

# Guide to Groundwater Management in NSW

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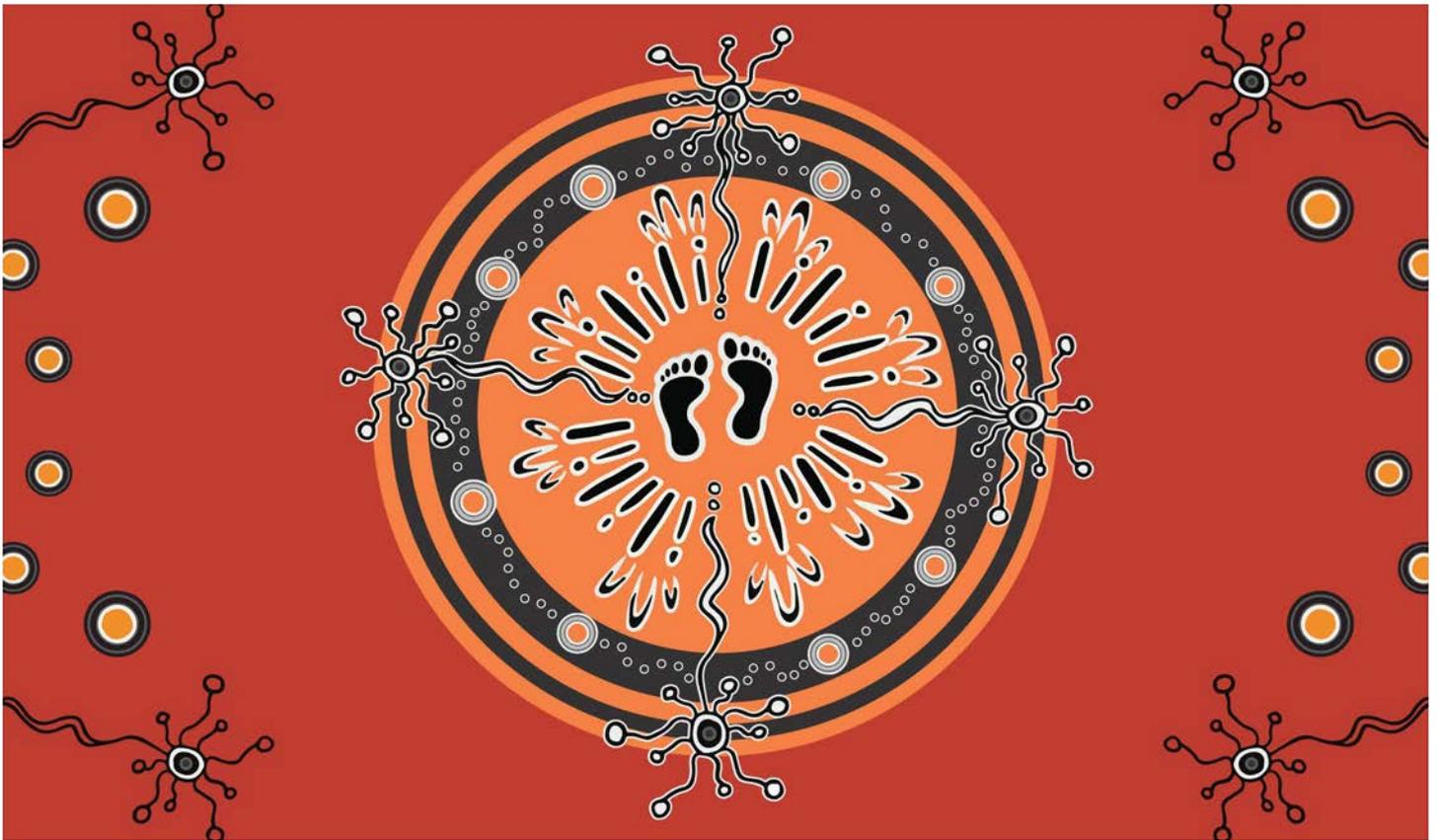
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**Cover image** Image courtesy of John Spencer, Department of Planning and Environment. Wetland flooded paperbark trees, Crowdy Bay National Park.

**More information** [water.dpie.nsw.gov.au/plans-and-programs/nsw-groundwater-strategy](https://water.dpie.nsw.gov.au/plans-and-programs/nsw-groundwater-strategy)

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# Acknowledgment of Country

The NSW Government acknowledges First Nations people as its first Australian people and the traditional owners and custodians of the country's lands and water. First Nations people have lived in NSW for over 60,000 years and have formed significant spiritual, cultural, and economic connections with its lands and waters.

Today, they practice the oldest living culture on earth.

The NSW Government acknowledges First Nations people as having an intrinsic connection with the lands and waters of New South Wales. The landscape and its waters provide First Nations people with essential links to their history and help them maintain and practice their traditional culture and lifestyle.

We recognise Traditional Owners as the first managers of Country. Incorporating their culture and knowledge into groundwater management in the region is a significant step towards closing the gap.

Through the NSW Groundwater Strategy, we seek to establish meaningful and collaborative relationships with First Nations people. We seek to shift our focus to a Country-centred approach; respecting, recognising and empowering cultural and traditional Aboriginal knowledge in water management processes at a strategic level.

We show our respect for Elders past and present through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places where First Nations people are included socially, culturally and economically.

As we refine and implement the NSW Groundwater Strategy, we commit to helping support the health and well-being of waterways and Country by valuing, respecting and being guided by First Nations people, who know that if we care for Country, it will care for us.

We acknowledge that further work is required under the NSW Groundwater Strategy to inform how we care for Country and ensure First Nations people hold a strong voice in shaping the future for First Nations communities.

Artwork courtesy of Nikita Ridgeway.

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Image courtesy of Destination NSW. Macquarie River Trail, Dubbo.

# Guide at a glance



Groundwater resources across NSW support a variety of water users, including the environment

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We need a framework to share fairly and transparently the groundwater that is sustainably available

page 18



## Our groundwater management framework



Our framework is guided by the National Water Initiative and NSW Government's strategic directions, specifically the NSW Groundwater Strategy

page 22



To carry out these directions, we have legislation and policies that govern the protection and use of groundwater resources

page 30



Tools such as statutory plans underpinned by data, science and information enable effective implementation of the framework

page 42



Approaches to groundwater management in NSW have evolved over time

page 62

# Facts about groundwater in NSW



The **Water Management Act 2000** and other laws provide the legal basis for sustainable management



Over **250 towns in NSW** rely wholly or partly on groundwater for domestic and commercial water supply



We have **36 water sharing plans** to protect our groundwater resources and allocate sustainably amongst users



Our management applies to over **500 inland and coastal groundwater sources**



There are more than **10,000 licences** to take groundwater in NSW



NSW has a network of over **4,600 monitoring bores** to track groundwater levels and use



Image courtesy of Department of Planning and Environment. Irrigation bore and centre pivot irrigation system.

# Purpose and context

# 1

Image courtesy of Destination NSW,  
Tumut, Kosciuszko National Park.

Groundwater is one of our most valuable water resources. Groundwater and the natural environments that depend on it support thriving communities and strong local economies – both now and into the future.



Image courtesy of Jess Thompson. Mascot Spring, Great Artesian Basin.

# Purpose

The *Guide to Groundwater Management in NSW* (Guide) provides an overview of the state's current groundwater management framework. This framework includes strategies, laws, policies, plans, guidelines and processes that apply to the management of our groundwater resources. The framework is implemented collaboratively by multiple local, state and federal government organisations, and the people, communities, industries and developments that rely on groundwater.

The NSW groundwater management framework is the culmination of more than 20 years of steady and successful groundwater management reform. It forms the baseline for future reforms to better respond in an ecologically sustainable way to the challenges of climate change, increasing water demand and the recognition of Aboriginal people's rights and interests in water.

This Guide, and its companion *Guide to Groundwater Resources in NSW* support the state's first *NSW Groundwater Strategy* which prioritises future groundwater management actions and reforms over a 20-year horizon.

The Guide updates and replaces the 1997 NSW State Groundwater Policy Framework Document. The Guide has been developed for groundwater users, local and state government agencies, development proponents and for anyone with an interest in groundwater and the ecosystems it supports. It will help all parties to better understand their roles and responsibilities around groundwater extraction and use, and provide practical guidance on NSW groundwater policies and guidelines.

**A glossary of terms used throughout this document is contained in Appendix B.**



Image courtesy of Craig Mason, Department of Planning and Environment. Ellenborough Falls, Elands NSW.

# Context

The *Guide to Groundwater Resources in NSW*<sup>1</sup> provides detailed information about groundwater occurrence and the different types of groundwater systems in NSW and their uses. A very brief summary is provided below. Further information can be found on the government's website at [water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science](http://water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science)

## Characteristics of groundwater

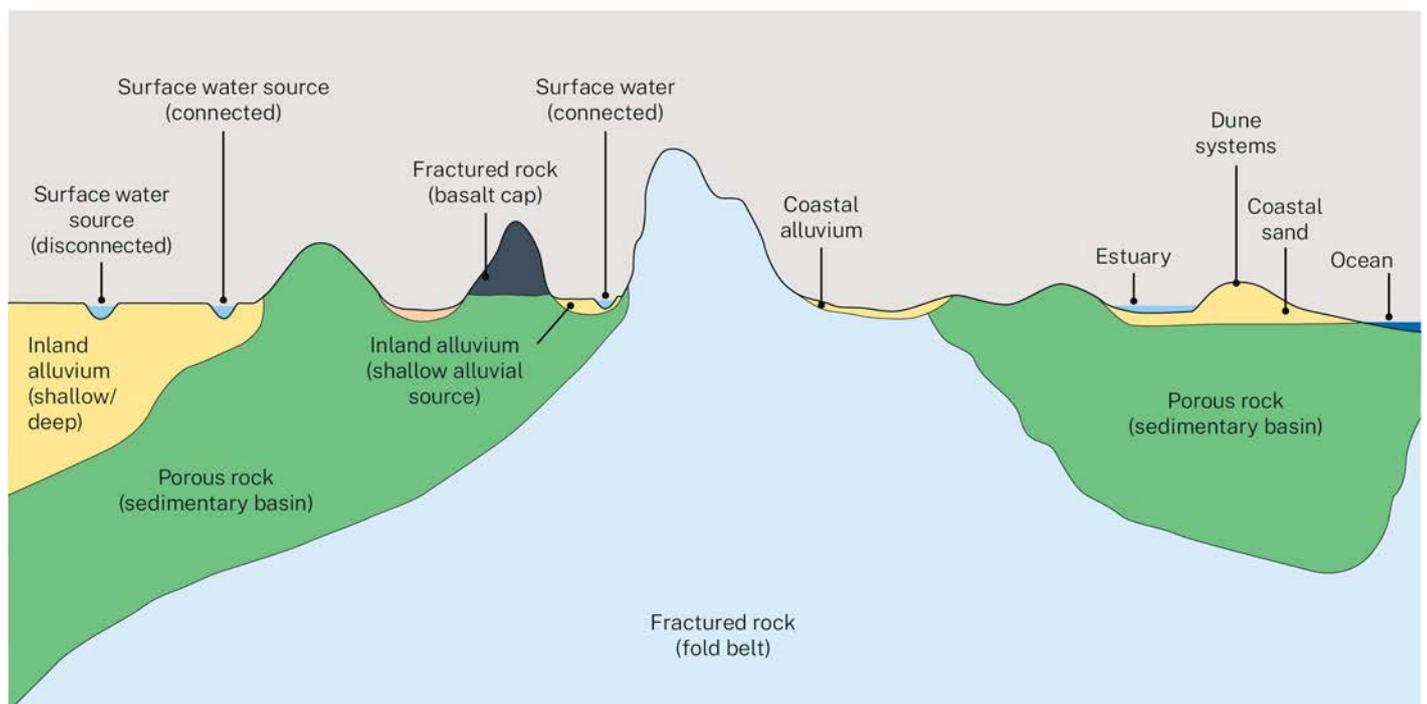
Groundwater is ubiquitous – it is water below the land surface. Groundwater slowly moves between gaps in sediments and in the cracks (or fractures) of rocks. Shallow groundwater is often connected to rivers, streams, lakes, wetlands and springs.

There are fundamentally 3 types of groundwater systems in NSW:

- unconsolidated alluvial and sand dune groundwater systems
- porous rock groundwater systems
- fractured rock groundwater systems.

The natural quality, quantity and yield of groundwater can vary depending on the system type, location, depth and other factors. Figure 1 below illustrates the different types of groundwater systems in NSW.

**Figure 1. Overview of NSW groundwater resource types in NSW**

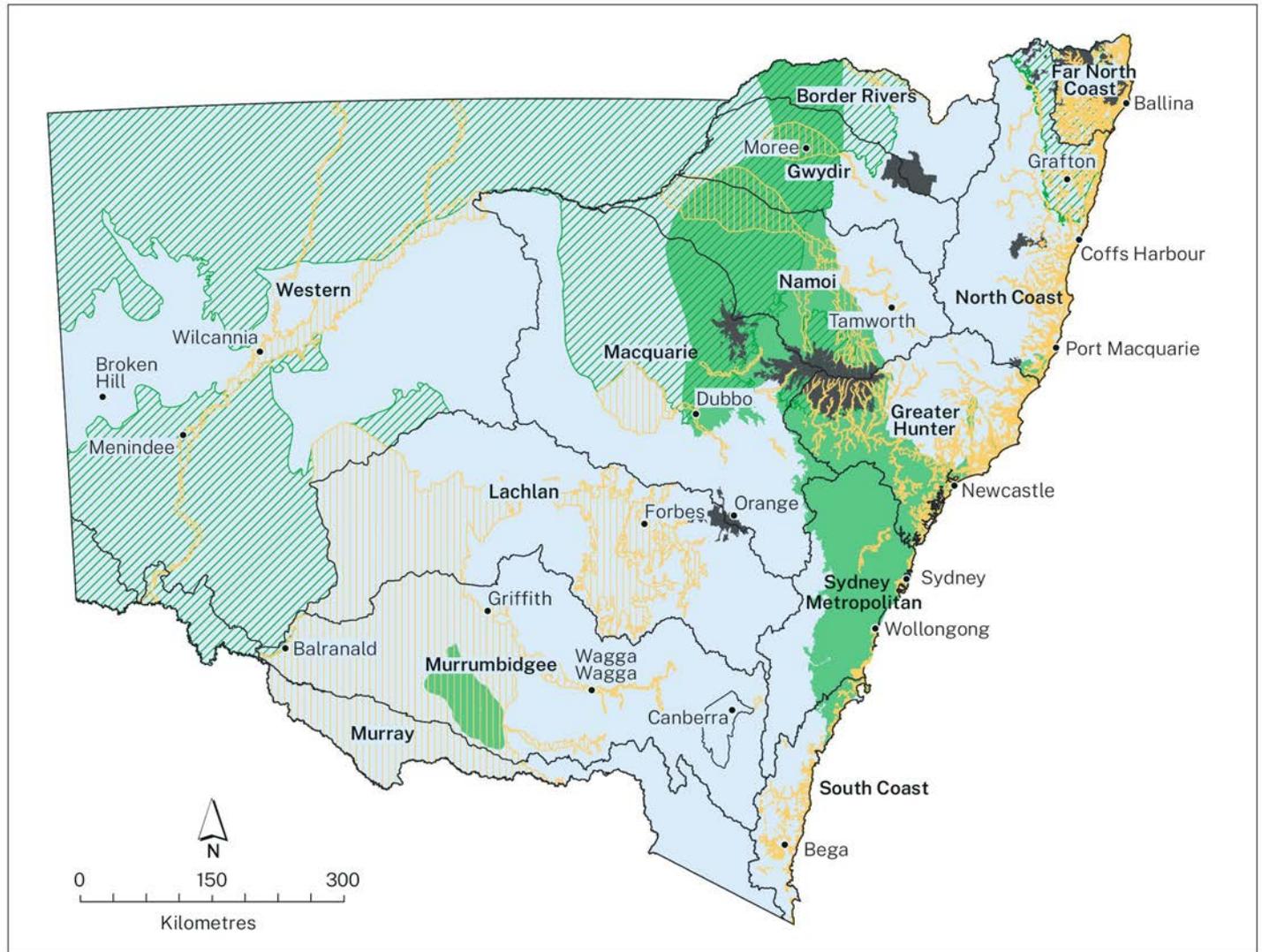


1. [www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy](http://www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy)

The most economically important groundwater systems in NSW are the large inland alluvial systems of the Murray–Darling Basin where much of the state’s irrigation activities occur. These systems are associated with current and past (now buried) river channels

and can store and yield large volumes of water for agriculture, industry, and towns. Figure 2 below shows the location of the primary groundwater systems in NSW.

**Figure 2. Location of main groundwater systems in NSW**



**Legend:**

- Water strategy boundary
- ▨ Alluvials, coastal sands and other sediments
- Fractured rock (Basalts)
- ▤ Younger porous rocks
- Older porous rocks
- Fractured rocks

# Groundwater use in NSW

Groundwater is a finite resource that supports almost every aspect of our daily lives, from the water we drink and use in our homes to water for crops and activities that support our industries and economy. Groundwater directly supports close to \$1 billion of economic production in NSW.<sup>2</sup> It is an important source of water for towns, industries and farmers across NSW.

## Domestic consumption

Groundwater supplies on average around 20% of all water needs in NSW<sup>3</sup> and is essential to the health and wellbeing of many residents.

Groundwater is vital in inland regions and many coastal communities where surface water is less reliable.

Around 150 inland towns rely wholly on groundwater for town water supply.

Another 100 other towns are partially dependent on groundwater, particularly during drought.

Many landholders rely on groundwater for domestic and stock use (Figure 3). Groundwater supports rivers and cave systems, springs, wetlands, trees and other vegetation. These are all important for the environment and underpin First Nations' and Aboriginal people's cultural values and practices. Groundwater becomes particularly important as a source of water during drought when the availability of surface water declines.

**Around 30% of the water treated at Dubbo's John Gilbert Water Treatment Plant is sourced from groundwater pumped from the South Dubbo Borefield.**



Source: Dubbo City Council

## Sustaining the environment

Groundwater supports vital environmental assets and sustains natural ecosystems and habitats, which support our unique flora and fauna.

It can be an important source of water to streams, sustaining our river ecosystems, particularly during dry periods.

Groundwater helps make our lives healthier and more productive and our communities more attractive and amenable places to live.

Groundwater dependent ecosystems cover over 8% of NSW's land surface according to the NSW Environment Protection Authority's 2022 State of the Environment report.<sup>4</sup>

**Wetlands provide valuable habitat for eucalypt species, including river red gums.**



Source: NSW Government

2. Department of Planning and Environment 2021, *Understanding NSW's economic dependency on groundwater*. Internal project report.  
3. NSW Government, *NSW Water Strategy 2022*, Department of Planning and Environment  
4. [www.soe.epa.nsw.gov.au/all-themes/water-and-marine/groundwater](http://www.soe.epa.nsw.gov.au/all-themes/water-and-marine/groundwater)

## Aboriginal water rights, interests and values

First Nations and Aboriginal people were the custodians of the original water industry.<sup>5</sup>

Water is deeply entwined with Aboriginal people's connection to Country and culture – providing food, kinship, connection, recreation, stories, songlines and healing.

Access to groundwater is relied upon to meet spiritual, cultural, social and economic needs.

## Aboriginal peoples' values, uses, risks, objectives and outcomes as considered in groundwater resource management.



Source: Artist Nathan Peckham, 2021

## Supporting agricultural production

Agriculture is the largest groundwater user in NSW, with the greatest volume being used for irrigation and stock use.

The agriculture industry plays a vital role in the NSW economy. In 2017–18,<sup>6</sup> irrigated agriculture contributed \$4.4 billion in gross value and indirectly generated jobs and income in regional communities. Agriculture uses over 65% of all groundwater extracted in NSW every year.<sup>7</sup>

For many farms in central and western NSW, groundwater is the only permanent water source.

## Groundwater spray irrigation of feed maize crop in the NSW Murray Valley.



Source: NSW Government

5. Frangos et al 2021, *The original water industry*, [watersource.awa.asn.au/business/diversity/original-water-industry](http://watersource.awa.asn.au/business/diversity/original-water-industry)

6. Australian Bureau of Statistics, Gross value of irrigated agricultural production – 2017–18

7. Based on average groundwater extraction calculated as mean between 2015–15 and 2019–20. Department of Planning and Environment 2021, *Understanding NSW's economic dependency on groundwater*, Internal project report.

## Supporting mining

Mining is a key industry in many regional areas and a key contributor to the broader NSW economy.

In 2019, mining contributed nearly half of the state's merchandise export revenue, along with \$1.7 billion in royalties, and directly employed around 30,200 people.<sup>8</sup> Groundwater can be used by mining operations, for minerals processing, dust mitigation, staff facilities and irrigating rehabilitated areas, and many mines intercept groundwater when undertaking their activities.

Many mining operations in central and western NSW are totally dependent on groundwater.

**After agriculture, mining is one of the largest users of groundwater in NSW.**



Source: NSW Government

## Supporting other key industries

Groundwater supports other important commercial, industrial and construction activities.

Industries such as mineral water extraction and bottling occur along coastal NSW.

Groundwater is an important water source for processes used in extractive industries such as quarrying and manufacturing (including paper manufacturing).

Some emerging energy producers are seeking to develop gas, geothermal and pumped hydro schemes.

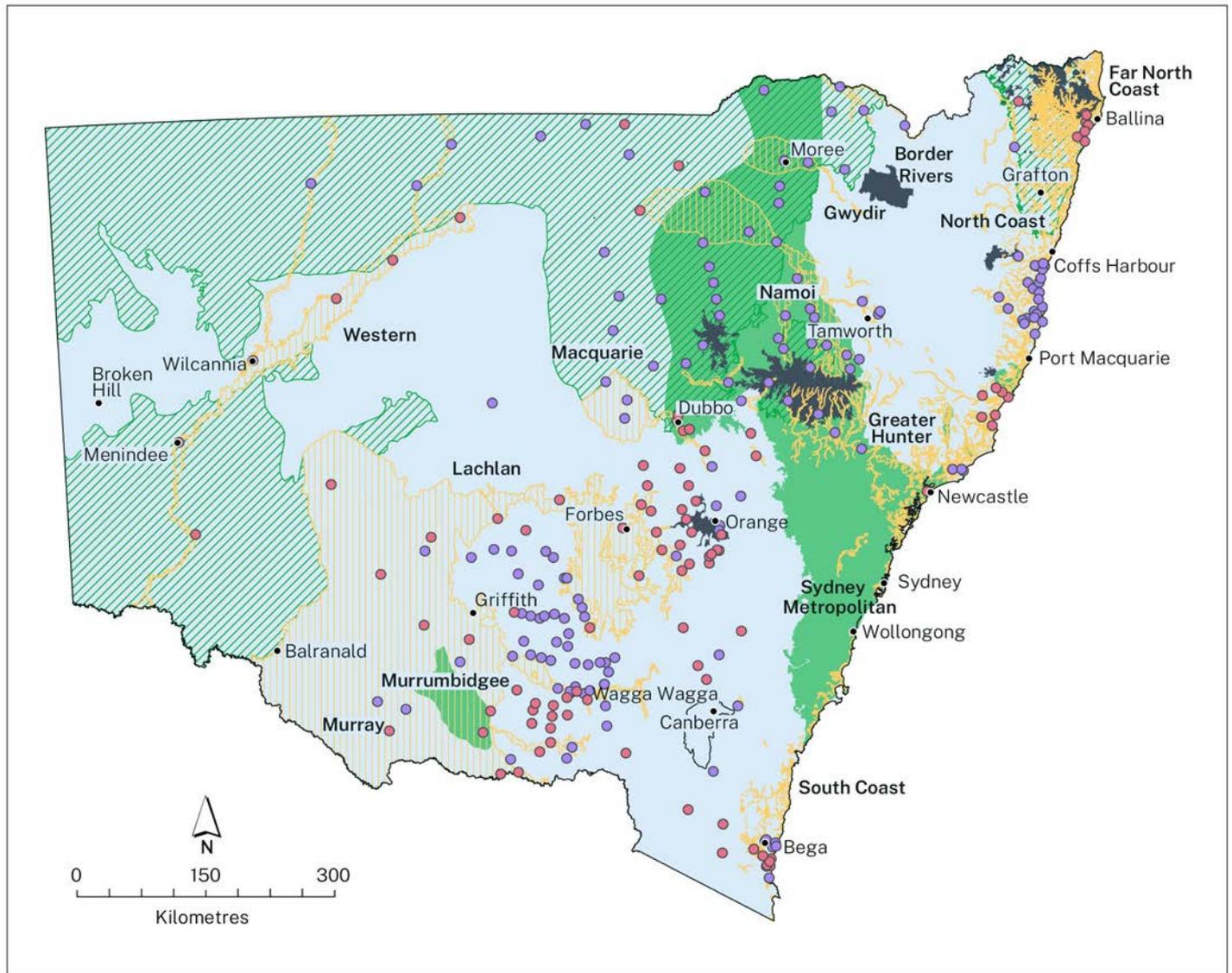
**Groundwater is used in the bottled water industry around the Sydney Basin and Northern Rivers region of NSW.**



Source: iStock

8. Australian Bureau of Statistics, Gross value of irrigated agricultural production – 2017-18

**Figure 3. Towns across NSW that rely on groundwater for some or all of their water supply. Groundwater is also the only source of water on many rural properties**



**Legend:**

- |  |                          |                    |
|--|--------------------------|--------------------|
| Alluvials, coastal sands and other sediments | Fractured rock (Basalts) | Older porous rocks |
| Younger porous rocks                         | Fractured rocks          |                    |

**Town water supplied by:**

- |             |                                       |
|-------------|---------------------------------------|
| Groundwater | Surface water with groundwater backup |
|-------------|---------------------------------------|

Source: Department of Planning and Environment data.



Image courtesy of Peter Simons, Department of Primary Industries. Bore overflowing.

# Our approach to groundwater management

# 2

Image courtesy of Department of Primary Industries.  
Recycled irrigation runoff water, Breeza.

# The need for a framework

Until the 1980s, NSW's groundwater management ethos was about finding and developing our groundwater resources and exploiting them. Little attention was paid to the concept of sustainable take or to the impacts that our land and water management practices were having on groundwater quality and dependent ecosystems. We needed to change the way water was managed to protect communities, the environment and the economy. The shift to sustainable groundwater resource management began and has continued with the introduction of the *Water Management Act 2000* and its implementation.

**For a more detailed history of groundwater management in NSW, see Appendix A.**

If we do not manage our groundwater resources sustainably, then they will not be available for us and future generations to use, and the ecosystems that depend on them may be damaged or permanently lost. If we take too much groundwater, supplies will continue to decline. Water quality may deteriorate and critical vegetation, river base flows and drought refuges in groundwater-fed streams will be lost. If we contaminate our groundwater, it is extremely difficult, time consuming and costly to clean up, and in the meantime individuals, communities and businesses cannot use it, and dependent ecosystems may be damaged or lost. We must share fairly the groundwater that is sustainably available. We must also recognise its many uses and values – as take for domestic and stock consumption, to support Aboriginal people's rights and interests, as water supply for villages, towns and cities, and as a critical contributor to vital environmental assets and habitats.



Image courtesy of Department of Primary Industries. Irrigation bore, Darlington Point.

# An overview of our framework

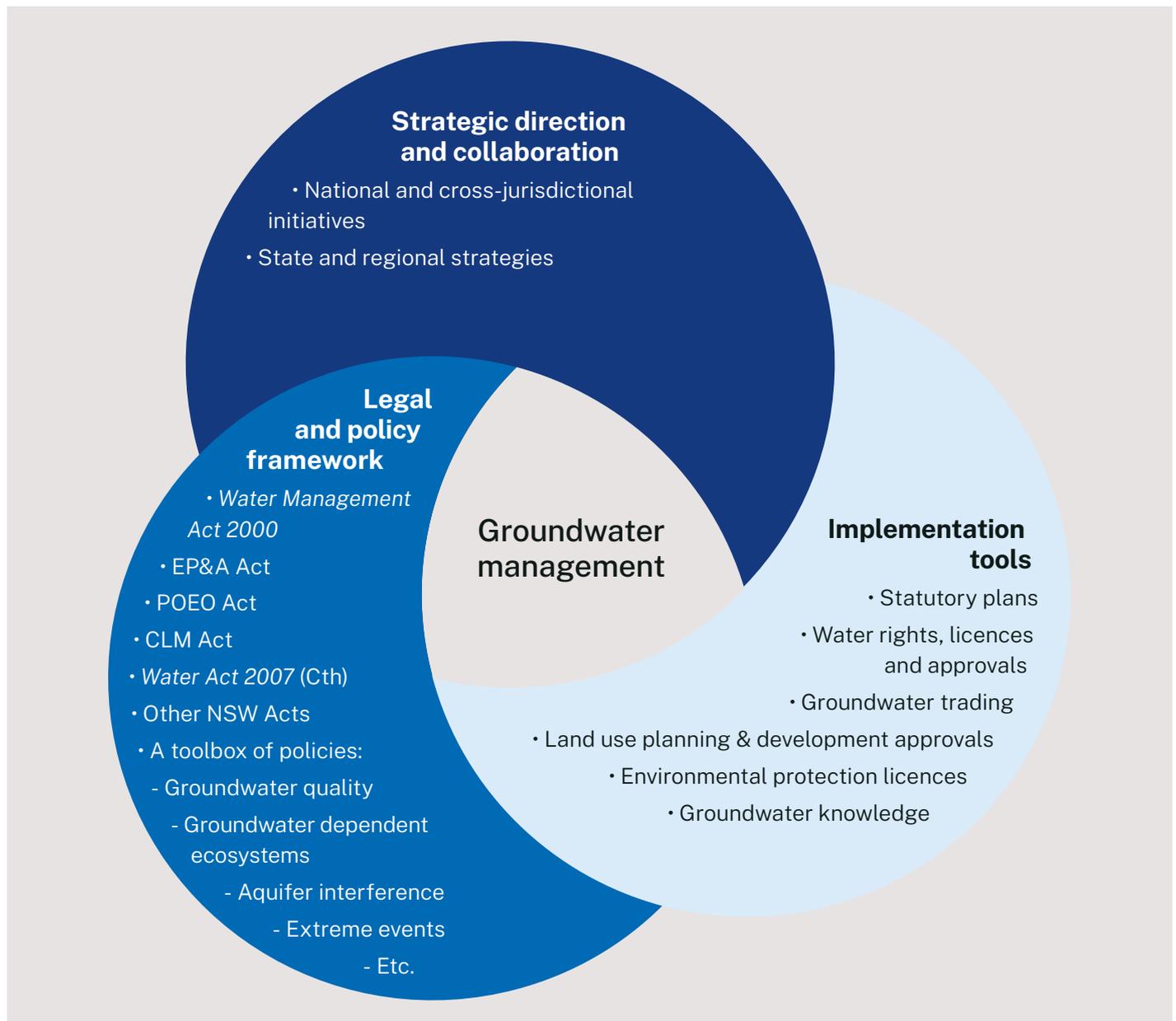
Groundwater management in NSW is multifaceted. At the highest level, our management is framed by the National Water Initiative and NSW Government's strategic directions, specifically the *NSW Groundwater Strategy* (Figure 4).

To enable these, we have legislation that governs the use and protection of groundwater, and the activities that may have an impact on these resources. There are also several policy documents that support the legislation. These relate to specific aspects of groundwater management or activities that intersect with groundwater management and regulation.

Finally, both the legislation and policies establish statutory and non-statutory tools to implement sustainable groundwater management in practice. These include statutory instruments such as plans for sharing and trading groundwater in designated water sources and legal rights and obligations relating to groundwater take (licences and approvals). They also include guidelines for licence holders and development proponents, and education, knowledge and training tools for industry and the community. Our data and information, and the science and systems that these support, underpin and enable transparent and effective groundwater management in NSW.

The following sections of this document outline the key elements of this framework in more detail.

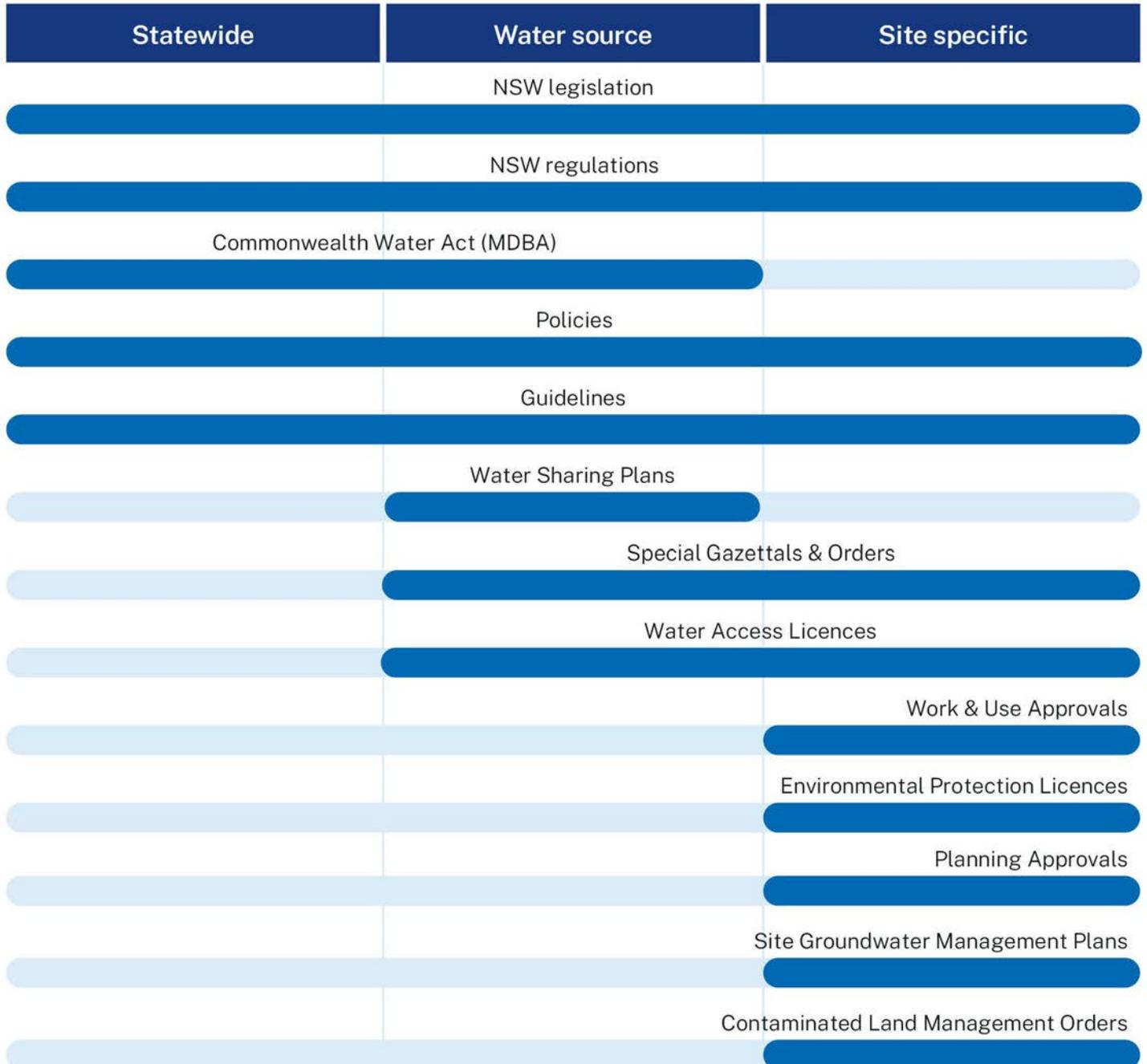
**Figure 4. Elements of groundwater management in NSW**



Groundwater management applies at several scales and even extends across state boundaries. The diagram below shows the scale at which the legislation, policies and implementation tools apply in NSW (Figure 5). These range from statewide to site specific. The 'water source' is the primary unit for sharing of groundwater established under the *Water Management Act 2000*. Groundwater sources are generally discrete groundwater systems (aquifers) or related aquifers. Licences to take groundwater are linked to a particular groundwater source and entitle their holder to a volume of or shares in the available water for that groundwater source.

There are 77 groundwater sources west of the Great Dividing Range in NSW, and most of these are relatively large. East of the Great Dividing Range there are about 450 coastal groundwater sources, many but not all of which are very small and associated with smaller coastal creeks and catchments. The rules for managing take from groundwater sources are specified in statutory water sharing plans. A single water sharing plan may apply to many groundwater sources. There are 36 water sharing plans relating to groundwater in NSW.

**Figure 5. Key laws, policies, rules and guidelines that apply to our groundwater resources**



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# Strategic direction and collaboration

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# 3

Image courtesy of Destination NSW.  
Township, Narrandera.

# National framework

The National Water Initiative (NWI) is the national blueprint for water reform, providing an overarching framework and principles for the sustainable management of water resources in Australia. Agreed by the Council of Australian Governments in 2004, it represents a shared commitment by all Australian governments to improve how water resources are managed, planned for, measured, priced and traded in Australia.<sup>9</sup>

Implementation of the NWI is intended to provide a nationally compatible, market, regulatory and planning based system for managing surface and groundwater resources. This initiative optimises economic, social and environmental outcomes for rural and urban water users.

A review of the NWI released by the Productivity Commission in 2021 called for the renewal of the NWI in partnership with state and territory governments.<sup>10</sup>

A separate National Groundwater Strategic Framework was developed by Australian, state and territory governments in 2017 providing a nationally coordinated approach to manage and secure Australia's groundwater systems. This framework has a 10-year vision within the NWI context and focuses on 3 priority objectives where action is required to sustain groundwater resources and enable ongoing access to this increasingly valuable water resource:

1. sustainable extraction and optimal use
2. provide confidence for investment through improved regulation
3. planning and managing now and for the future.<sup>11</sup>



Image courtesy of Department of Planning and Environment. Telemetered groundwater monitoring bore.

9. [www.pc.gov.au/inquiries/completed/water-reform/national-water-initiative-agreement-2004.pdf](http://www.pc.gov.au/inquiries/completed/water-reform/national-water-initiative-agreement-2004.pdf)

10. [www.pc.gov.au/inquiries/completed/water-reform-2020/report](http://www.pc.gov.au/inquiries/completed/water-reform-2020/report)

11. [www.dcceew.gov.au/sites/default/files/sitecollectiondocuments/water/national-groundwater.pdf](http://www.dcceew.gov.au/sites/default/files/sitecollectiondocuments/water/national-groundwater.pdf)

# Cross border collaboration

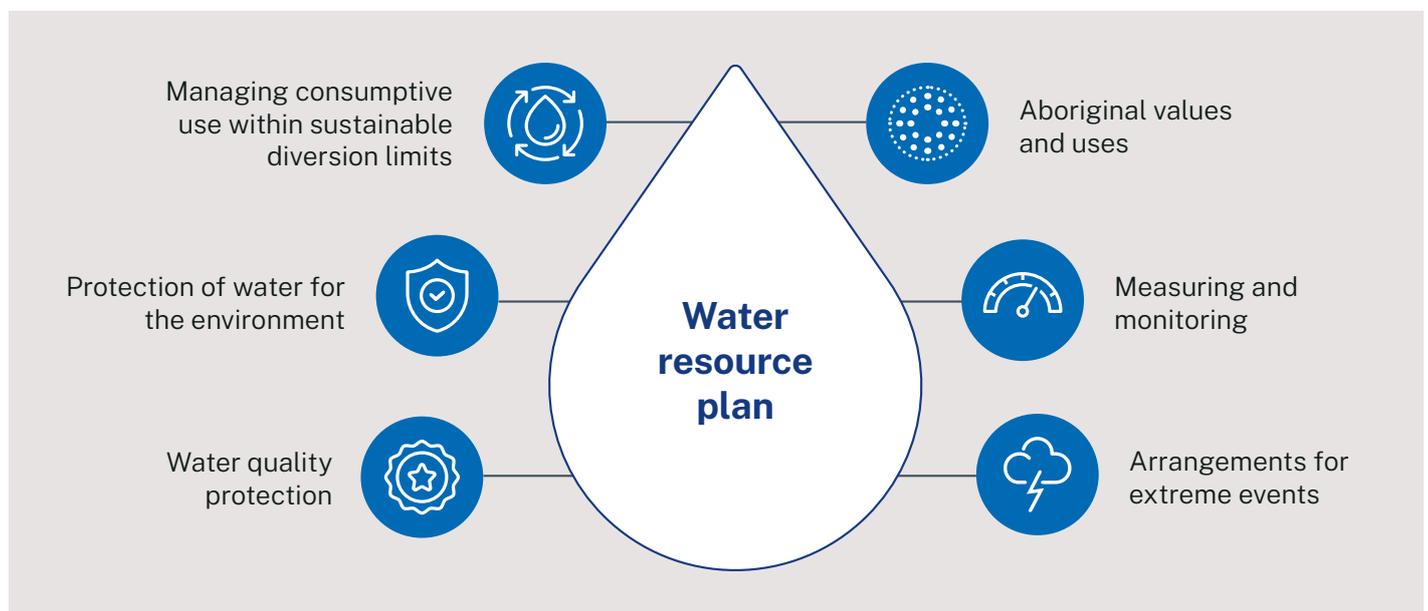
When there are water management concerns or interests that extend beyond NSW, the NSW Government works with the other states and territories to ensure there is a consistent management approach across borders.

## The Basin Plan and water resource plans

The Murray–Darling Basin (Basin) is the largest and most complex river basins in Australia, covering one million square kilometres of south-eastern Australia. Sharing of both groundwater and surface water in

the Basin states of NSW, Queensland, Victoria, South Australia and the ACT is subject to the requirements of the *Commonwealth Water Act 2007* and *Basin Plan 2012*. To meet the requirements of these instruments NSW has developed 11 water resource plans for its Basin groundwater resources. These outline how each NSW water resource plan area aims to achieve community, environmental, economic and cultural outcomes and ensure that state water management rules meet the Basin Plan objectives. The water resource plans include current water sharing plan arrangements and incorporate new arrangements that strengthen water management at a local level.

**Figure 6. Water resource plan objectives**



# Great Artesian Basin Strategic Management Plan

The Great Artesian Basin (GAB) is one of the largest and deepest underground freshwater resources in the world, extending across NSW, Queensland, South Australia and the Northern Territory. The Great Artesian Basin Strategic Management Plan<sup>12</sup> provides

a coordinated framework for governments, Aboriginal and Torres Strait Islanders, water users and other stakeholders to achieve economic, environmental, cultural and social outcomes for the GAB and its users.

Implementation of the plan will assist all parties to identify and respond to the risks, issues, challenges and opportunities associated with use of the GAB water.



Image courtesy of Jess Thompson. Mascot Spring, Great Artesian Basin.

12. [www.dcceew.gov.au/water/policy/national/great-artesian-basin/strategic-management-plan](http://www.dcceew.gov.au/water/policy/national/great-artesian-basin/strategic-management-plan)

# NSW water strategies

The NSW Government has developed the NSW Water Strategy<sup>13</sup> – a 20-year, statewide strategy to improve the security, reliability and quality of the state’s water resources over the coming decades. The NSW Water Strategy addresses key challenges and opportunities for water management and service delivery across the state, setting the direction for the NSW water sector over the long term.

Recognising that groundwater is likely to become an increasingly important water source in parts of regional NSW in the future, the NSW Water Strategy recognises the need for the development and implementation of a *NSW Groundwater Strategy* to improve groundwater management across NSW. This strategy addresses the challenges and opportunities around sustainable groundwater management and aims to secure and protect groundwater for thriving environments, communities and industries.

## Current and future groundwater management challenges

NSW has been at the forefront of sustainable groundwater management for the past 30 years. Our approach has served us well, particularly for managing extraction. But our groundwater management approaches need to evolve, mature and adapt to new and emerging challenges. There are 4 key drivers of this need to change:

- our climate is changing, and groundwater recharge and demands will be affected by this
- the risks to groundwater from development and land use change are increasing
- community notions of sustainability and fair access to groundwater have evolved over time
- our understanding of groundwater, its behaviour and use is improving.

In response to these broad drivers of change we have identified a number of key challenges that we face in light of achieving sustainable groundwater management:

- our policy framework for sustainable groundwater management needs to be refreshed and expanded to respond to emerging changes and future challenges
- ecosystems that depend on groundwater face increased threats
- our groundwater management framework needs to be better integrated with surface water and land management
- threats to groundwater quality are growing and need to be addressed
- increasing groundwater demand for town water supply and other domestic use
- new and expanding industries need to consider groundwater opportunities and constraints
- Aboriginal people’s rights to groundwater are not adequately recognised
- information about groundwater is lacking because it is underground and difficult to investigate
- there are gaps in our scientific knowledge and research capabilities
- our groundwater monitoring network is ageing and has limited coverage.

For more information please see, [www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy](http://www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy)

The NSW Government is also preparing regional water strategies that will bring together the most up-to-date information and evidence. These strategies will use a wide range of tools and solutions to plan and manage each region’s medium- and long-term water needs. The strategies look out over the next 20 to 40 years, and identify the challenges and choices involved in meeting the region’s future water needs.

The NSW Government acknowledges the importance of healthy waterways to Aboriginal people and

communities across NSW. We are exploring options to improve outcomes for Aboriginal people at statewide, regional and local levels and to increase the representation of Aboriginal water rights, interests and access to water in water resource management. We are working with peak Aboriginal groups on what needs to change through an Aboriginal Water Strategy.

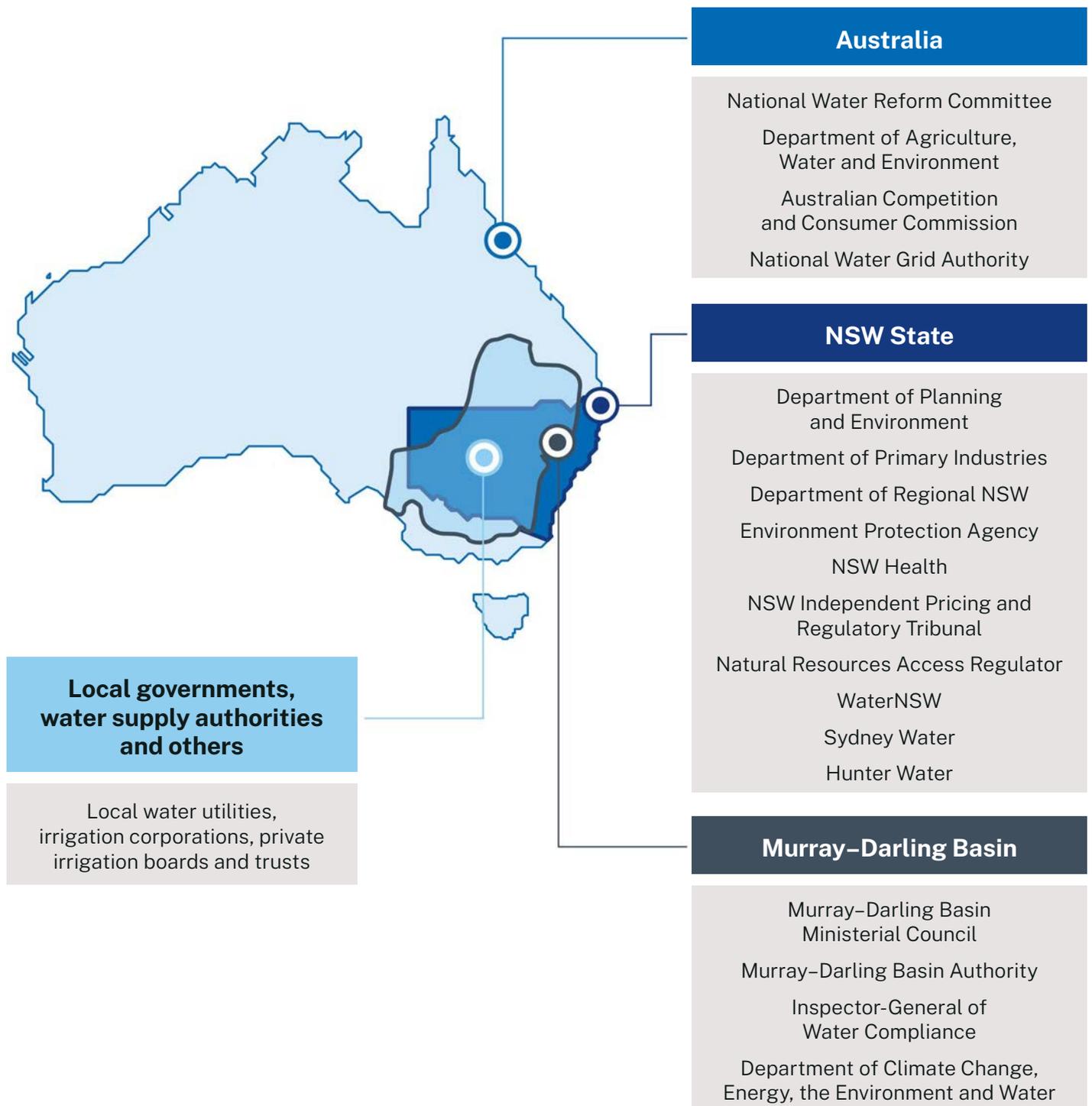
Collectively, these strategies plot a pathway to address key existing and emerging issues for sustainable groundwater management for the coming decades.

13. NSW Government, *NSW Water Strategy 2022*, Department of Planning and Environment

# Roles and responsibilities

While it is the state government that leads groundwater management in NSW, the responsibility is shared with the Australian and local governments (Figure 7). A number of state-owned corporations and non-government irrigation corporations also play roles in managing water resources. Effective planning and management of groundwater relies on cooperation and coordination between organisations, as well as water users and the broader community.

**Figure 7. Collaborative groundwater management**



At the state level, several agencies have key roles in managing groundwater, as shown in Figure 8. The Department of Planning and Environment – Water,<sup>14</sup> has the lead responsibility for managing the state’s water resources, including groundwater. Department of Planning and Environment – Water manages water policy, planning and regulation, and leads the interactions with other jurisdictions and the Commonwealth, including the Murray–Darling Basin Authority. Further detail on water management

responsibilities in NSW is available at the WaterNSW webpage.<sup>15</sup> All groundwater users are responsible for groundwater management. Many licensed users must monitor their groundwater take, and many also monitor groundwater levels and water quality to ensure that depletion and degradation of their local groundwater resource is not occurring. For large projects such as mining or infrastructure, monitoring networks are installed along with regular monitoring and reporting on take, groundwater levels and quality.



Image courtesy of Department of Primary Industries. Bore at Millie.

14. [water.dpie.nsw.gov.au/home](http://water.dpie.nsw.gov.au/home)

15. [www.industry.nsw.gov.au/water/what-we-do/how-water-is-managed](http://www.industry.nsw.gov.au/water/what-we-do/how-water-is-managed)

**Figure 8. Key NSW state government organisations with responsibility for groundwater management and regulation**

<p><b>Department of Planning and Environment</b></p>	<p><b>Water Agency:</b></p> <ul style="list-style-type: none"> <li>• Drives regulatory and policy agenda for NSW water management.</li> <li>• Operates under <i>Water Management Act 2000 and Water Management (General) Regulation 2018</i>.</li> <li>• Develops and implements water sharing/resource plans, policies and guidelines.</li> <li>• Develops regional and metropolitan water supply strategies for water security.</li> <li>• Advises on impact assessments for major projects.</li> <li>• Triggers regional investigations and monitoring programs.</li> <li>• Retains critical hydrogeological expertise to function as state’s primary groundwater manager.</li> <li>• Leads negotiations with Commonwealth, MDBA and other jurisdictions.</li> <li>• Reports on groundwater resources and management.</li> <li>• Water licensing for State Significant Developments, major utilities, state-owned corporations, government agencies.</li> <li>• Approvals for controlled activities in or near waterways.</li> </ul> <p><b>Planning Agency:</b></p> <ul style="list-style-type: none"> <li>• Determines major projects/developments.</li> </ul>
<p><b>WaterNSW</b></p>	<ul style="list-style-type: none"> <li>• Supplies bulk water needs.</li> <li>• Operates water supply system for Greater Sydney and regulated river systems.</li> <li>• Administers all water dealings for rural landholders or industries (licensing, approvals, trades, metering, billing).</li> <li>• Administers all licensing and water trades for rural landholders and industries.</li> <li>• Administers monitoring of groundwater resource, metering of water take and billing.</li> </ul>
<p><b>Natural Resource Access Regulator (NRAR)</b></p>	<ul style="list-style-type: none"> <li>• Compliance and enforcement of water management legislation.</li> <li>• Audits, investigates and prosecutes matters of non-compliance.</li> </ul>
<p><b>NSW Environment Protection Authority</b></p>	<ul style="list-style-type: none"> <li>• Environmental regulator, focuses on water quality and contaminated land.</li> <li>• Partners with business, government and community to reduce pollution and waste, protect human health, and prevent degradation of environment.</li> <li>• Issue environment protection licences under <i>Protection of the Environment Operations Act 1997</i>.</li> <li>• Compliance and investigations; issues orders, fines and prosecutions.</li> </ul>

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# Legal and policy framework

# 4

Image courtesy of Destination NSW. Goonoo Goonoo Station, Tamworth.

# Legislation

## Water Management Act 2000

The *Water Management Act 2000*<sup>16</sup> (the Act) is the key legislation for managing groundwater in NSW. The main object of this Act is 'to provide for the sustainable and integrated management of the water sources of the state for the benefit of both present and future generations'.

The Act is based on the concept of ecologically sustainable development – development today that will not threaten the ability of future generations to meet their needs. It includes water management principles to guide how NSW water resources should be used, shared and protected, and by which the Act must be administered.

In addition to the principles of ecologically sustainable development, the Act requires the applications of following principles:

- water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded
- habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored
- the water quality of all water sources should be protected and, wherever possible, enhanced
- the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised
- geographical and other features of Aboriginal significance should be protected

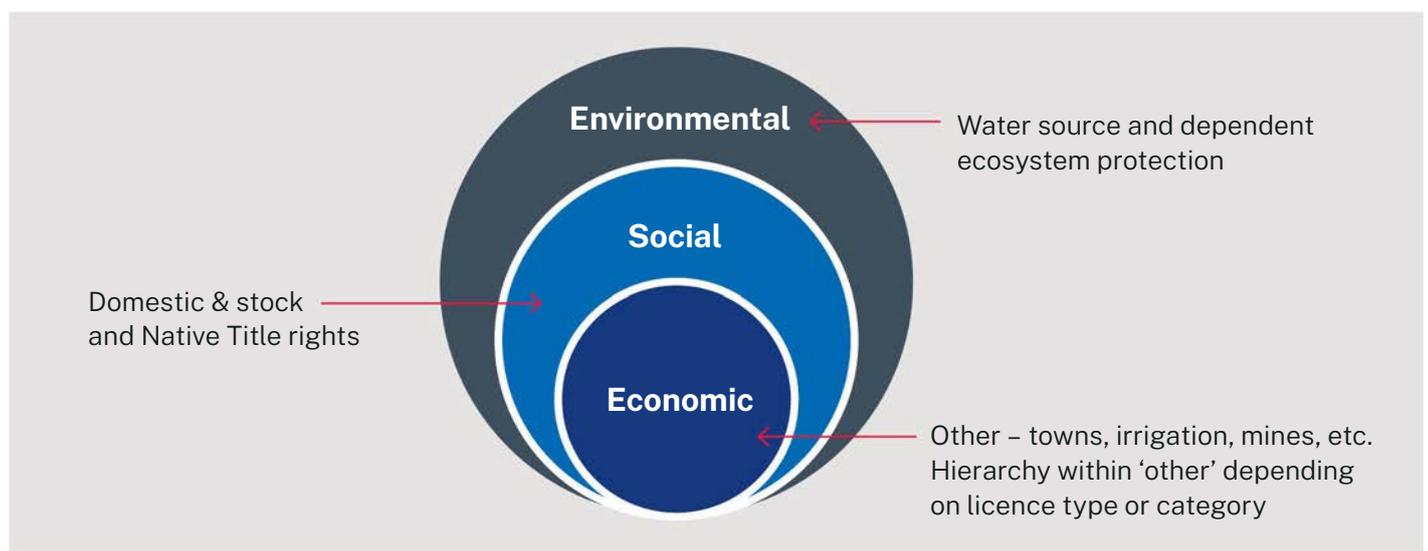
- geographical and other features of major cultural, heritage or spiritual significance should be protected
- the social and economic benefits to the community should be maximised
- the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

Specifically in relation to water sharing, the Act also requires us to protect a groundwater source and its dependent ecosystems as the highest priority, then to provide water for basic landholder rights (Native Title and domestic and stock uses). Extraction of groundwater by other licence holders can be optimised, providing this does not prejudice the environmental and social benefits derived from our groundwater resources. This nest hierarchy concept is shown in Figure 9 below.

The Act allows for development of management plans, including water sharing plans which share water between the environment and water users and among water users (see the *Statutory plans* section for more information). It also sets up the legal framework for licences and approvals to take and use groundwater, including the requirements to comply with conditions of these (see the *Rights, licences and approvals* section for more information). The Act also has provisions for the administration of private entities such as bore trusts, and of bore drillers.

Regulations such as the Water Management (General) Regulation 2018 contain procedural and technical rules to support the administration of the Act.

**Figure 9. Hierarchy of the 3 pillars of ecologically sustainable development and how this relates to sharing groundwater**



16. [legislation.nsw.gov.au/view/html/inforce/current/act-2000-092](http://legislation.nsw.gov.au/view/html/inforce/current/act-2000-092)

## Water Act 2007 and Basin Plan 2012

Sharing of groundwater in the NSW portion of the Murray–Darling Basin is subject to the requirements of the Commonwealth *Water Act 2007* and *Basin Plan 2012*.

## Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the main sustainable land use planning statute in NSW. It governs matters such as planning administration, planning instruments, development assessments, building certification, infrastructure finance, appeals and enforcement. The planning agency within the Department of Planning and Environment administers the *Water Management Act 2000* (the Act) at a state level. The Independent Planning Commission makes decisions on State Significant Development applications where there is significant community concern about the proposed development. Most decisions under the EP&A Act are made by local government through an integrated development process.

Any land use development has the potential to impact on groundwater, and decisions under the EP&A Act are relevant to groundwater management. Groundwater must be considered as part of any environmental impact assessment undertaken for an activity or work.

Importantly, the Act also provides for ‘planning instruments’, being strategic plans at various levels, State Environmental Planning Policies (SEPP), Local Environment Plans and Development Control Plans. While rarely used to explicitly protect groundwater, further use of planning instruments could be considered in the future. Currently, for example, the State Environmental Planning Policy (Coastal Management) 2018 manages development in the coastal zone. This policy protects the environmental assets of the coast and establishes a framework for land use planning to guide decision-making in the coastal zone. Many of our coastal wetlands and littoral rainforests are groundwater dependent. Some of our coastal areas contain acid sulphate soils which, when disturbed by drainage and lowering of groundwater levels, can cause acidification of the groundwater, wetlands and waterways, damage to infrastructure, and potentially fish deaths. This SEPP is a key mechanism for managing groundwater in our coastal areas.

## Protection of the Environment Operations Act 1997 and Contaminated Land Management Act 2007

The NSW Environment Protection Authority administers the *Protection of the Environment Operations Act 1997* (POEO Act) and the *Contaminated Land Management Act 2007* (CLM Act). Both these Acts play a key role in the management and protection of groundwater quality.

The POEO Act enables the government to:

- develop environment policies (PEPs) and adopt more innovative approaches to reducing groundwater pollution. PEPs are instruments for setting environmental standards, goals, protocols and guidelines
- licence activities or works to manage groundwater pollution. Issue clean-up notices, prevention notices and prohibition notices
- investigate pollution events and take enforcement action where necessary.

The CLM Act establishes a process for the NSW Environment Protection Authority to identify, investigate, and remediate land that it considers to be contaminated significantly enough to require regulation. This Act also ensures that contaminated land is managed with regard to the principles of ecologically sustainable development. The Act seeks impose the obligation and cost of remediating contaminated land on the person who caused the contamination. Contaminated land poses a significant risk to groundwater resources, particularly our more vulnerable, shallow groundwater, and the CLM Act provides the framework remediation if contaminated.

# Policies and guidelines

A range of policies guide the implementation of the statutory frameworks for managing groundwater in NSW. These support decision-makers, local authorities, development proponents and groundwater users, and are outlined below.

## Groundwater quality and contamination

The NSW Groundwater Quality Protection Policy establishes the principles and practices for protecting our valuable groundwater resources against pollution, based on the principle of pollution prevention over remediation. It requires all groundwater systems to be managed such that their most sensitive beneficial use (environmental value) is maintained and affords special protection to town water supplies. It also takes a risk management approach to consideration of new developments that potentially impact on groundwater quality. [Click here to watch a short video about why it is important to protect groundwater quality.](#)

There is also a water quality management plan (WQMP) for each the NSW Murray–Darling Basin (Basin) groundwater resources included in the relevant water resource plan. These WQMPs outline the causes, or likely causes, of groundwater quality degradation and identify current and future measures to protect and maintain the water quality of our Basin groundwater resources. The NSW Environment Protection Authority's Guidelines for the Assessment and Management of Groundwater Contamination outline best practice assessment and management of contaminated groundwater in NSW. The guidelines focus on groundwater pollution from point source contamination, rather than on broad-scale groundwater contamination from diffuse sources.

Where contamination of groundwater is identified, acute risks must be managed immediately and the source of contamination must be removed to ensure the protection of human health and the environment. Wherever practicable, the environmental values of the groundwater system must be restored, and groundwater quality must be restored to its natural background concentration.

## Groundwater dependent ecosystems

The NSW Groundwater Dependent Ecosystems Policy is specifically designed to guide the protection of our valuable ecosystems that rely on groundwater for survival. The objective of this policy is to maintain or restore, wherever possible, the ecological processes and biodiversity of these ecosystems for the benefit of present and future generations. Examples of groundwater dependent ecosystems are wetlands, red gum forests and other terrestrial vegetation, ecosystems in streams fed by groundwater, limestone cave systems and hanging valleys and swamps.

## Groundwater quantity

The (draft) NSW Groundwater Quantity Management Policy provides the statewide framework for the sustainable management of our groundwater resources, focusing on the quantity aspects of groundwater management. Its primary objectives are to:

- achieve the efficient, equitable and sustainable use of the groundwater resources of NSW
- prevent, or slow and halt, or reverse any degradation of the state's groundwater resources and their dependent ecosystems
- provide opportunities for development which optimise the cultural, social and economic benefits to the community, region, state and nation, within the context of environmental sustainability
- promote community awareness and understanding of, and participation in, the management of groundwater resources.

Broadly, the draft policy guides the management of groundwater extraction, including the setting of overall extraction limits for groundwater sources, and the management of the potential impacts of extraction on other users, water quality, and groundwater dependent ecosystems at the local level.

# Aquifer interference

The NSW Aquifer Interference Policy<sup>17</sup> sets out the licensing and assessment requirements for activities that:

- penetrate an aquifer
- interfere with groundwater in an aquifer
- change or obstruct groundwater flow in an aquifer
- take groundwater from an aquifer
- dispose of water taken from an aquifer.

Unless an exemption applies, these activities need a water access licence if there is a take of groundwater, and any works used in taking the groundwater require an approval (see the *Rights, licences and approvals* section below for more information).

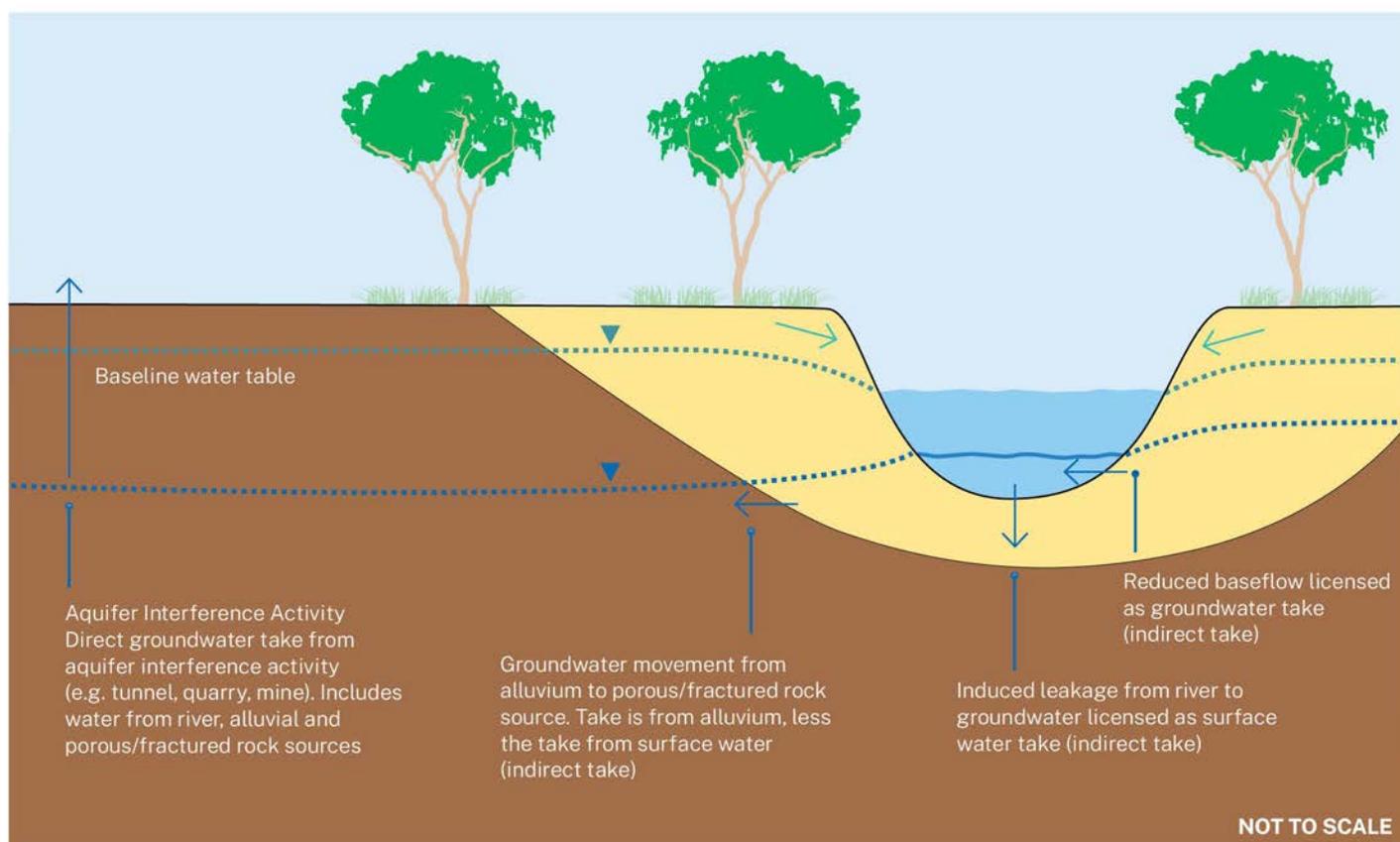
Aquifer interference activities generally do not include works or activities for the purpose of supplying water for consumptive use – these are managed as water

supply activities. An example of groundwater take by an aquifer interference activity and the potential impacts on adjacent water sources is shown in Figure 10.

Many projects fall within the definition of aquifer interference activities. An assessment framework tool<sup>18</sup> is available to determine whether a particular project development requires a detailed assessment under the Aquifer Interference Policy. The framework applies to all aquifer interference activities, such as quarrying, mining, construction dewatering and injection. This also includes developments that are seeking approval under the *Environmental Planning and Assessment Act 1979* (including state significant developments).

Under the Aquifer Interference Policy, ‘minimal impact considerations’ have been developed for impacts on groundwater sources, connected water sources and their dependent ecosystems, culturally significant sites and water users. These considerations detail the acceptable criteria for water table and confined pressure drawdown, as well as changes to groundwater and surface water quality.

**Figure 10. For an aquifer interference activity, flow induced from the primary aquifer and connected water sources is considered a take of water. In all cases, separate water access licences are required for take from all water sources**



**Legend:**  Alluvial groundwater source  Porous/fractured rock source

17. [www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0005/151772/NSW-Aquifer-Interference-Policy.pdf](http://www.industry.nsw.gov.au/_data/assets/pdf_file/0005/151772/NSW-Aquifer-Interference-Policy.pdf)

18. [water.nsw.gov.au/\\_data/assets/pdf\\_file/0004/507613/Groundwater-assessment-toolbox-for-major-projects-in-NSW.pdf](http://water.nsw.gov.au/_data/assets/pdf_file/0004/507613/Groundwater-assessment-toolbox-for-major-projects-in-NSW.pdf)

# Groundwater metering

Water meters measure groundwater use in NSW. Knowing how much water licensed users take is critical for understanding and managing our groundwater resources, for protecting the rights of authorised users, and for enforcing the responsibilities of those that use this public resource.

The NSW Government's non-urban water metering framework<sup>19</sup> was introduced in 2018 and is designed to improve the standard and coverage of non-urban water meters across NSW by 2024. It establishes NSW statewide rules for metering groundwater take. It does not apply to bores or works only used to take water for basic landholder rights (domestic and stock and Native Title rights). Metering requirements differ depending on the groundwater source, existing water metering conditions on a water supply works approval and the capacity of the groundwater pumping infrastructure (pump size) (Figure 11). Compliant water meters must be installed:

- if metering is required as a condition on an existing water supply work approval and the meter is replaced
- if metering is required as a condition on a new water supply work approval
- where licensed groundwater is extracted, irrespective of bore capacity, in specified groundwater sources areas (see the Figure 11 on page 36 and Schedule 9 to the Water Management (General) Regulation 2018)
- for a single groundwater bores in other areas, which are 200 mm or more in diameter
- for 2 groundwater bores on a landholding in other areas, which are 160 mm or more in diameter for all bores
- for 3 groundwater bores on a landholding in other areas, which are 130 mm or more in diameter for all bores

- for 4 or more groundwater bores on a landholding in other areas, which are 120 mm or more in diameter for all bores. See WMR 2018 231(3)c
- for any well, spearpoint or other groundwater work.

The non-urban metering rules are rolling out in stages to give water users, suppliers and installers of metering equipment enough time to prepare to become compliant with the rules. Licence holders in the northern inland groundwater sources and Murray–Darling Basin Porous and Fractured Rock systems must comply by December 2021. Those in the southern inland groundwater sources by 1 June 2023, and in coastal groundwater sources by 1 December 2024.

The NRAR is responsible for ensuring compliance with NSW water management laws, including the metering requirements. The NRAR undertakes proactive and planned compliance monitoring and audit programs, as well as reactive investigations. Their methods include the use of remote sensing and satellite imagery.

Meters must be pattern-approved, with tamper-evident seals and a data logger that is telemetry capable. These must be installed by a duly qualified person.<sup>20</sup> Telemetry is not required but may be installed voluntarily to reduce manual reporting requirements or to inform property water management.<sup>21</sup> Faulty meters must be reported within 24 hours using an online self-reporting form.

If an existing meter was installed prior to 1 April 2019 and is not pattern-approved, the owner must provide a meter manufacturer certificate that accuracy is within  $\pm 2.5\%$  or demonstrate accuracy to within  $\pm 5\%$ .

It is important for groundwater users to understand their responsibilities. The NSW Government's interactive, online Water Metering Guidance Tool is available to assist groundwater users.<sup>22</sup>



Image courtesy of Department of Primary Industries. Water meter gauge.

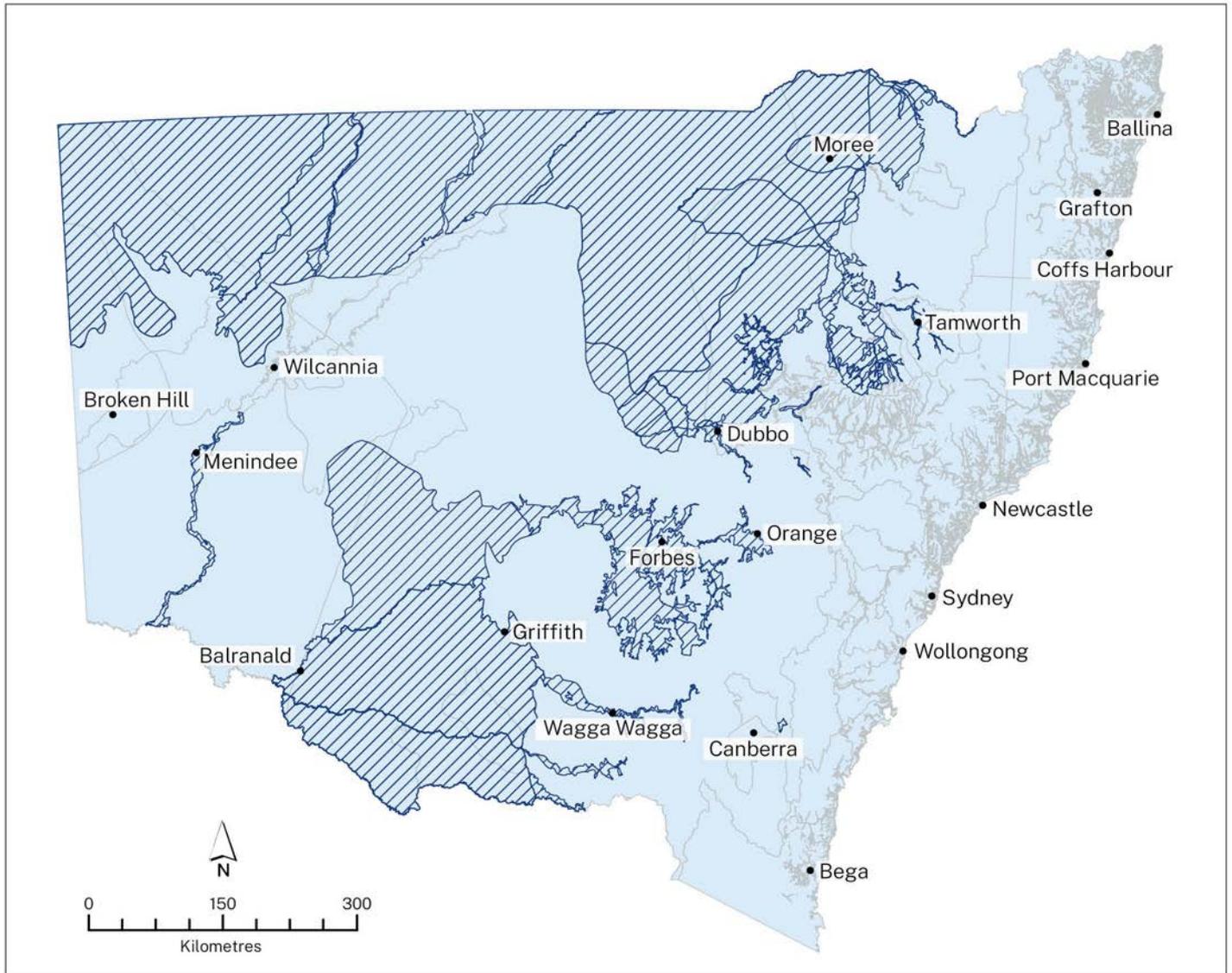
19. [www.dpie.nsw.gov.au/water/nsw-non-urban-water-metering](http://www.dpie.nsw.gov.au/water/nsw-non-urban-water-metering)

20. [www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0017/312335/nsw-non-urban-water-metering-policy.pdf](http://www.industry.nsw.gov.au/_data/assets/pdf_file/0017/312335/nsw-non-urban-water-metering-policy.pdf)

21. [www.dpie.nsw.gov.au/water/nsw-non-urban-water-metering](http://www.dpie.nsw.gov.au/water/nsw-non-urban-water-metering)

22. [nswdpietfaforms.net/267](http://nswdpietfaforms.net/267)

**Figure 11. Map of NSW where metering of groundwater extraction is required dependent on infrastructure/pump size (standard requirements) and required regardless of infrastructure/pump size**



**Legend:**

- Required regardless of infrastructure size
- Standard requirements

Note: Inland alluvium subject to standard metering requirements include Paroo, Warrego, Upper Darling, Upper Gwydir, Castlereagh, and Lower Murray Shallow.

Source: Based on data from the Department of Planning and Environment.

## Extreme events

During extreme events, such as prolonged droughts or a serious water quality event, critical human water needs become the highest priority for water sharing under the *Water Management Act 2000*, followed by the environment. This change in water sharing priorities is triggered when a water sharing plan (or part of a plan) is suspended. The aim is to operate within the plan rules for as long as possible because the plan provides certainty for all users. The plans consider historical droughts and are developed to operate in a range of climate circumstances. Only in extreme circumstances are plans, or some parts of plans, suspended to meet critical human water needs.

In the NSW Murray–Darling Basin (Basin), the NSW Extreme Events Policy<sup>23</sup> and regional Incident Response Guides provide further guidance on how water resources will be managed during such events. Outside of the Basin, local water sharing plans include a similar framework that is consistent with the NSW Extreme Events Policy.

The framework provided by the NSW Extreme Events Policy includes a staged approach and provides a range of measures for water managers to deploy as conditions deteriorate. For prolonged drought events, water managers will progressively introduce more stringent access restrictions as the event becomes more critical. For water quality events, management responses will be guided by the type of event. The Department of Planning and Environment website has a summary of the management responses at each stage.<sup>24</sup>

## Buried water sources

Fully buried or partly buried groundwater sources have little or no surface expression (outcrop) and therefore have very little water assigned for extraction based on rainfall recharge. The Policy for Managing Access to Buried Water Sources allows for the release of a very small percentage (0.002%) of the volume of water in storage in some deep porous rock groundwater systems where the extraction limit for the water source is reached and insufficient water is available to meet predicted water take.

## Managed Aquifer Recharge

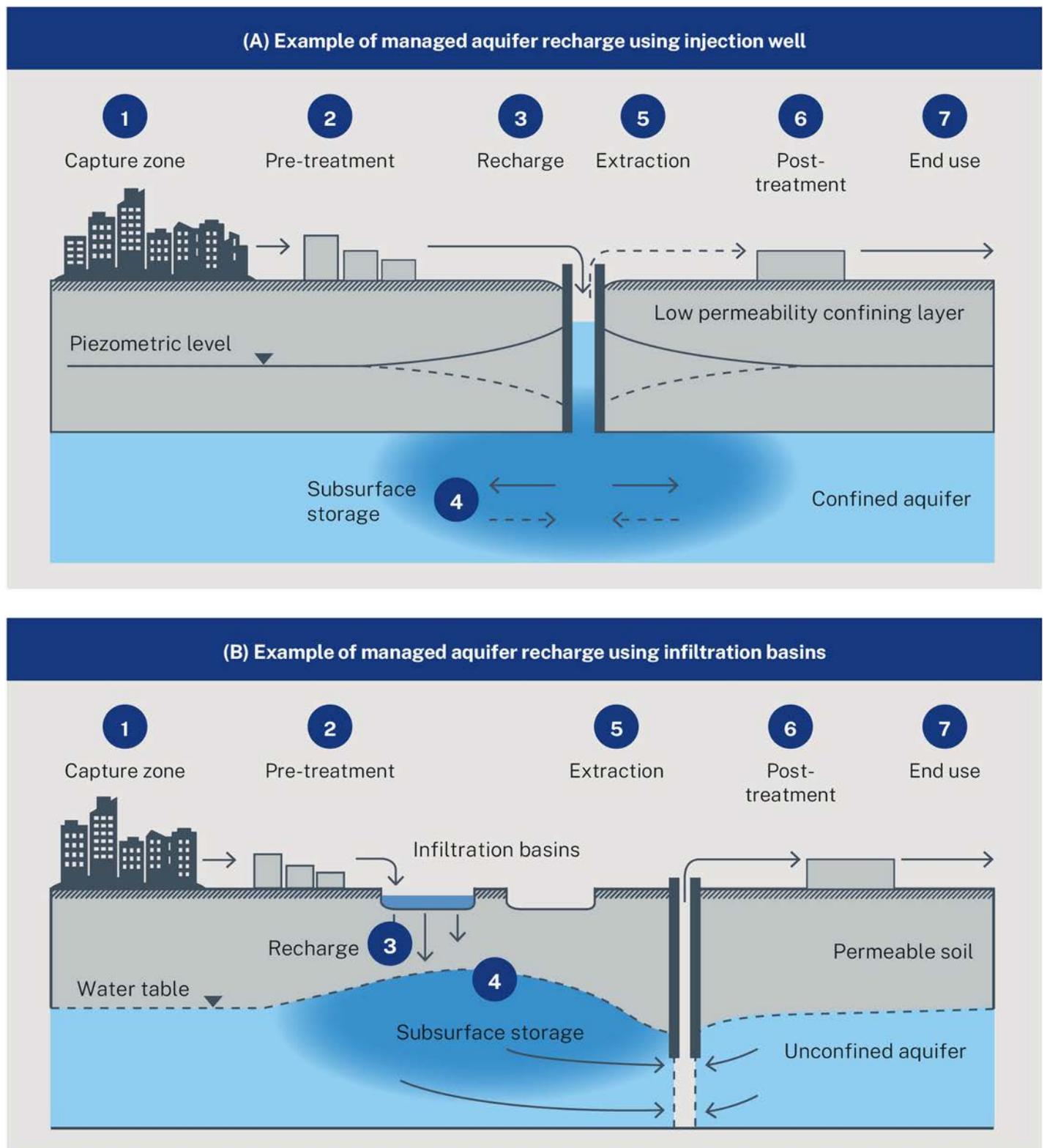
The basic idea of Managed Aquifer Recharge (MAR) is to use below-ground aquifers to temporarily store water. The aquifer acts as a water bank where water is diverted into the aquifer through injection wells or infiltration basins during times of plenty, and later redrawn using bores in times of scarcity (Figure 12).

We are working through a range of policy and legislative issues relevant to getting MAR up and running in NSW. This important piece of work will ensure MAR causes no unintended impacts on existing groundwater users and environments, such as soil salinisation, and make sure there are viable sources of water to put into MAR schemes, noting that many NSW water sources are already fully assigned. If carefully designed, MAR has the potential to be a significant opportunity for innovative water management in NSW, with benefits for town water security and possibly the other industries.

23. [www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0008/187703/Extreme-Events-policy.pdf](http://www.industry.nsw.gov.au/_data/assets/pdf_file/0008/187703/Extreme-Events-policy.pdf)

24. [www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/extreme-events](http://www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/extreme-events)

Figure 12. Two different methods of managed aquifer recharge



Note: Dillon, P. et al 2009, *Managed Aquifer Recharge. Waterlines Report Series No.13*, February 2009, National Water Commission.

# Constructing water bores

The national publication Minimum Requirements for the Construction of Water Bores in Australia provides technical and practical guidance for constructing water bores. The document complements and underpins the national drillers' licensing system by providing bore construction standards that are consistent across Australia (see Figure 13 and Figure 14 for examples of a typical stock and domestic and production bore

construction). It provides the technical base and minimum standard for licensed drillers, emphasises the necessity of bore licensing and is a useful reference for all types of bore construction and decommissioning. The standards aim to maximise the life of the bore, protect the target aquifer and any overlying aquifers, and ensure the long-term economic production of groundwater of the best possible quality. [Click here to watch a short video about how to correctly construct a bore.](#)

**Figure 13. Typical construction schematic for a stock and domestic bore (low-yielding, non-flowing)**

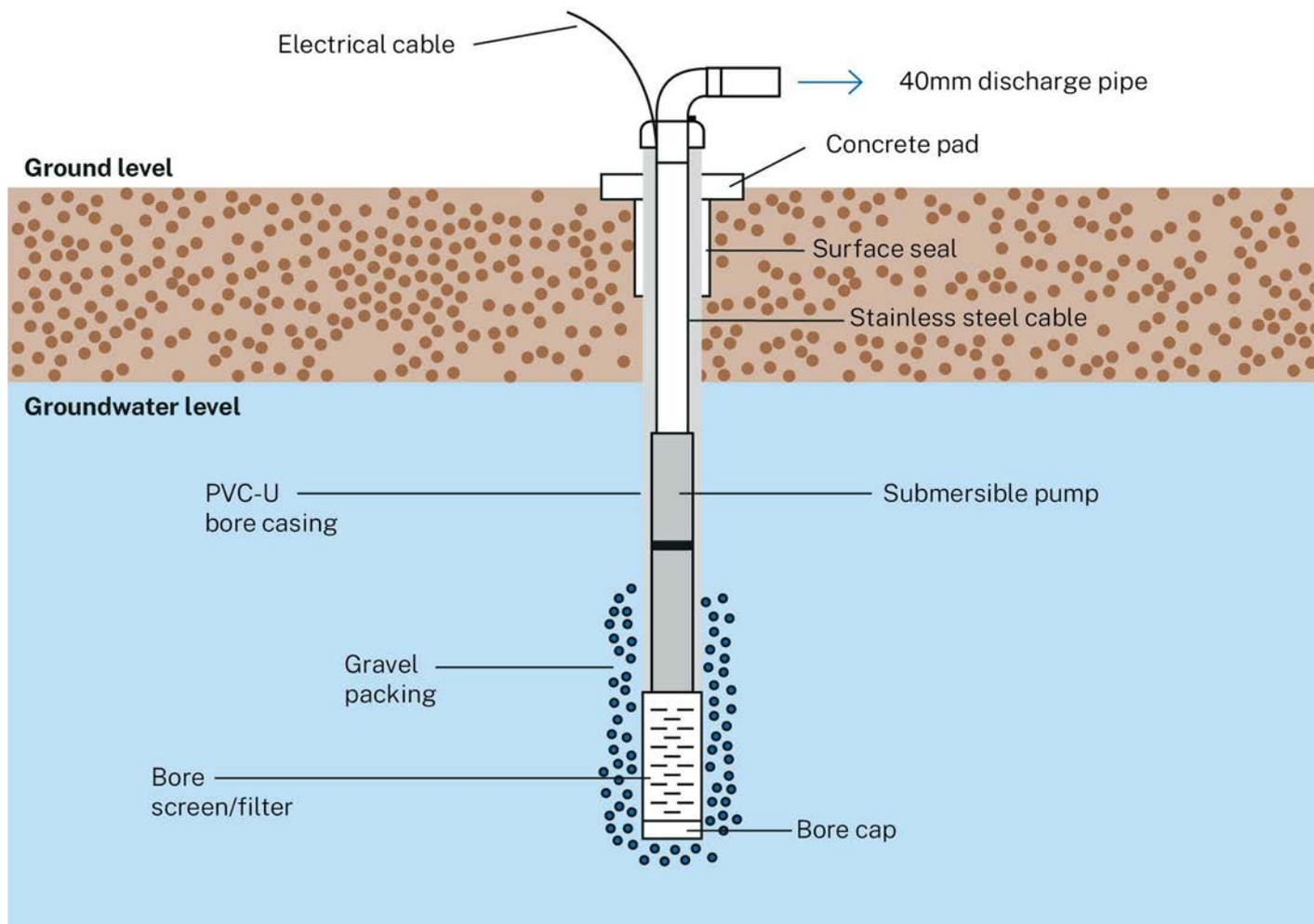
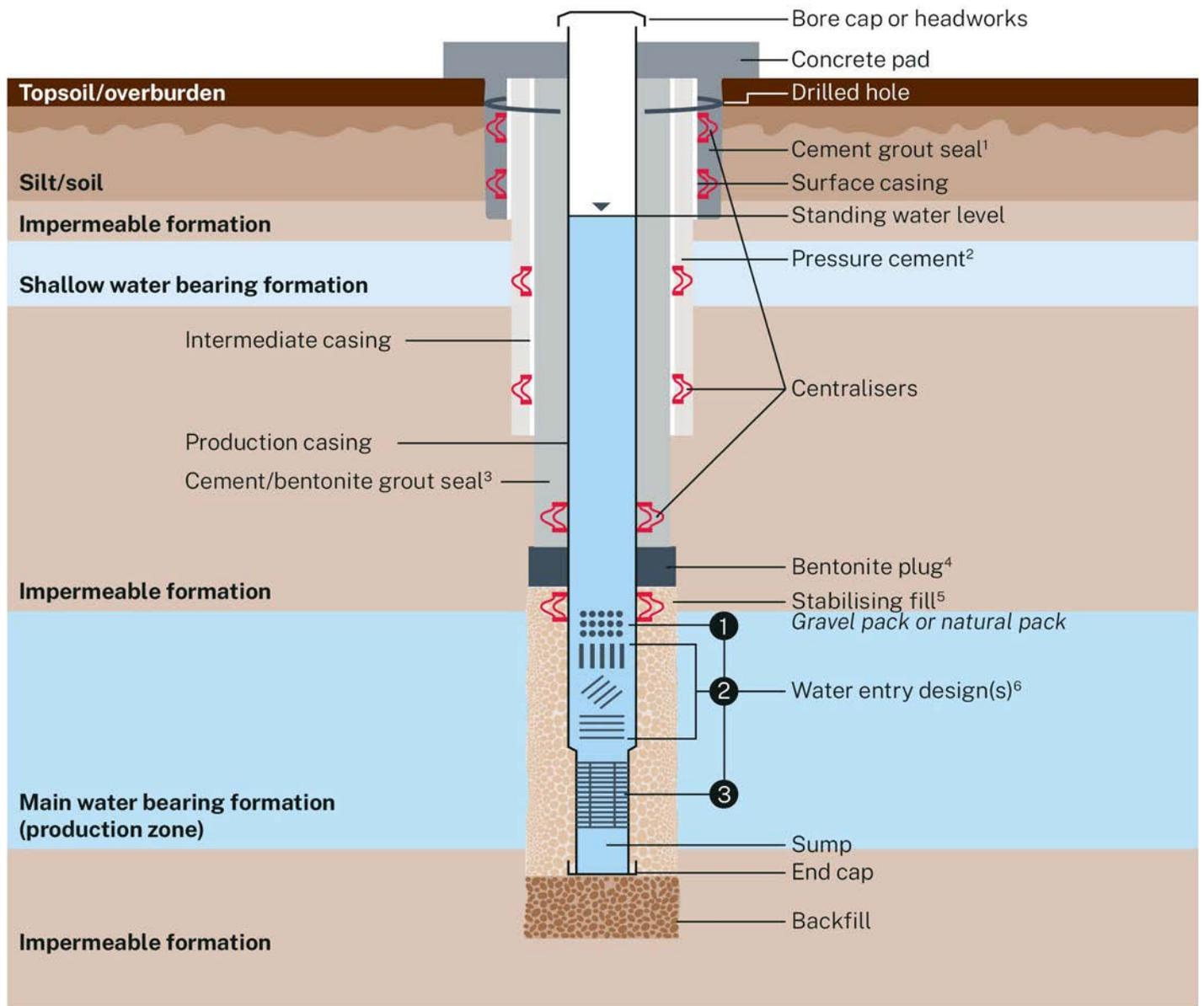


Figure 14. Typical construction schematic of a production bore



1. Cement grout seal – min 20 mm thick, 2. Pressure cement, – min 15 mm thick. Min curing time 24 hours, 3. Cement/bentonite grout seal – min 15 mm thick, 4. Bentonite plug – min 1.0 m length, 5. Stabilising fill – min 50 mm thick (min 1.0 m above aquifer), 6. Water entry designs – 1. Perforation, 2. Slots with alignments, a) vertical, b) diagonal, c) horizontal, 3. Screen assembly.

## Dewatering for construction

Constructing buildings with basements that require excavation below the water table is an aquifer interference activity (see example in Figure 15). This means it is subject to the *Water Management Act 2000*, the relevant water sharing plans and the NSW Aquifer Interference Policy.

Temporary dewatering associated with deep excavations can permanently reduce the capacity of the aquifer and induce the compaction of unconsolidated

sediments and any artificial fill, thereby possibly affecting the stability of adjacent buildings. Permanent dewatering places energy, water, maintenance and administrative demands on the future occupants of a development. It also permanently impacts groundwater systems and reduces the availability of groundwater for all users, including the environment.

The Minimum Requirements for Building Site Groundwater Investigations and Reporting<sup>25</sup> provide technical and licensing information for developers and consultants.

**Figure 15. Construction of a basement below the water table is an aquifer interference activity that can impact on groundwater flow paths and levels**



Source: Greg Russell, NSW Government.

25. [water.dpie.nsw.gov.au/\\_data/assets/pdf\\_file/0003/541605/minimum-requirements-for-building-site-groundwater-investigations-and-reporting.pdf](https://www.water.dpie.nsw.gov.au/_data/assets/pdf_file/0003/541605/minimum-requirements-for-building-site-groundwater-investigations-and-reporting.pdf)

# Implementation tools

# 5

Image courtesy of Department of Planning and Environment. River red gum.

# Statutory plans

## Water sharing plans

Water sharing plans are 10-year statutory plans made under the *Water Management Act 2000*<sup>26</sup> that set the rules for water access and sharing across NSW. These plans set the priorities and rules for sharing groundwater between water users and the environment and between different categories of water use, and for managing risks and impacts to groundwater. Consistent with the principles and priorities in the *Water Management Act 2000* discussed previously, the plans:

- commit water for fundamental ecosystem health or other specified environmental purposes, that cannot, to the extent committed, be taken or used for any other purpose (planned environmental water)
- set sustainable extraction limits for each water source in the plan area
- protect water for basic landholder rights – Native Title and domestic and stock uses. Provide secure, legal and tradeable water access rights
- set the rules for managing access to water – for making water ‘available’ from time to time for different access licence categories,<sup>27</sup> and relating to how much, if any, groundwater that is unused can be carried forward between years and held in the access licence water allocation accounts
- set rules to manage the impacts of extraction on groundwater dependent ecosystems, other users, water quality and Aboriginal cultural sites
- set rules for water trading – the buying and selling of water licences and annual water allocations (see the *Water access licences* section for more information)
- set the conditions that apply to access licences and works (bores) in the plan area.

## Water sharing overview

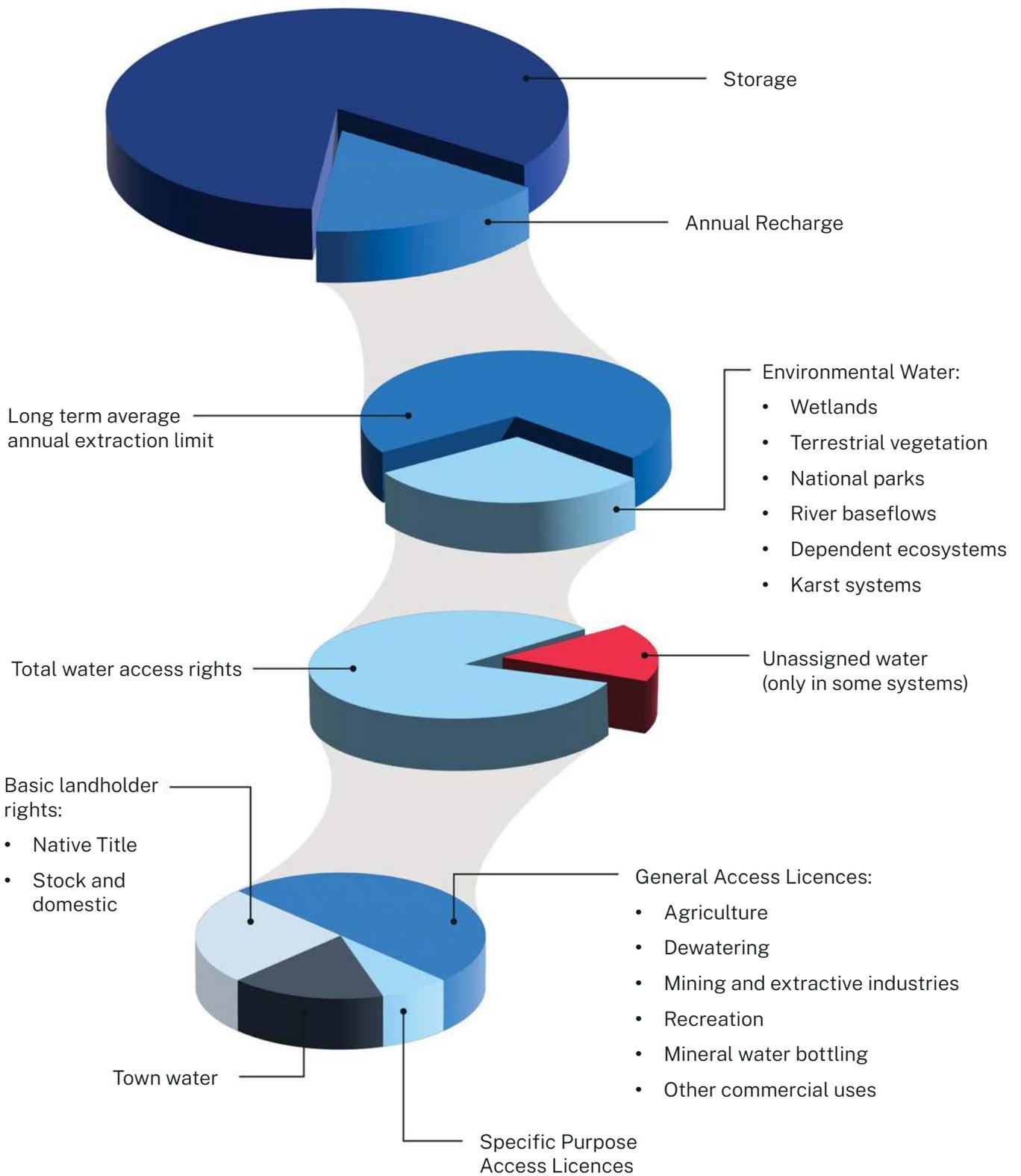
Figure 16 provides a simplified example of how groundwater may be shared – between the environmental and extractive use, and between different uses, and as specified in a water sharing plan.

Figure 19 shows the location of the 36 groundwater sharing plans in NSW. A water sharing plan can cover one or more of the groundwater sources in a catchment or geological province. In coastal areas it can apply to both surface water and groundwater where there is high connectivity between shallow groundwater and the overlying or adjacent streams.

26. [legislation.nsw.gov.au/view/html/inforce/current/act-2000-092](http://legislation.nsw.gov.au/view/html/inforce/current/act-2000-092)

27. [www.industry.nsw.gov.au/water/water-utilities/licensing-assistance/types](http://www.industry.nsw.gov.au/water/water-utilities/licensing-assistance/types)

**Figure 16. Simplified concept of water sharing as specified in water sharing plans**



Note: The relative proportions vary from water source to water source depending on local conditions.

## Long term average annual extraction

Groundwater sources generally store large volumes of water that may have accumulated over thousands of years. In all but totally buried groundwater sources, this stored water is also replenished from time to time by rainfall, river water and flood flows, and flow through from other groundwater sources – known as recharge. Generally, the volume in storage far exceeds the average annual recharge to a groundwater system.

In most groundwater sources, the storage – or volume in excess of the recharge – is retained as environmental water. Typically (but not in all circumstances), some of the average annual groundwater recharge is also set aside for the environment to maintain fundamental ecosystem health. The proportion of recharge set aside for the environment varies across the groundwater sources of NSW. The remaining volume is the long-term average annual extraction limit or LTAAEL. It is the amount or volume of groundwater available for allocation to groundwater users per year on average.

While the total volume of groundwater extracted by users may vary each year, on average it cannot exceed the LTAAEL. Water managers consider many factors when deciding how to set the LTAAEL, including the groundwater system type, risk of extraction to water quality and dependent ecosystems, data availability, existing rights, local community expectations and the principles of the *Water Management Act 2000* outlined previously. Thus, the method of calculating the LTAAEL varies across groundwater sources (Figure 17).

Water sharing plans also establish the rights within the LTAAEL – that is, the rights to take the available groundwater. Domestic and stock and Native Title rights take priority over other categories of use. Groundwater supplies for cities, towns and villages, and in some instances licences for other specific purposes, are also a high priority. All other groundwater take is authorised by a single category of licence, called an aquifer access licence. This is the lowest priority groundwater licence category. If extraction must be reduced to keep total use within the LTAAEL then take associated with these aquifer access licences is restricted.

## How groundwater entitlements link with extraction limits

For many large alluvial groundwater sources (water in gravel, sand, silt or clay in river channels or on floodplains), the entitlements are approximately equal to the extraction limit.

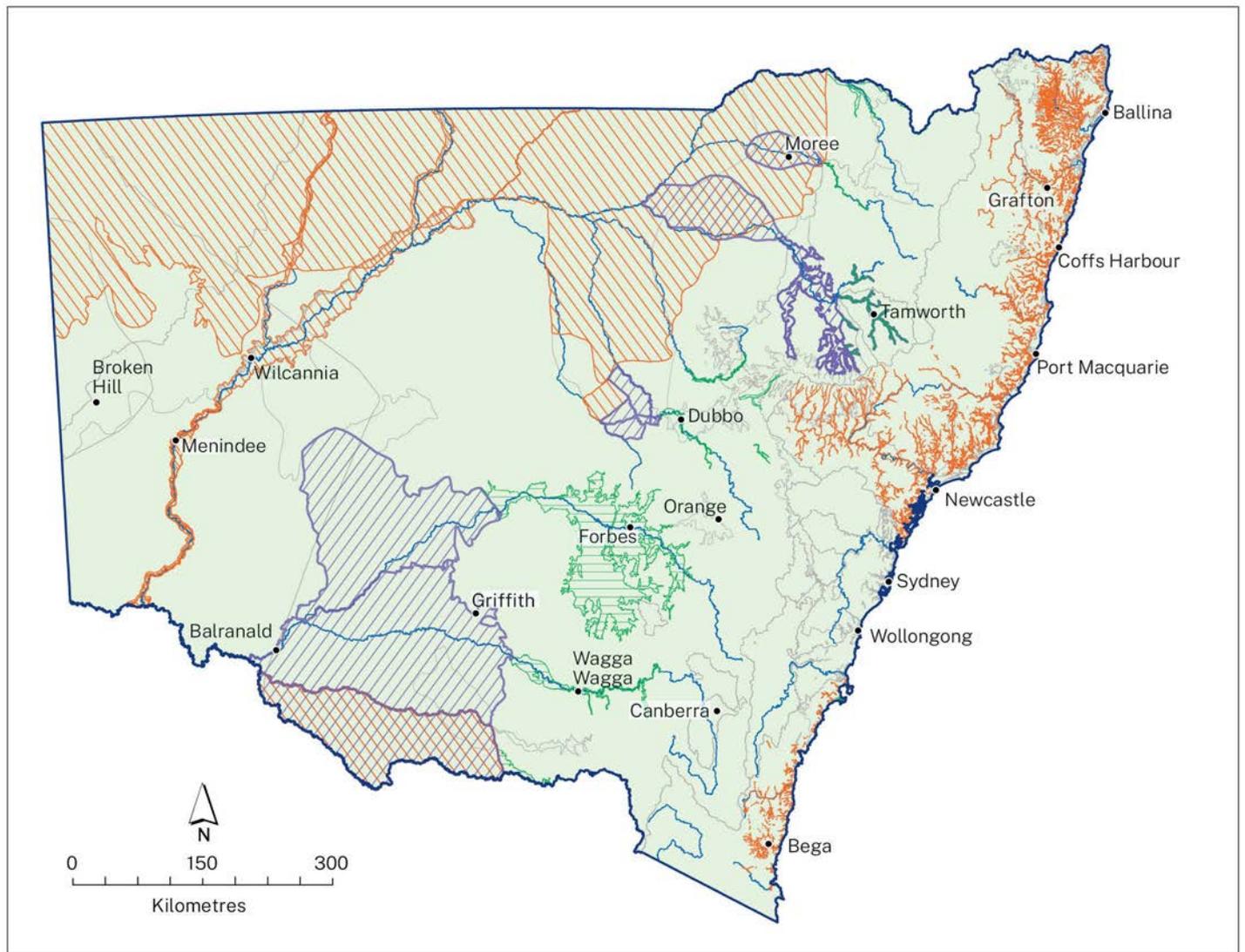
But for some groundwater sources, there are more entitlements (if each share = 1 ML). If licence holders increase the use of their entitlements, extraction can exceed the allowable limits. When this happens, allocations may be reduced in subsequent years to reduce the volume of water extracted. The number of entitlements remains the same but the volume of water allocated to each entitlement changes.

Water sharing plans allow groundwater to be temporarily pumped for some years at higher volumes than the annual limit. This provides some operational flexibility around seasonal variations in conditions such as droughts. The plans also set limits on the period that this higher level of extraction can continue. Once this compliance trigger is reached, groundwater

allocations may be reduced until extraction is back within the plan limit to prevent resource depletion. The allocation can also be reduced if the Murray–Darling Basin Plan sustainable diversion limit (SDL) for the groundwater resource is exceeded (see the section below on *Available water determinations and carryover and debit limits*).

In some groundwater sources, such as the Gunnedah-Oxley Basin Murray–Darling Basin groundwater source, the entitlements plus basic landholder rights is less than the extraction limit. For these sources there is some groundwater effectively ‘unallocated’, and the NSW Government may grant more entitlements through a process called ‘controlled allocation of access licences’. Controlled allocations are announced regularly – usually annually – and new aquifer access licences access licences in a groundwater source can be acquired through a competitive process.

**Figure 17. Map of groundwater sources where different methods are used to calculate LTAAEL**



**LTAAEL calculation methods:**

- |   |  |
|---|--|
|  % recharge                             |  Entitlements |
|  % recharge + committee recommendations |  Usage        |

Source: Based on data from the Department of Planning and Environment.

## Available water determinations and carryover and debit limits

Water sharing plans set the rules for making available water determinations and for managing the water allocation accounts of water access licences (WALs).

In each groundwater source, and for each licence category, available water determinations (AWDs) are made on 1 July each year.

An AWD credits the WAL water allocation account with an amount of water that can be taken. This is expressed as a percentage of the WAL entitlement (if the entitlement is expressed in megalitres per year – ML/year) or as number of megalitres per unit share (if the entitlement is expressed in unit shares – ML/unit share).

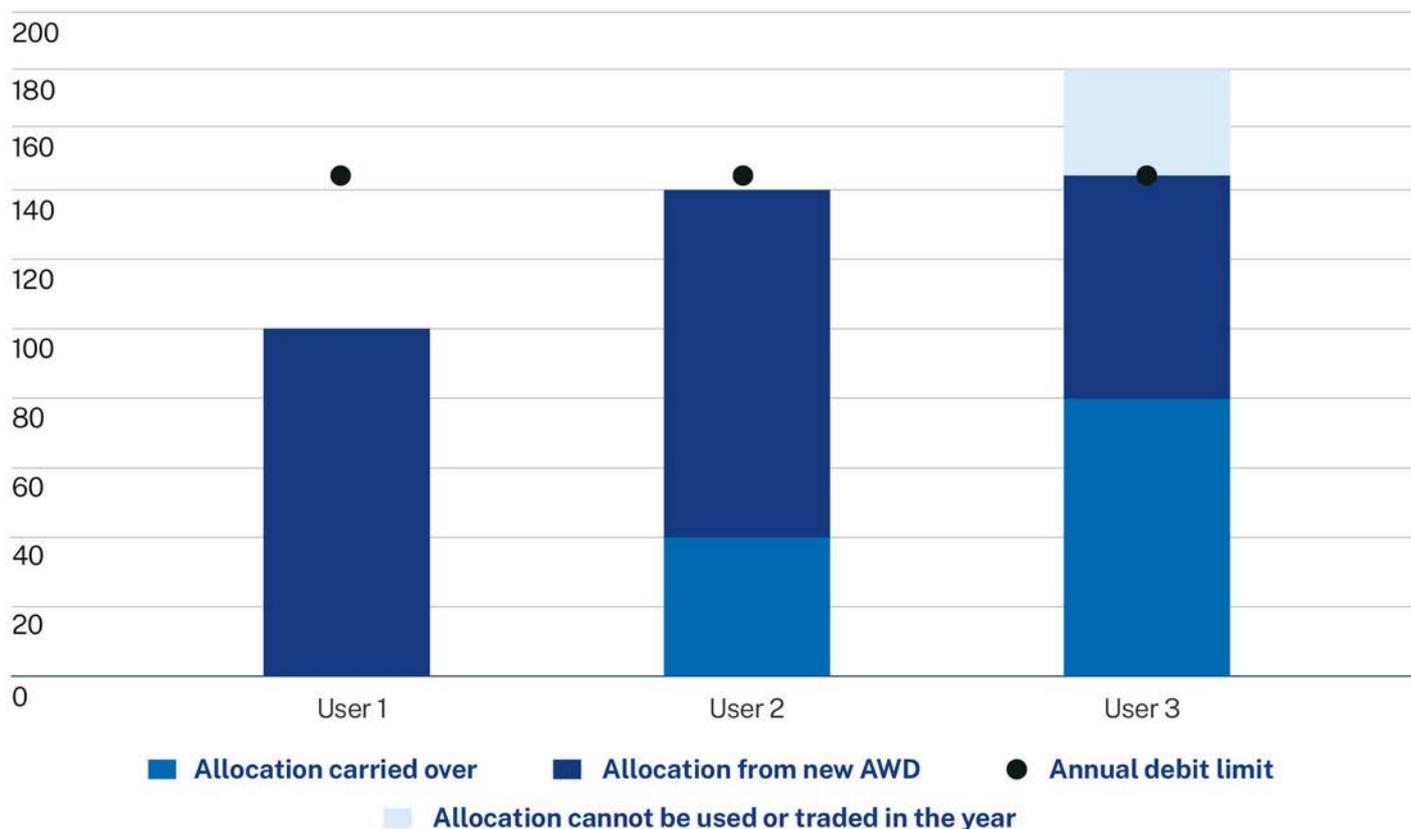
The AWDs can vary from year to year. Available water determinations are reduced if the average of annual extraction for the groundwater source for the preceding 5 water years exceeds the LTAAEL by an amount specified in the applicable water sharing plan (usually 10%). It is also reduced if the Basin Plan sustainable diversion limit (SDL) for the groundwater resource unit is exceeded. The extent of any AWD reduction considers several factors – including the degree of LTAAEL or SDL exceedance, local rules in the relevant water sharing plan, groundwater pumping patterns and historical trading.

In some groundwater sources some or all of a licence holder’s unused allocations can be carried over in the account from one year to the next. There are limits on the amount of carryover permitted and/or on the maximum volume of allocation that can be debited (taken or traded) from the account in a water year. The maximum water account debit can also be reduced to ensure overall extraction remains within the LTAAEL and SDL.

The operation of water allocation accounts is shown in Figure 18 for 3 licence holders each with a licence entitlement of 100 unit shares, with a carryover limit of 1 ML/unit share, and a maximum account limit of 1.5 ML/unit share. The 1 July AWD in this example is 1 ML/unit share. User 1 is very active and has an empty account coming into the water year. User 2 is partially active, carrying over some unused allocation. User 3 is largely inactive, carrying over a large account volume, and as a result a portion of their account water cannot be used or traded in the water year (but would be carried over into the next water year).

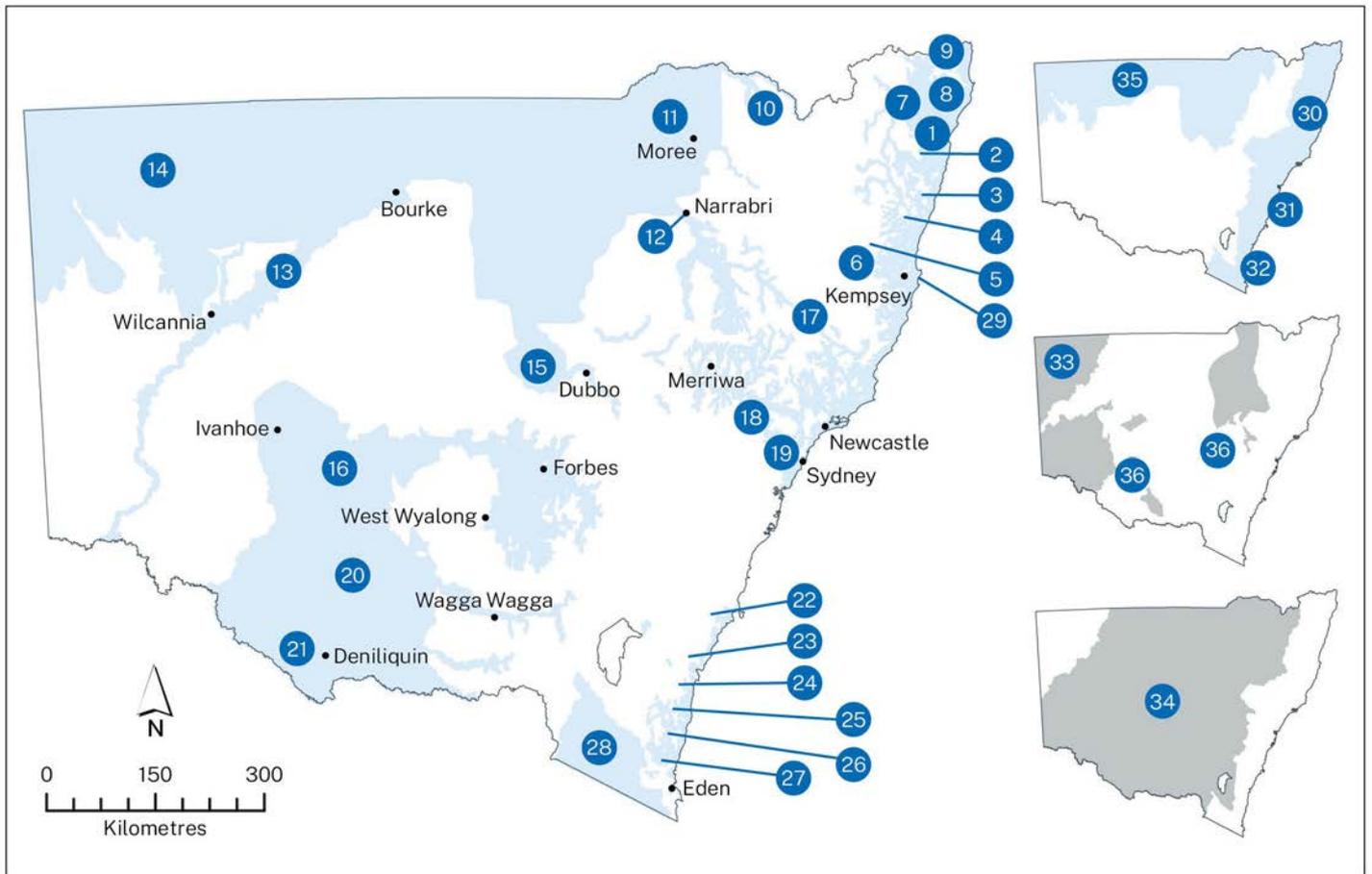
See the Department of Planning and Environment – Water website for more information.<sup>28</sup>

**Figure 18. Operation of water allocation accounts for active, partially active and largely inactive licence holders**



28. [www.dpie.nsw.gov.au/water/licensing-and-trade](http://www.dpie.nsw.gov.au/water/licensing-and-trade)

**Figure 19. Groundwater sharing plans across NSW**



**Legend:**

- |  |  |  |
|--|--|--|
| 1. North Coast Coastal Sands Groundwater Sources, 2016                         | 13. Darling Alluvial Groundwater Sources, 2020                             | 26. Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources, 2011 |
| 2. Clarence River Unregulated and Alluvial Water Sources, 2016                 | 14. NSW Great Artesian Basin Shallow Groundwater Sources, 2020             | 27. Towamba River Unregulated and Alluvial Water Sources, 2010                         |
| 3. Coffs Harbour Area Unregulated and Alluvial Water Sources, 2009             | 15. Macquarie–Castlereagh Groundwater Sources, 2020                        | 28. Snowy Genoa Unregulated and Alluvial Water Sources 2016                            |
| 4. Bellinger River Area Unregulated and Alluvial Water Sources, 2020           | 16. Lachlan Alluvial Groundwater Sources, 2020                             | 29. Hastings Unregulated and Alluvial Water Sources, 2019                              |
| 5. Nambucca Unregulated and Alluvial Water Sources, 2016                       | 17. Lower North Coast Unregulated and Alluvial Water Sources, 2009         | 30. North Coast Fractured and Porous Rock Groundwater Sources, 2016                    |
| 6. Macleay Unregulated and Alluvial Water Sources, 2016                        | 18. Hunter Unregulated and Alluvial Water Sources, 2009                    | 31. Greater Metropolitan Region Groundwater Sources, 2011                              |
| 7. Richmond River Area Unregulated, Regulated and Alluvial Water Sources, 2010 | 19. Central Coast Unregulated Water Sources, 2009                          | 32. South Coast Groundwater Sources, 2016  |
| 8. Brunswick Unregulated and Alluvial Water Sources, 2016                      | 20. Murrumbidgee Alluvial Groundwater Sources, 2020                        | 33. North Western Unregulated and Fractured Rock Water Sources, 2011                   |
| 9. Tweed River Unregulated and Alluvial Water Sources, 2010                    | 21. Murray Alluvial Groundwater Sources, 2020                              | 34. NSW Murray–Darling Basin Fractured Rock Groundwater Sources, 2020                  |
| 10. NSW Border Rivers Alluvial Groundwater Sources, 2020                       | 22. Clyde River Unregulated and Alluvial Water Sources, 2016               | 35. NSW Great Artesian Basin Groundwater Sources, 2020                                 |
| 11. Gwydir Alluvial Groundwater Sources, 2020                                  | 23. Deua River Unregulated and Alluvial Water Sources, 2016                | 36. NSW Murray–Darling Basin Porous Rock Groundwater Sources, 2020.                    |
| 12. Namoi Alluvial Groundwater Sources, 2020                                   | 24. Tuross River Unregulated and Alluvial Water Sources, 2016              |  |
|  | 25. Murrumbidgee–Wallaga Area Unregulated and Alluvial Water Sources, 2010 |  |

# Rights, licences and approvals

Water access licences and approvals issued under the *Water Management Act 2000* (the Act) are the main mechanism in NSW that enables groundwater to be managed within the sustainable sharing framework established in the applicable water sharing plan. Licences and approvals also set clear, exclusive and defensible rights for water users, as well as their responsibilities.

In most circumstances, people or entities wanting to use groundwater in NSW will need all of the following:

- a water access licence (WAL) to take water from a particular water source
- a water supply work approval to construct, replace or modify and operate a specified water supply work (a bore, excavation or spearpoint for example) at a specified location
- a water use approval to use water for a particular purpose at a particular location.

A water supply work approval and a water use approval are often combined into a single approval as they are both location specific. A WAL holder must apply to nominate an approved water supply work or extraction point in the water source designated on the WAL before groundwater can actually be taken from that work. This 'dealing' is processed by WaterNSW and noted on the WAL title by NSW Land Registry Services. [Click here to watch a short video of that explains how assessments for groundwater licences work.](#)

There are some exceptions to the requirements outlined above:

- state significant developments (SSD) or state significant infrastructure (SSI) do not require water supply work approvals or a water use approvals, as the site specific water management considerations are addressed in the *Environmental Planning and Assessment Act 1979* development consent and associated conditions. SSDs and SSI do, however, require WALs to account for any groundwater take associated with the development<sup>29</sup>
- no WAL or water use approval is required to exercise a Native Title or domestic and stock basic landholder right. However, a water supply work approval is required to construct a bore to take the groundwater for these purposes. This is so that the location of bores can be managed to avoid impacts, and to ensure they are constructed according to agreed standards

- the regulation to the Act specifies a number of exemptions to the requirements to obtain water access licences, work approvals or water use approvals, generally for temporary or very low impact activities. These include:
  - aquifer interference activities taking 3 ML or less of groundwater per year are exempt from requiring a water access licence and water use approval. However, a water supply work approval is still required, along with other reporting requirements. For mining and petroleum (including coal seam gas) activities, this applies at the exploration stage
  - for dewatering activities taking greater than 3 ML of groundwater per year, a water access licence or a water use approval may not be required if a water supply work approval has already been obtained and it specifies the maximum amount of water that can be taken during a year. This only applies to certain groundwater sources. WaterNSW has the latest information on its website<sup>30</sup>
  - for the removal of groundwater to address an immediate risk while undertaking urgent works that are required in response to an emergency event. It would include, for example, the removal of water from an excavation that had to be dug to fix a burst water supply or sewer pipe.<sup>31</sup>
- public authorities and transport authorities are exempt from requiring a water access licence for construction and maintenance of roads or railways<sup>32</sup>
- the NSW Government is exempt from requiring a water access licence to provide for urgent basic human water needs
- there are general exemptions from requiring a water access licence, a water use approval, or a work approval for water carting during drought relief for domestic consumption and stock watering, hydrostatic testing of gas pipelines, prospecting or fossicking for minerals or petroleum, water bore testing, environmental monitoring bores, emergency safety measures or establishment of sugar cane plantings.

29. [www.dpie.nsw.gov.au/water/licensing-and-trade/major-projects](http://www.dpie.nsw.gov.au/water/licensing-and-trade/major-projects)

30. [www.waternsw.com.au/customer-service/water-licensing/dewatering](http://www.waternsw.com.au/customer-service/water-licensing/dewatering)

31. [water.dpie.nsw.gov.au/licensing-and-trade/licensing/emergency-works-exemption](http://water.dpie.nsw.gov.au/licensing-and-trade/licensing/emergency-works-exemption)

32. [water.dpie.nsw.gov.au/licensing-and-trade/licensing/water-licensing-and-works-approvals-exemptions](http://water.dpie.nsw.gov.au/licensing-and-trade/licensing/water-licensing-and-works-approvals-exemptions)

## Basic landholder rights

A Native Title holder has the right to take and use groundwater in the exercise of Native Title rights.<sup>33</sup> Similarly, an owner or occupier of a landholding is entitled to take groundwater from an aquifer underlying their land, and to use that water for domestic consumption<sup>34</sup> and stock watering, but not for any other purpose.

Further information is on the Department of Planning and Environment – Water website<sup>35</sup> and the application process and forms can be found on the WaterNSW website.<sup>36</sup>

## Water access licences

### Licence categories

A water access licence (WAL) is not attached to a parcel of land. It entitles its holder to ‘shares’ in the groundwater made available to a category of licence in a specified groundwater source or part thereof. Most WALs, unless they are for a specific purpose, are expressed in unit shares. The value of these unit shares may change each year (see *Available water determinations*).

A WAL is generally required irrespective of whether water is taken actively for consumptive use (such as via pumping a bore or well), or its take or diversion is

incidental to the main activity. For example, dewatering of groundwater during building construction and groundwater filling and evaporating from a void post-activity requires a WAL (unless an exemption applies) even where that water is not being used consumptively as part of the activity’s operation.

The main WAL categories relevant to groundwater in NSW are:

- major utility – these are generally metropolitan water supply utilities and large energy providers, and are specified in Schedule 2 to the *Water Management Act 2000*
- local water utilities – these are the regional water supply authorities and local councils that supply reticulated water supply and sewage services to regional towns and villages
- domestic and stock (licensed) – these are held by entities or individuals that operate a shared bore or bores to supply water for domestic and stock purposes to a number of landholdings Specific Purpose Access Licences – these are specified in Division 1 of Part 2 of the Water Management (General) Regulation 2018, and as the name suggests are for specific purposes, and can be cancelled once the specific purpose is no longer required
- aquifer – these are the vast majority of licences, are perpetual, and can be used for any purpose, for example for irrigation, industry or mining.



Image courtesy of Destination NSW. Yarren Wines, Yenda.

33. [www.waternsw.com.au/customer-services/water-licensing/basic-landholder-rights#Native\\_title](http://www.waternsw.com.au/customer-services/water-licensing/basic-landholder-rights#Native_title)

34. Domestic consumption means consumption for normal household purposes in domestic premises situated on the land. Stock watering means the watering of stock animals being raised on the land, but does not include the use of water for raising of stock animals on an intensive commercial basis that are housed or kept in feedlots or buildings for all (or a substantial part) of the period during which the stock animals are being raised.

35. [www.waternsw.com.au/customer-services/water-licensing/basic-landholder-rights#Domestic\\_and\\_stock\\_rights](http://www.waternsw.com.au/customer-services/water-licensing/basic-landholder-rights#Domestic_and_stock_rights)

36. [www.waternsw.com.au/customer-service/water-licensing/basic-landholder-rights](http://www.waternsw.com.au/customer-service/water-licensing/basic-landholder-rights)

## How to obtain a licence

Water access licences can be obtained in one of 3 ways:

- via the water market (trading). In most groundwater systems, the available groundwater is fully assigned so purchasing water licences or annual allocations in the market is the only way to secure water for new or expanding commercial purposes. As most groundwater sources in NSW are fully committed, this is the main way of obtaining water access licences (WAL's) for most purposes
- by applying to the responsible agency for a Specific Purpose Access Licence
- through a 'controlled allocation' process.

### Water trading

Trading is the buying and selling of a water licence entitlement (the share component of a WAL) or water allocation (the volume of water (in megalitres) credited to a WAL water allocation account). All or part of an entitlement or water allocation can be traded. These are commonly known as permanent and temporary trading respectively.

The separation of land title from water means that water entitlements and water allocations can be traded separately to parcels of land. This provides flexibility and increases opportunities for water to move from low priority to higher priority uses.

Trading is important as it enables a more efficient and effective use of groundwater resources. It provides the opportunity for new or expanding commercial users to obtain access to water, particularly where groundwater sources are fully committed and where no further entitlements can be granted. It also allows licence holders who are not using all or part of their licences, either permanently or temporarily, to realise the capital value of their water asset.

Like many other markets, private sector brokers can assist in bringing buyers and sellers together. Prices are determined by the market and may fluctuate depending on supply and demand. Historical trade statistics, including prices, can be view on the NSW Water Register by groundwater source.

Groundwater trading is permitted within all groundwater sources, subject to the rules in:

- the *Water Management Act 2000 (the Act)* and its regulations
- the Access Licence Dealings Principles Order 2004
- any additional ministerial access licence dealings principles
- the relevant water sharing plan.

All trades are assessed against general principles<sup>37</sup> to ensure no adverse impact to neighbours, culturally important sites, groundwater dependent ecosystems and water quality. Trades are also assessed against additional specific principles depending on the location and type of licence. Where a trade involves a permanent change of ownership of a licence or part thereof, a new or amended WAL certificate needs to be issued by the NSW Land Registry Services.

More information about buying and selling groundwater is provided on the Department of Planning and Environment – Water website. Trades can be completed through WaterNSW.<sup>38</sup>

### Specific Purpose Access Licences

The Act (s.61) and Regulation (cl.10) allow for applications to be made for access licences for specific purposes. A water sharing plan can also allow this. Specific Purpose Access Licences categories are defined in the Dictionary to the Act and clauses 5 of the Regulation. In general terms, these licences are for high priority needs (such as town water supply, Aboriginal cultural purposes, and pumped hydropower initial fill and construction). They cannot be permanently traded and are cancelled if the purpose for which they were granted no longer exists. The assessment provisions of the Act apply to applications for these licences, and applicants must demonstrate that the proposed take and use of the water will cause no more than minimal harm to the water source.

37. [www.waternsw.com.au/customer-services/water-licensing/managing-your-licence](http://www.waternsw.com.au/customer-services/water-licensing/managing-your-licence)

38. [www.waternsw.com.au/customer-services/ordering-and-trading/trading-water](http://www.waternsw.com.au/customer-services/ordering-and-trading/trading-water)

## Controlled allocations

A controlled allocation is the mechanism for granting new aquifer access licences in groundwater sources with unassigned water. Unassigned water is the portion of the LTAAEL<sup>39</sup> that has not already been assigned to water users (see previous section on *Water sharing plans*). Controlled allocations only apply in some groundwater sources. They do not apply in fully committed groundwater sources where water access licences can generally only be obtained through trading.

Controlled allocations are announced regularly – usually annually – and are a competitive process for new aquifer access licences in a groundwater source.

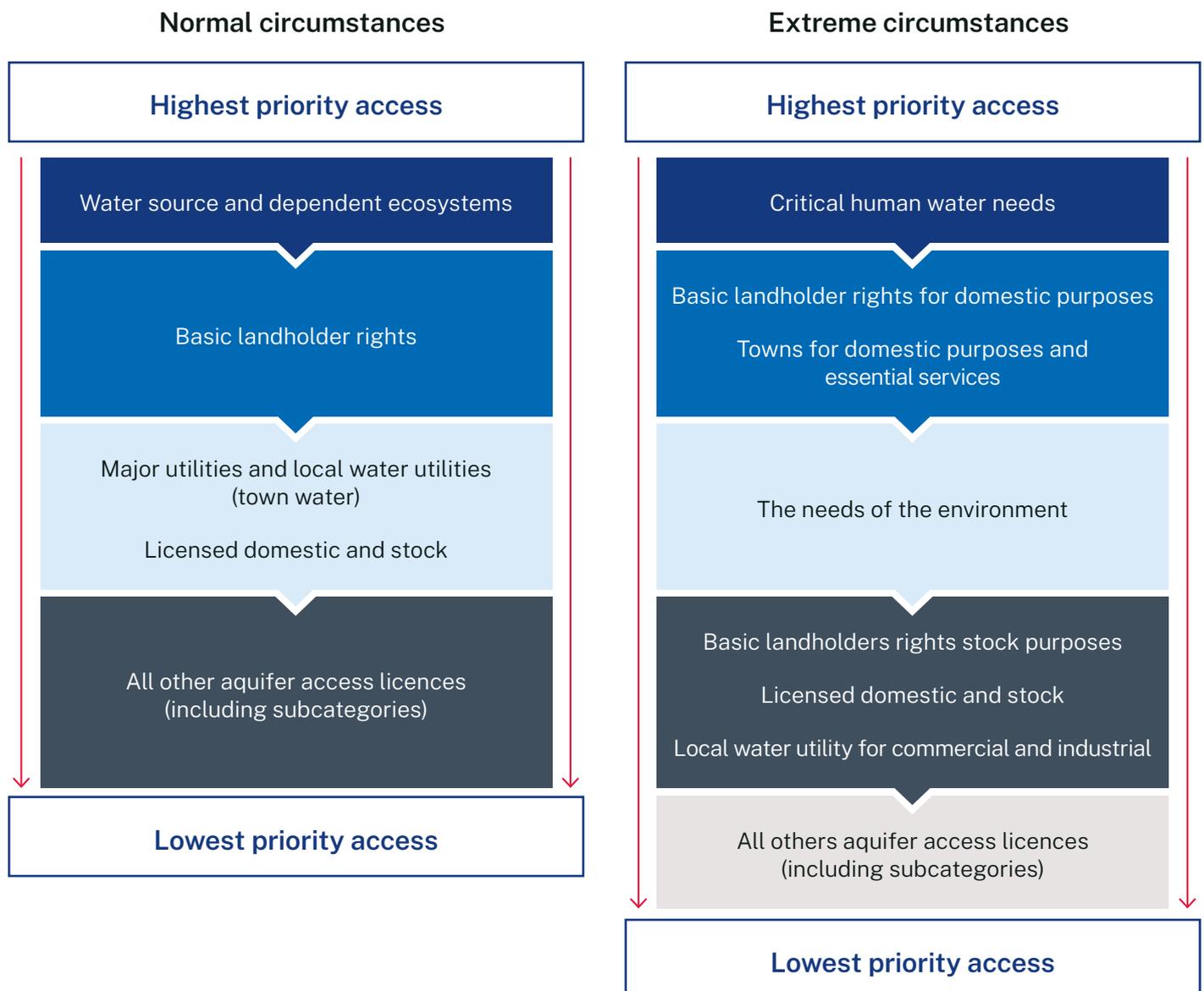
More information on controlled allocations is available on the Department of Planning and Environment – Water website.<sup>40</sup>

## Priority of access

The priority of access to groundwater for basic land holder rights and the water access licence categories and subcategories are shown in the figures below a) during normal circumstances, and b) during extreme circumstances such as severe drought (see Figure 20).

Under specific circumstances such as water shortages due to drought or threats to public health, orders can be made under Section 324 of the *Water Management Act 2000* to temporarily restrict groundwater take. These orders can be made where the Minister is satisfied that it is necessary to do so either in the public interest, or to achieve other objectives, such as to maintain or protect water levels in an aquifer, to maintain pressure, or to ensure pressure recovery, in an aquifer.

**Figure 20. Access priorities between different categories of groundwater licences during normal times and extreme events**



39. See Water sharing plans section for how this is determined.

40. [www.industry.nsw.gov.au/water/allocations-availability/controlled](http://www.industry.nsw.gov.au/water/allocations-availability/controlled)

# Approvals

Water supply work approvals and water use approvals are site specific, with conditions that ensure no adverse impact to neighbours, culturally important sites, groundwater dependent ecosystems, water quality and

the structure of the subject aquifer. Conditions relating to the construction of bores and to metering of take from a work are also set where applicable. [Click here to watch a short video that explains how to apply for a water supply work approval \(bore application\).](#)

## Who to ask about water access licence and a work/use approval requirements

Responsibilities for granting and managing water licences and approvals are split between the Department of Planning and Environment and WaterNSW.

WaterNSW is responsible for water access licences (WALs) and associated approvals required by private entities such as rural landholders, rural industries and developments. These make up approximately 96% of all water access licences in NSW.

The Department of Planning and Environment manages WALs (WALs and approvals) held or sought by a small cohort of larger water users including councils, state or Australian government agencies or authorities, major water utilities, water supply authorities or irrigation corporations, any person or entity requiring an Aboriginal commercial, Aboriginal community development, Aboriginal cultural or Aboriginal environmental subcategory of access licence, licensed network operators under the Water Industry Competition Act 2006 (NSW), mining or petroleum activities, and state significant developments or state significant infrastructure.

## Compliance and enforcement

The Natural Resources Access Regulator (NRAR) was established under the Natural Resources Access Regulator Act 2017 to ensure that water is lawfully used and that all communities, and the environment get a fair share.

The main purpose of NRAR is to build public trust and confidence as a regulator by:

- educating, enabling, and encouraging people to actively comply with natural resources laws
- enforcing the law to provide a deterrent, and to ensure fairness for the compliant
- championing improvements to the management of natural resources.

NRAR has many methods of finding breaches of water laws. In addition to responding to and investigating reports of alleged breaches, NRAR has teams of compliance officers across NSW who actively monitor and audit the use of surface water and groundwater. They also use technology including state-of-the-art satellite imagery, drones, motion-activated surveillance cameras and intelligent data to monitor unlawful water take.

NRAR is a risk-based regulator which means they approach investigations on a case-by-case basis. They consider the potential harm caused to the environment or other water users, the offender's culpability and compliance history as well as their attitude to the non-compliance.



Image courtesy of Jamie Plaza Van Roon, Department of Planning and Environment. Cattai Wetlands, Cooperook, NSW.

# Local impact management

While the LTAAEL sets the average annual level of extraction from a groundwater source as a whole, additional rules can be used to restrict the location or concentration of groundwater extraction. This is done to manage unacceptable impacts (see Figure 21). Generally, new bores cannot be constructed or additional water taken in locations where doing so would draw down the water levels to such an extent that:

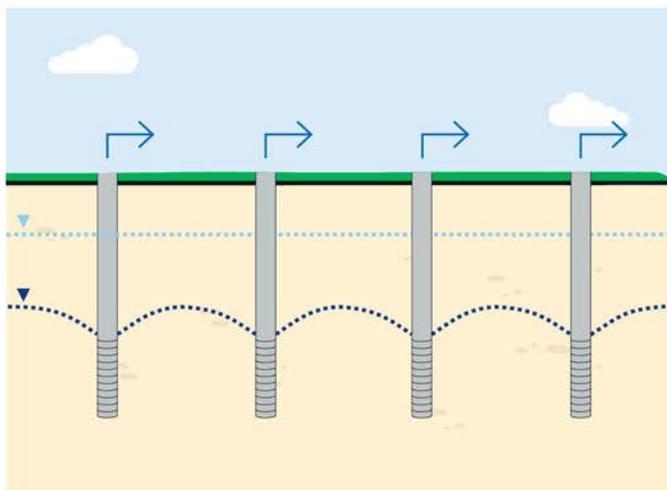
- dependent ecosystems lose contact with groundwater
- contaminated or salty water is mobilised and drawn into fresh groundwater

- the ability of other existing users to access groundwater is compromised
- the aquifer structure itself could be damaged if it is dewatered.

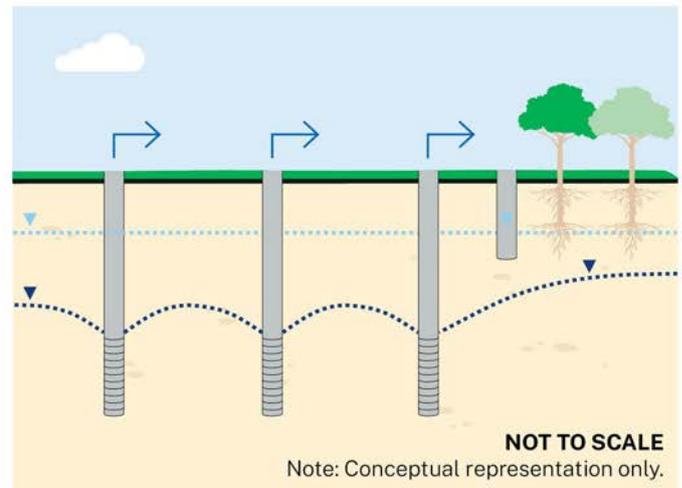
Various legal tools are used to enable local impact management, including rules in water sharing plans, issuing orders under Section 324 of the *Water Management Act 2000*, and application of assessment guidelines for new bores or water trading.<sup>41</sup>

**Figure 21. Groundwater drawdown under a long-term average annual extraction limit (LTAAEL) of 1,000 ML/year may be acceptable when all users can still access groundwater (a), however local rules are also needed to manage potential impacts to other features, like shallow stock bores or groundwater dependent ecosystems (b)**

**a) LTAAEL = 1,000 ML/year**



**b) LTAAEL = 1,000 ML/year**



**Legend:**    ↗ Pumping    ▬ Baseline groundwater level    ▬ Pumping groundwater level

41. [water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science/managing-groundwater-in-nsw](http://water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science/managing-groundwater-in-nsw)

## Distance rules for water supply works

Water sharing plans contain rules for determining where water supply works can be located. The rules specify distance criteria, or buffer distances, intended to minimise the impact on other water users and preserve the environmental values of a groundwater source. More specifically, distance criteria are used to:

- minimise interference between nearby water supply works
- protect town water supplies
- locate works away from contaminated sites
- protect groundwater dependent ecosystems and river baseflows
- protect groundwater dependent culturally significant sites
- manage surface and groundwater connectivity.



Image courtesy of Glen McPherson. Artesian bore headworks.

## Licensing for bore drilling

A landholder requires a water supply work approval from WaterNSW to drill and construct a water supply bore. This includes all new and replacement bores or widening or deepening existing bores. Any failed bores must also be properly abandoned to maintain the integrity of the groundwater system and documented with WaterNSW.

A licensed water bore driller must be engaged by the landholder to undertake this work, which must be compliant with the Minimum Construction Requirements for Water Bores in Australia.<sup>42</sup> The driller must hold the appropriate class licence and must sight a current water supply work approval before drilling and comply with any relevant conditions. After the bore has been completed, the driller must also give the relevant regulatory agency the location and construction details of the bore, as well as information on the quality and yield of groundwater.<sup>43</sup>

### Drillers' licences

WaterNSW issues several classes of drillers' licences, including licences to construct water level and water quality monitoring bores, sub-artesian stock and domestic supply bores, and flowing and non-flowing bores that penetrate the sandstone aquifers of the Great Artesian Basin. The licence classes recognise the different levels of knowledge and skills that are required to drill and construct bores in different aquifer systems. A driller's licence may also restrict the holder to using specific drilling methods. Drillers are only permitted to drill the kind of bore specified in their licence class.

Detailed information about the different licence classes is provided on the WaterNSW website. WaterNSW has also created a Drillers Portal, which gives drillers the ability to enter and submit the required forms and information from anywhere and at any time using a mobile phone, tablet or computer. The portal can be accessed at [driller.waternsw.com.au](http://driller.waternsw.com.au)



Image courtesy of Department of Planning and Environment. Drilling rig.

42. [adia.com.au/wp-content/uploads/2020/09/Minimum-Construction-Requirements-Edition-4.pdf](http://adia.com.au/wp-content/uploads/2020/09/Minimum-Construction-Requirements-Edition-4.pdf)

43. Drillers have to complete and return a form describing the particulars of the completed works to the relevant agency within 2 months of completing the work.

# Land use planning controls and other approvals

Water reliability and security are central to land use and urban development planning decisions in NSW. Land use planning should be integrated with the water management framework so that long-term investment decisions consider water extraction limits, water access constraints, reliability of water supply and water market conditions.

Multiple government agencies at local, state and in some instance federal levels, work together to ensure the impacts of developments on water resources are properly understood and regulated. The planning process also considers any policy, operational and infrastructure settings that may need to be changed to cater for future changes in water supply and demand.

Local governments determine non-major projects or developments in NSW, many of which have groundwater considerations.

Major projects that are important to NSW for economic, environmental or social reasons can be classified as state significant development (SSD) or state significant infrastructure (SSI). This classification occurs under the *Environmental Planning & Assessment Act 1979* (EP&A Act). Examples of SSD and SSI projects include:

- certain industries (mines, factories, power stations, schools, hospitals), generally due their size, economic value or potential impacts
- development on sites with strategic planning significance (Barangaroo, Darling Harbour, Sydney Opera House, Sydney Olympic Park)
- large-scale port, rail, road, water supply, storage or treatment facilities, certain pipelines and certain development in National Parks.

Department of Planning and Environment co-ordinates a whole-of-government assessment of the impacts of these projects against the requirements of the EP&A Act and in accordance with various policies and guidelines. See the Department of Planning and Environment website for more information on the application and assessment processes for SSD<sup>44</sup> and SSI<sup>45</sup> projects.

Department of Planning and Environment – Water advises on groundwater matters for SSD and SSI projects. The department has prepared guidelines<sup>46</sup> to help applicants comply with the NSW groundwater management framework. The guidelines set out the information requirements for pre-approval discussions, groundwater impact assessments to support an Environmental Impact Statement, post-approval site monitoring and management planning, and compliance reporting.

Unless exempt, any development that ‘takes’ groundwater also requires a water access licence under the *Water Management Act 2000* (see above). As outlined previously, SSD and SSI projects do not have to obtain separate water supply work and use approvals, as the assessment of these, and any associated conditions, is embedded in the EP&A Act consent process.

Environmental protection licences are required for any activity defined in Schedule 1 to the *Protection of the Environment Operations Act 1997*. These licences are a critical mechanism for preventing and managing the potential for pollution of our groundwater resources.

The *Contaminated Land Management Act 2007* is a key mechanism for groundwater contamination should it occur. If land is declared significantly contaminated, the NSW Environment Protection Authority can serve ‘management orders’ on the owner or occupier of the land to, amongst other things, remediate and monitor the land and groundwater.

44. [www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Planning-Approval-Pathways/State-Significant-Development](http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Planning-Approval-Pathways/State-Significant-Development)

45. [www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Planning-Approval-Pathways/State-significant-infrastructure](http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Planning-Approval-Pathways/State-significant-infrastructure)

46. [water.nsw.gov.au/\\_data/assets/pdf\\_file/0020/507611/Guidelines-for-Groundwater-Documentation-for-SSD-SSI-Projects.pdf](http://water.nsw.gov.au/_data/assets/pdf_file/0020/507611/Guidelines-for-Groundwater-Documentation-for-SSD-SSI-Projects.pdf)

# Groundwater knowledge

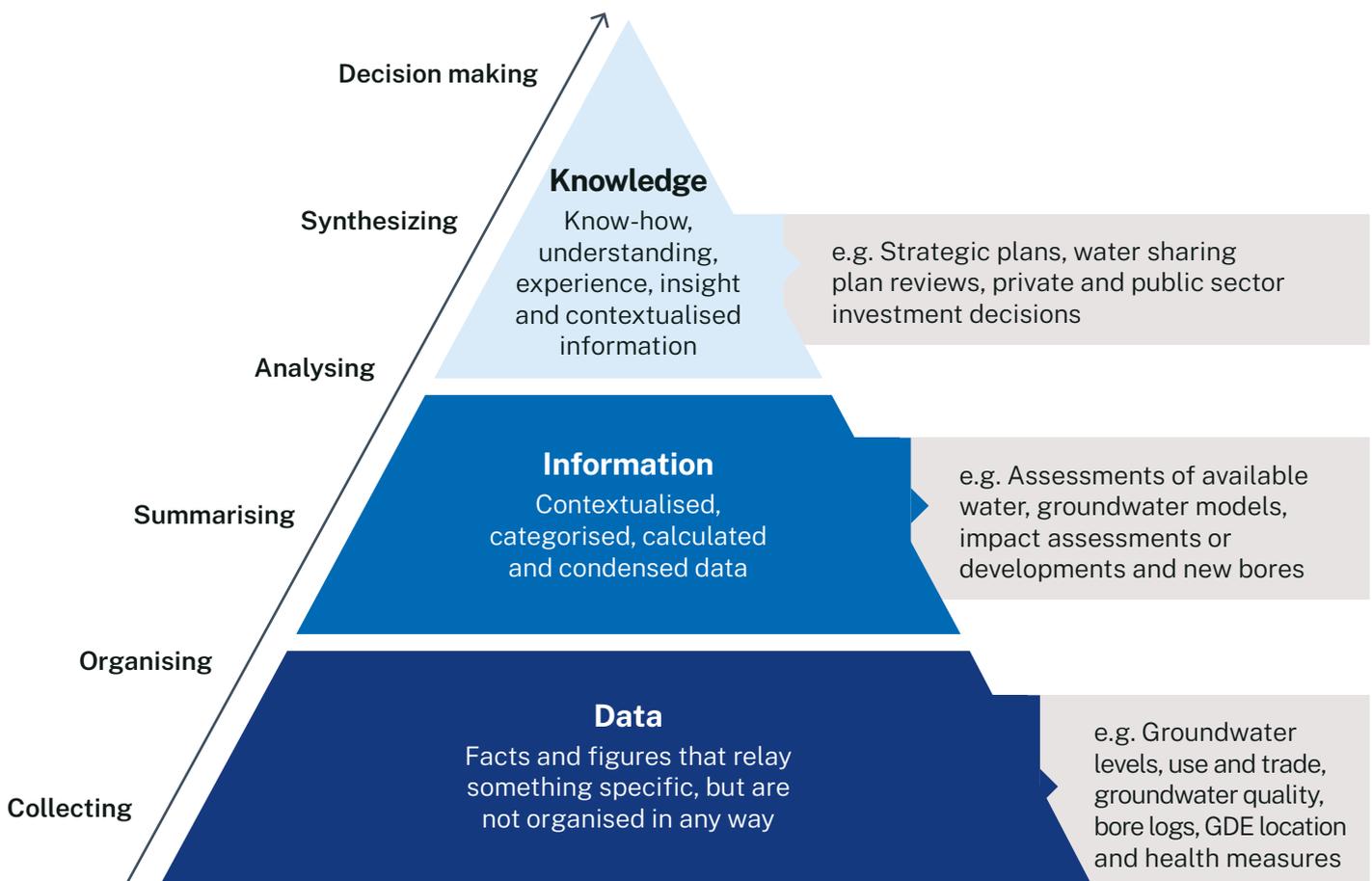
The NSW Government collects information about groundwater levels, quality and use through water bore monitoring and metering (see previous section on *Groundwater metering*).

The data collected is used in a range of ways to support groundwater management decisions, and made available to the community, water users and prospective developments (Figure 22).

Management activities supported by groundwater data include:

- detecting and monitoring groundwater level and quality changes and trends
- determining groundwater availability
- developing and evaluating the performance of water sharing plans
- monitoring compliance with NSW water management laws and licence conditions
- assessing groundwater approvals and trades applications.

**Figure 22. Data, information and knowledge are necessary to manage groundwater**

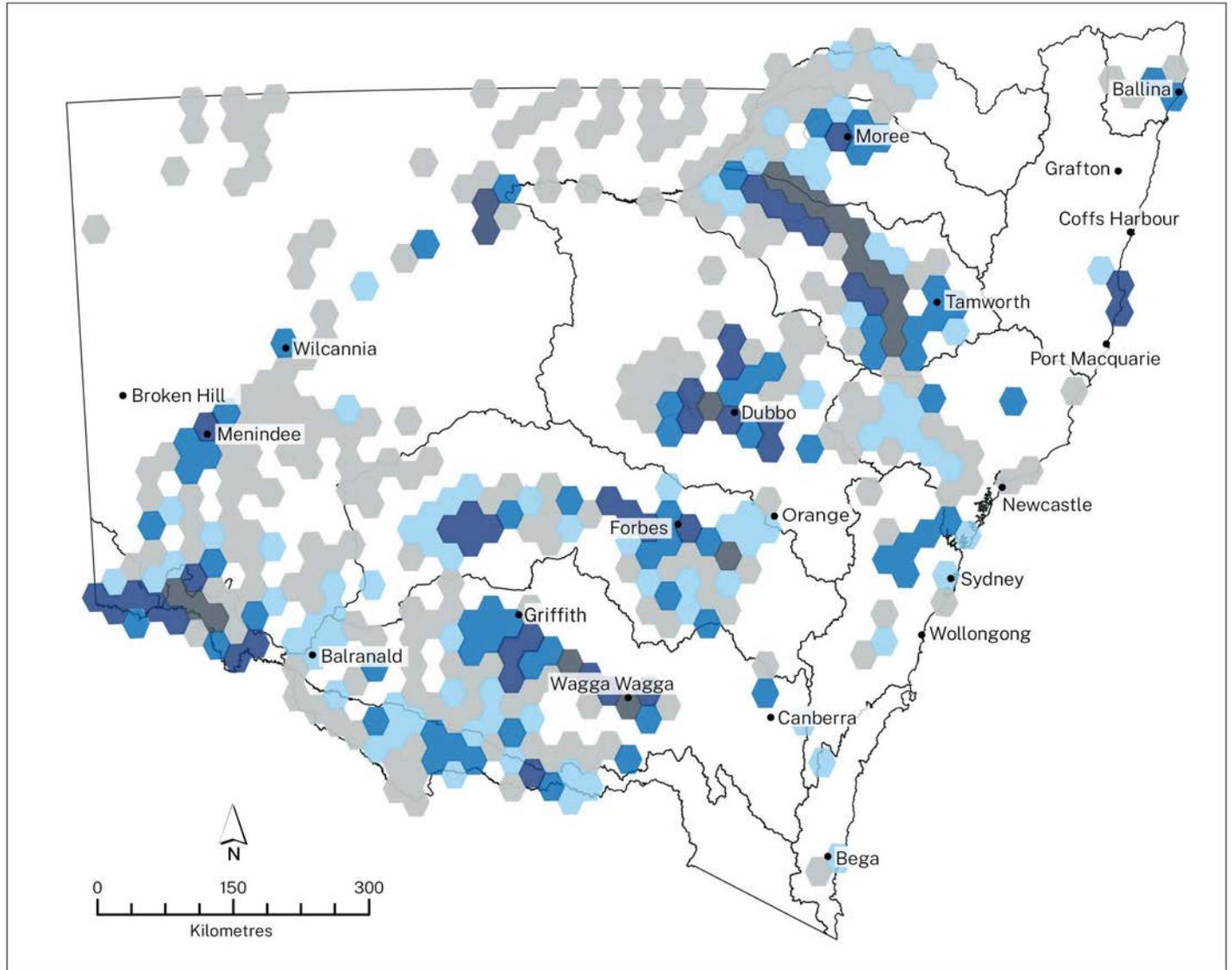


Source: Adapted from [www.knowledge-management-tools.net/knowledge-information-data.html](http://www.knowledge-management-tools.net/knowledge-information-data.html)

# Monitoring

WaterNSW manages a network of around 4,600 groundwater monitoring bores across NSW (Figure 23). For around 400 of these bores, real-time data is available by telemetry-enabled data loggers, which record and transmit electronic data from the field to a centralised database. Around 560 of these bores have data loggers, which record data that WaterNSW manually downloads. The remaining bores are monitored manually. NSW groundwater data can be accessed at: [www.waternsw.com.au/waterinsights/real-time-data](http://www.waternsw.com.au/waterinsights/real-time-data)

**Figure 23. Density of monitoring bores across NSW**



**Legend:**

□ Regional water strategy boundary

**Monitoring bores/500 km<sup>2</sup>**

■ 1-4      ■ 5-9      ■ 10-19      ■ 20-49      ■ 50-200

Source: Based on data from the Department of Planning and Environment.

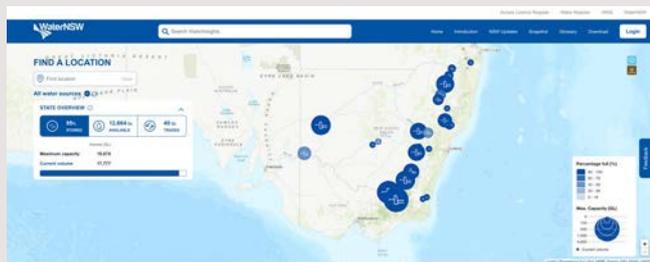
# Science and modelling

NSW water departments, industry and research institutions have developed a substantial knowledge base to help manage the state's groundwater resources.

Some of the important public databases and mapping portals that provide an insight into the state's groundwater resources are shown below.

Groundwater models help to predict water level and water quality trends and help to inform groundwater management decisions in NSW. These models use and produce extensive and detailed information on water levels, quality, availability and use for a range of climate, groundwater pumping and regulatory scenarios.

The **WaterInsights portal** provides access to information about how water is managed and shared in NSW, and how much water is in the system – in storage or in rivers or groundwater systems.



The **Continuous water monitoring network** provides access to the majority of surface and groundwater monitoring sites across the state.



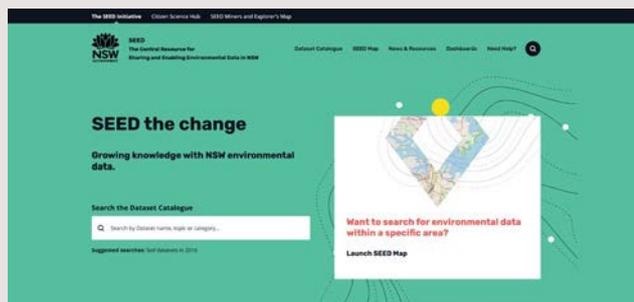
**Minview** provides access to a comprehensive range of geoscientific data for NSW.



The **Groundwater Dependent Ecosystems (GDE) Atlas** provides the location of all known or likely GDEs.



The **SEED portal** provides the ecological value of GDEs.



The **NSW Water Register** provides public access to information about water licences, approvals, water trading, water dealings, environmental water and other matters related to water entitlements in NSW.



## Information products

Department of Planning and Environment – Water generate and share information that is useful for water users to make decisions. This includes:

- publishing status reports and summary reports for major groundwater sources.<sup>47</sup> These reports explain how groundwater sources across NSW are responding to the volumes and patterns of extraction
- maintaining public information databases and mapping tools, including real-time water monitoring<sup>48</sup> and open access to spatial data<sup>49</sup>

- holding community information sessions on topics such as water availability,<sup>50</sup> water reforms,<sup>51</sup> water planning strategies<sup>52</sup> and notices and decisions<sup>53</sup>
- maintaining agency websites that provide groundwater policies, plans and guidelines (and relevant background documents)
- publishing news,<sup>54</sup> media releases<sup>55</sup> and government gazettals related to water in NSW.

Every 3 years, the NSW State of the Environment report<sup>56</sup> also provides an overview of the use and health of groundwater sources across the state.



Image courtesy of Jess Thompson. Mascot Spring, Great Artesian Basin.

47. [water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science/groundwater-document-library](http://water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science/groundwater-document-library)

48. [realtimedata.watnsw.com.au/](http://realtimedata.watnsw.com.au/)

49. [data.nsw.gov.au/](http://data.nsw.gov.au/)

50. [www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/drought-update/information-sessions](http://www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/drought-update/information-sessions)

51. [www.industry.nsw.gov.au/water/what-we-do/water-reform-action-plan](http://www.industry.nsw.gov.au/water/what-we-do/water-reform-action-plan)

52. [www.dpie.nsw.gov.au/water/plans-and-programs](http://www.dpie.nsw.gov.au/water/plans-and-programs)

53. [www.dpie.nsw.gov.au/water/licensing-and-trade/public-notices](http://www.dpie.nsw.gov.au/water/licensing-and-trade/public-notices)

54. [water.dpie.nsw.gov.au/news](http://water.dpie.nsw.gov.au/news)

55. [www.industry.nsw.gov.au/media/releases/2021-media-releases](http://www.industry.nsw.gov.au/media/releases/2021-media-releases)

56. [www.soe.epa.nsw.gov.au/](http://www.soe.epa.nsw.gov.au/)

# Appendix A



Image courtesy of Department of Planning and Environment. Bega River.

# History of groundwater management

## Our earliest water managers

The First Nations and Aboriginal people of NSW have been water managers, irrigators and farmers for millennia. They have rights and a moral obligation to care for water under their lore and customs. These obligations connect across communities and language groups, extending to downstream communities, throughout catchments and over connected surface water and groundwater systems. Since European occupation in 1788, First Nations and traditions of caring for Country have been generally excluded from water planning and management activities. This is changing: the NSW Government recognises Aboriginal rights and values and is committed to increasing access to and ownership of water for cultural and economic purposes.

## European occupation

From 1788 to the 1980s, management of groundwater resources was generally focused on identifying and developing the resource. This started with the first water supplies for Sydney, then expanded to the Great Artesian Basin and inland alluvial basins to support agricultural development. Under the *Water Act 1912*, the environment and Aboriginal interests were not formally recognised. Water licences for bores and wells for towns and stock and domestic and irrigation users were linked to land and were granted for a fixed term with no restriction on the volume that could be extracted.

By the 1970s, the rapid expansion of the irrigation industry, increasing competition for water resources and extended periods of drought were affecting the reliability of water supplies in inland NSW. Acknowledging that groundwater was a finite resource, from 1972 to 1983 new irrigation licences were issued based on the size of the area being irrigated. These licences had to be renewed every 5 years, but still had no volumetric limit on extraction (Gates & O’Keefe, 1997 Unpublished).

From 1984, all new high yield bores and wells (greater than 20 ML) were given a volumetric entitlement and old area-based licences were progressively converted. Volumetric entitlements were generally issued based on historical use, property area or bore capacity.

From 1986, comprehensive volumetric groundwater allocation policies were introduced throughout the state, and the issue of new licences was embargoed in some highly developed groundwater systems.

## The shift to sustainable management

In the 1990s, it was generally accepted that land and water management practices were contributing to natural resource degradation. We needed to change the way water was managed to protect communities, the environment and the economy. A shift to sustainable water resource management began in Australia with the Council of Australian Governments’ water reform agenda in 1994 and continued with the National Water Initiative 2004, the Commonwealth *Water Act 2007* and the Murray–Darling Basin Plan.

In NSW, the *Water Management Act 2000* (the Act) was a catalyst for significant changes to groundwater management.

The Act has at its heart the concept of ‘ecologically sustainable development’, with the protection of our water resources and their dependent ecosystems given the highest priority when sharing our water resources. The Act also provides for licensed water for Aboriginal cultural purposes.

Statutory water sharing plans developed under the Act since early 2000s have established limits on groundwater extractions. These limits are important to manage share our groundwater resources and there is a commitment to manage them so they can sustain important environmental, social, and cultural values as well as deliver economic outcomes for the people of NSW.

**Figure 24. Brief history of groundwater management in NSW**

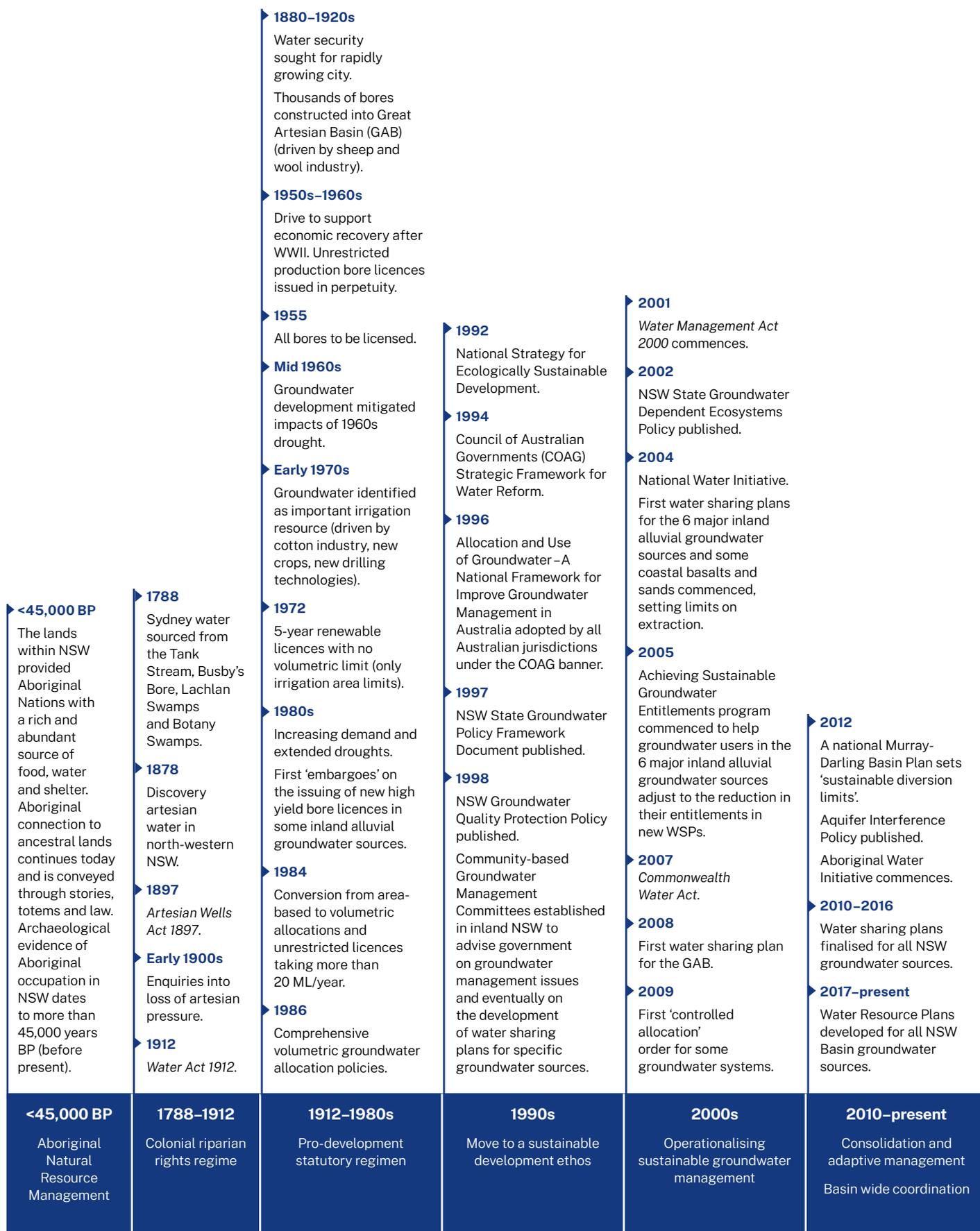




Image courtesy of Destination NSW.  
Bellbrook, Macleay Valley Coast.

# Appendix B



Image courtesy of Department of Planning and Environment. Train coal wagons, Namoi River.

# Glossary

Term	Definition
Aquifer	<i>Under the Water Management Act 2000</i> an aquifer is a geological structure or formation, or an artificial landfill that is permeated with water or is capable of being permeated with water. More generally, the term aquifer is commonly understood to mean a groundwater system that can yield useful volumes of groundwater. For the purposes of groundwater management in NSW the term 'aquifer' has the same meaning as 'groundwater system' and includes low yielding and saline systems.
Aquifer, confined	An aquifer which is bounded above and below by impermeable layers. Confined aquifers are typically under pressure so that when the aquifer is penetrated by a bore, the groundwater rises above the top of the confined aquifer.
Aquifer, unconfined	A groundwater system usually near the ground surface, which is in connection with atmospheric pressure and whose upper level is represented by the water table.
Aquifer interference activity	Under NSW water legislation, an aquifer interference activity is one involving any of the following: <ul style="list-style-type: none"> <li>• the penetration of an aquifer</li> <li>• the interference with water in an aquifer</li> <li>• the obstruction of the flow of water in an aquifer</li> <li>• the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations</li> <li>• the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.</li> </ul>
Artesian	Groundwater which rises above the surface of the ground under its own pressure by way of a spring or when accessed by a bore.
Australian Height Datum (AHD)	Elevation in metres above mean sea level.
Available water determination	A determination referred to in Section 59 of the <i>Water Management Act 2000</i> that defines a volume of water or the proportion of the share component (also known as an 'allocation') that will be credited to respective water accounts under specified categories of water access licence. Initial allocations are made on 1 July each year and, if not already fully allocated, may be incremented during the water year.
Basement (rock)	See Bedrock.
Basic landholder rights (BLR)	Domestic and stock rights, harvestable rights or Native Title rights.
Bedrock	A general term used for solid rock that underlies aquifers, soils or other unconsolidated material.
Beneficial use (category)	A general categorisation of groundwater uses based on water quality and the presence or absence of contaminants. Beneficial use is the equivalent to the 'environmental value' of water. <sup>57</sup>

57. As defined in, *Macro water sharing plans – the approach for groundwater*, NSW Office of Water, 2011.

Term	Definition
Bore (or well)	A small diameter hole (typically less than 500 mm) drilled into the ground.
Brackish water	Water with a salinity between 3,000 and 7,000 mg/L total dissolved solids.
Conceptual model	Documentation or schematic of the understanding of groundwater recharge and discharge processes, flow within a groundwater system, and the interaction of groundwater with surface water and groundwater dependent ecosystems.
Connected water sources	Water sources that have some level of hydraulic connection.
Consumptive use	Use of water for beneficial and consumptive purposes including irrigation, industry, mining, urban and stock and domestic use.
Development (of a groundwater resource)	The commencement of extraction of significant volumes of water from a water source.
Dewatering	Process of removing groundwater which ensures construction work can occur safely, keeps water from seeping into the site which could affect engineering, and protects the ongoing integrity of the structure and surrounding area.
Discharge	Flow of groundwater from a groundwater source.
Drawdown	The difference between groundwater level/pressure before take and that during take.
Environmental Value	Particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of contamination, waste discharges and deposits. <sup>58</sup>
Extraction limit	See long term average annual extraction limit (LTAAEL).
Fractured rock	Rocks with fractures, joints, bedding planes and cavities in the rock mass.
Groundwater Dependent Ecosystem (GDE)	Ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. <sup>59</sup>
Groundwater flow	The migration of water in aquifers and aquitards.
Groundwater level	The level of groundwater in an aquifer, typically measured in a water bore. In the case of an unconfined aquifer, the groundwater level is the water table level.
Groundwater recharge	The addition of water into a groundwater system by infiltration, flow or injection from sources such as rainfall, overland flow, adjacent groundwater sources, irrigation or surface water sources.

58. As defined in *Guidelines for Groundwater Quality Protection in Australia 2013*, published by the National Water Quality Management Strategy.

59. Kuginis L., Dabovic, J., Byrne, G., Raine, A., and Hemakumara, H 2016, *Methods for the identification of high probability groundwater dependent vegetation ecosystems*. Department of Primary Industries Water, Sydney, NSW.

Term	Definition
Groundwater system	Any type of saturated sequence of rocks or sediments that is in hydraulic connection. The characteristics can range from low yielding and high salinity water to high yielding and low salinity water.
Hydraulic Conductivity	The capacity of a porous medium to transmit water. Measured in meters/day.
Hydraulic connection	A path or conduit allowing fluids to be connected. The degree to which a groundwater system can respond hydraulically to changes in hydraulic head.
Hydrogeology	The branch of geology that relates to the occurrence, distribution and processes of groundwater.
Hydrograph	A plot of water data over time.
Infiltration	The movement of water from the land surface into the ground.
Long term average annual extraction limit (LTAAEL)	The long term average volume of water (expressed in megalitres per year) in a water source available to be lawfully extracted or otherwise taken.
Make good provisions (in reference to a water supply work)	The requirement to ensure third parties have access to an equivalent supply of water through enhanced infrastructure or other means for example deepening an existing bore, funding extra pumping costs or constructing a new pipeline or bore.
Management zone	A defined area within a water source where a particular set of water sharing rules applies.
Minimal impact considerations	Factors that need to be assessed to determine the potential effect of aquifer interference activities on groundwater and its dependent assets.
Monitoring bore	A specially constructed bore used to measure groundwater level or pressure and groundwater quality at a specific depth. Not intended to supply water.
Ongoing take	The take of groundwater that occurs after part or all of the principal activity has ceased. For example extraction of groundwater (active take) entering completed structures, groundwater filling abandoned underground workings (passive take) or the evaporation of water (passive take) from an abandoned excavation that has filled with groundwater.
Outcrop	Rocks which are exposed at the land surface.
Permeability	The capacity of earth materials to transmit a fluid.
Piezometric or Potentiometric head	The pressure or hydraulic head of the groundwater at a particular depth in the ground. In unconfined aquifers this is the same as the water table.
Porous rock	Consolidated sedimentary rock containing voids, pores or other openings in the rock (such as joints, cleats and/or fractures).

Term	Definition
Pre-development	Prior to development of a groundwater resource.
Recharge	The addition of water into a groundwater system by infiltration, flow or injection from sources such as rainfall, overland flow, adjacent groundwater sources, irrigation, or surface water sources.
Recovery	The rise of groundwater levels or pressures after groundwater take has ceased. Where water is being added, recovery will be a fall.
Regulated river	River on which a licensed entitlement regime exists with centralised allocation, and from which orders may be placed for upstream release of a licensed allocation from a dam.
Salinity	The concentration of dissolved minerals in water, usually expressed in EC units or milligrams of total dissolved solids per litre.
Saturated zone	Area below the water table where all soil spaces, pores, fractures and voids are filled with water.
Share component	An entitlement to water specified on an access licence, expressed as a unit share or for specific purpose licences a volume in megalitres (e.g. local water utility, major water utility and domestic and stock).
Stygofauna	Aquatic animals that live in groundwater systems.
Sustainable Diversion Limits	The volume of water that can be taken from a Sustainable Diversion Limit resource unit as defined under the <i>Murray–Darling Basin Plan 2012</i> .
Unassigned water	Groundwater in a water source that is not allocated because current water requirements (including all licensed volumes and water to meet basic landholder rights) are less than the extraction limit.
Unregulated river	A river where there is no entitlement system at all or where there is an entitlement system that does not allow orders to be placed for upstream release of a licensed allocation.
Water access entitlement/licence (WAL)	A perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant WRP or WSP.
Water balance	A calculation of all water entering and leaving a system.
Water bore	A bore means any work constructed: <ul style="list-style-type: none"> <li>• for the purpose of finding an aquifer, or</li> <li>• for the purpose of testing the production capacity or water quality of an aquifer, or</li> <li>• for the purpose of taking water from, or discharging anything into, an aquifer, or</li> <li>• for any other purpose prescribed by the regulations, being a bore that has been artificially created, widened, lengthened or modified by means of drilling, boring, augering, digging or jetting (<i>Water Management Act 2000</i>).</li> </ul>
Water resource	All natural water (surface water or groundwater) and alternative water sources (such as recycled or desalinated water) that has not yet been abstracted or used.

Term	Definition
Water resource plan (WRP)	A plan made under the Commonwealth <i>Water Act 2007</i> that outlines how a particular area of the Murray–Darling Basin’s water resources will be managed to be consistent with the <i>Murray–Darling Basin Plan 2012</i> . <sup>60</sup>
Water sharing plan (WSP)	A plan made under the <i>Water Management Act 2000</i> that set out the rules for sharing water between the environment and water users within whole or part of a water management area or water source.
Water source	EMM: Under NSW water legislation, water source means the whole or any part of: <ul style="list-style-type: none"> <li>• one or more rivers, lakes or estuaries</li> <li>• one or more places where water occurs on or below the surface of the ground (including overland flow water flowing over or lying there for the time being), and includes the coastal waters of the State (<i>Water Management Act 2000</i>).</li> </ul>
Water table	Upper surface of groundwater at atmospheric pressure, below which the ground is saturated.
Water year	Twelve month period from 1 July to 30 June.
Well	A large diameter hole (typically greater than 500 mm) drilled, excavated or dug into the ground.
Yield	The amount of water that can be supplied by a water supply works over a specific period.



Image courtesy of Department of Primary Industries. Flood irrigation in Leeton District.

60. [www.mdba.gov.au/basin-plan-roll-out/water-resource-plans](http://www.mdba.gov.au/basin-plan-roll-out/water-resource-plans) 21/03/17

