



15. Measuring and monitoring



Water level gauge markings (partially visible):
10
9
8
7
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2
1

Part 15.

Measuring and monitoring

The Basin Plan requires the Wimmera-Mallee Water Resource Plan to provide information about how Victoria measures and monitors water resources and what is done to ensure the measurements are maintained.

15.1 Basin Plan requirements

The Basin Plan requires the Wimmera-Mallee Water Resource Plan to include information about:

- the best estimate of the total long-term annual average quantity of water taken that is measured
- how the quantity measured was calculated
- the proportion of that quantity that is measured in accordance with agreed metering standards
- the best estimate of the total long-term annual average quantity of water taken that is not measured and how that quantity was calculated
- actions and timeframes for actions for maintaining and, if practicable, improving:
 - the proportion of take that is measured
 - the standard to which the take is measured
- monitoring of water resources to fulfil the reporting obligations under Section 13.14 of the Basin Plan.

15.2 Measuring and estimating volumes of take

Part 10 of Chapter 10 of the Basin Plan relates to the monitoring and measuring of water resources. It focuses on identifying the volume of water taken that is either measured or estimated in the relevant water resource plan area.

In Victoria, water corporations measure and monitor water taken by users who have entitlements. In the Wimmera-Mallee water resource plan area this is water taken under a bulk entitlement, environmental entitlement or take and use licences. Where water is taken under a statutory right (basic rights) or by way of interception (commercial plantations), Victoria makes its best estimate in accordance with the methods outlined in the Methods Report (see [Appendix C](#)).

15.3 Victorian Water Accounts

The annual Victorian Water Accounts provide detailed information about water availability and use. The first accounts were produced for 2003–04 and have been produced every year since.

Surface water accounts are produced for each of Victoria's 29 river basins, the definitions of which are based on the river basin boundaries designated by the former Australian Water Resources Council.

Groundwater accounts, applying rigorous accounting standards and practices, are produced for each of Victoria's groundwater basins. The boundaries of these basins do not align with the Wimmera-Mallee water resource plan area.

15.3.1 Surface water accounts

Surface water data in the water accounts generally aligns well with river basin boundaries. The only instance where this is not the case is where water is diverted from a waterway in one river basin and used in another. For the purposes of the basin water accounts, water is accounted for at the point of diversion from the waterway and not the point of use.

The surface water accounts present the catchment water balance for each basin. The water balance is made up of:

- change in the volume of water stored in the basin
- inflows to the basin
- diversions from the basin
- losses
- water passed at the basin outlet.

Information for the surface water accounts is obtained from:

- the Victorian Water Register
- data from water corporations, the Victorian Environmental Water Holder, Department of Environment, Land, Water and Planning, major users of water and the MDBA
- water consumption and recycled water data collected from water corporations by the Essential Services Commission
- hydrological information from selected streamflow monitoring sites
- climate information from selected rainfall and evaporation monitoring sites provided by the Bureau of Meteorology and water corporations
- estimated relationships between water use and climate or hydrological data, which is produced by water supply system modelling.

Details of the methodology used to quantify each component of the water balance are described in the Victorian Water Accounts (see for example, Victorian Water Accounts 2014–15 (DELWP, 2016c)). Accounts are prepared for the Wimmera (including Avon) and Avoca basins. No surface water balance is prepared for the Mallee Basin because all surface water supplies used in this area are sourced from outside the basin.

15.3.2 Groundwater accounts

Accounts are presented for each groundwater catchment. Boundaries of these catchments are determined by hydrogeological features and differ from surface water catchments. The groundwater accounts present data about:

- licensed groundwater volumes and use
- urban groundwater use, which is a sub-category of licensed use
- estimated number and groundwater use from domestic and stock bores.

Information for the groundwater accounts is obtained from:

- the Victorian Water Register
- responses to requests for data to water corporations, DELWP and major users of groundwater
- hydrogeological information from selected groundwater monitoring sites
- estimated relationships between water use and hydrological data, which is produced by water supply system modelling
- water corporation groundwater statements and annual reports.

The Wimmera-Mallee groundwater basin includes the area covered by the Wimmera-Mallee Water Resource Plan but incorporates groundwater data in the West Wimmera Groundwater Management Area and the South Australia–Victoria border zone. These areas are not included in the Wimmera-Mallee water resource plan area for the purpose of SDL calculations (see [Part 8](#)).

15.3.3 Estimating evapotranspiration

Evapotranspiration estimates are provided as supplementary information in the accounts. Data used in the accounts are estimated by the SoilFlux model as the sum of transpiration by plants, evaporation from soil and open water surfaces, and evaporation from the wet surfaces of plants soon after rainfall.

SoilFlux is a one-dimensional water balance model. It requires many approximations and assumptions, which limit its accuracy. Major assumptions and limitations of this method include:

- not accounting for water applied by irrigation
- not allowing for changes in water storage (i.e. rises and falls in the water table and soil moisture) or lateral flow
- using land use information from 2009, which has been condensed from the Victorian Land Use Information System into 10 representative land use types, for water balance modelling
- using one kilometre gridded data for land use, geology, depth to groundwater and rainfall.

15.3.4 Victorian Water Register

The Victorian Water Act requires records of all water entitlements to be recorded by the Victorian Water Register, which contains detailed water accounts. The register is the central source of information about surface and groundwater, and contains information on:

- bulk and environmental entitlements
- water shares (not applicable in the Wimmera-Mallee water resource plan area)
- water-use registrations (not applicable in the Wimmera-Mallee water resource plan area)
- take and use licences
- works licences.

The register records details about:

- ownership
- changes in ownership
- entitlement characteristics including maximum volume
- allocations to entitlements (where relevant)
- use
- carryover.

The register's water entitlement records are reconciled quarterly and finalised at the end of each financial year.

15.4 Collecting data for the accounts

15.4.1 Bulk entitlements

Each holder of a bulk or environmental entitlement must prepare and implement a metering plan that is designed to collect the data necessary to determine that the holder has complied with entitlement conditions. Entitlement holders are required to report on the volume of water taken at each offtake point. The metering plans must be prepared in accordance with the Minister's Guidelines for the Development of Bulk Entitlement Metering Programs (DSE, 2009a),

including meeting the relevant national standards.

Entitlement holders are also required to keep records collected from the metering program and provide reports to the Minister on request. Water corporations report on their take and use of water in their annual reports, which are tabled in Parliament. They are also required to include details of any non-compliance in these annual reports.

For example, GWMWater's audited annual report provides detailed reporting about water consumption, including compliance with the requirements of its bulk water entitlements (GWMWater, 2018).

15.4.2 Environmental entitlements

The Ministerial rules relating to the Victorian Environmental Water Holder (*Government Gazette*, 2014) require the VEWH to report each year on:

- the rights and entitlements in the water holdings at the end of the year
- water allocations made available
- changes in the water holdings
- the use of carryover
- water trading activity.

The VEWH annual report, which is also tabled in Parliament, contains comprehensive information about the use of environmental holdings in response to these requirements (see for example, the Victorian Environmental Water Holder Annual Report 2017-18 (VEWH, 2018b)).

15.4.3 Take and use licences

Victoria's metering policy for non-urban water supplies (Minister for Water, 2014c) includes:

Where a delegate issues, renews or approves the transfer of a licence to take water in a non-urban situation, the following conditions apply:

- a. *All new licences where the water taken under the licence is to be used for irrigation or commercial purposes must be metered.*
- b. *Existing licensed extraction sites must be metered if the licensed volume is –*
 - i. *10 ML or greater, for surface water, or*
 - ii. *20 ML or greater, for groundwater.*
- c. *The obligations in paragraph (a) and (b) do not apply if, in the view of the delegated authority, a meter would be impractical or can be exempted according to the following criteria:*
 - i. *Cost of metering can be shown to significantly outweigh the benefits*
 - ii. *Resource management objectives can still be achieved without impacting negatively on the resource, the environment or other users*
 - iii. *An exemption exists according to the Victorian Water Act.*

In these cases, the delegate must:

- *Document clearly the reasons for its view, and*
- *Identify a substitute method for estimating the volume of water taken to meet state and federal water accounting and reporting requirements.*

The above requirements do not preclude a delegate from requiring more extensive metering.

This policy is implemented through the *Minister's Policies for Managing Take and Use Licences* (Minister for Water, 2014b). These policies require details of all take and use licences to be recorded on the Victorian Water Register. Metered use is also recorded on the register.

Water corporations that provide non-urban supplies must prepare and implement metering action plans that comply with the Victorian implementation plan for the national metering standards for non-urban water meters (see clause 7.4 of the Statement of Obligations (Minister for Water, 2015b)).

15.4.4 Farm dams

No affordable method is available to measure the volume of water diverted from farm dams. There is no practicable way of metering (the mainly stock) use from these dams. The volume of water harvested by small dams is included in the Victorian Water Accounts. The estimated volume is based on the total volume of small catchment dams in a basin obtained from DELWP's sustainable diversions limits project in 2002 and flow-stressed ranking procedure project in 2005, and computer-based simulation modelling of the impact of small catchment dams on mean annual streamflow.

The estimated total water harvested by (or total impact of) small catchment dams in a basin is represented in the water balance as two separate components:

1. The estimated volume that owners extract from dams to supply their needs is accounted for as a diversion in the surface water balance. The volume extracted is based on the estimated capacity and assumed use of small catchment dams in a basin (dams are categorised as being for domestic and stock or commercial and irrigation purposes based on their estimated size).
2. The estimated volume of evaporation from small catchment dams is accounted for as a loss in the surface water balance. This volume is determined to be the difference between the estimated total water harvested (or total impact of) small catchment dams and the estimated volume extracted for use.

The method used to estimate the number and capacity of dams uses outputs from aerial photography. This dataset was wholly based on the MDBA waterbodies data prepared by Geoscience Australia in 2010 using aerial imagery from approximately 2004–05. This presented the best available information. The estimates of the number and volumes of the dams are imprecise and significant assumptions are required to convert estimates of take from the estimated volumes of the dams. These estimates are not sufficiently precise to provide accountable volumes of take.

15.4.5 Basic rights

15.4.5.1 Section 8 rights

The Victorian Water Accounts do not include estimates of the volume of water taken under the section 8 rights provisions of the Victorian Water Act, known as basic rights in the Basin Plan. The most significant use under this category is by stock drinking from unfenced waterways. There is no practicable way of estimating the volume taken and, given the relatively small volumes likely to be involved, no attempt has been made to estimate this volume.

Similarly, the use of groundwater from domestic and stock bores is not known with any precision. Records are kept of the works licences required to construct a domestic and stock bore. However, these bores are not metered and there is no record of which bores are actively used.

The number of domestic and stock bores includes all bores on the groundwater management database that are not licensed bores and that are less than 30 years old. The volume of domestic and stock use is estimated by assuming each bore uses 2 ML per year (DELWP 2016f).

15.4.5.2 Section 8A rights

The Victorian Water Accounts do not include estimates of the volume of water taken under the section 8A rights provisions of the Victorian Water Act, known as basic rights in the Basin Plan. These rights for Traditional Owners to take water under section 8A are outlined in more detail in [Part 6.2.2](#). At the time of producing this report there are 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*. An estimate has been used for determining permitted and actual take as described in [Appendix C](#).

15.5 Information related to take

The Basin Plan requires the best estimate of the total long-term annual average quantity of surface water taken that is measured and not measured in the Wimmera-Mallee Water resource plan area.

10.44(a) Surface water

In respect of the relevant class of water access right available in the Wimmera-Mallee (surface water) water resource plan area, the best estimate long-term annual average quantity of water taken that is measured is

- a. bulk entitlement for take from regulated rivers and from watercourses 66,874 ML; and
- b. take and use licences for take from watercourses 4,928 ML.

Groundwater

In respect of take by take and use licence in the Wimmera-Mallee (groundwater) water resource plan area, the best estimate for the long-term annual average quantity of water taken that is measured 68,880ML.

10.44(b) Surface water

In respect of the relevant water access rights, the long term annual average quantity of water taken in the Wimmera-Mallee (surface water) water resource plan area that is not measured:

- a. take and use licence for take by runoff dams and registration licences for take by runoff dams 13,100 ML
- b. basic rights for take by runoff dam 11,000 ML
- c. basic rights for take from regulated rivers and from watercourses that are not regulated rivers 1,135 ML.

Groundwater

In respect of take under basic rights in the Wimmera-Mallee (groundwater) water resource plan area, the best estimate of the take that is not measured is 1,280 ML.

10.44(c) The quantities identified under sections 10.44(a) and 10.44(b) of the Basin Plan were calculated in accordance with the methods for determining the baseline diversion limit as prescribed by the Basin Plan.

15.6 Improving measuring

Stream gauges are maintained by water corporations and DELWP according to national standards. Meters are installed and maintained by water corporations according to national standards. Non-urban metering is being progressively upgraded consistent with the national metering standards for non-urban water meters.

The Victorian Government has made the following commitments in *Water for Victoria* (actions 8.4 and 8.11) to improve water use information (DELWP 2016d):

- *monitor and report on the impact of water use on other users and the environment, and report on significant uses of water in the annual Victorian Water Accounts*
- *periodically review the long-term risks to Victoria's water resources through mechanisms such as long-term water resource assessments and sustainable water strategies*
- *work with water corporations and catchment management authorities to:*
 - *continue to invest in ongoing statewide surface water and groundwater monitoring networks*
 - *improve the quality and accuracy of monitoring data through investment in infrastructure upgrades and new technologies to receive more timely data*
 - *strengthen water resource assessments and modelling by including up-to-date information on catchment characteristics to better understand water availability, use and climate change.*

These actions are ongoing and will be reported through *Water for Victoria* implementation progress reports.

10.45(1) Victoria has committed to the following measures under *Water for Victoria* for maintaining and, where practicable, improving the proportion of take that is measured in the water resource plan area, and the standard to which take is measured by:

- a. Implementation Plan under the Basin Compliance Compact to improve metering against the National Standard for metering in accordance with the approved exemptions published in under Action 3.1 (including Actions 3.2-3.5) and supported by Actions VIC 3.1-3.7
- b. maintenance of stream gauges by water corporations and DELWP according to national standards
- c. installation and maintenance of meters by water corporations according to national standards
- d. upgrades to non-urban metering according to the *National Metering Standards for Non-Urban Water Meters*
- e. continued investment in ongoing Statewide surface water and groundwater monitoring networks
- f. investment in infrastructure upgrades and new technologies to improve the quality, accuracy and timeliness of monitoring data; and
- g. investigation into the introduction of a reasonable use limit for domestic and stock rights to improve monitoring and reporting of the quantity of water used under these rights.

10.45(2) These measures will be implemented over the next 10 years.

15.7 Monitoring water resources

In relation to reporting obligations under section 13.14 of the Basin Plan, Schedule 12 lists 21 matters that states, the MDBA, Commonwealth Environmental Water Holder and the relevant Commonwealth department must report on, annually or five yearly. From this list, Basin states are required to report on 13 of the matters, and monitoring of water resources is relevant to eight of these (matters 4, 8, 9, 10, 12, 14, 18 and 19).

15.7.1 Current Monitoring to meet Basin Plan requirements

Table 59 shows the undertaken to meet the accreditation requirements of the Basin Plan. Four core matters require monitoring of water resources in order to report against them:

- Matter 8 – Achievement of environmental outcomes at an asset scale
- Matter 9 – Identification of environmental water and monitoring of its use
- Matter 12 – Progress towards water quality targets
- Matter 19 – Compliance with water resource plans.

10.46 Table 59: Monitoring of water resources of the Wimmera-Mallee water resource plan area that will enable Victoria to fulfil its reporting obligations under section 13.14.

Matter	Relevant indicators	What will be reported	Monitoring to fulfil reporting obligations
8	Asset-scale indicators will be developed by Basin states following the development of objectives and targets for long-term watering plans and annual priorities using the Environmental Management Framework	Report on achievement of environmental outcomes at an asset scale as per indicators in the long-term watering plan	<p>Victoria undertakes the following monitoring to evaluate its long-term watering plan targets:</p> <ul style="list-style-type: none"> ecological monitoring of rivers through the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP) and the Native Fish Report Card ecological monitoring of wetlands through the Wetlands Monitoring and Assessment program for environmental flows (WetMAP) Victoria’s Regional Water Monitoring Partnerships program (water quality and hydrology) CMA monitoring related to long-term watering plan objectives. <p>To report against Matter 8, Victoria will also use data from the following Commonwealth funded programs:</p> <ul style="list-style-type: none"> Murray-Darling Basin Fish Survey (MDBFS)
9	9.1 Volume of water that was available for the identification and accounting of held environmental water (HEW)	<p>Volume of HEW entitlements by SDL resource unit</p> <p>Carryover and forfeiture of HEW by SDL resource unit</p> <p>Volume of HEW used by SDL resource unit</p>	Monitored through the Victorian Water Register which records all water allocated in Victoria.

continued

Matter	Relevant indicators	What will be reported	Monitoring to fulfil reporting obligations
	9.2 Volume of planned environmental water that was available	There is no planned environmental water in the Wimmera-Mallee water resource plan area	N/A
	9.3 Purpose and consequences of environmental water use	This indicator has been excluded	Monitoring of the use of held environmental water is managed through the Victorian Water Register. Monitoring of the impact of use of held environmental water is managed through monitoring done for Matter 8 outlined above.
12	12.1 Implementation of measures identified in water quality management (WQM) plans (Basin Plan s.10.33)	A summary of the implementation of measures set out in the WQM plan in each water resource plan area	Monitoring to be undertaken is detailed in Part 6 of the Water Quality Management Plan
	12.3 The number and severity of blue-green algae and blackwater events	An analysis of the frequency, duration and extent of blue-green algae and blackwater events	Blue-green algae monitoring to be undertaken by GWMWater as part of the Major Storages Operational Monitoring Program. Victoria does not currently monitor blue-green algae for recreational water quality unless notified of a possible problem (reactionary monitoring only.)
19	The MDBA does not propose reporting beyond the Statements of Assurance as agreed in the Implementation Agreement	Statement of Assurance	The monitoring outlined above will contribute to reporting on compliance with the Wimmera-Mallee Water Resource Plan. The Victorian Water Register will provide the relevant information relating to permitted and actual take. Monitoring to be undertaken is that required to measure compliance against the tasks under the Statement of Assurance.

10.46 The remaining four matters will be informed by the monitoring conducted for the purposes of the matters listed in **Table 59**. These four matters relate to:

- a. Matter 4 - the effectiveness of the management of risks to Basin water resources (informed by monitoring of Matters 8, 9 and 12)
- b. Matter 10 - implementation of the environmental management framework (informed by Matter 8)
- c. Matter 14 - the implementation of the water quality and salinity management plan including to the extent to which regard is had to the targets in Chapter 9 of the Basin Plan when making flow management decisions (informed by Matter 12)
- d. Matter 18 - the efficiency and the effectiveness of the operation of water resource plans, including in providing a robust framework under a changing climate (informed by Matters 8, 9, 12 and 19).

In Victoria the VEWH reports on its environmental watering in its annual publication, *Reflections*. The publication outlines the following:

- Carryover and trade that occurred during the year
- Volume of water delivered by region and by site
- Environmental outcomes resulting from the water delivered.

The VEWH undertakes monitoring, investigations and research projects that test assumptions and address knowledge gaps to improve on-ground adaptive management of environmental water. The VEWH's investment generally focuses on short-term projects with a defined question of interest, for example projects to improve understanding of the volume, magnitude or timing of flows that will improve outcomes achievable with the environmental water that is available. The VEWH's investment aims to be complementary to the investments in longer-term and broader-scale monitoring made by partner agencies such as DELWP (VEFMAP, WETMAP), MDBA (Environmental Water Knowledge and Research project) and CEWH (Long-Term Intervention Monitoring project). The VEWH also invests in small-scale complementary works and measures to improve outcomes achievable with environmental water.

In contributing to Victoria's Basin Plan obligations, each year VEWH reports on water use and alignment of outcomes with MDBA annual watering priorities. The results of monitoring and investigations supported by VEWH and its partner organisations contribute to building a comprehensive picture of the ecological benefits of environmental watering and inform reporting towards Basin Plan outcomes.

VEWH's publications can be found its website at: <http://www.vewh.vic.gov.au/news-and-publications/publications>

15.7.2 Proposed improvements to monitoring

To further support reporting against Matter 8 of Schedule 12 of the Basin Plan Victoria is currently working on the development of:

- an approach for monitoring the hydrological, physical or ecological response to environmental watering (WetMap);
- Aboriginal Waterways Assessment tool which is a methodology under development that can assess the cultural health of waterways and the outcomes of environmental watering.

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