Government of South Australia
South Australian Murray-Darling Basin
Natural Resources Management Board

South Australian Murray-Darling Basin
Natural Resources Management Board

Guide to the draft Marne Saunders Water Allocation Plan

A GUIDE FOR CONSULTATION

Foreword

Together, the community and government hope to establish long-term sustainable management that aims to balance social, economic and environmental needs for water. A key part of this process is the development of water allocation plans for several South Australian regions, including the Marne Saunders Prescribed Water Resources Area.

What is this Guide about?

This Guide has been produced to help the consultation process of the draft Marne Saunders Water Allocation Plan (the Plan). It summarises key parts of the Plan and can be used to more easily gain a basic understanding of the document.

The Plan needs to be unambiguous and legally correct because, as a statutory document, it will be used to enact Parliamentary law. As a result, it can sometimes be complex and hard to follow. This Guide outlines the Plan's key policies, goals and principles in plain language. For particularly interested readers, it also includes cross-references to relevant parts of the Plan and an index that matches principle numbers against sections in this Guide. For a more succinct summary, the short document 'Frequently Asked Questions about the draft Marne Saunders Water Allocation Plan' is available.

These documents are available from the South Australian Murray-Darling Basin Natural Resources Management Board (the SA MDB NRM Board) by telephoning (08) 8532 1432 or on the website at <www.samdbnrm.sa.gov.au>.

What you can expect to find

This Guide is based on the discussion papers developed as part of the previous consultation process and has been updated to reflect policy changes that have occurred as a result of feedback and further consideration. An outline of key changes is presented in Appendix A.

This Guide comprises five parts:

- basic information regarding the Plan and the prescription process
- general policies that apply to all water resources
- policies relating to surface water and watercourse water specifically
- policies relating to underground water specifically
- policies relating to key water affecting activities.

History of the process

The Plan has been produced by the SA MDB NRM Board following extensive deliberations by the community-based Marne Saunders Water Resources Planning Committee, collaborative work with organisations such as the Department for Water, Land and Biodiversity Conservation (DWLBC) and Rural Solutions SA, and with significant input from previous consultation stages. Figure 1 outlines the steps involved in developing a water allocation plan.

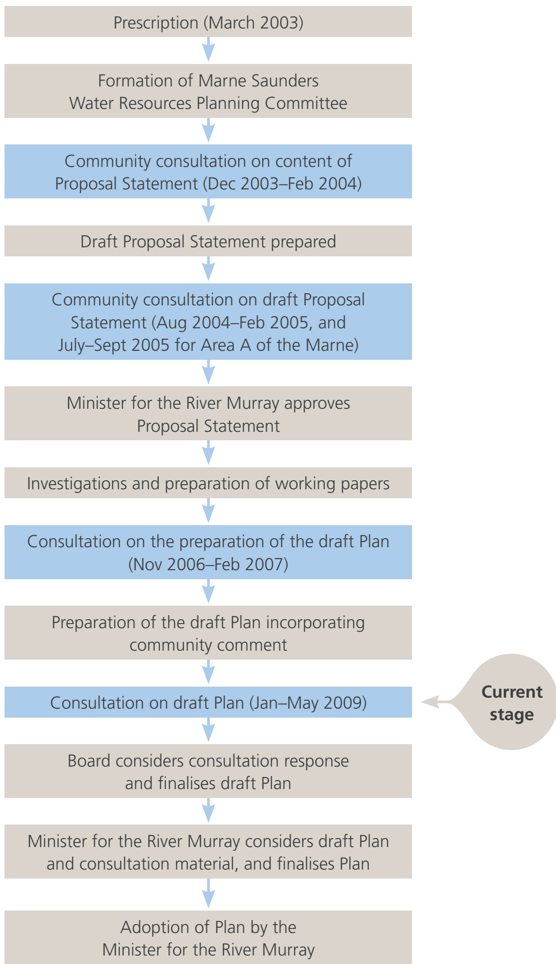


Figure 1: Plan development process with consultation stages shaded blue

Contents

Background on the Plan

A GUIDE TO THE DRAFT MARNE SAUNDERS WATER ALLOCATION PLAN

1 | *Background on the Plan*

1.1 | The Marne Saunders region

The Marne Saunders Prescribed Water Resources Area (PWRA) lies in the Eastern Mount Lofty Ranges and Murray plains area. It covers 743 km^2 and encompasses a wide range of climates, landforms, enterprises and water resources. It can be broadly divided into the hills zone and plains zone, as shown in Figure 2.

1.1.1 | Surface water resources

Most streamflow comes from the hills where the rainfall is highest; both the Marne River and Saunders Creek begin in this area. From the hills, these watercourses flow downhill to the east, passing through gorges before coming to the plains, where they eventually join the River Murray.

Rainfall in the area—and therefore streamflow, as well—is highly variable. Since 1973, when streamflow measurement began at the gauging station in the Marne Gorge, annual streamflow has ranged from 80 megalitres (in 1982) to 33,500 megalitres (in 1974). Most of the rain falls in winter and spring.

1.1.2 | Underground water resources

Besides flowing above the ground, rainfall and streamflow also soak down into the pores and cracks of water-bearing rock and sediment layers (known as aquifers) to become underground water. There are two main types of underground water aquifers in the Marne Saunders PWRA: the fractured rock aquifer in the hills and the sedimentary aquifers in the plains (see Figure 3).

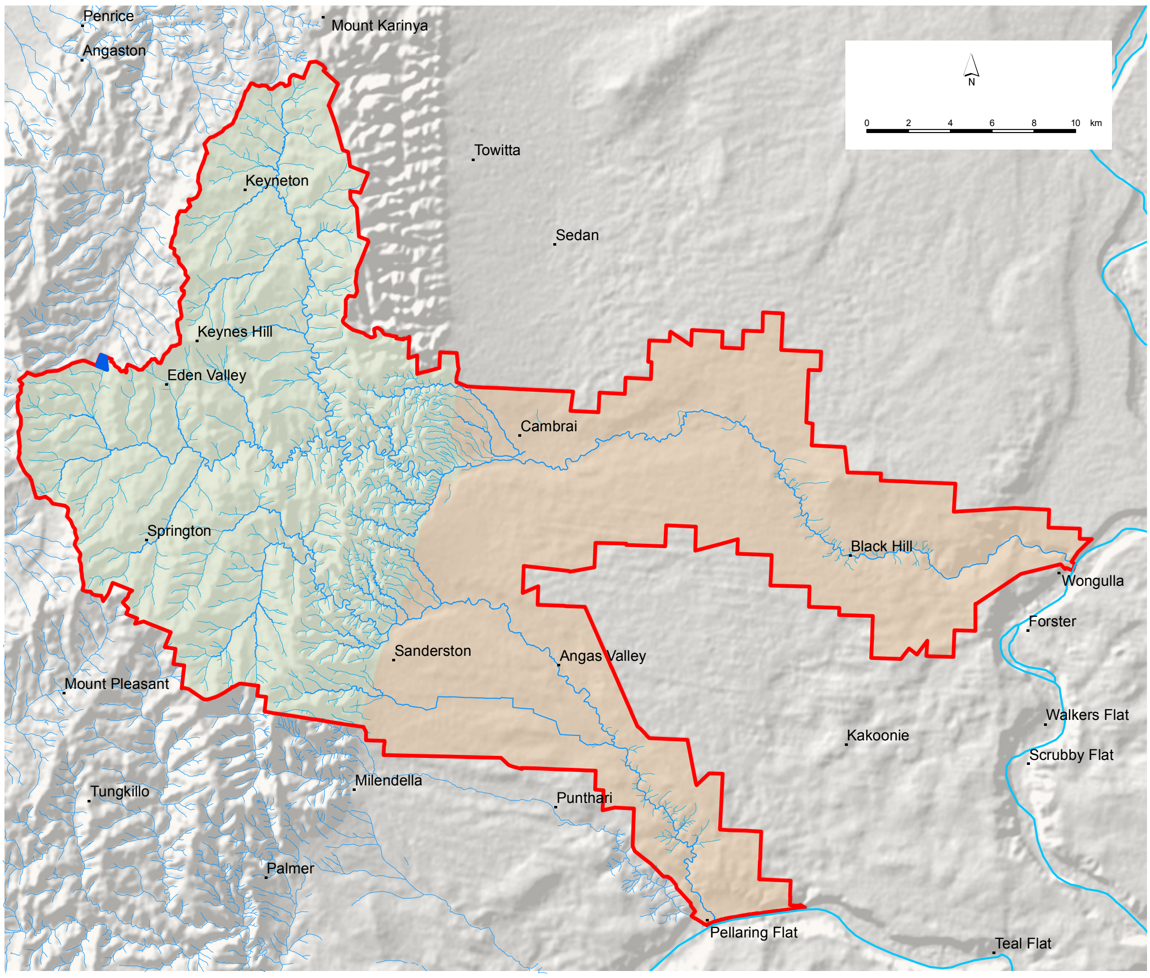
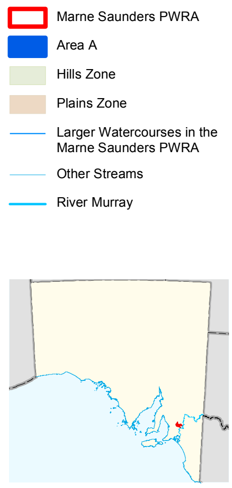


Figure 2: The Marne Saunders PWRA



There are three sedimentary aquifers on the plains, each at a different depth. From shallowest to deepest they are: the Quaternary aquifer, the Murray Group Limestone aquifer and the Renmark Group aquifer. The majority of water use is from the Murray Group Limestone aquifer.

All of these aquifers have different characteristics and behaviour, and so they require specific water management policies.

It is important to note that all the water resources in the Marne Saunders PWRA are strongly interlinked (see Figure 4). Surface water running over the land finds its way into watercourses, thus becoming watercourse water. Underground water can also feed into the watercourse as 'baseflow' via springs and seeps (Figure 5a). Baseflow to watercourses is known to occur throughout the hills and also in some plains locations, such as Black Hill Springs in the Marne River and near Lenger Reserve in Saunders Creek.

The fractured rock underground water generally flows to the east and replenishes, or 'recharges', the sedimentary aquifer at the base of the hills. Flow in watercourses can also seep through the bed of the watercourse and recharge the underground water (Figure 5b). Recharge from the stream to the aquifer is especially noticeable on the plains, where rainfall is low and streamflow provides the major source of recharge to the sedimentary aquifers beneath the watercourse. Away from the main watercourses, the main source of recharge for the sedimentary aquifers is the minimal amount of rainfall.

These interactions mean that actions in one resource can influence another—and they need to be managed together.

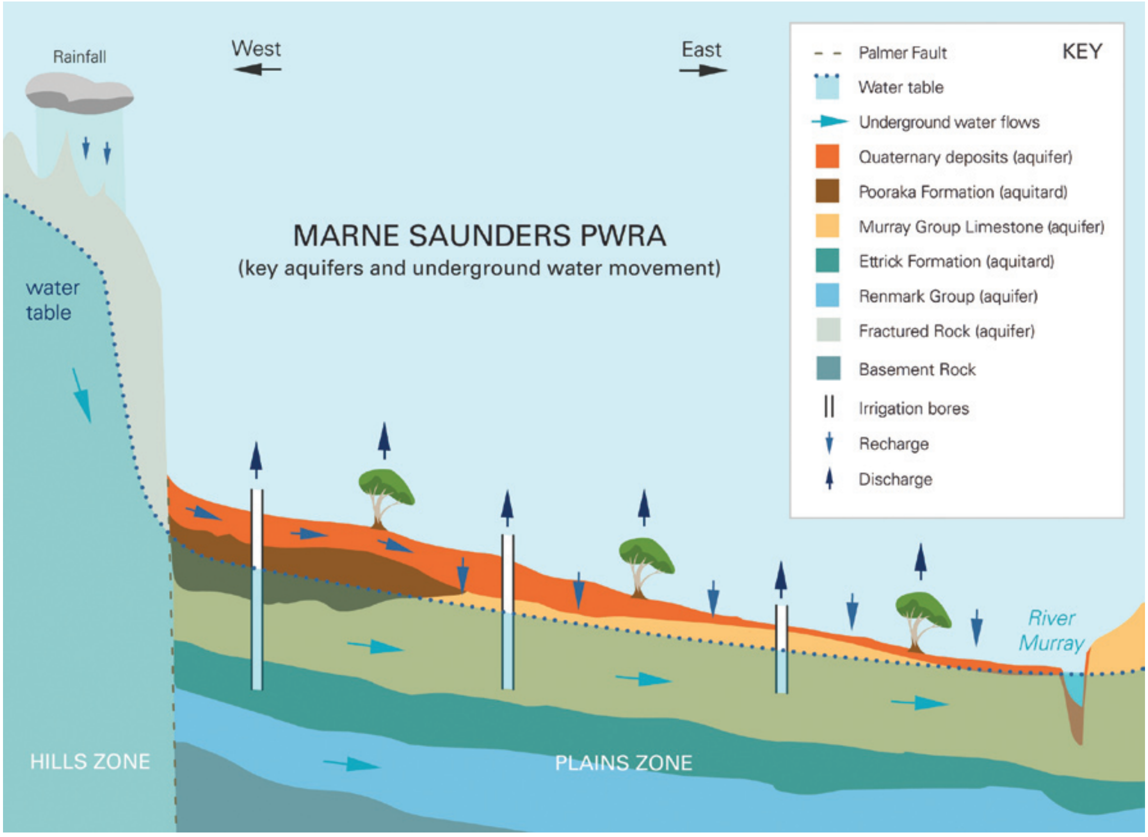


Figure 3: Key aquifers and the primary movement of underground water through the landscape in the Marne Saunders PWRA (Figures courtesy of DWLBC, illustrated by Ecocreative)

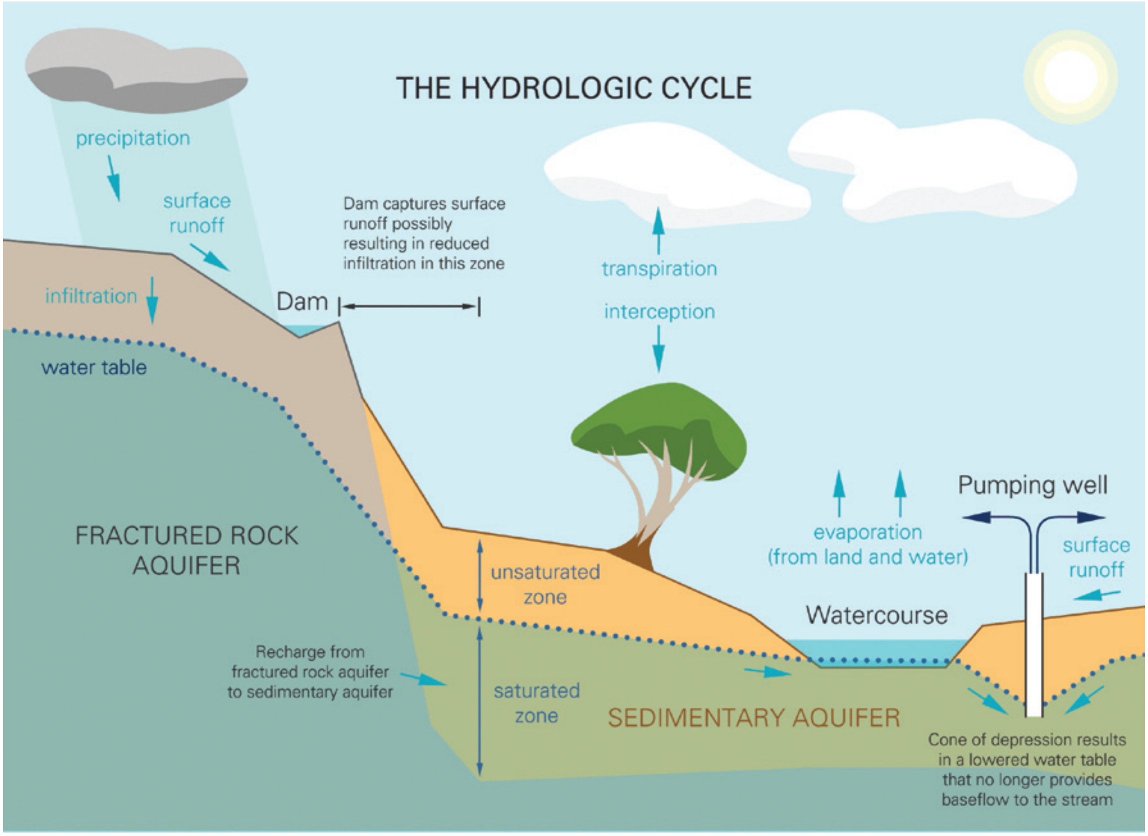


Figure 4: Paths of water movement and connection through the landscape (Figures courtesy of DWLBC, illustrated by Ecocreative)

5a: Provision of 'baseflow' in streams from underground water (stream 'gains' water from the underground water)

5b: 'Recharge' of underground water from streamflow (stream 'loses' water to the underground water)

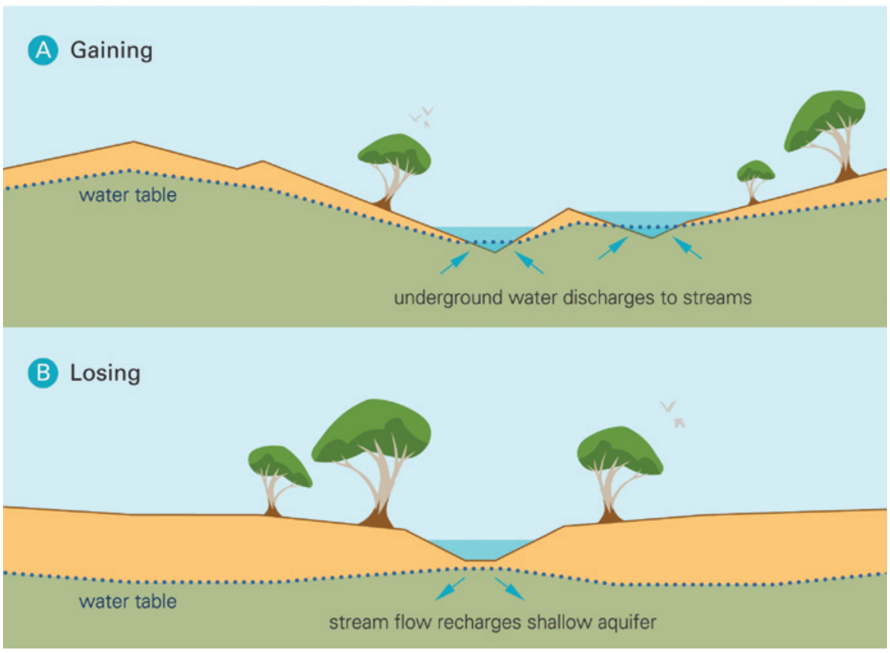


Figure 5: Interactions between surface water and underground water (Figures courtesy of DWLBC, illustrated by Ecocreative)

Chapters 3 and 4 (and sections 2.3 and 4.2 of the Plan) provide more information on the characteristics of each water resource and their various management issues.

1.2 | The water prescription process

Water is a vital resource in the Marne Saunders region. It is required for a variety of human activities including domestic use, raising stock, irrigation, industrial works and recreational activities. At the same time, the environment needs a certain amount and pattern of water to sustain itself.

Concern about the impact of water resource development on water sharing and the environment prompted the prescription of the Marne Saunders region in 2003. This created the Marne Saunders PWRA. Prescription also brings about a system of allocation and licensing of water, guided by a water allocation plan.

1.2.1 | Prescription

Prescription is a means by which water resources can be sustainably managed to provide security for all water uses, now and into the future[1]. It defines the boundary of a prescribed area, after which a user needs an allocation and licence to take prescribed water resources from this area for licensed purposes. This protects the resources from over-use, shares water between users, minimises adverse effects from new water resource development on water users, and ensures water is available to sustain the environment.

There are three key, linked parts of the prescription process:

- implementation of the allocation and licensing system by the Department for Water, Land and Biodiversity Conservation (DWLBC)
- allocation of water to existing users by DWLBC
- development of a water allocation plan by the relevant NRM Board.

The Plan sets out the sustainable use limits and policies for assessment of new allocations, transfers and water affecting activities. The Plan also sets out policies for ongoing management of allocations, such as water use efficiency, rollover of allocations from year to year, transfer of allocations between users, and monitoring and reporting. The *Natural Resources Management Act 2004* (SA)—or NRM Act—requires that the Plan is reviewed every five years.

This Guide is focused on the content of the Plan, not the licensing system or allocations to existing users. Some topics are interrelated and readers may be interested in all parts of the prescription process, so some basic information on key topics is included below[2].

As outlined above, the taking and use of prescribed water resources for licensed purposes requires a water allocation and licence. Water allocations and licences are personal property rights that are separate from land. They may be transferred between users, subject to the rules set out in the Plan and approval by the Minister[3].

A note for existing users

Water is allocated to existing users under a separate section of legislation[4]. In this legislation, entitlements of existing users are considered first, subject to the sustainable capacity of the water resources and the needs of the environment and non-licensed users. If any water remains available for allocation—within sustainable limits and after the entitlements of existing users have been considered—then this water can be allocated under the policies set out in the Plan.

Though the Plan does not set out how allocations to existing users are determined, it does set out the sustainable limits for the water resources and provides a framework that can be used for setting licence conditions for existing users.

For more information on the existing user allocation process, please contact the DWLBC Berri office on (08) 8595 2053. For an outline of proposals for allocating water to existing users, a discussion paper from the previous consultation period is available at <http://www.dwlbc.sa.gov.au/water/projects/mspwra.html>.

1. The prescription process and the management of prescribed water resources occurs in accordance with the *Natural Resources Management Act 2004* (SA).
2. The document *Frequently asked questions about the Marne Saunders Water Allocation Plan* discusses these topics in more detail.
3. In the Guide, references to 'the Minister' refer to the Minister responsible for administering the NRM Act. This is currently the Minister for Environment and Conservation.
4. The prescription process in the Marne Saunders PWRA was started under the *Water Resources Act 1997* (SA), so the existing user allocation process occurs under this Act. The Water Resources Act has since been replaced by the NRM Act.

Certain activities may have an impact on water resources and are managed under the NRM Act through a permit system. These activities are known as water affecting activities (WAAs) and the Plan sets out the policies that are used to assess WAA permit applications. WAAs include:

- drilling wells
- building and enlarging dams
- constructing and excavating in or around watercourses
- draining water into a well
- use of imported and effluent water.

1.2.2 | When an allocation is required

A water allocation and licence is required only when using water from a prescribed water resource and when using the water for a licensed purpose.

The following are prescribed water resources in the Marne Saunders PWRA that require allocation and licensing:

- surface water, including roof runoff
- watercourse water
- underground water.

A licence and allocation is required to take water for all purposes—including irrigation, industrial and recreational use—except for 'non-licensed purposes'. Non-licensed purposes currently include:

- domestic use
- provision of drinking water for stock that are not subject to intensive farming
- fire fighting
- making public roads
- purposes authorised by a notice under section 128 of the NRM Act, including:
    - the application of chemicals to non-irrigated crops or non-irrigated pasture, or to control a pest plant or animal (SA Government Gazette 16/3/06, pg 559)
    - taking up to 500 kilolitres of roof runoff under certain conditions for commercial, industrial, environmental or recreational use—but excluding irrigation use (SA Government Gazette 16/3/06, pg 906-912).

A permit—separate from an allocation and licence—may be required for using some non-prescribed water resources, such as effluent and imported water (see section 5.8).

Note: Approvals required for constructing wells and dams

It is important to note that having an allocation to take water is entirely separate from the approval required to drill the well or construct the dam to extract or capture that water.

A WAA permit (or sometimes a development approval) is required for drilling new wells or deepening existing wells and for construction or enlargement of a dam or other water diversion structures. A permit is required for these activities regardless of whether the captured water will be used for licensed or non-licensed purposes (see above).

WAA permits are not required for existing unmodified wells, dams and other water sources. However, if water from a source is used for licensed purposes, then licence conditions may govern how water may be captured by that source. For example, licensed users may be required to avoid the capture of low-flows by dams or from watercourses, or to abide by a maximum extraction rate from a well.

1.3 | Outline of the Plan

The Plan covers the following themes:

- understanding water resource supply and demand
- a policy framework that aims to balance social, economic and environmental demands for water within the supply or capacity of the water resources
- a monitoring and evaluation framework to facilitate adaptive management.

This Guide focuses on the policy framework sections of the Plan, although a basic summary of each theme is included below. Extensive work has been carried out to understand the behaviour and supply of different water resources in the area and to determine water needs, including environmental water requirements. This work determines the amount of water that can be sustainably taken from the available water resources. The findings have been used to develop the water management framework implemented by the policy sections of the Plan.

1.3.1 | Supply and demand

Sections 2 to 4 of the Plan describe the supply and demand of water in the Marne Saunders PWRA, including:

- description of landscape, geology and climate (section 2 of the Plan)
- characteristics of the different water resources, including the paths and quantities of natural water input and output across the landscape (section 2 of the Plan)
- environmental water requirements (section 3 of the Plan)
- current and likely future demand for water for licensed and non-licensed purposes (section 4.1 of the Plan)
- assessment of the impact of current demand on the resources and water-dependent ecosystems (section 4.2 of the Plan)
- development of the basis for the Plan's water management framework, including an assessment of the capacity of the water resources to meet the different demands under the framework (section 4.3 of the Plan)
- assessment of the impacts of water-taking and use on other water resources (section 5 of the Plan).

1.3.2 | Policy framework

In this Guide, a 'policy' expresses the intent of a specific principle—or group of principles—in the Plan. The Plan's 'policy framework' is the entire set of these principles. The policy framework is important to consider because many principles are interrelated and their meaning can only be fully understood as a whole.

The NRM Act provides two main mechanisms for management of water resources in a water allocation plan, which are:

- allocation and licensing of the taking and use of prescribed water resources for licensed purposes (sections 6 and 7 of the Plan)
- permitting of WAAs such as dam and well construction, construction and excavation in and around watercourses, and use of imported and effluent water (section 8 of the Plan).

1.3.3 | Monitoring and evaluation

Section 9 of the Plan outlines a monitoring and evaluation framework that considers the condition of the resources, water-dependent ecosystems and consumptive demand in order to trigger action if objectives are not met. This information will also establish a better understanding of supply and demand, which will inform policy development when the Plan is reviewed.

General policies in the Plan

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2 | *General policies in the Plan*

1. Policies relating to specific water resources are outlined in chapter 3 (surface water and watercourse water) and chapter 4 (underground water).

This chapter outlines general policies in the Plan that apply to all water resources[1], including:

- water allocation planning objectives
- key policies for new allocations (where available)
- key policies for use and transfer of allocations
- annual reporting by water users
- monitoring and evaluation.

2.1 | Allocation and transfer objectives

The objectives for allocation and transfer are to:

- allocate water sustainably
- provide for efficient use of water resources
- protect quantity and quality of water for all uses
- maintain and where possible rehabilitate water-dependent ecosystems by providing their water needs
- minimise adverse impacts of taking and using water on the environment, water resources and water users.

2.2 | Policies regarding general allocation, transfer and use

2.2.1 | Volumetric allocation

All allocations will be expressed as a volume of water that the holder is entitled to per water use year—1 July to 30 June of the following year (Plan principle 1). It is important to note that having an allocation does not guarantee the ability to physically access the full volume of allocation every year. Availability of water from year to year will be influenced by climate, water movement and other demands.

2.2.2 | Management zones and management sub-zones

The Marne Saunders PWRA has been divided into a series of management zones that reflect:

- different water resources (surface water, watercourse water and underground water)
- different parts of water resources (e.g. different types of aquifers, parts of a water resource with different supply of water).

Some of the management zones overlap, and are defined by the water resource or part of the water resource that they relate to. Further information on the management zones is given in chapter 3 and chapter 4.

These management zones are managed as independent units in the Plan, each with its own limits and rules. The management regimes for the management zones have been developed in consideration of the linkages between them.

Each management zone has an allocation limit (in megalitres or ML), and new allocations must not cause these limits to be exceeded (principle 8). These limits have been set by considering the available supply of water in different areas and the needs of non-licensed users and the environment. Section 4.3 of the Plan provides more information on how these limits were set.

Allocations can not be transferred between management zones (principle 85). This is because each management zone has its own allocation limit, set based on the zone's characteristics and movement of water between the management zones. Taking less water in one management zone (by transferring an allocation out of it) does not necessarily mean that there will be more water available to take in a different management zone.

Some management zones include management sub-zones that reflect finer scale differences within their parent management zone. The management sub-zones also have allocation or usage limits which must not be exceeded (principles 22 and 54-55). Allocations can be transferred within a management zone, including between the management sub-zones it contains, subject to the rules in the Plan (principle 86). See chapters 3 and 4 for more information on specific rules for transfer of surface water, watercourse water and underground water.

2.2.3 | Specifying resources, management zones, management sub-zones and sources

Each water allocation (except allocations that are not able to be taken or used, see section 2.2.9) will have the following information specified on the licence (principle 2):

- the management zone that it can be taken from, which effectively defines the type of water resource that the allocation can be taken from
- the management sub-zone that it can be taken from (where relevant);
- the water source or sources that it can be taken from (e.g. which well or dam)
- the allotment or allotments that the water can be used on.

The allocation must only be taken from those identified zones and sources (principle 3). This is to ensure that zone and local limits are not exceeded.

2.2.4 | New allocations

There is very little water available for new allocation under the Plan, as most management zones are fully allocated to existing users. There is no new surface water or watercourse water available under the Plan—except roof runoff, see section 3.4—and only limited amounts in some underground water management zones.

The management zones that have water available for new allocation have no or limited movement of water to the fully allocated management zones. Taking new water from the management zones that are not fully allocated is not likely to affect water availability in the fully allocated management zones.

Water may become available if returned voluntarily or as a result of breach of licence conditions. If water is returned in the management zones that are fully allocated to existing users, then this water will not be available for re-allocation. If water is returned from the management zones where water will be available for allocation when the Plan is adopted, then that volume may be available for new allocation at the Minister's discretion (principle 20).

Payment will generally be required for new allocations obtained from the Minister under the Plan (principle 7). Payment will not be required for rollover allocations (see sections 3.3.8 and 4.3.5), artificial recharge allocations (see section 4.4) or roof runoff allocations (see section 3.4).

The NRM Act sets out that when payment is required for new allocations, they must be sold by the Minister in accordance with the regulations by public auction or tender or, if either of those methods fail, by private contract.

Paying for a new allocation means that new allocations are treated using the same market-based approach as transfers, where a user buys water from another user. Water is also a precious resource, and paying for an allocation means that it is more likely to be valued.

2.2.5 | Transfers

Water allocations and licences may be transferred between users, subject to the rules in the Plan and approval of the Minister. Transfers may be made on a temporary or a permanent basis.

Payments between buyers and sellers of allocations and licences are not managed by the Plan.

Transfers of allocations are generally assessed in the same way as new allocations. They are subject to the rules in the allocation section of the Plan as well as the rules in the transfer section (principles 91 and 96). A transfer can only occur if all of the relevant principles can be met.

However, transfers may occur without considering the relevant allocation rules where there is no change to the volume allocated, which source the allocation is taken from, and to the licence conditions (principles 92 and 97). This situation generally occurs when a licence is transferred together with the sale of a property.

2.2.6 | Transfers between resources

Allocations generally can not be transferred between different resources (e.g. from surface water to underground water). This is due to the limitation on transferring water between management zones, as each management zone represents a particular water resource type. The only exception is that allocations may be able to be transferred between surface water and watercourse water (principle 98).

2.2.7 | Taking and use of allocations

All new allocations and transfers will be subject to general policies aimed at protecting the water resources, users and the environment from impacts associated with taking and use of water. For example, new allocations and transfers will not be permitted where the location and/or rate of taking and use of the water would lead to significant detrimental impacts on the water resource, other users, dependent ecosystems or on productive capacity of the land (e.g. dryland salinity, perched watertables, waterlogging, erosion) (principles 9 and 10).

2.2.8 | Water use efficiency

Inefficient use of water can lead to problems such as perched water tables. The Plan includes policies requiring licensees to use water efficiently, as appropriate for the particular circumstance, and in accordance with industry best practice standards (principle 11).

The SA MDB NRM Board will offer education and assistance on improving water use efficiency, coordinated with existing programs. Users who are consistently inefficient over time may be asked to implement a program to improve their practices as a last resort (principle 12).

2.2.9 | Water taking and holding allocations

The Plan allows for both water (taking) allocations and water (holding) allocations (principle 15). Water (taking) allocations allow the licensee to actually take and use the allocation from given source(s) under a certain set of conditions. Water (holding) allocations reserve that volume of water for the user, but do not allow the user to actually take the water from the resource. Water (holding) allocations also do not reserve a position in the landscape from which the water can be taken.

Water (taking) allocations can be converted to water (holding) allocations and vice versa. Converting a water (holding) allocation to a water (taking) allocation will be assessed as if it was a new allocation in accordance with section 153 (9) of the NRM Act, to manage potential impacts on current users. This means that the full volume of a water (holding) allocation will not necessarily be able to be converted to a water (taking) allocation for a particular location, depending on factors such as local limits and existing water resource development.

Water (holding) allocations are useful where someone may have an allocation but doesn't own land to apply it to (e.g. may have sold their property but retained their water allocation). Water (holding) allocations are not subject to requirements for annual reporting and provision of water samples for salinity testing (section 9.1.1 and 9.1.2 of the Plan). Section 2.2.11 outlines annual reporting and provision of salinity samples.

Water (holding) allocations also provide an administrative tool that can help to speed up transfer transactions. The buyer of the allocation can go through the more time-consuming assessment process for converting the water holding allocation to a water taking allocation after the transfer, which frees up the seller more quickly.

2.2.10 | Environmental water use

The Plan provides for the allocation of water for environmental water use. Water allocated for this purpose may not be later allocated for any other purpose (principle

17). This principle provides a mechanism to allow allocations to be permanently used for environmental benefit. This use may be inactive (e.g. simply not taking the water from the surface water, watercourses or underground water) or active (e.g. providing water to natural pools over summer).

2.2.11 | Annual reporting

Under the Plan, licensees will annually report on crop types and areas (or equivalent for non-irrigation enterprises), water usage by source and by crop type where possible, and irrigation system and method (where appropriate). General information can then be provided back to the community on practices in the area in the form of a water use and resource assessment report (Plan section 9.1.1). This information will allow users to assess their own performance against local practices. Any information reported back to the community will not include any personally identifiable information. The annual reporting information will also allow broad assessment of annual water use efficiency by property against maximum theoretical requirements for that crop/ enterprise and annual climate.

Licensees will also be asked to provide an annual water sample from their licensed sources for salinity testing (Plan section 9.1.2). This information will allow assessment of resource condition and trends over time, and will complement the catchment-wide monitoring data outlined below.

2.2.12 | Monitoring and evaluation

An important part of implementing the Plan is to monitor and evaluate the condition and behaviour of water resources, water use and water-dependent ecosystems. This work will be carried out by agencies such as the SA MDB NRM Board, DWLBC and the Environment Protection Authority, in partnership with the community and local groups.

Monitoring and evaluation serves a range of functions. For example, it can help identify problems—thus prompting action to be taken. Section 9.2 of the Plan sets out a range of triggers that indicate potential problems for the different water resources, such as a decline in underground water level or an increase in salinity. This section also outlines the minimum monitoring requirements to assess if these triggers have been reached. Once a trigger has been reached, an assessment will be made of the likely causes and impacts. If necessary, options for remedial action will be identified, reported to stakeholders and implemented as required. Monitoring and evaluation can also inform improvement of the Plan when it is reviewed in five years time (or earlier if required). Monitoring of parameters like underground water level, streamflow, salinity, water usage and health of water-dependent plants and animals will improve understanding of the nature and variability of water supply and demand over time. This monitoring will also help to check whether the Plan’s policies are working or need to be improved.

Surface water and watercourse water

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3 | Surface water and watercourse water

This chapter outlines policies for managing surface water and watercourse water allocations for licensed use. It does not discuss management of non-licensed use of water. See section 1.2.2 for information on when a licence isn't required[1].

This chapter outlines:

- the definitions of surface water and watercourse water
- key management issues for surface water and watercourse water in the Marne Saunders PWRA
- key policies for surface water and underground water, including:
    - allocation by source
    - transfer between water resources
    - transfer volume limits at different scales
    - protected areas where allocation transfers are not allowed
    - bypassing or returning key environmental flows
    - maximum diversion rates for watercourse diversions from restricted watercourses
    - rollover of unused parts of allocations for use in later water use years
    - limitations on the transfer of extra safety net allocations
- key policies for roof runoff.

3.1 | Definition of surface water and watercourse water

Water that flows in a watercourse is watercourse water. The NRM Act defines a watercourse as 'a river, creek or other natural watercourse (whether modified or not) in which water is contained or flows whether permanently or from time to time and includes:

a. a dam or reservoir that collects water flowing in a watercourse
b. a lake through which water flows
c. a channel (but not a channel declared by regulation to be excluded from the ambit of this definition) into which the water of a watercourse has been diverted
d. part of a watercourse
e. an estuary through which water flows
f. any other natural resource, or class of natural resource, designated as a watercourse for the purposes of this Act by an NRM plan'.

Watercourse water is commonly captured by diverting flow from the watercourse via a weir, pipe or pump into a water storage facility (e.g. a dam, tank or recharged into an aquifer). It is sometimes applied directly onto the crop.

Surface water flows over land—other than in a watercourse—after falling as rain or other precipitation. 'Land' includes structures attached to land, such as buildings.

Surface water is commonly captured by intercepting runoff in a dam or by directing roof-runoff into a tank or other storage facility.

There are obviously close links between surface water and watercourse water. The Plan generally manages these resources together. The term 'runoff' is generally used in this Guide to refer to surface water and watercourse water collectively.

Various devices are used to capture surface water and watercourse water, including dams, weirs and pumps. Water-capturing infrastructure are collectively referred to as 'diversion structures' in this Guide and the Plan.

3.2 | Key management issues

Rainfall is the ultimate source of all water resources in the Marne Saunders PWRA. Average annual rainfall is highest at the western side of the region (around 775 mm) and decreases towards the east, dropping down to around 300 mm on the plains.

1. It is important to remember that the allocation of water to take from a dam or watercourse is separate from the approval required to construct or enlarge a dam or other structure to capture that water. Chapter 5 outlines the key policies governing construction, modification and enlargement of dams and other diversion structures for all purposes of use, including non-licensed use.

As described in chapter 1, there are close links between the different water resources in the Marne Saunders PWRA. Runoff provides a major source of replenishment to some of the underground water aquifers, and some watercourse flow comes from the underground water via springs. Because of these strong links, surface water and watercourse water resources need to be managed and shared between all users. This includes licensed users, non-licensed users, users of different water resources that are linked to the surface water and watercourse water, and the environment.

3.2.1 | Scales of management

Runoff flows downhill—thus, capture of water by one user means that there is less water downstream. These impacts can be local (e.g. between neighbours) or can have effects on a broader scale (e.g. capturing runoff throughout the hills reduces the amount of flow to the plains). Therefore it is important to incorporate different scales of impact when managing surface water and watercourse water. Allocations are managed at different scales in the Plan, including those listed below.

- Management zone scale (upper and lower catchments)—Rules have been set at this scale to allow adequate sharing of water between the upper catchments (where most of the runoff is generated) and the lower catchments—and with linked underground water resources.
- Management sub-zone scale—The management zones have been divided into management sub-zones, based on the major tributaries that feed into the main watercourses. Rules have been set at this scale to ensure that each management sub-zone contributes its share of an adequate pattern and amount of flow to support the water-dependent ecosystems that are largely found in the main watercourses. Managing at this scale also allows recognition of different rainfall and runoff characteristics over the area.
- Diversion structure scale—Various rules have been set at the diversion structure scale to manage the local impacts on downstream users and the environment, and to recognise the physical limitations on the amount of water available to a user.

3.2.2 | Management considerations

Management of surface water and watercourse water is complex. The physical presence of diversion structures such as dams interrupts the pattern and amount of downstream flow. These effects occur regardless of whether the diversion structure is used for licensed or non-licensed purposes. Therefore, it is important to consider the impact of all diversion structures when assessing the impact of current or planned water capture and use.

Most of the runoff used in the Marne Saunders PWRA is captured in dams. The amount of water captured by a dam and the impact on downstream flow depends on:

- the size of the dam
- the amount of water used from the dam
- the amount of water lost from the dam via evaporation and seepage
- the amount of runoff coming off the catchment area upstream of the dam
- the amount of runoff intercepted by upstream users
- the way that the dam diverts water (e.g. whether low-flows are captured).

A dam with a low water level (through use from the dam, evaporation and/or seepage) will intercept more flow, and will take longer to fill and spill, compared with a fuller dam.

The issues listed above fall into three categories, which are the major components to be managed with surface water and watercourse water. They are:

- diversion (managing the pattern of taking, such as bypassing low-flows or setting a maximum rate for pumping from a watercourse)
- capture (managing the dam capacity)
- use (managing the volume taken from a dam or watercourse).

All of these components need to be considered in an integrated way, and can be managed with different combinations of rules to achieve the desired outcome.

3.2.3 | Current impacts

DWLBC have developed surface water models that can be used to assess different management options against targets for water sharing and environmental outcomes. These models represent the existing dam network and incorporate rainfall and other climate data, catchment characteristics and usage information to predict streamflow at different points in the catchment. The models have been calibrated using existing streamflow data.

The models can be used to assess the impacts of different rules for diversion, capture/capacity and use, compared against the amount and pattern of flow modelled to occur if there were no dams present.

At a regional scale, data from the surface water models shows that the current level of dam development has reduced the annual average flow from the hills in the Marne catchment by around 24% compared with what the flow would be without dams under the same conditions. This means that there is less flooding on the plains and less flow is available to recharge the sedimentary underground water aquifers.

At a local scale, there has also been evidence of inequities in water sharing between surface water users.

The water needs of the environment are as much about the pattern or regime of flow as they are about the amount. Important elements include the timing, frequency, duration and level of flow in different season. The key impact of dams and watercourse diversions on the environment is the interception of low-flows and break-of-season flows. Flows in the watercourse are delayed by several months until dams fill and spill. In the meantime, the pools that normally provide dry-season refuges for water-dependent plants and animals like fish and frogs are likely to become too salty or even dry up altogether. Break-of-season flows are also thought to trigger breeding in some native fish species, and annual fish monitoring has shown little breeding in local populations in most years. Therefore it is also important to manage runoff to provide environmental water at key times of year, as well as a suitable amount.

3.2.4 | Developing a management approach

It was decided that reducing existing dam capacities would be the least socially-acceptable option for addressing the impacts outlined above. Thus, considerable effort has been made to develop a management approach for surface water and watercourse water that accommodates the existing network of dams and other diversion structures. The surface water models have been used to test a range of combinations of diversion, capture and use against environmental water provision targets to set rules at different scales for allocation, use, dam capacity and diversion (outlined in section 4.3.2 of the Plan).

The allocation and transfer rules outlined in the next section deal with diversion and use of water for licensed purposes. Section 5.7 deals with construction, modification and removal of diversion structures that are used for any purpose, including non-licensed purposes. All of these rules have been developed together to give an integrated approach.

3.3 | Key policies for surface water and watercourse water[2]

3.3.1 | Allocations under the Plan

There is no water available for new allocations under the Plan from the surface water and watercourse water resources (principle 50). The available water is fully taken up by existing user allocations, non-licensed requirements and environmental water provisions. This means that the only way that a user can get an allocation once the Plan is

2. There are two 'key policy' sections in this chapter. The first deals with the key policies for allocation and transfer of the combined surface water and watercourse water resources—but excludes roof runoff. Roof runoff has its own particular characteristics and rules, and is covered in the second key policies section.

adopted is by transferring it from another licensee, subject to the rules in the Plan and approval of the Minister.

This chapter outlines a range of policies governing transfer of water allocations. A transfer may only occur if all of the rules can be satisfied.

A surface water allocation is the volume that may be taken from a dam or other storage vessel in a water use year. A watercourse water allocation is the volume that may be taken from a watercourse in a water use year.

3.3.2 | Allocation by source

A single allocation may be granted to be taken from a number of dams or other diversion structures, but only where these are all:

- in the same management sub-zone
- on the same flow path or 'hydrologically continuous' and
- the flow path between them stays within the same property (principle 51).

Varying the amount taken from these different dams should only affect other dams operated by that licensee. In any other case, an allocation will be granted per dam, based on rules in the Plan designed to minimise the impacts on downstream users and the environment.

3.3.3 | Transfer between resources

Allocations may be transferred between the surface water and watercourse water resources, in recognition of the close links between these two water resources (principle 98). As described in section 2.2.6 above, surface water or watercourse water allocations can not be transferred to the underground water resources.

3.3.4 | Transfer volume limits

The Plan sets out a range of limits to the maximum volume that can be taken from a dam or other diversion structure as a result of a transfer. The limits operate at different scales, from the catchment scale down to the individual dam scale, as described section 3.2.1.

The Plan expresses these limits as the total volume that can be taken from a dam or other diversion structure after the transfer—that is, the existing volume of allocation able to be taken there (if any) plus the new allocation volume from the transfer.

The allowable total allocation volume at a point is the smallest volume determined from all of these limits. The transfer will not be allowed if any of the limits work out to be the same or less than the existing allocation (if any) at the diversion structure to receive the transfer. This means that if there is no existing allocation at the receiving point, the transfer will not be permitted if any of the limits work out to be zero or less.

The Plan gives equations for calculating these limits. Worked examples of these equations are given in a separate information paper available from the SA MDB NRM Board's website at <www.samdbnrm.sa.gov.au> or on request by phoning (08) 8532 1432.

Figure 6 shows a flow chart of the process used to determine the maximum allocation that can be taken at a point, based on these limits. Descriptions of the limits are given overleaf.

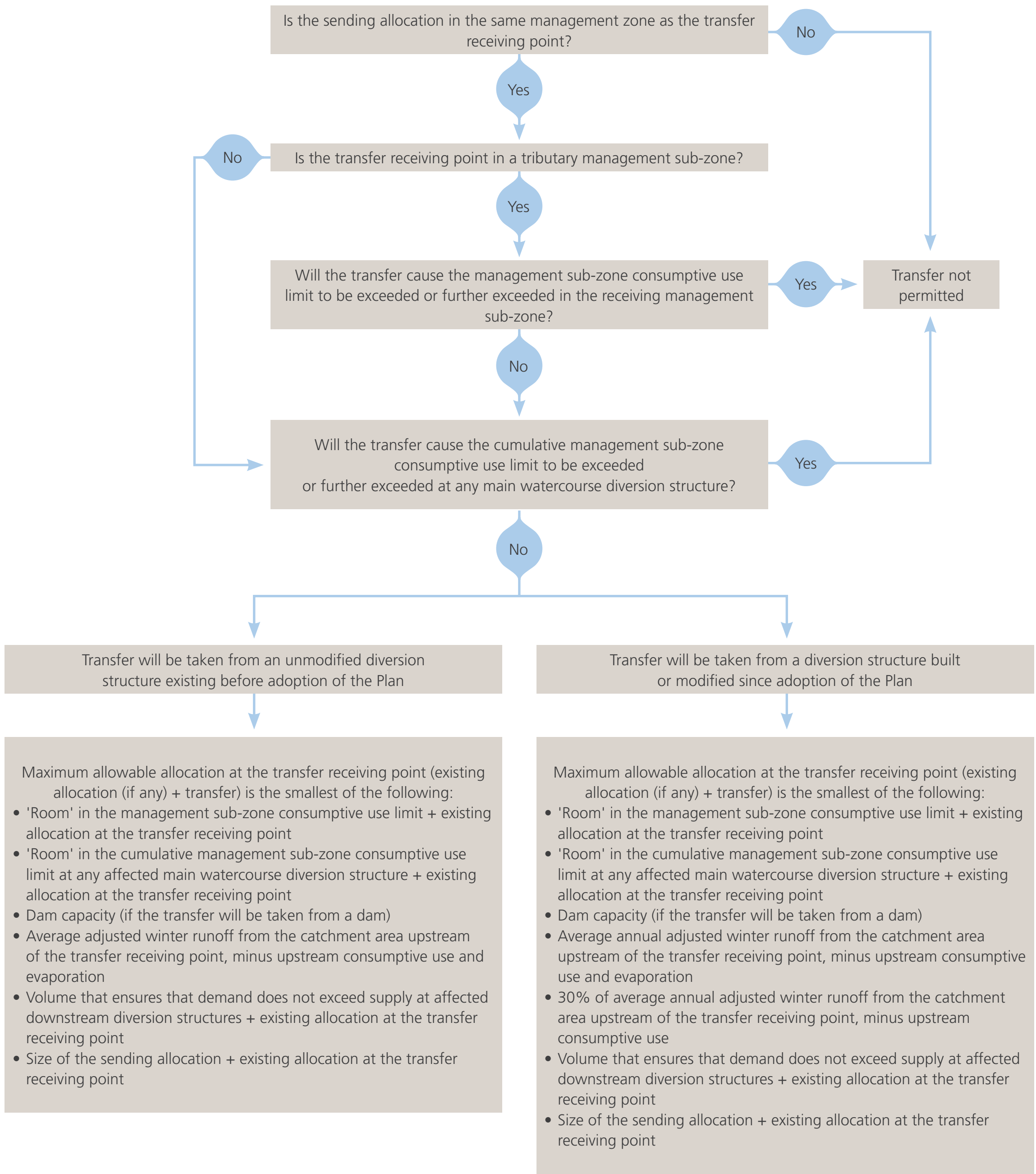


Figure 6: Flow chart of the process for determining the maximum allowable volume that could be taken as a result of a transfer

Other notes to Figure 6

- For more information on the processes listed in this flowchart, please consult section 3.3.4.
- Policies besides those in the flowchart may affect whether a transfer will be permitted.
- If the maximum allowable allocation calculated is the same or less than the existing allocation at the transfer receiving point, then the transfer will not be permitted.

Terms used in Figure 6

- Sending allocation: the allocation that is being sold in the transfer.
- Transfer receiving point: the diversion structure that the transferred allocation will be taken from

Management zone limits

Management zones

Four management zones have been defined for the surface water and watercourse water to reflect the movement of water through the catchments, and to recognise the different flow characteristics of the hills and plains areas. These are the Upper Marne, Lower Marne, Upper Saunders and Lower Saunders management zones (see Figure 7).

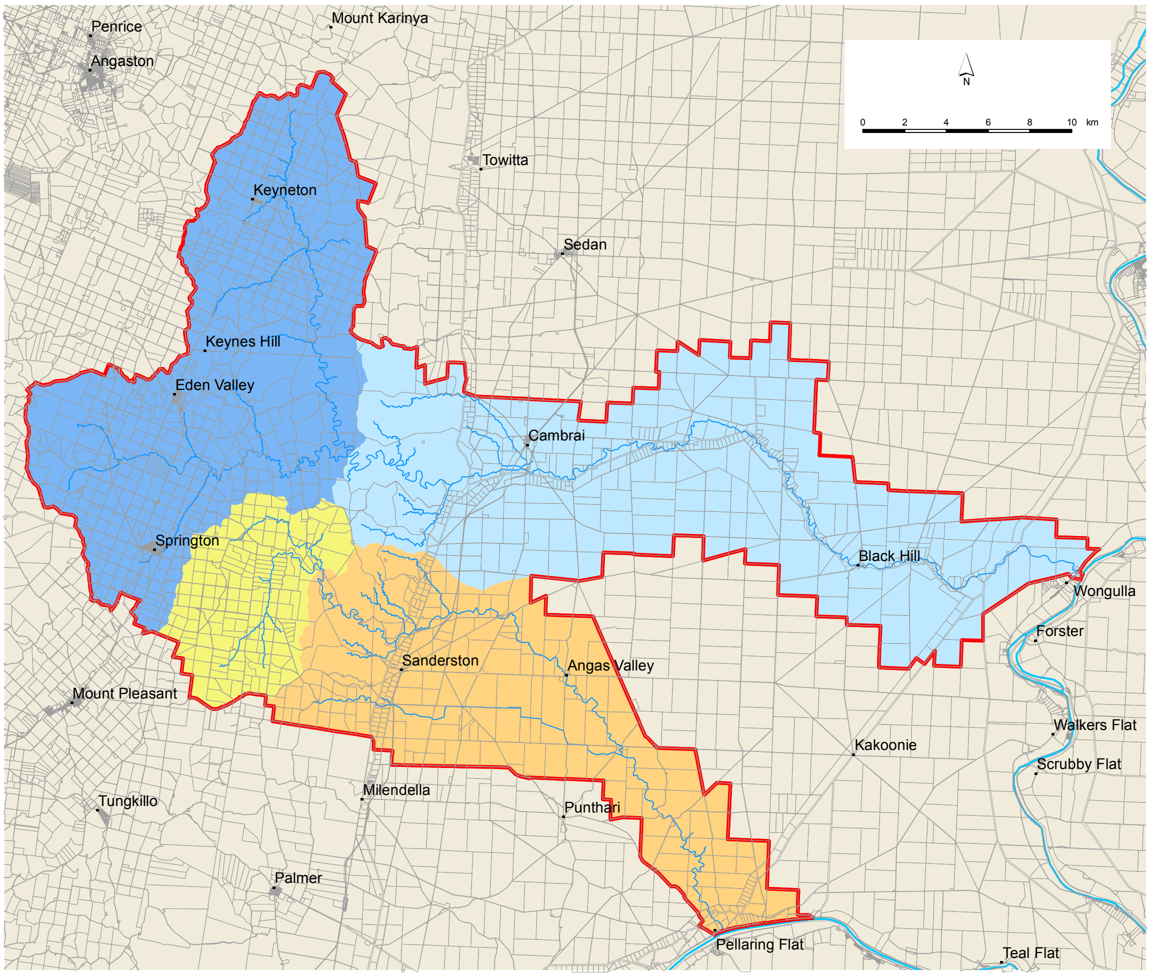
These management zones are treated independently in the Plan, with limits based on their particular characteristics.

Management zone allocation limits

An allocation limit has been set for each of these management zones to provide for the water needs of the environment and to allow sharing of water between the upper and lower parts of the catchments.

The total volume of water allocated in a management zone must not exceed the management zone allocation limit (principle 8). The allocation limit has been fully allocated to existing users in all surface water and watercourse water management zones, meaning that there is no water available for new allocation from these resources under the

Figure 7: Management zones boundaries for the surface water and watercourse water resources



Lower Marne Management Zone
Upper Marne Management Zone
Lower Saunders Management Zone
Upper Saunders Management Zone
Marne Saunders PWRA
Parcel Boundary
Larger Watercourses in the Marne Saunders PWRA
River Murray

Plan (principle 50). However, a user may obtain an allocation by transferring it from another licensee (within the same management zone), subject to the rules in the Plan and approval of the Minister.

Transfer between management zones

Allocations are not able to be transferred between management zones (principle 85). The logic behind this principle is that water does not flow between the Marne and Saunders catchments, so taking less water in one catchment (by transferring an allocation out of it) does not mean that there will be more water available to take in the other catchment.

Transfers are not allowed between the upper management zone and lower management zone within a catchment for two reasons. First, flows on the plains are of key importance for providing for the environmental water needs in this region, and should be protected from further extraction. Second, much of the flow on the plains soaks through the bed of the watercourse and recharges the sedimentary underground water. This means that not all of a 20 ML watercourse allocation from the hills would be available for extraction on the plains. A significant (but variable) proportion of that volume will have been lost from the watercourse water resource to the underground water resource by the time it reaches a transfer location on the

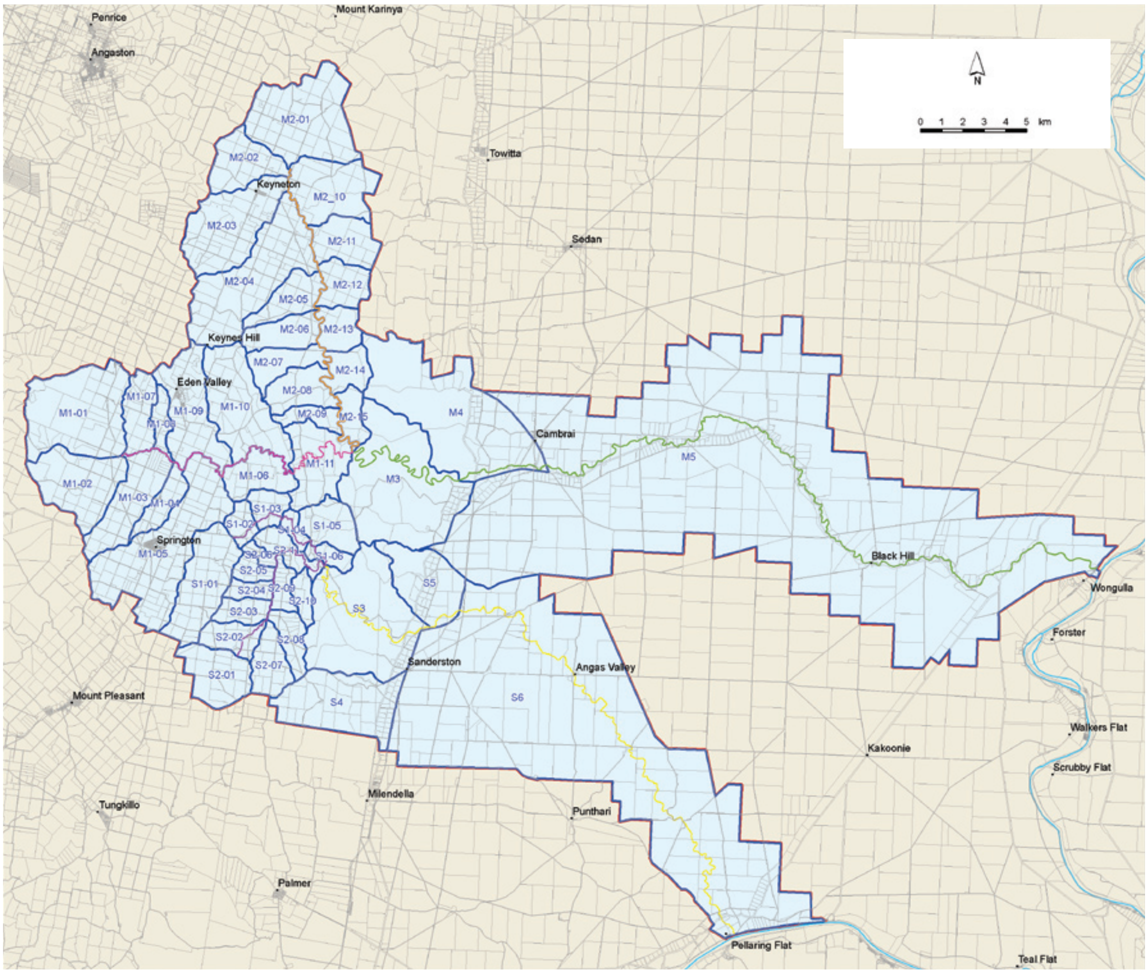


Figure 8: Management sub-zones boundaries for the surface water and watercourse water resources

plains. Current knowledge of the rate of loss is not sufficient to be able to determine a conversion factor. As a result, transfers between upper and lower management zones will not be permitted for this Plan. However, collection of data on flows and rates of loss may allow this to be reviewed in future Plans.

Management sub-zone limits

Management sub-zones

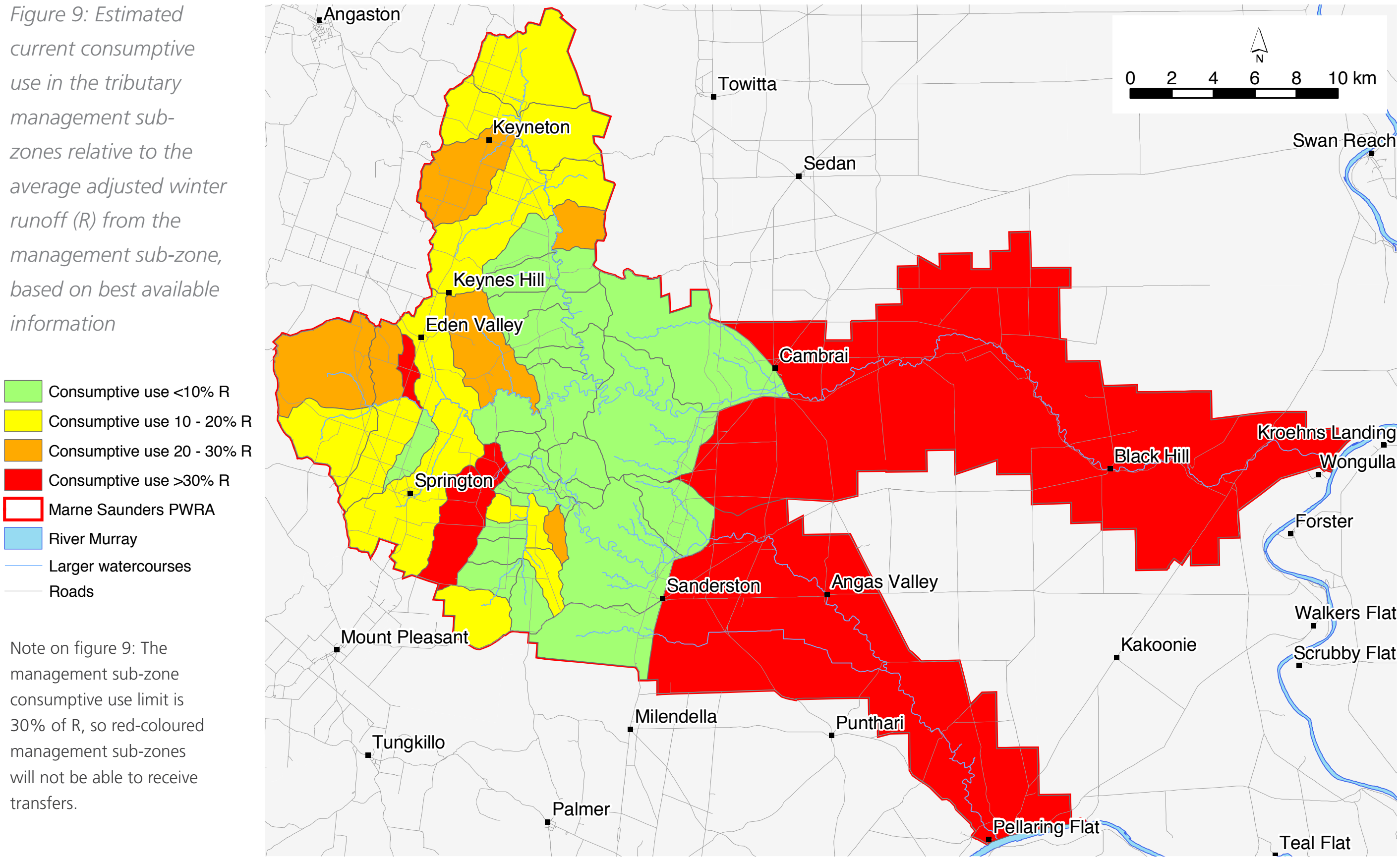
The management zones have been divided into management sub-zones to reflect finer scale differences in water supply (via rainfall) and demand. There are two types of management sub-zones for the surface water and watercourse water resources; these are the tributary management sub-zones and main watercourse management sub-zones. The tributary management sub-zones flow into the main watercourse management sub-zones. Boundaries of the management sub-zones are shown in Figure 8.

Managing water capture and use at the scale of these management sub-zones also ensures that each tributary contributes its share of the water requirements of the water-dependent ecosystems that are largely found in the main watercourses.

Consumptive use limits

Each tributary management sub-zone has a consumptive use limit, set as 30% of 'average adjusted winter runoff' from the management sub-zone. Average adjusted winter runoff is the modelled volume of water that would have run

Figure 9: Estimated current consumptive use in the tributary management sub-zones relative to the average adjusted winter runoff (R) from the management sub-zone, based on best available information



Note on figure 9: The management sub-zone consumptive use limit is 30% of R, so red-coloured management sub-zones will not be able to receive transfers.

off during May to November from an area if there were no dams present in the current landscape.

The consumptive use limit is different from an allocation limit, because the consumptive use limit includes all estimated usage in a management sub-zone, including non-licensed usage. It is the total capture and usage of surface water and watercourse water that creates impacts on downstream users and the environment, no matter what the water is used for. The consumptive use limit helps manage the sub-zone in order to minimise the impact on downstream users and ecosystems.

Consumptive use is the sum of allocations and estimated non-licensed use in an area such as a management sub-zone—see principle 53(e) in the Plan. Non-licensed use is estimated as 30% of the capacity of dams used only for non-licensed purposes. The Minister may also make an estimate of non-licensed use from licensed diversion structures, if necessary.

The management sub-zone consumptive use limit only applies when assessing transfers of allocations (i.e. for licensed purposes). The usage of water for non-licensed purposes can only be indirectly managed by managing the capacity of new or enlarged dams, as described in chapter 5 of this Guide.

Transfers and management sub-zones

Allocations may be transferred between management sub-zones within a management zone (principle 86). Transfers will not be permitted into management sub-zones where they would cause the total volume of consumptive use to exceed, or further exceed, the relevant consumptive use limit (principles 54-55).

Transfers into tributary management sub-zones

The extra volume able to be transferred to a receiving point can’t exceed the amount of ‘room’ left in the consumptive use limit of the receiving tributary management sub-zone (principles 54-55). 'Room' is calculated as the consumptive use limit minus the consumptive use. This means that the maximum possible allocation at a point as a result of a transfer is the room left in the consumptive use limit, plus any existing allocation at that point. Figure 9 shows estimated current consumptive use in the tributary management sub-zones compared to the average adjusted winter runoff.

Transfers relating to main watercourse management sub-zones

Consumptive use limits also apply to transfers to diversion structures that take water from main watercourse management sub-zones ('main watercourse diversion structures'). Such transfers must not cause consumptive use to exceed, or further exceed, the cumulative consumptive use limit. The difference lies in that the streams of the tributary management sub-zones feed into the main watercourse management sub-zones and provide the flow found in the main watercourses. Therefore, for main watercourse management sub-zones:

- the relevant consumptive use limit is the sum of the consumptive use limits for all of the tributary management sub-zones that are upstream of the main watercourse diversion structure
- the relevant consumptive use figure to compare this limit against is the sum of the consumptive use in all of the upstream tributary management sub-zones and from the portion of the main watercourse management sub-zone that is upstream of the main watercourse diversion structure.

A tributary management sub-zone is considered to be upstream of this main watercourse diversion structure if it lies entirely upstream, or if the major point of inflow from that tributary management sub-zone to the main watercourse management sub-zone is upstream of the diversion structure. The Plan provides a map identifying these major points of inflow (principles 53-55).

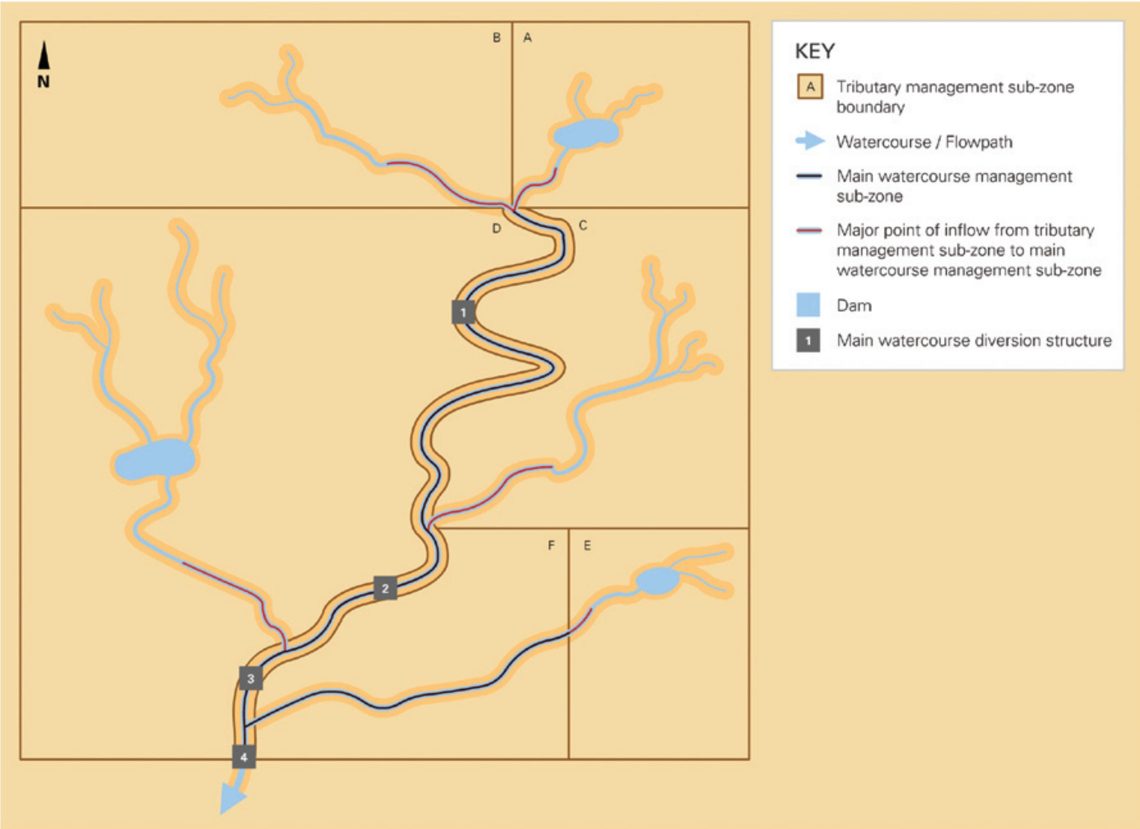
In addition, transferring an allocation to a different tributary management sub-zone means that the total consumptive use increases in the catchment area upstream of any main watercourse diversion structures that are downstream of the tributary management sub-zone that receives the transfer. This means that the effect of any transfer on total consumptive use compared against the consumptive use limit needs to be checked at main watercourse diversion points that are downstream of the transfer receiving point (principle 54-55).

This check only needs to be made at main watercourse diversion structures that might be affected by the transfer.

Examples of the places that will need to be checked are listed below.

- If water is transferred further downstream on the same watercourse, then the only place that needs to be checked is the receiving point. In this case, there will be no net difference to the amount of upstream flow that is taken for any diversion points that are downstream of the receiving point.
- If water is transferred further upstream on the same watercourse, then any diversion structures at and between the sending and receiving point will need to be checked. If extra water is being taken further upstream, then it may affect these users further downstream.

Figure 10: Examples of locations where checks need to be made of total consumptive use against the relevant consumptive use limit for main watercourse diversion structures, following a transfer of surface water or watercourse water



There will be no net difference to the amount of upstream flow that is taken for any diversion points that are downstream of the sending point.

- If water is transferred between two different watercourses, then only diversion structures at and downstream of the receiving point need to be checked, down to the point where the two watercourses meet. Any diversion structures downstream of the sending point will be better off. There will be no net difference to the amount of upstream flow that is taken for any diversion points that are downstream the point where the two watercourses join.

Diversion structure scale limits

Local physical capacity

Two limits have been set to make sure that the volume taken as a result of the transfer is physically available at the receiving point. These are the dam capacity limit and the runoff from upstream catchment limit.

Dam capacity limit

If the allocation will be transferred to a dam, then the volume transferred plus any existing allocation from the receiving dam must not exceed the dam capacity (principle 56).

Figure 10 provides an illustration of these examples.

Figure 10

Transfer of allocations must not cause consumptive use to exceed—or further exceed—the management sub-zone consumptive use limit in the receiving management sub-zone or at any main watercourse diversion structures that might be affected by the transfer.

In the hypothetical catchment to the left, consumptive use would need to be 'checked' against relevant management sub-zone consumptive use limits, as outlined below (please note that the shortened 'Sub-zone' has been used to name the tributary management sub-zones).

Calculation A—Transferring downstream on the same watercourse

If an allocation was transferred from the dam in Sub-zone A to the dam in Sub-zone D, then checking would only need to occur for Sub-zone D.

- Sub-zone A, Main Watercourse Diversion Structures 1 and 2: All are better off because there is less water being taken upstream—they don't need to be checked.
- Main Watercourse Diversion Structures 3 and 4: There is no net difference to these, as the total volume taken upstream stays the same—they don't need to be checked.
- Sub-zones B, C, E and F: None of these are downstream of Sub-zone A so won't be affected by the transfer—they don't need to be checked. These dams are not downstream of Sub-zone A because—to get to their watercourses from Sub-zone A—you would need to travel upstream at some point.

A similar situation would occur if an allocation was transferred from the dam in Sub-zone A to Main Watercourse Diversion Structure 3—that is, checking would only need to occur at Main Watercourse Diversion Structure 3 because the other Sub-zones and Main Watercourse Diversion Structures are either unaffected or better off.

Calculation B—Transferring upstream on the same watercourse

If an allocation was transferred from the dam in Sub-zone D to the dam in Sub-zone A, then checking would need to occur for Sub-zone A and also for Main Watercourse Diversion Structures 1 and 2. The relevant areas for determining total consumptive use against the consumptive use limit would be:

- for Main Watercourse Diversion Structure 1: Sub-zone A plus sub-zone B
- for Main Watercourse Diversion Structure 2: sum of Sub-zone A, Sub-zone B, Sub-zone C and Main Watercourse Diversion Structure 1

Checking would not need to take place at the following points:

- Main Watercourse Diversion Structures 3 and 4: no net difference, as the total volume taken upstream of them stays the same
- Sub-zone D: better off, as less water being taken upstream
- Sub-zone B, C, E and F: none of these are downstream of Sub-zone D, so won't be affected by the transfer.

Calculation C—Transferring between watercourses

If an allocation was transferred from the dam in Sub-zone E to the dam in Sub-zone A, then checking would need to occur for Sub-zone A and also for Main Watercourse Diversion Structures 1, 2 and 3. It would not need to be checked at the following points:

- Sub-zone E and F: better off because there is less water being taken upstream of it
- Main Watercourse Diversion Structure 4: no net difference, as the total volume taken upstream of it stays the same
- Sub-zones B, C and D: not downstream of Sub-zone E, so won't be affected by the transfer.

Figure 11: Example of calculation of the transfer limit based on runoff from the upstream catchment area of a diversion structure

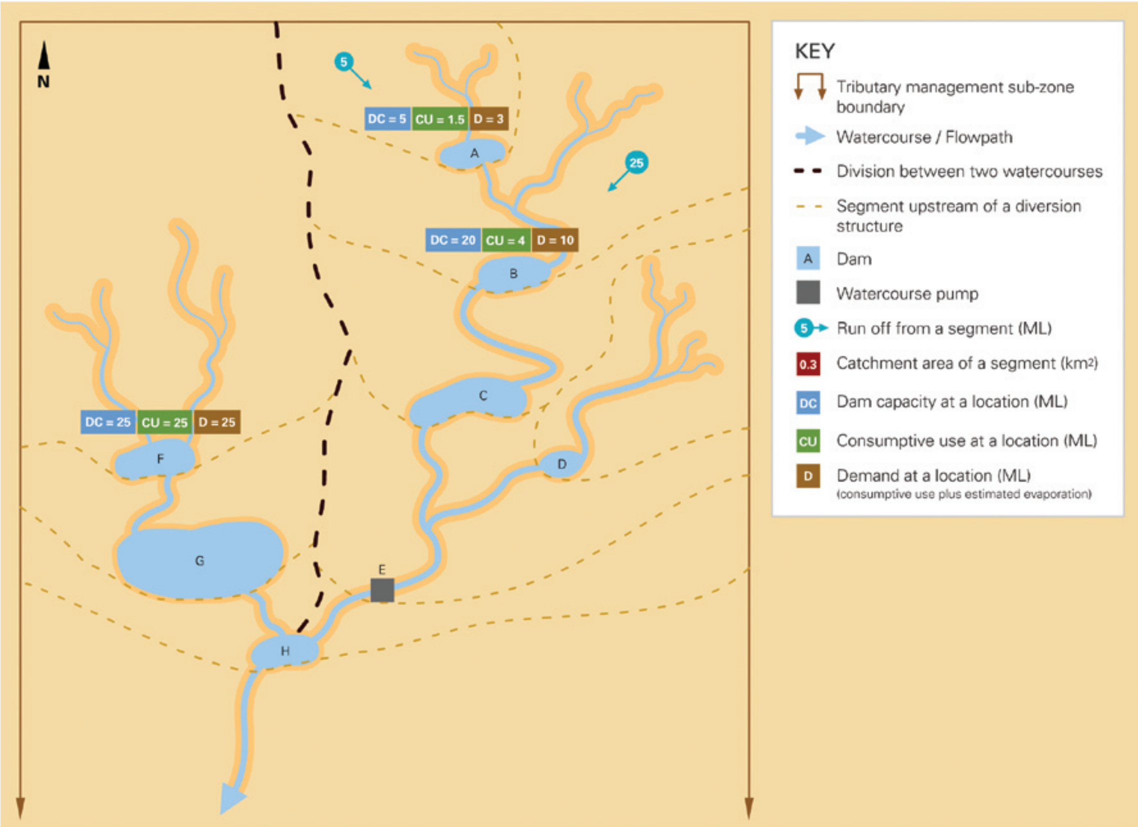


Figure 11

The user of Dam B wants to transfer in more water, buying it from the user of Dam F. The user at Dam B already has an allocation of 4 ML.

Calculation A—Runoff from upstream catchment limit

The allocation taken at Dam B must not exceed average adjusted winter runoff to Dam B minus upstream demand (consumptive use plus estimated evaporation). Thus:

- average adjusted winter runoff upstream of Dam B = runoff from Segment A and Segment B (5 ML + 25 ML = 30 ML)
- demand upstream of Dam B = demand from Dam A (3 ML)
- maximum allowable allocation at Dam B = average adjusted winter runoff – upstream demand (30 ML – 3 ML = 27 ML)
- maximum transfer = maximum allowable allocation – existing allocation (27 ML – 4 ML = 23 ML).

The maximum transfer is 23 ML, subject to meeting all of the other transfer limits.

Calculation B—Sustainable flow regime for new or enlarged dams

If Dam B was constructed *after* the Plan is adopted, then—in addition to the calculation above—the allocation taken at Dam B must not exceed 30% of average adjusted winter runoff to Dam B minus upstream consumptive use. Thus:

- 30% of average adjusted winter runoff upstream of Dam B: 30% of 30 ML = 9 ML
- consumptive use upstream of Dam B = consumptive use at Dam A (1.5 ML)
- maximum allowable allocation at Dam B = 30% of average adjusted winter runoff – upstream consumptive use (9 ML – 1.5 ML = 7.5 ML)
- maximum transfer = maximum allowable allocation - existing allocation (7.5 ML – 4 ML = 3.5 ML)

The maximum transfer is 3.5 ML, subject to meeting all of the other transfer limits.

Runoff from upstream catchment limit

The volume transferred plus any existing allocation at the receiving point must not exceed the amount of average adjusted winter runoff that is available at that point. This available runoff is calculated as the average adjusted winter runoff from the catchment area upstream of the receiving point, minus the upstream losses of existing consumptive use and estimated evaporation from dams in that catchment area (principles 57).

See Figure 11, Calculation A for an example.

The dam capacity and runoff from upstream catchment limits work in tandem. Where the dam capacity is small relative to the amount of available runoff, then the dam capacity will be the limiting factor. However, where the dam capacity is larger than the amount of available runoff, then the available runoff will be the limiting factor.

Sustainable flow regime for new or enlarged dams

A maximum of 30% of upstream average adjusted winter runoff can be taken from a dam or diversion structure built or enlarged after the Plan is adopted (principle 58). This limit represents a more stringent set of rules that ideally would be put in place when an area is first developed, to ensure that each dam provides adequate downstream environmental flows and sharing of water between users.

This limit is based on the total volume used from dams, so any consumptive use in the catchment area upstream of the diversion structure needs to be accounted for by subtracting it from the allowable limit.

See figure 11, Calculation B for an example.

Provision for downstream users

When water is transferred to a new location, it is important to minimise the impact on existing downstream diversion structures. Therefore the maximum volume of water able to be taken at a point (existing allocation plus transfer) is the volume that will allow downstream users to continue to access their allocation or estimated non-licensed usage, on average (principles 60-61).

This will be assessed using a water balance approach, which looks at water supply and demand at each of the diversion structures downstream of the transfer receiving point that may be affected by the transfer. The transfer will not be permitted if total 'demand' is greater than 'supply', or will become so as a result of the transfer, at any of these downstream diversion structures.

The supply at a diversion structure is the average adjusted winter runoff generated upstream of the diversion structure. The total demand at a diversion structure is the sum of all allocations, all estimated non-licensed use and estimated evaporation from dams at and upstream of that diversion structure.

Figure 12 shows an example of how this principle works.

3.3.5 | Restrictions on where water can be taken from

Water will not be allocated if it is proposed to be taken from within a mapped 'key environmental asset' (principle 62). The key environmental assets are the highly sensitive and ecologically-important areas of permanent flow, located at Black Hill Springs and around Lenger Reserve.

The only exception is where an allocation from within a key environmental asset was originally granted to an existing user. Such allocations may be transferred if the volume does not increase and it continues to be taken from the same location. This situation could occur when the licence is transferred together with the sale of a property. These allocations may also be transferred out of the key environmental asset to another location in the same management zone.

Neither will water be allocated if it is to be taken from a dam or other diversion structure constructed or enlarged after the Plan is adopted, unless that construction or enlargement is in accordance with the WAA policies for that activity, as discussed in section 5.7 (principle 63).

Figure 12: Example of calculation of the transfer limit based on provision for access of needs for downstream users

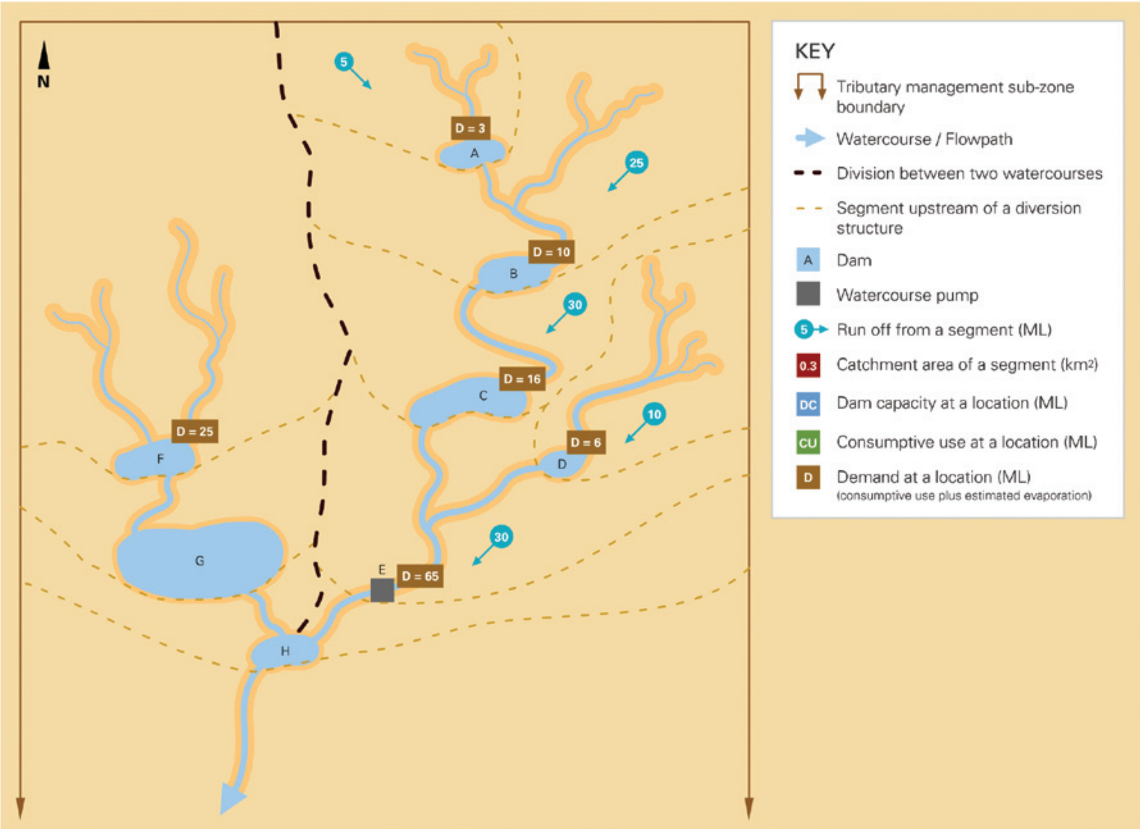


Figure 12

The user of Dam B wants to transfer in more water, buying it from the user of Dam F.

The allocation from Dam B must not cause total demand to exceed total supply at any diversion structures that might be affected.

The following diversion structures wouldn't be affected by the transfer:

- Dam A—upstream of Dam B
- Dam G—better off because less water taken upstream
- Dam D—not downstream of Dam B, as you would need to travel back up a watercourse to reach it from Dam B
- Dam H—moving water from Dam F to Dam B will not change the total demand upstream of Dam H.

Thus, the only diversion structures where supply and demand need to be checked are Dam C and Watercourse Pump E.

Calculation A: Dam C

- Total supply = runoff from Segments A, B and C (5 ML + 25 ML + 30 ML = 60 ML)
- Total demand = total demand from Dam A, Dam B and Dam C (3 ML + 10 ML + 16 ML = 29 ML)
- Total supply minus total demand is 60 ML – 29 ML = 31 ML

Calculation B: Watercourse Pump E

- Total supply = runoff from Segments A, B, C, D and E (5 ML + 25 ML + 30 ML + 10 ML + 30 ML = 100 ML)
- Total demand = total demand from Dam A, Dam B, Dam C, Dam D and Watercourse Pump E
  (3 ML + 10 ML + 16 ML + 6 ML + 65 ML = 100 ML)
- Total supply minus total demand is 100 ML – 100 ML = 0 ML

These calculations show that any extra water taken from Dam B would cause total demand to exceed total supply at Watercourse Pump E.

Therefore, no transfer would be permitted to Dam B from Dam F.

3.3.6 | Bypassing or returning low-flows

Licensees will need to provide for a component of environmental water needs by bypassing, releasing or avoiding the capture of flows at or below the threshold flow rate (principle 67-69).

The size of the threshold flow rate at a diversion structure (in litres per second) is determined by multiplying the size of the catchment area upstream of the diversion structure by the unit threshold flow rate given for its management sub-zone in the Plan (see example in Figure 13). The unit threshold flow rate is set on the basis of local runoff characteristics and flow patterns.

In the Marne Saunders PWRA, the threshold flow rate is the flow rate that is exceeded for approximately 90% of the time at a location. The volume of annual flow below the

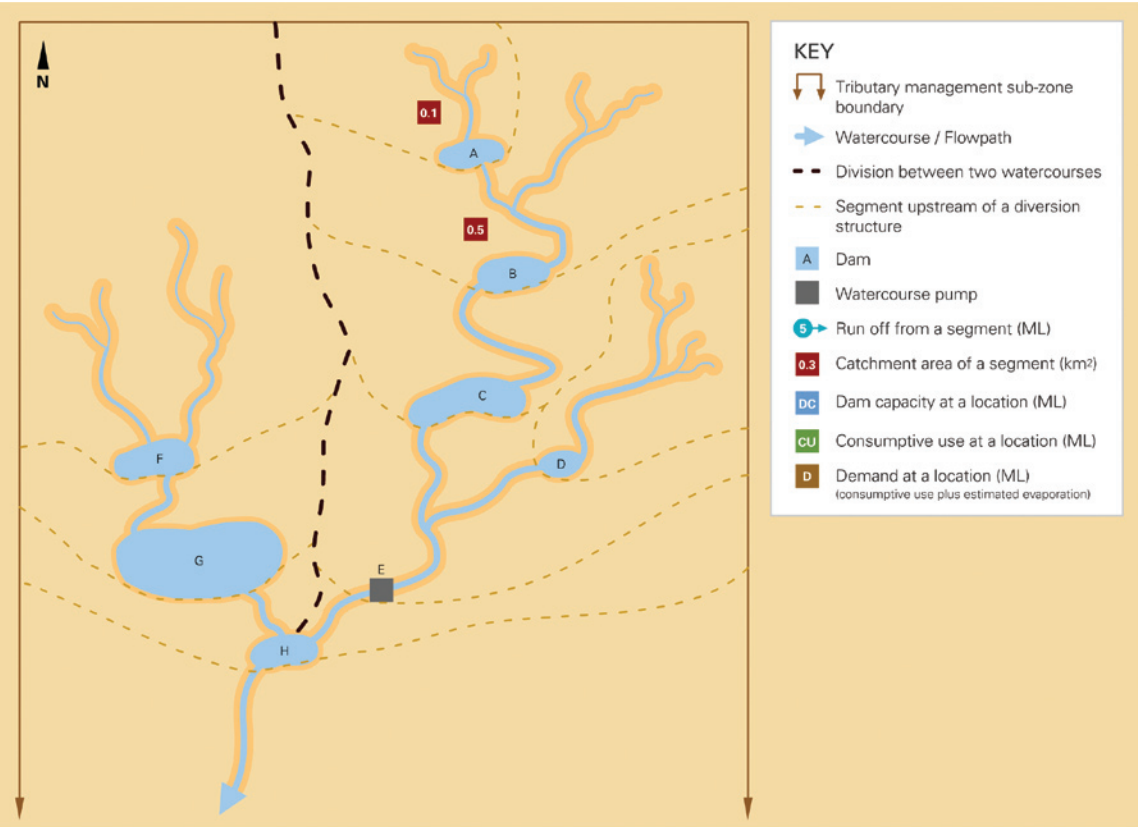


Figure 13: Example of how the threshold flow rate is calculated

Figure 13

The threshold flow rate is given in litres per second and is calculated as:
unit threshold flow rate for the management sub-zone[3] (in L/s/km^2) multiplied by catchment area upstream of the diversion structure (in km^2).

For the hypothetical management sub-zone above, the unit threshold flow rate is 2 L/s/km^2.

The area upstream of Dam B = area of Segment A plus Segment B (0.1 km^2 + 0.5 km^2 = 0.6 km^2)

So the unit threshold flow rate at Dam B is: 2 L/s/km^2 x 0.6 km^2 = 1.2 L/s

3. table 28 in the Plan

threshold flow rate is around 10% of the total annual flow at a location.

Water users have expressed concern that diversion structures in areas with very low-flow rates may rarely capture water under this policy. Therefore, an alternative is provided under the Plan where those with a threshold flow rate of 1 litre per second or less can instead choose to return 10% of all flow coming to their diversion structure at any time—in other words, capture 90% of flow at any time (principle 70). This means that such users are still contributing the equivalent flow, although the timing is not ideal in terms of environmental water needs. However, it means that all licensees are playing a part.

The device that bypasses, returns or avoids capture of low-flows (the 'low-flow bypass') needs to have the following properties:

- where flow is bypassed or returned, the flow needs to be returned to the same flow path or watercourse downstream of the diversion structure as soon as practical, and be of similar or better quality (principles 67 and 70)
- the correct operation of the low-flow bypass needs to be automated and not able to be manually over-ridden (principle 71)
- the low-flow bypass must not increase the area that contributes flow to the diversion structure beyond its natural catchment area (principle 71)
- the low-flow bypass must be maintained so that it continues to be effective, and must not be obstructed or tampered with (principle 71).

The applicant will need to show how they will satisfactorily return low-flows before the transfer will be approved (principle 72). A series of guidelines have been developed outlining how to construct several different types of low-flow bypass devices, and will be available on the SA MDB NRM Board's website in the future. The SA MDB NRM Board is also undertaking a project to investigate other design options. There are many ways that low-flows could be returned and all appropriate device designs submitted by transfer applicants will be considered.

It should be noted that the requirement to return key environmental flows allows allocation limits and dam capacity limits to be more generous than they would otherwise be.

3.3.7 | Maximum diversion rate for watercourse diversions

A maximum diversion rate (in litres per second) will be set as a licence condition for allocations where the water will be taken from a 'restricted' watercourse (principle 64-66)—these watercourses are streams of third order or higher (see Figure 14). The purpose of this maximum diversion rate is to allow a user to take a portion of the flow going past in a high flow event, while still allowing part of the flow event to pass on to downstream users and the environment.

The maximum diversion rate is determined as the allocation volume divided by 20 days, which is then converted to litres per second.

Flow modelling has been used to determine that flows above the threshold flow rate (see section 3.3.6) occur for at least 20 days in 60% of years. Using this figure allows the capture of flow to be spread over the time that flow is available and able to be extracted.

3.3.8 | Rollover of unused water allocation

Water users have asked for flexibility by being able to 'rollover' unused parts of allocations for use in later water use years. The Plan's policies allow for this flexibility, but also keep in mind potential adverse effects.

Hydrological experts have advised that rollover policies need to be carefully managed to protect the surface water and watercourse water resources—as well as the users and the environment that depend on them. They note that it is likely that many users will take their extra 'saved' water at the same time in a dry year, putting the resource under extra stress through the higher total use. In addition, unused parts of water allocations from one year will not necessarily still be accessible from that location in later years. Watercourse flows that are not extracted flow on down the catchment, and unused water in a dam will be subject to evaporation and seepage.

Size and life of rollover allocations

The Plan allows unused parts of the 'base' allocation to be rolled over into later water use years (principle 73), but limits the life and volume of rollover allocations to address the issues outlined above.

The unused allocation volume from a water use year is called a 'rollover credit'. A rollover credit has a life of two water use years (principle 77). That is, if 10 ML is unused in water use year 1, then a 10 ML rollover credit could potentially be used in water use year 2 and/or water use year 3. It will expire at the end of water use year 3 and won't be available in water use year 4. Rollover allocations and credits cannot be rolled over.

The maximum volume of a rollover allocation in a water use year is the sum of the licensee's rollover credits, capped at a maximum of 20% of their base allocation (principle 75). Furthermore, if the rollover allocation is taken from a dam, the rollover allocation plus the base allocation must not exceed the dam capacity.

Where rollover allocations can be taken from

A rollover allocation can only be taken from the diversion structure that it was saved from. This is because the saved water will only be available for later use from that local area. If a single allocation can be taken from a number of

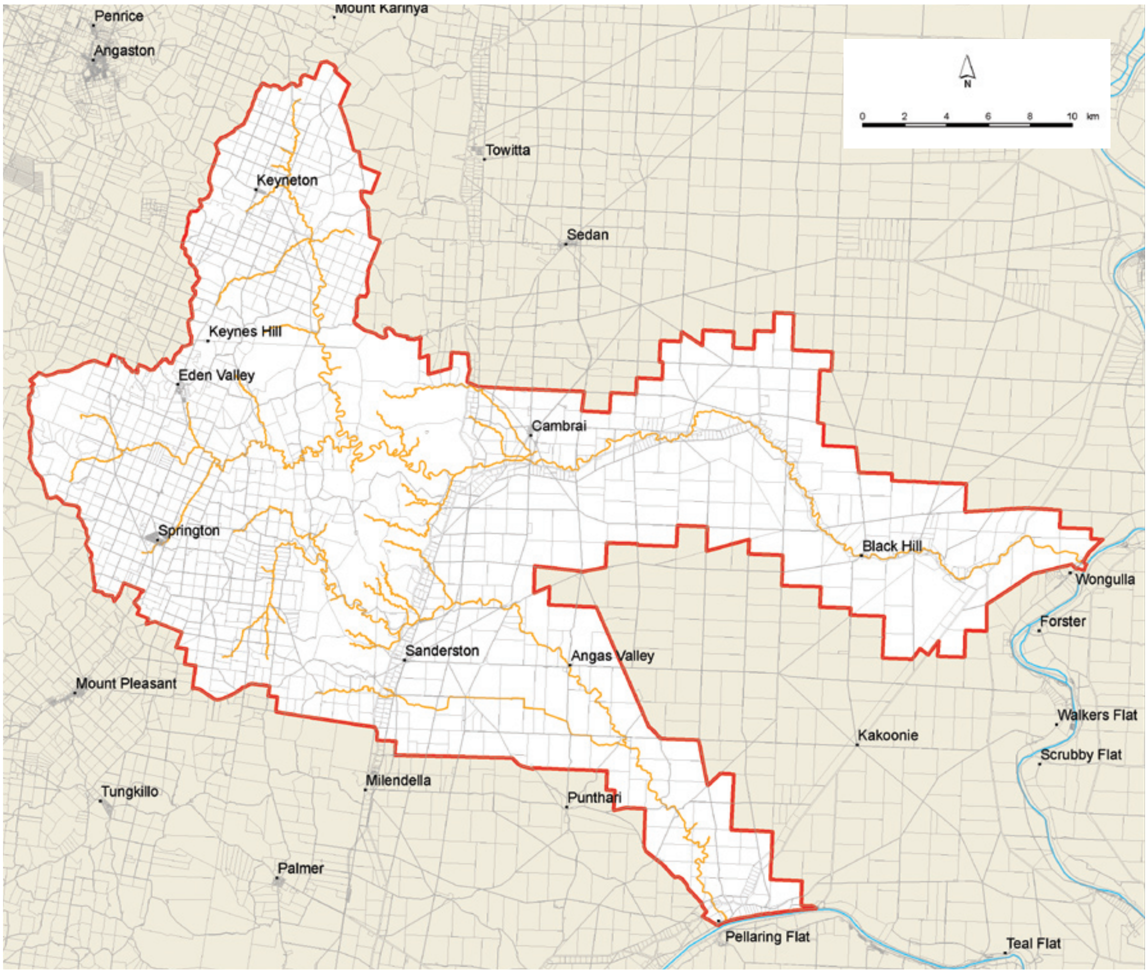


Figure 14: Restricted watercourses in the Marne Saunders PWRA

Table 1: Surface water and watercourse water rollover example

	Year 1	Year 2	Year 3	Year 4	Year 5
Base allocation	50 ML	50 ML	50 ML	50 ML	50 ML
Rollover credits from last 2 years (remaining unused base allocation from last 2 years)	-	5 ML from year 1	5 ML from year 1 8 ML from year 2	6 ML from year 2 (no credit earned in year 3)	0 ML (remaining credit from year 2 has expired, no credit earned in years 3 and 4)
Rollover allocation (sum of available rollover credits, capped at 20% of base allocation)	-	5 ML	10 ML	6 ML	0 ML
Total allocation (base + rollover)	50 ML	55 ML	60 ML	56 ML	50 ML
Total usage	45 ML	42 ML	57 ML	54 ML	50 ML
Base allocation used this year (base allocation is used first)	45 ML	42 ML	50 ML	50 ML	50 ML
Base allocation unused this year	5 ML	8 ML	0 ML	0 ML	0 ML
Rollover allocation used this year (credits are used in the order that they accrue)	-	0 ML	7 ML (5 ML from year 1 and 2 ML from year 2)	4 ML	0 ML
Rollover credits unused this year	-	5 ML from year 1	6 ML from year 2	2 ML from year 2 (expires at the end of the year)	0 ML

diversion structures and a rollover allocation is granted, then the rollover allocation can be taken from any of those diversion structures (principle 79).

Accounting for non-licensed use when determining rollover

Some licensees may use water that has passed through their water meter for non-licensed purposes. However, this volume would generally be counted as allocation used for licensed purposes, and so would not be able to be rolled over for use in later water use years.

If a licensee wants to have this non-licensed use accounted for when determining the unused allocation volume that can be rolled over, then the volume used for non-licensed purposes must be measured in accordance with state metering specifications (principle 78). This measurement is only necessary where the licensee wants this non-licensed use accounted for.

Order of use of rollover allocations

Rollover credits are used in the order in which they accrue. That is, a rollover credit from water use year 1 is used before a rollover credit from water use year 2 (principle 76).

Rollover allocations are considered to be used after the base allocation (principle 6). That is, rollover allocations only get used if all of the base allocation from that diversion structure gets used. This means that rollover allocations can't be rolled over indefinitely.

Table 1 shows an example of rollover.

Transfer of rollover allocations

A rollover allocation can only be transferred if it will still be taken from the same diversion structure (principle 87). This situation may occur where a licence is transferred together with the sale of a property.

Start date of rollover policies

Accumulation of rollover credits will begin in first full water use year after an existing user allocation is granted, and grants of rollover allocations will begin in the second full water use year (principle 80). This allows rollover credits to be properly earned on the basis of having a full water use year to use a full year's volume of allocation, before rollover allocations will be granted.

3.3.9 | Extra safety net allocation non-transferable

It is intended that some existing users of surface water or watercourse water will be granted a safety net allocation as a social consideration to allow businesses to continue to operate. The safety net allocation is made up of two parts, as shown below.

safety net allocation	=	foundation allocation	+	extra safety net allocation
50% of maximum theoretical enterprise requirement, capped at dam capacity		Allocation that would have been received under the existing user allocation process without the safety net allocation		Difference between safety net allocation and foundation allocation

It is proposed that the 'foundation allocation' for existing users is the lesser of:

- maximum theoretical enterprise requirement (MTER) for the location, type and size of their enterprise
- the user's share of the management sub-zone consumptive use limit
- dam capacity (surface water users only)
- 70% of average adjusted winter runoff from the catchment area upstream of the diversion point, minus upstream use[4].

If the foundation allocation is less than 50% of MTER, the existing user will be granted the safety net allocation of 50% of MTER, capped at their dam capacity. The difference between the safety net allocation and the foundation allocation is the extra safety net allocation.

This extra safety net allocation is a compromise in terms of the needs of the environment and downstream users. Therefore, if the user does not require this extra safety net allocation, they should not make a windfall gain from it by transferring it to another user. Nor should they be able to retain the benefit of the extra safety net allocation if they transfer any of their foundation allocation to another user.

Under the Plan, the extra safety net allocation is generally not able to be transferred (principle 88). The only exception is where the extra safety net is transferred with the entire foundation allocation and will continue to be taken from the same diversion structure under the same conditions. This situation may occur when a licence is transferred together with the sale of a property.

In addition, if a licensee transfers any of the foundation allocation away permanently (apart from the circumstances above), then the extra safety net allocation will revert to the Minister (principle 89). Any extra safety net allocation returned to the Minister will not be re-allocated (principle 19). The total volume granted as extra safety net allocations is not included in the management zone allocation limits.

A licensee will only be able to transfer their foundation allocation temporarily if they convert their extra safety net allocation to a water (holding) allocation (principle 90). This means that the licensee still holds the extra safety net allocation but is not able to take or use it (see section 2.2.9). The extra safety net allocation can only be converted back to a water (taking) allocation when the foundation allocation or equivalent volume is returned to the licence.

4. The discussion paper by DWLBC on allocating water to existing users describes how it is proposed that allocations will be made to existing surface water and watercourse water users (see page 5 *A note for existing users* for sources for this discussion paper).

3.4 | Key policies for roof runoff

Surface water is defined as water running off the surface of the land, which includes buildings and other structures attached to the land. Therefore using roof runoff for licensed purposes in a prescribed surface water resource area requires a licence. Section 1.2.2 outlines purposes of use that currently don't require a licence.

3.4.1 | Exemptions to licensing roof runoff

DWLBC have recognised that licensing all of the roof runoff used for licensed purposes would be resource intensive for both the landholder and the administering body. Therefore, a state-wide authorisation has been gazetted in which a licence is not required for roof runoff—under certain conditions—where the volume deemed to be captured is less than 500 kilolitres per year and is used for purposes other than irrigation. The volume deemed to be captured is calculated as the local rainfall multiplied by the size of the roof catchment area connected to water storages.

3.4.2 | Allocation of roof runoff[5]

Roof runoff allocations are separate from the management zone allocation limits and management sub-zone consumptive use limits. New roof runoff allocations may be made under the Plan. This is because the volume of water that runs off a roof is much higher than the volume that would run off the same area of land. Therefore, a proportion of the water running off a roof can be harvested while not significantly affecting 'natural' downstream flow.

5. Section 6.6 of the Plan sets out the policies for allocation of roof runoff where a licence is required.

Roof runoff allocations may only be granted where runoff from at least 15% of the connected roof area is allowed to return to its natural flow path (principle 81). This figure has been set as the average proportion that would return to the environment from that area if there was no impermeable roof in the way.

Thus, the volume of a roof runoff allocation is capped at 85% of the average annual rainfall over the connected roof area (principle 82) in order to provide for the return of 15% of the runoff to the environment.

Roof runoff allocations are not able to become allocations from any other water resource or part of a water resource (principle 5, 83, 99). For example, they will not be able to be taken from the 'normal' surface water or watercourse water resources.

Payment is not required for new roof runoff allocations (principle 7).

3.4.3 | Transfer of roof runoff allocations

Roof runoff allocations are not able to be transferred, unless the location that they are taken from stays the same (principle 100). This situation may occur where the licence is transferred together with the sale of a property. New roof runoff allocations are generally available, so it will not be necessary for them to be transferred to a new location.

Underground water

A GUIDE TO THE DRAFT MARNE SAUNDERS WATER ALLOCATION PLAN

4 | Underground water

This chapter outlines[1]:

- the nature of the underground water resources in the Marne Saunders PWRA
- key management issues for underground water
- key policies for underground water, including:
  - limits on allocation and transfer volumes at various scales
  - buffer zone policies to minimise interference by wells, both on other wells and on water-dependent ecosystems
  - maximum extraction rates for large allocations
  - deemed allocations per well
  - policies for the rollover of unused allocations
- key policies for allocation of water that has been artificially recharged into a well.

1. This chapter does not discuss policies for drilling and repair of wells or drainage of water into aquifers. These policies are outlined in chapter 5.

4.1 | The nature of the underground water resources

There are two main types of aquifers in the Marne Saunders PWRA, being the fractured rock aquifer in the hills, and the sedimentary aquifers on the plains. Section 2.3.2 of the Plan provides information on the characteristics of these different aquifers, with major points given below.

The word 'wells' is used throughout this Guide and the Plan as a collective term for wells, bores and any other source that accesses underground water.

4.1.1 | Fractured rock aquifer

The fractured rock aquifer is made up of hard, largely impermeable basement rock where the underground water is stored and moves through the cracks or fractures in the rock. The yield of a well drilled into the aquifer depends on how many fractures the well intercepts, the size of the fractures, how many other fractures they are connected to and whether they are holding water. These features are all highly variable over the landscape, making the behaviour of fractured rock aquifers hard to predict. The basement rock in the Marne-Saunders area has few open systems of fractures, so yields are generally low (although there are some exceptions).

The main source of replenishment or recharge to the fractured rock aquifer is from local rainfall soaking through the soil into the fractures.

Water from the fractured rock aquifer flows into the watercourses in the hills through seeps and springs. This is called 'baseflow' and is a key source of water for sustaining the environment, as it helps maintain permanent pools during the drier seasons. These permanent pools are critical refuges for plants and animals that depend on the presence of water to survive, including fish, frogs, water-plants and bugs.

4.1.2 | Sedimentary aquifers

Sedimentary aquifers are made up of layers of sediments such as sands, clays, gravels and limestone. The water is stored and moves through the pore spaces between the sediments. There is generally good connection between the pore spaces and water can flow through evenly. This means that water movement in sedimentary aquifers is generally more consistent and predictable than in fractured rock aquifers.

There are three main sedimentary aquifers in the plains zone, which (from shallowest to deepest) are the Quaternary aquifer, Murray Group Limestone aquifer and Renmark Group aquifer. The vast majority of water used for consumptive purposes in the plains zone is from the Murray Group Limestone aquifer, because it is more accessible and the water yield is generally higher, more reliable and fresher.

Sedimentary Murray Group Limestone aquifer

The section of the Murray Group Limestone aquifer closest to the hills is 'confined', or disconnected from the surface, by a very thick layer of clay washed out of the hills. Water in a confined aquifer is held at greater than atmospheric pressure. This pressure causes water level in confined aquifer wells to rise above the surface of the aquifer. Underground water levels may change rapidly in a confined aquifer as a pressure response.

The main source of recharge to the confined aquifer is thought to be flow from the fractured rock aquifer in the hills. Yield and salinity of the water is good in the vicinity of the Marne River. Demand for water here is very high and monitoring shows that water level is declining (see section 4.2.2 of the Plan for more information). Yields drop and salinity increases in the confined aquifer south of the Marne River.

The Murray Group Limestone aquifer becomes unconfined where the clay layer thins east of Cambrai. An unconfined aquifer has connection to the surface and water is held at atmospheric pressure. Underground water level changes in unconfined aquifers are typically slower than in confined aquifers.

The unconfined Murray Group Limestone aquifer near the Marne River on the plains is thought to be mainly recharged from streamflow soaking down through the stream bed. Yield and salinity of the water is generally good in the unconfined aquifer in the vicinity of the Marne River. Demand for water here is very high and monitoring has showed significant water level decline in some locations during dry years (for more information, see section 4.2.2 of the Plan).

Further away from the Marne River, the recharge rate is much smaller because it mainly comes from local rainfall. This lower recharge rate means that the well yield away from the Marne River is generally smaller, the water is saltier, and the sustainable extraction limits are lower.

Springs from the Quaternary and Murray Group Limestone aquifers provide permanent flow in the otherwise largely dry watercourses near the end of the Marne River (near Black Hill) and Saunders Creek (near Lenger Reserve). The permanent flow supports highly significant ecosystems that depend on underground water. The Black Hill Springs support one of four remaining known populations of River Blackfish in the South Australian Murray-Darling Basin. The springs at Lenger Reserve support the only currently known native fish population in the Saunders catchment.

Quaternary and Renmark Group aquifers

The Quaternary and Renmark Group aquifers are not currently used for licensed purposes in the Marne Saunders PWRA. The yield of the Quaternary aquifer is generally poor. Baseflow from this aquifer is likely to support water-dependent ecosystems between the Marne gorge and Cambrai, and at the end of the catchments as described above. No water will be available for allocation from this resource under the Plan, as a precautionary approach to protect the environment and non-licensed users.

The Renmark Group aquifer is a confined aquifer lying beneath the Murray Group Limestone. It is not well studied. Yields and salinity are quite variable in the limited wells that have been drilled into this aquifer.

4.2 | Key management issues

Key management issues for underground water in the Marne Saunders PWRA include:

- maintaining regional underground water level to maintain access and water movement
- minimising adverse water quality impacts via water level draw-down
- minimising local interference by wells, both on other wells and on water-dependent ecosystems
- managing impacts at a variety of scales.

4.2.1 | Regional effects

The regional underground water level depends on the amount of inflow and outflow of water. If outflow is higher than the inflow (e.g. as a result of excessive pumping), the level will decrease. Effects of this can be that the water level may decrease below the depth of pumps or the roots of trees tapping into the underground water. A decrease in level may also affect regional flow from one aquifer to another, or from an aquifer to a watercourse.

Excessive extraction may create a persistent area of water level draw-down or 'cone of depression' around the extraction wells. A cone of depression may influence the direction of flow of underground water by creating a new low point toward which underground water will flow. Apart from disrupting the normal movement of underground water across the landscape, this has the potential to draw nearby saltier underground water into fresher areas.

4.2.2 | Local effects

Extraction from a well also leads to local draw-down of underground water level as illustrated in Figure 15. This may interfere with the ability to extract water from affected wells.

Pumping from a well can also interfere with local streamflow. Underground water flows from higher to lower levels, with the level at watercourses typically being the lowest in the local landscape. If pumping leads to local draw-down of underground water level, then underground water is less likely to flow towards the watercourse. This may reduce the amount of water discharged to the watercourse as baseflow, and potentially even cause flow in the watercourse to move into the underground water towards the well.

In a fractured rock aquifer, the likelihood of interference between wells, or from a well to a water-dependent ecosystem that depends on baseflow, will depend on the connectivity of the fracture sets between them (see Figure 15).

The more consistent nature of the sedimentary aquifer means that when water is pumped from a well, there tends to be a draw-down of underground water level in a circular area around the well. The spread and depth of the draw-down is largely governed by the volume and rate of water taking, and by aquifer characteristics such as how easily water can be transmitted through the aquifer.

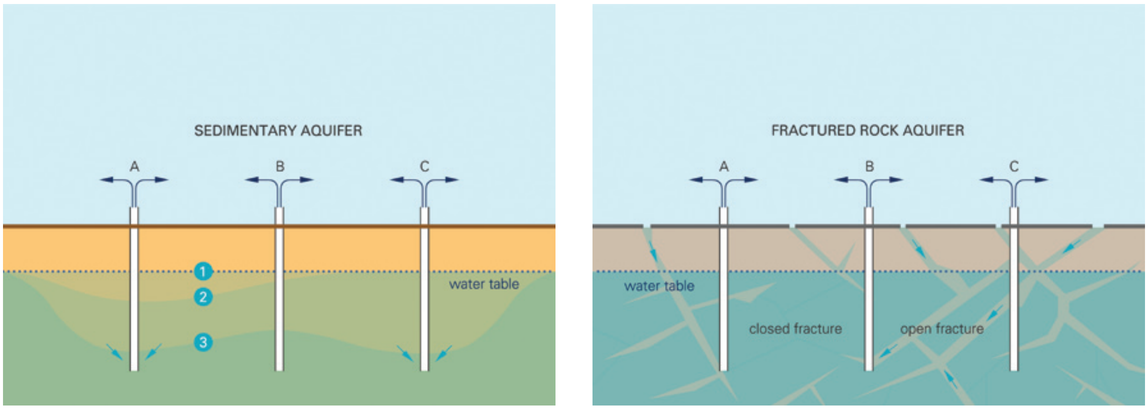
The draw-down of underground water level in a confined aquifer in response to pumping is more exaggerated compared with an unconfined aquifer. As a result, two wells the same distance apart and pumping at the same rate are more likely to interfere with each other in a confined aquifer than in an unconfined aquifer.

4.2.3 | Scales of management

The impacts outlined above occur across the landscape, at a range of scales from large to small. Listed below are examples of impacts at various scales and how the Plan provides for them.

- The total outflow of water needs to be balanced against total inflow at a broad scale to protect regional underground water level. This is provided for in the Plan by defining allocation limits at the scale of the management zone and management sub-zone.
- Concentrated extraction in a local area may lead to a persistent cone of depression. This is managed in the

Figure 15: Behaviour of aquifer types during pumping (figure courtesy of DWLBC, illustrated by Ecocreative)



1. Water table when no extraction from wells
2. Drawdown that occurs if only Well A is pumped. Water levels in Well B drop slightly. Water levels in Well C remain the same.
3. Combined draw-down effect if both Well A and Well C pump at the same time. This causes significant drop in the water level of Well B.

This decrease in water level is referred to as 'well interference'. Well interference can occur in sedimentary and fractures rock aquifers.

Fractures that are intersected by Well A have restricted connection to fractures intersected by Well B or Well C. Therefore, pumping from Well A will have a limited impact on water levels in Well B or Well C. However, in the case of Well B and Well C the fractures are connected and pumping from either well may cause a decrease in water levels in the other well. This decrease in water level is referred to as 'well interference'. Well B intersects less fractures and is likely to have a lower yield. In contrast, Well C intersects more fractures, resulting in a higher yield.

Plan by setting allocation limits at the management sub-zone scale, placing maximum extraction rates on large allocations, and placing buffer zones around wells.

- Pumping from a single well may interfere with a neighbouring well or environmental asset. This is managed in the Plan by spacing new underground water resource development from existing wells and environmental assets via buffer zones.

4.3 | Key policies for underground water[2]

The key policies regarding underground water have been organised into the following sections:

- management zones, management sub-zones and allocation limits
- policies to minimise interference by wells via buffer zones
- maximum extraction rates for large allocations
- deemed allocations per well
- policies for managing the rollover of unused water allocations.

4.3.1 | Management zones, management sub-zones and allocation limits

Defining management zones

The different aquifer characteristics described above have been used to divide the underground water resource into management zones. These are:

- the Fractured Rock Aquifer (in the hills—see Figure 16)

2. There are two 'key policy' sections in this chapter. The first deals with the key policies for allocation and transfer of underground water resources. The second deals with allocation and transfer of water that has been artificially recharged down a well.

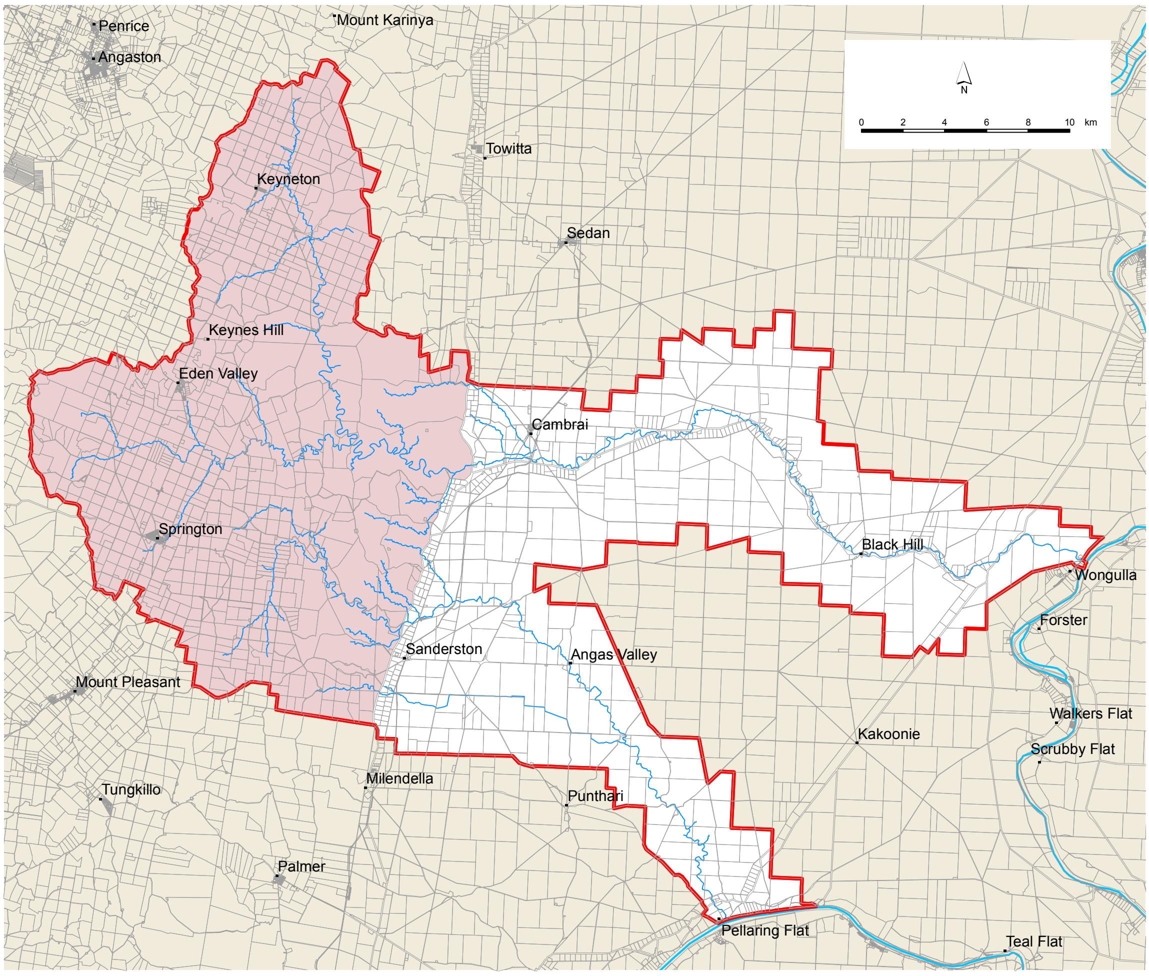


Figure 16: The Fractured Rock Aquifer management zone of the Marne Saunders PWRA

- the Quaternary Aquifer (see Figure 17)
- the Renmark Group Aquifer (see Figure 17)
- the Unconfined Zone 1 (in the Murray Group Limestone, mainly recharged by the Marne River—see Figure 18)
- the Unconfined Zones 2-6 (in the Murray Group Limestone, mainly recharged by local rainfall—see Figure 18)
- the Confined Zones A and B (in the Murray Group Limestone—see Figure 18)
- the Exclusion Zone (in the Murray Group Limestone, location of very important springs fed by the underground water—see Figure 18)

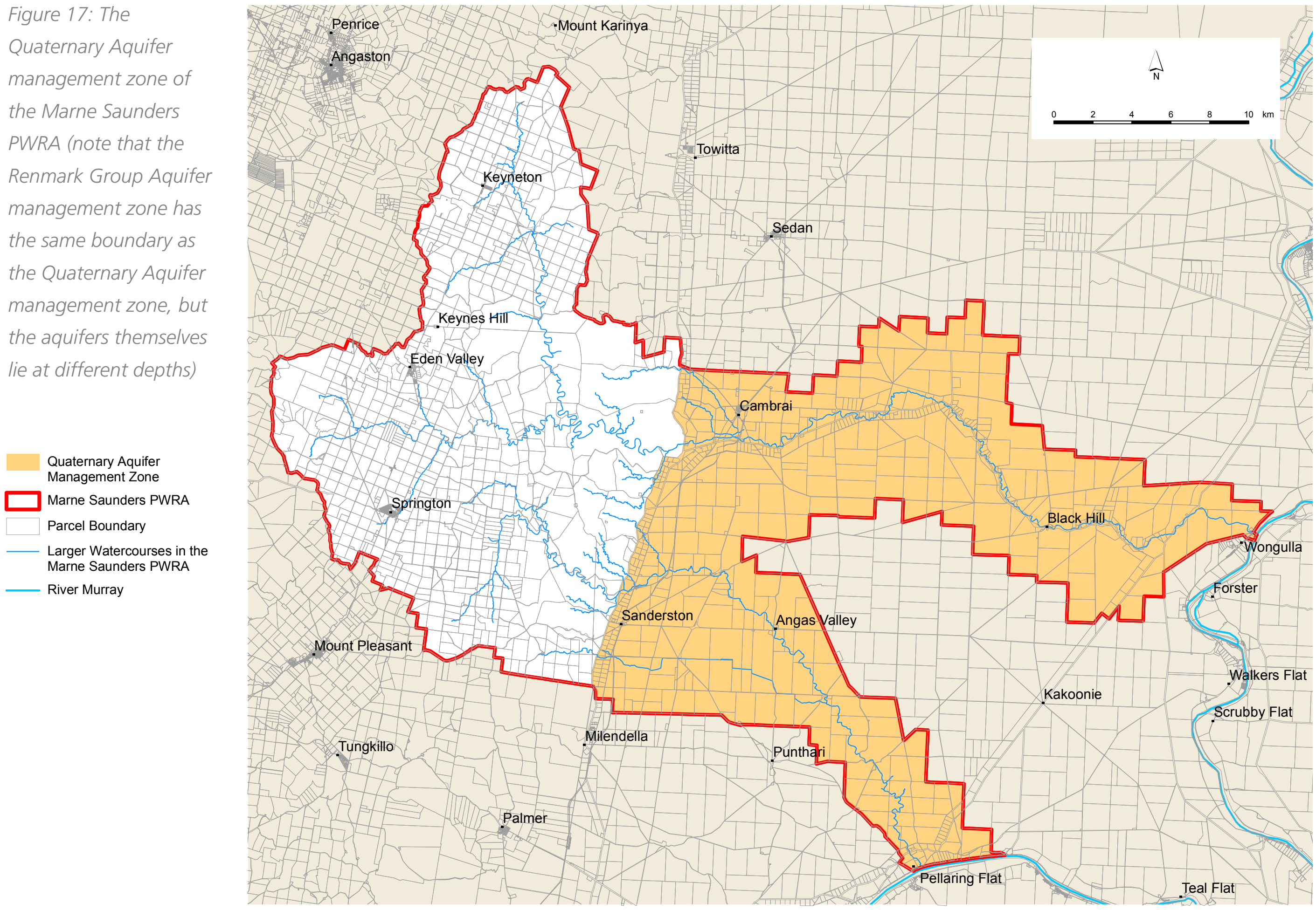
The management zone that an allocation is associated with is governed by where it is taken from in relation to the management zone boundaries and the aquifer that the allocation is taken from. The management zones are treated independently in the Plan, with their own rules set based on their particular characteristics.

Management zone allocation limits

Each management zone has an allocation limit, which is the sustainable volume of water that is available for licensed use each year. The purpose of the management zone allocation limit is to balance total inflow and outflow at a regional scale. The size of the allocation limits have been set using different approaches, including:

- modelling to determine the volume of extraction that can occur while keeping the level of the underground water within acceptable limits—then setting aside

Figure 17: The Quaternary Aquifer management zone of the Marne Saunders PWRA (note that the Renmark Group Aquifer management zone has the same boundary as the Quaternary Aquifer management zone, but the aquifers themselves lie at different depths)



estimated non-licensed needs

- determining the annual recharge to the underground water for an area and subtracting estimated non-licensed needs and environmental water requirements, while accounting for movement between aquifers.

See section 4.3.3 of the Plan for more information on how allocation limits have been set.

The total volume of water allocated in a management zone must not exceed the management zone allocation limit (principle 8). Unconfined Zone 1 and Confined Zone A are fully allocated to existing users, which means that there will be no new allocations in these areas under the Plan (principle 21). No allocations are permitted in the Exclusion Zone and Quaternary Aquifer management zones. The other management zones are not fully allocated to existing users, so there is a small amount of water available for allocation in these areas. There is likely to be less than 100 ML available in the Fractured Rock Aquifer management zone, less than 50 ML available in the Confined Zone B and Unconfined Zone 2 management zones and less than 5 ML available in the Unconfined Zone 6 management zone. There are no existing user demands from the remaining underground water management zones.

In the fully-allocated management zones, the only way that a user can receive an allocation is to transfer an allocation from another licensee. Transfers are subject to the rules in the Plan and the approval of the Minister.

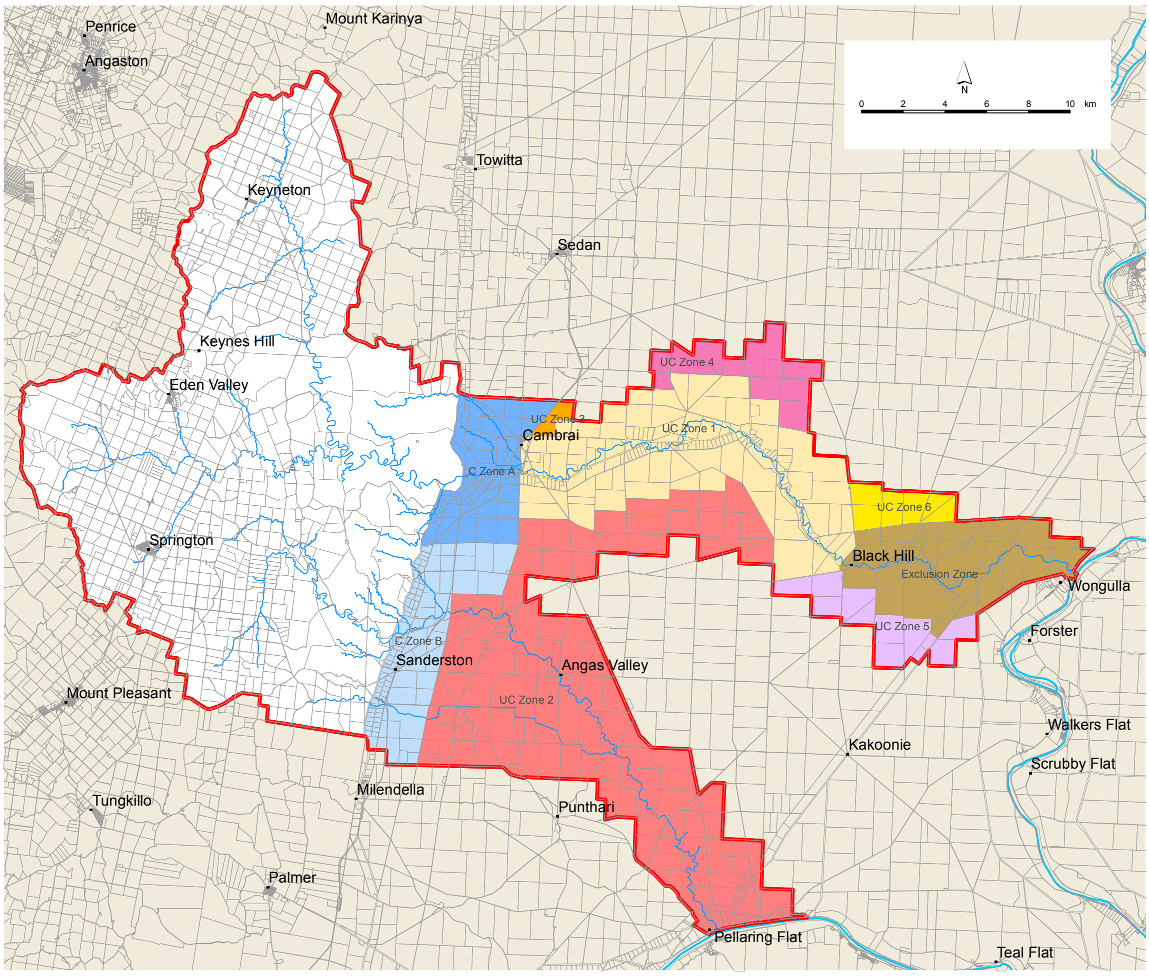


Figure 18: The various management zones associated with the Murray Group Limestone in the Marne Saunders PWRA

Allocations are not able to be transferred between management zones (principle 85), not even between overlapping management zones. This is because each allocation limit has been set based on the characteristics of its management zone; taking less water in one management zone (by transferring an allocation out of it) does not mean that there will be more water available to take in a different management zone.

Management sub-zones

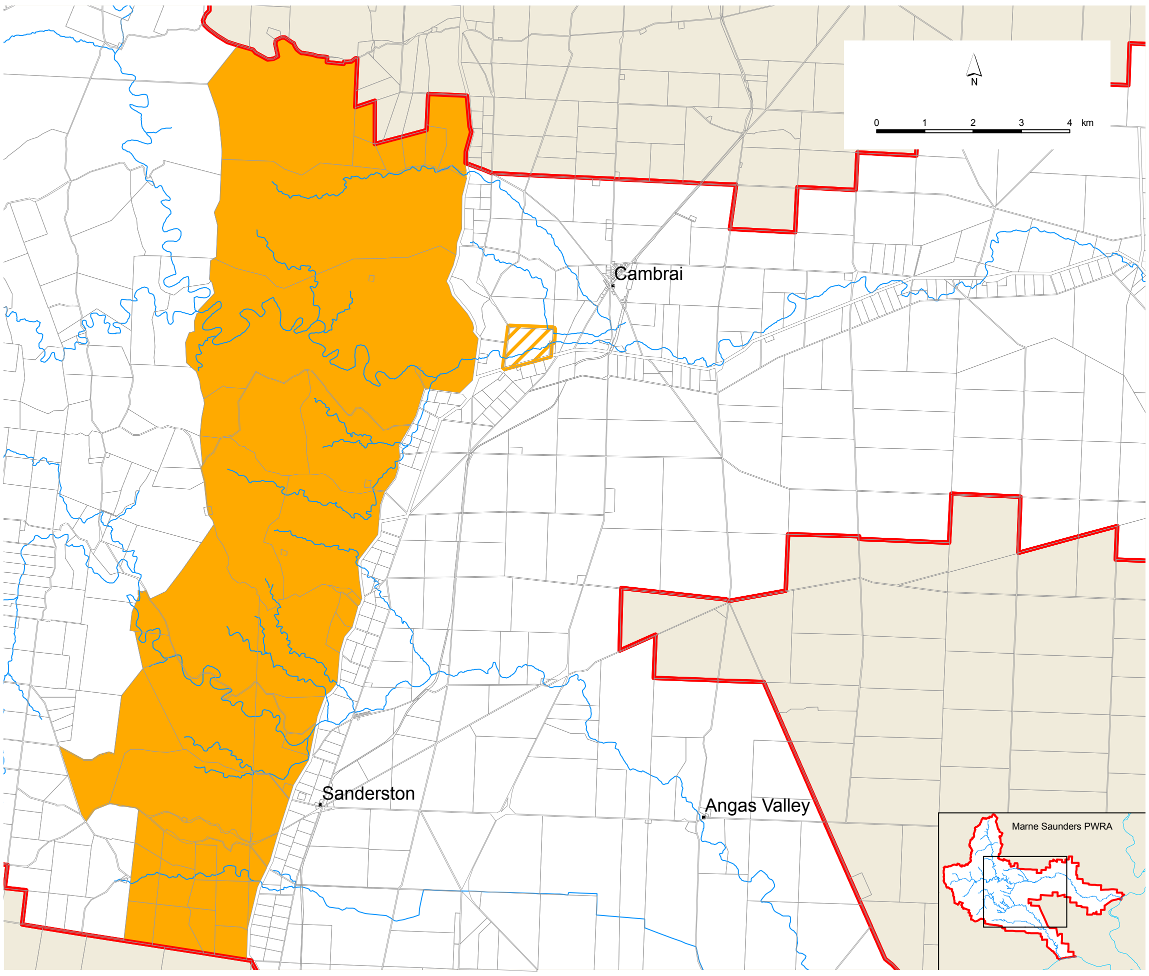
The Fractured Rock Aquifer and Confined Zone A management zones each contain a management sub-zone (the Fractured Rock Sub-Zone and Confined Sub-Zone respectively—see Figure 19). These management sub-zones also have an allocation limit that must not be exceeded by new allocations or transfers (principle 22).

The Confined Sub-Zone has been identified as being particularly at risk from creation of a permanent cone of depression because of the nature of the confined aquifer and intensive extraction in that area. Therefore, it has its own allocation limit in order to reduce the likelihood of permanent water level draw-down.

Underground water flows from the fractured rock aquifer in the hills to the confined sedimentary aquifers on the plains. It is thought that most of this throughflow comes from the rocky gorge country on the eastern side of the fractured rock aquifer. Therefore, this area has been defined as the

Figure 19: Underground water management sub-zones in the Marne Saunders PWRA

Confined Sub-Zone
Fractured Rock Sub-Zone
Marne Saunders PWRA
Parcel Boundary
Larger Watercourses in the Marne Saunders PWRA



Fractured Rock Sub-Zone and given its own allocation limit in order to protect this throughflow.

The allocation limits for these management sub-zones are part of the allocation limit for their parent management zone. Allocations can be transferred within management zones, including transfers between management sub-zones and their parent management zone (principle 86). These transfers must not cause the management sub-zone allocation limit to be exceeded (principle 22).

4.3.2 | Buffer zones

A circular buffer zone will be centred on each operational well—including wells used for non-licensed purposes—and underground water-dependent ecosystems, or 'environmental assets' (principles 26 and 27). The purpose of the buffer is to minimise new impacts to the well user or the environmental asset, which is caused by increasing demand on the resource in a particular location. The buffers will also reduce the likelihood of concentrated extraction in an area and therefore will help to minimise localised draw-down.

Overlapping well buffers

A new allocation or transfer generally will not be permitted if the buffer zone around that well overlaps the buffer zone around other landholder's operational well that takes water from the same aquifer (principle 25).

There is already significant overlap of buffers in some areas. Policy needs to be flexible to help facilitate the transfer and new allocation of water while minimising new impacts on users and the environment. Therefore, exceptions to the 'overlapping buffer' rule may be provided in some circumstances, which are listed below.

- If the allocation was originally granted to an existing user, and will still be taken from the well that it was originally granted to be taken from—or a replacement well, as discussed section 5.5.3 (principle 29 and 34). This could happen when an allocation is transferred as part of a property sale.
- If the user is transferring in extra water to take their allocation up to the average metered usage for 2003/04 to 2005/06 for that well. This exception only applies if the user holds an allocation that was originally granted to an existing user for that well, and if the application is made within three years of adoption of the Plan (principle 30). In some management zones, existing user allocations have been reduced from maximum theoretical enterprise requirements to keep within the allocation limits. This exception allows users to get their allocation back up to their previous usage via transfers from other users. They can continue to have the same impacts they were having before adoption of the Plan, but not create new ones.
- If the user can demonstrate that they will not have significant detrimental impacts on the water level, yield or water quality in overlapped wells through carrying out a suitable aquifer pumping test (principle 31). If this exception is granted, then a maximum extraction rate (in litres per second) will be placed as a licence condition, and the user must not exceed that extraction rate (principle 32). The maximum extraction rate will be based on the results of the aquifer test to ensure that impacts on overlapped users will be minimised. It is intended that operational wells will be identified from the state wells database (SA Geodata). It will be up to the proponent to arrange the aquifer pumping test in accordance with the Minister's requirements, and to seek permission from overlapped well owners to verify the existence of overlapped wells and to monitor their behaviour during the aquifer test.

Overlapping environmental asset buffer zones

A new allocation or transfer will not be permitted if the buffer zone around that well overlaps the buffer zone of an environmental asset that is thought to rely on water from the same aquifer (principle 25). The only exception is the first point described above, where allocations originally granted to existing users may overlap the buffer zone of an environmental asset (principle 33).

Existing buffer overlaps

Many of the wells currently in existence will have buffers that overlap the buffers around environmental assets or other landholder's wells. These existing potential impacts

Table 2: Radius of the buffer zone around wells and environmental assets in different aquifer types

Underground water aquifer and management zones	Well type/ environmental asset	Radius of buffer
Murray Group Limestone confined aquifer (Confined Zone A and B)	Allocation greater than 10 ML	1000 m
	Allocation 10 ML or less	500 m
	Non-licensed use only	250 m
Murray Group Limestone unconfined aquifer (Unconfined Zone 1-6 and Exclusion Zone)	Allocation greater than 10 ML	200 m
	Allocation 10 ML or less	100 m
	Non-licensed use only	50 m
	Environmental asset	500 m
Quaternary Aquifer	Non-licensed use only	25 m
	Environmental asset	50 m
Renmark Group Aquifer	All wells	2000 m
	Environmental asset	500 m
Fractured Rock Aquifer	All wells	200 m
	Environmental asset	200 m

are recognised as a legacy of past water management practices and it is not proposed to take action to reduce the overlaps or associated interactions through the Plan. The purpose of the buffers is to minimise new impact on users and environmental assets associated with transfers and new allocations.

Buffer sizes

The size of the radius of the buffer zones have been set for different management zones, in accordance with aquifer characteristics (shown in Table 2). Figure 20, Figure 21 and Figure 22 show the buffer zones of environmental assets for the different aquifer types.

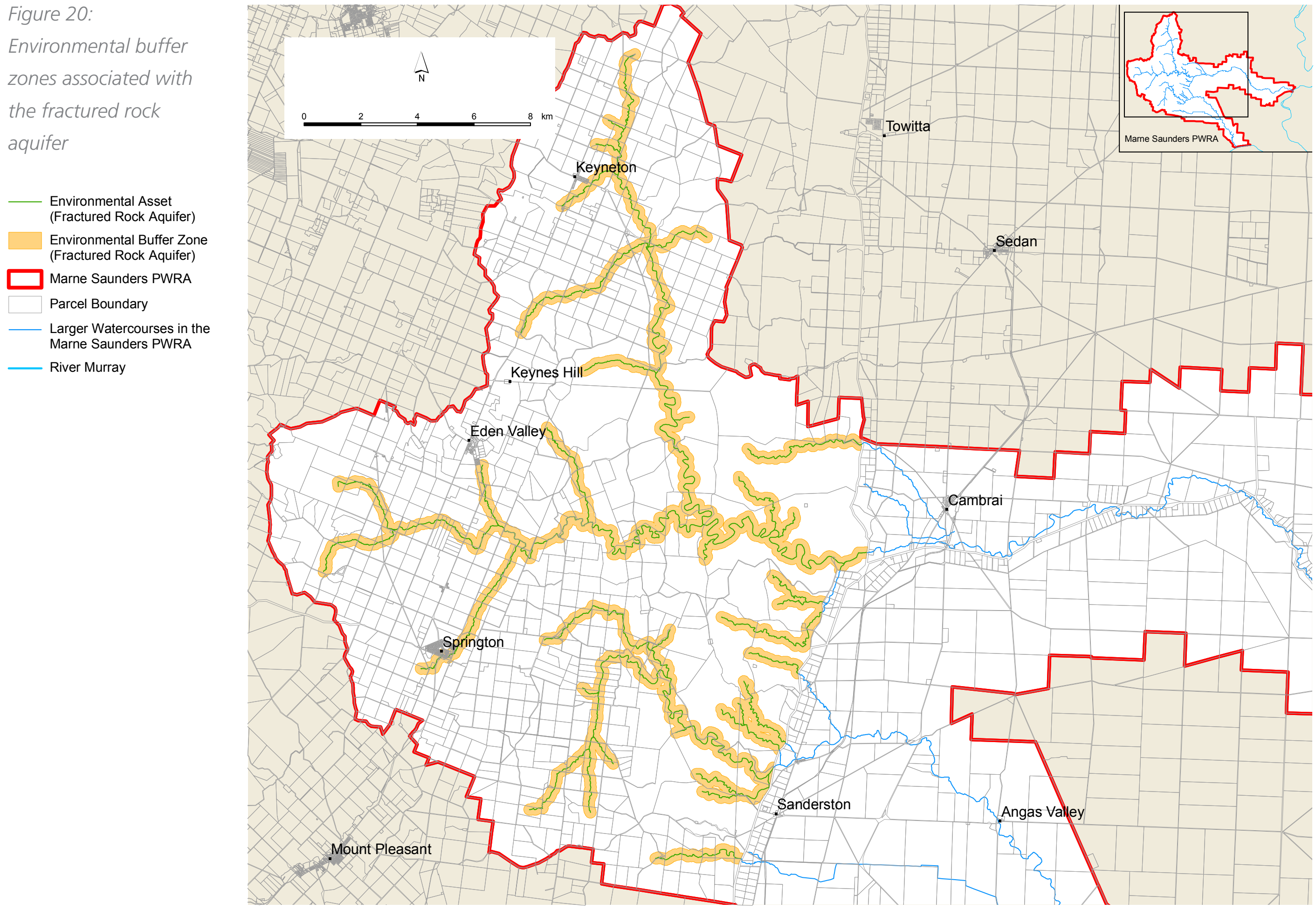


Figure 20: Environmental buffer zones associated with the fractured rock aquifer

The buffer radius in the fractured rock aquifer is fixed because interference between wells or to environmental assets is largely governed by the connection between fractures. It is expected that the impacts of draw-down around a well would not be felt more than 200 metres from the well, based on the current understanding of the local fracture characteristics. Therefore a well should not interfere with the fractures associated with another well or environmental asset if their buffers of 200 metres radius don't overlap (i.e. if they are at least 400 metres apart).

The size of the radius for the buffer zones in the sedimentary aquifers vary in accordance with aquifer characteristics and the purpose of use/volume of allocation from a well. This variation reflects the even flow rate and responsiveness to pumping in sedimentary aquifers. When determining the size of a well buffer zone based on allocation size, the volume of allocation from the well excludes rollover allocations and artificial recharge allocations[3].

Buffers, transfers and holding allocations

If a licensee transfers away part or all of their allocation temporarily, then the buffer zone around their well will be maintained at the same size (principle 94). This prevents another user from getting a new or transferred allocation with a buffer zone that would overlap the original user's buffer zone when their allocation returns after the temporary transfer.

3. See section 4.3.5 and section 4.4

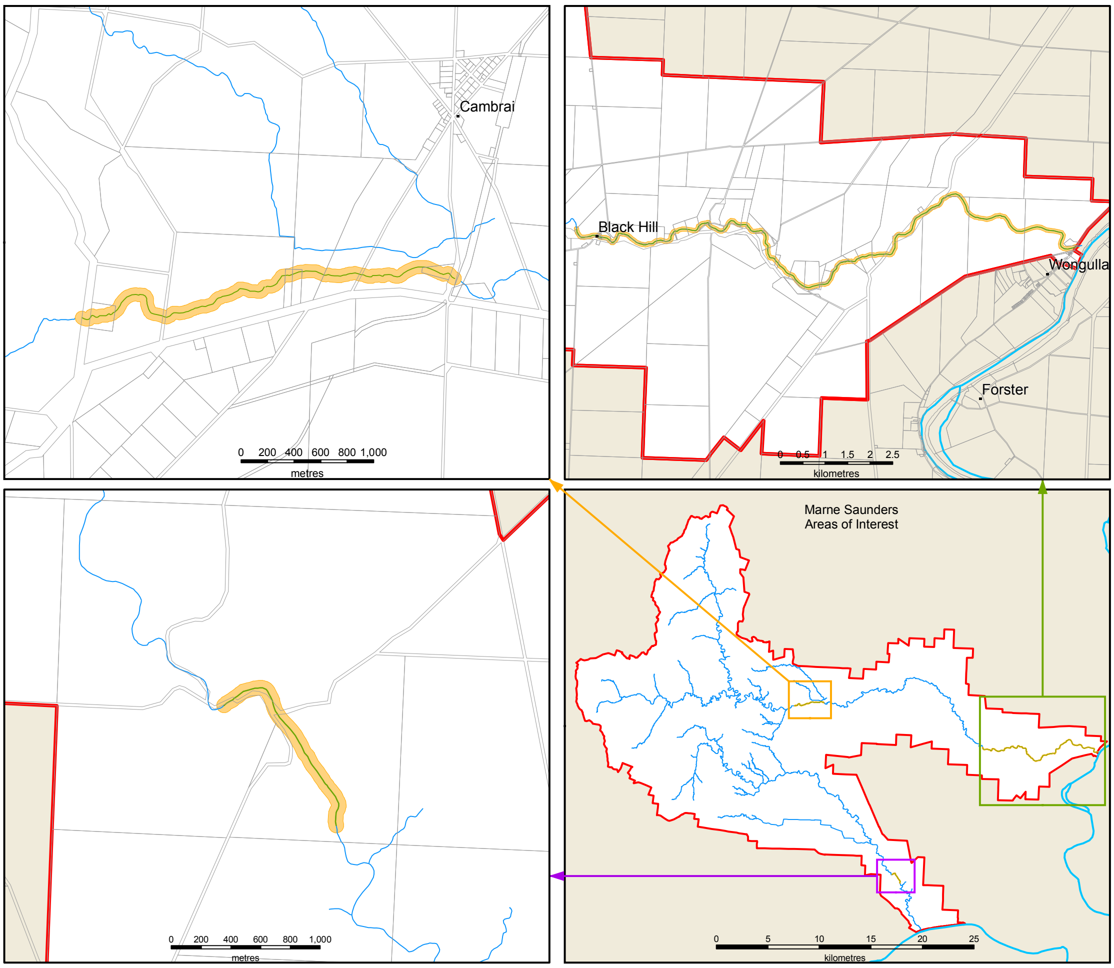


Figure 21: Environmental buffer zones associated with the Quaternary aquifer

5. See section 2.2.9

4. See section 4.3.5 and section 4.4

If a licensee transfers away part of their allocation permanently or converts it to a water (holding) allocation[4], then their well buffer zone size will be reduced (if necessary) to the appropriate size for the remaining allocation—or to the appropriate size for a well only used for non-licensed purposes if no allocation remains (principle 28 and 93).

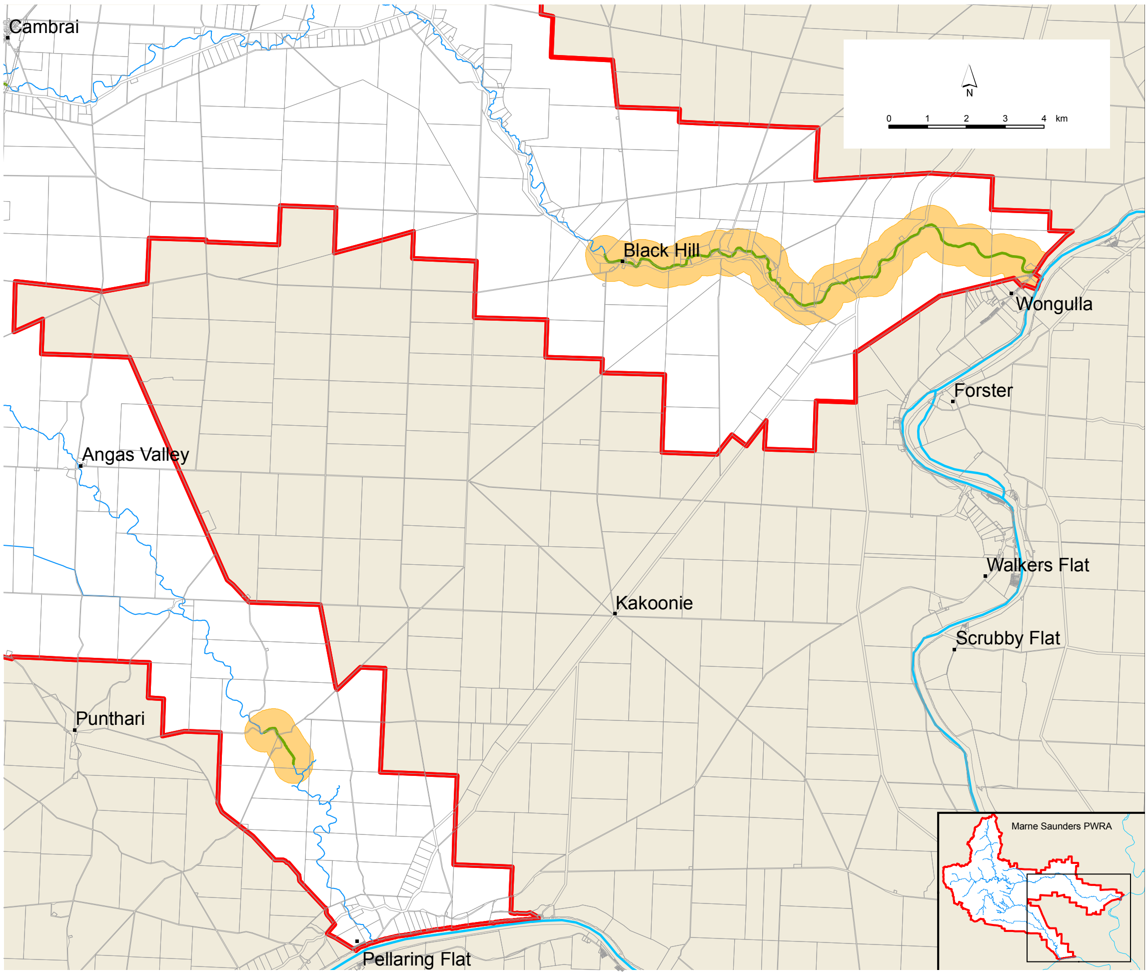
4.3.3 | Maximum extraction rate

A maximum extraction rate (in litres per second) will be set for wells that end up with a large allocation as a result of a new allocation or transfer (principle 35). A large allocation is considered to be more than 50 ML in the Fractured Rock Aquifer management zone, and more than 100 ML in the other underground water management zones (excluding rollover allocations and artificial recharge allocations[5]).

The maximum extraction rate provides an additional level of protection for neighbouring users and the long-term local sustainability of the resource—beyond the protection provided by buffer zones—when the volume taken from a well is large. The maximum extraction rate is important to allow underground water levels to recover between pumping periods.

This requirement does not apply to transfers of allocations originally granted to existing users that continue to be taken

Figure 22: Environmental buffer zones associated with the Murray Group Limestone and Renmark Group aquifers



from the same well (principle 37). This situation may occur where a licence is transferred together with the sale of a property.

The maximum extraction rate will be set on the basis of a properly conducted aquifer pumping test (principle 36). It will be up to the proponent to arrange the aquifer pumping test in accordance with the Minister's requirements.

4.3.4 | Deemed allocation per well

The buffer zone and maximum extraction rate policies outlined above relate to the volume of allocation that may be taken from a well. It is likely that a single allocation will be granted to be taken from a group of wells in many cases, which allows flexibility for the user (governed by principle 23). The Plan needs to set out how much water is deemed to be taken from each well in such a case, so that the buffer zone and maximum extraction rate rules can be applied appropriately.

Where a single allocation can be taken from a group of wells, the volume deemed to be taken from any of those wells is the allocation that can be taken from the group (principle 24). This approach is the most protective for other users and the environment. A licensee could choose to specify the allocation to be taken from individual wells if they wish. This may reduce their flexibility to vary the amount taken from different wells from year to year, but may favourably change the way that the buffer zone and maximum extraction rate policies would apply.

4.3.5 | Rollover of unused water allocations

Water users have asked for flexibility by being able to 'rollover' unused parts of allocations for use in later water use years. The Plan's policies allow for this flexibility, but also keep in mind potential adverse effects.

Hydrogeological experts have advised that rollover policies need to be carefully managed to protect the underground water resources—and the users and the environment that depend on them. Underground water flows from high to low level, and so unused parts of water allocations from one year will not necessarily still be accessible from that location in later years. It is also likely that many users will take their extra 'saved' water at the same time in a dry year, putting the resource under extra stress through the higher total use.

Size and life of rollover allocations

The Plan allows unused parts of the base allocation to be rolled over into the next water use year—giving a 'rollover allocation' (principle 38)—but limits the volume and life of rollover allocations to address the issues outlined above. The maximum size of a rollover allocation is 20% of the base allocation in the Fractured Rock Aquifer management zone, and 10% of the base allocation in the remaining underground water management zones (principle 40). Underground water rollover allocations only have a life of one year (principle 42).

For example, a user with a 50 ML allocation in the Unconfined Zone 1 management zone only takes 42 ML of their allocation in water use year 1. In water use year 2, they would be able to take up to 55 ML (50 ML allocation plus 5 ML rollover allocation—rollover is capped at 10% of allocation, so it is 5 ML even though they had 8 ML unused in water use year 1). If they did not use this rollover allocation in water use year 2, it would expire and would not be available in water use year 3.

The cap on the size of rollover allocations is larger in the Fractured Rock Aquifer management zone because some of the volume potentially available for extraction has been set aside to offset the additional 10% rollover allowance, instead of being available for new allocations. This has been done to balance the desire to be conservative in making new water available against community requests to provide more flexibility for users. In particular, some underground water users use their fractured rock aquifer wells as a secondary source to supplement surface water in drier years. These users have requested flexibility to be able to take more from their wells at these times. Increasing the size of the rollover allows all fractured rock underground water users to manage their allocations with more flexibility. Users also have the option of securing additional water as a new allocation or transfer if they can meet the relevant rules, including the overlapping buffer rules.

Table 3: An example of rollover of an underground water allocation from one of the sedimentary aquifer management zones

	Year 1	Year 2	Year 3	Year 4	Year 5
Base allocation	50 ML	50 ML	50 ML	50 ML	50 ML
Rollover allocation (unused base allocation from last year, capped at 10% of base allocation)	-	5 ML	0 ML (no unused base allocation in year 2, and unused rollover allocation saved from year 1 has expired)	5 ML	5 ML
Total allocation (base + rollover)	50 ML	55 ML	50 ML	55 ML	55 ML
Total usage	42 ML	50 ML	45 ML	45 ML	55 ML
Base allocation used this year (base allocation is used first)	42 ML	50 ML	45 ML	45 ML	50 ML
Base allocation unused this year	8 ML	0 ML	5 ML	5 ML	0 ML
Rollover allocation used this year	-	0 ML	0 ML	0 ML	5 ML
Rollover allocation unused this year (expires at the end of this year)	-	5 ML	0 ML	5 ML	0 ML

Accounting for non-licensed use when determining rollover

Some licensees may use water that has passed through their water meter for non-licensed purposes. However, this volume would generally be counted as allocation used for licensed purposes, and so would not be able to be rolled over for use in the next water use years.

If a licensee wants to have this non-licensed use accounted for when determining the unused allocation volume that can be rolled over, then the volume used for non-licensed purposes must be measured in accordance with state metering specifications (principle 41). This measurement is only necessary where the licensee wants this non-licensed use accounted for.

Where rollover allocations can be taken from

A rollover allocation can only be taken from the well that the previous year's allocation was not fully used from (principle 39). This is because the saved water will only be available for later use in that local area. If a single allocation can be taken from a number of wells and a rollover allocation is granted, then the rollover allocation can be taken from any of those wells.

Rollover allocations are used last

Rollover allocations are considered to be used last (principle 6). That is, rollover allocations only get used if all of the base allocation from that well gets used. This means that rollover allocations can't be rolled over indefinitely. Table 3 shows an example of rollover.

Transfer of rollover allocations

A rollover allocation can only be transferred if it will still be taken from the same well (principle 87). This situation may occur where a licence is transferred together with the sale of a property.

Start date of rollover policies

Rollover allocations will only start to be granted in the second full water use year after an existing user allocation is first granted (principle 43). This allows rollover allocations to be properly earned on the basis of having a full water use year to use a full year's volume of allocation before rollover allocations will be granted.

4.4 | Key policies for water artificially recharged down a well

Managed aquifer recovery (MAR) is the process where water is artificially recharged down a well for later recovery. MAR requires a number of approvals as follows:

- a licence and allocation is required to take the source water to be artificially recharged down the well if:
    - the source water is a prescribed resource (such as watercourse water or surface water—which may include roof runoff) and
    - if the recovered water is to be used for licensed purposes
- a permit or other authorisation is required to drain or discharge water down a well (see section 5.6 in this Guide)
- an allocation is required to recover the recharged water from the well, if the water is to be used for licensed purposes. This type of allocation is called an artificial recharge allocation in the Plan (section 6.4 of the Plan).

Not all of the water artificially recharged down a well is able to be recovered. Under the Plan, the artificial recharge allocation is a maximum of 67% of the volume recharged down the well in the Fractured Rock Aquifer management zone, and a maximum of 80% of the volume recharged down a well in the other management zones (principle 46).

An artificial recharge allocation has a limited life, expiring at the end of the first water use year after the year that it was recharged into the well (principle 49). Any unused part of the artificial recharge allocation after this period can not be 'rolled over' for later use.

An artificial recharge allocation must be taken from within 100 metres of the well that it was recharged into (principle 47). In addition, an artificial recharge allocation can only be transferred if the well that it is recovered from is within 100 metres of the well that it was recharged into (principle 95). This is most likely to occur when the allocation is transferred as part of the sale of a property.

Water affecting activities

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SAUNDERS WATER
ALLOCATION PLAN

5 | Water affecting activities

The NRM Act sets out a number of activities known as water affecting activites (WAAs) that may require a permit. These activities include drilling a well, building a dam, construction or excavation in or around a watercourse and using effluent and imported water. The relevant NRM plan or water allocation plan can set out the policies used to assess permit applications and to set conditions for successful applications.

This chapter outlines activities that will require a WAA permit, as well as policies for assessing and setting conditions for these permits.

5.1 | When is a permit required?

Table 4 shows the range of WAAs set out in the NRM Act that potentially require a permit. As shown in the table, some activities always require a permit, while the other activities only require a permit if stipulated by the relevant NRM Plan or water allocation plan.

The Initial South Australian Murray-Darling Basin Natural Resources Management Plan (SAMDB NRM Plan) is already in place over the Marne-Saunders PWRA. The SAMDB NRM Plan currently requires a permit for some activities, as

Table 4: Water affecting activities that currently require a WAA permit under the SAMDB NRM Plan, and will require a WAA permit under the Marne-Saunders Water Allocation Plan

Water Affecting Activity (paraphrased from the NRM Act)	Example of activity	Requires a permit under the SAMDB NRM Plan?	Requires a permit under the Marne-Saunders WAP?
Drilling, plugging, backfilling or sealing of a well*		Yes but no specific policies	Yes
Repairing, replacing or altering the casing, lining or screen of a well*		Yes but no specific policies	Yes
Draining or discharging water directly or indirectly into a well*	Aquifer storage	Yes but no specific policies	Yes
Erection, construction, modification, enlargement or removal of a dam, wall or other structure that will collect or divert surface water or watercourse**	Building a dam, weir, bank or pump-house that diverts water	Yes	Yes
Erection, construction or placement of any building or structure in a watercourse, lake or floodplain	Building a culvert	Yes	Yes
Draining or discharging water into a watercourse or lake		Yes	Yes
Depositing or placing an object or solid material into a watercourse or lake	Placing rock in a watercourse for erosion control	Yes	Yes
Obstructing a watercourse or lake in any other manner		No	No
Depositing or placing an object or solid material on the floodplain of a watercourse or near the bank or shore of a lake to control flooding from the watercourse or lake	Building a levee bank	No	No
Destroying vegetation growing in a watercourse, lake or floodplain	Clearing reeds	No	Yes – key areas only
Excavating or removing rock, sand or soil from a watercourse, lake or floodplain; or close enough to a lake's banks to be likely to damage the banks	Digging out a creek channel	Yes	Yes
Using imported water in the course of carrying on a business	Using mains water for business purposes	No	Yes
Using effluent in the course of carrying on a business	Effluent spreading	Yes	Yes

* Always requires a permit. ** Always requires a permit for prescribed surface water/watercourse water and/or in the Mount Lofty Ranges Watershed.

shown in Table 4. The Marne Saunders Water Allocation Plan will also require a permit for these activities, in addition to several more, as shown in Table 4. Once adopted, the policies in the Marne Saunders Water Allocation Plan will take precedence over the policies in the SAMDB NRM Plan.

A WAA permit is generally *not* required if the activity is already authorised by another type of approval—as set out in section 129 of the NRM Act. Examples of approvals that may remove the need for a WAA permit include:

- development approval for activities such as construction of dams over a certain size, building many types of structures and excavating greater than certain volumes of material
- approval for clearance of native vegetation under the *Native Vegetation Act 1991* (SA)
- an environmental authorisation or licence under the *Environment Protection Act 1993* (SA), or the EP Act, for activities such as dredging, recharging water into a well and for using effluent under certain circumstances
- where an activity is undertaken to implement protection/reparation orders issued under the NRM Act, EP Act and *River Murray Act 2003* (SA), or as part of obligations to control pest plants under the NRM Act
- where an activity is authorised by a water licence (e.g. holding a River Murray licence for use of off-peak water means that a WAA permit for using imported water is not required).

The provisions of the NRM Act are additional to the provisions of other Acts. This means that seeking or holding a WAA permit does not replace the need for these other types of approvals. For example, holding a WAA permit to destroy vegetation does not allow the holder to contravene the provisions of the Native Vegetation Act.

Some development approvals, such as building or enlarging a dam or other diversion structure, are referred to the relevant authority for issuing permits for comment or direction. It is intended that the policies in the Plan will help to inform these comments or directions.

5.2 | General objectives for water affecting activities

The general objectives for managing all WAAs in the Plan are to:

- protect water-dependent ecosystems
- protect waterbody and floodplain geomorphology and aquifer structure
- provide for equitable and sustainable water sharing
- protect water quality for all uses
- maintain hydrological and hydrogeological systems, including natural discharge and recharge between water resources
- minimise interference between users
- minimise adverse impacts of water affecting activities on the environment, water resources and water users.

5.3 | General principles for water affecting activities

There are a range of principles that apply to all WAAs in the Plan (principles 101 and 102). These principles generally set out the outcomes that an activity should achieve.

The principles also set out those things that a WAA must *not* do. Thus, a WAA:

- must not cause or exacerbate erosion, watercourse destabilisation, unnatural water logging, rising water tables or flooding
- must not cause or be likely to cause significant detrimental impacts by being located in ecologically or culturally sensitive areas
- must not have significant detrimental impacts on water resources, other natural resources, communities or water-dependent ecosystems

- must not cause unacceptable deterioration in water quality
- must not impact authorised scientific devices or activities.

5.4 | Activities requiring a permit

Specific principles for some activities that require a WAA permit are outlined in the remainder of this chapter, specifically:

- well drilling, backfilling and repair
- discharging water into a well
- construction or enlargement of dams and water diversion structures
- using imported water and effluent.

A range of activities that require a permit under the Plan are not discussed further in this chapter because their specific principles are straight-forward and quite similar to the general principles listed above. They include:

- the erection, construction or placement of any building or structure in a watercourse or lake or on the floodplain of a watercourse (see section 8.5 of the Plan)
- draining or discharging water directly or indirectly into a watercourse or lake (see section 8.6 of the Plan)
- depositing or placing an object or solid material in a watercourse or lake (see section 8.5 of the Plan)
- destroying vegetation growing in a watercourse or lake or growing on the floodplain of a watercourse (see section 8.7 of the Plan)
- excavating or removing rock, sand or soil from
  - a watercourse or lake or the floodplain of a watercourse or
  - an area near to the banks of a lake so as to damage, or create the likelihood of damage to, the banks of the lake (see section 8.8 of the Plan).

Note that, a permit is only required for destroying vegetation growing in a watercourse, lake or floodplain when the activity will occur within a key environmental asset—in addition to the requirements of the Native Vegetation Act (principle 155). The key environmental assets are defined in the Plan, and are centred on the highly environmentally sensitive and significant areas of permanent flow around Black Hill Springs and Lenger Reserve.

5.5 | Well drilling, backfilling and repair

A WAA permit is required for all cases of:

- drilling, plugging, backfilling or sealing of a well
- repairing, replacing or altering the casing, lining or screen of a well.

This permit requirement includes replacement wells and deepening of existing wells, and applies to wells used for licensed and/or non-licensed purposes (e.g. stock and domestic use). The policies outlined below apply to all of the different aquifers in the Marne-Saunders PWRA, including the fractured rock aquifer in the hills, and the different sedimentary aquifers on the plains including the Murray Group Limestone aquifer, the Quaternary aquifer and the Renmark Group aquifer.

When a new well is drilled, the WAA permit only relates to the construction of the well. The volume of water able to be taken from a well for licensed purposes is regulated by the allocation process (see chapter 4 of this Guide).

5.5.1 | General works requirements

Well construction or other works must be carried out in a way that doesn't adversely affect underground water quality (principle 103) or aquifer integrity (principle 104).

Where a well passes through two or more aquifers, an impervious seal must be made and maintained between the aquifers to prevent leakage between aquifers (principle 105). This principle is relevant on the plains where there are several aquifers at different depths.

Wells that are to be used for artificial recharge of water at pressures greater than gravity must be pressure cemented along the full length of the casing (principle 106). This is required to prevent pressurised recharge from either forcing water upwards along the well casing, which may erode the aquifer sediment, or blowing out the toe placed at the bottom of the casing in fractured rock aquifers.

5.5.2 | Well location

In order to prevent interference to existing assets, new wells will not be able to be drilled within a certain distance of existing operational wells or environmental assets thought to depend on underground water. As outlined in section 4.3.2, all operational wells and environmental assets which depend on underground water will have a circular buffer zone placed around them. In general, new wells will not be permitted if their buffer zone would overlap the buffer zone of an environmental asset or of an operational well owned by another landholder that uses water from the same aquifer (principle 107). The size of the buffer zone in different types of aquifers is outlined in Table 2 in chapter 4. The different buffer sizes reflect different water resource characteristics.

The buffer zone around a new well that is only used for non-licensed purposes may overlap the buffer zone around another landholder's operational well or an environmental asset if the location of the proponent's property and the overlapping buffer zones means that it is not possible or reasonably practical to avoid overlapping buffer zones. In this case, the new well will still need to be a minimum of 50 m from other landholders' operational wells and environmental assets that rely on water from the same aquifer (principle 108).

This exception does not apply in the case of the buffer zones around key environmental assets (the Black Hill Springs and permanent pools near Lenger Reserve). These areas are of very high environmental significance and the water supply to them should not be compromised.

5.5.3 | Replacement wells

If a well needs to be replaced, the replacement well can be drilled despite overlapping buffer zones as long as:

- the replacement well is drilled within 20 m of the original well and
- the original well is backfilled and
- the replacement well only takes water from the same aquifer as the original well (principle 109).

5.5.4 | Deepening wells

A well can be deepened despite overlapping buffer zones, as long as the deepened well does not penetrate a different aquifer (principle 110).

5.6 | Discharging water into a well

Water can be artificially drained or discharged into a well for later recovery in a process known as managed aquifer recovery (MAR). Storing water underground can reduce the need to build above-ground storage facilities from which water can evaporate. Aquifer storage may also be used to freshen underground water or increase underground water levels drawn down by over-extraction.

The Plan's policies for artificial recharge of water into a well aim to ensure sustainable management of MAR schemes as well as protection of water quality, aquifer integrity, environmental values, infrastructure and other users.

5.6.1 | Regulation of managed aquifer recovery

A WAA permit is required for drainage or discharge ('artificial recharge') of water into a well.

Recovering artificially recharged water for licensed purposes requires a water licence and allocation (see section 4.4). Furthermore, a water licence and allocation is required to take the source water to be artificially recharged down the well if the source water is a prescribed water resource (e.g. watercourse water or surface water, potentially including roof runoff) and if the recovered water is to be used for licensed purposes. Chapter 3 outlines policies for allocation of surface water and watercourse water.

Discharge of water into a well is also governed by the state-wide *Environment Protection (Water Quality) Policy 2003* (the EPP), which falls under the EP Act. The policies in the Plan have been developed to be consistent with this legislation. An environmental authorisation from the Environment Protection Authority (EPA) is not currently required for draining water into a well in the Marne Saunders PWRA.

5.6.2 | Water quality and testing

Water to be artificially recharged must meet the water quality criteria set out in the EPP (principle 111). The EPP may allow the recharge of poorer quality water where the aquifer has the ability to improve the water quality within an attenuation zone. However, such an exemption must currently be sought from the EPA, and involves strict monitoring requirements.

Water testing is to be carried out before the artificial recharge permit is approved to assess the quality of the source water to be recharged (principles 114 and 116) and the ambient underground water (principles 114 and 115). The source water testing will be based on a risk assessment approach, where the greater the risk of pollution, the greater the range of water quality parameters that need to be tested. For example, roof runoff is considered to be relatively clean and would require testing of fewer parameters compared with imported water. Source water samples need to be taken at time(s) that are representative of the water quality to be recharged and the variability of the water quality.

5.6.3 | Hydrogeological assessment

The proponent will need to arrange for a suitably qualified person to carry out a hydrogeological assessment of the suitability and capacity of the aquifer for artificial recharge, and likely risk of adverse impacts, including impacts on structural integrity of the aquifer, rising water tables and impacts on the environment and other users. This assessment will need to be provided to the relevant authority that assesses the permits (principle 112). This assessment may not be required if the relevant authority determines that the proposed activity is of low risk (principle 113).

5.6.4 | Ongoing monitoring and reporting

The quality of the underground water will need to be monitored and reported on at least annually (principle 117). Ongoing monitoring of the quality of roof runoff, other surface water and watercourse water is not required unless specified by the relevant authority. Ongoing monitoring and reporting of the water quality of other sources is required unless the supplier is able to ensure consistent water quality over time or provide appropriate water quality monitoring data (principle 118).

5.7 | Construction or enlargement of dams and water diversion structures

A WAA permit is required for all cases of constructing, enlarging, modifying or removing a dam, wall or other structure that collects or diverts surface water or watercourse water, unless the activity requires development approval instead. Such a diversion structure includes a dam, weir, bank or fixed pump. This permit requirement applies to all such diversion structures, whether they will be used for non-licensed purposes (such as stock and domestic use), licensed purposes, or both.

When a diversion structure is constructed or enlarged, the WAA permit only relates to the construction and ongoing management of that structure. The volume of water able to be taken from or by a diversion structure for licensed purposes is regulated by the allocation process instead (see chapter 3).

5.7.1 | Dam capacity limits and scales of management

The Plan sets out a range of limits to the allowable volume or capacity of a new or enlarged dam. These limits only apply to dams, and not to other diversion structures that don't have a volume, like pumps.

The limits operate at different scales, from the catchment scale down to the individual dam scale. Section 3.2.1 provides information on why managing water capture at different scales is important. Many of these limits are similar to the limits on the volume of water that can be allocated, as described in section 3.3.4. The scales of management for dam capacity are:

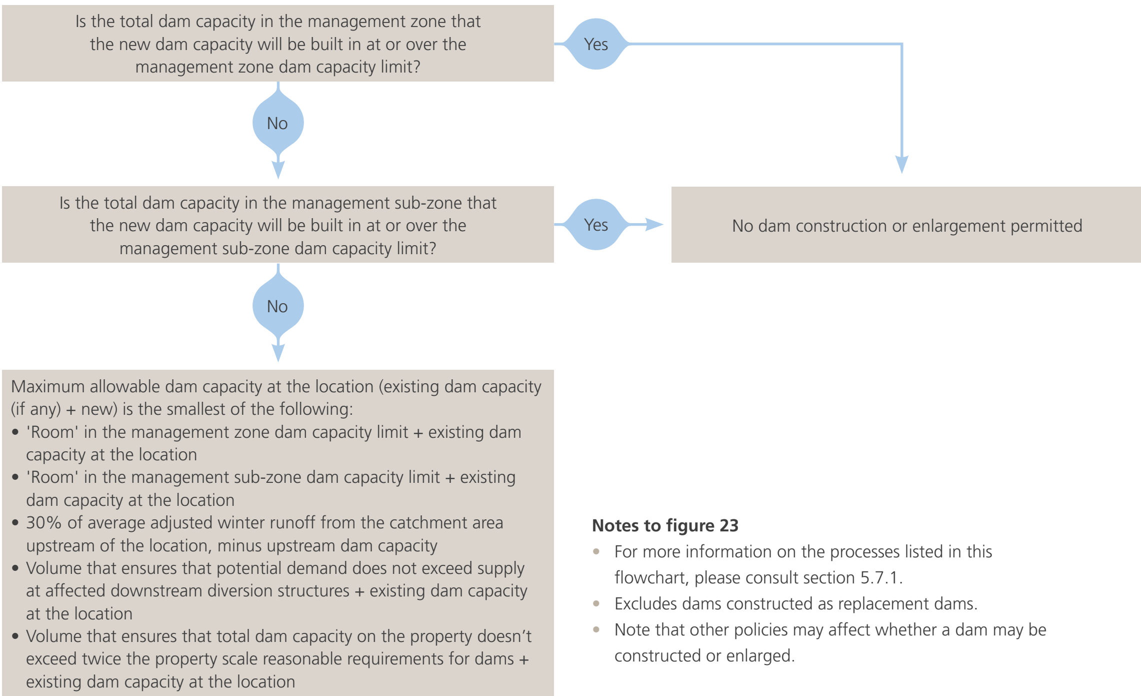
- management zones
- management sub-zones
- local dam scale—upstream catchment and downstream users
- property scale.

These limits are described below. Figure 23 provides a flow chart showing the process for determining the allowable size of a new or enlarged dam, based on these limits.

The Plan expresses these limits as the total dam capacity that will be allowed at a point when a dam is enlarged or a new dam constructed—that is, existing dam capacity that is already there (if any) plus the proposed volume of new dam capacity.

The allowable total dam capacity at a point is the smallest volume determined from all of these limits. No new dam capacity will be allowed to be constructed at the point if

Figure 23: Flow chart of process for determining the maximum allowable capacity of a new or enlarged dam



Notes to figure 23

- For more information on the processes listed in this flowchart, please consult section 5.7.1.
- Excludes dams constructed as replacement dams.
- Note that other policies may affect whether a dam may be constructed or enlarged.

Event	Management zone dam capacity limit	Total dam capacity in the management zone	Outcome
Adoption of the Plan	1,000 ML	1,000 ML	No 'room' in the dam capacity limit, so no new dams can be constructed
Removal of a 20 ML dam	20% of 20 ML is 4 ML So limit becomes 1,000 ML – 4 ML = 996 ML	1,000 ML – 20 ML = 980 ML	There is 16 ML of 'room' in the dam capacity limit (996 ML – 980 ML), so up to 16 ML of new dam capacity can be constructed

Table 5: An example of how the '80% rule' operates

any of the limits work out to be the same or less than the existing dam capacity at the point. This means that if there is no existing dam at the point, then a new dam will not be allowed to be constructed there if any of the limits work out to be zero or less.

The Plan gives equations for calculating these limits. Worked examples of these equations are given in a separate information paper available from the SA MDB NRM Board's website at <www.samdbnrm.sa.gov.au> or on request by phoning (08) 8532 1432.

Management zone scale dam capacity limit: the 80% rule

No new dam capacity can be constructed unless existing dam capacity is removed from within the same management zone (by removing or reducing the capacity of another dam). Furthermore, only up to 80% of the dam capacity that is removed can be re-constructed. For example, if a 10 ML dam is removed then up to 8 ML of new dam capacity may be re-constructed. This is known as the '80% rule'.

This process is managed through management zone dam capacity limits that must not be exceeded (principle 128, 130 and 131). When the Plan is adopted, the value of each of the management zone dam capacity limits will be equal to the existing total capacity of dams in the relevant management zone. The limit gets smaller each time a dam is removed or reduced in capacity in a management zone, decreasing by 20% of the capacity that has been removed (principle 129). Table 5 provides an example of how this works.

If a landholder nominates that they are reducing dam capacity for the benefit of the environment, then the management zone dam capacity limit is reduced by the total dam capacity that has been removed—principle 129 (d). This means that none of that removed dam capacity can be re-constructed.

Background on management zone scale dam capacity limits

The total capacity of dams in each of the management zones in the Marne Saunders PWRA exceeds the long-term dam capacity target. This target is 30% of the average adjusted winter runoff, and has been set using surface water modelling and environmental water provision targets, as described in chapter 3. The water allocation framework in the Plan has been developed so that an acceptable level of environmental stress and water sharing occurs with the existing network of dams. However, environmental outcomes and security of supply for remaining users will be further improved if the total capacity of dams in the management zones is reduced.

The 80% rule provides a way to gradually reduce the total dam capacity towards the long-term dam capacity target in the management zones. This approach is not retrospective. Landholders can choose to move dam capacity around in a management zone in the knowledge of how the Plan policies will affect the volume of dam capacity that is able to be constructed.

Unlike an allocation or licence, dam capacity is not a formal property right and so can't be transferred under the Plan in the same way. Any arrangements to exchange dam capacity between landholders will need to be privately made, but will require separate WAA permits for dam removal and dam construction. The permit to construct new dam capacity will not be issued until written notification is given that enough dam capacity has been removed and the approving authority is satisfied that it has occurred (principle 147).

It will be important for landholders to submit the various approvals and paperwork in the correct order when arrangements have been made to exchange dam capacity between landholders. This will help to ensure that the party that intends to receive the dam capacity actually ends up with the permit to construct it, rather than an independent party who happens to put in a dam construction application around the same time. The application to construct the new dam should be submitted at the same time as the written notification of removal of dam capacity (principles 147-149 in the Plan).

The further limits described below only apply if sufficient dam capacity has been removed from the management zone. The volume of dam capacity that can be re-constructed is the *smallest* volume allowed by all of these limits.

Management sub-zone scale dam capacity limit

Each management sub-zone has a dam capacity limit that must not be exceeded (principles 132-133). This means that new dam capacity can not be constructed in a management sub-zone where the total capacity of existing dams there is over the dam capacity limit. This total capacity includes all types of dams, no matter what their purpose.

The management sub-zone dam capacity limit has been set as 30% of average adjusted winter runoff. The purpose of the limit at this scale is to make sure that each tributary provides its share of the flow pattern needed to sustain the water-dependent ecosystems largely found in the main watercourses.

If the management sub-zone dam capacity limit has not been exceeded, then the new dam capacity that can be constructed can not exceed the 'room' left in the limit (principle 133). This means that the total dam capacity allowed at a point must not exceed the existing dam capacity at the point plus the 'room' in the management sub-zone dam capacity limit.

Figure 24 shows the current level of dam capacity relative to average adjusted winter runoff in the different management sub-zones. It can be seen that the majority of zones have exceeded their dam capacity limit of 30% of average adjusted winter runoff, and will not be able to have new dams constructed or existing dams enlarged in them until the existing dam capacity is reduced below the limit.

Local catchment scale limit

The total capacity of a new or enlarged dam must not exceed 30% of the average adjusted winter runoff from the catchment area upstream of the dam, taking upstream dam capacity into account (principle 134). Surface water modelling has shown that an environmentally acceptable flow pattern can occur downstream of a dam if:

- its capacity is 30% of the average adjusted winter runoff
- use from the dam is up to 100% of this dam's capacity
- it bypasses or returns low-flows.

These limits represent a set of rules that ideally would be put in place when an area is first developed, to ensure that each dam provides adequate downstream environmental flows and sharing of water between users.

Any dams that are already in the catchment area of the proposed new or enlarged dam will be taking up some of this allowable 30% capacity limit. Therefore, the capacities of these existing dams need to be subtracted from the local limit when setting the allowable size of the new or enlarged dam.

Local scale—provision for downstream diversion structures

When a dam is constructed or enlarged, it is important to minimise the impact on existing downstream dams and other diversion structures. Therefore the maximum total dam capacity at a point (existing capacity—if any—plus new capacity) is the volume that will, on average, allow downstream diversion structures to continue to access their full potential supply (principles 135-136).

This will be assessed using a water balance approach, which looks at water supply and demand at each of the diversion structures downstream of the proposed new or enlarged dam that may be affected by the construction of new dam capacity. The new dam or dam enlargement will not be permitted if total demand is greater than supply, or will become so as a result of the new or enlarged dam, at any of these downstream diversion structures.

The 'supply' at a diversion structure is the average adjusted winter runoff generated upstream of the diversion structure. The total 'demand' at a diversion structure is the sum of the capacities of dams upstream of the diversion structure (or consumptive use from diversion structures that are not dams), plus the capacity of that diversion structure if it is a dam (or consumptive use from the diversion structure if it is not a dam).

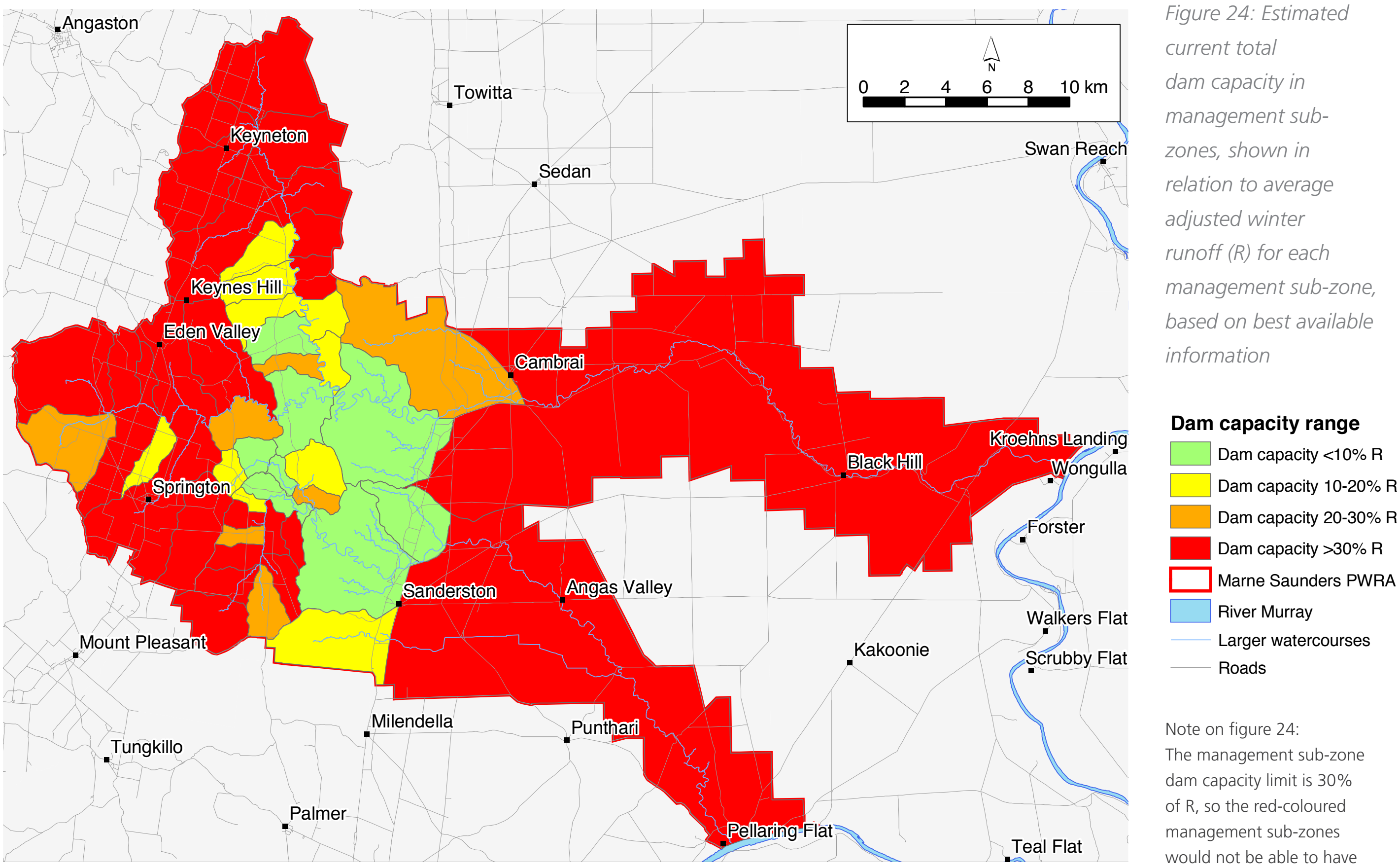


Figure 24: Estimated current total dam capacity in management sub-zones, shown in relation to average adjusted winter runoff (R) for each management sub-zone, based on best available information

Note on figure 24:
The management sub-zone dam capacity limit is 30% of R, so the red-coloured management sub-zones would not be able to have new or enlarged dams constructed there.

Figure 25: An example of how to determine the limit for dam capacity based on provision for downstream access of potential supply

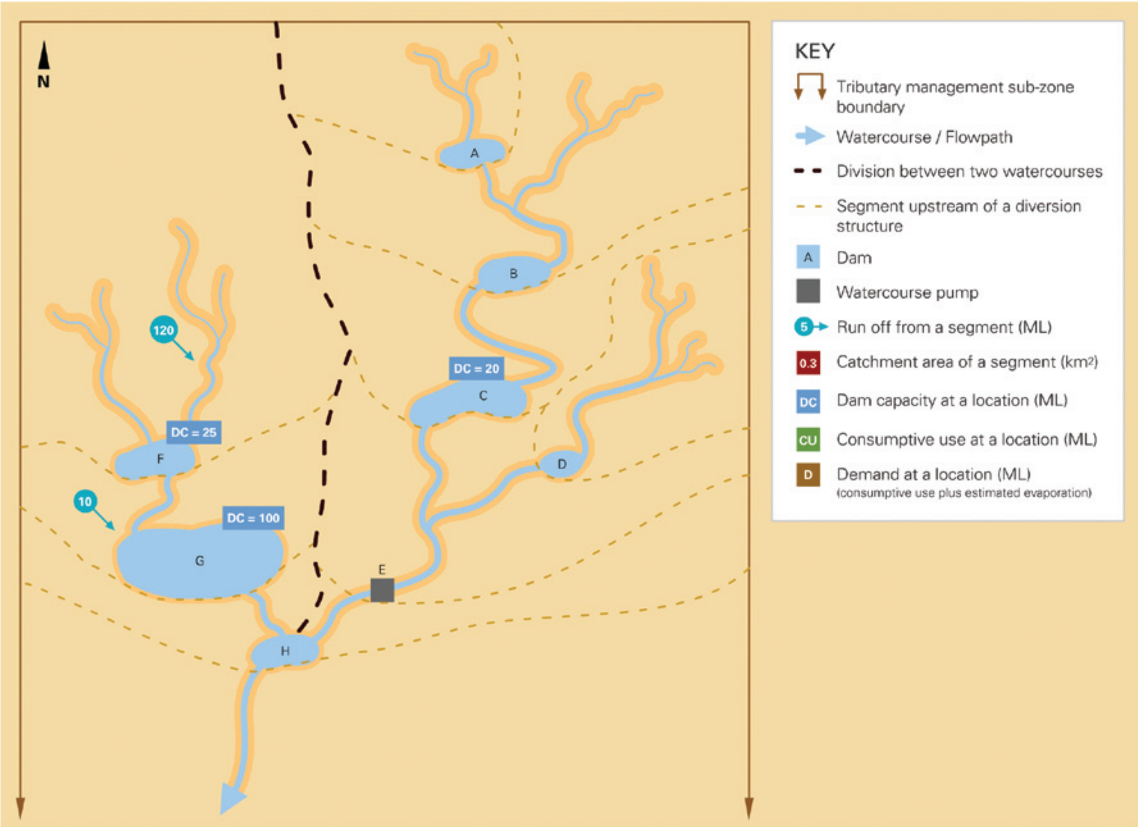


Figure 25

The user of Dam F wants to enlarge their dam, and has made arrangements with the owner of Dam C, who will remove or reduce their dam capacity to offset the new dam capacity.

The new capacity of Dam F must not adversely affect the potential supply at any diversion structures downstream, on average. In other words, it must not cause total potential 'demand' to exceed total 'supply' (demand includes both dam capacity and consumptive use from diversion structures other than dams).

Following is a list of diversion structures that will not be adversely affected by moving dam capacity from Dam C to Dam F.

- Dam A and Dam B are upstream of Dam C—so not affected by what happens at Dam C.
- Watercourse Pump E will be better off, because there is less dam capacity upstream.
- Dam D is not considered to be downstream of Dam C even though it is further south; this is because water would need to travel back up a watercourse to reach it from Dam C. Thus, it is not affected.
- The total potential demand upstream of Dam H will not change if dam capacity moves from Dam C to Dam F; in fact, the situation will improve slightly because only 80% of what is removed can be reconstructed.

The only diversion structure that may be adversely affected is Dam G and so supply and potential demand will need to be checked at this point. The calculations for this check are given below.

Total supply for Dam G:	120 ML + 10 ML = 130 ML
Total potential demand from Dam F and Dam G:	25 ML (Dam F) + 100 ML (Dam G) = 125 ML
Maximum extra dam capacity for Dam F:	130 ML – 125 ML = 5 ML

Thus, the maximum extra dam capacity that could be constructed at Dam F is 5 ML. This means the existing 25 ML Dam F could be enlarged to 30 ML, subject to meeting all of the other dam capacity limits.

Figure 25 shows an example of how this principle works.

Property scale limit

The new or enlarged dam must not cause the total capacity of dams on a property to exceed twice the reasonable water requirements from dams for the property (principle 137).

The reasonable water requirements of the property include allocations taken from dams (if any) plus the estimated stock and domestic water requirements of the property. Stock and domestic water requirements for a property will be estimated based on the number of houses, property size, stock carrying capacity, net evaporation and local climate (principle 138). Allowing the total dam capacity on the property to be twice the reasonable requirements allows storage of more than one year of supply.

The purpose of this limit is to provide for sharing of available dam capacity between landholders, based on property requirements.

If a property gets sub-divided after the Plan is adopted, then the capacity of existing dams and the property scale requirements of the original allotment will be considered, including an allowance for additional domestic water requirements on the new allotment where relevant (principle 139).

5.7.2 | Replacement dams

If a dam has been washed away, it may—in general—be replaced by a dam of the same capacity on the same flow path within the property despite the '80% rule' and other dam capacity limits (principle 140). If the original dam was on a restricted watercourse (a watercourse of third order or greater—see figure 14 in chapter 3), it may only be replaced on a part of that watercourse with a stream order that is the same or less than that of the original dam (principle 141). The Strahler stream ordering system is described in the glossary. The capacity of the original dam and replacement dams also need to be measured by a licensed surveyor (principle 140).

5.7.3 | Bypassing or returning low-flows

Any new or modified diversion structure needs to be constructed so that low-flows at or below the threshold flow rate are not captured or are otherwise bypassed or returned (principle 142).

As outlined in chapter 3, the key impact of dams and other diversion structures on the environment is the interception of low-flows and break-of-season flows. Therefore, new or enlarged dams and diversion structures will need to provide for a component of environmental water needs by bypassing, releasing or not capturing flows at or below the threshold flow rate.

Section 3.3.6 describes the requirements for bypassing, returning or not capturing low-flows at or below the threshold flow rate as a condition for licensed allocations. These requirements also apply to any new or modified diversion structure as a condition of a WAA permit (e.g. principle 144-145). As for all of the other policies outlined in this section, this requirement applies to all new or modified diversion structures, including those used for non-licensed purposes.

Water users have expressed concern that dams in areas with very low-flow rates may rarely capture water under this policy. Therefore, an alternative is provided under the Plan where those with a threshold flow rate of 1 litre per second or less can instead choose to return 10% of all flow coming to their diversion structure at any time—in other words, capture 90% at any time (principle 143). This means that such users are still contributing the equivalent flow, although the timing is not ideal in terms of environmental water needs. However, it means that all new diversion structures are playing a part.

The applicant will need to show how they will satisfactorily return low-flows before the permit will be approved (principle 145).

It should be noted that the requirement to return key environmental flows allows sustainable limits on dam capacity and the volume of water able to be taken from dams to be more generous that they would otherwise be.

5.7.4 | Siting, design and construction

Key principles relating to siting, design and construction are listed below.

- New diversion structures must not be constructed within 200 metres ecologically sensitive areas, including mapped key environmental assets (principle 122). The key environmental assets are the highly sensitive and ecologically important areas of permanent flow at Black Hill Springs and around Lenger Reserve.
- Diversion structures must not be constructed in areas prone to erosion (principle 122).
- Diversion structures should not contribute to salinity problems or detrimental impacts due to underground water level changes (principle 122).
- Diversion structures must be designed, sited, constructed and maintained in a way that minimises vegetation destruction and minimises soil erosion and siltation (principles 123 and 124).
- New dams must be constructed as off-stream dams unless it can be demonstrated that there is no suitable location on the property for an off-stream dam (principle 126). In any case, dams must not be constructed or enlarged across restricted watercourses (principle 125), unless in accordance with the principles for replacement dams (see section 5.7.2 of the Guide). Restricted watercourses are third order and greater watercourses, as shown in Figure 14 in chapter 3.
- Diversion structures must be designed and constructed in accordance with best practice standards (principle 121).
- The capacity of a new or modified dam must be measured by a licensed surveyor, and the capacity of a dam before and after removal must also be measured by a licensed surveyor (principle 127).

5.7.5 | Reduction of capacity if allocation is permanently transferred

If a new or enlarged dam is used for licensed purposes, and part or all of the allocation gets permanently transferred away from the dam in the future, then the landholder will be required to modify the dam so that the volumetric capacity of the dam to store water is reduced by the volume of water that has been transferred away (principle 146). The modification could include reducing the dam wall height or spillway height, or putting a pipe in the wall of the dam at the appropriate height to effectively reduce the dam capacity.

This requirement will be set out as a condition on the permit for construction or enlargement of the dam.

5.8 | Using imported water and effluent

5.8.1 | When is a permit required?

A permit will be required for using imported water in the course of carrying on a business, where more than 1 ML of imported water is used per year (section 8.9 of the Plan). Imported water is water that has been brought into the Marne-Saunders PWRA by means of a pipe or other channel, such as mains water.

A permit will be also required for using effluent in the course of carrying on a business, where more than 1 ML of effluent is used per year (section 8.9 of the Plan). If effluent is imported into the Marne Saunders PWRA, then it will be treated under the rules for permitting use of effluent (principle 161).

Effluent includes domestic and industrial wastewater; these terms are defined below (definitions from the NRM Act).

Domestic wastewater is water used in the disposal of human waste; water used for personal washing; water used for washing clothes or dishes; and water used in a swimming pool.

Industrial wastewater means water—apart from domestic wastewater—that has been used in the course of carrying on a business (including water used in the watering or irrigation of plants) that has been allowed to run to waste or has been disposed of or has been collected for disposal.

A permit for using effluent or imported water in the course of carrying on a business is only required when the water will be applied to land and/or stored in a dam that is not a turkey nest dam (principle 159). For example, using imported water or effluent for irrigation would require a permit, while using mains water to run a shop generally wouldn't.

5.8.2 | When isn't a permit required?

The use of imported water does not require a WAA permit if the imported water has been obtained under a water licence from another prescribed water resource. This is instead governed by the water allocation plan from the other prescribed resource. For example, a WAA permit would not be required for use of water obtained under a River Murray licence and supplied through the SA Water system (commonly known as off-peak water).

A WAA permit is not required in circumstances where use of effluent requires an environmental authorisation or licence under the EP Act and this has been granted.

A WAA permit is not required for using effluent when an enterprise is obligated to comply with a mandatory code of practice, consistent with the principles in the Plan (principle 160). The EPA's Code of Practice for Milking Shed Effluent is an example of such a mandatory code of practice.

5.8.3 | Impacts to be managed

It is important to manage the potential negative impacts associated with imported water and effluent, including:

- pollution of water resources (e.g. nutrients, salts, bacteria)
- importation of salt into the Marne-Saunders PWRA
- impacts of chlorine treated water on the environment
- impacts on natural resources and the environment as a result of applying water to the land (e.g. rising or perched water tables, salinity, waterlogging, pollution of water resources).

These potential impacts need to be balanced against the risk of these impacts occurring and the resources required for the permitting system. Therefore a threshold level of 1 ML/year has been proposed, below which a permit would not be required because the risks associated with use of this amount of imported water or effluent are thought to be relatively small.

5.8.4 | General principles

Permit applications for use of effluent or imported water will be assessed against a range of principles, which will also be used to set permit conditions. These include:

- considering the potential impacts of storage and use on underground water level; natural flow and quality of water; water-dependent ecosystems; productive capability of the land—e.g. salinity, waterlogging, perched water tables or unlocking toxic elements in the soil (principle 162)
- preventing effluent and chlorine-treated imported water from being directly or indirectly discharged into watercourses (principle 164)
- preventing detrimental impacts on water-dependent ecosystems and water resource quality through the use of appropriate storage facilities (principle 165), with more stringent criteria for storage of effluent (principle 166).

The use of effluent would not be permitted within a mapped key environmental asset (principle 163). The key environmental assets are the highly sensitive and ecologically important areas of permanent flow at Black Hill Springs and around Lenger Reserve.

Monitoring requirements may be included in permit conditions where the scale or manner of use of imported water or effluent carries a reasonable risk of negative impacts. This monitoring requirement will be assessed on a case-by-case basis and could include monitoring of underground water level and water quality.

Endmatter

Appendix A—Summary of key policy changes since the previous consultation round

The intentions of the policies of the Plan are very similar to what was proposed in a consultation period in late-2006 to early-2007. This earlier consultation period included a series of discussion papers in a booklet entitled *Discussion papers: Proposals for the draft Marne-Saunders Water Allocation Plan* (November 2006), released by the SA MDB NRM Board.

The table below gives an overview of key changes in policy direction between these 'old discussion papers' and the current Plan. The table is arranged by section number from the old discussion papers (DP) and gives the reference to the equivalent policy section in this Guide, where relevant.

Section # in old DP	Section # in this Guide	Policy in old discussion papers	Equivalent policy in the Plan	Rationale
3.1.2	2.2.1	Water is allocated as a share of the available limit and expressed as a volume, allowing changes in water availability to be easily and transparently reflected.	Water is allocated as a volume (no share-based allocation).	Current licensing system is not able to support share-based allocation. An appropriate system is being developed for the DWLBC separating water rights project, intended to be ready by the time the Plan is reviewed.
4.2.1.2, 7.4.4	3.3.6, 5.7.3	Policy requires the bypass or release low-flows for transfers of surface water and watercourse water and for new or enlarged diversion structures.	Policy requires water users to bypass, release or avoid the capture of low-flows at or below the threshold flow rate—or where the threshold flow rate is 1 L/s or less then option to return 10% of incoming flows. Applies to transfers and to new or enlarged diversion structures.	Consultation response expressed concern that dams with low threshold flow rate may rarely capture water if must return flows below threshold flow rate. Developed alternative approach to allow such dams to capture flow while making a contribution to environmental flows.
4.2.1.3	5.7.5	Water user must cease to capture allocation if surface water allocation is permanently transferred away.	Similar principle, but can only be applied to dams that have been constructed since adoption of the Plan.	No mechanism currently available to implement policy to existing dams. Dam capacity will still be managed via WAA permits.
4.2.1.4	3.3.9	If any part of a foundation allocation is transferred away, then the equivalent proportion of the extra safety net allocation is returned to the Minister permanently.	If any part of a foundation allocation is transferred away permanently, then the whole extra safety net allocation is returned to the Minister. A foundation allocation can only be temporarily transferred if the extra safety net allocation is converted to a holding allocation.	If any of the foundation allocation is not required, then the user should not have any benefit from the extra safety net. Provides more flexibility for dealing with temporary transfers while still keeping intent that extra safety net is not accessible if foundation allocation is transferred away.
4.2.2	3.2.1, 3.3.4	Surface water and watercourse water divided into management zones only (no management sub-zones).	Management zone scale is now the Upper Marne, Lower Marne, Upper Saunders and Lower Saunders. Mangement zones in the old discussion papers now termed 'management sub-zones'.	Makes accounting more straight-forward.
4.2.2.1	3.3.4	Transfers must not cause allocation to exceed usage limit at equivalent of management sub-zone.	Transfers must not cause allocation to exceed usage limit in tributary management sub-zones and/or at downstream main watercourse diversion structures.	This change provides additional protection to main watercourse diversion structures.
4.2.2.2	3.3.4	Dam scale allocation limit based on available runoff—determined as 70% of upstream average adjusted winter runoff minus upstream use.	Dam scale allocation limit based on available runoff—determined as 100% of upstream average adjusted winter runoff minus upstream use and evaporation.	The new policy more accurately reflects available runoff at the dam scale.

Section # in old DP	Section # in this Guide	Policy in old discussion papers	Equivalent policy in the Plan	Rationale
4.4	3.3.7	Maximum diversion rate for diversion points taking water from equivalent of restricted watercourses, set on basis of share of zone scale total maximum diversion rate.	Maximum diversion rate for diversion points taking water from restricted watercourses set on basis of allocation divided by 20 days.	The intention is the same—setting maximum diversion rate—but the new approach is more straightforward to calculate and more locally relevant.
4.5, 5.2, 6.2	3.3.8, 4.3.5	Policy does not specify order of taking of rollover allocations.	Policy specifies that rollover allocations are considered to be taken last.	This prevents rollover allocations from being rolled over indefinitely, as this would otherwise defeat the purpose of the limited rollover life.
4.6	3.4, 2.2.4	Policy does not provide for allocation of roof runoff—therefore roof runoff not able to be allocated (as no new surface water allocations are available).	New roof runoff allocations can be made within policies. Payment is not required for roof runoff allocations.	A higher proportion of water runs off a roof compared with land, so some can be harvested without significantly affecting downstream users and environment.
5.1	(see Plan Table 27)	The total allocation limit for the fractured rock aquifer is 2,200 ML.	The total allocation limit for the fractured rock aquifer is 2,000 ML.	Community consultation indicated the desire to minimise new allocation where there is uncertainty. 200 ML used to offset additional rollover in this resource (see below).
5.1	4.3.1	Fractured Rock management zones 1 and 2.	Fractured Rock management zone 1 becomes Fractured Rock Aquifer management zone; Fractured Rock management zone 2 becomes Fractured Rock management sub-zone.	Makes accounting more straightforward.
5.2	4.3.5	Maximum rollover of 10% of allocation in fractured rock aquifer.	Maximum rollover of 20% of allocation in fractured rock aquifer.	Provides additional flexibility requested by the community, particularly for conjunctive users. Additional rollover offset by reducing allocation limit while still having some water available for new allocation.
5.4, 6.4	n/a	Where another landholder's well buffer would be overlapped by a transfer, that landholder would be notified and have an opportunity to make submissions.	No specific notification is required by Plan.	If overlapped as a result of the 'pump test exemption', then the overlapped landholder will already be aware of this because they will need to give permission for measurements for the pump test. The other buffer rule exemption is based on allowing a user to get back to where they were prior to existing user allocation and continue same level of impact—it doesn't make sense to allow for notification/submission process if the intent is to allow an existing impact to continue. In addition, no legislative tool is available to apply the same principles to new allocations, thus requirements would be inequitable.
5.4, 6.4, 5.6, 6.6	3.3.8, 4.3.5, 4.4	Rollover allocations and artificial recharge allocations are not able to be transferred.	Rollover allocations and artificial recharge allocations are able to be transferred only if they will be taken from the same location (e.g. sale of property).	Water has been saved or artificially recharged, so there is no reason why it shouldn't be able to be used by the next landholder.

Section # in old DP	Section # in this Guide	Policy in old discussion papers	Equivalent policy in the Plan	Rationale
n/a	3.3.8, 4.3.5	No equivalent principle exists.	If water that has passed through the meter is used for non-licensed purposes, then the licensee may have that volume accounted for when determining the size of a rollover allocation if the volume used for non-licensed purposes is measured in accordance with state metering specifications.	This provides a way for a landholder to choose if they want to have non-licensed use of water that has passed through the meter accounted for when determining rollover allocations.
n/a	3.3.8, 4.3.5	No equivalent principle exists.	Rollover allocations won't be granted until the start of the second full water use year after existing user allocations are granted.	This ensures that rollovers are justly earned. Otherwise, if an existing user allocation is granted part way through a water use year, a rollover allocation could be earned by having less than a full year in which to use a full year's allocation.
5.4, 6.4	4.3.2	Where an underground water allocation is temporarily transferred, the original well buffer zone will be maintained for up to 2 years.	Where an underground water allocation is temporarily transferred, the original well buffer zone will be maintained for the duration of the transfer.	Consultation response asked for maintenance of buffer for duration of transfer. This is due to the risk of the original user not being able to take their allocation when the temporary transfer returns if someone has created an overlapping buffer in the meantime.
5.5, 6.5	4.3.3	Maximum volumetric allocation of underground water is limited to the lesser of reasonable enterprise requirements or well yield (determined by a pump test).	No specific limit on volume of new or transferred allocations, besides resource capacity limits, although large allocations will have a maximum extraction rate set on the basis of a pump test.	This provides flexibility to users to seek an allocation size of their choice, within sustainable limits, at different scales. Maximum extraction rate for large allocations provides a better balance of managing risks to resources and other users against involved requirements for applicants, compared with all applicants for new allocations or transfers needing to do a pump test.
7.2.2	5.5.2	A new non-licensed well can be drilled despite the overlapping buffer rules—if the property is entirely overlapped by other buffer zones (besides key environmental buffer zones).	A new non-licensed well can be drilled despite the overlapping buffer rules, if the arrangement of property boundaries and buffers is such that it is not possible or reasonable to avoid overlapping buffers (besides key environmental buffer zones).	This provides more flexibility with minimal extra risk to other landholders and environmental assets.
7.2.4	5.5.4	Deepening a licensed well in the fractured rock aquifer will be treated as if it is a new well in terms of overlapping buffer rules. Wells in other aquifers and non-licensed wells in the fractured rock aquifer can be deepened despite overlapping buffer rules.	Any well can be deepened, despite the overlapping buffer rules, as long as the well doesn't penetrate a different aquifer.	A licensed fractured rock aquifer underground water user may need to deepen a well because they have been negatively affected by someone else's use. Not being able to do so would appear unfair, because they didn't cause the problem. It is likely to be difficult to determine what, exactly, caused the problem that led to the desire to deepen the well.

Section # in old DP	Section # in this Guide	Policy in old discussion papers	Equivalent policy in the Plan	Rationale
7.3.2	n/a	Where water is to be artificially discharged into a well, the quality of the water to be discharged may be poorer than the ambient underground water—if the aquifer has the capacity to improve the quality of the discharged water in an attenuation zone.	No specific provisions for attenuation zones.	Attenuation zones can only be authorised by the EPA. Applicants will need to approach the EPA individually, rather than seeking an attenuation zone as part of the WAA permit.
7.4.5	n/a	New domestic dams of up to 2 ML permitted despite management zone dam capacity limits if there are not already existing sufficient supplies available on the property.	No exemptions from the dam capacity limits.	New domestic dams provided under the exemption may negatively affect domestic use from other dams; this is inequitable.
7.4.5.4	5.7.1	New dam capacity should not cause total dam capacity on the property to exceed reasonable property scale limit, including provision for storage of more than one year of supply. Considers non-licensed use only.	New dam capacity should not cause total dam capacity on the property to exceed twice the reasonable property scale limit, excluding provision for storage of more than one year of supply. Considers licensed and non-licensed use.	Determining the limit is now more straightforward and transparent; allocation and non-licensed use are combined into a single limit (already a limit of dam capacity as 2x allocation in old discussion papers, section 4.2.3.3).
n/a	5.7.1	No equivalent principle exists.	New dam capacity should not cause total potential demand to exceed supply for any downstream diversion structures.	Equivalent principles in section 3.3.4 in this Guide for transfer of surface water and watercourse water allocations. Provides additional protection for downstream users.
n/a	5.7.2	No equivalent principle exists.	Replacement dams can be reconstructed at the same capacity, despite the various dam capacity limits, within certain conditions.	This allows an existing impact to continue in the case where a dam is lost though external causes.

Glossary

This glossary defines a selection of terms used in this Guide. A more complete and precise set of definitions is given in the Plan and the NRM Act.

Allotment: Has the same meaning as in the *Real Property Act 1886* (SA).

Aquifer: A saturated geological material that, when drilled into, can yield a useable quantity of underground water.

Aquifer, confined: An aquifer that is bound above and below by an impermeable confining bed—the pressure in a confined aquifer is usually greater than atmospheric pressure, resulting in water levels in wells rising above the top of the aquifer.

Aquifer, fractured rock: An aquifer where underground water is stored and moves through joints and fractures in the rocks.

Aquifer, sedimentary: An aquifer where underground water flows through the pore spaces within the sediments.

Aquifer, unconfined: An aquifer which has the watertable as its upper surface and which may be recharged directly by infiltration from the ground surface.

Artificial recharge allocation: An allocation granted in accordance with section 6.4 of the Plan, to allow water artificially drained or discharged into a well to be recovered for licensed use.

Average adjusted winter runoff: The average depth or volume (as appropriate) of water modelled to run off an area from May to November under the 'no-dams' modelling scenario.

Base water (taking) allocation: A water (taking) allocation that is not a rollover allocation or an artificial recharge allocation.

Catchment area: The catchment area of a particular point means all of the land, determined by natural topographic features, from which runoff has potential to naturally flow to that point.

Confined aquifer: An aquifer that is bound above and below by an impermeable confining bed—the pressure in a confined aquifer is usually greater than atmospheric pressure, resulting in water levels in wells rising above the top of the aquifer.

Connected roof area: The area of roof that drains (usually through gutters and downpipes) to water storage facilities. Where there are multiple connected roof areas on a property, the connected roof area for the property is the total of all connected roof areas for that property.

Consumptive use: In general, the use of water for private benefit consumptive purposes including irrigation, industry, urban and stock and domestic use.

Dam: A dam including, but not limited to, an off-stream dam and a turkey nest dam—but excluding turkey nest dams that only store water other than prescribed surface water and/or watercourse water from the Marne Saunders PWRA.

Dam, off-stream: A dam that is not constructed across a watercourse and is primarily designed to hold water from a source other than the catchment area of the dam. Other water sources may include, but are not limited to, underground water and water diverted or pumped from a watercourse and/or flow path that is not in the catchment area of the dam. Off-stream dams may capture a limited volume of surface water from the natural catchment area of the dam (up to 5% of its total capacity, determined on the basis of average adjusted winter runoff from the catchment area upstream of the dam).

Dam, turkey nest: An off-stream dam that does not capture any surface water from the catchment area upstream of the dam.

Diversion structure: A dam, wall or other structure, object or device that will collect or divert water flowing in a watercourse or surface water flowing over land—including, but not limited to, a dam, weir, levee or pump.

Domestic water use: The taking of water for ordinary household purposes—including the watering of land in conjunction with a dwelling not exceeding 0.4 hectares for non-commercial purposes.

Drawdown: A reduction in water level and/or pressure level in an aquifer as a result of the taking of underground water from that aquifer.

Ecosystem: A community of organisms, which may include humans, interacting with one another and including the physical, chemical and biological processes inherent in their interaction and the environment in which they live.

Environmental asset: For the purposes of the Plan, an environmental asset is a section of watercourse that supports water-dependent ecosystems that interacts with or is linked to a particular underground water aquifer. The environmental assets are mapped in the Plan.

Environmental buffer zone: An environmental buffer zone is an area radiating from an environmental asset, and is linked to an aquifer or aquifers. The environmental buffer zones and the aquifers that they are linked to are shown in GRO Plans 54/08, 55/08 and 56/08 and in the Plan, reproduced at a reduced scale in Figure 20, Figure 21 and Figure 22 in this Guide.

Environmental water provisions: Those parts of environmental water requirements that can be met at any given time—this is what can be provided at that time with consideration of existing users' rights, social and economic impacts.

Environmental water requirements: The water regime needed to sustain the ecological values of aquatic ecosystems, including their processes and biological diversity, at a low level of risk.

Environmental water use: The use of water to maintain, rehabilitate or restore locally indigenous water-dependent ecosystems, habitats, communities or species for a purpose and in a manner accredited by the SA MDB NRM Board. Environmental water use may include non-active environmental use (where water is retained in aquifers, surface waters and/or watercourses) and active environmental use (including, but not limited to, activities such as watering naturally occurring habitat).

Extra safety net allocation: A particular type of allocation granted to an existing user, pursuant to the intended regulation setting out the process for allocations to existing users—see section 3.3.9 of this Guide for more information.

Flow path: The natural preferential path or direction of surface water flow.

Foundation allocation: A particular type of allocation granted to an existing user pursuant to the intended regulation setting out the process for allocations to existing users—see section 3.3.9 of this Guide for more information.

Fractured rock aquifer: An aquifer where underground water is stored and moves through joints and fractures in the rocks.

Hydrogeology: The study of the underground water, which includes its occurrence, recharge and discharge processes and the properties of aquifers.

Hydrologically continuous: Two or more points on the landscape connected by the same flow path or watercourse.

Hydrology: The study of the characteristics, occurrence, movement and utilisation of water on and below the earth's surface and within its atmosphere.

Key environmental asset: For the purposes of the Plan, a key environmental asset is a section of watercourse and a 50 m wide strip of surrounding land centred on that watercourse that supports water-dependent ecosystem of key significance. Specifically, they are the highly sensitive and ecologically important areas of permanent flow at

Black Hill Springs and around Lenger Reserve. The key environmental assets are shown in GRO Plan 58/08, which is reproduced at a reduced scale in Figure 35 of the Plan.

Key environmental buffer zone: An environmental buffer zone is an area radiating from a key environmental asset, and is linked to an aquifer or aquifers. The extent of the key environmental buffer zones and the aquifers they are linked to is shown in GRO Plans 60/08 and 61/08 reproduced at a reduced scale in Figures 36 and 37 in the Plan.

Main watercourse diversion structure: A diversion structure that may take water from a main watercourse management sub-zone.

Main watercourse management sub-zone: Management sub-zones that represent the main watercourses that the tributaries feed into in the Marne Saunders PWRA. Water taken from the watercourse represented by the main watercourse management sub-zone is excluded from the adjacent tributary management sub-zones. Main watercourse management sub-zones are shown in GRO Plan 1/09, reproduced at a reduced scale in Figure 8.

Major point of inflow: The major point of inflow from a tributary management sub-zone to a main watercourse management sub-zone. Major points of inflow from the tributary management sub-zones to the main watercourse management sub-zones are shown in GRO Plan 2/09, reproduced at a reduced scale in Figure 39 in the Plan.

Managed aquifer recovery (MAR): The process where water is artificially recharged into an aquifer for later recovery.

Management sub-zone: A specific part of a management zone. Policies in the Plan relating to a management zone also apply to the management sub-zones that are part of it. Boundaries of management sub-zones are shown in GRO Plans 52/08 and 1/09 and in the Plan, and Figure 8 and Figure 19 in this Guide show these Plans at reduced scale. See also tributary management sub-zone and main watercourse management sub-zone.

Management sub-zone allocation limit: The maximum volume of water available for allocation from an underground water management sub-zone in a water use year, excluding rollover allocations and artificial recharge allocations. The volume of the management sub-zone allocation limit is part of the volume of the allocation limit of the associated management zone. The volume of the management sub-zone allocation limit is not additional to the volume of the management zone allocation limit. The volume of the management sub-zone allocation limit for each relevant management sub-zone is given in column 'Management sub-zone allocation limit' of Table 28 of the Plan.

Management sub-zone consumptive use limit: The maximum volume of water available for consumptive use in a water use year from a surface water and watercourse water management sub-zone—or portion of management sub-zone—excluding rollover allocations and roof runoff (surface water) allocations. The management sub-zone consumptive use limit is determined in accordance with principles 53 and 55 of the Plan, in combination with column 'Management sub-zone consumptive use limit' of Table 28 of the Plan.

Management sub-zone dam capacity limit: The total volumetric capacity of dams in a management sub-zone that must not be exceeded when determining an application to erect, construct or enlarge a dam under section 8.4 of the Plan. The volume of the management sub-zone dam capacity limit for each relevant management sub-zone is given in column 'Management sub-zone dam capacity limit' of Table 28 of the Plan.

Management zone: A part of the Marne Saunders Prescribed Water Resources Area—boundaries shown in GRO Plans 47/08, 48/08, 49/08, 50/08 and 51/08 and in the Plan. The boundaries are shown at a reduced scale in Figure 7, Figure 16, Figure 17 and Figure 18 of this Guide. A management zone includes the specified water resource(s) or part of a water resource as shown in column 'Water resource type' of Table 27 of the Plan that lie within that management zone's boundaries.

Management zone allocation limit: The maximum volume of water available for allocation from a management zone in a water use year, excluding rollover allocations, artificial recharge allocations, roof runoff (surface water) allocations and extra safety net allocations (where relevant). The allocation limit for a management zone only applies to the water resource or resources that the management zone is linked to as defined in column 'Water resource type' of Table 27 in the Plan. The volume of the management zone allocation limit for each management zone is given in column 'Management zone allocation limit' of Table 27 in the Plan.

Management zone dam capacity limit: The total volumetric capacity of dams in a management zone that must not be exceeded when determining an application to erect, construct or enlarge a dam under section 8.4 of the Plan. The volume of the management zone dam capacity limit for each management zone is determined in accordance with principle 129 of the Plan.

Management zone long-term dam capacity target: The long-term target for dam capacity for a management zone that will provide enhanced environmental outcomes and better security of supply for users. The management zone long-term dam capacity limit for each management zone is given in column 'Management zone long-term dam capacity target' of Table 27 of the Plan.

Maximum diversion rate: The maximum rate (in litres per second) at which water may be diverted from a restricted watercourse, as determined in accordance with principles 64–66 of the Plan.

Maximum extraction rate: The maximum rate (in litres per second) at which water may be extracted from a well taking endorsed on a licence. Types of maximum extraction rates that may apply are:

- maximum extraction rate from a well where its well buffer zone will overlap another well buffer zone, as determined in accordance with principles 31–33 of the Plan
- maximum extraction rate from a well with a large allocation, as determined in accordance with principles 35–37 of the Plan.

Non-licensed consumptive use: Consumptive use of prescribed water resources for non-licensed purposes. Non-licensed purposes at the date of publication include:

- domestic use
- provision of drinking water for stock that are not subject to intensive farming
- fire fighting
- making of public roads
- purposes authorised by a notice under section 128 of the NRM Act in the area. At the date of publication of the Plan, water may be used for the following purposes without a licence:
  - the application of chemicals to non-irrigated crops or non-irrigated pasture, or to control a pest plant or animal (SA Government Gazette 16/3/06, pg 559)
  - taking up to 500 kilolitres of roof runoff under certain conditions for commercial, industrial, environmental or recreational use, but excluding irrigation use (SA Government Gazette 16/3/06, pg 906-912).

Off-stream dam: A dam that is not constructed across a watercourse and is primarily designed to hold water from a source other than the catchment area of the dam. Other water sources may include, but are not limited to, underground water and water diverted or pumped from a watercourse and/or drainage path that is not in the catchment area of the dam. Off-stream dams may capture a limited volume of surface water from the natural catchment area of the dam (up to 5% of its total capacity, determined on the basis of average adjusted winter runoff from the catchment area upstream of the dam).

Operational well: A water well that has not been abandoned or backfilled. The SA Geodata database will be used as the primary source to identify the existence, location and status of water wells. Alternative information on the existence, location and status of water wells may also be considered by the Minister.

Point of taking: The point or location at which an allocation is taken or is to be taken.

Property: An allotment or contiguous allotments owned or occupied by the same person, persons or body and operated as a single unit. Allotments will be considered to be contiguous if they abut at any point, or are separated only by a road, street, lane, footway, court, alley, railway, thoroughfare, easement, right-of-way, watercourse, channel or a reserve or similar open space.

Restricted watercourse: A watercourse marked as an orange line in GRO Plan 3/09, shown at a reduced scale in Figure 14 of this Guide. Restricted watercourses have been identified as watercourses of third order and greater using the Strahler stream ordering system.

Riffle: Stream section with fast and turbulent flow.

Riparian: Relating to the area which adjoins, directly influences, or is influenced by a body of water.

Rollover allocation: An allocation granted in accordance with principles 38–43 and 73–80 of the Plan, allowing allocation that has not been used in previous water use years to be taken in later water use years under certain conditions.

Roof runoff (surface water): Water that runs off a roof after being precipitated.

Roof runoff (surface water) allocation: An allocation of roof runoff (surface water) granted in accordance with section 6.6 of the Plan.

Safety net allocation: A particular type of allocation granted to an existing user pursuant to the intended regulation setting out the process for allocations to existing users—see section 3.3.9 of this Guide for more information

Sedimentary aquifer: An aquifer where underground water flows through the pore spaces within the sediments.

Source: A specific point of taking, such as a given well, diversion structure or roof.

Stream order: A method of classifying the size of a part of a watercourse, based on the hierarchy of connecting watercourse segments. The Strahler stream ordering system is used in the Plan. The most upstream part of a watercourse is a first order stream. Two first order watercourses join together to become a second order watercourse. Two second order watercourses join together to become a third order watercourse and so on. Arthur Strahler first proposed the approach in 1952 in an article in the Geological Society of America Bulletin. Watercourses are defined in the basis of current 1:50,000 topographic maps produced by the state government.

Stock water use: The taking of water to provide drinking water for stock other than stock subject to intensive farming (as defined in the NRM Act)—includes temporary feedlotting.

Surface water: Defined as:

a. the water flowing over land (except in a watercourse)
   I. after having fallen as rain or hail or having precipitated in any other manner; or
   II. after rising to the surface naturally from underground
b. water of the kind above that has been collected in a dam or reservoir.

Temporary feedlotting: Where animals are confined to a small space or area and are fed by hand or mechanical means for less than six months of the year and stock numbers are equal to or less than the carrying capacity of the property with consideration given to exceptional circumstances for drought.

Threshold flow rate: The flow rate at or below which surface water or watercourse water must not be diverted or must be bypassed or otherwise returned around a diversion structure in accordance with principles 67 and/or 142 of the Plan. The threshold flow rate is determined in accordance with principle 68 of the Plan.

Tributary management sub-zone: A surface water and watercourse water management sub-zone representing a tributary area that feeds into a main watercourse. Tributary management sub-zones are shown in GRO Plan 1/09 and in the Plan, and shown at a reduced scale in Figure 8 in this Guide. The water resources of a tributary management sub-zone exclude water taken from the watercourse represented by a main watercourse management sub-zone.

Turkey nest dam: An off-stream dam that does not capture any surface water from the catchment area upstream of the dam.

Unconfined aquifer: An aquifer which has the watertable as its upper surface and which may be recharged directly by infiltration from the ground surface.

Watercourse: A river, creek or other natural watercourse (whether modified or not) and includes:

a. a dam or reservoir that collects water flowing in a watercourse
b. a lake through which water flows
c. a channel into which the water of a watercourse has been diverted
d. part of a watercourse
e. an estuary through which water flows.

Water-dependent ecosystem: Those parts of the environment, the species composition and natural ecological processes, which are determined by the permanent or temporary presence of flowing or standing water. Water-dependent ecosystems include riparian vegetation, springs, wetlands, floodplains, estuaries, in-stream areas of watercourses, wetted sediments below and alongside rivers (hyporheic zone), and underground water systems that support organisms (stygofauna).

Water quality criteria: Has the same meaning as in the *Environmental Protection Act 1993* (SA) and any associated policy

Water use year: The period between 1 July in any calendar year and 30 June in the following calendar year.

Well: Defined as:

a. an opening in the ground excavated for the purpose of obtaining access to underground water
b. an opening in the ground excavated for some other purpose but that gives access to underground water
c. a natural opening in the ground that gives access to underground water.

The term 'well' is used in this Guide and the Plan to encompass all of the types of infrastructure used to access underground water, including wells and bores. Wells may be equipped with a pump (including a windmill) or unequipped.

Well buffer zone: A circular area centred on an operational well. The well buffer zone is linked to the aquifer that the well takes water from. The radius of the well buffer zone is determined in accordance with Table 29 in the Plan, and is also shown in Table 2 in this Guide.

Wild flooding: Flood irrigation where no adequate system such as land levelling or irrigation bays is used to ensure a controlled distribution of water.

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