

Appendix C Methods Report





Appendix C

Methods Report

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Summary of methods

Permitted take in the Northern Victoria water resource plan area, Victorian Murray water resource plan area and the Goulburn-Murray water resource plan area is either calculated or estimated based on the best available information for that form of take and the water resources in the water resource plan area.

Actual take is the volume of water actually taken from the system within an accounting period. At the end of each water accounting period, actual take is subtracted from the annual permitted take. The difference is recorded as either an annual debit or credit, as outlined in section 6.11 of the Basin Plan. To remain compliant with sustainable diversion limits (SDL), cumulative debit cannot be equal to or greater than 20 per cent of the SDL (section 6.12).

A summary of whether permitted take and actual take are estimated or calculated is shown in **Table 1**.

Where the form of take relates to take under an entitlement, the method relies on information on entitlement volumes recorded in the Victorian Water Register (VWR). The register provides the most up-to-date information about entitlement volumes for an area or resource as it records the volume taken under a particular entitlement. These volumes are measured rather than estimated.

Where there is no recorded entitlement data, such as for domestic and stock rights, or the water available in the sustainable diversion limit resource unit is not fully allocated under entitlements, an estimate is required to determine the permitted take for the accounting period. Equally, where there is no recorded entitlement data for a form of take, an estimate will be required to determine actual take.

Table 1: Summary of permitted take and actual take methods

Form of take	Method	
	Permitted take	Actual take
Surface water		
Take from a regulated river (excluding basic rights)	Determined using an interim water resource plan model with the modelled diversions scaled to match the BDL minus recovery included in the model and adjusted for environmental recovery and trade	Calculated using usage data on the Victorian Water Register (VWR)
Take from a regulated river under basic rights	Determined based on best available hydrological model information	Estimated based on best available hydrological model information

Form of take	Method	
	Permitted take	Actual take
Take from a watercourse (excluding basic rights)	Determined using entitlement data on the Victorian Water Register	Calculated using usage data on the Victorian Water Register
Take from a watercourse under basic rights	Determined based on best available water user information	Estimated based on best available water user information
Take by runoff dams (excluding basic rights)	Determined based on entitlement data on the Victorian Water Register	Calculated based on entitlement data on the Victorian Water Register
Take by runoff dams under basic rights	Determined based on best available hydrological model information	Estimated based on best available hydrological model information
Net take by commercial plantations	Determined using the SoilFlux model	Estimated using the SoilFlux model
Groundwater		
Take from groundwater (excluding basic rights)	Determined by the relevant SDL	Calculated using entitlement data on the Victorian Water Register
Take from groundwater (basic rights)	Determined based on best available water user information	Estimated based on best available water user information

1. Background information

1.1 Basin Plan requirements

Division 2—Take for consumptive use

Note: This Division sets out the principal provisions for how a water resource plan incorporates and applies the sustainable diversion limit for each SDL resource unit. Sustainable diversion limits take effect from 1 July 2019. Water resource plans may be accredited before then and ordinarily have effect for 10 years. See section 64 of the Commonwealth Water Act.

10.10 Annual determinations of water permitted to be taken

For each SDL resource unit in a water resource plan area, and for each form of take, the water resource plan must set out the method for determining the maximum volume of water that the plan permits to be taken for consumptive use during a water accounting period.

The method for subsection (1) may include modelling, and must be designed to be applied after the end of the relevant water accounting period, having regard to the water resources available during the period.

The method must:

- *account for the matters in subsection 10.12(1); and*
- *be consistent with the other provisions of the water resource plan*

The plan must also set out a demonstration that the method relates to the SDL of each resource unit in such a way that, if applied over a repeat of the historical climate conditions, it would result in meeting the SDL for the resource unit, including as amended under section 23B of the Act.

Note 1: Under the Basin Plan, the SDL is the same as the long-term annual diversion limit because the temporary diversion provision for each SDL resource unit is zero. Section 6.04 and Schedules 2 and 4 set out the SDLs for each SDL resource unit.

Note 2: Amendments under section 23B of the Act are made following proposals for adjustment under Chapter 7.

If, as a result of an amendment under section 23B of the Act, the SDL for a surface water SDL resource unit is expressed as a formula that changes with time, the SDL for subsection (4) is taken to be:

- *for a water accounting period beginning on or after 1 July 2019—the SDL as it stood on 30 June 2019; and*
- *for a water accounting period beginning on or after 1 July 2022—the SDL as it stood on 30 June 2022; and*
- *for a water accounting period beginning on or after 1 July 2024—the SDL as it stood on 30 June 2024*

10.12 Matters relating to accounting for water

3. For paragraph 10.10(3)(a), the following matters must be accounted for:

- all forms of take from the SDL resource unit and all classes of water access right;
- water allocations that are determined in one water accounting period and used in another, including water allocations that are carried over from one water accounting period to the next;
- for a surface water SDL resource unit—return flows, in a way that is consistent with arrangements under the Agreement immediately before the commencement of the Basin Plan;
- subject to subsection (3)—trade of water access rights;
- water resources which have a significant hydrological connection to the water resources of the SDL resource unit;
- circumstances in which there is a change in the way water is taken or held under a water access right;
- changes over time in the extent to which water allocations in the unit are utilised; Note: Paragraph (g) includes what is commonly known as a growth-in-use strategy;
- water sourced from the Great Artesian Basin and released into a Basin water resource, by excluding that water; and
- water resources which are used for the purpose of managed aquifer recharge
- Subject to this section, the method may account for other matters
- For paragraph (1)(d), the water resource plan must account for the disposal and acquisition of held environmental water separately and in a way that does not affect the method under section 10.10

Division 3—Actual take

10.15 Determination of actual take must be specified

1. A water resource plan must set out how the quantity 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 information available at the time.

Note: The annual actual take for the SDL resource unit is the sum of the quantity of water actually taken by each form of take for consumptive use: see subsection 6.10(2).

Paragraph 71(1)(c) of the Act requires the annual actual take to be set out in a report to the Authority within 4 months after the end of the water accounting period.

2. For a particular form of take, and subject to the requirement that a determination use the best information available at the time, a determination may be made by:

- measuring the quantity of water actually taken; or
- estimating the quantity of water actually taken; or
- a combination of the above

Where a determination for a form of take is made by estimating the quantity of water actually taken, the water resource plan must provide for the estimate to be done consistently with the method under subsection 10.10(1) that relates to that form of take.

The quantity of water actually taken must:

- *include water that was held environmental water which was disposed of and then used in the SDL resource unit for consumptive use; and*
- *exclude water sourced from the Great Artesian Basin and released into and taken from a Basin water resource*

1.2 Best available information summary

Victoria has used the best available information to develop the models and methods in this report.

The information is considered the best available because:

- it is the most current at the time at which the model or method must account for water taken from the system
- it is based on an updated model and more accurately reflects the management of Victoria's water resources
- it is obtained in a manner that is cost effective and fit for purpose
- the Victorian Water Register (VWR) holds the most accurate and up-to-date information regarding water entitlements

It is not proposed to use methods of obtaining information to assess consumptive water take from the system where the cost and effort involved in obtaining the information is not commensurate with the benefit or increased certainty achieved by including the data.

For the purposes of determining take by entitlement holders, the Victorian Water Register is the most accurate means of determining the number of entitlements and the total volume authorised to be taken under those entitlements. All entitlements issued in Victoria are recorded on the register in accordance with the requirements in the Victorian Water Act.

1.3 Utilisation

The sustainable diversion limit (SDL) represents the long-term average of the environmentally sustainable limit on the volume of water that can be taken from the Murray-Darling Basin resource. In Victoria, water entitlements (water access rights) are not issued above the sustainable limit for the relevant resource. This sustainable limit will now be represented by the SDL in Victoria's water resource plan areas.

In determining whether entitlements can be issued, there is an assumption of full use of an entitlement. This means that in considering whether a new entitlement can be issued in respect of a resource or system, consideration is given to the total volume of water authorised to be taken from that resource or system under existing entitlements.

In circumstances where water users are not using the total volume of their entitlement, it is not assumed that underutilised water from an existing entitlement is water available for new users. Victoria's commitment to secure entitlements to water is based on water management decisions that advance security and reliability of a user's entitlement to the extent possible.

As a result, there may be circumstances where the total volume of water allocated under entitlements is higher than the volume of water actually taken by the entitlement holders in a system. However, this does not result in the allocation of new entitlements to take up the unused water.

2. Baseline diversion limit and sustainable diversion limit estimates

2.1 Sustainable diversion limits (SDL)

2.1.1 Shared and local reduction amounts

Sustainable diversion limits are focused on confining consumptive water use to an environmentally sustainable limit. The difference between baseline diversion limits and sustainable diversion limits is the volume of water that needs to be recovered. The sustainable diversion limits take effect from 1 July 2019 and are made up of local reduction amounts, shared reduction amounts and offsets achieved through the sustainable diversion limit adjustment mechanism.

Local reduction amounts are identified for specific SDL resource unit in Schedule 2 of the Basin Plan in reference to estimated BDLs.

The shared reduction amounts are allocated between SDL resource units and must meet the southern Basin Victoria zone shared reduction target of 425.3 GL per year. This is because this volume is intended to contribute to broader environmental outcomes across the Basin. The final shared reduction targets for northern Victorian catchments will be confirmed in early 2019. The total amounts by SDL resource unit are shown in [Table 2](#).

In Victoria the water has been recovered through a number of projects and partly through Commonwealth purchases. The recovery to date has been from regulated systems.

2.1.2 Sustainable diversion limit adjustment mechanism

The Basin Plan allows for changes to water recovery targets through the sustainable diversion limit adjustment mechanism (SDLAM).

The adjustment mechanism allows for up to 605 gigalitres (GL) of the Basin Plan's total water recovery target to be achieved through offsets from projects that deliver equivalent environmental outcomes without the need for more water, and therefore increases the sustainable diversion limit. Projects may include environmental works and measures or operational rule changes. The projects are explained further in [Schedule 1](#).

The 605 GL Basin-wide offset has been apportioned to each SDL resource unit in Victoria's North and Murray water resource plan area as shown in [Table 2](#). The Basin Plan limits the offset to 5 per cent of the Basin's sustainable diversion limit which at the time was equal to 543 GL. Therefore, an additional 62 GL of efficiency measures must be implemented by 2024 across the Basin for the full 605 GL adjustment to be available.

As the efficiency measures are progressively completed, the SDL will change between 2019 and 2024 to reflect this. Section 10.10(5) of the Basin Plan allows for a staged sustainable diversion limit to reflect this, since the method for determining permitted take is a formula that changes with time.

Table 2: Local and shared reduction amounts and SDL offsets by SDL resource unit

SDL resource unit ¹	Local reduction amount (GL)	Shared reduction amount (GL) ²	Apportioned SDL offset (GL) ³	Target recovery at 30 June 2024 ^{2,3}
Victorian Murray	253.0	202.3	72.8	382.6
Kiewa	0	1.4	1.3	0
Ovens	0	3.0	3	0.1
Goulburn	344.0	192.4	174.5	361.9
Broken	0	1.6	1.1	0.5
Campaspe	18.0	13.8	2.6	29.1
Loddon	12.0	10.8	10.9	11.9
Total	627	425.3	266.2	786.1

1. does not include Wimmera-Mallee SDL resource unit

2. subject to change: final shared reduction targets will be confirmed in early 2019

3. full apportioned offset only applies if 62 GL of efficiency measures are complete

2.1.3 Sustainable diversion limits and Basin Plan section 10.10(5) requirements

Taking into account the information in [sections 2.1.1](#) and [2.1.2](#), the sustainable diversion limit for the relevant water year will be determined based on the target recovery as at 30 June of the preceding year. The target recovery will be determined by the volume of target environmental water to be recovered as at 30 June, accounting for any offsets achieved. As the sustainable diversion limit is a formula that changes with time, section 10.10(5) of the Basin Plan applies. This means:

- As at 1 July 2019: $SDL = BDL - \text{target recovery as at 30 June 2019}$
- As at 1 July 2022: $SDL = BDL - \text{target recovery as at 30 June 2022}$
- As at 1 July 2024: $SDL = BDL - \text{target recovery as at 30 June 2024}$

Column 5 in [Table 2](#), gives the expected target recovery for 30 June 2024. The sustainable diversion limits in [Table 3](#) for Victoria’s estimate reflect this expected volume, which assumes the SDLAM efficiency measures are complete.

2.2 Comparison to Basin Plan estimates of baseline diversion limits and sustainable diversion limits

This section provides a brief discussion and comparison of Victoria’s estimates of baseline diversion limits (BDL) and sustainable diversion limits provided in [Table 3](#), compared to the estimates of these numbers provided in schedules 2–4 of the Basin Plan.

In each case the revised estimate is based on the same level of development as specified in the Basin Plan, 30 June 2009, for all SDL resource units in the Victorian Murray and Northern Victoria water resource plan areas. Refer to [section 3](#) of this report for more detailed discussion of the method used to determine the sustainable diversion limit in each case.

2.2.1 Surface water

The total surface water BDL for the Victorian Murray water resource plan area was estimated to be 1731.6 GL in the Basin Plan compared to *<TBC – pending revised BDL from MDBA model>* GL in Victoria's estimate. For the Northern Victoria water resource plan area, the total surface water BDL was estimated to be 2161 GL in the Basin Plan compared to *<TBC – pending revised BDL from MDBA model for Ovens>* GL in Victoria's estimate.

Victoria's SDL estimates in [Table 3](#) for take from a regulated river (excluding basic rights) account for the local reduction amounts, shared reduction amounts and offsets achieved from the sustainable diversion limit adjustment mechanism offsets. This is an expected SDL for 2024 and assumes all efficiency measures are complete.

For all other forms of take, the sustainable diversion limit equals the baseline diversion limit. An explanation between the differences between the Basin Plan BDL estimates and Victoria's BDL estimates is given in [Table 4](#), and the methods are further explained in [Table 6](#).

2.2.2 Groundwater

The Basin Plan estimates of baseline diversion limits and sustainable diversion limits for groundwater have been adopted as shown in [Table 5](#).

Table 3: Comparison of Victoria's and Basin Plan surface water baseline diversion limit and sustainable diversion limit estimates for each form of take for all SDL resource units in the Victorian Murray and Northern Victoria water resource plan areas.

Form of take:		(a)	(b)	(c)	(d)	(d)(i)	(d)(ii)	(e)
SDL resource unit		Take from a regulated river (excluding basic rights)	Take from a watercourse (excluding basic rights)	Take from a waterway (regulated river and watercourse) under basic rights	Take by run off dams	Runoff dams (excluding domestic and stock)	Runoff dams (domestic and stock)	Net take of water by commercial plantations
Victorian Murray (SS2)	Basin Plan		1662	n/a	23	n/a	n/a	22
			1279.4 ^a	n/a	23	n/a	n/a	22
Victoria	BDL (GL)	TBC ^b	14.9	8.1	12.4	4.8	7.6	24.2
	SDL (GL)	TBC ^b	14.9	8.1	12.4	4.8	7.6	24.2
Kiewa (SS3)	Basin Plan	n/a	11	n/a	6.6	n/a	n/a	7
		n/a	11	n/a	6.6	n/a	n/a	7
Victoria	BDL (GL)	n/a	16.1	1	8.2	4.5	3.7	7.3
	SDL (GL)	n/a	16.1	1	8.2	4.5	3.7	7.3
Ovens (SS4)	Basin Plan		25	n/a	26	n/a	n/a	32
			24.9 ^a	n/a	26	n/a	n/a	32
Victoria	BDL (GL)	TBC ^b	16.6	2.8	25	12.5	12.5	32.5
	SDL (GL)	TBC ^b	16.6	2.8	25	12.5	12.5	32.5
Goulburn (SS6)	Basin Plan	1552	29	n/a	86	n/a	n/a	23
		1190.1 ^a	29	n/a	86	n/a	n/a	23
Victoria	BDL (GL)	1552.2 ^d	46.5	6.3	51.5	27.1	24.4	22.4
	SDL (GL)	1,190.3 ^c	46.5	6.3	51.5	27.1	24.4	22.4

Form of take: SDL resource unit		(a) Take from a regulated river (excluding basic rights)	(b) Take from a watercourse (excluding basic rights)	(c) Take from a waterway (regulated river and watercourse) under basic rights	(d) Take by run off dams	(d)(i) Runoff dams (excluding domestic and stock)	(d)(ii) Runoff dams (domestic and stock)	(e) Net take of water by commercial plantations
Broken (SS5)	Basin Plan	13	0	n/a	30	n/a	n/a	13
		BDL (GL)						
		12.5 ^a	0	n/a	30	n/a	n/a	13
	Victoria	13.2	3.8	1.6	16.7	10.4	6.3	14.9
		BDL (GL)						
		12.7 ^c	3.8	1.6	16.7	10.4	6.3	14.9
Campaspe (SS7)	Basin Plan	111	2	n/a	39	n/a	n/a	1
		BDL (GL)						
		81.9 ^a	2	n/a	39	n/a	n/a	1
	Victoria	114.7 ^d	1.1	1.5	20.5	6.1	14.4	1.8
		BDL (GL)						
		85.6 ^c	1.1	1.5	20.5	6.1	14.4	1.8
Loddon (SS8)	Basin Plan	89	0	n/a	85	n/a	n/a	5
		BDL (GL)						
		77.1 ^a	0	n/a	85	n/a	n/a	5
	Victoria	86.1 ^d	21.2	4.8	34.6	18.1	16.6	5.5
		BDL (GL)						
		74.2 ^c	21.2	4.8	34.6	18.1	16.6	5.5

a. includes the local and shared reduction amounts*, and the full offset volume apportioned from the SDL adjustment mechanism, assuming 62GL of efficiency measures are complete

b. to be confirmed, models under development by MDBA in consultation with Victoria

c. expected SDL from 1 July 2024 – see [ssection 2.1.3](#)

d. may be subject to change

*shared reduction volumes may change up until 31 December 2018, including any changes from the revision of long-term diversion equivalent factors

Table 4: Forms of take

Form of take		Explanation in difference between Basin Plan and Victoria's estimates
(a)	Take from a regulated river (excluding basic rights)	Changes in estimates are based on updated information and models
(b)	Take from a watercourse (excluding basic rights)	This volume was estimated based on existing entitlements recorded on the Victorian Water Register (VWR) as June 2016. The Basin Plan estimate was based on a proportion of the modelled regulated river take.
(c)	Take from a waterway under basic rights	The volume is estimated based on a model of stock and domestic use. This volume also includes a best estimate of take under section 8A rights by Traditional Owners who have a natural resource agreement under the <i>Traditional Owner Settlement Act 2010</i> .
(c) (i)	Take from a regulated river under basic rights	This is not being estimated separately
(c) (ii)	Take from a watercourse under basic rights	This is not being estimated separately
(d)	Take by runoff dams	Volume is based on more accurate data and comprises consumptive take and take for domestic and stock purposes by runoff dams
(d) (i)	Runoff dams (excluding domestic and stock)	This volume was estimated based on the sum of existing entitlements recorded on the Victorian Water Register as of July 2016
(d) (ii)	Runoff dams (domestic and stock)	Estimate is based on modelling using the number and volume of dams shown in aerial imagery as at 2005 adjusted to account for the entitlements shown in item (d)(i)
(e)	Net take of water by commercial plantations	Estimate is based on modelling recently undertaken by DELWP

Table 5: Basin Plan groundwater baseline diversion limit and sustainable diversion limit estimates for each form of take

Form of take		BDL (ML) ^a	SDL (ML) ^b
Goulburn-Murray: Shepparton Irrigation Region SDL resource unit			
1	Take from groundwater (excluding basic rights)	244,100	244,100
2	Take from groundwater under basic rights		
Goulburn-Murray: Highlands SDL resource unit			
1	Take from groundwater (excluding basic rights)	38,300	68,700
2	Take from groundwater under basic rights		
Goulburn-Murray: Sedimentary Plain SDL resource unit			
3	Take from groundwater (excluding basic rights)	203,500	223,000
4	Take from groundwater under basic rights		
Goulburn-Murray: deep SDL resource unit			
5	Take from groundwater (excluding basic rights)	0	20,000
6	Take from groundwater under basic rights	0 [^]	0 [^]

a. estimates from column 3, Schedule 4 of the Basin Plan have been adopted

b. estimates from column 4, Schedule 4 of the Basin Plan have been adopted

[^] at the time of setting these estimates there was no take from the deep SDL resource unit under basic rights, but this may be revised in the future.

2.3 SDL resource units for compliance with sustainable diversion limits

Part 3 of Chapter 10 of the Basin Plan provides the basis for how Victoria must report and demonstrate compliance with sustainable diversion limits.

The sustainable diversion limit compliance test is provided for in sections 6.10, 6.11 and 6.12 of the Basin Plan. Under these sections, SDL compliance reporting is done in this way:

- A determination of annual permitted take is made in accordance with the methods provided in Victoria's North and Murray Water Resource Plan in accordance with section 10.10 of the Basin Plan
- A determination of annual actual take is made in accordance with the methods provided in Victoria's North and Murray Water Resource Plan in accordance with section 10.15 of the Basin Plan
- An assessment is made as to whether actual take exceeded permitted take for the accounting year
- If actual take does exceed permitted take in an accounting year, an assessment is made as to whether the excess take is equal to or more than 20 per cent of the relevant sustainable diversion limit

Section 6.12(2)(a) of the Basin Plan allows for the combined limits for Victorian Murray, Kiewa and Ovens SDL resource units to be treated as a single SDL resource unit. Section 6.12(2)(b) of the Basin Plan also allows the combined limits for Goulburn, Broken, Campaspe and Loddon SDL resource units can be treated as a single SDL resource unit.

This means that when reporting compliance with sustainable diversion limits, the Victorian Murray water resource plan area will include the resources of the Ovens SDL resource unit and the Northern Victoria water resource plan area will exclude the Ovens SDL resource unit. Victoria's obligation is to ensure that water taken does not exceed these limits:

- combined Victorian Murray sustainable diversion limit
- combined Northern Victoria sustainable diversion limit
- Goulburn-Murray groundwater sustainable diversion limit

The Murray-Darling Basin Authority is required to publish a register of the amount of water taken each year across the basin. Further information on this process and how MDBA and basin states will respond to non-compliance with sustainable diversion limits can be found in *Sustainable Diversion Limit Reporting and Compliance Framework – Summary* (Murray-Darling Basin Authority, 2018).

3. Surface water

3.1 Determination of permitted and actual take

Under section 10.10(1) of the Basin Plan, Victoria's North and Murray Water Resource Plan is required to set out the method for determining permitted take for each form of take in the water resource plan areas.

The Basin Plan, section 6.10, defines permitted take to be the maximum volume of water permitted to be taken by each form of take for consumptive use from the sustainable diversion limit resource unit. Section 6.10 defines actual take as the sum of the volume of water actually taken by each form of take for consumptive use from the SDL resource unit.

Permitted take is determined for each form of take using the methods detailed here. The method for determining permitted take will be applied at the end of each water accounting period (yearly), using the best available information at the time.

The Victorian Murray water resource plan area and the Northern Victoria water resource plan area consider the following forms of take:

- take from a regulated river (excluding basic rights)
- take from a watercourse (excluding basic rights)
- take from a regulated river under basic rights
- take from a watercourse under basic rights
- take by runoff dams (excluding basic rights)
- take by runoff dams under basic rights
- net take by commercial plantations

Actual take is the water diverted or taken by water users from the resource or system to be stored or used. [Chapter 5](#) on Measuring and monitoring of the Victoria's North and Murray Water Resource Plan Comprehensive Report discusses actual take and how take is metered or measured.

Section 10.15 of the Basin Plan requires that Victoria's North and Murray Water Resource Plan sets out how the volume of water actually taken for consumptive use will be determined for each form of take within each SDL resource unit.

Actual take must be assessed against permitted take and the difference is recorded as either a debit or credit. The cumulative volume of water actually taken cannot exceed or equal a debit of 20 per cent of the sustainable diversion limit.

The following sections provide a summary of the water management framework and assessment tools used to determine actual take and permitted take for above forms of take. [Table 6](#) outlines the methods used for determining actual and permitted take for each form of take in the Northern Victoria water resource plan area and the Victorian Murray water resource plan area.

The methods for permitted take outlined in [Table 6](#) apply to all surface water SDL resource units under Victoria's North and Murray Water Resource Plan, except for take from a regulated river (excluding basic rights), where there is a separate method for the combined Victorian Murray SDL resource unit and for the combined Northern Victoria SDL resource unit.

Where the form of take relates to take under a Victorian entitlement (water access right), the Victorian water management framework has measures in place to make sure that actual take during the accounting period responds to water availability during that same period. These mechanisms are outlined in this section.

For forms of take that rely on the estimation of use because they are not actively monitored, and take is not metered, the tools used to estimate the volume of actual use are also outlined here.

Table 6: Methods for determining permitted take—surface water

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
1	<p>Take from a regulated river (excluding basic rights)</p>	<p>The method used for determining permitted take from a regulated river (excluding basic rights) in the Victorian Murray (SS2), Kiewa (SS3) and Ovens (SS4) SDL resource units includes the <Source Murray Model/- TBC> which was developed by:</p> <ul style="list-style-type: none"> Updating the BDL model with known operating changes since 30 June 2009 <model details TBC - currently under development in consultation with MDBA> <p>Model outputs are then adjusted:</p> <ul style="list-style-type: none"> <TBC - adjustment for trade> <TBC - adjustment for environmental water recovery> 	<p>The actual take for the Victorian Murray (surface water) resource plan area is the sum of all diversions taken under an entitlement from a regulated river excluding take of environmental water held (or HEW) by VEWH and CEWH as recorded in the Victorian Water Register as of 30 June in each year.</p>	<p>The model is based on policy and operating rules that are applicable from 1 July 2019 and it therefore consistent with the other provisions of the water resource plan.</p>

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
2	<p>Take from a regulated river (excluding basic rights)</p>	<p>The method used for determining permitted take from a regulated river (excluding basic rights) in the Goulburn (SS6), Broken (SS5), Campaspe (SS7) and Loddon (SS8) SDL resource units includes an interim WRP model which was developed by:</p> <ul style="list-style-type: none"> Updating the BDL model with known operating changes since 30 June 2009 (reserve rules, carryover and change in storage volume) Scaling modelled diversions to match the BDL minus recovery included in the model (note: where no recovery is included, this is equivalent to the BDL) <p>The interim WRP model will be used at the end of each year as follows:</p> <ol style="list-style-type: none"> 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 the 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 and adjusting it for: <ul style="list-style-type: none"> Any water recovery not included in the model using a scaling method that accounts for different entitlement types; and adjusting for any trade based on data from the Victorian Water Register. 	<p>The actual take for the Northern Victoria (surface water) water resource plan area is the sum of all diversions taken under an entitlement from a regulated river excluding take of environmental water held (or HEW) by VEWH and CEWH as recorded in the Victorian Water Register as of 30 June in each year.</p>	<p>The interim model is based on policy and operating rules that are applicable from 1 July 2019 and it therefore consistent with the other provisions of the water resource plan.</p> <p>The method described in column 2 will be used to determine annual permitted take until better information is available to allow WRP conditions to be modelled to a satisfactory level of certainty.</p>
<p>This method applies to the following SDL resource units: Goulburn (SS6), Broken (SS5), Campaspe (SS7) and Loddon (SS8) located in the Northern Victoria water resource plan area</p>				

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
3	Take from a watercourse (excluding take under basic rights)	Permitted take is equal to the sustainable diversion limit. The SDL equals the baseline diversion limit and the method for determining the BDL is based on the maximum licensed entitlement volume of specific unregulated bulk entitlements and take and use licences, as taken from the Victorian Water Register as at July 2016.	The actual take for the Victorian Murray (surface water) water resource plan area and the Northern Victoria (surface water) water resource plan 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.	<p>The SDL method is the best available information. No new surface water entitlements have been issued in unregulated waterways in the Victorian Murray water resource plan area or the Northern Victoria water resource plan area since 30 June 2009. Register data from 2016 was used as the best estimate of entitlement volume as at 30 June 2009 as there may have been minor changes to data records in the register since 2010 to fix errors in electronic records. July 2016 - the date when this estimate was developed initially - is the best available estimate of 30 June 2009 entitlements.</p> <p>Victoria's position is that permitted take equals the SDL to allow Victorian water users the ability to fully use all water available under the prescribed SDL.</p> <p>It is not cost-effective or fit-for-purpose to develop a simulation model for the small volume of the SDL that applies to this form of take. The method proposed is considered to be fit-for-purpose and has appropriate regard to the water resources available in the water accounting period for this form of take.</p> <p>The method excludes take and use licences that are included in the estimates for take by runoff dams (excluding basic rights).</p>
<p>Methods apply to all SDL resource units in the Northern Victoria water resource plan area and Victorian Murray water resource plan area</p>				

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
4	<p>Take from a regulated river under basic rights</p> <p>Take from a watercourse under basic rights</p>	<p>Estimated as the sum of:</p> <ul style="list-style-type: none"> 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/ha of land grazed. The modelled estimate includes an allowance for growth and uncertainty; and 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 <i>Traditional Owner Settlement Act 2010</i>. 		<p>This is the baseline diversion limit (BDL) method. Water taken under this form of take can only be used for stock and domestic or in accordance with a section 8A right and represents a relatively consistent pattern of use compared to commercial uses of water. As such, the volume of water taken is not expected to vary greatly from year to year. The method to determine annual permitted take is based on estimates of the long-term average of water taken each year having regard to the water resources available in the water accounting period. This is explained in Stock and Domestic Water Use Modelling Resource Manager's Handbook (RMCG, 2011) and is based on best available information. The method for determining permitted take and actual take is fit-for-purpose for this form of take. The number of properties with access to a main waterway is determined in accordance with GIS modelling. A review of the number of properties will be conducted five yearly, to account for any subdivisions.</p> <p>To date there has been no water taken under section 8A of the Victorian Water Act in the Northern Victoria water resource plan area. For this reason, an estimate has been made of the expected demand for the Northern Victoria water resource plan area or the Victorian Murray water resource plan area. Further work is being undertaken in response to Part 14 of Chapter 10 of Basin Plan to build capacity of Aboriginal communities and explore how section 8A can be utilised. As the level of take increases the method will be reviewed to consider whether it needs to be amended. Where take under basic rights increases to a level that may impact on compliance with sustainable diversion limits, section 10.13 of the Basin Plan applies (for more information see Chapter 9 of Victoria's North and Murray Water Resource Plan Comprehensive Report).</p>

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
5	Take by runoff dams (excluding basic rights)	<p>Sum of the total volume of licences and registrations associated with runoff dams based on a fixed annual volume in the Victorian Water Register as at July 2016.</p> <p>Note: Total volume of licences and registrations refers to the maximum volume authorised to be taken under take and use licences and registration licences.</p>		<p>This is the baseline diversion limit method. The method for determining permitted take and actual take is fit-for-purpose for this form of take and has appropriate regard to the water resources available in the water accounting period for this form of take. This is the volume of existing entitlements as at 30 June 2009 based on data from the Victorian Water Register as at July 2016. Information on the register is considered to be the best available information regarding entitlements in Victoria, and no further licences or registrations for runoff dams have been issued since 30 June 2009. Further information on runoff dams can be found in Chapter 11 on Interception in the Victoria's North and Murray Water Resource Plan comprehensive report.</p> <p>Bulk entitlements are not included as no bulk entitlements have been issued for this form of take in the Northern Victoria water resource plan area or the Victorian Murray water resource plan area.</p>

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
6	Take by runoff dams (basic rights)	<p>Estimate is based on modelling using the number and volume of dams shown in aerial imagery as at 2005, adjusted to ensure that dams which are associated with entitlements which are not basic rights are fully excluded. Entitlement information was adopted as given in the Victorian Water Register as at July 2016.</p>		<p>As forecast information is not reliable at the present time and introduces additional uncertainty into the estimate, the 2005 aerial imagery is considered to be the best available information for the BDL estimate.</p> <p>Changes in the extent of runoff dams within the Northern Victoria water resource plan area or the Victorian Murray water resource plan area will be determined using aerial imagery periodically at least every 10 years. This information is proposed to be reviewed at least every 10 years as part of the review of Victoria's sustainable water strategies and the plan will be amended as required to reflect any update in the method.</p> <p>Water taken under this form of take can only be used for stock and domestic, or where a section 8A right applies, and represents a relatively consistent pattern of use compared to commercial uses of water. As such, the volume of water taken is not expected to vary greatly from year to year, and the method for permitted take uses the long-term averages taken. The method for determining permitted take and actual take is fit-for-purpose for this form of take.</p>

Item	Form of take	Permitted take (accredited text for 10.10(1))	Actual take (accredited text for 10.15(1))	Best available information
7	Net take by 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. 2009 is considered the best available data and best available evidence suggests that this has not changed. The long-term average rate of evapotranspiration will be estimated using the SoilFlux model.		<p>Victoria's estimate is based on modelling recently undertaken by DELWP, whereas the Basin Plan volume was an estimate prepared by the MDBA. The method is based on the SoilFlux model, which is considered to be the best available information.</p> <p>Changes in the extent of plantations within Northern Victoria water resource plan area or the Victorian Murray water resource plan area will be determined using information that is provided on an annual basis by the managers and owners of large plantation estates for bushfire and emergency management purposes. This information will be reviewed every ten years subject to any significant changes in the industry which would cause a review to occur earlier.</p> <p>Take by this form is relatively consistent from year to year, and the method uses the long-term average rate of evapotranspiration to calculate take. The method has appropriate regard to the water resources available in the water accounting period.</p>

3.1.1 Consistency with permitted take method

Section 10.15(3) of the Basin Plan also requires that the determination of actual take where it is estimated is done consistently with the method used to determine permitted take. [Table 6](#) identifies the methods for actual and permitted take. For all forms of take where actual take is estimated, the same method is used to determine permitted take.

3.1.2 Managing forms of take under methods for permitted take

3.1.2.1 Take from regulated rivers (excluding under basic rights)

This form of take accounts for the largest proportion of total surface water take in the Northern Victoria water resource plan area and the Victorian Murray water resource plan area.

The seven declared water systems covered in the water resource plan areas are the Murray, Ovens, Broken, Goulburn, Campaspe, Bullarook and Loddon. These systems have been declared in accordance with section 6A of the Victorian Water Act.

In a declared water system, individual water rights and take and use licences have been converted into unbundled entitlements, which means individuals hold water shares, water-use licences or water-use registrations, and works licences or delivery shares.

Goulburn-Murray Water (GMW) is the Authority appointed under section 64GA of the Victorian Water Act to make seasonal determinations in these systems. GMW is responsible for determining the volume of water available to entitlement holders each year in the regulated river systems of the Victorian Murray water resource plan area and the Northern Victoria water resource plan area.

Seasonal determinations are made by Goulburn-Murray Water regularly throughout the season and these inform entitlement holders of the percentage of their entitlement that is available to them in the current year.

Seasonal determinations are based on a water budget which accounts for how much water is in the dams and the expected inflows over a planning period. It also accounts for the volume of water already allocated (i.e. in the current year, carried over from previous years, or water held in inter-valley trade accounts), losses from storages, river and channels, passing flows, reserves for the following year and supplements.

The method for making seasonal determinations is set out in Goulburn-Murray Water's bulk entitlements for each system.

Detailed calculation methods are set out for the larger systems as:

- Murray System: Schedule 3 of Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999
- Goulburn System: Schedule 8 of Bulk Entitlement (Eildon-Goulburn Weir) Conversion Order 1995
- Loddon System: Schedule 4 of Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005

In the Goulburn and Murray systems, an early reserve exists to improve the security of system operations. Under the early reserve rule for each system, when seasonal determinations against high-reliability water shares for the current season reach 30 per cent, half of the further resource improvements are reserved for the following season until specific volumes are set aside. The volume is 270 GL in the Goulburn system and 218 GL in the Murray system. This water is set aside for the following year's water balance.



In the Campaspe and Loddon systems, if full allocation to high-reliability entitlements is possible where the seasonal determination is 100 per cent high-reliability water shares, the water budget is calculated over a two-year period. This means inflows and commitments to the end of the following season are considered. This is a less secure reserve than the Goulburn and Murray systems, but it creates some reserves to secure operating water the following year if conditions turn dry.

In the Broken and Bullarook systems, once seasonal determinations reach 100 per cent high-reliability water shares, additional resource is attributed to increasing allocation of low-reliability water shares, up to 100 per cent.

Victoria's seasonal determination policy is where possible to secure the following year's allocation of high-reliability entitlements before making seasonal determinations to low-reliability entitlements. The security of our high-reliability entitlements has supported the development of high-value irrigated agriculture in Victoria.

These methods are replicated in the models used as part of the method for determining annual permitted take at the end of each year, and this is how the method responds to water availability as required under section 10.10(2) of the Basin Plan.

Method and models for Victoria's North and Murray water resource plan

Hydrological models are used as part of the method for determining permitted take from regulated rivers (excluding basic rights). The models are further described in [Table 6](#) and the key model runs are listed in [Table 7](#).

Method for Victorian Murray, Kiewa and Ovens SDL resource units

This method has been developed in consultation with the Murray-Darling Basin Authority for the Victorian Murray, Kiewa and Ovens SDL resource units and the details are still under development.

Method for Goulburn, Broken, Campaspe and Loddon SDL resource units

Victoria is developing a water resource plan model (WRP model) that will include all water recovery and an assumption of how recovered environmental water is used. At the time of accrediting the Victoria's North and Murray Water Resource Plan, there were uncertainties in modelling some projects that were still in progress, such as Goulburn-Murray Water Connections Project and New Goulburn Constraints Measure. Additionally, there was uncertainty in the how recovered environmental water would be used.

Until the better information is available to allow these conditions to be modelled to a satisfactory level of certainty, the method for determining permitted take uses an interim WRP model (interim model) developed from the BDL model. The interim model will reflect the best available knowledge of water resource plan conditions post 30 June 2019, but without Basin Plan water recoveries. It may include some Basin Plan water recoveries if these are deemed to have been recognised and/or formalised, and modelling details for these recoveries have been agreed upon at the time of application of this method. The interim model will have average annual diversions under historical climate conditions equal to the baseline diversion limit if no water recovery is included, or equal to the BDL adjusted for modelled water recoveries if some are included. This model can be used to determine annual permitted take through the appropriate scaling of modelled diversions to adjust for water recoveries not included in the model.

Any changes to infrastructure or operational rules that impact on the application of the interim model to adequately determine permitted take during the life of the Victoria's North and Murray Water Resource Plan will be considered in accordance with the review process outlined at [section 1.7](#) of the Comprehensive Report.

Table 7: Model runs documented in the modelling technical reports

Run description	Key files	Consumptive demands	Model run period	Analysis period
Model for Victorian Murray, Kiewa and Ovens SDL resource units				
Interim model	TBC	TBC	Jan 1891–June 2018	July 1895 – June 2009
BDL model	TBC	TBC	Jan 1891–June 2018	July 1895– June 2009
Model for Goulburn, Broken, Campaspe and Loddon SDL resource units				
Interim model	TBC	TBC	TBC	July 1895 – June 2009
BDL model	TBC	TBC	TBC	July 1895 – June 2009

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

This form of take relates to take from unregulated rivers (excluding basic rights). The permitted take is determined by the volumes of all bulk entitlements and section 51 take and use licences for unregulated rivers of the relevant SDL resource unit.

This method is further outlined in [Table 6](#) and is considered appropriate because:

- the upper limit of take from a watercourse is a small fraction of the sustainable diversion limit volume for the largest SDL resource units by consumptive volume in the Victorian Murray and Northern Victoria water resource plan areas
- the existing simulation model for the Goulburn, Broken, Loddon and Campaspe systems does not include take on these unregulated streams. Victoria does not support the development of a new simulation model suitable for determining annual SDL compliance for this component of take because of the high cost associated with a very limited return
- the bulk entitlements specify rules that limit take at each of the diversion points, 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
 - volumetric limits on take.
- the take and use licences are required to comply with:
 - local management plans and water supply protection area water management plans and their respective rules, restriction and bans.

3.1.2.3 Take from a regulated river and watercourses under basic rights

Basic rights are defined under the Basin Plan to include rights to take water for domestic and stock purposes and Traditional Owner rights. Under Victorian legislation, basic rights are prescribed in section 8 of the Victorian Water Act and Traditional Owner’s rights are described in section 8A of the Victorian Water Act.

Under section 8, waters users have a right to take water, free of charge, from a waterway for domestic and stock purposes under prescribed circumstances. In general terms, a person can exercise that right if they occupy the land over which the water is flowing, or their land is next to



a waterway of which the bed and banks remain the property of the Crown. See [Chapter 7](#) of the Comprehensive Report for more detail on basic rights.

The right of Traditional Owners to take water under section 8A where the Traditional Owners have a natural resource agreement under the *Traditional Owner Settlement Act 2010* aligns with the requirements under section 8 regarding the circumstances in which the right can be exercised.

Traditional Owner rights to take water under section 8A are outlined in more detail in [Chapter 7](#) of the Comprehensive Report. At the time of producing this report there are no circumstances of Traditional Owner groups exercising this right in the Northern Victoria water resource plan area. However, this may change as a result of the implementation of the Aboriginal Water policy outlined in *Water for Victoria*.

Take under basic rights is generally not metered and the volume of take is difficult to estimate precisely. Take under this right may be metered in circumstances where bores or pumps are used to take water for other purposes under an entitlement, along with water taken under domestic and stock rights. 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.

While take under this right is not metered, the total take is relatively small. Water taken under this right cannot be used for commercial purposes and most of the regulated parts of the Northern Victorian rivers and their tributaries are covered by a Crown Reserve. As a result the landowners who are separated from the waterway by Crown land are not eligible to exercise the right under section 8 of the Victorian Water Act.

Also because of irregular seasonal flows in this region, the majority of stock and domestic take in these circumstances is likely to be harvested and stored in runoff dams, which are already included as a separate form of take.

3.1.2.4 Take by runoff dams (excluding basic rights)

Runoff dams, often referred to in Victoria as small catchment dams, are small dams not located on a defined watercourse. Runoff dams used for commercial and irrigation purposes are required to be licensed or registered in Victoria. Refer to [Chapter 11](#) of the Comprehensive Report for further details on runoff dams.

Some hydrologic modelling of this form of take was done as part of addressing take by runoff dams under basic rights. Due to significant uncertainties in the modelling, the modelled results were not used. Instead, the recorded entitlement volume was considered to be the best available estimate of the 'long-term annual average limit' of take as required by Schedule 3 of the Basin plan for this form of take.

The annual volume of water authorised to be taken by these runoff dams by individuals is estimated to be 61,600 ML in the Northern Victoria water resource plan area and 21,800 ML in the Victorian Murray water resource plan area. The estimate was obtained from the Victorian Water Register as of July 2016.

3.1.2.5 Take by runoff dams under basic rights

Under section 8 of the Victorian Water Act, occupiers of land may take water free of charge for domestic and stock use under prescribed circumstances. As with other section 8 rights, the take is not required to be metered.

Victoria has estimated the number and volume of runoff dams used for domestic and stock purposes in the Northern Victoria water resource plan area and Victorian Murray water resource plan area, and also the total annual extraction which varies with climatic conditions. These

estimates were made from desktop studies and hydrologic modelling using maps and aerial photographs from 2005.

Many dams identified in aerial photographs were already licensed and so were already counted as a different form of take. These licensed dams were separated, based on the data available, to avoid double counting of take.

The annual volume of water authorised to be taken by unlicensed runoff dams used for stock and domestic (basic rights) purposes is 61,600 ML within the Northern Victoria water resource plan area and 23,700 ML within the Victorian Murray water resource plan area.

When estimating the volume of permitted take and actual take for runoff dams under basic rights, the volume determined does not represent a legislative limit for take under section 8 rights. The Victorian Water Act does not set a volumetric limit on the right to take water under section 8. The right to take water under section 8 is limited by the method of access and the purposes for which the water may be used.

3.1.2.6 Net take by commercial plantations

Commercial plantations are a significant industry in the Upper Murray, Kiewa and Ovens valleys, but less so in other valleys in the Victorian Murray and Northern Victoria water resource plan areas. Plantations depend on rainfall and typically occur in regions with more than 600 to 800 mm of annual rainfall (SMEC, 2010). Sufficient rainfall for commercial timber plantations occurs only in the eastern parts of the Victoria's North and Murray water resource plan areas.

Commercial plantations cover an area of 667 km² of the Northern Victoria water resource plan area and this plantation area has remained stable since 2009. A small reduction occurred in the Goulburn River basin, where the area of plantations decreased by 3km² since 2009. In all other areas, there was no change in the area of plantations between 2009 and 2016.

Where a small reduction did occur in the Goulburn River basin, this change will increase runoff and recharge at a small local scale where plantations have been removed, and therefore reduce interception, depending on what replaces the plantations. Little or no growth in commercial plantations or the scale of existing plantations is expected to occur over the next decade, so interception by commercial plantations is expected to remain equal to 2009 levels.

The effect of commercial forestry plantations on the water balance in the Northern Victoria water resource plan area and Victorian Murray 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. The long-term average rate of evapotranspiration will be estimated using the SoilFlux model.

The long-term annual average net take by commercial plantations is estimated to be 77,000 ML in the Northern Victoria water resource plan area, and 31,500 ML in the Victorian Murray water resource plan area.

3.2 Accounting for water availability

Section 10.10(2) of the Basin Plan requires the method to be designed to 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 on a monthly basis throughout the accounting period. Water available



during the period is accounted for in the models used as part of the method to determine permitted take at the end of the period, based on seasonal conditions in the preceding year and the allocation rules detailed in [section 3.1.2.1](#) and [Table 8](#) of this report.

For take from watercourses that are not regulated rivers, excluding take under basic rights, the method is based on the sum of the entitlement volumes so the permitted take method does not vary annually. Actual take in this circumstance will be adjusted by measures that respond to water shortages as outlined in [Chapter 10](#) of the Comprehensive Report.

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. As a result, the method for permitted take does not take into account water availability on an annual basis.

3.3 Matters accounted for in the permitted take method (10.12)

The matters identified in section 10.12 of the Basin Plan are accounted for in the methods proposed for determining the maximum volume of water that the plan permits to be taken for consumptive use during a water accounting period. [Table 8](#) outlines how the matters were taken into account (the alphabetical numbering corresponds to the paragraph numbering in section 10.12 of the Basin Plan).

Table 8: Matters relating to accounting for water (surface water)

	Section 10.12(1) Basin Plan	How the matters were accounted for by the requirements methods for determining permitted take
(a)	All forms of take from the SDL resource unit and all classes of water access right	<p>For the Northern Victoria water resource plan area and the Victorian Murray water resource plan area all forms of take from each SDL resource unit and all classes of water access rights are accounted for by the methods specified for the purposes of 10.10(1), as detailed in section 3.1 of this report. The classes of water access right accounted for by the methods are:</p> <ul style="list-style-type: none"> • bulk entitlement, environmental entitlement, water share and take and use licence (take from a regulated river and a watercourse) • take and use licence (runoff dams excluding basic rights) • section 8 and section 8A rights to take water (basic rights)

	Section 10.12(1) Basin Plan	How the matters were accounted for by the requirements methods for determining permitted take
(b)	Water allocations that are determined in one water accounting period and used in another, including water allocations that are carried over from one water accounting period to the next (also referred to as carryover)	<p>Carryover applies to take from a regulated river (excluding basic rights). It is enabled in all of the regulated surface water systems of Northern Victoria and Victorian Murray water resource plan areas, except the Ovens system where storages are too small to support carryover.</p> <p>Carryover is accurately accounted for in the model for the form of take being taken from the relevant regulated rivers.</p> <p>Under the relevant bulk and environmental entitlements, carryover is accounted for and included when the appointed authority Goulburn-Murray Water makes seasonal determinations.</p> <p>Carryover is not relevant to other forms of surface water take.</p>
(c)	For a surface water SDL resource unit, return flows must be taken into account in a way that is consistent with arrangements under the Murray–Darling Basin Agreement immediately before the beginning of the Basin Plan	<p>Return flows are enabled in the regulated rivers of the Northern Victoria and Victorian Murray water resource plan areas under bulk and environmental entitlements held by the VEWH and water corporations.</p> <p>Goulburn-Murray Water, as the Resource Manager in the regulated river systems, is required to approve any return flow credits if the application meets the conditions outlined in the bulk entitlement. Return flows are accounted for and included in the equation used by Goulburn-Murray Water, as the authority appointed to make seasonal determinations.</p>
(d)	Trade of water access rights	<p>For take from a regulated river (excluding basic rights) the models used as part of the method for determining permitted take account for legacy exchange rate trade from the Goulburn (as at 30 June 2009) using the IVT account and tagged trade from the Goulburn is modelled as an end of system demand.</p> <p>All other changes to entitlements or allocation as a result of trade is recorded in the VWR and is taken into account in the method used to determine permitted take for both take from a regulated river (excluding basic rights) and take from a watercourse (excluding basic rights). This includes separate accounting of held environmental water (section 10.12(3)).</p> <p>The trade of water from consumptive use to HEW or from HEW to consumptive use will not impact on the methods used to determine permitted take under section 10.10 of the Basin Plan since the net balance of any disposals or acquisitions of HEW will be used to adjust the permitted take.</p>

	Section 10.12(1) Basin Plan	How the matters were accounted for by the requirements methods for determining permitted take
(e)	<p>Water resources which have a significant hydrological connection to the water resources of the SDL resource unit</p>	<p>The Kiewa, Ovens, Goulburn, Campaspe and Loddon (Bullarook) rivers are natural waterways that flow into the River Murray. Further, part of the flow in the Broken river may also flow into the River Murray as the Broken River splits at Casey's Weir and the main branch (west branch), the continuation of the Broken River, flows into the Goulburn River and then to the River Murray. The east branch flows north and directly into the River Murray.</p> <p>Surface water transfers via infrastructure from the Goulburn River to the Murray, Campaspe and Loddon Rivers are included in the method for determining permitted take for regulated systems (excluding basic rights).</p> <p>Details of other significant hydrological connections for the Northern Victoria and Victorian Murray water resource plan areas can be accessed at the Victorian Water Register where there are details in bulk entitlements about supplements and are explained in Chapter 4 of the Comprehensive Report.</p>
(f)	<p>Circumstances in which there is a change in the way water is taken or held under a water access right</p>	<p>The method used to determine permitted take for regulated rivers (excluding basic rights), includes simulation of environmental demand patterns that differ from previous consumptive demand patterns. The impacts of changes in consumptive demand patterns will be taken into account, like a result of any future trade or conversion of additional water savings to held environmental water. This will be done by adjusting permitted take for trade of allocation in a single year or in updates to the method and water resource plan as a result of any permanent changes.</p>

	Section 10.12(1) Basin Plan	How the matters were accounted for by the requirements methods for determining permitted take
(g)	<p>Changes over time in the extent to which water allocations in the unit are used.</p> <p>Note: Paragraph (g) includes what is commonly known as a growth-in-use strategy</p>	<p>For take from regulated rivers (excluding basic rights), Victoria allocates water in a system based on an assumption of full use and meeting required reserves for the following water year. The total licensed volume of entitlements is included in the models used in the method and the models replicate allocation rules used in the seasonal determinations.</p> <p>Analysis done until now does not indicate any growth in use. Any changes to this will be resolved through the reasonable excuse provision under MDBA's reporting and compliance framework (Murray-Darling Basin Authority, 2018). The MDBA framework allows for further investigation to be undertaken if cumulative annual actual take exceeds 20 percent of the sustainable diversion limit. If the investigation determines an exceedance is the result of increased utilisation under the allocation framework, Victoria will consult with stakeholders on appropriate corrective actions.</p> <p>For example, subsequent allocations could take into account any excess take that must be accounted for, similar to clauses in declared system bulk entitlements that require corrective actions to be implemented to mitigate non-compliance with consumptive diversion limits.</p> <p>For take from watercourses (excluding basic rights), the full volume of entitlement is permitted to be taken, therefore, growth-in-use is not applicable to this form of take.</p> <p>For take under basic rights, where there is growth in use that may affect compliance with sustainable diversion limits, section 10.13 of the Basin Plan applies (for more information see Chapter 9 of the Comprehensive Report).</p>
(h)	<p>Water sourced from the Great Artesian Basin and released into a Basin water resource, by excluding that water.</p>	<p>This matter is not relevant to the Northern Victoria and Victorian Murray water resource plan areas.</p>
(i)	<p>Water resources which are used to manage aquifer recharge.</p>	<p>This matter is not relevant to the Northern Victoria and Victorian Murray water resource plan areas.</p>

3.4 Demonstration of method

Section 10.10(4) of the Basin Plan requires that Victoria's North and Murray Water Resource Plan sets out a demonstration that the method relates to the sustainable diversion limit of each resource unit in such a way that, if applied over a repeat of the historical climate conditions, it would result in the meeting of the SDL for the resource unit. This includes amendments under section 23B of the Commonwealth Water Act.

3.4.1 Take from a regulated river (excluding basic rights)

The methods for determining take from a regulated river (excluding basic rights) as explained in [Table 6](#) are scaled to ensure that under historical climate conditions (1985–2009), the long-term average diversions are equal to the sustainable diversion limit.

This includes the scaling adjustments for any recovered entitlements that are not explicitly included in the model.

The sustainable diversion limit is defined on 30 June of the preceding water year based on the target recovery (see [Table 4](#) for take from a regulated river (excluding basic rights)).

3.4.2 All other forms of take

In Victoria, the method for determining permitted take is the same method used for determining the sustainable diversion limit for all other forms of take. This means that methods are based on the same climate sequences and therefore the permitted take method would always produce the same result as the SDL model. Therefore, the requirement under section 10.10(4) of the Basin Plan is considered satisfied for all forms of surface water take.

Given that Victoria is required to run the method for permitted take on an annual basis, only the long-term average of permitted take can be compared to the sustainable diversion limit to demonstrate compliance with SDLs over the life of the Victoria's North and Murray Water Resource Plan.

[Table 9](#) and [Table 10](#) identify the same volumes for sustainable diversion limit and long-term average permitted take on the basis that the methods for calculating permitted take and SDL are identified and based on identical climate sequences, and therefore always provide the same result.

Table 9: SDL volume and permitted take volume (10.10(4) Basin Plan) for Victorian Murray water resource plan area

Form of take	Victorian Murray		Kiewa	
	SDL (ML)	Long-term average permitted take (ML)	SDL (ML)	Long-term average permitted take (ML)
Take from a regulated river (excluding basic rights)	TBC*			
Take from a watercourse (excluding basic rights)	14,910	14,910	16,072	16,072
Take from a waterway under basic rights which includes: <ul style="list-style-type: none"> take from a regulated river under basic rights take from a watercourse under basic rights 	8,089	8,089	982	982
Take by runoff dams (excluding basic rights)	4,832	4,832	4,531	4,531
Take by runoff dams under basic rights	7,605	7,605	3,680	3,680
Take by commercial plantations	24,163	24,163	7,303	7,303

*See [ssection 3.4.1](#) – demonstration cannot be established until the model is finalised in consultation with the MDBA

Table 10: SDL volume and permitted take volume (10.10(4) Basin Plan) for Northern Victoria water resource plan area

Form of take	Ovens		Goulburn		Broken		Campaspe		Loddon	
	SDL (ML)	Long-term average permitted take (ML)	SDL (ML)	Long-term average permitted take (ML)	SDL (ML)	Long-term average permitted take (ML)	SDL (ML)	Long-term average permitted take (ML)	SDL (ML)	Long-term average permitted take (ML)
Take from a regulated river (excluding basic rights)	See section 3.4.1									
Take from a watercourse (excluding basic rights)	16,623	16,623	46,514	46,514	3,862	3,862	1,028	1,028	21,217	21,217
Take from a waterway under basic rights which includes: <ul style="list-style-type: none"> take from a regulated river under basic rights take from a watercourse under basic rights 	2,843	2,843	6,321	6,321	1,569	1,569	1,546	1,546	4,814	4,814
Take by runoff dams (excluding basic rights)	12,518	12,518	27,099	27,099	10,394	10,394	6,096	6,096	18,057	18,057
Take by runoff dams under basic rights	12,449	12,449	24,356	24,356	6,261	6,261	14,399	14,399	16,578	16,578
Take by commercial plantations	32,475	32,475	22,401	22,401	14,871	14,871	1,753	1,753	5,507	5,507

4. Groundwater

4.1 Determination of permitted take and actual take

4.1.1 Permitted take

Under section 10.10 of the Basin Plan, Victoria's North and Murray 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. The method for determining permitted take must be applied at the end of each accounting period (yearly). Actual take must be assessed against permitted take to ensure that the volume of water actually taken during the year does not exceed permitted take and therefore will not exceed the sustainable diversion limit.

The Basin Plan at section 6.10 defines permitted take to be the maximum volume of water permitted to be taken by each form of take for consumptive use from the sustainable diversion limit resource unit. Section 6.10 defines actual take as the sum of the volume of water actually taken by each form of take for the consumptive use from the SDL resource unit.

The determination of permitted take in the Goulburn-Murray water resource plan area varies depending on the form of take. [Table 8](#) outlines the methods used for determining permitted take for each form of take in the Goulburn-Murray water resource plan area.

4.1.2 Actual take

The Basin Plan (section 10.15) requires that a water resource plan set out how the volume of water actually taken will be determined after the end of the water accounting period, using the best information available.

Actual take of groundwater incorporates entitlement use as recorded in the Victorian Water Register and estimates of domestic and stock use (basic rights). The method incorporates information from the register, which is considered to have the most accurate information regarding the inputs into the method.

Water used as part of a Managed Aquifer Recharge (MAR) Scheme is not relevant to the Goulburn-Murray water resource plan area where there are no MAR schemes operating. At such time as MAR schemes do operate this will be incorporated into the accounting of actual take in accordance with the estimated net take of groundwater and surface water.

4.1.3 Managing and determining take in the Goulburn-Murray

In the Goulburn-Murray water resource plan area there are these forms of take:

- take from an aquifer (excluding basic rights)
- take from an aquifer under basic rights

These forms of take are prescribed as 'take from groundwater' under the Basin Plan. For this reason, the tables in this report refer to take from groundwater when providing the methods and volumes for sustainable diversion limit and permitted take to meet Basin Plan requirements.

Victoria uses its Water Register to account for all groundwater entitlements and groundwater use. This public register of all water-related entitlements in Victoria was designed and built to record water entitlements with integrity and provide crucial information for managing the state's water resources.



For the 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 Goulburn Murray water resource plan area. This is made up of the Goulburn Murray Highlands SDL resource unit, the Goulburn Murray Sedimentary Plain SDL resource unit, the Goulburn Murray Shepparton Irrigation Region SDL resource unit and the Goulburn Murray deep SDL resource unit. Victoria manages the resource and licensing within this water resource plan area.

The groundwater management framework is applied by Victoria for accounting and reporting purposes and this does not align exactly with the four Goulburn Murray SDL groundwater resource units specified in the Goulburn–Murray water resource plan area.

Work is progressing to enable the Victorian Water Register to generate the report on the volume of groundwater taken from each respective SDL resource unit in the Victoria’s North and Murray Water Resource Plan, including trade and carryover.

The Victorian Government plans to enable reporting at the scale of the water resource plan SDL units. This will help with the relevant MDBA trading rules where applicable and reporting on compliance with the Basin Plan SDL unit for groundwater in the future.

4.1.3.1 Take from an aquifer (excluding basic rights)

Take from an aquifer is managed through Victoria’s entitlement framework, except where it is under a basic right, and 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 by all users, to prevent third party impacts from extraction and to protect the resource and environment.

4.1.3.2 Take from an aquifer under basic rights

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 section 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. In general terms, people or businesses can exercise that right if they own the land on which the bore is located. See [Chapter 7](#) for detail on basic rights.

Take under section 8 is generally not metered and the volume 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, the works only provide 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.

The right of Traditional Owners to take water under section 8A aligns with the requirements under section 8 regarding the circumstances in which the right to take can be exercised.

Traditional Owner rights to take water under section 8A are outlined in more detail at [Chapter 7](#). At the time of producing this report there are no circumstances of Traditional Owner groups

exercising this right in the Goulburn-Murray water resource plan area. However, this may change as a result of the implementation of the Aboriginal Water Policy outlined in *Water for Victoria*.

4.1.4 Methods

The methods for determining permitted take and actual take of groundwater in the Goulburn-Murray water resource plan area apply to the following forms of take in the following SDL resource units:

- Goulburn-Murray: Shepparton Irrigation Region
- Goulburn-Murray: Highlands
- Goulburn-Murray: Sedimentary
- Goulburn-Murray: deep

Table 11: Methods for determining permitted take and actual take - groundwater

Form of take	Method	Actual take 10.15(1) Basin Plan	Best available information
The methods apply to all groundwater SDL resource units in the Goulburn-Murray water resource plan area			
Take from groundwater (excluding basic rights)	For each SDL resource unit, the permitted take is equal to the SDL as prescribed in schedule 4 of the Basin Plan, minus the take from groundwater under basic rights.	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.	<p>Permitted take for groundwater SDL resource units is determined by the sustainable diversion limit prescribed for the SDL resource unit. This method is considered the most appropriate method as further work is required to determine the most suitable and cost-effective means for determining permitted take for groundwater.</p> <p>Further consultation is occurring between Basin states and the MDBA to progress the development of permitted take methods. In the absence of these methods, it has been agreed between Victoria and the MDBA to refer to the SDL volumes for the respective SDL resource unit for setting permitted take.</p> <p>Actual take reflects entitlements in Victoria as this is how a user is authorised to take water in a given accounting period. Therefore, the water actually taken is equal to the water taken under entitlement for this form of take. The best available information in relation to entitlement use is the Victorian Water Register. This includes metered and estimates for unmetered bores. In Victoria bores greater than 20ML are metered except in the Shepparton Irrigation region GMA where take is estimated for all licences from a sample of metered bores.</p>
Take from groundwater under basic rights	Estimated based on the number of bores in the SDL resource unit less than 30 years old with a rate of 2 ML/year.		<p>This estimate is considered to be based on the best available information. Victoria’s assessment of bores and reasonable domestic and stock use identified:</p> <ul style="list-style-type: none"> • 2 ML/year as a reasonable volume for domestic and stock users and expected to be sufficient on average to allow for any uptake of Traditional Owner rights as permitted under basic rights • 2ML/year allowance is for a typical size farm and may be adjusted to reflect the property size • bores older than 30 years are considered to be non-functional and are excluded from the estimation.

4.2 Matters accounted for in the permitted take method (10.12)

The matters outlined in section 10.12 of the Basin Plan are accounted for in the methods proposed for determining the maximum volume of water that the plan permits to be taken for consumptive use during a water accounting period. The alphabetical numbering corresponds to the paragraph numbering in Basin Plan 10.12.

Table 12: Matters relating to accounting for water (groundwater)

Section 10.12(1) Basin Plan		How the matters were accounted for by the methods requirements for determining permitted take
(a)	All forms of take from the SDL resource unit and all classes of water access right	<p>All forms of take from the SDL resource unit and all classes of water access rights are accounted for by the methods specified for the purposes of 10.10(1).</p> <p>A different method has been developed for each form of take being taken from groundwater (excluding basic rights) and from groundwater under basic rights, as detailed in section 3.1 of this report.</p> <p>The classes of water access right accounted for by the methods are:</p> <ul style="list-style-type: none"> take and use licences (take from groundwater) section 8 and section 8A rights (take from groundwater under basic rights)
(b)	Water allocations that are determined in one water accounting period and used in another, including water allocations that are carried over from one water accounting period to the next, also referred to as carryover	<p>Carryover of groundwater take is permitted in some groundwater management areas and is recorded in the Victorian Water Register.</p> <p>Carryover does not affect the SDL method for permitted take as it is based on the long-term average take and is based on unused allocation from a previous reporting period.</p>
(c)	For a surface water SDL resource unit, return flows must be taken into account in a way that is consistent with arrangements under the Murray–Darling Basin Agreement immediately before the beginning of the Basin Plan	This matter is not relevant for the Goulburn–Murray water resource plan area.

Section 10.12(1) Basin Plan		How the matters were accounted for by the methods requirements for determining permitted take
(d)	Trade of water access rights	<p>Trade of entitlements to take and use groundwater is permitted in the water resource plan and is enabled through the groundwater statutory and local management plans.</p> <p>Groundwater is not held under an entitlement for the environment and therefore the requirement in section 10.12(3) is not relevant for the Goulburn-Murray (groundwater) water. As a result, the only trade that affects the SDL method for permitted take (based on the long-term average take) is trade between SDL resource units. Like all trade, this is recorded in the VWR and will be used to adjust the method for permitted take if any such trade occurs.</p>
(e)	Water resources which have a significant hydrological connection to the water resources of the SDL resource unit	<p>Goulburn Murray groundwater SDL resource units have limited connections to water resources outside the Basin Plan area which are predominantly south of the hydrological divide of the Great Dividing Range. and is not considered to have a significant hydrological connection for accounting purposes and there is no intent to trade between these resources that would affect compliance with the SDL.</p> <p>The groundwater resources in the Goulburn Murray: Sedimentary Plain SDL resource unit has a significant hydrological connection to the Ovens River surface water system however the relatively small volumes extracted from groundwater will be accounted for as groundwater for SDL compliance purposes.</p> <p>The hydraulic connection with the Wimmera Mallee Sedimentary Plain and Highlands SDL resource units are not considered significant for accounting purposes as groundwater flows generally down groundwater catchments and the two WRP areas contain distinct groundwater catchments to purposes of groundwater take and there is no intent to trade between these resources that would affect compliance with the SDL of these resource units.</p> <p>There may be significant hydrological connection with NSW groundwater resources under the Murray River between Yarrawonga and Echuca adjacent to the Katunga and Lower Campaspe WSPAs. Work with NSW will assess the degree of connection and if sufficiently connected, whether trade may be allowed and accounting for this for trade purposes and consequences for compliance with the SDL.</p>
(f)	Circumstances in which there is a change in the way water is taken or held under a water access right	<p>This matter is not relevant to the Goulburn-Murray (groundwater) water resource plan area.</p>

Section 10.12(1) Basin Plan		How the matters were accounted for by the methods requirements for determining permitted take
(g)	<p>Changes over time in the extent to which water allocations in the unit are used.</p> <p>Note: Paragraph (g) includes what is commonly known as a growth-in-use strategy.</p>	<p>This matter is not relevant for the Goulburn-Murray water resource plan area.</p> <p>The SDL method for permitted take allows for growth as full utilisation of existing licences is well below SDL and therefore growth in use is permitted up to this prescribed limit.</p> <p>For take under basic rights, where there is growth in use that may affect compliance with sustainable diversion limits, section 10.13 of the Basin Plan applies.</p>
(h)	Water sourced from the Great Artesian Basin and released into a Basin water resource, by excluding that water	This matter is not relevant to the Goulburn-Murray water resource plan area as there is no water sourced from the Great Artesian Basin.
(i)	Water resources which are used to manage aquifer recharge	This matter is not relevant for the Goulburn-Murray water resource plan area. Currently there are no managed aquifer recharge schemes operating or proposed in the Goulburn-Murray water resource plan area.

4.3 Demonstration of method

Section 10.10(4) of the Basin Plan requires that Victoria’s North and Murray Water Resource Plan set out a demonstration that the method relates to the sustainable diversion limit of each resource unit in such a way that, if applied over a repeat of the historical climate conditions, it would result in meeting the SDL for the resource unit, including as amended under section 23B of the Commonwealth Water Act.

The demonstration or explanation as to how this requirement has been met is outlined in **Table 13** for each method outlined in this report. **Table 11** relates to the methods for determining permitted take for groundwater forms of take.

As Victoria is required to run the method for permitted take on an annual basis, only the long-term average of permitted take can be compared to the SDL to demonstrate compliance with sustainable diversion limits over the life of the plan.

Table 13 identifies the same volumes for SDL and long-term average permitted take on the basis that the methods for calculating permitted take and sustainable diversion limit are identified and based on identical climate sequences, and therefore always provide the same result.

Table 13: SDL volume and permitted take volume (10.10(4) Basin Plan)

Form of take	SDL (ML)	Long-term average permitted take (ML)
Goulburn-Murray: Shepparton Irrigation Region SDL Resource Unit		
Take from groundwater (excluding basic rights)	241,490	241,490
Take from groundwater under basic rights	2,610*	2,610
Goulburn-Murray: Highlands SDL Resource Unit		
Take from groundwater (excluding basic rights)	55,590	55,590
Take from groundwater under basic rights	13,110*	13,110
Goulburn-Murray: Sedimentary Plain SDL Resource Unit		
Take from groundwater (excluding basic rights)	211,454	211,454
Take from groundwater under basic rights	11,546*	11,546
Goulburn-Murray: deep SDL Resource Unit		
Take from groundwater (excluding basic rights)	20,000	20,000
Take from groundwater under basic rights	0	0

* basic rights estimate from original SDL estimates (2010)

5. References

Murray-Darling Basin Authority. (2018). *Sustainable Diversion Limit Reporting and Compliance Framework Summary*. Canberra: Murray-Darling Basin Authority.

RMCG. (2011). *Stock and Domestic Water Use Modelling Resource Manager's Handbook*.

SMEC. (2010). *Afforestation Risks to Water Resources in the Murray-Darling Basin*. Canberra: Murray-Darling Basin Authority.

6. Schedule 1

6.1 Sustainable diversion limit adjustment mechanism projects

The Murray–Darling Basin Ministerial Council endorsed the final package of environmental works and measures to be included in the sustainable diversion limit adjustment mechanism in June 2017.

The Murray–Darling Basin Authority has been progressively modelling the offsets from all projects from Victoria, New South Wales and South Australia.

Victoria has put forward 22 projects to achieve the Basin Plan's environmental targets without the need for further Commonwealth water buybacks. These projects will contribute significantly to meeting the requirements of the Basin Plan.

Victoria's 22 projects will deliver great outcomes for regional communities with real benefits for local waterways and wetlands along the Murray and its tributaries.

The package of 22 projects includes constraints and rules-based projects and an Enhanced Environmental Delivery Project. It also contains the completed Living Murray Projects already delivering results, including Chowilla Floodplain, Gunbower Forest, Hattah Lakes Environmental Flows, Koondrook-Perricoota Forest Flood Enhancement, Lindsay Island (Stage 1) Upper Lindsay Watercourse Enhancement and Mulcra Island Environmental Flows.

6.2 Environmental works and measures

Environmental works include channels, regulators and pumps that deliver water to priority, high-value sites to meet the needs of plants and animals such as fish, frogs, waterbirds and river red gum and black box woodlands.

Works provide a better outcome for areas of high environmental value, particularly during dry years. They directly deliver the water flows an ecosystem needs that often are not possible under river regulation.

Works can deliver and hold water in specifically targeted areas on the river floodplain that are usually only inundated where there are high flows. This means natural flood-dependent ecological processes can occur, even under regulated river conditions.

These projects aim to improve environmental outcomes at large Murray floodplain areas and key river red gum ecosystems. Water delivery through works improves forest, river and wetland habitats and provides conditions for successful feeding, breeding and migration of native fish, reptiles, birds, frogs and insects.

Environmental works projects include:

Belsar-Yungera Floodplain Management Project

This proposed supply measure will maintain and improve flora and fauna habitat values and provide periodic breeding opportunities for wetland species like fish, frogs and waterbirds. Managed flows will be able to be delivered to 2,370 hectares of highly valued floodplain, representing one third of the total area.

The works can be operated flexibly to meet the water requirements of different vegetation localities, mimicking a broad range of River Murray flows of up to 170,000 megalitres per day (ML/d). By constructing three large regulators, a series of smaller supporting regulators, track raising to form levees and a pipeline to allow use of temporary pumps, this project will connect extensive floodplain areas through tiered watering events. These works will make use of natural

flow paths to increase the extent, frequency and duration of inundation from either Basin Plan flows or pumping during low-flow events.

Burra Creek Floodplain Management Proposal

The proposed works will enable inundation of a 407 hectare area. This represents 33 per cent of the total forest area and almost all of the flood-dependent ecological communities found within the forest, and provides a greater extent of watering than is possible under Basin Plan flows. The works involve the construction of three large regulators, raising tracks to form levees and removing barriers to flow on the floodplain.

Gunbower National Park Floodplain Management Project

The project has been developed to enable the delivery of environmental water to the wetlands and forest of the Gunbower National Park. It will mimic a natural flood of up to 45,000 (ML/d) in the River Murray across 500 hectares. This includes almost half of the permanent and temporary wetlands in the project area and 20 per cent of river red gum with flood-dependent understorey seedlings and saplings. The package of works includes a pump station, regulator and creek enhancement works. The mid-forest works will consist of a 100 ML/d pump station located on the Murray and a number of regulators, as well as upgrades to infrastructure on Camerons Creek. This will provide water to around 500 hectares of Gunbower National Park which currently cannot be watered by any other infrastructure.

Guttrum and Benwell State Forests Floodplain Environmental Works Project

The project will reinstate a more natural flooding regime for the Guttrum and Benwell Forests and addresses the reduced frequency and length of floods. The proposed works will water 1,200 hectares by pump stations off the River Murray, including semi-permanent wetlands and 82 per cent of the river red gum forest with flood-dependent understorey seedlings and saplings. The works will include two separate pump stations to deliver environmental water into Guttrum Forest, one pump station in Benwell Forest and containment works of regulators and levees in both forests to contain water on the floodplain. The works have been designed to meet the water requirements of the forest by mimicking a 26,000 ML/d flood event in the River Murray for Guttrum Forest and a 24,000 ML/d flood event for Benwell Forest.

Hattah Lakes North Floodplain Management Project

This project will complement the Living Murray initiative works at the Hattah Lakes Icon Site by boosting flooding across higher floodplain terraces. The proposed works will water an additional 1,130 hectares of floodplain by constructing two new regulators, a causeway across an existing track and 1.7 kilometres of levees along track alignments. The project will increase flexible environmental water management across the lakes.

Lindsay Island (Stage 2) Floodplain Management Project

The Lindsay Island Floodplain Project will inundate 5,152 hectares of the floodplain. It will connect many parts of the floodplain through tiered watering events, including areas of unique fast-flowing aquatic habitat, through to sections of black box and lignum and onto the higher alluvial terraces. The proposed works will operate alongside the recently completed Living Murray works at this Lindsay State 1 site and Lock 7 to mimic flows of 40,000 to 120,000 megalitres per day.

The proposed works include two components:

- Primary: Berribee Regulator and fishway, five containment regulators and 2.6 kilometres of levees along track alignments
- Secondary: 13 regulators and associated work and 4.9 kilometres of levees along track alignments



Nyah Floodplain Management Project

The proposed works will water almost 500 hectares of floodplain within Nyah Forest, replicating River Murray flows of up to 25,000 ML/d. They will influence over 53 per cent of the total forest area and almost all of the flood-dependent plants and animals. The works consist of four regulators, three on the downstream end of Parnee Malloo Creek and one on the upstream end. Extra works to contain water within the forest include 1.7 kilometres of low-level track raising, forming a levee at the downstream end of the forest.

Vinifera Floodplain Management Project

This project will water up to 350 hectares of floodplain within Vinifera Forest. It represents 55 per cent of the total 638 hectare forest area and almost all of the flood-dependent plant species. The proposed works involve constructing four regulators and raising 1.1 kilometres of low-level track to control both flood and pumped flows into and out of Vinifera Creek. Water will be delivered to the site through a combination of natural inflows or temporary pumping when river flows are insufficient.

Wallpolla Island Floodplain Management Project

Wallpolla Island is part of the Living Murray Lindsay-Wallpolla Islands Icon Site and proposed works will complement existing Living Murray works at this site. This project will increase the frequency and length of floodplain inundation across 2,650 hectares, significantly benefitting nationally important species, threatened vegetation, ecological values, carbon cycling and downstream water quality. This will benefit both Wallpolla Island and the broader Lower Murray region.

The proposed works include four major regulators, 22 smaller containment regulators and 4.5 kilometres of levees or raised tracks. The works have been designed to complement weir pool manipulation activities at Locks 8 and 9 and connect areas of flowing aquatic habitat with sections of black box, lignum and higher alluvial terraces. This will enable watering at a landscape scale, mimicking flows of 30,000 to 120,000 megalitres per day.

6.3 Constraints Management Strategy

As well as the agreed 2,750 GL sustainable diversion limit, the Basin Plan allows for a potential further 450 GL of water to be recovered for the environment by 2024 by removing operational and physical constraints in the river system. The Commonwealth has agreed it will fund works required under its Constraints Management Strategy 2013 to 2024 provided that the works are socio-economically neutral and have no adverse third party impacts.

Victoria has been looking at opportunities to get better environmental outcomes by delivering environmental water more efficiently. This includes exploring opportunities to increase natural higher flows by putting measures in place that prevent and mitigate any potential impacts of higher flows on public and private land. Two constraints measures are included in Victoria's package of 22 projects that seeks to achieve the Basin Plan's environmental targets without the need for further Commonwealth water buybacks. These constraints measures are in their early development and involve ongoing community consultation.

Hume to Yarrawonga key focus area

Investigation of opportunities to address physical and policy constraints to the delivery of higher regulated flows of up to 40,000 ML/d from Hume Dam. Investigations will include the potential effects of higher flows on third parties and mitigation options to address unacceptable impacts, including easements and/or infrastructure, to allow the delivery of these flows to support improved river and wetland health outcomes. Landholder acceptance of potential works will be critical. This project must be considered in relation to the other southern connected Basin constraints projects.

New Goulburn key focus area

Investigation of opportunities to address in-channel constraints to the delivery of higher regulated flows of up to 20,000 megalitres per day at Shepparton. Allowing the delivery of flows to the top of the bank would improve river health outcomes. This work will be done with communities in a staged and bottom-up way to understand the risks, impacts and costs, and develop feasible and acceptable solutions to mitigate third party impacts.

Building on this work, further improvements to environmental water delivery will also be investigated in close consultation with landholders and communities. Landholder acceptance of potential works will be critical. This project must be considered in relation to the other southern connected Basin constraints projects.

6.4 Operational rule changes and system enhancements

Victoria is working with other Basin states on projects that involve changing the way river systems operate. These are known as Operational Rule Changes.

Five Operational Rule Change projects are part of Victoria's package of 22 projects to achieve the Basin Plan's environmental targets without the need for further Commonwealth water buybacks. These are joint projects with New South Wales.

The projects involve changes to river operation rules to improve flexibility and control over delivering environmental water to the River Murray. They achieve the environmental outcomes of the Basin Plan using less water to meet the rigorous statutory requirements for offsets under the sustainable diversion limit adjustment mechanism.

Barmah-Millewa Forest Environmental Water Allocation

Rule change to vary the rules associated with the water set aside by Victoria and New South Wales in the Barmah-Millewa Forest Environmental Watering Account to water the Barmah-Millewa Forest. The change proposes allowing the use of other environmental entitlements to target the environmental requirements specified in the Basin Plan. This measure proposes to not initiate or continue release from the Barmah-Millewa Forest Environmental Watering Account if a four-monthly flood has already occurred.

Flexible rates of fall in river levels downstream of Hume Dam

Rule change to allow releases from Hume Dam to be reduced more quickly when flows have not been elevated for an extended period beforehand. The water saved would be released at a different point in time or in a different flow pattern to provide additional environmental benefits. The extra flexibility improves Hume Dam operational efficiency.

Hume Dam airspace management and pre-release rules

Rule change to allow future environmental water releases in airspace management.

2011 Snowy Water Licence schedule 4 amendments to River Murray increased flow call out provisions

Amendments to Snowy Hydro licence in 2011 allow the water recovered by the River Murray Increased Flows to be held and called out. Previously the release of the water was at the discretion of Snowy Hydro and was generally at times suited to Snowy Hydro's commercial outcomes. The proposal intends to provide a way of controlling the timing of River Murray Increased Flows water releases from the Snowy Scheme, allowing more flexibility to achieve environmental outcomes targeted in the River Murray below Hume Dam.

6.5 Efficiency measures

Efficiency measures recover and provide more water for the environment by increasing the efficiency of consumptive water uses, like irrigation.

Victoria has carried out a series of water efficiency programs to meet its share of the 2,750 GL water recovery target. However the Basin Plan also allows for efficiency measures - usually called 'upwater' - to deliver a further 450 GL above that target for the environment. The Basin Plan requires that these 450 GL efficiency measures achieve neutral or improved socio-economic outcomes.

Victoria has a number of projects that aim to improve water delivery. These processes involve upgrading or evolving components specific to each project, while minimising impacts to the environment and economy.

Modernising irrigation systems can involve:

- automating and upgrading channels to reduce the need to operate the system manually, while measuring water flows accurately and in real time
- removing redundant channels
- replacing open channels with pipelines to minimise water losses
- upgrading the accuracy of metered outlets that deliver water to farms
- lining and remodelling channels to minimise water lost during transport.

These works, combined with changes to the way systems operate, are improving service levels to irrigators and saving billions of litres of water.

There are a number of modernisation projects currently underway that aim to bring existing irrigation systems to current standards.

On-farm water funding opportunities

The Victorian Farm Modernisation Project is a Commonwealth Government-funded water recovery irrigation efficiency project. It has helped meet Victoria's commitment under the Basin Plan by avoiding untargeted buybacks and transferring around 17.4 GL of high-reliability water share for the environment.

The project aimed to provide funds to irrigators doing farm works to improve water-use efficiency and reduce losses that happen when farms are irrigated. No less than 55 per cent of the estimated water savings generated through farm upgrades is transferred to the Commonwealth Environmental Water Holder, while part is retained by the irrigator.

Since 2013 up to \$100 million has funded 241 irrigator projects with over 26,750 hectares of improvements, including automated irrigation, laser grading of land, soil moisture monitoring and improved sprinkler technology.

The Victorian Farm Modernisation Project is delivered through the regional Farm Water Program, led by the Goulburn Broken Catchment Management Authority and involving North Central Catchment Management Authority, North East Catchment Management Authority, Agriculture Victoria and Goulburn-Murray Water.

Goulburn-Murray Water Connections Project

The Connections Project is the largest irrigation modernisation project in Australia, ensuring a sustainable future for productive agriculture in northern Victoria and long-term water security for the Goulburn-Murray Irrigation District.

The \$2 billion Victorian and Commonwealth Government-funded project is upgrading the irrigation delivery system to recover 429 GL of water savings to benefit irrigators, the environment and Melbourne retail water corporations. The project is a key part of Victoria's contribution to the Basin Plan in a way that minimises any socio-economic impacts.

At 30 June 2018, the project had installed almost 7300 outlets, decommissioned more than 1130 kilometres of channels and fully treated assets servicing almost 5800 customers.

When it is completed, water users in the region will benefit from a world-class, modern delivery system providing increased productivity, greater security and real water savings.

Sunraysia Modernisation Project

The \$120 million Sunraysia Modernisation Project has created a more efficient irrigation network with better water quality across the Mildura, Merbein and Red Cliffs irrigation districts.

It has:

- upgraded key pump stations across the three districts
- replaced approximately 24 kilometres of open channels with pipelines
- installed channel automation in the remaining 20 kilometres of open channels, including 19 regulating structures

The project was funded with \$103 million from the Commonwealth Government and \$17 million from the Victorian Government through Lower Murray Water's capital works budget. It was delivered by Lower Murray Water and officially opened in September 2016.

Benefits of the project include:

- greater reliability and water availability for more than 2,000 customers, with 365-day access to irrigation water through the ordering system
- improved water quality helping to reduce on-farm filtration costs
- greater operational flexibility to improve service delivery to irrigation customers
- seven GL in water savings transferred to the environment to bridge the gap under the Basin Plan

