



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
<p>Reduction in area of plantations</p> <p>It is estimated that the area of plantations in the Wimmera-Mallee water resource plan area has decreased from 44.93 km² in 2009 to 41.50 km² in 2015 (a reduction of 343 ha)</p>	<p>This reduction will increase runoff and recharge and therefore reduce interception, subject to what it is replaced with.</p>
<p>Reduction in use from runoff dams</p>	<p>In a drying climate, water used from farm dams is likely to decrease 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.</p>
<p><i>Activities that decrease runoff or recharge (increase interception)</i></p>	
<p>Revegetation projects for waterway protection, dryland salinity control and biodiversity</p> <p>No estimate is available of the area revegetated</p>	<p>Planted for environmental benefits and should be excluded from calculation of interception.</p> <p>In part replacing senescent remnant vegetation that is deteriorating.</p>
<p>Establishment of new commercial plantations</p>	<p>Current trend is for the area of plantations to decline.</p> <p>Almost all of the Wimmera-Mallee water resource plan area is unsuitable for commercial plantations because of inadequate rainfall.</p>

continued

Activity	Comments
<p>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</p>	<p>Growth in number of runoff dams is expected in the higher rainfall areas on the flanks of the Grampians (<i>Gariwerd</i>) and Pyrenees.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>A similar effect occurs in individual drought years. If dam inflows are very low, less water is available to intercept.</p> <p>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.</p> <p>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.</p>
<p>Interception by mining activities, including coal seam gas mining</p>	<p>There are currently no mining activities in the Wimmera-Mallee water resource plan area that intercept significant volumes of water.</p> <p>There is no coal seam gas mining in the Wimmera-Mallee water resource plan area.</p>
<p>Floodplain harvesting</p>	<p>No floodplain harvesting is permitted in the Wimmera-Mallee water resource plan area.</p>

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.

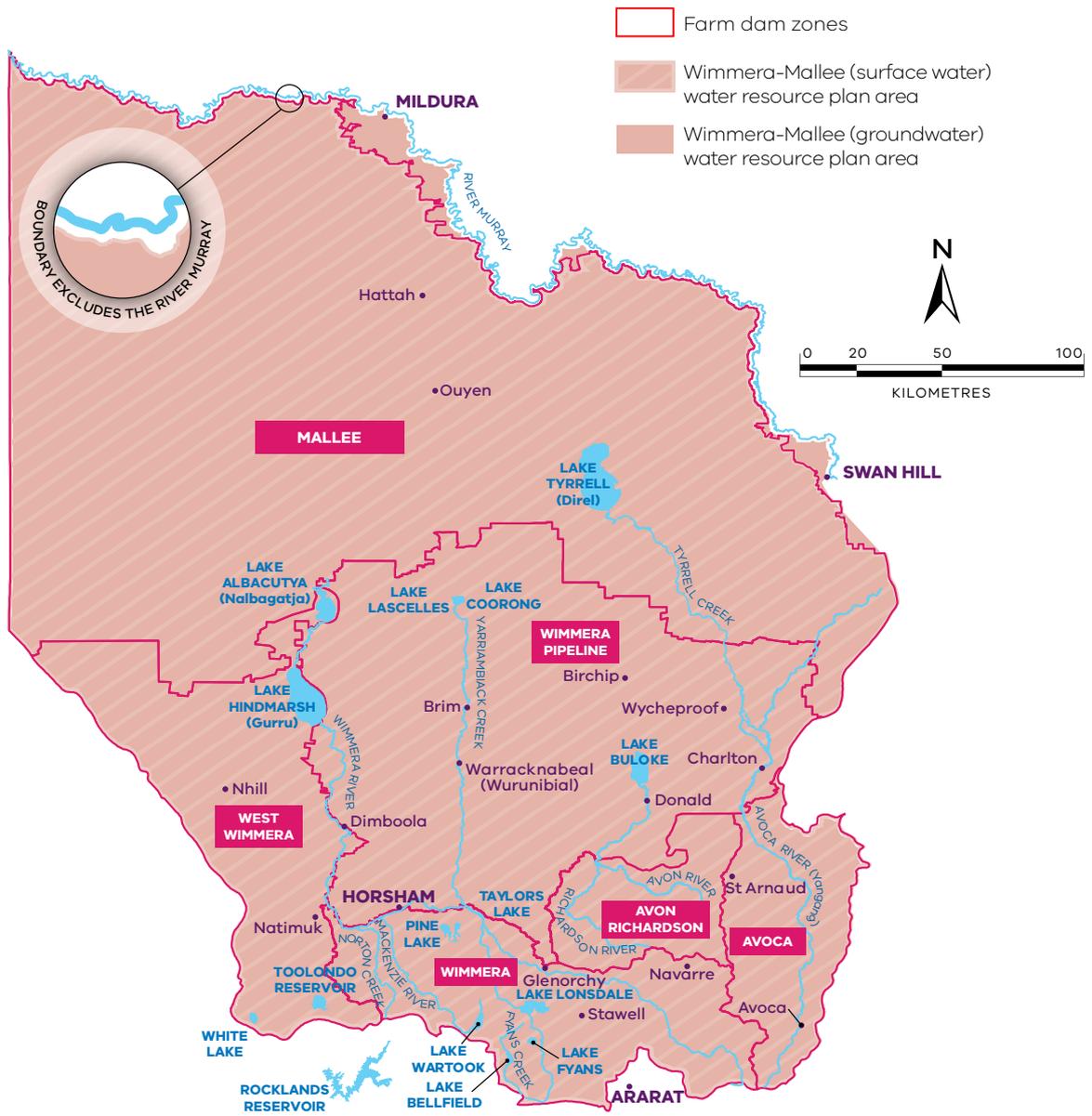


Figure 24: Zones for categorising types of dams across the Wimmera-Mallee water resource plan area

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 km² 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

Plantation type	Year	
	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