used on land for fire prevention purposes which may be taken as set out above, water may be taken from a:

- spring
- soak
- dam
- waterway
- groundwater.

Broadly speaking, a 'kitchen garden' for this purpose is a domestic garden from which no produce is sold. Use for commercial purposes such as dairies, piggeries, feedlots, poultry or intensive or commercial use is excluded.

6.2.2 Traditional Owner rights under section 8A

Any member of a Traditional Owner group who has a natural resource agreement under the *Traditional Owner Settlement Act 2010* can take and use water from a waterway or bore for traditional purposes in accordance with an authorisation order made under that Act. Traditional purposes mean providing for personal, domestic or non-commercial communal needs of the group members.

6.3 Water entitlements and supply arrangements

The statutory entitlements provided for under the Victorian Water Act are:

- bulk entitlements
- environmental entitlements
- take and use licences (also called section 51 licences)
- water shares (in declared systems only)
- registration licences

All water entitlements are recorded in the Victorian Water Register, which provides an authoritative record of the entitlement volumes and associated transactions including allocations and trade. Useful information for water users about water entitlements and related arrangements can be found at **http://waterregister.vic.gov.au/**

These entitlements are referred to as 'water access rights' in the Commonwealth Water Act.

Protection of the resource and of existing entitlement holders is supported by safeguards in the Victorian Water Act including:

- offences for unauthorised take of water
- requirements relating to notification regarding new entitlements
- matters for consideration when dealing with applications for new entitlements or amending entitlements
- processes for consultation before amending entitlements
- a cap on the total amount of water that may authorised – including, for example, a permissible consumptive volume
- in the case of bulk entitlement, provision for either House of Parliament to disallow the creation of a bulk entitlement.

6.3.1 Bulk and environmental entitlements

6.3.1.1 Bulk entitlements

Under the Victorian Water Act, the Minister for Water may make an order granting a bulk entitlement to allow the holder to take a volume of water subject to any conditions specified in the bulk entitlement.

A bulk entitlement may only be held by a water corporation, the Minister administering the *Conservation, Forests and Land Act 1987*, a generation (power) company within the meaning of the *Electricity Industry Act 2000*, or the Victorian Environmental Water Holder (VEWH).

A bulk entitlement does not have a specified term or period and is therefore an ongoing entitlement. As noted, a bulk entitlement may be issued subject to conditions and obligations.

These typically provide for the:

- rate, location and conditions of take
- reliability associated with the entitlement
- obligations to release environmental and passing flows
- metering, accounting and reporting obligations.

The general structure of all bulk and environmental entitlements is described in **Figure 16**. However, all entitlements are unique as each one needs to reflect the nature of the system in which it is held.

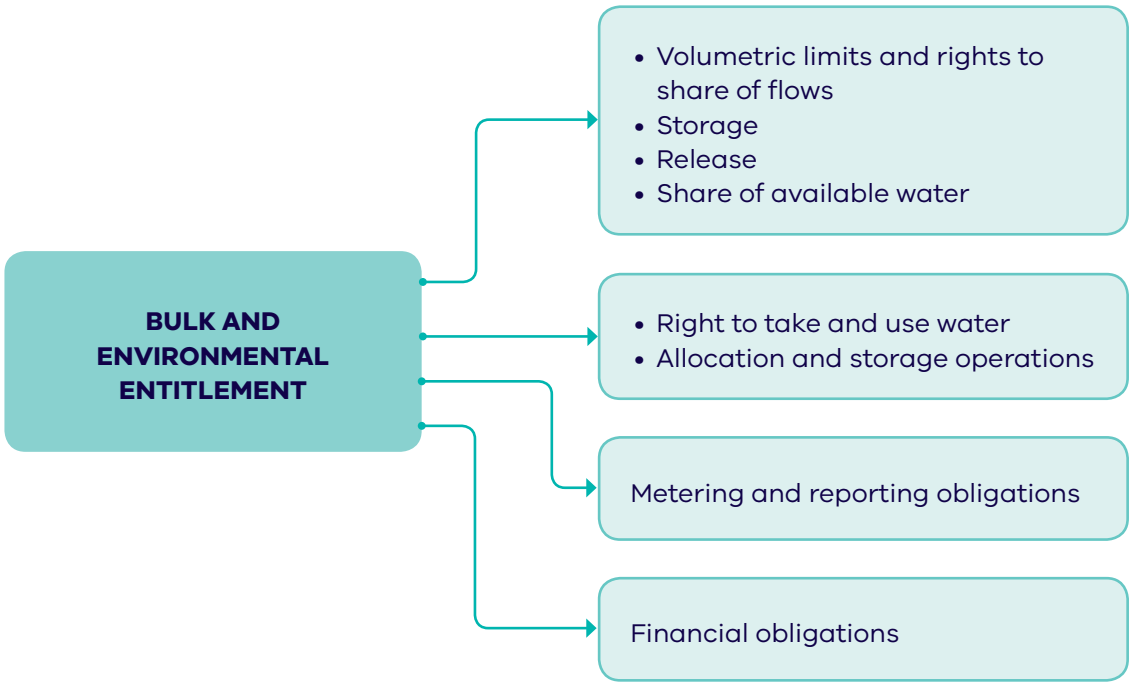

Figure 16: Simplified structure of bulk and environmental entitlements

6.3.1.2 Environmental entitlements

The Minister for Water may, by instrument, allocate water under an environmental entitlement to the Victorian Environmental Water Holder (VEWH). The VEWH is a corporate body established under Part 3AA of the Victorian Water Act.

The purposes of environmental entitlements are to:

- contribute to the environmental water reserve
- improve the environmental values and health of water ecosystems, including their biodiversity ecological functioning and water quality
- assist other uses that depend on good or improved environmental condition.

See **Part 12** for more information.

As with a bulk entitlement, the Minister for Water must consider the matters set out in the Victorian Water Act in considering whether or not to allocate an environmental entitlement.

These include:

- any adverse effect that the allocation or use of water under the entitlement is likely to have on existing authorised uses of water in the water system
- the conservation policy of the government
- the maintenance of the environment water reserve in accordance with the environmental water reserve objective
- whether the proposed source of water is within a heritage river area or natural catchment area within the meaning of the *Heritage Rivers Act 1992*, and any restriction on the use in the area under that Act
- any relevant sustainable water strategy
- any other matter the Minister thinks fit to take into account.

Environmental entitlements and bulk entitlements can be amended and traded.

6.3.2 The storage manager

The Minister may formally appoint a storage manager for bulk water supply systems that supply multiple bulk and environmental water holders and, in declared systems, water shares. The instrument of appointment sets out the Minister's expectations about the operation of the supply system. The main responsibility of the storage manager is to supply water to meet entitlements. Other functions include:

- operating the supply system safely
- preparing an annual supply system operating plan
- calculating the volume of water available to entitlement holders and making allocations
- reporting on operations to entitlement holders
- preparing a water resource outlook for the coming water year assuming wet, average, dry and drought scenarios
- preparing water accounts for each entitlement that separately identify carryover and allocations
- recording any significant variations to the operating plan and/or discretionary operational decisions that are made and the reasons for those decisions (for example, the decision in 2012 not to transfer water from Rocklands to Toolondo)
- reviewing any significant events that may occur (such as flooding and droughts)
- consulting and working with the community to identify opportunities to provide public benefits from headworks storages

- preparing annual work plans and budgets to undertake the functions identified above.

GWMWater is the storage manager for bulk and environmental entitlements granted for the Wimmera-Glenelg headworks system. The legal document through which GWMWater was appointed and which describes its roles and responsibilities is the Appointment of Grampians Wimmera Mallee Water Corporation as Storage Manager for the Wimmera-Glenelg Headworks System (Minister for Water, 2010).

GWMWater is required to achieve 11 objectives in its storage management role, and is guided by strategically important operating rules described in Storage Management Rules for the Wimmera-Glenelg Headworks System (GWMWater, 2016).

6.3.3 Specific water entitlements in the Wimmera-Mallee supply system

In western Victoria, bulk entitlements have been granted to water corporations and the VEWH. Bulk entitlements have been granted to water corporations that supply water to urban water users or supply urban water corporations, and an environmental entitlement has been granted to the VEWH.

For the Wimmera-Glenelg regulated system the 'source' bulk entitlement has been granted to GWMWater which gives GWMWater the right to harvest water and the obligation to deliver water to primary entitlement holders. These primary entitlement holders include urban water corporations with bulk entitlements and the VEWH (see **Part 4.7.3**).

GWMWater also holds entitlements in the Pyrenees system and the Willaura system to supply towns (see **Part 4.7.4**).

GWMWater also holds an entitlement in the Murray system to supply the Northern Mallee Pipeline, this is detailed further in Victoria's North and Murray Water Resource Plan.

The volume of water available in each reservoir in the Wimmera-Glenelg headworks system is pooled to calculate the total volume of water available for allocation to parts of the supply system by the Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010 and the associated entitlements. **Figure 17** shows the framework for entitlements supplied by the Wimmera-Glenelg headworks system.

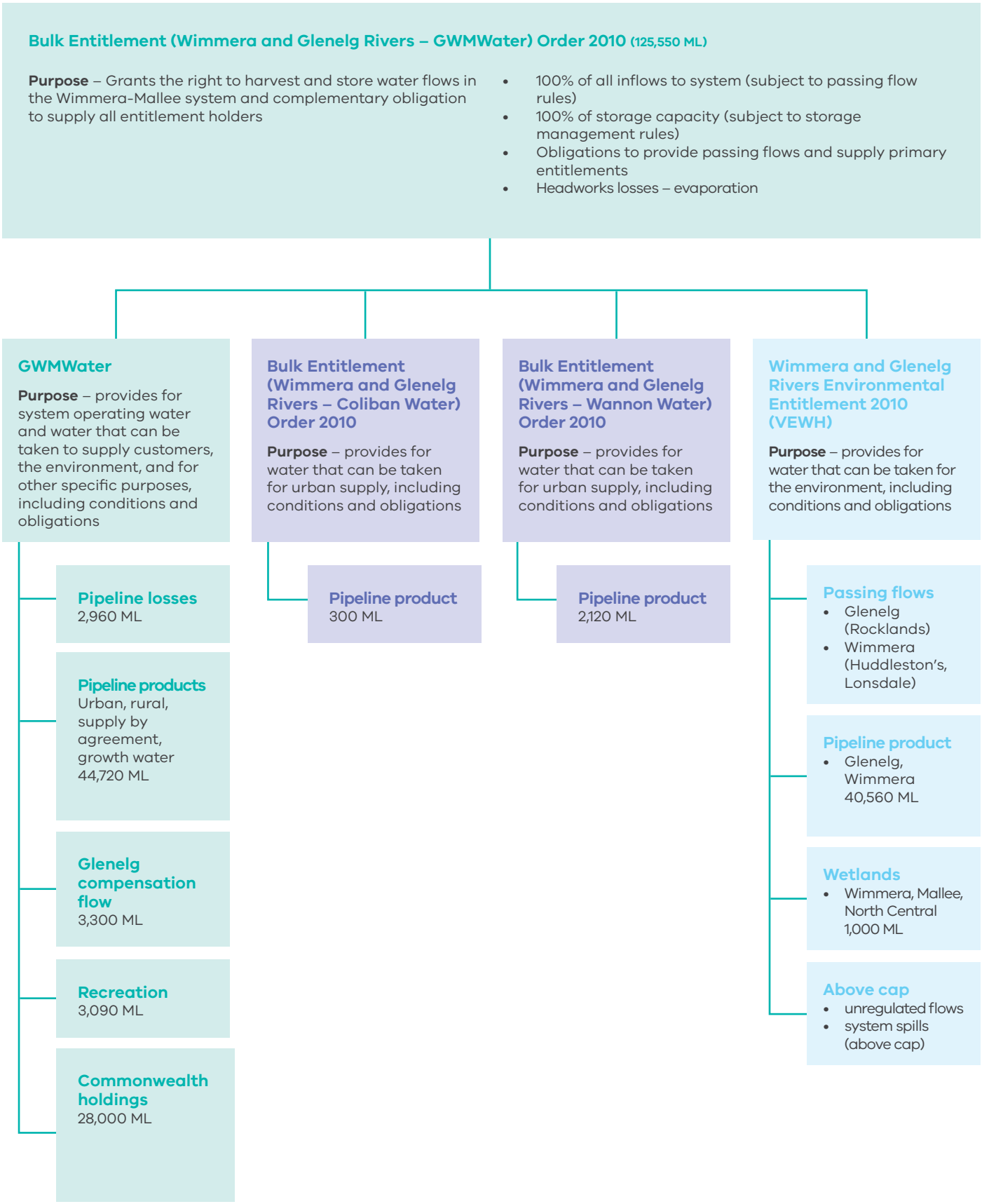

Figure 17: Water entitlement framework for the Wimmera-Glenelg headworks system

All bulk entitlements specify reservoir full supply levels and maximum operating levels, the types and size of entitlements to be supplied and the rules to share the volume of water available in the headworks between the entitlements.

Not all water harvested and stored by the headworks system is available for use. Evaporation, seepage and leakage are factored into headworks management, and fluctuate throughout the year, and between years.

The volume of water allocated in a year to each entitlement holder depends on how much water is available in the headworks system. The storage manager calculates how much water is available to be allocated in accordance with the rules specified in the bulk entitlement.

GWMWater's bulk entitlement is divided into the five water products shown in **Table 6**.

When water is plentiful, each product and each entitlement holder receives their full allocation (100 per cent) of their entitlement. However, in years when there is insufficient water available to fully supply all entitlements, allocations to entitlement holders are in accordance with Schedule 2 of the bulk entitlements. **Table 6** shows how water allocations are increased as the volume of water available increases. The storage management rules include more details about how the system is operated, including how the system reserve requirements are calculated and how the water available for allocation is determined.

Table 6: Water entitlements and allocations supplied by the Wimmera-Glenelg headworks system

Water available (ML)	Entitlement	A	B	C	D	E	F
	volume (ML)	126,050	98,050	75,971	53,459	45,253	0
Grampians Wimmera Mallee Water							
Pipeline and balancing storage losses	2,960	100%	100%	100%	100%	100%	0
Commonwealth Environmental Water Holder	28,000	100%	0%	0%	0%	0%	0
Glenelg compensation flow	3,300	100%	100%	25%	2%	2%	0
Recreation	3,090	100%	100%	21%	0%	0%	0
Wimmera-Mallee Pipeline product	44,720	100%	100%	81%	58%	48%	0
Coliban Water							
Wimmera-Mallee Pipeline product	300	100%	100%	81%	58%	48%	0
Wannon Water							
Wimmera-Mallee Pipeline product	2,120	100%	100%	81%	58%	48%	0
Environment							
Wetlands	1,000	100%	100%	25%	0%	0%	0
Wimmera-Mallee Pipeline product	40,560	100%	100%	81%	58%	48%	0

Notes in relation to Table 6:

- If the volume available is between any two columns, the share is calculated accordingly. For example, if there is 60,000 ML of water available (between columns C and D), Wannon Water's share is: [(1,723-1,220)x(60,000-53,459)/(75,971-53,459)]+1,220 = 1,366 ML.
- The calculation in the above is to be rounded to the nearest whole number.

Table 6 shows that 126,050 ML of water is supplied when sufficient water is available. Different entitlements are restricted at different rates when less water is available. The pipeline product is the most secure. The recreation, wetland and Glenelg compensation flow product have a lower reliability. The Commonwealth Environmental Water Holder has the lowest reliability of supply.

Each entitlement holder may use their allocation over the year and may also carry over any unused allocation to use in the following year. The carried-over volume is reduced by 15 per cent to account for evaporative losses over the year.

GWMWater supplies its urban and rural customers through its pipeline product. The two customer groups are not differentiated in the bulk entitlement. Unused water from either customer group is pooled and redistributed to supply both customer groups in the following years. The availability of carryover provides additional flexibility to GWMWater to secure its water resources over the long term and avoid restrictions in years with insufficient water available to make a full allocation.

GWMWater's rural customers supplied by the Wimmera-Mallee Pipeline have tradeable supply by agreements. These are recorded at an individual customer level in the Victorian Water Register.

Coliban Water and Wannon Water supply towns in the Wimmera-Mallee water resource plan area and have bulk entitlements of pipeline product for this purpose. Wannon Water can be supplied only from Rocklands Reservoir.

The environmental manager (VEWH) has an entitlement of 40,560 ML of pipeline product, and 1,000 ML of wetland product. These products are supplied from the headworks in accordance with environmental watering proposals prepared by the Wimmera, Mallee, North Central and Glenelg-Hopkins catchment management authorities and authorised by the VEWH. The VEWH maximises the benefits from the available water by releasing stored environmental allocations to supplement passing flows, unregulated flows and spills that may occur after heavy rain.

The entitlement held by VEWH includes pipeline product and conditions that require passing flows to be provided immediately below harvesting points. The volumes of passing flows released are reduced in the same proportion as the pipeline product is restricted when the volume of available water falls below 98,050 ML.

Storage inflows that exceed the full supply level of the headworks storages cannot be harvested and are released as spills, providing flows to the environment. These passing flows, unregulated flows and spills make up a significant proportion of above cap water that is available to the environment.

However, an important characteristic of these flows is that the environmental manager cannot influence when and where they occur.[6]

6 Passing flows generally occur from June to November, December to May for Huddleston's Weir, all year at Fyans Creek and November to May for Wannon River. They can be accumulated or released from other reservoirs following agreement between the storage manager and the VEWH to improve environmental effects, allow for maintenance or protect water quality in the Wimmera-Glenelg headworks system (GWMWater, 2016).

6.4 Individual arrangement for access to water

6.4.1 Take and use licences

A person must apply to the Minister for a take and use licence to take surface or groundwater from a specified source. The licence authorises a person to take and use water from a waterway, catchment dam, spring, soak or aquifer.

A take and use licence is issued for a set period of up to 15 years.

The Minister has delegated licensing responsibilities to GWMWater and Goulburn-Murray Water within their boundaries. In practice, the relevant rural water corporation issues licences unless there is a conflict of interest. In these cases, the Minister makes a decision about the licence application.

The Minister and their delegates must have regard to a range of matters when considering an application for a licence, including but not limited to:

- the existing and projected availability of water in the area
- the need to protect the environment
- any permissible consumptive volume (PCV). A PCV is a cap on the total volume of water that may be licensed for extraction from a specific unit, zone or water system
- any adverse effect that the allocation or use of the water is likely to have on existing authorised uses, a waterway or aquifer.

Licences are issued and managed by water corporations in line with the Ministerial Policies for Managing Take and Use Licences (Minister for Water, 2014b). These policies set out matters and actions the Minister asks delegates to consider or carry out. Policies have also been issued for protecting high-value ecosystems that depend on groundwater when water corporations are considering applications for take and use of groundwater (Minister for Water, 2015a).

Each licence is subject to conditions specified on the licence. A standard set of conditions is included in each licence. Additional customised conditions may also be included.

Take and use licences to access surface water include conditions that enable restrictions and bans to protect environmental flows and to share available water during periods of low flow. Restriction rules are developed and documented in statutory management plans for water supply protection areas and local management plans in other areas.

Policies have also been issued for protecting high-value groundwater-dependent ecosystems when considering applications for take and use of groundwater (Minister for Water, 2015a).

Take and use licences can be renewed. Renewal is subject to consideration of the same matters as those that applied to the issue of a licence. The Minister must renew a licence unless he or she believes there is good reason not to. Further or different conditions may be included in a renewed licence.

Take and use licences can be traded subject to the requirements of the Victorian Water Act and any local rules to control third-party impacts.

DELWP has released guidelines (DELWP, 2015b) on how to determine resource share for the purpose of deciding whether to set a cap for groundwater.

Water users must also hold a works licence under section 67 of the Victorian Water Act if they require works, such as a pump on a waterway or a bore, to take water under a take and use licence.

6.4.2 Registration licences

A registration licence authorises take and use from a dam, spring or soak. Registration licences were issued between 1 July 2002 and 30 June 2003 and recognised historical water use. A registration licence is perpetual and does not attract a licence fee. It is attached to land and can only be transferred on the sale of land. As noted, a registration licence cannot be traded, except with the sale of the land, but may be converted into a take and use licence if the holder wants to trade.

6.4.3 Water shares

A water share is an ongoing entitlement to a share of the water available in a water system. To date, water shares have been issued only for declared systems with irrigation districts. These are regulated systems with dams or storages that harvest large volumes of water for regulated release to a large number of irrigation customers. A water share identifies its water system, the maximum volume (e.g. 100 ML), and whether it is a high- or low-reliability water share.

Both water shares and allocations under water shares can be traded. No water shares have been issued in the Wimmera-Mallee water resource plan area.

6.5 Other supply arrangements

6.5.1 Urban water supply

Individuals who are supplied by urban water corporations are not required to obtain an entitlement or to exercise a right under the Victorian Water Act to obtain water for use in their homes. Urban reticulated water supply is managed by water corporations. A water corporation with a water district must supply water to the owners of all serviced properties. This obligation is met under the entitlement to water in the urban water corporation's bulk entitlement or privately-owned water shares.

Where a serviced property is supplied by a water corporation, the volume of water is subject to restrictions under the permanent water saving rules or water restrictions imposed during times of water shortage (see **Part 9.3.1**).

6.5.2 Supply by agreement

A water corporation may decide to enter into contractual arrangements known as a supply by agreement to supply water to customers where, for example, there are properties that are not designated as serviced properties[7]. This is a contractual arrangement which may specify a range of matters including the volume of water, flow rates, quality, period of time and the purpose for which the water will be used. The water supplied under these supply by agreements is sourced from the water corporation's bulk entitlement to water. For example, the Commonwealth Environmental Water Holder hold a supply by agreement with Grampians Wimmera Mallee Water for their entitlement.

6.6 Above cap and system water

In addition to individual water entitlements, there is a large amount of other water, 'above cap' water, that is left in the system which is in excess of the water which is authorised to be taken under the Victorian Water Act. System water is defined in bulk and environmental entitlements to support reliability, water quality, or to support delivery of individual water entitlements, for example passing flows or defined losses. Both above cap and system water can have multiple benefits including supporting system reliability, environmental values and deliverability. How this

7 Serviced properties (section 144) and water districts (Part 6A, section 122GA) are declared under the Victorian Water Act

water contributes to achieving environmental outcomes or objectives is outlined further in **Part 12.2.3**.

Each system has system specific rules, defined in bulk entitlements, which reflect the historic operations, the needs of users, interactions with other systems and the environment.

6.6.1 Above Cap

Above cap water is the water which is left over after passing flows have been met and all take under an entitlement or right has been extracted. In unregulated systems, this is most of the flow in the river that remains after entitlement holders have extracted water available under their entitlements or right. In regulated systems this is the flow in the river which is not allocated under entitlements and is not meeting a requirement downstream. This may occur when storages spill and there is not sufficient airspace in storages or consumptive demand downstream to make use of this water.

This water contributes to environmental outcomes but is not solely for the environment as it also supports stock and domestic users and may be re-regulated downstream for consumptive use, for example, spills from one storage may become inflows to a downstream storage.

6.6.2 System water

System water is all the water that is described in the bulk entitlements which is not specifically for environmental or consumptive use. This water will likely have a specific purpose, for example water for passing flows, water to cover delivery losses in irrigation districts or water reserves for release to mitigate water quality impact from water quality events.

Bulk and environmental entitlements usually include conditions that require passing flows to be provided to meet target flows at key points in the system as specified in the bulk or environmental entitlement, with the volume delivered based on total water availability. The volume of water provided by passing flows is not known in advance because the volume released from storages or weirs varies from day to day, depending on the natural inflows occurring at the time. Different systems prescribe different portions for the system water and will depend on the complexity of the system and the arrangements as described in the bulk entitlements. System water may go by other names as specific to the use of the water. Note that **Part 7** and **Appendix B** assessed the risks to system water (controlled water and system operating water) for the environment separate to consumptive and other economic users.

6.7 Specific water access arrangements under entitlements

Access arrangements are an important tool used by water managers to protect passing flows when conditions are dry. Restricting take in these times protects environmental values and section 8 and 8A rights.

6.7.1 Rosters, bans and restrictions

In undeclared regulated or unregulated water systems conditions in some bulk entitlements preserve baseflows in rivers, and rosters, bans and restrictions are used to ration take and use licence holders' access to water in dry conditions. Bulk entitlements usually have a passing flow clause, which describes a base level of water that cannot be taken for consumptive use.

Take and use licences authorising access to surface water include conditions that enable restrictions and bans to protect the environment and support water sharing during periods of low flow.

In unregulated systems, environmental flows are provided by the naturally variable flow but are affected by any authorised consumptive uses. Environmental flows in these systems are not

managed. Instead, some level of protection is provided by placing limits on the total volume of water that can be diverted from waterways or aquifers and through conditions on take and use licences that can limit when water can be taken over the year (i.e. winter-fill licences) and impose restrictions and bans on take during periods of low flows. Restriction rules are developed and documented in statutory management plans in water supply protection areas or communicated in local management plans in other areas.

6.7.2 Water allocation

The water allocation rules describe how water available will be shared amongst primary entitlement holders including bulk entitlement holders, environmental entitlement holders and recreational users in accordance with rules defined in bulk and environmental entitlements. The water allocation method determines the amount of water available for use in the water system for that season.

The water allocations are made at the start of each water year based on the total water in storage and a forecast of inflows during the year, minus an estimate of the total water required to operate that system over the year and water already committed, including carryover. Water allocations are revised monthly throughout the year and increases to allocations are made based on current operational data such as actual deliveries, losses and inflows, and revised forecasts for the remainder of the season.

6.7.3 Carryover

Surface water carryover

Carryover was initially introduced in the Wimmera-Glenelg systems in 2010 following the completion of modernisation works and the restructure of entitlements. Carryover arrangements allow water not used in a water season to be taken and used into the next water season. A central principle behind carryover is that unused water may be carried over by individuals to the next year but must not displace inflows that support new allocations. Carryover is designed to maximise the water available in the early part of the season. It allows the holder more flexibility to hold, use or trade water when it's of the greatest value to their business, and to prepare for water shortages.

The Victorian Water Act enables the Minister for Water to make a declaration in relation to a water system allowing for carryover in that system. A declaration provides that water not used in one water season may be taken and used, that is 'carried over', in the next water season subject to any rules or conditions determined by the Minister for Water.

The Minister has made rules about how users can carry over water so that carryover does not have a negative impact on other entitlement holders or the environmental water reserve.

Groundwater carryover

The Minister has made declarations for the carryover of groundwater in some groundwater management areas. Groundwater carryover operates on the same principles as for surface water. The declaration enables the licence holder to carry over a fixed percentage of their unused licence volume to the following year.

6.8 Certainty of entitlements

The volume and reliability of existing entitlements to surface water and groundwater may be eroded if additional entitlements are granted. The Victorian Water Act provides significant safeguards to protect the integrity of water shares, bulk and environmental entitlements and take and use licences.

These safeguards include:

- offences for unauthorised use of water
- formal statutory processes that must be followed to:
  - issue a new water share
  - issue a new or amend bulk entitlement (see **Figure 18**)
  - issue a new or amend an environmental entitlement (see **Figure 19**)
  - issue a new take and use licence
  - amend conditions of a take and use licence under a water supply protection area management plan
- a cap on the total amount of water that can be authorised for extraction in the Wimmera-Mallee (surface water) water resource plan area from a surface water system is limited by the sustainable diversion limits set by the Murray-Darling Basin Authority
- a cap on the total amount of groundwater that can be authorised for extraction in the Wimmera-Mallee (groundwater) water resource plan area is limited by the sustainable diversion limits set by the Murray-Darling Basin Authority and where a groundwater system has been declared by the Minister by an Order published in the Government Gazette (section 22A) is limited by the permissible consumptive volumes which also cap the total volume of water available to issue under a take and use licence
- requirements for notification to be given to other entitlement holders when the Minister is considering an application to grant or amend a:
  - bulk entitlement (section 38)
  - environmental entitlement (section 48D)
  - take and use licence (section 49)
- considerations which the Minister must regard when considering an application to issue or amend an entitlement (for example, sections 33J, 53, 40 and 48F), including:
  - any adverse effect that the allocation or use of water under the entitlement is likely to have on existing authorised water users
  - the maintenance of the environmental water reserve
- provision for either House of Parliament to disallow a bulk entitlement

The Victorian Water Act requires an application to be made to the Minister for the issue or amendment of a bulk or environmental entitlement. Further, the Act outlines the consultation steps and matters to consider before an entitlement can be amended.

A bulk entitlement may be amended on application to the Minister made by an Authority holding a bulk entitlement or another Authority with the support of the Minister. Bulk entitlements are amended in the same manner as they are granted. The process to grant or amend a bulk entitlement is set out in section 44 of the Victorian Water Act. This process must be followed before an amendment may be made. The Act prevents the Minister from issuing a direction about how the Victorian Environmental Water Holder is to manage its environmental entitlements.

Applications for new, or major amendments to, bulk and environmental entitlements can take up to two years to be approved. The Act provides procedural safeguards to minimise the influence of vested interests and to address the technical challenges in explicitly and exclusively specifying rights to water resources that move through river drainage basins and groundwater systems.

A minor amendment may be made to a bulk entitlement by notice using a streamlined process where the proposed amendment would:

- correct a mistake in the description of any element of the entitlement
- make a minor variation arising from practical operations
- vary or impose a new obligation on a resource manager or storage manager
- make any other amendment that does not impact on another person's entitlement to water and does not adversely affect the environmental water reserve

Bulk entitlements may be traded permanently (transferred under section 46D) and water held under a bulk entitlement can be temporarily traded (assignment of allocation under section 46). These trades require approval by the Minister for Water or the Minister's delegate and the Authority whose works will be used to deliver the water.

As with bulk entitlements, environmental entitlements are ongoing and can be traded, along with allocations under an environmental entitlement. Trade (assignment) of environmental entitlements needs approval by the Minister and the Authority whose works will be used to deliver the water.

Figure 18 and **Figure 19** show the processes set out in the Victorian Water Act that must be followed to grant a new bulk water entitlement or make a major amendment to an existing one. The process for environmental entitlements is similar.

The process to issue or amend a bulk or environmental entitlement is transparent. The Victorian Water Act requires bulk and environmental entitlement holders to apply to the Minister for their entitlement to be amended. The Act prevents the Minister from issuing a direction about how the environmental water holder manages its environmental entitlements.

Applications for new, or for major amendments to, bulk and environmental entitlements can take up to two years to be approved. The Act provides procedural safeguards to minimise the influence of vested interests and address the technical challenges in explicitly and exclusively specifying rights to water resources that move through river and groundwater basins.

Process in the *Water Act 1989* (Vic) to amend a bulk water entitlement

Authority applies to Minister for Bulk Entitlement or amendment of Bulk Entitlement

Minister provide copy of application to:

- Minister responsible for CFL Act
- Planning Minister
- Statutory Authorities (Water Authorities and Catchment Management Authorities)

The Minister must advertise in a manner deemed fit and may invite submissions on the application

OR

Require the VEWH to advertise in a manner specified by the Minister and may invite submissions on the application

Likely effects of granting application must be assessed in line with Section 40 of the Act

Minister may appoint panel to investigate effects (modeling and environmental assessment), considers submissions and consults. Consensus approach (can take more than a year)

Minister considers application. Must not approve is likely to have significant adverse effect on authorised uses of water or the environment

Minister published approved Order in Government Gazette

Either House of Parliament may disallow Order within 18 sitting days

Figure 18: Process in the Victorian Water Act to amend a bulk water entitlement

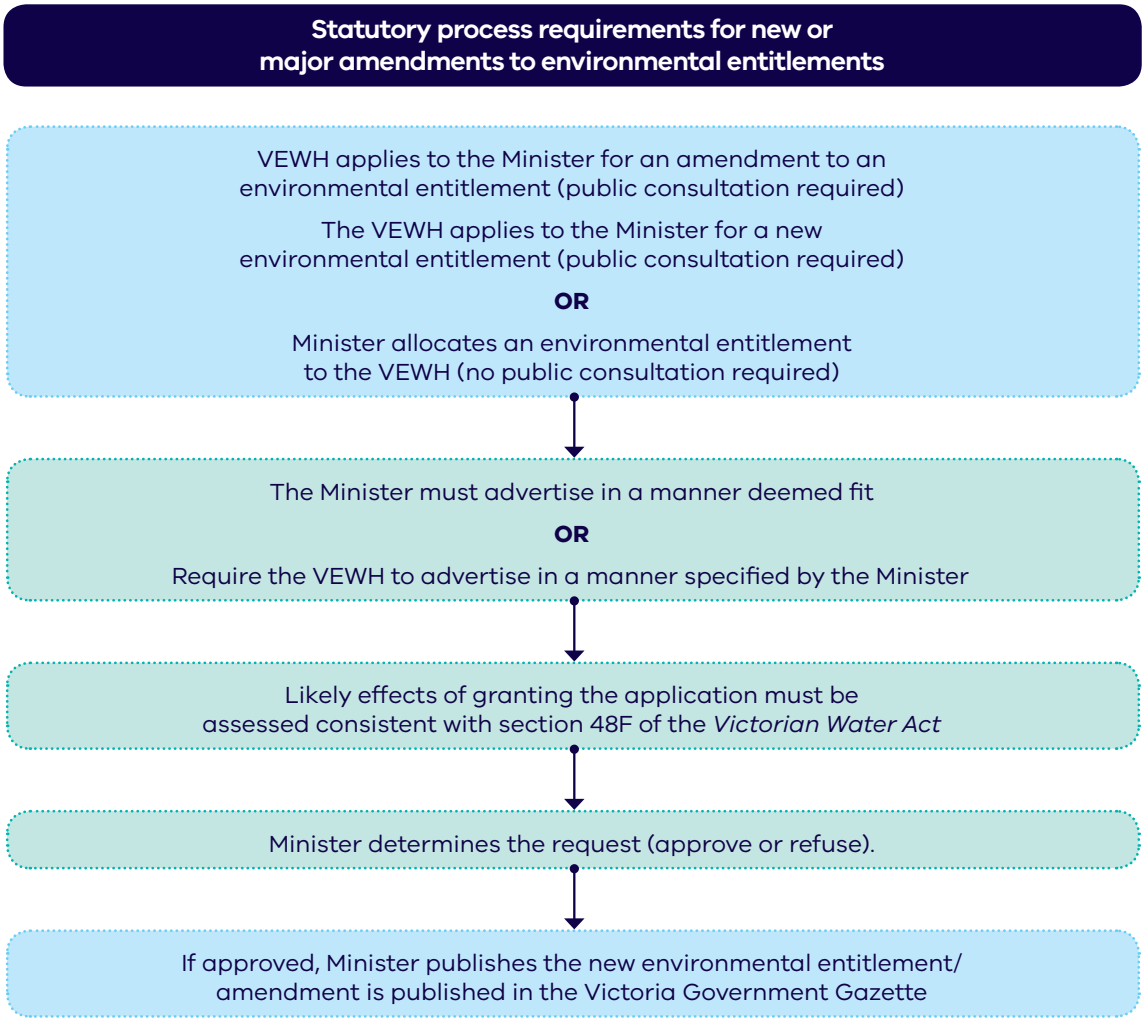

Figure 19: Statutory process requirements for new or major amendments to an environmental entitlements

6.9 Qualification of rights

In extreme events described in **Part 9**, the Minister may qualify any water entitlement. This is an emergency measure which allows the Minister for Water to intervene by declaring a water shortage and qualifying rights and entitlements in a water system. This may temporarily overrule some or all the water sharing arrangements in a system.

Section 33AAA of the Victorian Water Act allows the Minister to qualify rights temporarily if he or she declares that a water shortage exists. The Minister must be satisfied that there is, or will soon be, insufficient water available to satisfy any rights to water. This power has been used during severe droughts, for example to reduce passing flow obligations to make sure town water demands can be supplied under Stage 4 restrictions.

The Department of Land, Environment, Water and Planning (DELWP) has issued guidelines for exercising these powers and expects that qualification of rights will only be done in extraordinary and unforeseen circumstances (DELWP, 2016b).

The Minister may also permanently qualify rights to water under section 33AAB of the Victorian Water Act. Permanent qualification of rights can be declared only on completion of a long-term water resource assessment. Assessments are to be reviewed every 15 years.

6.10 The Victorian Water Register

The Victorian Water Register provides water users with essential information about water entitlements, seasonal determinations, trade and transfers. The Water Register is the authoritative record of water entitlements and facilitates the transactions that underpin Victoria's water markets.

All water entitlements in the Wimmera-Mallee water resource plan area are recorded on the Victorian Water Register (VWR), which provides the Victorian Government with the point of control for the state's water entitlement and allocation system. It is a public register of all water-related entitlements in Victoria and was designed and built to record water entitlements with integrity and provide crucial information for managing Victoria's water resources. Important attributes of the register are shown in **Figure 20**.

The register holds statewide surface water and groundwater entitlement records and information about ownership, transfers and where relevant, allocations to bulk entitlements, environmental entitlements, water shares (in declared systems), licences to take and use water and supply by agreements. It also records ownership and details about water-use licences, water-use registrations and water shares (in declared systems) and works licences. See **Part 15** for more information.

Victorian Water Register

- central to Victorian water management
- provided for under the *Water Act 1989*
- supports the state's entitlement framework
- governed by a partnership between DELWP, the Water Registrar and water corporations

Features of the Victorian Water Register

- good governance
- all entitlements recorded
- conditions recorded
- trading rules consistently applied
- standard processes consistently applied
- standard application fees
- predictability
- probity, integrity, trust

Register of water entitlements

- attributes of the entitlements
- mortgages (water shares)
- changes to entitlements

Records information relating to:

- allocations
- usage
- trades
- carryover

Also holds information on:

- works licences
- water-use licences and registrations (in declared systems)
- delivery shares (in declared systems)

The Register is linked, but separate to, water corporation water ordering and billing systems

Commercially accepted accounting standards

- governance structure for processing all transactions
- internal controls on processing
- every transaction recorded on register and is auditable
- all transactions linked back to application form and approvals, providing a rigorous audit trail
- water accounts regularly reconciled and audited
- searchable, in real time, publicly available reports and market information

Customer focused with online capabilities

Facilitates the market, reduces transaction costs, reduces transaction times and improves accuracy, transparency and accountability.

Figure 20: Key attributes of the Victorian Water Register

6.11 Water markets

Within Victoria, the Victorian Water Act enables the transfer of bulk entitlements, environmental entitlements, water shares (in declared systems) and take and use licences subject to the requirements of the Act and any Ministerial rules. The rules are made by Ministerial Order, published in the *Government Gazette*. The rules aim to limit third-party impacts and protect environmental values.

The Ministerial Order specifying the trading rules for declared water systems (Minister for Water, 2014a) is available from the Victorian Water Register website (**http://www.waterregister.vic.gov.au**) but this does not apply to the Wimmera-Mallee water resource plan area.

Statewide guidance for trade in unregulated surface water systems and groundwater systems are set out in the Ministerial Policies for Managing Take and Use Licences, which are also available from the Victorian Water Register (Minister for Water, 2014b).

In addition, some groundwater trading rules are applied in statutory management plans approved by the Minister and in local management plans prepared by water corporations.

The Wimmera-Mallee system is not declared so the predominant markets are:

- trade of allocations made to bulk and environmental entitlements
- trade of unregulated water take and use licences
- transfers by supply by agreement holders.

GWMWater facilitates the transfer of water between individual domestic and stock users supplied from the Wimmera-Mallee Pipeline under its bulk entitlement.

6.12 Basin Plan requirements for trade

Water trading of surface water in the Wimmera-Mallee water resource plan area is covered in Chapter 12 of the Basin Plan, which sets out the Basin Plan surface water trading rules that came into effect in Victoria on 1 July 2014. The Basin Plan does not require general surface water trading arrangements to be included in water resource plans.

Trade of groundwater entitlements is prohibited under the Basin Plan unless certain conditions are met. Part 8 of Chapter 10 of the Basin Plan requires water resource plans to set out circumstances in which trade is permitted between:

- two locations within a groundwater SDL resource unit (10.37)
- two groundwater SDL resource units (10.38)
- a groundwater SDL resource unit and a surface water SDL resource unit (10.39).

6.13 Victorian trading policies and rules

Victoria's regulatory regime for water trading is set out in the Victorian Water Act and various other documents whose applicability depends on the type of entitlement being traded:

- Ministerial Order specifying the trade rules for declared regulated surface water systems (Minister for Water, 2014a)
- Minister's policies for managing take and use licences (policies), typically for unregulated surface water and groundwater systems
- guidelines for groundwater licensing and the protection of high-value groundwater-dependent ecosystems
- statutory management plans
- local management plans established by water corporations.

The Victorian Water Act provides a framework for water trading. It enables trades to occur in accordance with trading rules that protect against impacts on other water users or the environment. In accordance with section 12.19 of the Basin Plan, Victoria has provided evidence to the MDBA regarding restrictions on trade in surface water systems which are necessary and in accordance with Section 12.18 of the Basin Plan.

Groundwater trade can occur in the Wimmera-Mallee water resource plan area. The circumstances under which this is possible are described in the policies. Further system-specific trading rules are defined in local management plans established by the water corporation. Local management plans also reference interstate agreements, for example the *Groundwater (Border Agreement) Act 1985*, and Victorian Irrigation Development Guidelines.

Temporary and permanent trade rules for groundwater entitlements in the Wimmera-Mallee water resource plan area are set out in local management plans and the policies.

6.14 Entitlement trade in the Wimmera-Mallee (groundwater) water resource plan area

Part 8 of Chapter 10 of the Basin Plan requires the Wimmera-Mallee Water Resource Plan to identify the circumstances in which trade of water access rights (entitlements) may occur within and between groundwater SDL units in order to satisfy the conditions outlined in sections 12.24, 12.25 and 12.26 of the Basin Plan. The circumstances in which trade may occur in accordance with Basin Plan requirements are outlined below.

There is generally very little development of groundwater aquifers in the Wimmera-Mallee water resource plan area where it is typically too saline for productive use, or too deep to be economically developed, or both. Because of the generally low level of development and the BDL being well below the SDL for the Wimmera-Mallee (groundwater) water resource plan area, there is little demand for groundwater trade. Current management arrangement in Victoria's water entitlement framework are sufficient to manage impacts from trade decisions and where local management plans have been developed, specific trading rules are documented to facilitate efficient trade decisions.

Victoria's entitlement framework enables groundwater trade to occur in line with the requirements of Chapter 12 of the Basin Plan. **Figure 21** below identifies how the considerations prescribed under the Victorian Water Act relating to decisions to transfer entitlements (trade) align with Basin Plan requirements. In addition to the legislative framework for trade decisions, the hydrologic connection of groundwater is defined by groundwater catchments which represent regions of connected groundwater resources and are based on groundwater flow systems. The groundwater catchments in the Wimmera-Mallee water resource plan area are shown in **Figure 2** and were a product of the Secure Allocations, Future Entitlement Project (DSE, 2012)

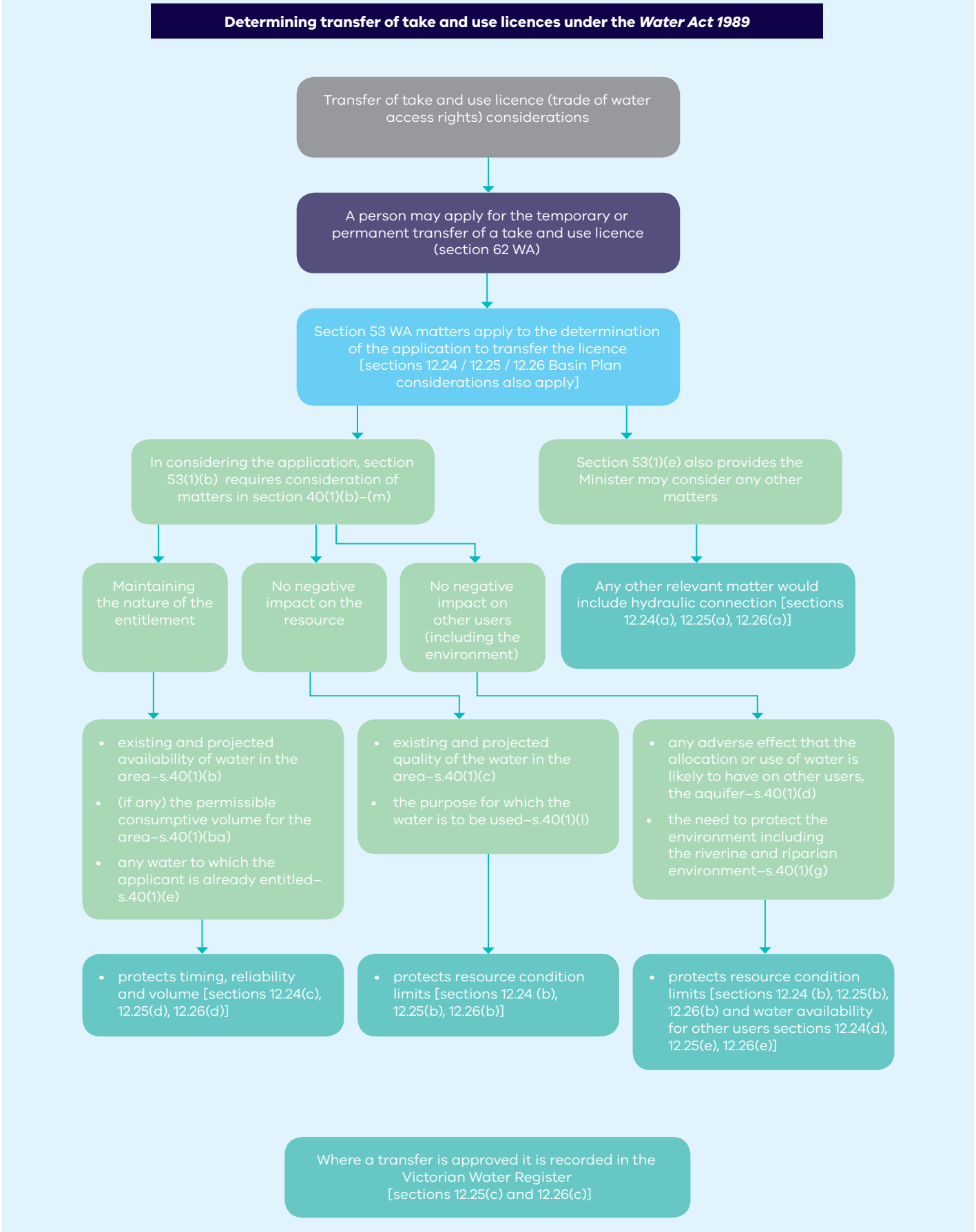

Figure 21: Determining transfer of take and use licences under the Victorian Water Act

6.14.1 Trades between two locations within a groundwater SDL resource unit

Trading between two groundwater areas is permitted by the Victorian Water Act, subject to the Act, the policies and any rules in a local or statutory management plan that apply to the area.

As at February 2018, only the Murrayville local management plan has been published in the Wimmera-Mallee water resource plan area. Other plans are being developed by water corporations. It should be noted that the groundwater SDL resource area excludes the area of the Murray-Darling Basin in the West Wimmera GMA.

Each plan documents a Groundwater Management Area (GMA) which is covered by a permissible consumptive volume that is a subset of the applicable Basin Plan Wimmera-Mallee SDL. PCVs have been declared by the Minister for Water under the Victorian Water Act (see, for example, Permissible Consumptive Volume Groundwater (Murrayville Groundwater Management Area) Amendment Order 2017) or each GMA.

Trade is permitted between management zones within GMAs subject to rules established by the corporation within the local management plan. Trade volumes are generally small because there is often still room available to issue new licences under the PCV.

Where there is no PCV set in the water resource plan area, this is because of the low level of development, and the low potential for this to occur. Other than existing controls identified in Chapter 6 there is no need for additional restrictions placed on issuing groundwater licences through setting additional PCVs, and no additional rules are considered necessary to manage groundwater outside of the existing GMAs.

To meet the requirements of section 10.37 of the Basin Plan, the Wimmera-Mallee Water Resource Plan must identify the circumstances in which trade is permitted to ensure that the conditions of section 12.24 of the Basin Plan are met. Where the conditions prescribed in section 12.24 are not met, trade is prohibited. Section 12.24 sets out the following conditions in which trade may be permitted:

- sufficient hydraulic connectivity between the two locations
- resource condition limits in the SDL resource unit specified in any water resource plan will not be exceeded as a result of the plan
- the entitlements traded have substantially similar characteristics of timing, reliability and volume, or measures are in place to ensure the entitlement traded will maintain its characteristics of timing, reliability and volume
- measures are in place to address the impact, as a result of trade, on water availability in relation to a water access right held by a third party.

Trade is permitted within the Wimmera-Mallee water resource plan area only between locations within the same groundwater catchment as this provides the basis for sufficient hydraulic connectivity being present. Trade may occur only within PCVs which prevent resource condition limits in the relevant SDL resource unit being exceeded. Entitlements traded have similar characteristics of timing, reliability and volume because:

- all groundwater licences are 'all-year' licences
- in the Wimmera-Mallee water resource plan area, restrictions are not currently applied. However, if this were to be the case, the adaptive management regime in the water resource plan area would ensure that any trade rules were reviewed to maintain reliability of the traded entitlement and prevent impacts on other users
- no changes to entitlement volume are made as part of a trade; the buyer receives what the seller sells.

The conditions under section 12.24 are further supported by Victoria's water resource management framework which protects other users and the environment (and resource) in determining the take and use of water.

10.37(1) Trade between two locations within a single Wimmera-Mallee groundwater SDL resource unit is permitted in the following circumstances:

a. if the two locations are within the same geology as defined by the SDL groundwater unit which demonstrate sufficient hydraulic connectivity; and

b. if the relevant permissible consumptive volume is not exceeded, because the permissible consumptive volume is the limit set to protect the resource condition; and

c. if the volume to be traded is specified, noting that in Victoria timing is not a condition on groundwater take and the reliability and any other conditions or characteristics of the water access right are not changed due to trade; and

d. where regard has been had to any adverse effect that the trade is likely to have on existing authorised users of water and measures are in place to address any adverse effect.

Figure 21 of the Wimmera-Mallee Comprehensive Report depicts the process for determination of a transfer (trade) of a take and use licence under the *Water Act 1989* (Vic) and demonstrates how the conditions set out in section 12.24 of the Basin Plan align with the Victorian framework. Reference to the *Water Act 1989* (Vic) in **Figure 21** of the Wimmera-Mallee Comprehensive Report does not form part of the response and is included for reference only.

6.14.2 Trades between two groundwater SDL resource units

The Wimmera-Mallee (groundwater) water resource plan area contains three groundwater resource SDL units as described under Schedule 4 of the Basin Plan:

- Wimmera-Mallee: Sedimentary Plain (GS9)
- Wimmera-Mallee: Highlands (GS9)
- Wimmera-Mallee: deep (GS9).

To date, there has been no trade between these SDL units. Current GMAs in the Wimmera-Mallee water resource plan area, being areas where the majority of licences exist, are confined to the Sedimentary Plain SDL unit, so trade between SDL units is not anticipated. This does not mean that trade will not be allowed in the future where there is sufficient hydraulic connectivity between these SDL units, as defined by the groundwater catchments. If demand for trade between SDL units eventuates in future, it is expected that the relevant GMA boundary would be amended so that trading rules could be developed via a local management plan. Trade will be able to occur only within PCVs which prevent resource condition limits in the relevant SDL resource unit being exceeded. Entitlements traded will have similar characteristics of timing, reliability and volume because:

- all groundwater licences are 'all-year' licences
- trade rules will be established to maintain reliability of the traded entitlement and prevent third-party impacts to other users
- no changes to entitlement volume will occur as part of a trade; the buyer receives what the seller sells.

The conditions under section 12.25 are further supported by Victoria's water resource management framework, which protects other users and the environment (and resource) in determining the take and use of water.

10.38(1) Trade between two groundwater SDL resource units within the Wimmera-Mallee Water Resource Plan area is permitted in the following circumstances:

a. the two locations are within the same groundwater catchment, because groundwater catchments are determined based on regional groundwater flow paths which demonstrates sufficient hydraulic connectivity; and

b. if the relevant permissible consumptive volume is not exceeded, because the permissible consumptive volume is the limit set to protect the resource condition; and

c. if the volume to be traded is specified, noting that in Victoria timing is not a condition on groundwater take and the reliability and any other conditions or characteristics of the water access right are not changed due to trade; and

d. where regard has been had to any adverse effect that the trade is likely to have on existing authorised users of water and measures are in place to address any adverse effect.

Where trade occurs in the above circumstances it will be recorded on the Victorian Water Register.

Figure 21 of the Wimmera-Mallee Comprehensive Report depicts the process for determination of a transfer (trade) of a take and use licence under the *Water Act 1989* (Vic) and demonstrates how the conditions set out in section 12.25 of the Basin Plan align with the Victorian framework. Reference to the *Water Act 1989* (Vic) in **Figure 21** of the Wimmera-Mallee Comprehensive Report does not form part of the response and is included for reference only.

6.14.3 Trades between surface water and groundwater SDL resource units

Trade may be permitted between surface water and groundwater SDL resource units according to rules set out in local management plans. While local management plans cannot set out enforceable rules for managing trade of water, it is a useful policy tool that articulates how the considerations under the Victorian Water Act (outlined above in **Figure 21**) for temporary or permanent transfer of entitlements may apply in an area.

There are no local management plans in the Wimmera-Mallee water resource plan area that allow trade between surface water and groundwater. This is primarily because physical connections between surface water and groundwater resources have not been researched thoroughly enough. In the Murrayville GMA the groundwater is deep and does not connect with surface water.

If there is a change in rules to allow trade between groundwater and surface water SDL resource units, the Wimmera-Mallee Water Resource Plan will be reviewed to determine what amendments are necessary.

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7. Challenges for water planning, management and use – the risk assessment

Part 7. Challenges for water planning, management and use – the risk assessment

The following Chapter outlines the current and future risks to the availability and condition of water resources in the Wimmera-Mallee water resource plan area identified through the risk assessment completed to meet the requirements of Part 9 of Chapter 10 of the Basin Plan.

7.1 Water availability

The Wimmera-Mallee water resource plan area has highly variable climatic conditions. This was exemplified by the extreme water shortages during the Millennium Drought when many waterways dried out and significant water quality issues arose in the few remaining waterbodies that held water.

The drought was followed by large floods in the summer of 2010–11. Low inflows returned after that year until 2016–17. Overall trends indicate decreasing water availability in the future.

Climate change and severe drought are expected to have the most significant effect on future water availability and condition. Climate change is projected to cause serious reductions in rainfall, groundwater recharge and runoff (see **Figure 22**).

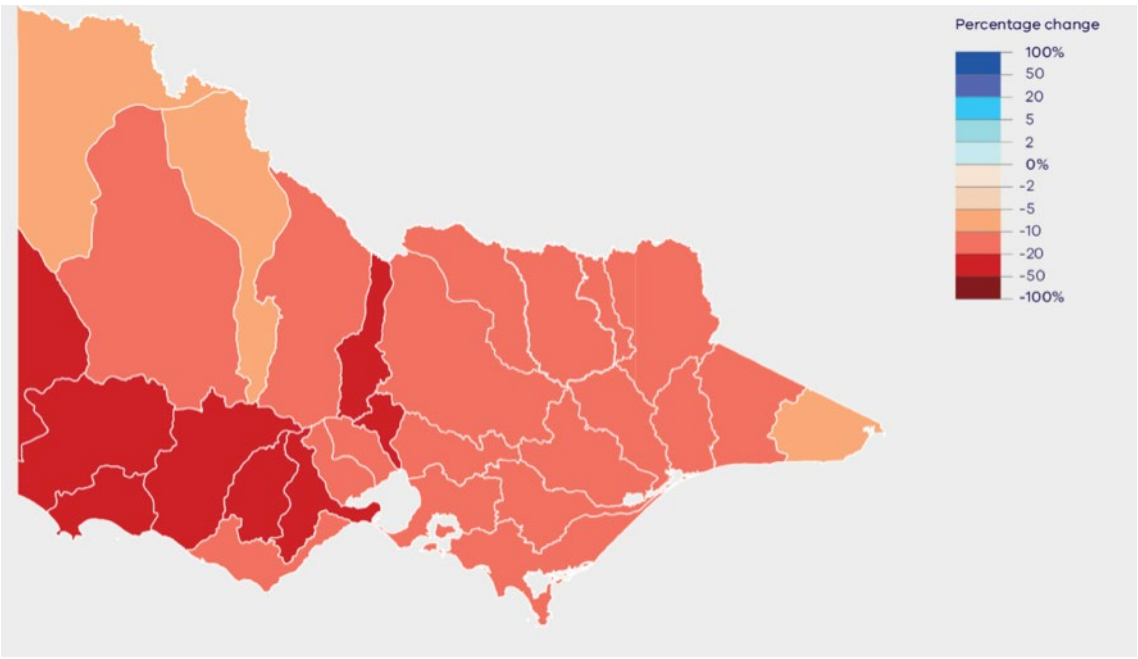

Figure 22: Changes in runoff to 2065 under a medium climate change scenario
Source: Figure 2.4 of DELWP (2016d)

Surface water entitlements in the Wimmera-Avon and Avoca River systems are capped meaning that no additional surface water entitlements can be issued.

The volumes of groundwater SDLs in some areas permit increases in groundwater entitlements but because groundwater is brackish in most of the water resource plan area, it is expected that demand for this resource will remain within the SDL volume for the foreseeable future. Victoria's comprehensive water framework manages annual extractions within the SDLs (see **Part 8**).

Victoria's water sector is well placed to manage future water shortages because of the existing legislative framework, experience from the Millennium Drought and the actions and policies in *Water for Victoria*, which are documented throughout this report with reference to the Wimmera-Mallee water resource plan area.

7.2 Water resource condition

The third index of stream condition report (DEPI, 2013a) found that water quality in the waterways of the Wimmera basin ranged from good to very poor.

All river reaches with water quality results had elevated levels of turbidity and generally high levels of phosphorus. The lower reaches of the Wimmera River had very high levels of salinity. Water quality is largely attributable to water availability and historic land use practices that caused erosion and elevated nutrient and salinity levels.

The environmental condition of waterways includes hydrology, physical form, streamside zone and aquatic life in addition to water quality. Most of the stream length in the Wimmera basin was in moderate condition (63 per cent) and 21 per cent in poor or very poor condition. More than half (56 per cent) of the stream length in the Avon-Richardson River system was in poor condition.

DEPI (2013a) assessed four of 23 reaches in the Avoca River. All had poor to moderate water quality, which was attributed to elevated phosphorus and salinity levels. The majority of stream length in the Avoca Basin was in moderate condition.

There is a low risk of further deterioration in waterway condition due to the management activities (including fencing, revegetation, weed control and environmental watering undertaken by CMAs and landholders in the region).

As with water availability, Victoria is well placed to manage future challenges related to the condition of water resources with proposed reforms documented in *Water for Victoria*.

7.3 Water resources for Aboriginal values and uses

Water availability and condition pose risks to cultural values and uses of water by Traditional Owners.

Until recently, Victoria's Traditional Owners and Aboriginal Victorians have had very limited involvement in decision making in Victoria's water planning and management framework. **Part 11** looks at how the Victorian Government will work with Traditional Owners on water-related matters.

7.4 Commonwealth Water Act

The Commonwealth Water Act requires the Basin Plan to identify the risks to the condition or continued availability of water resources (section 22(1), (item 3)).

The risks must deal with the availability of basin water resources which arise from the taking and use of water (including interception activities), the effects of climate change, land use changes and limitations on the state's knowledge of water resources on which estimates about matters relating to basin water resources are made.

7.5 Basin Plan requirements

Consistent with the Commonwealth Water Act, section 4.02 of the Basin Plan identifies potential risks to Murray-Darling Basin water resources, particularly to the condition or continued availability of water, and strategies to manage or address these risks. Risks include:

- insufficient water being available for the environment
- water being of unsuitable quality for use
- poor health of water-dependent ecosystems.

The Basin Plan identifies that the consequences of these risks eventuating would be insufficient water of suitable quality being available:

- for consumptive and other economic uses
- to maintain social, cultural, Indigenous and other public benefit values.

Section 4.03 of the Basin Plan details a number of strategies to manage, or address, the risks identified in section 4.02. These strategies are:

- implementation of the Basin Plan, including its following key elements:
  - environmental watering plan
  - water quality and salinity management plan
  - water trading rules
  - water resource planning
- developing water resource plans and amendments to the Basin Plan based on the best available knowledge and in consultation with relevant stakeholders
- promoting a risk-based approach to water resource planning and management
- managing flows to optimise outcomes across the range of water uses in the Murray-Darling Basin
- ensuring effective monitoring and evaluation of the implementation of the Basin Plan
- promoting and enforcing compliance with the Basin Plan and water resource plans
- improving knowledge of water requirements within the Murray-Darling Basin including:
  - environmental watering requirements
  - requirements relating to the social, spiritual and cultural use of Basin resources by Indigenous peoples
  - the impact of climate change on water requirements
  - the water required to deliver social and economic benefits to Basin communities
- improving knowledge of the impact on Basin water resources of the following:
  - interception activities and land use change
  - floodplain harvesting and peri-urban and industrial take
  - climate change
- improving knowledge of:
  - groundwater and surface water resources, including through improved measurement
  - the causes of water quality degradation and the effects of water quality on environmental assets and ecosystem function.

The risk assessment has been used as the basis for the preparation of the water resource plan. Identified risks are discussed throughout the water resource plan and the measures and strategies to address those risks presented in the relevant part of the water resource plan.

7.6 Water resource plan requirements

Section 10.41(1) of the Basin Plan requires Victoria to prepare its water resource plans having regard to the current and future risks to the condition (quality) and continued availability of water in the water resource plan area.

The methodology for conducting the risk assessment, described in the Basin Plan (section 10.41), covers a mix of primary causes, threatening processes and implications for beneficial uses of water resources. These requirements are set out in multiple cross-referenced provisions within the Basin Plan (see below).

The identification and interpretation of the detailed requirements of the risk assessment can be challenging. However, the key requirement is clear: that the risk assessment should consider "current and future risks to the condition and continued availability" of water resources (Basin Plan, section 10.41(1)).

A water resource plan must:

- identify, list, assess and define the level of risk (high, medium or low) in line with the AS/NZS 120 31000:2009 (10.40)
- describe the data and methods used to assess the risk (10.41(7))
- describe quantified uncertainties (10.41(8)).
- for risks assessed as medium or high risks, must describe the risks (10.42(a)) and the factors contributing to the risks (10.42(b)) as well as describing strategies to address them (10.43).

The Commonwealth Water Act, Basin Plan and MDBA provide interpretation of the terms that assist to set the context for the water resource plan's risk assessments:

- water resource—includes "all aspects of the water resource, including water, organisms, other components and ecosystems".
- condition—includes condition of all the above aspects of the water resource.
- current and future risks—includes risks that could occur during and beyond the life of the water resource plan, regardless of whether a management strategy is currently in place.

7.6.1 Availability and condition of water resources

The following risks relating to availability and condition of water resources are to be considered:

- risks relating to water condition and availability (10.41(1)) for economic (4.02(2) (a)), social, cultural, Indigenous/Aboriginal and other public benefit values (4.02(2) (b))
- risks that water will not be of a suitable quality for use (4.02 (1) (b)) including salinity (10.41(2)(d))
- poor health of water-dependent ecosystems (4.02(1) (c)) (10.41(2)(a))
- risks to meeting environmental watering requirements (identified in Victoria's long-term watering plans) (10.41 (2) (a))
- risks to groundwater systems (including structural damage and groundwater/surface water connections) (10.20(1)(a) and (b)) (10.41(2)(b))
- risks arising from elevated salinity and other types of water quality degradation (10.31 and 10.41(2)(d)).

7.6.2 Interception

Risks from interception activities (10.41(c)) that may have a significant impact on water resources including those identified in section 10.23 of the Basin Plan include:

- runoff dams
- commercial plantations
- mining activities, including coal seam gas mining
- floodplain harvesting.

7.6.3 Extreme events

As required by the Basin Plan, a water resource plan must describe how the water resources of the water resource plan area will be managed during extreme events (10.51).

These events include extreme dry periods (drought), extreme water quality events and other events that compromise the ability to meet critical human needs.

These types of risks are 'event based' extreme drought, major asset failure, bushfire, point source discharge, flooding, and overbank inundation and were included in the risk assessment in terms of their impact on the ability to meet critical human water needs.

In Victoria, critical human needs are defined as: "The volume of water required to supply Stage 4 restricted demand in urban areas, supply domestic and stock needs and operate the distribution system to deliver that water".

7.6.4 Aboriginal objectives

Under the Basin Plan, a water resource plan must identify the objectives and outcomes sought by Aboriginal people in relation to the management of water resources in the water resource plan area (10.52). Regard must be had to the social, spiritual and cultural values of Indigenous peoples and the uses of water resources for these purposes.

7.6.5 Environmental outcomes

The risk assessment has also considered risks related to matters within Chapter 10, Part 4 which sets out the requirements in relation to the sustainable use and management of water resources of the water resource plan area within the long-term annual diversion limit and SDL resource unit:

- surface water – environmental water requirements for priority environmental assets and ecosystem functions (10.17 and 10.22(b))
- groundwater – related risks including groundwater requirements for priority environmental assets and ecosystem functions (10.18)
  - groundwater and surface water connections (10.19)
  - productive base of groundwater and its management (10.20)
  - environmental outcomes related to groundwater (10.21 and 10.22(b)).

7.6.6 Priority environmental assets and ecosystem functions

The risk assessment includes risks to:

- priority environmental assets and ecosystem functions relating to surface water (10.17)
- priority environmental assets and ecosystem functions relating to groundwater (10.18)
- meeting environmental watering requirements, identified in Victoria's long-term watering plans.

Victoria has developed three long-term watering plans (LTWPs), for the three surface water water resource plan areas.

The priority environmental assets identified in Victoria's LTWPs are the environmental watering assets assessed in this risk assessment.

7.7 Victoria's approach to the risk assessment – data and methods used to identity and assess risks (10.41(7))

A single, common and consistent risk assessment framework has been adopted for Victoria's five water resource plan areas. The framework adopted provides a transparent, comprehensive assessment of risk, allowing all risks to be documented and explicitly considered.

The framework allows for a detailed exploration and analysis of risk and allows any individual risk to be reviewed and updated if and as required. The structured nature of the framework also enabled risks to be combined and analysed in themes, enabling summaries of risks across the water resource plan areas to be generated and evaluated.

The assessment was undertaken over a 12-month period and overseen by the:

- DELWP Water Resource Plan Risk Assessment Working Group: comprising subject matter leads from within DELWP, with skills and responsibilities in fields of surface water policy, interception (farm dams and forestry), climate change, groundwater, environmental water, water quality and drought. This group provided preliminary review and input to data, methods and project outputs before a review by the Water Resource Plan Risk Assessment Advisory Panel.
- Water Resource Plan Risk Assessment Advisory Panel: this panel was established to provide milestone review of the risk assessment. It consisted of representatives from DELWP, rural water corporations, CMAs, VicWater, Murray Lower Darling Rivers Indigenous Nations and the Victorian Environmental Water Holder. A representative from the Victorian Farmers Federation was also invited to attend as an observer. The advisory panel members and their respective organisations provided critical review of the data used in the risk assessment, the identification of risks, the method adopted for the risk assessment, the scenarios to be assessed and the outcomes of the assessment.

The following core concepts framed the scope of the risk assessment and the assessment of risks.

7.7.1 Scope of the risk identification and assessment

The risk assessment must identify the current and future risks to the condition and availability of water resources in the water resource plan area (10.41(1)).

Basin Plan definitions have been adopted for this risk assessment and as a consequence the condition of the water resource includes not only water quality, but the health of the water-dependent ecosystems including priority environmental assets. The risk assessment identifies and assesses the risks to the condition of organisms, water-dependent ecosystems and other components of the water resource.

The identified risks need to include (but not be limited to) those specified in the Basin Plan. The risk assessment has included these risks and others identified through the risk identification process.

7.7.2 Temporal and spatial scale

The Basin Plan requires water resource plans to address risks to the availability and condition of water resources in Victoria's water resource plan areas.

For the purpose of this assessment, risks were assessed in terms of their scale of impact on water resources and the uses of the water resource plan area.

This scale of impact included explicit assessment of the magnitude, spatial extent and duration of impact within the water resource plan area over the life of the water resource plan (2019 to 2029) and beyond. This approach has enabled site-specific and broad-scale risks to be assessed, reflecting the issues within each water resource plan area.

7.7.3 Residual risk

The risk assessment is based on the current level of risk assuming existing policy and practice are in place. In this respect the risk assessment identifies the level of residual risk under current arrangements in Victoria.

7.7.4 Data used to identify and assess risks

Data has formed the basis of the risk assessment.

The literature reviewed is listed in **Schedule 1** of **Appendix B**, in line with its thematic category. The adequacy of the literature to describe its relevant relationship is rated High (H), Medium (M) or Low (L).

The Basin Plan requires that the data and methods used to identify and assess risk be described in the water resource plan. The descriptions provided in this report and the accompanying materials are considered to be adequate for MDBA to understand and to assess the water resource plan and the risk assessment against Basin Plan requirements. There is also a requirement for the water resource plan to describe any quantified uncertainties and sensitivity analysis. The data and methods adopted for the risk assessment and the level of uncertainty in the assessment have been explicitly included in the risk assessment and reporting including the risk register.

7.8 Risk identification and assessment methodology (10.41)

The Basin Plan requires water resource plans to describe the data and methods used to identify and assess risk. The descriptions provided in the water resource plan and Risk Assessment Report in **Appendix B**.

When preparing a water resource plan, Chapter 10 of the Basin Plan requires a water resource plan to have regard to the risks, strategies and guidelines from Chapter 4 – Identification and management of risks.

Victoria undertook a comprehensive risk assessment in accordance with the requirements of the Basin Plan as described above. The approach adopted for the risk assessment was based on the requirements of the Basin Plan for water resource plans (10.41).

For the purpose of this risk assessment, risks have been identified in terms of causes, threats and beneficial uses of the water resource, whereby a cause may result in a threat that impacts on a beneficial use of water.

The risk assessment required an approach that provides structure to the mix of causes, threats and beneficial uses, set out in the Basin Plan. Such structure enables a methodical, systematic, repeatable and transparent approach to the identification and evaluation of risks necessary for the development of the water resource plans.

Victoria undertook the risk assessment in accordance with the requirements of the Basin Plan. This approach is summarised below.

The approach adopted for the risk assessment aligns with international and national standards for risk assessment, with risk being assessed as the product of the likelihood and consequence of a threat impacting on an 'asset'.

In accordance with the provisions of the Basin Plan, levels of risk assigned to events and their consequences have been defined in a manner consistent with AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines. The approach adopted for risk identification and assessment has been undertaken in accordance with the risk management process set out in ISO 31000. As set out in ISO 31000:2009, the likelihood and consequence assessment must be appropriate to the context of the risk assessment, and customisation of likelihood and consequence categories is entirely appropriate.

The Basin Plan describes the requirements for determining risk. Under the provisions of the Basin Plan:

- the assessment examined risks in a consistent, structured and transparent way. Risks were assessed taking into account Victoria's comprehensive water management arrangements and influencing factors such as environmental management, land use planning and emergency management to determine the residual risks on identified beneficial uses.
- risk levels, ranging from very low to very high, were determined as a product of likelihood and the consequence of a risk occurring. When assessing the consequence of the risk occurring, it was considered on a water resource plan scale rather than on a local scale.
- likelihood is assessed in terms of how each cause impacts on each threat.

Consequence is assessed in terms of how each threat impacts on each beneficial use.

The overall risk therefore represents how each cause will impact on each threat, and how that threat will in turn impact on each beneficial use.

For the purpose of this risk assessment likelihood has been defined as a function of susceptibility and probability, and consequence defined as a function of sensitivity. This framework developed and adopted for the preliminary risk assessment is shown in **Figure 23**.

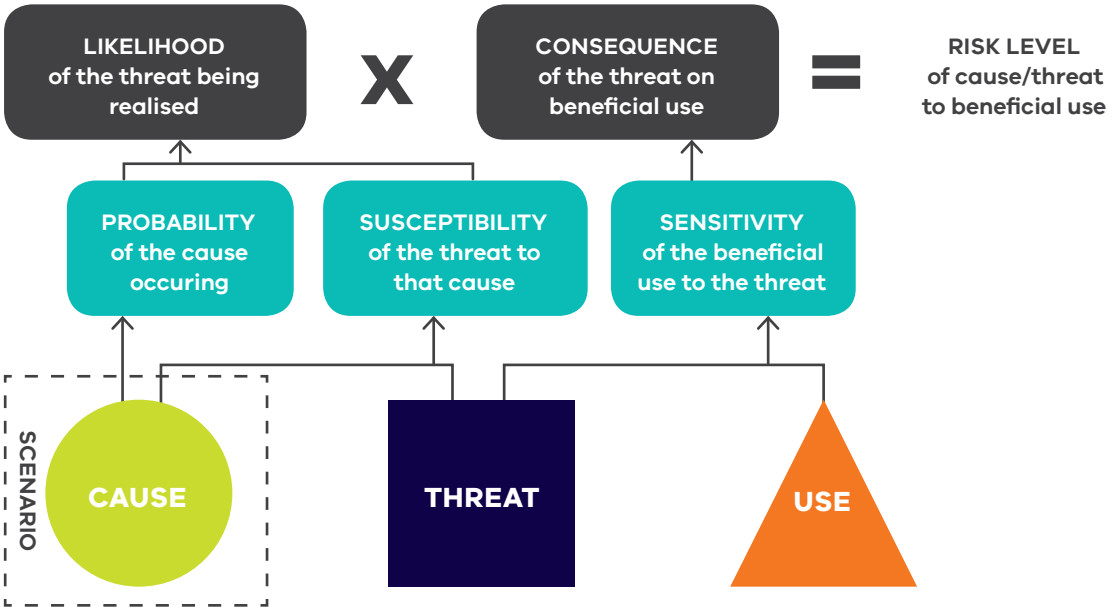

Figure 23: Risk assessment matrix

Example: risk identification

A cause (e.g. extreme drought) may result in a threat (e.g. decline in water availability) that impacts on a use (e.g. consumptive use) of water.

As an example, there may be a risk associated with an increased number of farm dams ('cause'), that leads to a reduction in volume of surface water available ('threat'), adversely impacting on the environment ('use').

7.9 Identifying risks in the water resource plan area

A set of potential causes of risk were identified from the literature and through the engagement process. The causes identified (e.g. climate change) were assigned a specific scenario that would generate an adverse threat. These causes and accompanying scenarios included one-off natural events, gradual changes over time, and incremental changes to land and water use and management.

The risk assessment included:

- 16 causes and scenarios
- 13 threats
- 37 water use categories.

7.9.1 Causes and scenarios

CAUSE

A cause is defined as: an event and accompanying scenario that gives rise to or generates a threat. For this risk assessment, the causes are described as the events that led to the development of a threat. Causes can be changes in levels of development such as increased use of existing rights and entitlements, or events such as climate change or bushfires.

A set of potential causes of risk were identified from an extensive literature review and through the engagement process (see **Appendix B**). Based on a detailed literature review and consultation the causes identified (e.g. climate change) were then assigned a specific scenario that would generate an adverse threat.

These causes and accompanying scenarios included one-off natural events, gradual changes over time, and incremental changes to land and water use and management. Descriptions of these causes and the scenario adopted are provided in **Table 7**.

7.9.2 Scenarios

Specific scenarios for each cause are required to enable risks to be assessed. Each scenario adopted for the risk assessment comprises a detailed description of the specific cause to be assessed.

Many alternative scenarios could be envisaged for each cause. For example, many alternative climate change scenarios are possible. Analysis of each possible scenario for each potential cause would significantly expand the list of potential risks and render the analysis unworkable. For the purpose of this assessment, one scenario has been assessed for each identified cause. As an example, the International Panel on Climate Change median warming scenario has been adopted for the assessment of the cause 'climate change'.

A full description of the scenario options and rationale for the scenario chosen is contained in the Preliminary Risk Assessment Report.

A brief description of each adopted scenario within each water resource plan area is set out in **Table 7** with further detail provided in criteria adopted for the selection of scenarios included:

- the probable scenario that produces the highest risk (e.g. extreme drought) and
- an extrapolation of past trends (e.g. farm dams, land use) or
- that which is adopted in the literature (e.g. median climate change).

Importantly, the scenarios cover a range of possible future situations and are not 'forecasts' of a most likely future. The scenarios each represent a possible future. The risk assessment has not combined these scenarios to form one overall future scenario. Each scenario has been assessed independently to identify the risk associated with that cause and related scenario. Scenarios have also been identified at the water resource plan area scale to ensure their relevance to the causes and threats that will potentially drive risks in each area.

Table 7: Causes and adopted scenarios of risk considered in the risk assessment

Cause category	Cause	Consequence	Surface water area scenario	Groundwater area scenario
Climate change	Climate change	Likely to lead to reduced rainfall over south-eastern Australia, increased variability of rainfall and increased mean temperatures	Median (50th percentile) of global climate model projections based on Moran and Sharples (2011). The median is considered appropriate given much of the analysis available is based on the median rather than the high scenario, and scenario based on the Millennium Drought (see extreme drought scenario) is equivalent to the high scenario in mid to late this century. This scenario and its analysis will be based on the outputs from Scenario B from the Western Region Sustainable Water Strategy (DSE, 2011) and Northern Region Sustainable Water Strategy (DSE, 2009b)	As for surface water
Extreme events	Bushfires	Impacts on availability and condition of water resources arising from bushfires	Water quality: Major fire during water resource plan period followed by significant flow event (based on worst known examples, including post 2005–06 Grampians bushfire) Water quantity: assessed but expected to be negligible based on lack of Ash species in these catchments	Water quality: Water quality impacts of bushfire on groundwater based on Wimmera-Mallee (surface water) water resource plan area Water quantity: Assessed based on scenario for Wimmera-Mallee (surface water) water resource plan area
Extreme events	Extreme drought	An extended period of low rainfall resulting in severe, low-water availability	Repeat of the Millennium Drought 13-year climate pattern scaled to represent the rarity of a 1 in 100 year drought. Scenario includes low flow events (minor freshes) within the drought	As for surface water

continued

Cause category	Cause	Consequence	Surface water area scenario	Groundwater area scenario
Extreme events	Extreme wet period	An extended period of above average rainfall, which may lead to rising groundwater levels and associated waterlogging and salinity threats	Wet period equivalent to late 1980s to early 1990s scaled to represent the rarity of a 1 in 100-year wet period. Scenario includes periods of low flow (events) within the wet period	As for surface water
Extreme events	Flooding and overbank inundation	Significant flooding can adversely impact on the condition of water resources	5% annual exceedance probability event (or appropriate historical example)	Not applicable
Extreme events	Major asset failure	A catastrophic failure of major water harvesting and storage infrastructure	50% reduction in the available storage volume in Lake Bellfield over the period of the water resource plan	Failure of bores / bore casings on up to 5% of bores based on review of state bore data
Extreme events	Point source discharges	Point source discharges are assumed to be a continuation of existing licensed discharges, urban stormwater runoff, and accidental spills Note: Point source discharges associated with mining are described under the 'earth resource development' cause Point source discharges associated with irrigation drainage are assessed as a component of 'land use practice'	Agricultural chemical spill directly into the Wimmera River	Leaking landfill sites
Land use and interception	Earth resource development	The development, operation, closure and legacy of earth resource activities such as mining, quarrying, oil and gas (hydrocarbons), carbon capture and storage, geothermal and pipelines that intersect aquifers/aquitards and/or are near waterways pose hazards to surface and groundwater availability and condition (including structural damage to aquifers)	Coal seam gas: There is no coal seam gas development in Victoria's water resource plan areas. Note that there may also be effects on Victoria's groundwater resources due to gas development in NSW. Mining: The cessation of mining (and aquifer dewatering) in the region, and legacy issues (such as mercury and arsenic contamination) in the historic mining areas. Ongoing gold mining with tailing storage facilitates. Open pit: Quarrying – 20% expansion of existing floodplain-based sand and gravel extractions with onsite disposal dams. Mineral sands – development in the Wimmera and Mallee	As for surface water

continued

Cause category	Cause	Consequence	Surface water area scenario	Groundwater area scenario
Land use and interception	Failure to continue to invest in best practice land use initiatives	Failure to invest in best practice management: grazing, irrigation, cultivation, clearing, road and other infrastructure construction	Continuation of existing land and waterway management practice in the absence of ongoing support for existing strategies and plans of management	As for surface water
Land use and interception	Increase in farm dams	Increased construction of farm dams to supply water for domestic and stock consumption	4 GL increase in the volume of small farm dams in rural-residential developments over a period of 10 years	As for surface water
Land use and interception	Land use change (affecting water availability)	In western Victoria, significant revegetation activity is being undertaken under the Wimmera Regional Salinity Action Plan (2005) to protect soils. Revegetation activity is also being undertaken under several other funding arrangements including vegetation and carbon offsets	Increase in catchment vegetation cover consistent with Wimmera Region Salinity Action Plan	As for surface water
Land use and interception	Land use change (affecting water condition)	Conversion from grazing to cropping is likely to have a significant impact on runoff water quality in stream systems particularly in the western areas of the state In the Wimmera-Mallee, the conversion of grazing land to cropping could generate some adverse impacts on the condition of the water resource	Conversion of 5% of grazing land to cropping	N/A This issue is not expected to have any measurable effect on groundwater recharge rates, and has therefore not been considered for groundwater water resource plans
Land use and interception	Pests and weeds	Considers the impact of weeds such as willow colonisation of stream systems and pests such as carp invasions. Pest plants such as willow and pest animals such as carp have the potential to pose significant threats to the condition of water resources. Willow can lead to seasonal increases in biological oxygen demand and decreases in dissolved oxygen levels. Willow can also contribute to the abandonment of stream systems. Invasive species such as carp can increase turbidity in stream systems, while trout can predate on native fish species	Adopt current level of willow extent Adopt 25% increased level of carp	N/A

continued

Cause category	Cause	Consequence	Surface water area scenario	Groundwater area scenario
Non-compliance	Non-compliance with the Victorian Water Act	Includes the unauthorised take and/or use of water or the constructing or altering of works without consent	5% illegal take and continuation of current level of unauthorised works on waterways	5% above licensed bore take without authorisation and 10% of Domestic and Stock bore use being applied to (unlicensed) non 'domestic and stock' use
Water access, take, utilisation and location	Increase in the number of rights and volume of entitlements	Leads to increased take. The MDBA has capped surface water diversions and there are caps on groundwater entitlement volumes in major groundwater management areas. There are no limits on the number of domestic and stock users. Risk lies in the issue of new groundwater licences (for commercial or irrigation purposes) in unincorporated areas outside existing groundwater management areas (GMAs) or in GMAs where total entitlement volumes are lower than the permissible consumptive volume	For surface water resources, the only plausible increase in rights or entitlements could be through stock and domestic use, excluding farm dams. Even a generous estimate of increase in these small entitlements would represent a negligible proportion of the overall unregulated licence pool. On this basis, this scenario has not been applied to surface water	5% increase in unincorporated areas
	Increased utilisation of water access rights	Some existing water entitlements are not fully utilised by their holders. Increased utilisation of these entitlements may impact on the availability/condition of water resources	5% increase in use of unregulated surface water entitlements	2006–07 levels of demand occurs on two or more occasions and a 2.5% increase in the domestic and stock bores
	Timing and location of demand	Changes to the timing and location of demands for water within the river system may give rise to a range of threats to water availability and/or condition	Victoria does not envisage any significant change in the timing of delivery of water in the Wimmera region or a change that will impact on groundwater resources	As for surface water

7.9.3 Threats

THREAT

A threat is a deviation from an agreed starting point that may affect the use of the water resource or this risk assessment. A deviation from an agreed starting point could include:

- adverse changes in the volume or pattern of water
- continuation or changes in water quality or ecosystems that renders them not fit-for-purpose.

Table 8: Threat categories assessed

Threats	Category	Sub category	Definition
Continued availability of the water resource	Surface water	Reduction in volume	A change to the inflow of water to the water resource plan area
		Changes to seasonal pattern of water	A change to the seasonal pattern of rainfall and runoff (e.g. a shift in weather patterns that results in an increase in summer rainfall within the water resource plan area)
		Changes to the inter-annual pattern	A change to the annual pattern of water such as increased annual variability
	Groundwater	Decline or adverse rise in inflow to aquifer	A long-term decline or adverse rise in the inflow of water to the aquifers of the area. An adverse rise would include increases that result in waterlogging or rising salinity
		Adverse change to the seasonal pattern of inflows to aquifer	A change to the seasonal pattern of inflow to the aquifers of the area that have an adverse impact on users and beneficial uses

continued

Threats	Category	Sub category	Definition
Condition of the water resource Risks arising from elevated salinity and other types of water quality degradation (10.31 and 10.41(2)(d))	Water quality	Levels of salinity	Level of salinity in the water resource plan area
		Levels of suspended sediment and/or nutrients	Level of suspended sediment and nutrients (phosphorus and nitrogen) in the water resource plan area
		Levels of toxicants	Level of toxicants (pesticides, herbicides, heavy metals, hydrocarbons) in the water resource plan area
		Levels of pathogens	Level of pathogens (such as Giardia and cyanobacteria) present in the water resources of the water resource plan area
		Other water quality attributes	Level of other water quality attributes such as water temperature, pH and/or dissolved oxygen including temperature
Priority environmental assets and ecosystem functions – surface water (10.17)	Structural form (physical/ non-water/ non-biological) of priority rivers and wetlands	Loss or decline in longitudinal connectivity	Defined to comprise barriers to fish passage and other barriers such as vegetation connectivity
		Loss or decline in lateral connectivity	Defined to comprise loss of floodplain connectivity such as levees
		Loss or decline in physical habitat	Defined to comprise the loss or decline in condition of instream physical habitat such as sedimentation, erosion, loss of large wood
Priority environmental assets and ecosystem functions dependent on groundwater (10.18)	Environmental water	Environment: high-reliability bulk entitlement Environment: low-reliability bulk entitlement Controlled water (passing flows) Uncontrolled water (above-cap water)	Availability of environmental water to meet watering needs
Groundwater surface water connections (10.19) Risks to the productive base of ground water (10.20)	Risks to groundwater systems (including structural damage and groundwater/ surface water connections) (10.19) (10.20 (1) (a) and (b))	Loss of structural form of aquifer as an impact affecting connection to surface water Risk to the productive base of groundwater for consumptive uses	Loss of structural form of aquifer as an impact from the causes Risk to availability consumptive uses of groundwater
Environmental outcomes related to groundwater (10.21)	Availability impacts on groundwater resources for environmental purposes	Basin Margin Deep Basin Margin Shallow Upland Layered Valley Uplands	Considerations around environmental water needs captured in local and statutory management plans

7.9.4 Use of water

The use to which water resources are applied including, environmental, consumptive, recreational/social and Indigenous/Aboriginal.

For this risk assessment, the water resource plans have been developed to protect the "condition and continued availability" of Basin water resources for the identified beneficial uses.

For the purpose of this risk assessment the impact on the availability of water for the environment (surface or groundwater) considers all water used by the environment, not only water which has been specifically released from storage for environmental purposes, or water which is allocated as an environmental entitlement. In this respect environmental, recreational/social and Indigenous/Aboriginal values may be supported by the provision of water and may not 'use' water in the same manner as consumptive use.

Water resource plan area (surface water)

Beneficial uses have been assessed in terms of:

- consumptive uses
- environmental uses
- social/recreational uses
- Aboriginal/Indigenous uses.

These beneficial uses have been assessed based on risk to:

- surface water availability based on categories that define the legal entitlement or right to water
- groundwater availability based on categories that reflect the physical attributes of the aquifer from which water is derived
- water quality condition based on the State Environment Protection Policy (Waters) beneficial use categories
- structural form of surface water resources based on categories that reflect priority assets:
  - wetlands and rivers
  - structural form of aquifer.

Table 9: Beneficial use categories for assessment of surface water availability risk

Beneficial use	Entitlement and right/form of access to water (temporal)
Environment	High-reliability bulk entitlement and water shares
	Low-reliability bulk entitlement and water shares
	Controlled water (passing flows)
	Uncontrolled water (above-cap water)
Consumptive	Very high-reliability water (urban bulk entitlements)
	High-reliability bulk entitlements and water shares
	Low-reliability bulk entitlements and water shares
	System operation water
	Section 51 licences
	Section 8 domestic and stock rights
Social/ Recreational	Recreation bulk entitlement (Wimmera-Mallee (surface water) water resource plan area only)
	Social and recreation values not provided by a recreation bulk entitlement
Indigenous/ Aboriginal	Section 8A Traditional Owner Rights Note: Other indigenous uses of surface water include consumptive, environmental and social uses. The current entitlement framework for these are set out under these headings above

Water resource plan area (groundwater)

The groundwater beneficial use sub-categories from the risk assessment divide the Basin into groundwater areas based on recharge rates, and the size of the aquifer. The rate of recharge is associated with the storage (S) of the aquifer relative to recharge (R) rate to the aquifer (S/R), such that an aquifer with a small S/R will be more sensitive to a change in recharge condition.

Conversely, an aquifer with a high S/R has a significantly large storage volume relative to annual recharge and hence is less sensitive to a change in recharge. This method was used in the development of the groundwater SDLs for the Basin Plan (CSIRO & SKM, 2010).

Table 10: Beneficial use categories for assessment of groundwater availability risk

Beneficial use	Beneficial use sub-class	Storage to recharge ratio	Form of access to water
Environment	Basin GCS	S/R >40	None (disconnected to surface systems)
	Basin Margin GCS (deep)	S/R 20–40	
	Basin Margin GCS (shallow)	S/R 10–20	Considerations around environmental water needs captured in groundwater management plans
	Upland Layered Valley	S/R 10–20	
	Uplands GCS	S/R <10	
Consumptive	Basin GCS	S/R >40	Licence entitlements and D&S rights
	Basin Margin GCS (deep)	S/R 20–40	
	Basin Margin GCS (shallow)	S/R 10–20	
	Upland Layered Valley GCS	S/R 10–20	
	Uplands GCS	S/R <10	
Social/ Recreational	Not assessed		
Indigenous/ Aboriginal	Aboriginal values provided by groundwater		

7.9.5 Condition

The beneficial uses categories adopted for the assessment of water quality (condition) reflect those set out in the State Environment Protection Policy (Waters).

Table 11: Beneficial use categories for assessment of surface (water quality) condition risk

Beneficial uses	Categories
Environment/ aquatic ecosystems	Largely unmodified
	Slightly to moderately modified
	Highly modified
Consumptive	Human consumption after appropriate treatment
	Agriculture and irrigation
	Aquaculture
	Industrial and commercial use
	Fish, crustaceans and molluscs for human consumption
Social/ recreational	Primary contact recreation (e.g. swimming)
	Secondary contact recreation (e.g. boating)
	Aesthetic enjoyment
Indigenous/ Aboriginal	Indigenous cultural and spiritual values

7.9.6 Structural form

The structural form surface water has been limited to rivers and wetlands for the water resource plan's risk assessment, although it could have been grouped based on use, such as environmental, social and Indigenous uses.

Table 12: Beneficial use categories for assessment of (structural form) condition risk

Beneficial uses	Categories
Environment/ aquatic ecosystems	Rivers
	Wetlands
Consumptive	Not applicable or assessed
Social/ recreational	Not assessed
Indigenous	Not assessed

7.10 Risks in the water resource plan area

The Basin Plan requires water resource plans to describe the data and methods used to identify and assess risk. The descriptions provided in the water resource plan and Risk Assessment Report in **Appendix B** are considered to be adequate.

Risk levels, ranging from very low to very high, were determined as a product of likelihood and the consequence of a risk occurring. When assessing the consequence of the risk occurring, it was considered on a water resource plan scale rather than on a local scale.

7.10.1 Description of risks

The Basin Plan requires all the identified risks to be listed in the water resource plan (10.41 (4)). A list has been provided in table form in **Appendix B**. **Part 3.1** of this refers to the surface water and **Part 3.2** refers to the groundwater. These tables assess the quantified uncertainty of each risk and are presented as follows:

- Wimmera-Mallee (surface water) water resource plan area – List and assessment of risks
- Wimmera-Mallee (surface water) water resource plan area – Level of confidence
- Wimmera-Mallee (groundwater) water resource plan area – List and assessment of risks
- Wimmera-Mallee (groundwater) water resource plan area – Level of confidence.

Thousands of potential risks are included in these tables. A hierarchical structure has been adopted to manage the analysis and management of these risks. Importantly, this hierarchal structure has not resulted in the arbitrary exclusion of risks. The approach adopted has enabled detailed analysis of specific risks and grouping of risks into themes that allows broad analysis of issues.

The water resource plans must either describe a strategy to address medium and high risks or explain why any such risk cannot be addressed in a water resource plan. All medium- and higher-level risks have a number of identified strategies stipulated to manage the risk.

7.11 Wimmera-Mallee (surface water) water resource plan area

A total of 114 consolidated risks were identified in the Wimmera-Mallee (surface water) water resource plan area. Of these, 77 were identified to be of medium to very high risk.

Table 13: Wimmera-Mallee (surface water) water resource plan area consolidated risk levels

Cause category	Cause	Water Availability				Structural Form		Condition			
		Environment	Consumptive	Recreational	Aboriginal	Environment	Aboriginal	Environment	Consumptive	Recreational	Aboriginal
Climate change	Climate change	5	5	5	5	5	5	5	5	5	5
Extreme events	Bushfires	3	3	0	4	0	0	0	3	0	4
	Extreme drought	4	4	4	4	4	4	4	4	3	4
	Extreme wet period	2	2	1	3	3	3	3	4	2	4
	Flooding and overbank inundation	0	0	0	0	3	3	1	2	1	3
	Major asset failure	3	3	3	3	1	1	2	3	2	3
	Point source discharges	0	0	0	0	0	0	1	2	2	3
Land use and interception	Earth resource development	0	0	0	0	0	0	2	3	3	4
	Failure to continue to invest in best practice land use initiatives	0	0	0	0	3	3	5	5	3	5
	Increase in farm dams	3	3	3	4	2	2	3	3	2	4
	Land use change (affecting water availability)	3	3	3	3	0	0	0	0	0	0
	Land use change (affecting water condition)	0	0	0	0	1	1	2	3	1	4
	Pests and weeds	0	0	0	0	3	0	4	4	3	4

continued

Cause category	Cause	Water Availability				Structural Form		Condition			
		Environment	Consumptive	Recreational	Aboriginal	Environment	Aboriginal	Environment	Consumptive	Recreational	Aboriginal
Non-compliance	Non-compliance with the Victorian Water Act	2	2	1	3	1	1	3	3	2	4
Water access, take, utilisation and location	Increase in the number of rights and volume of entitlements	0	0	0	0	0	0	0	0	0	0
	Increased utilisation of water access rights	2	2	1	3	0	0	3	3	1	3
	Timing and location of demand	0	0	0	0	0	0	0	0	0	0

Legend	5	4	3	2	1	0
	Very high risk	High risk	Medium risk	Low risk	Very low risk	Not plausible – no risk

7.11.1 Risks to water availability

Surface water availability was assessed on the form of legal entitlement of beneficial users to the surface water. Due to this level of assessment a large number of risks were identified.

It was found that climate change could activate threats related to a reduction in volume and/or change to seasonal pattern across:

- low-reliability water and uncontrolled water for environmental purposes
- low-reliability and section 51 licences for consumptive purposes
- recreational bulk entitlements for social purposes.

Extreme drought leading to a reduction in volume, change to seasonal pattern and/or changes to inter-annual pattern also generated high risks across low-reliability, uncontrolled, section 51 and section 8 licences under the Act, and recreational bulk entitlements. Bushfires, land use change affecting availability, farm dams and major asset failure generate some medium-level risks across environmental, consumptive and social uses.

7.11.2 Risks to water condition

Surface water condition assessments were based on the beneficial uses and users of water (based on Victoria's State Environment Protection Policy (Waters)).

The risk assessment found that climate change could activate threats related to salinity, suspended solids and nutrients, toxicants, pathogens and other water quality impacts which may pose a very high, high or medium risk to the consumptive use of water for human drinking, agricultural and irrigation, aquaculture, industry and commercial and fish/crustaceans consumption, and medium-level threats across the other beneficial consumptive uses. Release of toxicants also posed a very high risk to environmental use of water.

The risk assessment found that a failure to continue to invest in improving existing land and waterway management practice would trigger very high-level threats of salinity across environmental beneficial uses and several consumptive beneficial uses.

High risks were recorded across the causes of extreme drought, extreme wet and pests and weeds.

7.11.3 Risks to social/recreational and Aboriginal uses of water

Risks to recreational and amenity and Aboriginal cultural values were assessed in terms of the risks associated to the condition and quality of water available for these purposes, and the availability of water for these functions.

The social, environmental, and consumptive uses of water are relatively well understood as water resource planning concepts. However, Aboriginal uses of water are not as well understood which is why a large number of risks have been generated as high at this stage in the risk assessment.

Climate change generated very high risks associated with impacts on Aboriginal uses of water with regard to:

- reduction in volume
- change to seasonal pattern
- salinity
- suspended solids and nutrients
- toxicants
- other water quality impacts
- loss or decline in longitudinal connectivity
- loss or decline in lateral connectivity
- loss or decline in instream physical habitat.

Climate change and extreme drought also posed medium or high risks to recreational and amenity uses due to threats associated with declines in water availability. Changes to seasonal patterns of inflows were associated only with climate change.

7.11.4 Risks to rivers and wetlands (structural form/waterway biota)

Climate change generated high and very high risks with regard to waterway biota in rivers and wetlands including:

- loss or decline in longitudinal connectivity
- loss or decline in lateral connectivity
- loss or decline in instream physical habitat.

Extreme drought generated some high-level risks, while extreme wet, flooding and overbanking inundation, failure to continue to invest in best practice land use initiatives and pests and weeds were also assessed as having the potential to generate medium-level risks to waterway biota in rivers and wetlands.

7.12 Wimmera-Mallee (groundwater) water resource plan area

For the Wimmera-Mallee (groundwater) water resource plan area, 66 consolidated risks were identified. Of these, 29 were identified to be of medium to very high risk. Causes associated with the high occurrence of these moderate to very high risks were:

- climate change
- land use and interception.

Table 14: Wimmera-Mallee (groundwater) water resource plan area consolidated risk levels

Cause category	Cause	Water Availability				Structural Form		Condition	
		Environment	Consumptive	Recreational	Aboriginal	Environment	Aboriginal	Consumptive	Aboriginal
Climate change	Climate change	5	5	3	5	0	0	5	5
Extreme events	Bushfires	1	1	1	3	0	0	1	3
	Extreme drought	1	1	1	3	0	0	1	3
	Extreme wet period	0	0	0	0	0	0	1	3
	Flooding and overbank inundation	0	0	0	0	0	0	1	3
	Major asset failure	0	0	0	0	0	0	0	0
	Point-source discharges	0	0	0	0	0	0	2	3
Land use and interception	Earth resource development	1	1	1	4	1	4	2	4
	Failure to continue to invest in best practice land use initiatives	0	0	0	0	0	0	1	3
	Increase in farm dams	1	1	1	3	0	0	1	3
	Land use change (affecting water availability)	1	1	1	3	0	0	1	3
	Land use change (affecting water condition)	0	0	0	0	0	0	3	4
	Pests and weeds	0	0	0	0	0	0	0	0

continued

Cause category	Cause	Water Availability				Structural Form		Condition	
		Environment	Consumptive	Recreational	Aboriginal	Environment	Aboriginal	Consumptive	Aboriginal
Non-compliance	Non-compliance with the Victorian Water Act	1	1	1	3	0	0	1	3
Water access, take, utilisation and location	Increase in the number of rights and volume of entitlements	1	1	1	3	0	0	1	3
	Increased utilisation of water access rights	1	1	1	3	0	0	1	3
	Timing and location of demand	0	0	0	0	0	0	0	0

Legend	5	4	3	2	1	0
	Very high risk	High risk	Medium risk	Low risk	Very low risk	Not plausible – no risk

7.12.1 Risks to water availability

Groundwater availability was assessed on the physical attributes of the aquifer. The risk assessment found that climate change could cause medium to very high-level risks across the availability of water for environmental and consumptive uses, with the exposure to risk depending on individual aquifers.

It was found that climate change could activate threats related to:

- a decline in inflows to or increased extraction of water from the aquifer
- adverse changes to the seasonal pattern of inflow or extraction
- increased salinity affecting water availability for consumptive uses.

7.12.2 Risks to water condition

Groundwater condition assessments were based on the beneficial uses and users of water (based on Victoria's State Environment Protection Policy (Waters)).

The risk assessment found that climate change could activate threats related to increased salinity which poses very high risk across a variety of consumptive uses.

The risk assessment also found that land use changes within the water resource plan area had the potential to impact on some consumptive uses generating medium-range threats related to increasing salinity and the potential release of toxicants into aquifers.

7.12.3 Risks to social/recreational and Aboriginal uses

Risks to Aboriginal cultural values were assessed in terms of the risks associated with the condition or quality of water available and the availability of water for these functions. The social, environmental and consumptive uses of water are relatively well understood as water resource planning concepts. However, Aboriginal use or value of water is not as well understood, contributing to the large number of risks generated at this stage in the risk assessment.

Climate change generated very high risks associated with impacts on Aboriginal cultural uses of water, followed by land use changes affecting water condition, and threats generated from earth resource development which were assessed as high risks.

Climate change also posed medium risks with regard to recreational and amenity uses due to threats associated with declines in water availability and changes to seasonal patterns of inflows to or extraction from aquifers.

7.13 Strategies for addressing medium- and higher-level risks

Under the provisions of the Basin Plan (10.42), water resource plans are required to address medium- or higher-level risks.

In addressing the risks, water resource plans must describe the risk and the factors that contribute to those risks. Adequate information must be captured in the data-gathering process to enable the development of a description of the risk and the factors contributing to risks for the risk register and the risk assessment.

The tables provided in **Appendix B Part 4.2** (surface water) and **Part 4.3** (groundwater) provide a description of risks for the water resource plan area defined in accordance with sub-section 10.41(6) as having:

- a medium or higher level of risk (10.42(a))
- the factors that contribute to those risks (10.42(b))
- the quantified uncertainties in the level of risk attributed to each risk by way of sensitivity analysis (10.41(8)).

In addressing the risks, the water resource plans must describe the risks and the factors contributing to those risks. The tables in the Risk Assessment Report at **Appendix B Part 4.2** (surface water) and **Part 4.3** (groundwater) clearly describes the causes, activated threats and impact on users/use types.

Adequate information must be, and has been, captured in the data-gathering process to enable the development of a description of the risks and the factors contributing to the risks. The risks and factors contributing to these risks and the assumptions underlying the risk assessment were set out in the Risk Assessment Report and an accompanying risk register (**Appendix B**).

Under Victorian legislation there is no one 'water resource plan'. Rather, risk-based water resource planning is undertaken through a range of processes, plans and strategies, many of which embed risk management practices.

Based on the themes identified in the risk assessment, the medium- to high-level risks identified will be addressed through the ongoing development and implementation of existing broad-scale policies and improvement programs identified through *Water for Victoria* and existing policies and programs. Addressing risks will be achieved through a combination of state-based policy and program development, collaboration with regional water managers and engagement with regional stakeholders and interstate water planning agencies.

Examples of such planning and policy development include:

- review and enhancement of climate change adaption policy and practice
- review and enhancement of drought management policy and practice
- review and enhancement of statewide water quality policy
- reaffirmation of continued commitment to support existing programs of best practice management including waterway management programs, soil conservation programs, forestry management, dairy management, grazing management and irrigation management.

The assessment of risks to the availability and condition of water resources together with a description of the risks, the estimated level of each risk and the level of confidence in the estimate and strategies to address medium- and high-level risks are contained in the following tables in **Appendix B** (**Part 4.2** and **Part 4.3** of the Risk Assessment).

Identified medium, high and very high risks are managed in Victoria through various mechanisms commensurate to their risk level. Risks are managed through a combination of long-term water resource planning, water allocation, land use/catchment management planning, environment protection policies and enforcement provisions.

Almost 40 strategies were identified as part of Victoria's water and catchment management framework. Continued implementation of these strategies will address the risks identified to the availability and condition of water resources. These strategies are a combination of the policy directions contained and reinforced through *Water for Victoria* and existing regulations and guidelines. These strategies are identified in **Table 78** of **Appendix B**. Each medium- or high-level risk has been linked to the strategies where they contribute to the management of that risk.

7.13.1 Surface water risks

Appendix B Part 4.2 identifies the medium- or higher-level risks, confidence level and identifies the strategies to address the risk for the Wimmera-Mallee (surface water) water resource plan area.

7.13.2 Groundwater risks

Appendix B, **Part 4.3** identifies the medium- or higher-level risks, confidence level and strategies to address the risk for the Wimmera-Mallee (groundwater) water resource plan area.

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8. Sustainable diversion limits (SDLs)

Part 8. Sustainable Diversion Limits

The aim of the Basin Plan is to better protect the environment through reducing how much water can be taken for consumption, while also promoting the sustainable use of water for communities, agriculture and industries.

To support this, the Basin Plan prescribed sustainable diversion limits (SDLs) as a maximum volume of water that can be taken from Basin resources for consumption. Water taken for the environment is not part of the sustainable diversion limit volumes.

8.1 Basin Plan requirements

Clause 5.05 of the Basin Plan states:

Objective and outcomes in relation to long-term average sustainable diversion limits (SDLs)

1. *The objective in relation to long-term average sustainable diversion limits is to establish environmentally sustainable limits on the quantities of surface water and groundwater that can be taken for consumptive use from Basin water resources, having regard to social and economic impacts, and in doing so:*
    a. *inform environmental water recovery measures, including water purchasing and infrastructure that improves water use efficiency; and*
    b. *provide greater certainty for all water users, including in times of drought and low water availability; and*
    c. *provide time for water access entitlement holders and communities to transition and adjust to long-term average sustainable diversion limits.*
2. *The outcomes in relation to the establishment of long-term average sustainable diversion limits are:*
    a. *the restoration and protection of water-dependent ecosystems and ecosystem functions in the Murray-Darling Basin; and*
    b. *well-informed water recovery measures, including water purchasing and infrastructure, enable a transition to long-term average sustainable diversion limits; and*
    c. *greater certainty of access to Basin water resources; and*
    d. *water access entitlement holders and communities of the Murray-Darling Basin are better adapted to reduced quantities of available water.*

8.2 What are baseline diversion limits and sustainable diversion limits?

8.2.1 Cap reporting framework

As noted by the Murray-Darling Basin Authority (MDBA), the Murray-Darling Basin Ministerial Council introduced the Murray-Darling Basin Cap on surface water diversions in 1995 to protect and enhance the riverine environment and protect the rights of water users. The Cap introduced long-term limits on how much water could be taken from rivers in 24 designated river valleys in the Murray-Darling Basin.

The Cap also introduced a requirement that Basin states had to work out ways to turn the long-term limits into annual cap targets that take account of changes such as the weather conditions and water availability in each year.

Under the Cap, Basin states had to provide data to the Murray -Darling Basin Authority (MDBA) to show how much water was actually taken each year compared to the annual cap targets.

8.2.2 Basin Plan reporting framework

The Basin Plan introduced a new water accounting and compliance framework to replace the Cap. When the Basin Plan was being developed, estimates were made of the volume of water diverted from the Basin under the conditions and level of development that were present in 2009 (or as at 31 October 2010 for some forms of take in the Wimmera-Mallee). These volumes, termed baseline diversion limits (BDLs) are the long-term average estimates of consumptive water use before the Basin Plan.

Sustainable diversion limits (SDLs) represent a maximum limit of water diverted from the Basin at an environmentally sustainable level.

The considerations for developing sustainable diversion limits were:

- the baseline diversion limit, as in how much water was being extracted from river or groundwater systems for use at the time of the Basin Plan's development
- the volume of water that could be extracted from river or groundwater systems without serious adverse impacts on the Basin's environmental health
- how much water needed to stay in the Basin's river or groundwater systems so that the environment across the Basin could thrive.

The Murray-Darling Basin Authority assessed these considerations and identified that the sustainable level of extraction from all Basin resources was an average of 10,873 gigalitres (GL) of surface water and 3,324 GL of groundwater per year.

This total volume for the Basin was then divided into water resource plan areas for surface water and groundwater. Each Basin state is required to demonstrate how it will limit the volume of water permitted to be taken in a water resource plan area to comply with sustainable diversion limits.

The water resource plan areas are further broken down into sustainable diversion limit resource units. In the Wimmera-Mallee water resource plan areas there is one surface water SDL resource unit and three groundwater SDL resource units. Further information on the water resource plan areas and SDL resource units relevant to the Wimmera-Mallee Water Resource Plan can be found in **Part 4**.

8.2.3 Baseline diversion limits and sustainable diversion limits for the Wimmera-Mallee Water Resource Plan

Victoria's surface water BDL and SDL estimates in the Wimmera-Mallee (surface water) water resource plan area are summarised for each form of take in **Table 15**. The surface water entitlement volumes and the characteristics of each class of right and any conditions on the exercise of the rights are provided in **Part 6**.

Victoria has not undertaken independent modelling to determine SDL for the Wimmera-Mallee (groundwater) water resource plan area resources. Instead, Victoria has adopted the BDL and SDL figures prescribed in the Basin Plan for groundwater.

A summary of the Basin Plan groundwater management units in the Wimmera-Mallee water resource plan area and the relationship with the BDLs and SDLs, the Victorian management units and the licensed volumes is shown in **Table 16**.

The groundwater SDL does not include groundwater take within the West Wimmera Groundwater Management Area (GMA), because the groundwater resources in the West Wimmera GMA have been excluded from the water resources of the Murray-Darling Basin under the *Water Regulations 2008 (Cth)*. This is due to the groundwater resources within the West Wimmera GMA being only remotely hydrologically connected to the River Murray and disconnected to surface ecosystems in the Murray-Darling Basin. A map of the West Wimmera area is provided in **Figure 1** of **Appendix C**.

Table 15: Long-term average surface water diversion limits in the Wimmera-Mallee (surface water) water resource plan area according to form of take specified in the Basin Plan

Form of take – surface water	BDL (ML)	SDL (ML)
Take from a regulated river (excluding basic rights)	66,874	43,842
Take from a watercourse (excluding take under basic rights)[2]	1,299	1,299
Take under basic rights including: take from a regulated river under basic rights take from a watercourse under basic rights	1,065	1,065
Total take by runoff dams	24,100	24,100
Take by runoff dams (excluding take under basic rights)	*13,100*	*13,100*
Take by runoff dams under basic rights	*11,000*	*11,000*
Net take by commercial plantations	5,700	5,700
Total (ML)[1]	**99,038**	**76,006**[3]

Notes to table:

1. Schedule 2 of the Basin Plan specifies the water recovery target for the Wimmera-Mallee by stating that the surface water SDL for the Wimmera-Mallee is the BDL minus 23 GL[8]. The MDBA, in Schedule 3 of the Basin Plan, estimates the BDL to be 129 GL per year and so the SDL is estimated to be 106 GL per year. This 23 GL difference in the Basin Plan corresponds to the Basin Plan estimate of long-term average annual take by the former Wimmera Irrigation District under its entitlement of 28 GL (which included a 9 GL loss entitlement). This 28 GL entitlement was purchased by the Commonwealth Government for environmental watering in 2013.

8 Victoria considers that the full water recovery target for Wimmera-Mallee has been achieved. The MDBA currently reports this entitlement as equivalent to 22.6 GL long-term average on its website. This estimate will be updated by MDBA following the finalisation of Long-Term Diversion Limit Equivalent (LTDLE) factors.

2. Under the Basin Cap the BDL for take from a watercourse (excluding basic rights) was calculated as a proportion of take from regulated rivers (excluding basic rights). The BDL is currently estimated as 1.9% of the BDL for take from a regulated river (excluding basic rights), assuming similar utilisation rates (which equates to a volume of 1.3 GL for the Wimmera-Mallee (surface water) SDL resource unit). Recognising there are flaws in this method, Victoria is proposing to revise the estimate within the next two years to determine a more accurate means of representing levels of take as at 2010 for this form of take. See **Part 2.2** and **Part 3.1.1.2** of the Methods Report at **Appendix C** for more information.
3. The BDL minus the SDL volume for the revised estimate above is 23,032 ML, slightly higher than the 23 GL required in Schedule 2 of the Basin Plan.

Table 16: Groundwater diversion limits in the Wimmera-Mallee water resource plan area by SDL resource unit

SDL resource unit	Form of take	BDL[1] (ML)	SDL[2] (ML)	Permitted take (ML)
Highlands	Take from groundwater (excl. basic rights)	1,110	2,575	2,575
	Take from groundwater under basic rights	150	175	175
Sedimentary Plain	Take from groundwater (excl. basic rights)	67,770 less West Wimmera take[3]	189,284 less West Wimmera take[3]	189,284 less West Wimmera take[3]
	Take from groundwater under basic rights	1,130	816	816
deep	Take from groundwater (excl. basic rights)	0	20,000	20,000
	Take from groundwater under basic rights	0	0	0

Notes to table:

1. BDL is the baseline limit of take from an SDL resource unit (i.e. the volume of take before the SDL was determined). The diversion estimates from column 3, Schedule 4 of the Basin Plan have been adopted.
2. SDL means the long-term average diversion limit to be achieved. The estimates from column 4, Schedule 4 of the Basin Plan have been adopted.
3. The West Wimmera GMA PCV is 53,357 ML (at 30 June 2018) and includes groundwater resources outside the Murray-Darling Basin. There is approximately 3,200 ML of entitlement in the Murray-Darling Basin area of the West Wimmera GMA.

8.2.4 Modelling for regulated surface water BDL and SDL

The Wimmera-Mallee BDL and SDL models have been developed in the following manner:

- Wimmera-Mallee BDL model – this model represents infrastructure, operational rules and entitlements to water as at 31 October 2010. This represents the point in the time when entitlements were created to distribute the final water savings from the Wimmera-Mallee Pipeline.
- Wimmera-Mallee SDL model – this model represents infrastructure, operational rules and entitlements to water as in the BDL model, with the exception of the transfer of the 19 GL of former irrigation entitlement and the associated distribution losses of 9 GL to the Commonwealth Environmental Water Holder.

The Wimmera-Mallee BDL and SDL models will be used to determine the long-term average diversion limit and the annual permitted take from the Wimmera-Mallee (surface water) water resource plan area for regulated rivers.

The BDL and SDL models were run over the Basin Plan historic climate period of July 1985 to June 2009 and estimated the long-term BDL and SDL (for take from regulated rivers only) to be 66,874 ML per year and 43,842 ML per year. These values are broadly consistent with the corresponding Murray-Darling Basin caps (MDB caps) of 66,899 ML per year and 44,185 ML per year respectively. These MDB caps were estimated using the previously accredited Wimmera-Mallee post-pipeline and post-irrigation cap models.

For more information on the difference between the Basin Plan BDL and SDL estimates and the estimates based on Victoria's BDL and SDL models, see **Appendix C**.

8.2.5 Accounting for inter-basin transfers

Three inter-basin transfers are associated with the take in the Wimmera-Mallee water resource plan area. First, under its Wimmera and Glenelg rivers bulk entitlement, GWMWater takes water from several sources in the Glenelg basin, outside the Murray-Darling Basin, for transfer into the Wimmera basin. These diversions are from the Upper Wannon River to Stawell township and Lake Bellfield; from Upper Glenelg River to Moora Moora Reservoir and then to the Wimmera basin; and Glenelg River to Rocklands Reservoir.

Victoria's approach to cap compliance has been to include the Glenelg basin transfers in the Wimmera basin inflows because:

- the Glenelg basin is a major source of water for the Wimmera-Mallee system and contributes to the resources that determine available water and allocations for entitlement holders
- the Wimmera-Mallee is operated as an integrated system and it is not practical to track Glenelg water once it enters the system.

Any consumptive use or environmental release in the Glenelg basin from the Wimmera-Mallee system is not accounted for in the Wimmera-Mallee water resource plan area.

Second, GWMWater holds two bulk entitlements authorising it to take water from sources other than the Wimmera basin to supply its customers in the Wimmera-Mallee water resource plan area:

- Bulk entitlement River Murray–Grampians Wimmera Mallee Water Conversion Order 1999 authorises GWMWater to take up to 3,492 ML per year from the River Murray to supply its customers in the area who are serviced by the Northern Mallee Pipeline and Supply System 5 of the Wimmera-Mallee Pipeline. This water is sourced from the Northern Victoria water resource plan area.
- Bulk entitlement Quambatook–Grampians Wimmera Mallee Water Conversion Order 2006 authorises GWMWater to take up to 100 ML per year from the Goulburn system within the Northern Victoria water resource plan area to supply the township of Quambatook.

These transfers into the basin are accounted as diversions in the Victorian Murray and Northern Victoria water resource plan areas respectively, and so are not included in the BDL or SDL for the Wimmera-Mallee water resource plan area.

Third, GWMWater's Willaura water supply system takes water from three small creeks on the eastern slopes of the Grampians (*Gariwerd*) to supply a group of towns (Willaura, Wickliffe, Moyston, Lake Bolac and Glenthompson) and rural properties. For more information regarding this supply, see the **Appendix C**.

8.3 Annual determinations of permitted take

Under section 10.10 of the Basin Plan, the Wimmera-Mallee Water Resource Plan is required to set out the method for determining permitted take for each form of take in the water resource plan area.

Section 6.10 of the Basin Plan specifies that permitted take is the maximum quantity of water allowed to be taken by each form of take for consumptive use from the SDL resource unit in each water accounting period.

For surface water permitted take equates to authorised take and for groundwater permitted take equates to SDL under the Victorian framework. Actual take is the water diverted or taken by water users from the resource or system to be stored or used (see **Part 8.4**).

In Victoria, permitted take is determined to be equal to the SDL for that water resource plan area or resource. The methods used to determine permitted take are outlined below.

8.3.1 Surface water

The determination of permitted take in the Wimmera-Mallee (surface water) water resource plan area varies depending on the form of take. **Table 17** outlines the methods used for determining permitted take for each form of take in the Wimmera-Mallee (surface water) water resource plan area.

These methods are based on the best available information for the relevant form of take. The Victorian Water Register provides the most accurate and up-to-date information regarding water taken by entitlement holders in Victoria. It records the volume of water the entitlement holder is permitted to take during an accounting period and also the volume of water actually taken against the entitlement.

Where the volume of take is estimated, the estimates are based on the best available data and latest models available. For example, the best available data includes the most recent aerial photographs for farm dams and the latest models for determining commercial plantation interception. For more information on the best available information for each method, see **Table 5** of **Appendix C**.

Table 17: Methods for determining permitted take – surface water

Form of take	Permitted take (accredited text for 10.10(1))
Take from a regulated river (excluding basic rights)	The method used for determining permitted take for take from a regulated river (excluding basic rights) in the Wimmera–Mallee (surface water) water resource plan area is the scaled water resource plan model which was developed by: • updating the SDL model to represent infrastructure, policy, operational rules and full use of entitlements as required and defined by the currently published Bulk and Environmental Entitlements relevant to Wimmera–Mallee (surface water) water resource plan area (i.e. 2014 BEs and EEs) as at 31 December 2017 • scaling the modelled diversions to ensure that average annual diversion over the historical climate conditions from 1895 to 2009 matches the SDL. The scaled water resource plan model will be used at the end of each year as follows: • extend the inputs (inflows, rainfall, evaporation and demands) to 30 June, being the end of the last water accounting year • run the model from 1 July 2019 to end of the last water accounting year by initialising the simulation with recorded storage volumes at the end of June 2019 • determine the annual permitted take using the consumptive diversions calculated by the model • less any incomplete recovery The model version is from 16 May 2018 and the key model files are: • WP01.sys • WP01.scn • WP01.log The disposal and acquisition of held environmental water is accounted for separately and in a manner that does not affect the permitted take method.
Take from a watercourse (excluding take under basic rights)	The permitted take for the Wimmera-Mallee (surface water) water resource plan area equals actual take, where actual take equals the sum of all diversions taken under an entitlement from a watercourse that is not a regulated river minus environmental water held (or HEW) by VEWH and CEWH as recorded in the VWR as at 30 June in the relevant year.

continued

Form of take	Permitted take (accredited text for 10.10(1))
Take from a regulated river under basic rights Take from a watercourse under basic rights	Estimated as the sum of: • a modelled estimate of the volume of water taken from freehold land and Crown frontage based on estimated domestic demand of 0.3 ML/house/year and stock drinking water of 0.03ML/year/per ha of land grazed. • an estimate of the volume of expected water demand under section 8A of the Victorian Water Act where the Traditional Owners have a natural resource agreement under the *Traditional Owner Settlement Act 2010*
Take by runoff dams (ex basic rights)	To be determined from the total volume of licences and registrations based on a fixed annual volume in the Victorian Water Register as at 30 June in the relevant year (being the water accounting period). Note: Total volume of licences and registrations refers to the maximum volume authorised to be taken under take and use licences and registrations.
Take by runoff dams (basic rights)	Estimate is based on modelling using the number and volume of dams shown in aerial imagery as at 2005, adjusted to account for entitlements to take from runoff dams as given in the Victorian Water Register as at July 2016.
Net take by commercial plantations	Net take is estimated as the difference between the long-term average rate of evapotranspiration from commercial plantations that were present as at 30 June 2009 and from the vegetation type that was thought to be present before the commercial plantations were established. The long-term average rate of evapotranspiration is estimated using the SoilFlux model. The long-term average rate of evapotranspiration from commercial plantations present in 2009 was estimated by using the SoilFlux model with the following inputs: • areas of plantations present as at 2009 using data from the Victorian Land Use Information System (VLUIS) dataset 2009 and improved using aerial imagery and plantation industry data. This is considered the best available data of current commercial plantation conditions and best available evidence suggests that this has not changed between June 2009 and June 2016. • climate data between 1961 and 2016 from the Bureau of Meteorology The long-term average rate of evapotranspiration from plantations present before the plantations were established was estimated by using the SoilFlux model with the following inputs: • Estimated land use types present prior to establishment of plantations present in 2009 using nearby land use data from the Victorian Land Use Information System (VLUIS) dataset and expert judgement. • climate data between 1961 and 2016 from the Bureau of Meteorology.

8.3.2 Groundwater

The determination of permitted take in the Wimmera-Mallee (groundwater) water resource plan area varies depending on the form of take. **Table 18** outlines the methods used for determining permitted take for each form of take in the Wimmera-Mallee (groundwater) water resource plan area.

These methods are based on the best available information for the relevant form of take. The Victorian Water Register provides the most accurate and up-to-date information regarding water taken by entitlement holders in Victoria. It records the volume of water the entitlement holder is permitted to take during an accounting period and the volume of water actually taken against the entitlement.

For more information on the best available information for each method, see the Methods Report (**Table 8** of **Appendix C**).

Table 18: Methods for determining permitted take – groundwater

Form of take	Method
Take from groundwater (excluding basic rights)	**Highlands** The method for determining permitted take is the method used to determine the SDL for the Wimmera-Mallee: Highlands SDL resource unit as prescribed in Schedule 4 of the Basin Plan minus the SDL volume for take from groundwater under basic rights. **Sedimentary Plain** The method for determining permitted take is the method used to determine the SDL for the Wimmera-Mallee: Sedimentary Plain SDL resource unit as prescribed in Schedule 4 of the Basin Plan minus the SDL volume for take from groundwater under basic rights. The reduction in the SDL to account for the West Wimmera is determined using entitlement data on the Victorian Water Register, based on the location of licensed bores. **deep** The method for determining permitted take is the method used to determine the SDL for the Wimmera-Mallee: deep SDL resource unit as prescribed in Schedule 4 of the Basin Plan minus the SDL volume for take from groundwater under basic rights.
Take from groundwater (basic rights)	**All SDL resource units** Estimate based on the number of bores less than 30 years old with a rate of 2 ML per year (as at 30 June 2010)

8.3.3 Accounting for water availability

Section 10.10(2) of the Basin Plan requires the method be applied after the end of the relevant water accounting period, having regard to the water resources available during that period.

In respect of take from a regulated river (excluding basic rights) the impact of water availability is managed in practice throughout the accounting period on a monthly basis. Water available during the period is accounted for in the SDL model at the end of the period based on seasonal conditions in the preceding year and the same allocation rules as detailed in Part 3.1.1.1 and **Schedule 1** of the Methods Report at **Appendix C**.

For take from watercourses that are not regulated rivers (excluding take under basic rights) the interim method is based on actual diversions until a review of the method is completed (see **Appendix C**, **Part 3.1.1.2**) Annual actual take determination in this circumstance reflects any measures that respond to water availability as outlined in **Part 6.7** or water shortages during extreme dry periods as outlined in **Part 9.3**.

For all other forms of take, there is no mechanism to allocate or restrict water take on an annual basis and the estimates are based on long-term averages hence the method for permitted take does not take into account water availability on an annual basis.

10.10(2) Surface water

The methods for the purposes of section 10.10(1) of the Basin Plan are applied at the end of each accounting period having regard to the water resources available during that period, where relevant. For take from a regulated river (excluding basic rights) a method for determining allocations based on water availability is included in the method for determining permitted take.

Groundwater

The method is applied at the end of each accounting period having regard to the water resources available during that period.

8.4 Annual determinations of actual take

Section 10.15 of the Basin Plan requires that the Wimmera-Mallee Water Resource Plan set out how the volume of water actually taken for consumptive use by each form of take from each SDL resource unit will be determined after the end of a water accounting period using the best available information at the time. Actual take is the quantity of water actually taken from the system within an accounting period. Long-term average actual take should be less than or equal to permitted take in order to comply with the SDL.

Section 6.10 of the Basin Plan defines actual take as the sum of the quantity of water actually taken by each form of take for consumptive use from the SDL resource unit. Actual take is the water diverted or taken by water users from the resource or system to be stored or used.

8.4.1 Managing surface water actual take during the accounting period

Take under entitlements

The Wimmera-Mallee system includes all regulated rivers in the Wimmera-Mallee water resource plan area.

GWMWater's bulk entitlement (Bulk Entitlement (Wimmera and Glenelg Rivers – Grampians Wimmera-Mallee Water) Conversion Order 2010) grants the corporation the right to harvest and store water flows in the Wimmera-Mallee system with a complementary obligation to supply all entitlement holders.

This corresponds with take from a regulated river but also includes take from several small diversions on unregulated tributaries in the catchment that are part of the overall Wimmera-Mallee supply system and are covered under GWMWater's bulk entitlement. These include the Mt Cole, Langi Ghiran, Huddleston's Weir and Panrock Creek diversions in the upper reaches of the Wimmera basin.

It also includes water taken from the Glenelg River catchment and used to supply the Wimmera-Mallee system. These flow diversions are transfers into the Murray-Darling Basin.

The bulk entitlements contain all the provisions required to determine the maximum quantity of water that the Basin Plan permits to be taken for consumptive use during a water accounting period.

GWMWater, as the storage manager, is required to determine the available water that can be taken from the system during the accounting period and make the corresponding water allocations for all consumptive users and the environment. Schedule 3 of the storage manager instrument of appointment (Minister for Water, 2010) establishes the rules the storage manager must use when determining available water and allocations.

The distribution of available water is determined by a formula that allocates water to each user group, including the environment, according to the reliability of their entitlement. The storage manager determines the available water (and corresponding entitlement allocations) as specified by its instrument of appointment for the accounting period from 1 July of one year to 30 June of the next.

Take from watercourses that are not regulated rivers (excluding take under basic rights)

This category includes take by small urban water supply systems and take and use licence (see **Appendix C**).

The authorisation to take water under the bulk entitlements for small urban water supply systems is based on full utilisation of each entitlement, however, these instruments specify rules that limit take that can respond to water availability year to year, including:

- minimum passing flows to be met before diversions can occur, and in some cases the months of the year when no diversion is permitted
- capacity of on-stream storage
- maximum rates of diversion

Take and use licence holders are required to comply with rosters, bans or restrictions. These rosters, bans and restrictions are articulated in either local management plans or water supply protection area water management plans.

Until Victoria can determine a more appropriate and cost-effective method for determining permitted for take from a watercourse (excluding basic rights) that recognises adjustments under bans and restrictions it is proposed that the permitted take method is the same as the annual actual take determination in the water accounting period.

Victoria will revise the BDL estimate within the next two years to determine a more accurate means of representing levels of take as at October 2010 for this form of take. This is explained further in **Appendix C**, **Part 2.2** and **Part 3.1.1.2**.

Take from a regulated river or watercourse that is not a regulated river under basic rights

Basic rights as defined by section 1.07 of the Basin Plan includes a right under state law to take water for domestic and stock purposes and a Native Title right.

These include rights to take water under section 8 and section 8A of the Victorian Water Act. Under section 8, water users have a right to take water, free of charge, from a waterway for domestic and stock purposes under prescribed circumstances (see **Part 6.2**).

Take under basic rights is not managed in the same manner as take under an entitlement. Water users exercising their rights under section 8 are not required to meter their extraction, report on the volume of extraction or otherwise monitor their use. There is a widely used figure of 2 ML per year that is considered a reasonable estimate of the average volume for domestic and stock use as defined in the Victorian Water Act (SKM, CSIRO and the Bureau of Rural Sciences, 2010).

Total take under this form is small given the right cannot be exercised for commercial purposes and therefore only small volumes of water are used. Additionally, the unregulated rivers in the Wimmera-Mallee water resource plan area dry up regularly and most of the unregulated parts of the Wimmera and Avoca rivers and their tributaries are bordered by Crown land. Under section 8, a person can access water where their land is next to the waterway and the bed and banks of the waterway have remained the property of the Crown. The rights do not apply where there is Crown frontage between the waterway and freehold land.

Under section 8A of the Victorian Water Act, a Traditional Owner group with a Settlement Agreement has a right to take water in accordance with the conditions of section 8A. To date, no water has been taken from the Wimmera-Mallee water resource plan area under the right prescribed in section 8A of the Victorian Water Act. Therefore, to ensure water is available under the BDL and SDL volumes for this type of take, an estimate has been made of the expected demand for the Wimmera-Mallee water resource plan area based on eligibility under section 8A. This estimate is based on the number of Traditional Owner groups and information regarding access to main waterways, given the basis for accessing water under section 8A depends on the circumstances under which water can be accessed under section 8 of the Victorian Water Act.

Take by runoff dams

Runoff dams (often referred to in Victoria as small catchment dams) are small dams not located on a defined watercourse. Small catchment dams are used mainly for:

- commercial and irrigation purposes, which are required to be licensed or registered in Victoria
- domestic and stock purposes, which take water under the basic right provided under section 8 of the Victorian Water Act.

See **Part 10.3.1** and **Part 10.4.1** for further details on runoff dams.

The volume of water authorised under a licence to be taken by these runoff dams by individuals is estimated to be 12,753 ML (in the Wimmera-Avon and Avoca basins).

The volume of water authorised to be taken by unlicensed runoff dams used for stock and domestic (basic rights) purposes within the Wimmera-Mallee water resource plan area is 29,826 ML.

Victoria has estimated the number and volume of runoff dams used for domestic and stock purposes in the Wimmera-Mallee water resource plan area and also the total annual extraction, which varies with climatic conditions. These estimates were made from desktop studies using maps and aerial photographs. Dams used for commercial and irrigation purposes which are subject to licensing were separated, based on the imperfect data available, to avoid double counting of take.

Net take by commercial plantations

The effect of commercial forestry plantations on the water balance in the Wimmera-Mallee water resource plan area is not accurately monitored and good data is not readily available.

The annual permitted take of water by commercial plantations will be estimated as the difference between the long-term average rate of evapotranspiration from plantations that were present in 2009 and from the vegetation type that was thought to be present before the plantation was established. Commercial plantations cover 42 square kilometres within the Wimmera-Mallee water resource plan area and take an estimated 5,700 ML per year.

8.4.2 Managing groundwater actual take during the accounting period

For purposes of the Basin Plan requirements for groundwater management and trade, Victoria acknowledges that the state management unit (as defined by the Commonwealth groundwater trade guidelines) is the Wimmera-Mallee water resource plan area (comprising the Highlands SDL resource unit that is longitudinally connected to the Sedimentary Plain SDL resource unit and the deep SDL resource unit at depth). Within this water resource plan area, Victoria manages the resource and licensing.

The groundwater management parameters used for measurement and reporting by Victoria do not align exactly with the groundwater SDL resource units specified in the Basin Plan.

Further work is required to enable Victoria's water accounting and reporting arrangements to accurately differentiate the volume of groundwater taken from the groundwater resources included in the Wimmera-Mallee Water Resource Plan.

The Victorian Government plans to upgrade the Victorian Water Register to enable better reporting at the scale of the water resource plan SDL resource units. This will help with the relevant MDBA trading rules where applicable, and reporting on compliance with the Basin Plan SDL resource units for groundwater in future. Given that the total licensed volume of groundwater take in the area is significantly below the total SDL, there is no risk to groundwater SDL compliance in the Sedimentary Plain, and only a low risk in the Highlands due to the current boundary misalignment.

Take from an aquifer (excluding basic rights)

This form of take is prescribed as "take from groundwater (excluding basic rights)" under the Basin Plan. For this reason, the tables in this Water Resource Plan and the Methods Report (**Appendix C**) refer to take from groundwater when providing the methods and volumes for SDL and permitted take to meet Basin Plan requirements.

Take from an aquifer, excluding where it is under a basic right, is managed through Victoria's entitlement framework. A water user must hold a take and use licence and a works licence to take water from an aquifer. The works licence regulates the construction, use, maintenance and alteration of the bore used to extract groundwater. The take and use licence is the water access right that authorises the maximum volume the user is permitted to take in a year. The take and use licence also prescribes the place at which groundwater may be taken, and the time and rate. These conditions protect other users and the aquifer by regulating how water is extracted overall to prevent unacceptable third-party impacts from extraction and also protect the resource and environment.

In the Wimmera-Mallee: Sedimentary Plain SDL resource unit, the water taken from Basin resources in the West Wimmera GMA is excluded from the water resource plan and the SDL maximum volume. The limit on taking groundwater from the Wimmera-Mallee: Sedimentary Plain SDL resource unit excludes groundwater taken (licensed and domestic and stock) from the West Wimmera Groundwater Management Area (GMA) in the Murray-Darling Basin (see **Figure 1** in **Appendix C**). This volume is estimated to be 3.2 GL. The volume may vary due to trade within the West Wimmera GMA but is not expected to increase markedly, due to the poor quality of groundwater in the area.

Take from an aquifer under basic rights

This form of take is prescribed as 'take from groundwater (excluding basic rights)' under the Basin Plan. For this reason, the tables in this water resource plan and the Methods Report (**Appendix C**) refer to take from groundwater when providing the methods and volumes for SDL and permitted take to meet Basin Plan requirements.

Basic rights are defined under the Basin Plan to include rights to take water for domestic and stock purposes and a Native Title right. Basic rights are prescribed in sections 8 and 8A of the Victorian Water Act.

Under section 8, water users have a right to take water, free of charge, from a bore for domestic and stock purposes under prescribed circumstances (see **Part 6.2**). In general terms, people or businesses can exercise that right if they own the land on which the bore is located.

Take under section 8 is generally not metered and the quantity of take is unknown. Take under this right may be metered in circumstances where bores are used to take water for other purposes under an entitlement in addition to water taken under section 8. In these cases, a meter may be attached to the works; however, where the works provide only for take for domestic and stock rights, there is no requirement to install a meter to monitor volumes of take. Take under basic rights is relatively small because water taken under this right cannot be used for commercial purposes including irrigation.

Traditional Owner rights to take water under section 8A where the Traditional Owners have a natural resource agreement under the *Traditional Owner Settlement Act 2010* are outlined in more detail in **Part 6.2.2** of this Water Resource Plan. At the time of publication, there were no circumstances of Traditional Owner groups exercising this right in the Wimmera-Mallee water resource plan area. However, this may change as a result of the implementation of the Aboriginal Water Policy outlined in *Water for Victoria*.

8.4.3 Determining actual take

The Basin Plan (section 10.15) requires a water resource plan to set out how the quantity of water actually taken will be determined after the end of the water accounting period using the best information available.

Table 19: Approaches to determine actual take for surface water and groundwater (10.15(1) Basin Plan)

Form of take	Determination of actual take
Surface water	
Regulated rivers (excluding basic rights)	The actual take for the Wimmera-Mallee Water Resource Plan surface water area is the sum of all diversions taken under an entitlement from a regulated river minus environmental water held (or HEW) by VEWH and CEWH as recorded in the Victorian Water Register.
Regulated rivers under basic rights and watercourses that are not regulated rivers under basic rights	Estimated as the sum of: a. a modelled estimate of the volume of water taken from freehold land and Crown frontage based on estimated domestic demand of 0.3 ML/house/year and stock drinking water of 0.03ML/year/per ha of land grazed. b. an estimate of the volume of expected water demand under section 8A of the Victorian Water Act where the Traditional Owners have a natural resource agreement under the *Traditional Owner Settlement Act 2010* Note: This volume is estimated in conjunction with take from watercourses that are not regulated rivers under basic rights.
Watercourses that are not regulated rivers (excluding take under basic rights)	The actual take for the Wimmera-Mallee Water Resource Plan surface water area is the sum of all diversions taken under an entitlement from a watercourse that is not a regulated river minus environmental water held (or HEW) by VEWH and CEWH as recorded in the Victorian Water Register as at 30 June in the relevant year (being the water accounting period).
Runoff dams (excluding take under basic rights)	To be determined from the total volume of licences and registrations based on a fixed annual volume in the Victorian Water Register as at 30 June in the relevant year (being the accounting period).
Runoff dams under basic rights	Estimate is based on modelling using the number and volume of dams shown in aerial imagery as at 2005, adjusted to account for entitlements to take from runoff dams as given in the Victorian Water Register as at July 2016.
Commercial plantations	Estimated as the difference between the long-term average rate of evapotranspiration from plantations that were present in 2009 and from the vegetation type that was thought to be present before the plantation was established. The long-term average rate of evapotranspiration will be estimated using the SoilFlux model.

continued

Form of take	Determination of actual take
Groundwater	
Aquifer (excluding basic rights)	**Highlands** Determined using entitlement data from all forms of take except basic rights use on the Victorian Water Register, based on the location of licensed and registered bores in the water resource plan SDL reporting area. **Sedimentary Plain** Determined using entitlement data from all forms of take except basic rights use on the Victorian Water Register, based on the location of licensed and registered bores in the water resource plan SDL reporting area (excluding bores in the West Wimmera Groundwater Management Area that are also in the Basin). **deep** Determined using entitlement data from all forms of take except basic rights use on the Victorian Water Register, based on the location of licensed and registered bores in the SDL resource unit.
Aquifer under basic rights	**Highlands** Estimate based on the number of bores less than 30 years old with a rate of 2 ML per year (as at 30 June 2010). **Sedimentary Plain** Estimate based on the number of bores in the SDL resource unit less than 30 years old with a rate of 2 ML/year as at 30 June 2010, (excluding those bores in the West Wimmera GMA). **deep** Estimate based on the number of bores in the SDL resource unit less than 30 years old with a rate of 2 ML/year (as at 30 June 2010).

8.5 Ensuring actual take does not exceed permitted take

Part 6 explains the rules that govern the volume of water that can be taken from the Wimmera-Mallee system. As discussed in **Part 6**, certainty of entitlements is central to Victoria's water management framework. This certainty is provided in two distinct ways:

- limiting the ability to take and use water to those with express authorisation
- requiring the allocation of water in a system to be subject to considerations of the impact on other users, including the environment.

The methods for determining permitted take outlined in **Appendix C** are based on the assumption of full use of all entitlements. For surface water, the current level of consumptive use aligns with the SDL. For groundwater the current level of entitlements is below the SDL. The management of allocation or actual take underneath the primary entitlement only occurs to respond to water availability in accordance with the methods identified in **Appendix C**.

Fundamentally, managing access to water to ensure that actual take does not exceed permitted take is done through limiting the authorisation to take water. As outlined above in **Part 5.1**, the Minister authorises the take and use of water through entitlements issued under the Victorian Water Act. These entitlements are subject to terms and conditions which include:

- the maximum volume that may be taken
- the time, place and rate at which water may be taken
- limitations on the take under the maximum volume by way of allocations or restrictions imposed to respond to water availability during the accounting period.

The rules relating to allocations or restrictions are included in the methods for determining permitted take. The issuing of entitlements, amendment of entitlements and exercise of powers to restrict authorisations during the accounting period are a core component of the power of the Minister (or their delegates) to authorise the take and use of water.

In order to ensure that authorisations to take water under the Victorian Water Act do not cause actual take to exceed permitted take, the Minister (and delegates) is subject to the following obligation in relation to the issue of new entitlements in the Wimmera-Mallee water resource plan area.

10.11(1) 1. From 1 July 2019, the Victorian Minister for Water must not:

a. amend entitlements; or

b. issue entitlements to take water; or

c. make rules regarding allocations or restrictions to entitlement holders;

in respect to entitlements to take water from a water resource in the Wimmera-Mallee (surface water) water resource plan area or the Wimmera-Mallee (groundwater) water resource plan area if to do so would cause annual permitted take for that resource unit to be exceeded.

Note: The response to section 10.08(2) of the Basin Plan, requiring the holder of a water access right to comply with the conditions specified in the water access right instrument supports the above obligation to ensure, as far as practical that actual take does not exceed permitted take.

2. From 1 July 2019, if the cumulative volume of annual actual take is identified to equal or exceed the cumulative volume of annual permitted take, in accordance with section 6.11 of the Basin Plan, by the threshold established in section 6.12(1)(a)

of the Basin Plan, Victoria will meet the requirements to ensure compliance with sustainable diversion limits established under section 71(1)(h) of the Water Act 2007 (Cth) and Part 4, Chapter 6 of Basin Plan.

This obligation is included in the Wimmera-Mallee Water Resource Plan to provide assurance that no new entitlements will be issued and no entitlement will be amended in the water resource plan area that would result in authorised take in Victoria exceeding the SDL or permitted take. The obligation also requires that the exercise of powers to adjust authorisations to respond to water availability must consider the impact on permitted take and the SDL. This obligation reflects the obligation currently contained in section 6 of the Victorian Act that requires the Minister and Authorities to exercise their discretion in accordance with the Murray-Darling Basin Agreement and *Murray-Darling Basin Act 1993*. Section 6 of the Victorian Water Act invalidates any decision that is made to the extent that it is inconsistent with the Murray-Darling Basin Agreement and *Murray-Darling Basin Act 1993*. The above obligation is enforceable under the Commonwealth Water Act by the MDBA.

8.6 Limits on certain forms of take

Section 10.13(1) of the Basin Plan states that a water resource plan must require that the long-term annual average quantity of water that can be taken from a surface water SDL resource unit for consumptive use by:

- take under basic rights
- take by runoff dams
- net take by commercial plantations

does not exceed the level specified in column 2 of Schedule 3 for the form of take.

10.13(1)

1. The long term annual average quantity of water in the Wimmera-Mallee surface water SDL resource unit that can be taken for consumptive use for the forms of take listed at section 10.13(1) of the Basin Plan is the level specified in item 24 of Column 2 of Schedule 3 to the Basin Plan. This is the level of take at a specified point in time and is represented by the estimated volume of the baseline diversion limit identified in Column 5 of **Table 3** of **Appendix C** to the Wimmera-Mallee Comprehensive Report for that form of take from the Wimmera-Mallee surface water SDL resource unit.

2. Annual actual take under the Wimmera-Mallee Water Resource Plan is limited by the volume of annual permitted take determined by the method specified in response to section 10.10(1) of the Basin Plan for the following forms of take:

   a. take under basic rights; or

   b. take by runoff dams; or

   c. net take by commercial plantations.

3. The requirement for section 10.13(1) of the Basin Plan is met by the response to sections 10.08(2), 10.10(1) and 10.11(1).

4. The Department will monitor actual take for the above specified forms of take and where the actual take increases above annual permitted take the application of section 10.13(2) of the Basin Plan to the Wimmera-Mallee Water Resource Plan will be assessed by the Department and an amendment to the Plan will be pursued if necessary.

Note 1: Volume for annual permitted take is identified in **Table 7** of **Appendix C** to the Wimmera-Mallee Comprehensive Report. The methods for determining the volume of annual permitted take is identified in **Table 5** of **Appendix C**. The Table further identifies the modelling related to determining permitted and actual take will be reviewed as follows:

a. take under basic rights every 5 years;

b. take by runoff dams every 10 years;

c. take by commercial plantations every 10 years subject to any significant changes in the industry in which case a review would occur earlier.

Note 2: The relevant responses identified in (3) above relate to:

a. section 10.08(2) of the Basin Plan which requires holders of a water access right to comply with the conditions of that right;

b. section 10.10(1) of the Basin Plan which sets out the method for determining permitted take limits for the relevant forms of take in the Wimmera-Mallee water resource plan area;

c. section 10.11(1) of the Basin Plan which ensures that actual take does not exceed permitted take.

Victorian legislation does not regulate take under domestic and stock rights, take by commercial plantations or take by runoff dams under domestic and stock rights. Access to water for domestic and stock purposes is limited by the scope of that right under Section 8 of the Victorian Water Act (see **Part 6.2**). Victoria does manage a portion of runoff dams via licences. Where a runoff dam collects water for purposes other than domestic and stock use under section 8 of the Victorian Water Act, a licence is required for the use of that dam to take water from the system.

8.6.1 Take under domestic and stock rights

Information on expected future growth in take under a domestic and stock right, is not available. Any estimate of future trends for this form of take must be based on future climate projections.

The climate in western Victoria is likely to become drier with decreased surface runoff. Streamflow in waterways is expected to become less reliable. In this climate, take under domestic and stock rights extracted directly from waterways is very unlikely to increase. Reliability concerns will make direct surface water extraction a less desirable option. Overall, no significant growth in this form of take is expected in future.

8.6.2 Take by runoff dams

The number of runoff dams is expected to increase in the higher rainfall areas on the flanks of the Grampians (*Gariwerd*) and Pyrenees. Net growth in the number and volume of runoff dams in the Wimmera-Mallee water resource plan area is expected to continue at a low rate. Additionally, licensed runoff dams will not increase as the Minister will not issue new licences in circumstances where it will cause the relevant SDL to be exceeded. How the Victorian Water Act and commitments under the Basin Plan limit the ability of the Minister to issue new entitlements is outlined in **Part 5.1**.

8.6.3 Net take by commercial plantations

The trend in the Wimmera-Mallee water resource plan area is for the area of plantations to decline. Almost all of the Wimmera-Mallee water resource plan area is unsuitable for commercial plantations because of inadequate rainfall. On this basis, it is considered a very low risk that net take by commercial plantations will exceed the relevant SDL (see **Part 10.3.2** and **Part 10.3.3**).

9. Extreme events and critical human water needs

Part 9. Extreme events and critical human water needs

9.1 Basin Plan requirements

Part 13 of the Basin Plan seeks to ensure that water resource plans allow for a range of extreme events. Section 10.51 requires water resource plans to describe how the water resources of the water resource plan area will be managed during the following types of events:

a. an extreme dry period – a drought that is outside the range of experience contained in the 114-year historical climate baseline

b. a water quality event that results in water being acutely toxic or unable to be used for its established values and uses (for example, a blackwater event or blue-green algal bloom)

c. any type of event that has resulted in the suspension of a statutory regional water plan in the past 50 years (including a transitional water resource plan or interim water resource plan).

It also requires the water resource plan to set out measures to meet critical human water needs during the above events.

The event identified at (c) above is not relevant to Victoria because our water management framework does not include statutory regional water plans and there has been no event that has caused the suspension of the transitional water resource plan. This type of event will not be addressed in the Wimmera-Mallee Water Resource Plan.

The Commonwealth Water Act (section 86A(2)) defines critical human water needs as the needs for a minimum volume of water, that can only reasonably be provided from Basin water resources, required to meet:

a. core human consumption requirements in urban and rural areas

b. those non-human consumption requirements that a failure to meet would cause prohibitively high social, economic or national security costs.

Under this definition, water used for irrigation is not considered to be a critical human water need, but water for livestock generally is.

Critical human needs

In Victoria, critical human needs is defined as the volume of water required to supply Stage 4 restricted demand in urban areas, supply domestic and stock needs and operate the distribution system to deliver that water.

9.2 Extreme events in the risk assessment

Extreme events were assessed in the risk assessment based on specific scenarios (see Risk Assessment in **Appendix B**). Extreme events considered in the risk assessment were extreme drought, major asset failure, bushfire, point source discharge, flooding and overbank inundation. These events were considered in terms of their impact on the ability to meet consumptive (including critical human water needs), environmental (including priority environmental assets), recreational/social and Aboriginal uses.

The risks identified for the Wimmera-Mallee (surface water) water resource plan area and the Wimmera-Mallee (groundwater) water resource plan area are outlined in the Risk Assessment in **Appendix B**. A summary of these medium and higher-level risks is presented below in **Table 20** for the Wimmera-Mallee (surface water) water resource plan area and **Table 21** for the Wimmera-Mallee Water (groundwater) water resource plan area.

Table 20: Summary of risks from extreme events in the Wimmera-Mallee (surface water) water resource plan area

Cause	Availability				Priority environmental assets (structural form)		Condition			
	Environment	Consumptive	Social	Aboriginal	Environment	Aboriginal	Environment	Consumptive	Social	Aboriginal
Bushfire	3	3	1	4	2	2	2	3	2	4
Extreme drought	4	4	4	4	4	4	4	4	3	4
Extreme wet period	2	2	1	3	3	3	3	4	2	4
Flooding and overbank inundation	0	0	0	0	3	3	1	2	1	3
Major asset failure	3	3	3	3	1	1	2	3	2	3
Point source discharges	0	0	0	0	0	0	1	2	2	3

Legend	5	4	3	2	1	0
	Very high risk	High risk	Medium risk	Low risk	Very low risk	Not plausible – no risk

Table 21: Summary of risks from extreme events in the Wimmera-Mallee (groundwater) water resource plan area

Cause	Availability				Priority environmental assets (structural form)		Condition	
	Environment	Consumptive	Social	Aboriginal	Environment	Aboriginal	Consumptive	Aboriginal
Bushfire	1	1	1	3	0	0	1	3
Extreme drought	1	1	1	3	0	0	1	3
Extreme wet period	0	0	0	0	0	0	1	3
Flooding and overbank inundation	0	0	0	0	0	0	1	3
Major asset failure	0	0	0	0	0	0	0	0
Point source discharges	0	0	0	0	0	0	2	3

Legend	5	4	3	2	1	0
	Very high risk	High risk	Medium risk	Low risk	Very low risk	Not plausible – no risk

In order to address the risks identified above, the Risk Assessment identifies a number of strategies (in accordance with Basin Plan Requirements) including:

- ensuring water corporations maintain an emergency water supply
- ensuring appropriate planning is in place to respond to extreme events
- leading climate change adaptation across Victoria's water system
- being prepared to respond to and manage exceptional circumstances and the impact on availability and the condition (quality) of water.

There are a number more specific strategies identified in the Risk Assessment in **Table 78** of **Appendix B**.

More specifically, risks to Aboriginal values and uses of water from extreme events were identified. These will be addressed through the Aboriginal Water Policy outlined in *Water for Victoria* and are discussed in more detail in **Part 11.4.2**. The Aboriginal Water Policy seeks to provide a framework for water planners to better understand, recognise, incorporate and manage for Aboriginal values.

9.3 Extreme events impacting on critical human water needs

Managing water resources for all competing uses during times of extreme events is a complex interaction of:

- climatic conditions (that is, patterns and reliability of rainfall)
- physical water systems (supply infrastructure and natural waterways)
- water-sharing arrangements (secure entitlements and trade)
- water planning arrangements (preparedness in the short and long term)
- demand for water for different purposes (domestic use including gardens, industrial use, rural consumption including for irrigation, stock, environmental and recreational water).

Victoria's water sector planning framework is designed to enable critical human water needs to be met throughout climatic extremes. It does this by integrating long-term planning, short-term planning and contingency planning. These arrangements complement Victoria's water entitlement framework, which provides the legal basis for how water is shared.

In addition to the extreme events specified in the Basin Plan, Victoria has reviewed its strategies and measures in relation to other types of extreme events. These additional events are outlined in the Risk Assessment at **Table 47** of **Appendix B** and were assessed as a combination of their impact on consumptive uses. The strategies identified in those tables are outlined in **Table 78** of the Risk Assessment (**Appendix B**).

These are:

- major asset failure
- bushfire
- flooding
- point source discharge
- overbank inundation.

The tools used to manage extreme dry events and water quality events are also used to manage the above extreme events.

9.3.1 Managing a water shortage

The Victorian Water Act provides for a range of tools to manage access to water during times of water shortage. Water shortage may occur because of extreme drought or because insufficient water is available that is fit for purpose.

Individuals managing their own risks

Since the early 1990s, state and federal water management policy has emphasised the responsibility of individuals to manage their farming practices in response to climate variability, especially drought, by recognising that those individuals are best placed to make decisions that affect their livelihoods.

Regional sustainable water strategies guide management from a longer-term perspective, through the collaborative development of policies aimed at ensuring security and flexibility for stakeholders in the system.

This strategic planning focuses on ensuring stakeholders have tools available to make the most effective decisions about their water resources. Such tools include the opportunity to trade on temporary and permanent water markets, and the ability to carry over allocated water from one year to the next. Trade and carryover are water management options available to urban water corporations and environmental water managers in many large regulated supply systems across Victoria. Such options enable individuals to judge their own needs during the season, and act accordingly.

Individuals accessing water under private rights (domestic and stock) are responsible for their own water supply and are not subject to restrictions or bans. The risk of reduced water availability is borne by individuals. If aquifer levels drop and extraction is not possible or surface water becomes unavailable, individuals are responsible for carting water to their properties.

When water is limited for availability or quality-related reasons, affected users may sometimes need to cart water from distant sources to provide for basic needs and to water stock. Local government authorities and water corporations own and manage water supply points to provide water supplies for water carting during drought. GWMWater offers access to potable and non-potable water from standpipes connected to its urban and rural reticulation systems for water carting. Fees apply as per GWMWater's Schedule of Tariffs.

The conditions of the Millennium Drought required special measures, sometimes on an unprecedented scale, to ensure essential water needs were met. On regulated systems, significant lessons were learned about delivering water for entitlement holders who take water specifically for domestic and stock purposes and the environment under low water availability scenarios.

As domestic and stock supply is for essential needs (household use and stock watering), the consequences are critical when not enough water is available to run a system. Rural pipeline users are required to have three days' on-farm storage. In some cases, domestic and stock customers can manage their own supplies through trade. However, for some small domestic holdings, this may be an unrealistic expectation, given the small volume of entitlement.

In order to mitigate the risks of a water shortage, many domestic and stock customers not connected to the reticulated pipelines can store up to five months' supply on their properties (in dams or tanks), and have additional supply available through rainwater tanks or groundwater bores in areas where groundwater quality is suitable. However, in extended dry periods, the capacity of many users to augment their supply is limited.

Statutory powers

To support a more equitable distribution of scarce water resources, the Victorian Water Act provides the following powers:

- the Minister may declare a water shortage to temporarily qualify rights under section 33AAA
- a water authority may reduce or restrict water delivered to a serviced property under section 231
- a water authority may reduce or restrict water supplied to a serviced property under section 141 or
- water restrictions may be applied to water supplied to serviced properties in urban areas.

Temporary qualification of rights may occur where the Minister has declared a water shortage exists in an area or a system. The temporary qualification of rights will result in the reduction of the volume of water a person is authorised to take under their entitlement. This reduction will apply for the determined period of time. A qualification of rights must apply to all rights in the same proportion unless the Minister deems there are extreme circumstances that warrant differential qualifications.

The water corporation may also reduce, restrict or discontinue the volume of water that is delivered or supplied to a serviced property in a range of circumstances. Section 231 of the Victorian Water Act sets out the circumstances in which the water corporation may reduce or restrict the delivery of water. Similarly, section 141 of the Act sets out the circumstances for reducing, restricting or discontinuing the supply of water. Water delivery typically refers to irrigation water or water delivered to an entitlement holder under a bulk entitlement. Water supply refers typically to urban water supply.

The circumstances in which the delivery or supply of water may be reduced or restricted include:

- insufficient capacity to deliver or supply the water (section 231(1)(a) and section141 (1)(a))
- necessity to avoid future water shortages (section 141(1)(b)(i))
- the quality of water available for supply does not meet the standards for its intended authorised use (section 141(1)(c)).

The ability to reduce, restrict or discontinue water supply in urban areas is further supplemented by permanent water saving rules and staged water restrictions. These measures, which were part of the response to the Millennium Drought, work to reduce the use of drinking water supplies to critical human needs in times of low water availability.

Victoria's permanent water saving (or use) rules are a set of common sense rules to reduce demand and ensure we use water efficiently. These rules are in place at all times. Whenever water restrictions are also in place, the more severe rule or restriction applies. There are penalties for not following the rules.

The permanent water saving rules are uniform across Victoria and form part of each water corporation's permanent water saving plan.

The rules do not prevent the need for water restrictions during major droughts but help ensure water is used more efficiently and encourage all Victorians to value this precious resource for the long term. These rules took effect from November 2011.

As water becomes incrementally less available, staged water restrictions may be imposed. Four stages are currently prescribed under water corporation by-laws. These staged restrictions progressively restrict more and more uses of water. For example, the ability to water a garden is limited progressively from odd or even days and at specific times to the use of watering cans rather than a hose. Stage 4 restrictions represent Victoria's position on what constitutes critical human water needs and operate to ensure urban water supplies are used only for those purposes in times of severe shortage.

These measures are designed to ensure the limited volume of drinking water available is secured for critical human needs for a longer period of time.

Planning

The Minister and water corporations undertake a range of long-term, short-term and contingency planning to manage the impacts of extreme events.

Long-term planning uses a 50-year outlook and a range of climate change and population growth scenarios.

Short-term planning uses a one to five-year outlook, depending on the physical characteristics of the water supply systems, the volume of water in storage at the beginning of the period and a range of flow scenarios.

Drought preparedness plans set out the actions that need to be prepared for and actions in response to water shortages if they arise in the immediate to short term – for example, if inflows are worse than expected under the assumptions on which urban water strategies are based, or

in response to water quality issues. Drought preparedness plans include drought response plans that need to be reviewed at least every five years.

Contingency plans are prepared to respond to extreme events that are outside the short-term planning assumptions. These are often reviewed after an extreme event in order to build learnings back into short-term planning assumptions where relevant.

Existing response measures to meet critical human water needs in the Wimmera-Mallee water resource plan area during an extreme event include:

- utilising existing cross-connection of reticulated supply networks, and/or additional cross-connections where necessary
- connecting to alternate supply sources where feasible (both surface and groundwater)
- implementing water restrictions (urban)
- purchasing bulk water allocations from other users where opportunities exist
- utilising existing groundwater licences and infrastructure to supplement surface water supplies (Horsham, eastern Grampians towns)
- carting water to supplement supplies for small towns reliant on harvesting from unregulated streams
- implementing various measures to increase operational efficiency (reduce water losses).

In addition to the above, where a water supply protection area has been declared in accordance with Part 3 of the Victorian Water Act, a consultative committee must prepare a statutory management plan in accordance with any guidelines issued by the Minister. These may be prepared for surface water or groundwater. These plans describe the resource, management objectives and specific rules for measures such as restrictions during water shortages, trade and carryover (where applicable).

The plans aim to ensure that surface water and groundwater resources are managed equitably and sustainably in declared water supply protection areas. There are currently no statutory management plans prepared for surface water or groundwater in the Wimmera-Mallee water resource plan area.

Case study: Emergency supply to Wimmera-Mallee domestic and stock customers

Domestic and stock supply for customers connected to the Wimmera-Mallee supply system is delivered in accordance with the bulk entitlement held by GWMWater. Before the Wimmera-Mallee Pipeline was built, water was delivered to town and domestic and stock customers' dams through a 20,000 km network of open, earth channels dating to the 1800s. The channel system was extremely inefficient, with losses of up to 85 per cent through seepage and evaporation.

The supply to domestic and stock customers' on-farm dams was not metered. In a water shortage, GWMWater could restrict customers to filling one dam per specified area (for example, one dam per 250 hectares), depending on the severity of the shortage. GWMWater could reduce losses further by running only the more efficient channels.

Between 1997 and 2009, record low inflows were recorded in the Wimmera-Mallee supply system, with storage levels so low that not enough water was available to undertake all the normal channel runs. By January 2007, storages finished the month at 4.6 per cent of capacity. A winter channel run had been made to fill town storages only, including towns that normally received water from a summer channel run. There was not enough water to provide a summer channel run for domestic and stock supply to farms.

Most domestic and stock customers were not supplied with water from the channels. However, enough water was supplied to the town storages to provide emergency supplies for some 2,300 properties for basic domestic purposes. GWMWater carted 28,000 litres for domestic use every second month from the town storages to each rural customer not supplied by a channel, or where water in their dam had become unusable.

Customers could access additional water from urban storages for stock watering or crop spraying, provided they arranged for carting and covered the costs. Water could also be accessed by people who were not GWMWater customers (for domestic use only) under a permit system for carting.

The Wimmera-Mallee Pipeline

The Wimmera-Mallee Pipeline Project, which commenced in late 2006, proved more critical for securing water for urban and domestic and stock supplies than initially anticipated. Construction of the pipeline was completed five years ahead of schedule in 2010, due in part to the dry weather enabling construction to continue all year-round. As construction of sections of the pipeline were completed, towns and domestic and stock customers were able to receive emergency supplies via the pipeline rather than carting. The pipeline construction schedule was designed to reduce losses by minimising the number of channels run.

9.3.2 Management of water resources during extreme dry periods

Surface water

In addition to the above general powers to address water shortages in extreme dry periods, water corporations have specific requirements. Under the Statement of Obligations issued by the Minister to water corporations, GWMWater is required to prepare a strategy for managing water security to provide water services in the towns and cities in its district now and into the future.

The Urban and Rural Water Supply Strategy has a long-term outlook of 50 years and is based on the latest scientific research on future water availability scenarios. As GWMWater has urban and rural responsibilities, the strategy considers urban and rural pipeline supplied customers in its five water supply systems – Murray, Goulburn, Grampians, Pyrenees and eastern Grampians and groundwater towns.

In addition to the long-term outlook, GWMWater is also required to prepare the following short-term planning strategies:

- Emergency Management Plans which provide guidance in response to sudden and severe water shortages due to emergencies such as bushfire, water quality events or terrorism.
- Drought Preparedness Plans document the contingency measures the water corporation will implement to secure urban supply during times of water scarcity. This may include the implementation of water restrictions, including a decision-making framework for how and when restrictions are to be applied. As well as demand reduction measures (restrictions), drought preparedness plans may outline contingency measures to further reduce demand or augment supplies. Before the unprecedented dry period between 2006 and 2009, many drought preparedness plans treated drought as relatively short term, often based on experience of historic events, such as 1967–68. All water corporations updated their drought preparedness plans in 2011–12 to incorporate the learnings of the Millennium Drought and again in 2017–18 as part of their five-yearly review.
- water corporations should engage with councils and other public open space managers to identify and assess which important liveability assets would be impacted under restrictions and the extent to which they should be exempted or covered under a water conservation plan.
- Annual Water Outlook (AWO), which is required to be published online and submitted to the Department of Environment, Land, Water and Planning by 1 December each year. The objective of AWOs is to provide stakeholders and the community with an annual snapshot of the current total system storage levels, recent trends in water use and an outlook of storage positions under a range of streamflow scenarios for each water supply system. AWOs also identify demand management measures (e.g. water restrictions, water efficiency programs, community awareness measures) to maintain security of water supply and ensure critical human water needs can be met in the 12-month period from 1 December each year.

Based on the streamflow scenarios, water corporations are required to identify a range of short and medium-term water supply measures such as:

- using pre-existing drought reserves or alternative water sources (e.g. groundwater entitlements/ allocations)
- purchasing water allocations on the water market
- bringing forward augmentations previously identified.

All urban water corporations engage in extensive consultation in undertaking drought preparedness planning. In particular, in setting agreed levels of service with their customers, taking into account customers' ability and preparedness to pay for a greater level of water security.

Groundwater

Groundwater towns throughout GWMWater's area have reliable access to water under their entitlements by virtue of the sheer volume of groundwater reserves in these areas. As a result, groundwater allocations are largely independent of short-term climatic conditions. Regional groundwater resources remain secure, with regular water level monitoring conducted across the groundwater resource areas.

GWMWater supplies 10 towns from the Murray Group Limestone Aquifer in the west of the region. Irrigation and domestic and stock are the major groundwater users. The urban demand for groundwater is currently:

- West Wimmera – baseline water demand for urban use over the past five years (2012-2016) is approximately 912 ML. Urban use in the West Wimmera and Murrayville areas make up less than two per cent of the total permissible annual volume that can be extracted from this resource.
- Nhill – urban groundwater demand has decreased significantly as the town has been connected to the Wimmera- Mallee Pipeline since 2012–13.
- Willaura system – baseline annual use for the eastern Grampians is 89 ML per year.
- Horsham – supplements town supply during surface water shortage. The supply source has not been used to supplement Horsham in the past five years. The average demand over the past five years is 18 ML per year, which has been used for testing of bore operation and water quality.

10.51(1)(a)

Water corporations may reduce or restrict the delivery of water to rural customers where there is insufficient capacity in the system (water shortage). Water corporations may reduce, restrict or discontinue the supply of water to urban towns where there is insufficient capacity for authorised use.

Permanent water saving rules have been in place since the Millennium Drought. These provide permanent restrictions on the use of drinking water outside the home. Water corporations may also apply staged water restrictions to further restrict the use of drinking water in order to protect the availability of water for critical human need in the long term.

The Minister requires water corporations, under a Statement of Obligations, to undertake short term and long-term planning of future water needs to ensure available water is managed in order to meet critical human needs within those events that can be predicted. This planning includes a drought response plan for rural water, drought preparedness plans for urban supply, and emergency management plans.

The Minister also causes a water security outlook to be published to inform the management of water resources under a range of water availability conditions.

Where the measures employed by water corporations is not sufficient to address the impacts of an extreme dry period, the Minister may declare a water shortage in an area or for a resource and temporarily qualify rights to temporarily change the water sharing arrangements in a system by reducing the water available to holders of a water access right in the area or resource.

9.3.3 Management of water resources during a water quality event

During an extreme water quality event, the water resource may not be fit-for-purpose use due to issues such as blue–green algae, a blackwater event, ash and sedimentation following a bushfire or the release of other pollutants.

The Risk Assessment found that bushfires, extreme drought, an extreme wet period, flooding and overbank inundation, major asset failure and point source discharges generated medium-or high-level risks to the condition of the water resource across some uses in the surface water area.

In the water resource plan area (groundwater), bushfires, extreme drought, extreme wet period, flooding and overbank inundation, major asset failure and point source discharges were found

to have medium-or higher-level risks to Aboriginal uses due to a lack of understanding of what these values are.

In addition to managing the impacts of water quality events on rural customers, water corporations are also required to comply with the standards in the *Safe Drinking Water Act 2003* for urban town supply.

Under the *Emergency Management Act 1986*, GWMWater is regional coordinator for major blue-green algae outbreaks in waterways within the GMWWater boundary. GWMWater coordinates the management of major outbreaks across these areas, while local water managers monitor and manage local blooms under their own emergency plans.

This approach is outlined in the Blue-Green Algae Regional Coordination Plan, which is based on the Victorian Emergency Management Manual. GWMWater is required to facilitate regional coordination planning and arrangements for monitoring and managing blue-green algal outbreaks.

Strong overarching statewide emergency management framework

- Emergency Management Manual Victoria contains policy and planning documents for emergency management in Victoria, and provides details about the roles organisations play in emergency management.
- Victoria has a statewide coordination plan for water quality incidents. This plan details prevention, response and recovery and typically classified as a Class 2 emergency
- Specific arrangements for blue-green algae management are outlined in the Algal Bloom Response Plan and the Blue-green Algae Circular, which is coordinated by DELWP, including:
  - roles and responsibilities of state and local government agencies, water managers and catchment management authorities in regard to blue-green algal blooms such as the Department of Health and Human Services advising about the potential health effects of algal blooms and administering the Victorian *Safe Drinking Water Act 2003*
  - during a substantial regional blue-green algal bloom, regional emergency arrangements are implemented.

In order to protect security of urban town supplies, the powers relating to restricting, reducing and discontinuing water supply can also be used in response to a water quality event. Modifying supply allows water corporations to support longer-term availability of urban town supplies to meet critical human needs.

The Basin Plan requires that the Wimmera-Mallee Water Resource Plan describe how water is managed during a water quality event that prevents the water being used for established purposes.

10.51(1)(b) Where water is no longer fit for purpose due to a water quality event, water corporations may reduce, restrict or discontinue the supply of water to urban towns where the quality of the water available does not meet the standards for authorised use, and in order to protect the availability of water for critical human needs.

Blue-green algae (BGA) is the predominant water quality event that can occur in Victoria. Responses to blue-green algae events relate to recreational use and public health and safety. Emergency response procedures are set out in the Blue-Green Algae Regional Coordination Plan and relate to protecting drinking supply and protecting the public from contact but do not aim to mitigate impacts of water taken from the system. Water corporations coordinate the management of major outbreaks while local water managers monitor and manage local blooms under their own emergency plans.

There is insufficient data on the impacts BGA has on domestic and stock use and irrigation and therefore there are no strategies to manage these impacts.

In addition, the Environment Protection Authority Victoria has powers to issue remedial notices, pollution abatement notices, clean-up notices and directions for pollution-related events.

As identified in the Risk Assessment, there is insufficient information regarding Aboriginal values and uses of water in order to have an adequate strategy for managing the impacts of water quality events in this context. As information about the impacts on these values improves, management strategies to respond to water quality events will be developed.

Water corporations develop management plans to manage risks to water resources. Where risks to the water quality are identified the public is immediately notified of the risks and restrictions on access may occur to prevent harm to individuals as a result of contact with contaminated water.

Table 22 of the Wimmera-Mallee Comprehensive Report details specific storage and asset actions during an extreme water quality event.

GWMWater does, however, manage a number of reservoirs which offer access for recreational use and undertake monthly sampling for algal analysis over the summer period when these lakes are in high use. Where risks to the water quality are identified the public is immediately notified of the risks and restrictions on access to the reservoirs may occur to prevent harm to individuals as a result of contact with the contaminated water.

Part 13 of this water resource plan outlines the recreational water values in the Wimmera-Mallee water resource plan area and identifies how water is made available for recreational uses.

Improving understanding of Aboriginal values and uses of water will enable increased capacity to plan and manage the impacts of extreme events on those values and uses. How this will be undertaken is outlined in more detail in **Part 11**.

Table 22 provides asset-specific information of actions that would be undertaken during a water quality event and addresses the requirements of section 10.51(1)(b) of the Basin Plan.

Table 22: Storage and asset-specific actions during an extreme water quality event

Asset	Action during extreme water quality event
Wimmera-Mallee Pipeline	The Wimmera-Mallee Pipeline water is supplied from Lake Bellfield, and provides drinking water for many towns. In the case that Lake Bellfield develops blue-green algae, the drinking water guidelines apply. In the case of the Lake Bellfield supply being shut down customers supplied from the trunk main may need to have water carted to them. In the event that both storages have an algae bloom, the storage may be dosed with a coagulant such as FL4440 (PolyDADMAC) or an algicide. Note that large volumes may be required for this and a full feasibility and risk assessment of this action and impact should be undertaken prior to initiation of any works.
Lake Wartook	Lake Wartook supplies Horsham, Natimuk, and surrounding areas with drinking water and rural supply. There are currently no options for alternative pumping from nearby headworks storages, though Horsham does have a supplementary borefield which could be called on in critical situation. A curtain screen was installed on the outlet of the storage in 2014 as a result of bushfires in the catchment. The impact of the curtain on water quality may screen out some blue-green algae in the event of a blue-green algal bloom. In the event of a blue-green algal bloom, there are options to isolate the storage and use an established borefield as an emergency water supply. Depending upon the requirement for environmental flows, blue-green algae affected water may need to be released from Lake Wartook.
Moora Moora	Water in Moora Moora Reservoir is used to support GWMWater's Wimmera-Mallee Pipeline Supply System 6 (WM12P SS6) via the Brimpaen storages, but may also be used to support environmental demands from Distribution Heads should there be sufficient water to do so. If sufficient water, flows can be transferred from Moora Moora to the Distribution Heads and onto Taylors Lake. Water can also move from Moora Moora Reservoir to the Glenelg River, that forms part of the inflows to Rocklands Reservoir. In the event that Moora Moora has a blue-green algal bloom, water can be supplied from Lake Wartook to Brimpaen and on to Supply System 6. Rural stock and domestic customers are supplied water from this supply system. Any customers prior to the Brimpaen storages would have to receive water carting once blue-green algae triggers have been reached.
Lake Bellfield	In the event that Lake Bellfield experiences a blue-green algae outbreak, limited alternative supply options exist. No options are available to bypass the storage directly, and Halls Gap, Pomonal and rural customers will be required to cease water use at relevant triggers; however, options exist for Supply Systems 1, 2, 3 and 4 to use water from Taylors Lake if required. All the water treatment plants providing drinking water to towns must isolate their supply from Lake Bellfield and begin carting water if the toxic blue-green algae species limits are exceeded. An option is also to establish emergency powder activated carbon (PAC) dosing at water treatment plants.

continued

Asset	Action during extreme water quality event
Lake Fyans	Water for Lake Fyans is harvested from Fyans Creek and its tributaries downstream of Lake Bellfield. Water may also be transferred from Lake Bellfield to Lake Fyans if required. Water in Lake Fyans is primarily used to supply the towns of Stawell, Ararat, and Great Western, as well as the Landsborough Valley Pipeline. In the event of having a blue-green algae outbreak in Lake Fyans, water from Lake Bellfield can be on stand-by to transfer water to Lake Fyans to manage blue-green algae and moderate poor quality water entering Stawell, Ararat and Great Western. If Lake Fyans has blue-green algae in it, a curtain can be installed at the inlet to the pump to minimise intake of algae into the pipe network. A curtain is stored at the Stawell depot. Stock and domestic customers will need to be isolated from the system and water carting initiated to ensure ongoing supply. For Stawell drinking water customers, an option is to establish emergency PAC dosing. If known toxic blue-green algae species limits are exceeded Great Western and Stawell Water Treatment Plants (WTPs) must isolate their supply and begin carting water. Ararat has PAC dosing, and may continue providing treated drinking water; however, algal and toxin monitoring must be conducted to ensure that no toxins or blue-green algae are exiting the WTP.
Rocklands Reservoir	Water held in Rocklands Reservoir is used to supply Wannon Water towns, and to provide water for environmental flow demands on the Glenelg River system. Water from Rocklands can be transferred to Lake Toolondo and Taylors Lake if required. If known toxic blue-green algae species limits are exceeded for drinking water, GWMW will inform Wannon Water immediately, and keep Wannon Water notified of results as they come in.
Taylors Lake: acting as a source water	If Taylors Lake is acting as a source water for water supplied into Supply Systems 1, 2, 3 and 4, it can be fed with water from Rocklands or Lake Bellfield. If the Wimmera River has adequate flows, water can also be harvested into Taylors Lake. If known toxic blue-green algae species exceed specified levels then the WTP storages need to be isolated, regulated towns are isolated and rural customers are advised to turn off their water meter. GWMWater would cart water for domestic use. Water supplied for crop spraying can be supplied until a biovolume of 10 mm^3/L for known toxic species and then farmers are advised to use an alternative source.

continued

Asset	Action during extreme water quality event
William system	The Willaura-Lake Bolac system supplies drinking water to Willaura, Lake Bolac, Glenthompson (Wannon Water), and non-drinking water to the regulated supplies of Moyston and Wickliffe. Water is supplied principally by bores in the summer, and a mixture of bores and surface water in cooler months. The water is pumped to a 2 ML storage in the headworks, and on to Moyston and rural customers, as well as the Mt Pleasant and Bald Hill storages. If known toxic blue-green algae species exceed specified levels then GWMW will isolate the drinking water supply at Willaura WTP and cart water. If no toxins are present, open storages may be dosed with coagulant to help remove blue-green algae cells prior to treatment. Treated water should be analysed to ensure that treated water does not contain blue-green algae above the specified trigger values. At specified levels rural supplies are also advised to turn off their water meter and supplement their supplies with water carting. Water supplied for crop spraying can be supplied until a biovolume of 10 mm^3/L for known toxic species and then farmers are advised to seek an alternative supply.
Mt Cole system	Water is gravity fed from the Mt Cole Reservoir into the Copes Hill Reservoir for use at the Ararat WTP. The Ararat WTP has PAC dosing, and may continue to be supplied with blue-green algae affected water, provided daily sampling is conducted to ensure that no blue-green algae or toxins are present in the treated water above drinking water trigger points.

9.3.4 The role of the Environment Protection Authority Victoria

While water corporations have responsibility for maintaining the quality of water in the system to ensure that it is fit for purpose, the role of the Environment Protection Authority Victoria (EPA) is to manage pollution-related water quality events. In particular, the EPA has powers to issue the following:

- remedial notices that require the recipient to undertake works or activities to remediate the pollution. For example, the direction may be to conduct a clean-up, stop works, install controls or change a process or activity
- pollution abatement notices which aim to prevent further occurrence of pollution or potential environmental risk through installation of risk controls and changes to onsite processes and practices
- clean-up notices which aim to prevent further contamination and impact through removal of waste, clean-up activities, ongoing management of pollution and altered handling, storage or location of industrial or prescribed industrial waste
- directions to immediately stop an activity, address an incident or undertake an activity to prevent imminent danger to life, limb or the environment. Directions can be verbal or written.

9.3.5 Measures to meet critical human needs

Section 10.51(2) of the Basin Plan requires the Wimmera-Mallee Water Resource Plan to set out measures to meet critical human water needs during the extreme events where such events would compromise Victoria's ability to meet critical human water needs.

Given the arrangements outlined above and the powers in place to manage the ongoing supply of drinking water to cities and towns, Victoria does not consider that an extreme dry period or a water quality event such as those outlined above would compromise Victoria's ability to meet critical human water needs.

10.51(2) Measures to meet critical human water needs during extreme dry periods (section 10.51(1)(a) of the Basin Plan) or water quality events (section 10.51(1)(b) of the Basin Plan) are not required as adequate arrangements are in place to ensure that critical human water needs are not compromised.

The situation described in paragraph (c) of section 10.51(1) of the Basin Plan is not relevant to the Wimmera-Mallee water resource plan area.

9.4 New scientific information

Section 10.51 (3) of the Basin Plan requires that the water resource plan must provide that, if new scientific information suggests a change in the likelihood of an event of a type listed in 10.51(1) occurring (for example, due to climate change), consideration must be given whether, as a result of this new information, the water resources should be managed differently.

10.51(3) If new scientific information suggests a change in the likelihood of an event of a type listed in section 10.51(1) of the Basin Plan occurring, consideration will be given as to whether, as a result of this new information, the water resources should be managed differently.

Water for Victoria is the Victorian Government's adaptation response to the impacts of climate change on water resources and on the availability of water in the future. Victoria's temperature has steadily increased since the 1970s and overall streamflows have decreased by around 50 per cent or more over the past 20 years.

The Millennium Drought brought with it a seasonal shift in rain towards less rainfall during the cooler months (April to October), when runoff is greatest and storages usually fill. Climate science predicts this is the new reality with more extreme events likely to happen too, such as floods, droughts and bushfires which affect water availability and condition.

In Australia, we accept that drought is part of life and many parts of Victoria have experienced drought conditions over the past decade. The Millennium Drought was a wake-up call for many Victorians about taking water for granted, the importance of water security and the need to build resilience to drought. The Millennium Drought's severity has been linked to human-induced climate change.

Water for Victoria recognises that government has a key role in applying research to water management policy, planning and practice. The Victorian Climate Initiative, in partnership with the Bureau of Meteorology and CSIRO, means that Victoria's understanding of climate change and its impacts on water resources has grown substantially in recent years.

Through *Water for Victoria*, the state has committed to build on this understanding by continuing to invest in research and working with partners including community groups, local government, Traditional Owners, research organisations and the water sector.

Improving Victoria's ability to apply this research to water management policy, planning and practice is also vital. Tools for modelling and scenario planning help inform decisions about options for action in a future with climate change and periods of reduced water availability. The Department of Environment, Land, Water and Planning will continue to assess and report on changes in water resources, including changes in rainfall, streamflow and groundwater to inform adaptation and evaluation of actions. This is reflected in the Risk Assessment, which ties to action 2.2 in *Water for Victoria*.

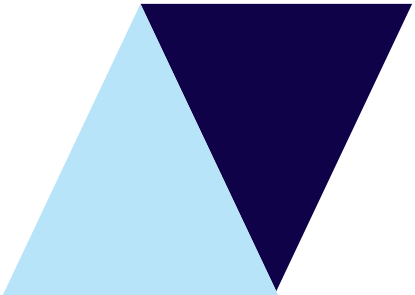
Practically, the Statement of Obligations issued to water authorities requires water authorities to comply with any guidelines forecasting the impact of climate change on water supplies issued by DELWP and utilise these guidelines in preparing their urban water strategies.

The GWMWater Urban and Rural Water Strategy will be reviewed and updated every five years to ensure that its actions remain appropriate to changing conditions (such as climate variability and customer awareness) and that it is based on the best available scientific information.

In terms of water quality response planning, the Regional Coordination Plan is reviewed annually to ensure:

- the plan reflects the current state of knowledge in relation to blue-green algae and water quality event management
- the plan is consistent with the latest DELWP Blue-Green Algae Circular
- GWMWater has up-to-date contact details for the various local water managers and other agencies.

Local water managers also annually review their risk management and incident response plans and provide a copy to the regional coordinator.



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10. Interception

Part 10. Interception

The Basin Plan (section 10.23) identifies the following interception activities that may have a significant impact on water resources in a water resource plan area:

- interception by runoff dams
- interception by commercial plantations
- interception by mining activities, including coal seam gas mining
- interception by floodplain harvesting

The Basin Plan defines a runoff dam as a dam that collects surface water flowing over land.

10.1 Basin Plan requirements

The Basin Plan requires that:

(1) A water resource plan must, having regard to the risk identification and assessment conducted for section 10.41, specify whether any types of interception activity in the water resource plan area have the potential to significantly affect:

a. *the water resources of the water resource plan area; or*

b. *water resources which are hydrologically connected to the water resources of the water resource plan area;*
whether on an activity-by-activity basis, or cumulatively.

A water resource plan is required to:

- *list interception activities that are identified as having the potential to have a significant impact on the water resources of the water resource plan area*
- *monitor the impact of these significant interception activities*
- *identify actions that will be taken in the event that monitoring indicates that the listed activities compromise environmental watering requirements or there is an increase in the quantity of water being intercepted.*

Actions are not required if increases in the quantity of water intercepted is included in the method used for determining the maximum quantity of water the water resource plan permits to be taken each year (see Basin Plan 10.10(1)).

The Basin Plan (10.23) identifies the following interception activities that may have a significant impact on water resources in a water resource plan area:

- *interception by runoff dams*
- *interception by commercial plantations*

- *interception by mining activities, including coal seam gas mining*
- *interception by floodplain harvesting.*

The Basin Plan defines a runoff dam as a dam that collects surface water flowing over land.

10.2 Interception in the risk assessment

The activities listed in the Basin Plan (10.23) were included in the risk assessment conducted as part of the development of the Wimmera-Mallee Water Resource Plan.

Table 23: Types of interception in the Basin Plan and their related cause in the risk assessment

Types of interception in the Basin Plan	Related cause and scenario in risk assessment
(a) runoff dams	Farm dams
(b) commercial plantations	Land use change (affecting availability) Land use change (affecting condition)
(c) interception by mining activities, including coal seam gas mining	Earth resource development
(d) interception by floodplain harvesting	N/A

The risk assessment found that the interception activities listed below, in **Table 24** and **Table 25**, pose a medium or higher risk to water availability and/or condition across the following uses.

Table 24: Identified medium or higher risks to the availability and condition of surface water from interception of surface water in the Wimmera-Mallee water resource plan area

Cause	Availability				Priority environmental assets (structural form)		Condition			
	Environment	Consumptive	Social	Aboriginal/Indigenous	Environment	Aboriginal/ Indigenous	Environment	Consumptive	Social	Aboriginal/ Indigenous
Increase in farm dams	3	3	3	4			3	3		4
Land use changes which affect availability	3	3	3	3						
Land use changes which affect condition								3		4
Earth resources development								3	3	4

Legend:	5	4	3
	Very high risk	High risk	Medium risk

Table 25: Identified medium or higher risks to the availability and condition of surface water from groundwater interception in the Wimmera-Mallee water resource plan area

Cause	Availability				Priority environmental assets (structural form)		Condition	
	Environment	Consumptive	Social	Aboriginal/Indigenous	Environment	Aboriginal/Indigenous	Consumptive	Aboriginal/Indigenous
Increase in farm dams				3				3
Land use changes which affect availability				3				3
Land use changes which affect condition							3	
Earth resources development				4		4		4

Legend:	5	4	3
	Very high risk	High risk	Medium risk

10.3 Addressing risks to water resources from interception

The Basin Plan requires states to identify strategies to address medium- or higher-level risks. These are described in detail in the Wimmera-Mallee Water Resource Plan Risk Assessment (see **Appendix B**).

The Victorian Water Act prohibits the take and use of water for mining and by floodplain harvesting without a water entitlement. The take and use of water by these activities is accounted for in sustainable diversion limits and is not considered further here.

Water for Victoria recognised that there are potentially a number of water uses that are not accurately accounted for, monitored and reported that may affect efficient water allocation as water becomes scarcer.

Two areas identified in the risk assessment that warranted closer monitoring were:

- the future exercise of section 8 rights to take water for domestic and stock use without a licence
- large-scale changes to land use that affected catchment water balance.

Both these areas were identified in the Western Region Sustainable Water Strategy (DSE, 2011). The growth in the number of farm dams and domestic and stock groundwater bores and the widespread conversion of pasture land to commercial wood plantations were identified as having the potential to affect runoff and groundwater recharge (DSE, 2011).

More specifically, risks to Aboriginal values and uses of water from interception were identified as in **Part 11**. The Aboriginal Water Policy provides a framework for water planners to better understand, recognise, incorporate and manage for Aboriginal values.

Risks to recreational/social values and uses of water from interception were also identified and will be addressed through a strategy that seeks to better understand, recognise, incorporate and manage for recreational values (see **Part 13.2**).

10.3.1 Runoff dams

The Victorian Water Act permits landholders to build runoff dams without a licence if the dam is not located on a waterway and the water is not used for irrigation or commercial purposes. These two conditions significantly restrict the volume of water that can be taken by these runoff dams.

The first condition that requires dams supplying irrigation and commercial uses to be licensed removes the financial incentive to make runoff dams larger than required for domestic and stock use.

The second condition prohibiting building runoff dams on waterways (including floodplains) limits the size of the local catchment above the dam site and therefore the runoff available to be captured. Dam sites with the potential to reliably harvest significant volumes of runoff will be on waterways and therefore always require a licence.

10.3.2 Land use changes

Land use changes are occurring constantly and may include changes between:

- annual pastures and perennial pastures
- grazing and cropping
- till cropping and no-till cropping
- pasture and plantations
- rural land use and urban land use.

Depending on the direction of the change, runoff and groundwater recharge may increase or decrease.

Statutory land use planning powers reside in the *Planning and Environment Act 1987* rather than the Victorian Water Act. Planning provisions are usually general in nature and not used to regulate land use activities on farms on the basis of their effect on the catchment water balance.

10.3.3 Monitoring potential interception activities

Victoria has established two processes to periodically assess the risks of interception activities on water resources in the Wimmera-Mallee water resource plan area (and across the state more generally) and, if required, initiate actions, determined by the Minister, to address issues:

- Division 1B of Part 3 of the Victorian Water Act sets out the process for the Minister to prepare sustainable water strategies for regions of the state (**Part 13.12.1**). Sustainable water strategies are used to identify risks to the water resources and actions to mitigate those risks. The Act requires the Minister to review sustainable water strategies every 10 years.
- Division 1C of Part 3 of the Victorian Water Act requires the minister to undertake long-term water resource assessments to identify whether there has been any:
  - decline in the long-term availability of surface water or groundwater and whether the decline has fallen disproportionately on the environmental water reserve or on the allocation of water for consumptive purposes
  - deterioration in waterway health for reasons related to flow.

The Minister must determine the actions that need to be taken if the assessment determines that there has been a decline in the availability of surface water or groundwater, which has had a disproportionate effect on consumptive water use or water for the environment.

Action 8.4 of *Water for Victoria* commits to better monitor and report on the effects of emerging water uses on other uses in the Victorian Water Accounts and to periodically review these emerging uses in sustainable water strategies and long-term water resource assessments.

10.4 Potential interception in the Wimmera-Mallee water resource plan area

10.23(1) No interception activity has been identified in the risk assessment to have a significant impact, nor to have the potential to have a significant impact, on water resources that are in or are hydrologically connected to the Wimmera-Mallee (surface water) or (groundwater) water resource plan areas.

Types of potential interception activities in the Wimmera-Mallee water resource plan area are summarised in **Table 26**.

Table 26: Catchment activities that may affect the volume of water being intercepted

Activity	Comments
Activities that increase runoff or recharge (decrease interception)	
Urbanisation increases impermeable areas and increases runoff	1 ha of impermeable area in an area with 500 mm of rainfall per year will produce 5 ML of runoff per year
Decommissioning farm dams in areas supplied by new piped supply systems, including the: Wimmera-Mallee system West Loddon system (proposed)	Will reduce the volume of water captured by farm dams located on natural waterways that were incorporated into the channel system in the northern parts of the catchment. Some dams in areas now served by piped systems have not been decommissioned, but these will deteriorate over time unless maintained. An unknown number of these dams are not connected to the Wimmera River because they are in closed catchments.
Shift from grazing enterprises to cropping enterprises	Reduce consumption of water from stock dams by an unknown volume, but likely to be significant volume. No data available. Conversion from deep-rooted native perennial pasture to shallow-rooted annual crops is likely to increase recharge and runoff. Over time, many farmers have adapted cropping practices to retain more soil moisture. Effect in aggregate could be significant because of large areas involved, but no estimates are available.

continued

Activity	Comments
Reduction in area of plantations It is estimated that the area of plantations in the Wimmera-Mallee water resource plan area has decreased from 44.93 km^2 in 2009 to 41.50 km^2 in 2015 (a reduction of 343 ha)	This reduction will increase runoff and recharge and therefore reduce interception, subject to what it is replaced with.
Reduction in use from runoff dams	In a drying climate, water used from farm dams is likely to decease where the yield and reliability of supply from dams fall and self-supply irrigation activities are less feasible. However, the overall impact on interception volumes may be marginal because evaporation from existing dams is expected to be higher in a drying climate.
Activities that decrease runoff or recharge (increase interception)	
Revegetation projects for waterway protection, dryland salinity control and biodiversity No estimate is available of the area revegetated	Planted for environmental benefits and should be excluded from calculation of interception. In part replacing senescent remnant vegetation that is deteriorating.
Establishment of new commercial plantations	Current trend is for the area of plantations to decline. Almost all of the Wimmera-Mallee water resource plan area is unsuitable for commercial plantations because of inadequate rainfall.

continued

Activity	Comments
Growth in number of runoff dams. Runoff dams are the primary source of domestic and stock water in the southern part of the Wimmera-Mallee water resource plan area	Growth in number of runoff dams is expected in the higher rainfall areas on the flanks of the Grampians (*Gariwerd*) and Pyrenees. Most of these dams are upstream of the water harvesting sites of the Wimmera-Mallee system. Therefore, any increase in interception will reduce water availability and the volume available for allocation. Many runoff dams in the central and northern parts of the Wimmera-Mallee water resource plan area are not hydrologically connected to the water resources of the plan area. At first, in a drying climate the net take by runoff dams will remain similar. Higher evaporation will tend to increase take, but this is likely to be balanced by a reduction in the availability of local catchment inflows. However, as the climate dries further, long-term average dam inflows will be significantly reduced with dams remaining dry for long periods of time. In this situation, take from runoff dams will be significantly reduced on average – there can be no interception if there are no inflows to intercept. This reduction is expected to be very pronounced in the Wimmera region. A similar effect occurs in individual drought years. If dam inflows are very low, less water is available to intercept. In a drying climate, there is an added impact where partly empty dams will intercept small rainfall/flow events, which has the potential to significantly affect downstream ecology. Net growth in the number and volume of runoff dams in the Wimmera-Mallee water resource plan area is expected to continue at a low rate.
Interception by mining activities, including coal seam gas mining	There are currently no mining activities in the Wimmera-Mallee water resource plan area that intercept significant volumes of water. There is no coal seam gas mining in the Wimmera-Mallee water resource plan area.
Floodplain harvesting	No floodplain harvesting is permitted in the Wimmera-Mallee water resource plan area.

In summary, of the four specific types of interception noted under the Basin Plan (10.23), none are expected to have a significant impact on the water resources of the Wimmera-Mallee water resource plan area:

- Interception by runoff dams – modest growth is expected over the period of the water resource plan, but the additional take as a result of growth cannot be accurately estimated. Any additional take is expected to be small and is unlikely to have a significant impact on water resources.
- Interception by commercial plantations – no growth is expected over the period of the water resource plan, indicating that there will be no additional impact of water resources.
- Interception by mining activities, including coal seam gas mining – there are currently no mining activities in the water resource plan area that intercept significant volumes of water.
- Interception by floodplain harvesting – no floodplain harvesting is permitted in the water resource plan area.

10.4.1 Farm dams in the Wimmera-Mallee water resource plan area

Number and capacity of runoff dams

For the purposes of interception requirements under Chapter 10, Part 5 of the Basin Plan, runoff dams in the Wimmera-Mallee water resource plan area are farm dams that:

- intercept catchment runoff (or overland flow)
- are used only to supply domestic and stock water
- are not licensed or registered because they are on a waterway or used for irrigation or commercial activities
- are not filled using a water entitlement from another water source.

All dams of this type in the Wimmera-Mallee water resource plan area are located in the Wimmera, West Wimmera, Avoca, and Avon-Richardson zones, as shown in **Figure 24**. The total capacity of runoff dams in these three areas is estimated to be 53,120 ML. Note that the estimated capacity of the dam is not the same as the volume of take.

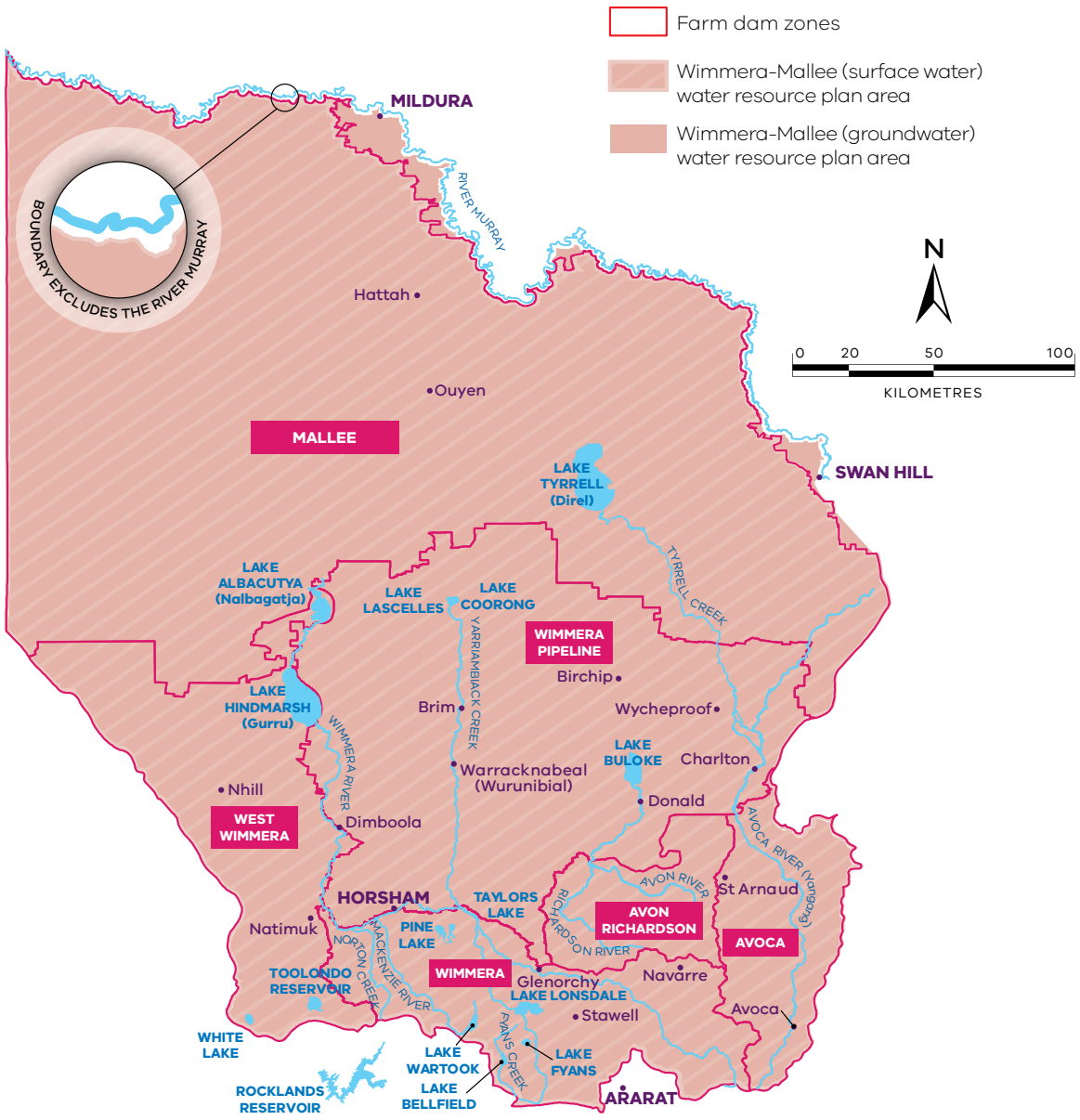

Figure 24: Zones for categorising types of dams across the Wimmera-Mallee water resource plan area

The estimated capacity of dams in the six zones is shown in **Table 27**.

Table 27: Volumes of types of dams (ML) across each zone in the Wimmera-Mallee water resource plan area

Zone	Dams historically connected to pipeline/ channel system (ML)	Hydrologically disconnected dams (ML)	Other dams (ML)	Total runoff dams (ML)
Mallee	31,022	-	-	-
Wimmera Pipeline	40,133	-	-	-
West Wimmera	1,409	9,132	-	10,541
Wimmera	1,964	-	20,706	22,669
Avoca	307	-	13,046	13,353
Avon-Richardson	964	-	5,592	6,556
Total	**75,800**	**9,132**	**39,343**	**53,120**

Notes about the definitions of these zones:

- in the Mallee and Wimmera pipeline zones, all dams are assumed to have been originally constructed to be supplied from an external source and not to intercept surface runoff. This means that there are no runoff dams. While these dams are included as a form of take so that all take is accounted for, the lack of hydrological connection needs to be considered when managing different forms of take across the WRP area.
- in the West Wimmera zone, all dams are hydrologically disconnected from the Wimmera River, and therefore have no impact on the water resources of any other part of the water resource plan area.
- in the Wimmera, Avoca, and Avon-Richardson zones, all dams are assumed to be runoff dams. Dams which were historically connected to pipelines or channels in this area are not currently in use, but some intercept surface runoff from disused channels under certain conditions. On this basis, all dams in these zones have been assumed to be runoff dams, including those originally constructed to be connected to a channel/pipeline.

Of the above dams, many have an associated licence (as explained in **Part 6**). The total volume of all licensed and registered runoff dams in the Wimmera-Mallee water resource plan area is 13,086 ML, leaving 40,034 ML of unlicensed runoff dams used for domestic and stock purposes.

Take by runoff dams

The capacity of runoff dams is relatively straightforward to estimate based on available data. However, the take by runoff dams is complex to estimate and involves a high degree of uncertainty because of:

- estimates of on-farm demands – average volumes of water extracted from domestic and stock dams cannot be accurately estimated because very few dams used for these purposes are metered. Current estimates of annual extraction from domestic and stock dams are therefore highly uncertain (up to ±50 per cent). This uncertainty directly translates to a similar degree of uncertainty in overall take.
- estimates of inflows to dams – the volume of inflows to each dam is a key driver of take, but observed data at this scale is not available. Data products estimating local surface runoff across Australia have been recently developed by various research institutions; however, such products are still in their infancy and are unable to provide locally accurate data. Estimates of inflows at a local scale still carry significant uncertainties.

- changes in on-farm demands over time – it is possible that on-farm demands may change based on climate or agricultural economic drivers. For example, in a drying climate landholders may attempt to increase their reliability of supply by increasing the capacity of their dams. If on-farm demands remain the same, this may or may not increase the long-term take.
- losses and level of hydrologic connection – seepage rates from dams and each dam's location in the landscape are major elements in understanding take by runoff dams. Generalisation of dam characteristics across a region is very difficult and the level of hydrologic connection to downstream waterways is low in some instances. This means that take by runoff dams estimated at each dam site may be very different to the take by the same dams estimated at a major downstream waterway.
- interaction with other users – increased take by runoff dams in future is likely to reduce system inflows, in turn causing lower allocations in the regulated system. This will reduce the take in the regulated system, making the net effect on take across the whole system uncertain.

Victoria has recently developed a new method for estimating annual take by runoff. This method relies on hydrological modelling of each individual dam in an area, taking into account rainfall, evaporation, dam inflows, and on-farm demands. This modelling indicates that the long-term average annual take by runoff dams in the Wimmera-Mallee region can be estimated with an uncertainty range of about ±50 per cent to ±100 per cent.

Future growth in runoff dams

DELWP (2016f) estimates that the number of unlicensed farm dams grew by 0.25–0.55 per cent a year between 2010 and 2015, with each new dam having a capacity of about 1.7 ML on average. This is the best available information on which to estimate growth into the near future.

Assuming a conservatively high growth rate of 0.55 per cent a year, the capacity of runoff dams across the Wimmera-Mallee water resource plan area is estimated to increase by 3.0 GL over 10 years. However, the inherent uncertainty in estimating take could mean that current long-term average take from existing runoff dams can be estimated only to within ±5 GL–10 GL.

In addition, any estimates of take may change if patterns of on-farm demands change due to climate or agricultural economic drivers. More runoff dams could lead to increased take, but a drying climate and changing patterns of on-farm demand could lead to reduced take.

Given the high uncertainty associated with estimating take from runoff dams, it is not clear whether increased numbers and capacity of runoff dams will necessarily lead to increased take. In addition, the uncertainty in estimated take is significantly greater than forecast growth, so estimating take as a result of future growth is not practical.

The above reasoning gives rise to two important assumptions which have been adopted for reporting of take from runoff dams:

- estimating take as a result of future growth is not practical, therefore Victoria will assume no growth in runoff dams unless spatial data is updated to allow that growth to be directly measured;
- if growth is not going to be considered, then the best available information on which to base estimates of take is the spatial data from approximately 2005. While this data could be adjusted to represent growth up to 2009, this is not appropriate as it would introduce additional uncertainty with little practical benefit.

Future monitoring

The water resource plan risk assessment indicates that runoff dams are not generally a significant risk for the Wimmera-Mallee water resource plan area. It is recognised that future growth may elevate this risk, which cannot currently be quantified. On this basis, Victoria proposes to focus effort on improving hydrological understanding of runoff dams. Collection of

data regarding numbers and volumes of dams will remain a lower priority until hydrological uncertainties are reduced.

Victoria will review the impacts of runoff dams and the risks they pose to water resources as part of:

- the Northern Region Sustainable Water Strategy outlined in the Victorian Water Act
- the Long-Term Water Resource Assessment outlined in the Victorian Water Act
- Action 8.4 of *Water for Victoria*, which commits to better monitoring and reporting on the effects of emerging water uses on other uses in the Victorian Water Accounts.

These processes will provide opportunities to review and improve hydrological understanding of runoff dams, as well as opportunities to consult stakeholders and communities about risks posed by runoff dams and possible mitigation measures.

Comparison with risk assessment

The Water Resource Plan Risk Assessment (see **Appendix B**) concluded that the risk associated with growth in runoff dams during the water resource plan period to 2029 was rated medium to very low, depending on the specific end use of the water. This suggests that runoff dams could become a significant risk. However, this risk rating was based on:

- a scenario of an additional 4 GL of domestic and stock dams in the water resource plan area within 10 years
- an assumption that the 4 GL of additional dams will have a total additional take of 4 GL (that is, long-term average annual take is 100 per cent of dam capacity).

While these assumptions were based on the best information available at the time, more recent studies have shown both these assumptions to be conservatively high. More appropriate assumptions would be:

- a scenario of an additional 0.55 per cent of domestic and stock dams per year in the water resource plan area (DELWP 2016c), giving a total of approximately 2 GL of dams over 10 years
- long-term average annual take from runoff dams in the Wimmera-Mallee water resource plan area could vary from less than 10 per cent of dam capacity to more than 40 per cent of dam capacity, based on recent modelling developed by DELWP.

On this basis, the additional take from 3 GL of extra runoff dams could be 0.3 GL or less, or could be 1.2 GL or more. The uncertainty means that any single estimate of additional take is misleading. In any case, the additional take due to growth in runoff dams appears to be very small and does not present a significant risk to water resources. Strategy 1 for addressing risk – better recording, monitoring and accounting for significant uses of water – will ensure Victoria's understanding and management of interception continues to improve. This information has informed Victoria's response to Part 5 of Chapter 10 of the Basin Plan.

Victoria will update the risk assessment for farm dams when the uncertainty associated with estimates of take can be reduced.

Methods for estimating take

The long-term average annual take is the net change in streamflow caused by each dam and includes the combined effect of storage, on-farm demands, and rainfall and evaporation from the dam surface.

A robust and defensible method for estimating annual take by farm dams has been developed by Victoria based on the best available data. While the method itself is defensible, many of the inputs to this method are very uncertain. As a consequence, it is not possible to estimate long-term average annual take by runoff dams with a reasonable degree of confidence.

Overall, the capacity of all runoff dams in the Wimmera-Mallee water resource plan area is about 53 GL based on aerial imagery as of 2005, including dams for irrigation as well as those for domestic and stock use. As a result of uncertainty in modelling inputs, long-term average annual take could vary between 6.5 GL (or less) and 18 GL (or more), with a 'best estimate' of approximately 14.6 GL.

Note that this figure of 14.6 GL includes take by all dams including irrigation, commercial or basic rights. The method for calculating take for different types of dams is defined below. Also, as noted previously, all dams in the West Wimmera zone are hydrologically disconnected from the Wimmera River and therefore have no impact on the water resources of any other part of the water resource plan area. While these dams are included as a form of take, the lack of hydrological connection needs to be considered when managing different forms of take across the water resource plan area.

Take by runoff dams excluding basic rights

The Basin Plan Schedule 3 item 24 (e) requires that the SDL includes the "long-term annual average limit on the quantity of water that can be taken by runoff dams (excluding take under basic rights) calculated on the basis of the quantity of water that could be taken under state water management law as at 31 October 2010".

On this basis, the long-term annual average take by runoff dams excluding basic rights is estimated as 13.1 GL, which is the total volume of entitlements recorded in the Victorian Water Register associated with runoff dams as at July 2016. This volume of entitlements is equal to the maximum quantity of water which licensees could extract each year. Data from the Victorian Water Register has been extracted as of July 2016. Due to ongoing improvements and data management within the Water Register, obtaining historical data from 2009 is currently not practical. However, current management of Section 51 licences ensures that the overall entitlement pool for section 51 licences cannot increase over time. This means that the total entitlements volume in 2016 has remained unchanged since prior to 2009. As a result, licence information from July 2016 is considered a suitable source of information for this situation.

Permitted and actual take will be calculated using the same method as the SDL.

Take by runoff dams under basic rights

The Basin Plan Schedule 3 item 24 (f) requires that the SDL includes the "long-term annual average take of water by runoff dams under basic rights calculated on the basis of the take under the level of development that existed on 30 June 2009".

Based on hydrological modelling, the long-term average annual take by all runoff dams is 14.6 GL based on aerial imagery in 2005. This will be proportionally adjusted based on dam volumes to represent only take by runoff dams under basic rights, excluding take by runoff dams which are licensed under section 51 of the Victorian Water Act. This adjusted figure for take is 11 GL, as described in the table below.

Permitted and actual take will be calculated using the same method as the SDL.

Table 28: Calculating take (ML) from runoff dams in the Wimmera-Mallee water resource plan area

Capacity of runoff dams	53,100 (A)	Source: spatial data
Total long-term average annual take	14,600 (B)	Source: *hydrological modelling*
Volume of section 51 licences associated with runoff dams	13,100 (C)	Source: *Victorian Water Register*
Capacity of runoff dams under basic rights	40,000 (D = A - C)	Calculation
Take by runoff dams (excluding take under basic rights)	13,100 (= C)	Calculation
Take by runoff dams under basic rights	11,000 (= B / A x D)	Calculation

Note: A–D is used to denote the relationship between the figures.

10.4.2 Land use change

Net changes in interception associated with land use changes (excluding commercial plantations) are not expected to have a significant effect on the water resources of the Wimmera-Mallee water resource plan area.

In recent decades, there has been a shift from grazing activities on perennial and annual pasture to cropping activities. There has been a progressive shift to no-till cropping in cropping areas. The net effect of these changes on the catchment water balance is unknown.

Higher-density urbanisation around regional centres such as Horsham and Stawell will increase runoff and decrease groundwater recharge, although the areas involved are expected to be relatively small so this impact is unlikely to be significant. Lower-density urbanisation will tend to increase numbers of runoff dams for domestic and stock purposes, which tends to decrease surface water runoff.

10.4.3 Commercial plantations

Commercial plantations are a minor industry in the Wimmera-Mallee water resource plan area. Plantations are rainfall dependent and typically occur in regions with more than 600–800 mm of annual rainfall (SMEC, 2010). Sufficient rainfall for commercial timber plantations occurs only in the upper reaches of the Wimmera and Avoca River catchments.

Commercial plantations cover an area of 42 km^2 of the Wimmera-Mallee water resource plan area. The area of plantations has decreased by 8 per cent since 2009. Little or no growth is expected to occur over the next decade, so interception by commercial plantations is expected to remain less than or equal to 2009 levels.

Table 29: Area of commercial plantations in the Wimmera-Mallee water resource plan area

	Year	
Plantation type	2009	2015
Softwood plantations (km^2)	9.04	9.04
Hardwood plantations (km^2)	35.88	32.46
Total (km^2)	44.93	41.50