



Water Resources Management in Australia

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NSW Department of Planning, Industry and Environment

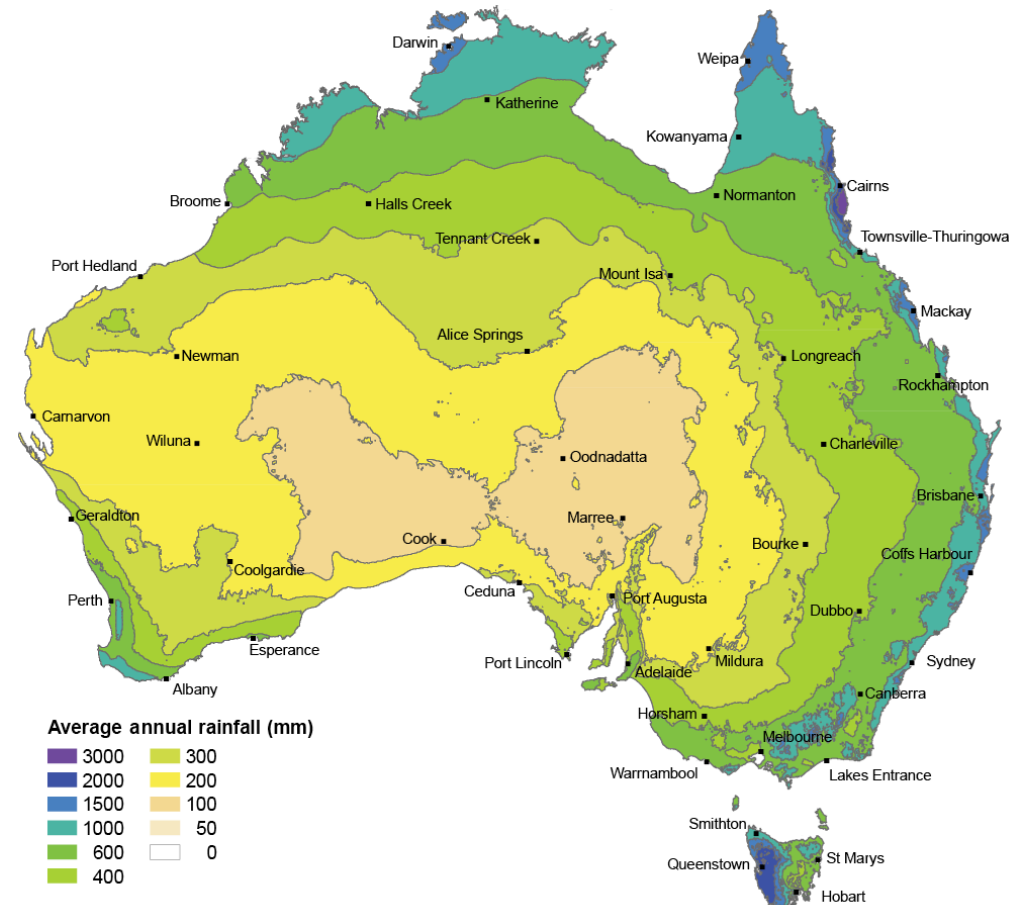
03 November 2019

Content

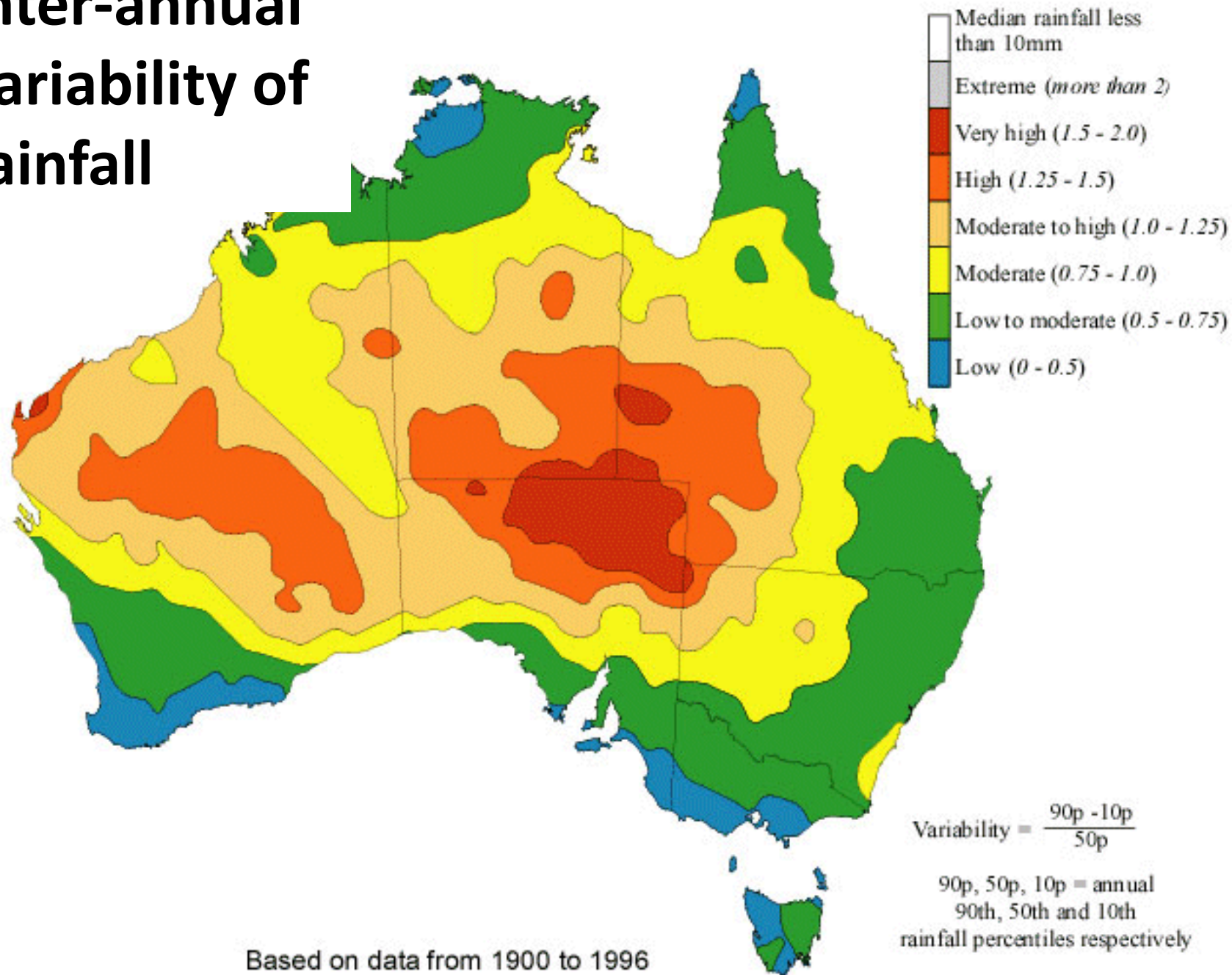
- Overview of water resources in Australia
- Water management in NSW
- NSW Drought Management Approach
- Role of Modelling in water management

Australian Climate and Hydrology

- Driest continent after Antarctica
- Average annual rainfall: 430 mm (varies from 100 - 3000 mm)
- Inter and intra annual variability of rainfall is very high
- Most is lost through evapotranspiration
- Annual average runoff coefficient is ~12%



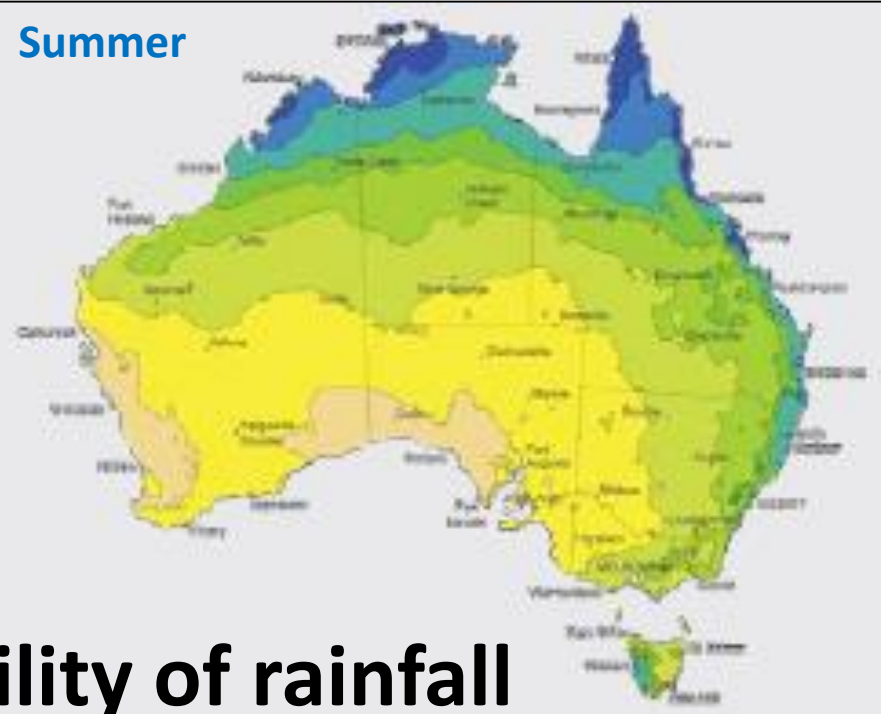
Inter-annual variability of rainfall



Spring



Summer

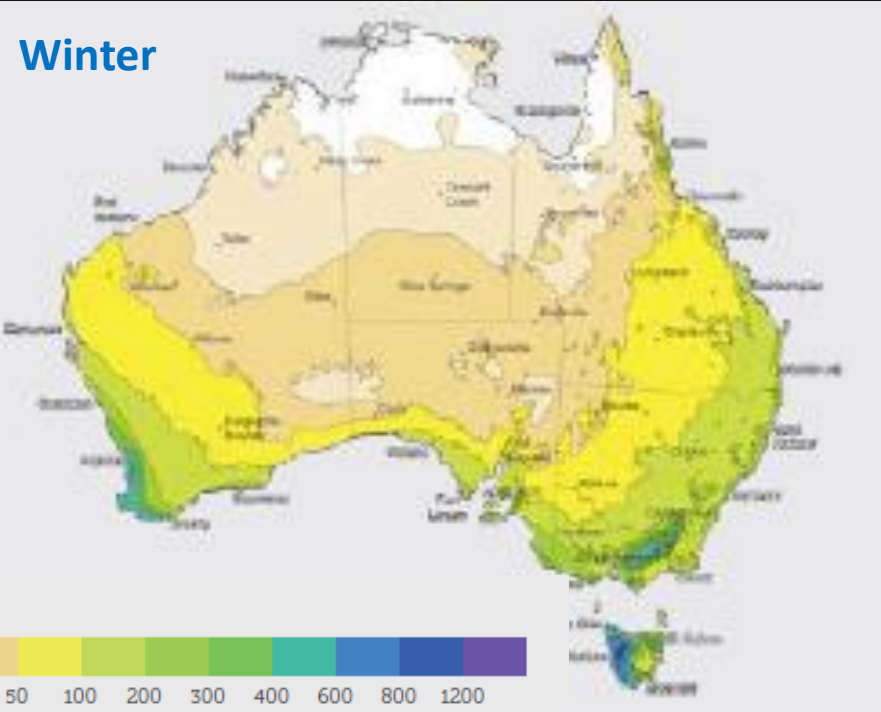


Seasonal variability of rainfall

Autumn



Winter



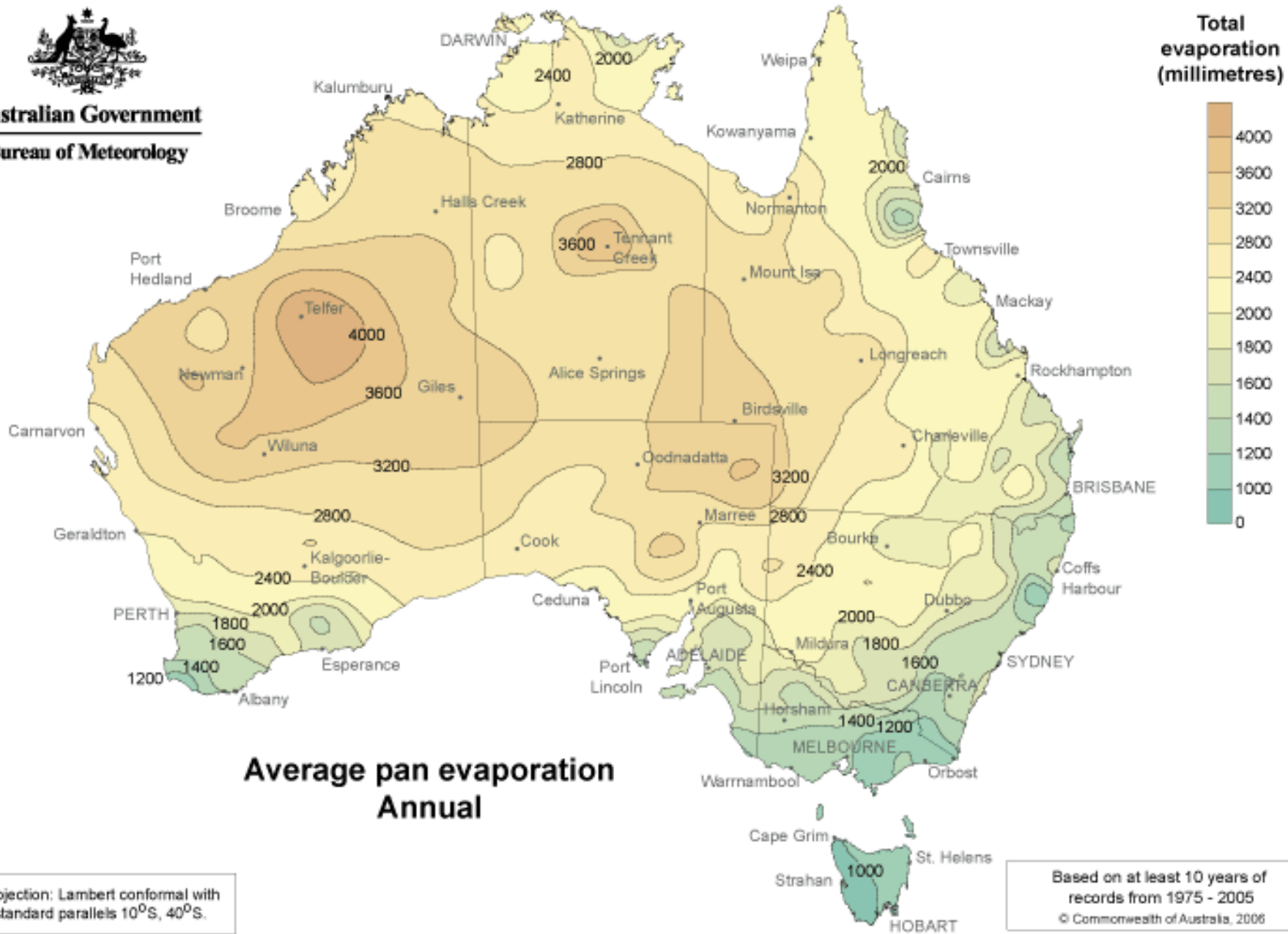
Millimetres



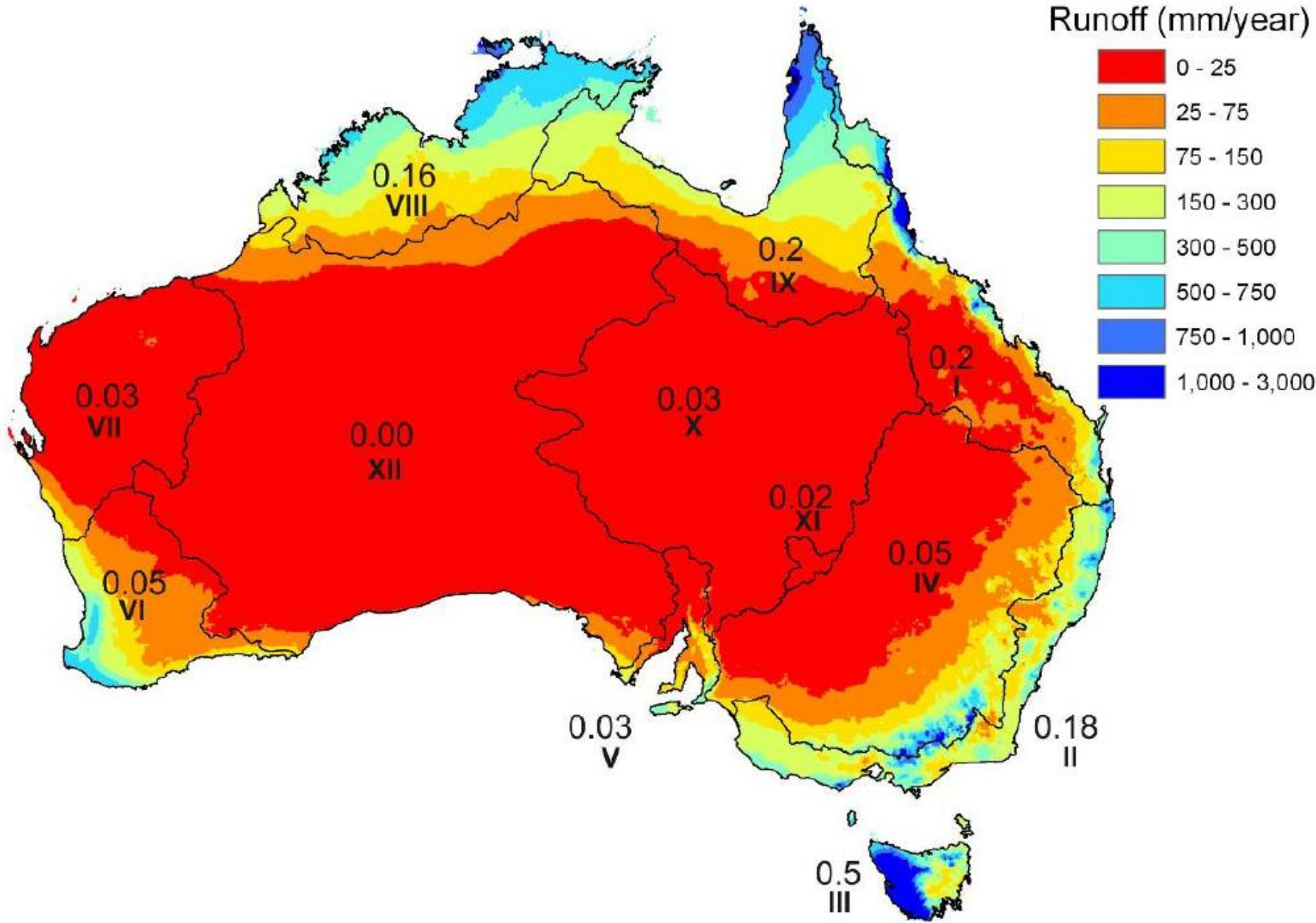
Average pan evaporation



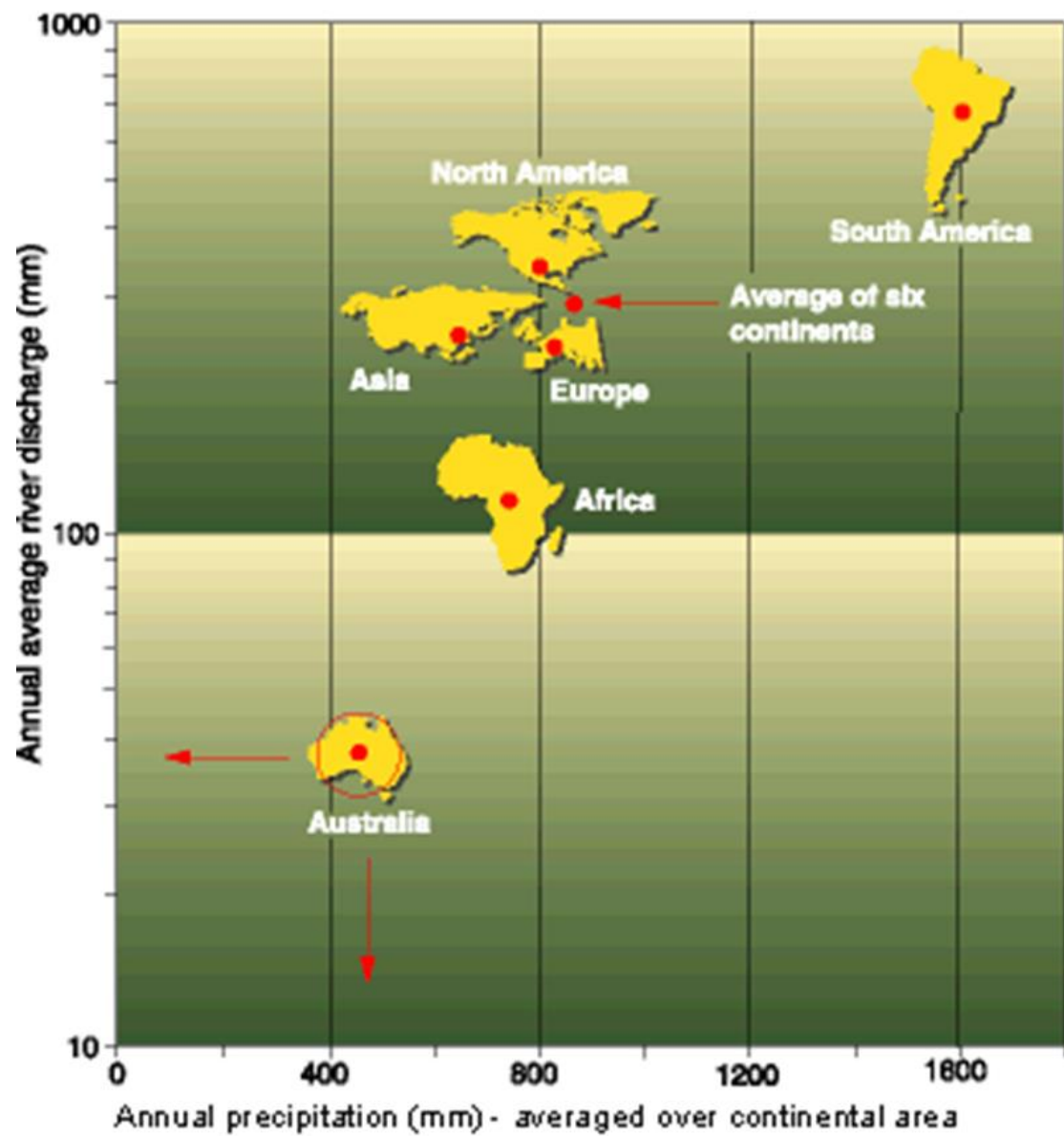
Australian Government
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Average annual runoff and runoff coefficients

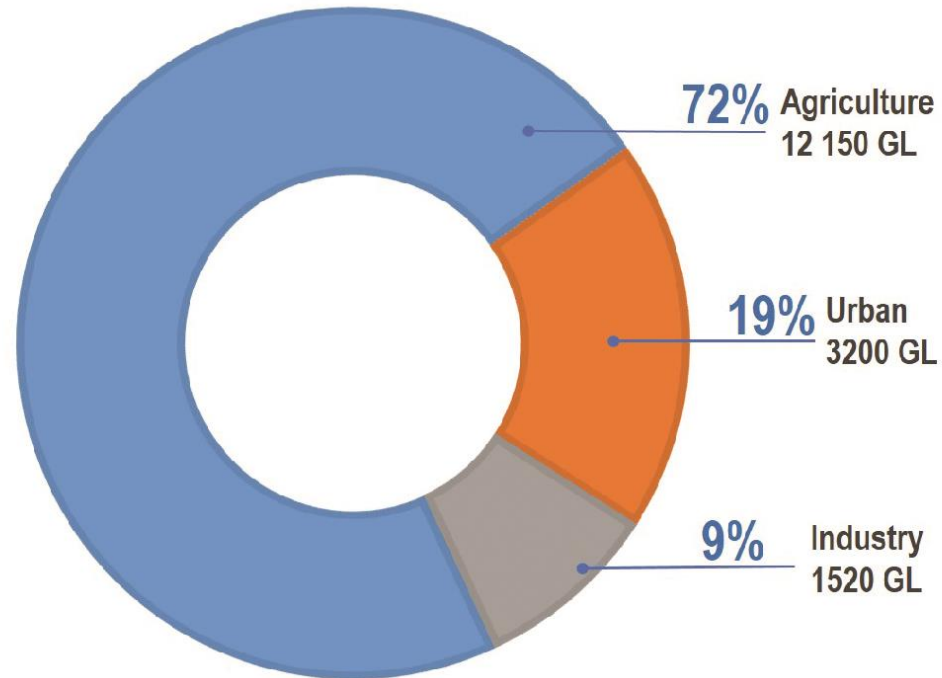


River Discharge by Continent



Water Usages in Australia

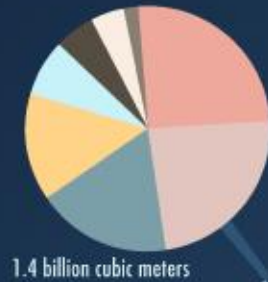
- water management infrastructure capacity of above 80,000 GL to distribute water across time and space.
- States and territories have direct role in managing water resources for both consumptive and environmental purposes.
- Agriculture is single largest water-consuming industry, usages: 9400–12,800 GL/yr



Total bulk water abstractions by category in 2017–18

Australian Water Consumption

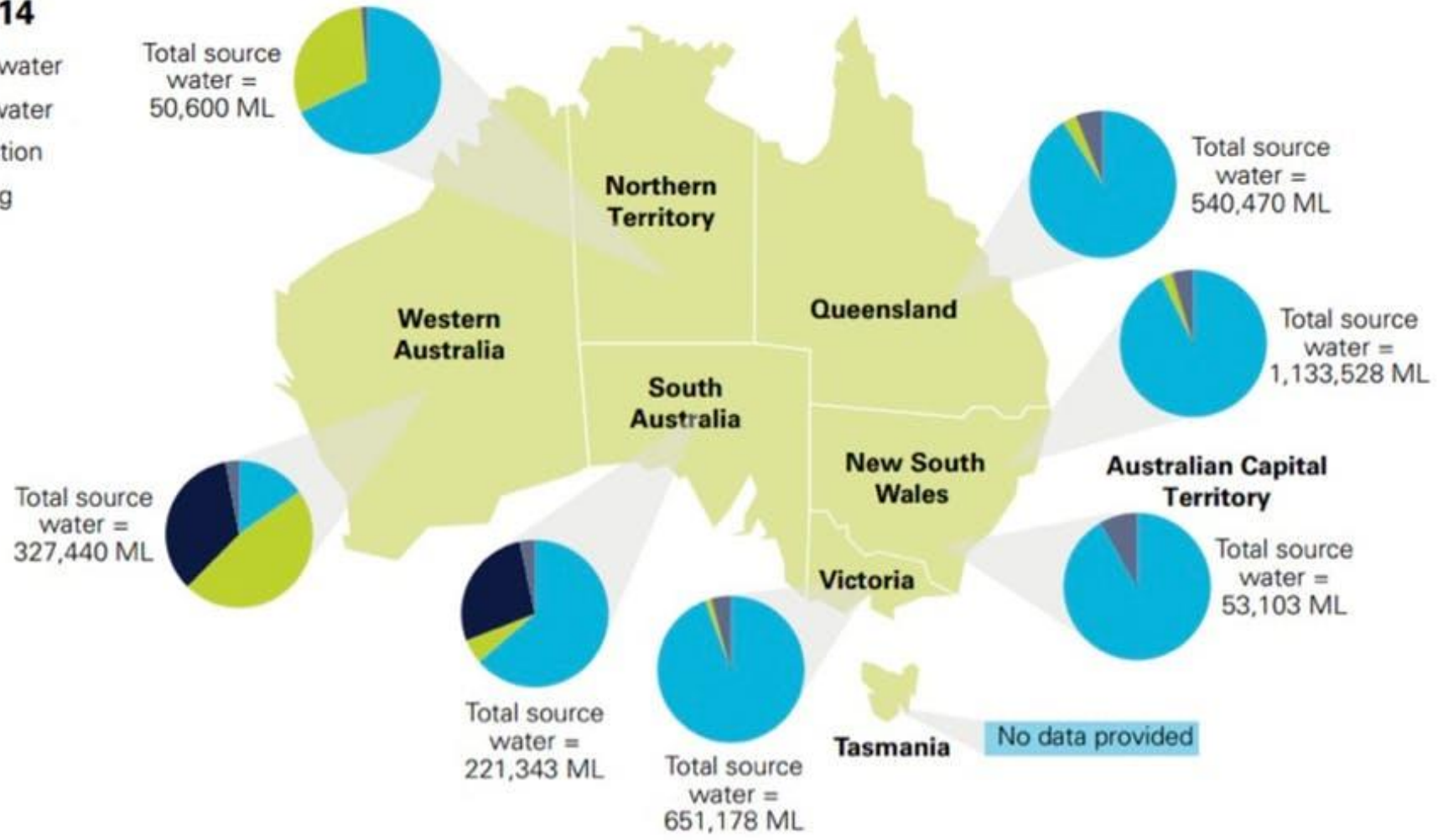
annual use by state and territory



Sources of Water in Australia

2013-14

- Surface water
- Groundwater
- Desalination
- Recycling



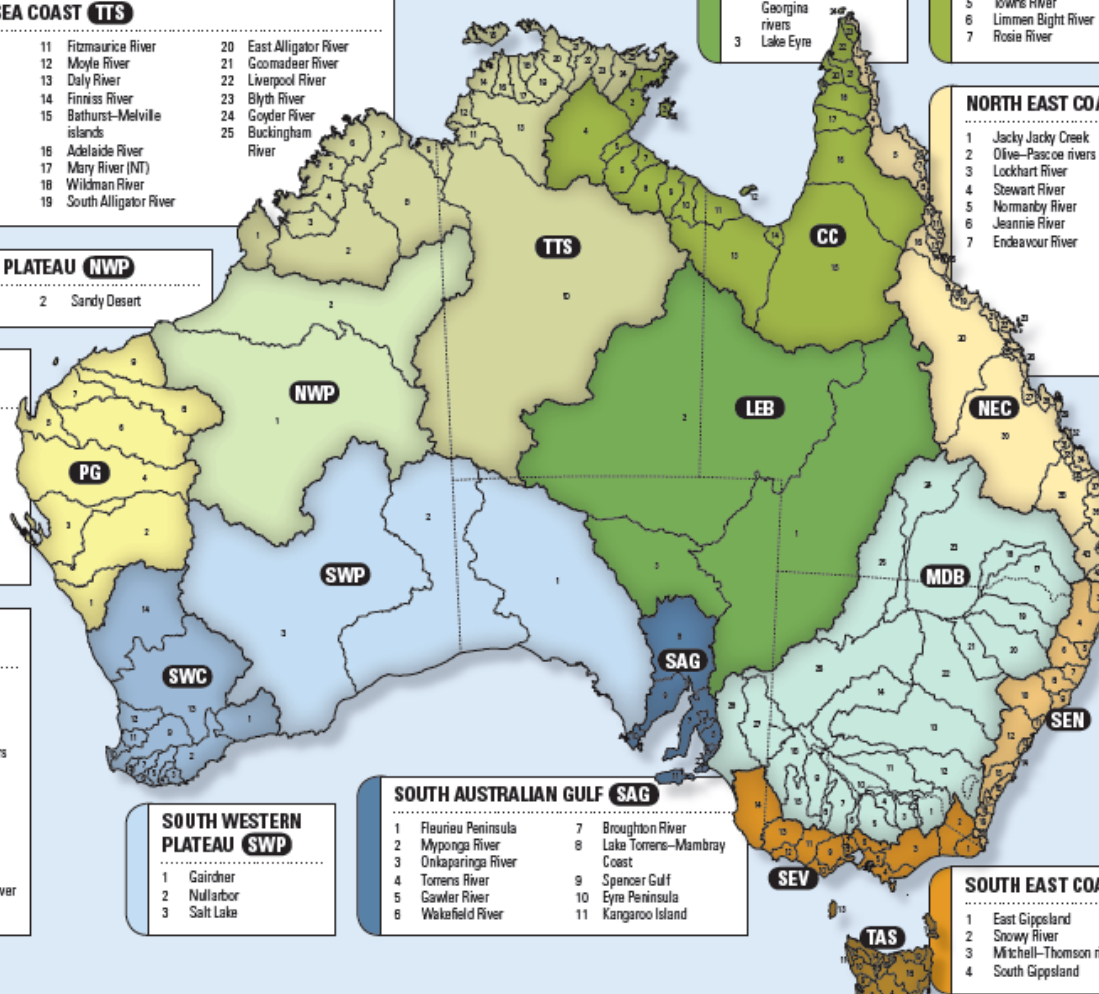
Major Drainage divisions



Australian Government
Bureau of Meteorology

Australian Hydrological Geospatial Fabric (Geofabric)

Topographic Drainage Divisions and River Regions



TANAMI-TIMOR SEA COAST (TTS)

- | | | |
|------------------------|------------------------------|-------------------------|
| 1 Cape Leveque Coast | 11 Fitzmaurice River | 20 East Alligator River |
| 2 Fitzroy River (WA) | 12 Moyle River | 21 Goomadeer River |
| 3 Lennard River | 13 Daly River | 22 Liverpool River |
| 4 Idell River | 14 Finnis River | 23 Blyth River |
| 5 Prince Regent River | 15 Bathurst-Melville islands | 24 Goyder River |
| 6 King Edward River | 16 Adelaide River | 25 Buckingham River |
| 7 Drysdale River | 17 Mary River (NT) | |
| 8 Ord-Pentecost rivers | 18 Wildman River | |
| 9 Keep River | 19 South Alligator River | |
| 10 Victoria River-Wiso | | |

NORTH WESTERN PLATEAU (NWP)

- | | |
|-----------------|----------------|
| 1 De Grey River | 2 Sandy Desert |
|-----------------|----------------|

PILBARA-GASCOYNE (PG)

- | |
|----------------------|
| 1 Greenough River |
| 2 Murchison River |
| 3 Woosamel River |
| 4 Gascoyne River |
| 5 Yarnamua River |
| 6 Ashburton River |
| 7 Onslow Coast |
| 8 Fortescue River |
| 9 Port Hedland Coast |

SOUTH WEST COAST (SWC)

- | |
|--------------------------|
| 1 Esperance Coast |
| 2 Albany Coast |
| 3 Denmark River |
| 4 Kent River |
| 5 Frankland-Deep rivers |
| 6 Shannon River |
| 7 Warren River |
| 8 Donnelly River |
| 9 Blackwood River |
| 10 Busselton Coast |
| 11 Collie-Preston rivers |
| 12 Murray River (WA) |
| 13 Swan Coast-Avon River |
| 14 Moore-Hill rivers |

SOUTH WESTERN PLATEAU (SWP)

- | |
|-------------|
| 1 Gairdner |
| 2 Nullarbor |
| 3 Salt Lake |

SOUTH AUSTRALIAN GULF (SAG)

- | | |
|----------------------|------------------------------|
| 1 Fleurieu Peninsula | 7 Broughton River |
| 2 Myponga River | 8 Lake Torrens-Mambray Coast |
| 3 Onkaparinga River | 9 Spencer Gulf |
| 4 Torrens River | 10 Eyre Peninsula |
| 5 Gawler River | 11 Kangaroo Island |
| 6 Wakefield River | |

LAKE EYRE BASIN (LEB)

- | |
|------------------------------|
| 1 Cooper Creek-Bulloo River |
| 2 Diamantina-Georgina rivers |
| 3 Lake Eyre |

CARPENTARIA COAST (CC)

- | | | | |
|----------------------|--------------------------------|----------------------------------|--------------------------|
| 1 Koolstong River | 8 McArthur River | 14 Morning Inlet | 20 Embley River |
| 2 Walker River | 9 Robinson River | 15 Flinders-Norman rivers | 21 Wenlock River |
| 3 Gooite Eycland | 10 Calvert River | 16 Mitchell-Coleman rivers (Old) | 22 Ducie River |
| 4 Roper River | 11 Settlement Creek | | 23 Jardine River |
| 5 Towns River | 12 Mornington Island | 17 Holroyd River | 24 Torres Strait Islands |
| 6 Limmen Bight River | 13 Nicholson-Leichhardt rivers | 18 Archer-Watson rivers | |
| 7 Rosie River | | 19 Ward River | |

NORTH EAST COAST (NEC)

- | | | | |
|-----------------------|----------------------------|------------------------|------------------------|
| 1 Jacky Jacky Creek | 8 Daintree River | 21 Don River | 34 Baffle Creek |
| 2 Olive-Pascoe rivers | 9 Mossman River | 22 Proserpine River | 35 Kolan River |
| 3 Lockhart River | 10 Barron River | 23 Whitsunday Islands | 36 Burnett River |
| 4 Stewart River | 11 Mulgrave-Russell rivers | 24 O'Connell River | 37 Burrum River |
| 5 Normanby River | 12 Johnstone River | 25 Pioneer River | 38 Mary River (Old) |
| 6 Jeannie River | 13 Tully-Murray rivers | 26 Plane Creek | 39 Fraser Island |
| 7 Endeavour River | 14 Cardwell Coast | 27 Styx River | 40 Noosa River |
| | 15 Hinchinbrook Island | 28 Shoalwater Creek | 41 Maroochy River |
| | 16 Herbert River | 29 Water Park Creek | 42 Pine River |
| | 17 Black River | 30 Fitzroy River (Old) | 43 Brisbane River |
| | 18 Ross River | 31 Calliope River | 44 Stradbroke Island |
| | 19 Haughton River | 32 Curtis Island | 45 Logan-Albert rivers |
| | 20 Burdekin River | 33 Boyne River | 46 South Coast |

MURRAY-DARLING BASIN (MDB)

- | | | |
|--------------------------|----------------------------|----------------------------|
| 1 Upper Murray River | 11 Billabong-Yanco creeks | 20 Namoi River |
| 2 Kiewa River | 12 Murrumbidgee River | 21 Castlereagh River |
| 3 Owens River | 13 Lachlan River | 22 Macquarie-Bogan rivers |
| 4 Broken River | 14 Benanee-Willandra Creek | 23 Condamine-Culgoe rivers |
| 5 Goulburn River | 15 Wimmera River | 24 Warrago River |
| 6 Campaspe River | 16 Loddon River | 25 Paroo River |
| 7 Loddon River | 17 Border rivers | 26 Darling River |
| 8 Avoca River | 18 Avon River-Tyrell Lake | 27 Lower Mallee |
| 9 Avon River-Tyrell Lake | 19 Gwydir River | 28 Lower Murray River |

SOUTH EAST COAST (NSW) (SEN)

- | | | |
|-------------------|-------------------------------|---------------------------|
| 1 Tweed River | 9 Kanahva River | 15 Shoalhaven River |
| 2 Brunswick River | 10 Hunter River | 16 Clyde River-Jarvis Bay |
| 3 Richmond River | 11 Macquarie-Tuggerah lakes | 17 Murrumbidgee River |
| 4 Clarence River | 12 Hawkesbury River | 18 Turross River |
| 5 Bellingen River | 13 Sydney Coast-Georges River | 19 Bega River |
| 6 Macleay River | 14 Wollongong Coast | 20 Towamba River |
| 7 Hastings River | | |
| 8 Manning River | | |

SOUTH EAST COAST (VICTORIA) (SEV)

- | | | | |
|---------------------------|-------------------|---------------------------------|--------------------|
| 1 East Gippsland | 5 Bunyip River | 9 Banwon River-Lake Corangamite | 12 Portland Coast |
| 2 Snowy River | 6 Yarra River | 10 Otway Coast | 13 Glenelg River |
| 3 Mitchell-Thomson rivers | 7 Werribee River | 11 Hopkins River | 14 Millicent Coast |
| 4 South Gippsland | 8 Moorabool River | | |

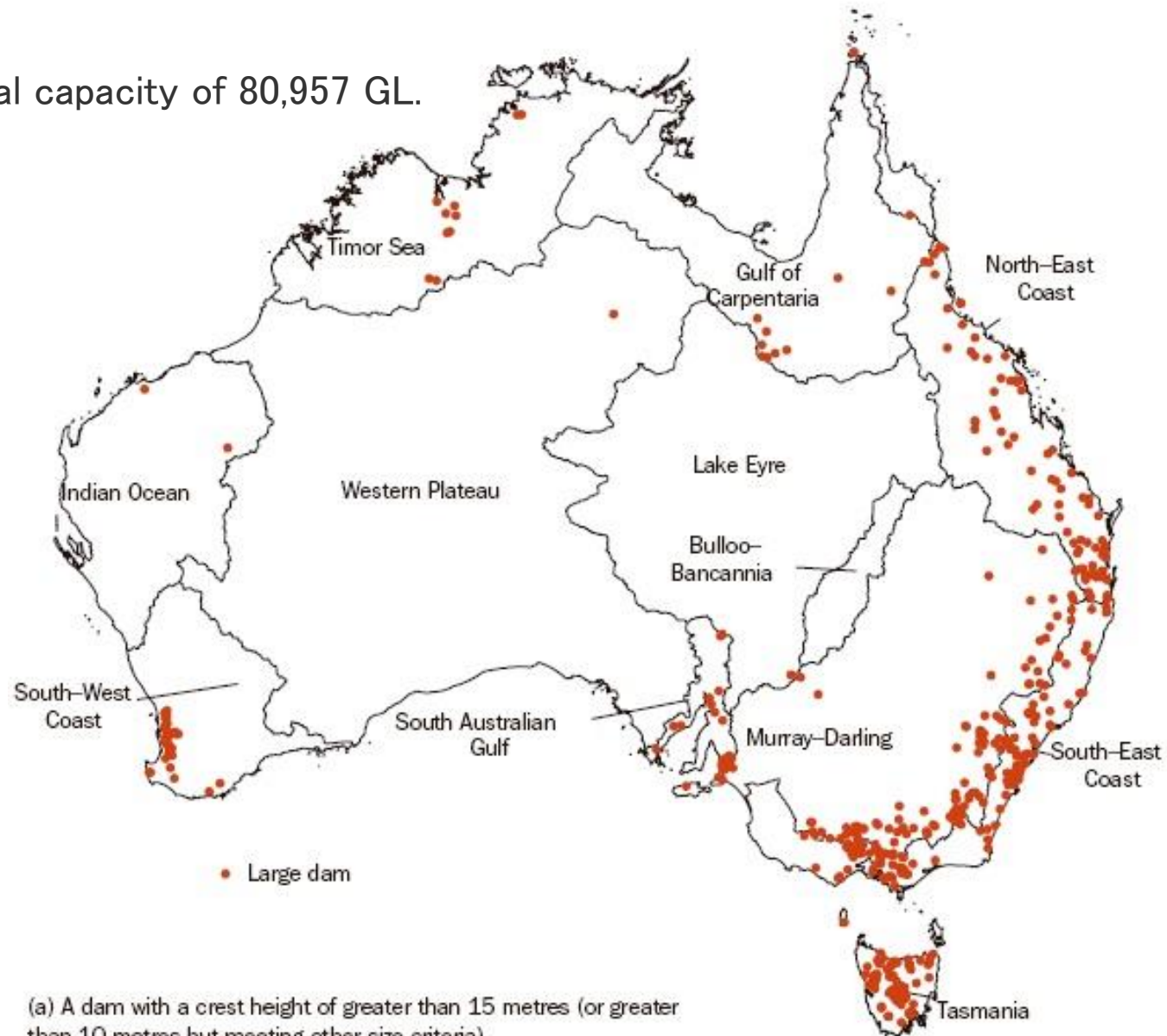
TASMANIA (TAS)

- | | | | | |
|--------------------------------|--------------------|---------------------|--------------------------|----------------------------|
| 1 Flinders-Cape Barren islands | 4 Derwent River | 8 Gordon River | 12 Arthur River | 16 Marsay River |
| 2 East Coast | 5 Kingston Coast | 9 King-Henty rivers | 13 King Island | 17 Rubicon River |
| 3 Coal River | 6 Huon River | 10 Peman River | 14 Smithton-Burnie Coast | 18 Tamar River |
| | 7 South-West Coast | 11 Sandy Cape Coast | 15 Forth River | 19 Piper-Ringarooma rivers |



Large Storages in Australia

>300 storages with a total capacity of 80,957 GL.



(a) A dam with a crest height of greater than 15 metres (or greater than 10 metres but meeting other size criteria).

Source: Geoscience Australia.

Desalination plants in Major Urban Centres

Urban centre	Built	Approximate capacity (GL/year)	Supply in 2017–18		Comments on plant operation
			(GL)	(% of total urban water sourced) ¹⁶	
Perth: Seawater Desalination Plant	2006	45	149	52	Both desalination plants were running close to their capacity in 2017–18 and supply was similar to that of the previous year.
Perth: Southern Seawater Desalination Plant	2013	100			
Adelaide	2012	100	4.3	3	In 2017–18 the desalination supply was similar to that of previous year.
Melbourne	2012	150	15	3	Desalinated water was ordered for the first time in 2016–17. The contribution from desalination declined in 2017–18.
Sydney	2010	90	0	0	The plant operates when the storage capacity falls below 60 per cent. ¹⁷ No desalinated water has been used to meet requirements since 2012.
Gold Coast	2009	49	2.8	1	Operates in a 'hot' standby mode.

15 www.awa.asn.au

16 www.bom.gov.au/water/nwa/2018

17 www.sydneydesal.com.au

- Current storage level for Sydney Supply: 47.5%
- Sydney Desal plant re-started operation in January 2019

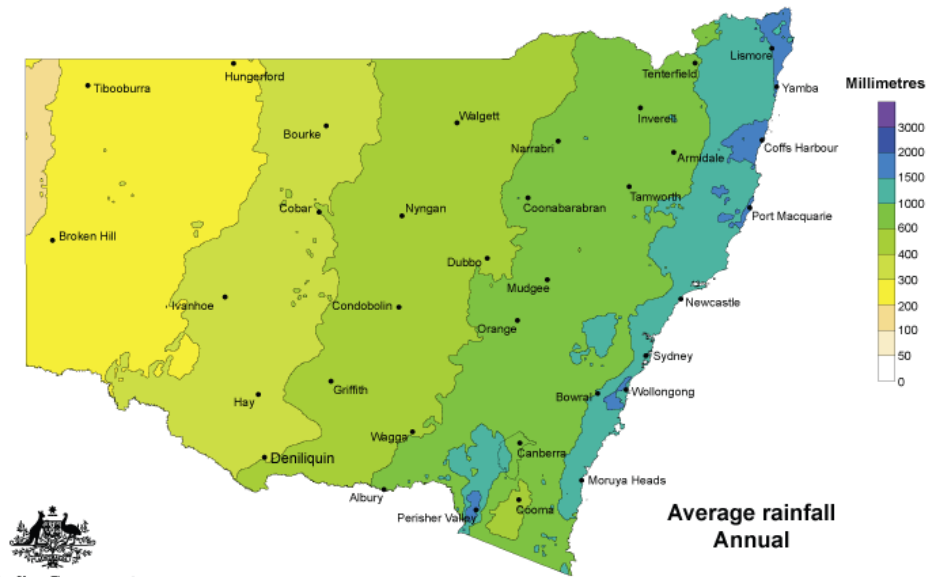




Water Management in NSW

NSW – Climate and Water Resource

- NSW – Sub tropical region with four distinct seasons
- Extreme Temperature Variability
 - (Historical 49°C to -23° C)
- Extreme Rainfall Variability
 - North West: 80 mm (Avg.)
 - East: 700- 1400 mm (Avg.)
- 42 Major Dams




Australian Government
Bureau of Meteorology

Based on a standard 30-year climatology (1961-1990)
© Commonwealth of Australia, 2010



Water Resources Management in NSW

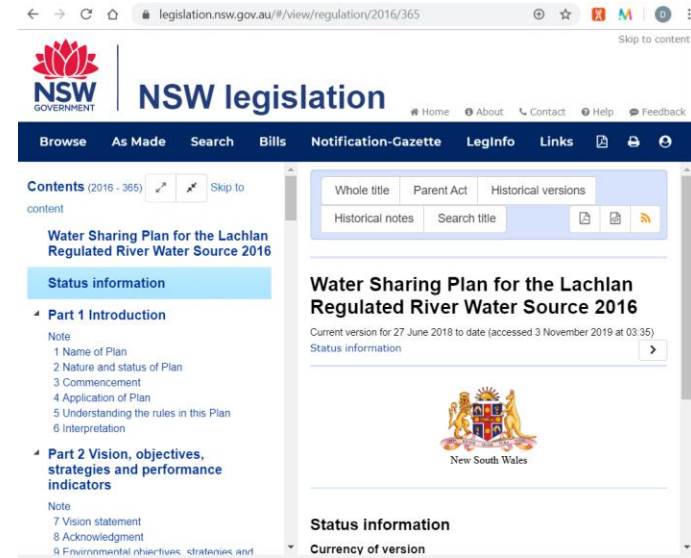
- NSW water resources are managed through planning, policy and regulation under the **Water Management Act 2000** of NSW.

Water Sharing Plans

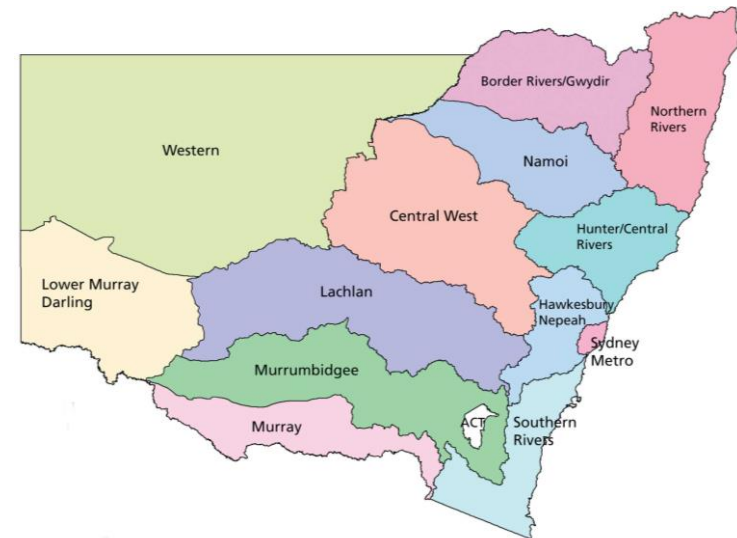
- Define the rules for sharing water resources of each Valley between consumptive users and environment.
- A statutory obligation under the Water Management Act 2000.
- 1st WSP in 2004, since then 80 WSPs developed for rivers and GW.
- Currently, there are 56 WSPs in force.

Water Resource Plans

- A key requirement of the Basin Plan 2012 under **Water Act 2007**.
- 20 WRPs are being developed in NSW.



The screenshot shows the NSW legislation website for the 'Water Sharing Plan for the Lachlan Regulated River Water Source 2016'. The page includes a navigation bar with 'Browse', 'As Made', 'Search', 'Bills', 'Notification-Gazette', 'LegInfo', and 'Links'. The main content area displays the title, a 'Status information' section, and a table of contents. The table of contents lists 'Part 1 Introduction' and 'Part 2 Vision, objectives, strategies and performance indicators'. The 'Status information' section indicates the current version is for 27 June 2018 to date, accessed on 3 November 2019 at 03:35. The NSW Government logo is visible at the bottom of the page.



Water Management Agencies in NSW

Agencies responsible for developing and implementing the regulatory framework for water management in regional (&metro) NSW

- **Department of Planning, Industry and Environment**
- **WaterNSW (and metro water agencies for Sydney and Hunter regions)**
- **National Resources Access Regulator**

Goal:

- To achieve economic social, cultural and environmental outcomes for the people of NSW.

Involved in:

- the design of the water market,
- NSW water management rules,
- operating the river system and other water delivery systems within NSW, and
- enforcing compliance with NSW water management rules

**Department of
Planning, Industry
and Environment**

Government agency

WaterNSW
Independent
state-owned corporation

**Natural Resources
Access Regulator**
Independent regulator

Makes the rules

Implements the rules

Enforces the rules

Developing regulatory
framework, plans and
rules

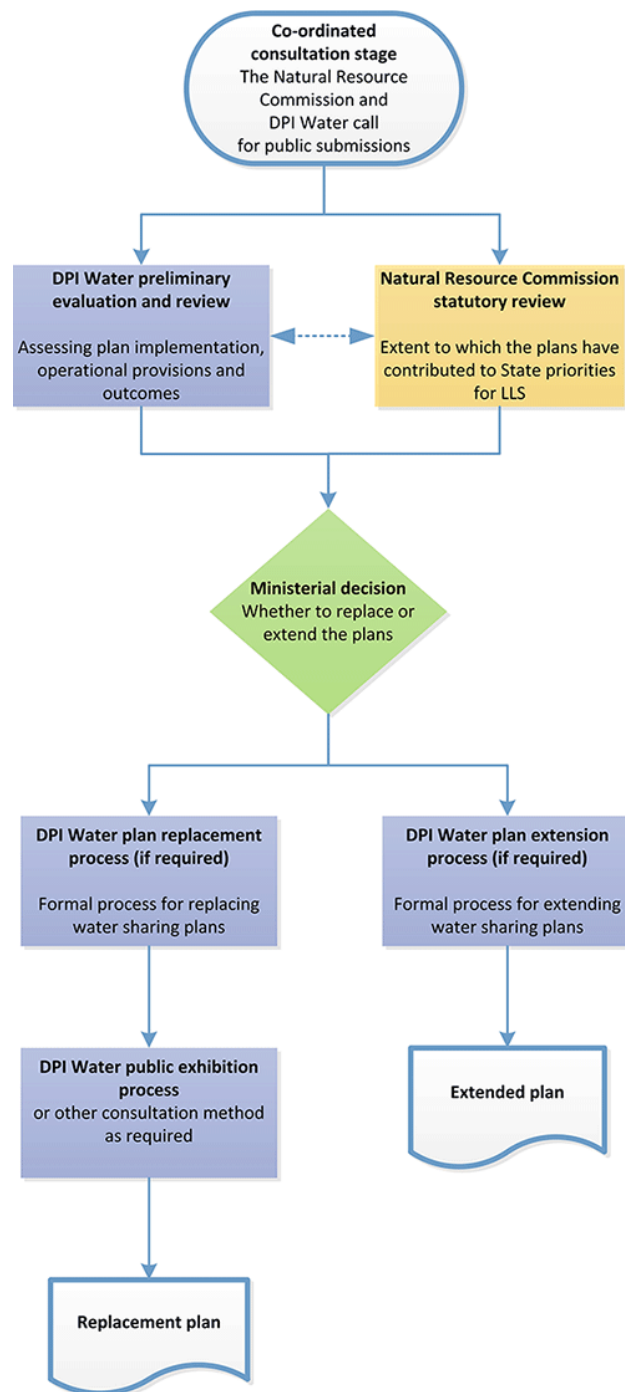
Processing customer
licensing applications
and renewals and
providing information
services

Enforcing compliance
and providing
compliance information
services

Water users and the general public
Work within the rules

WSP Review process

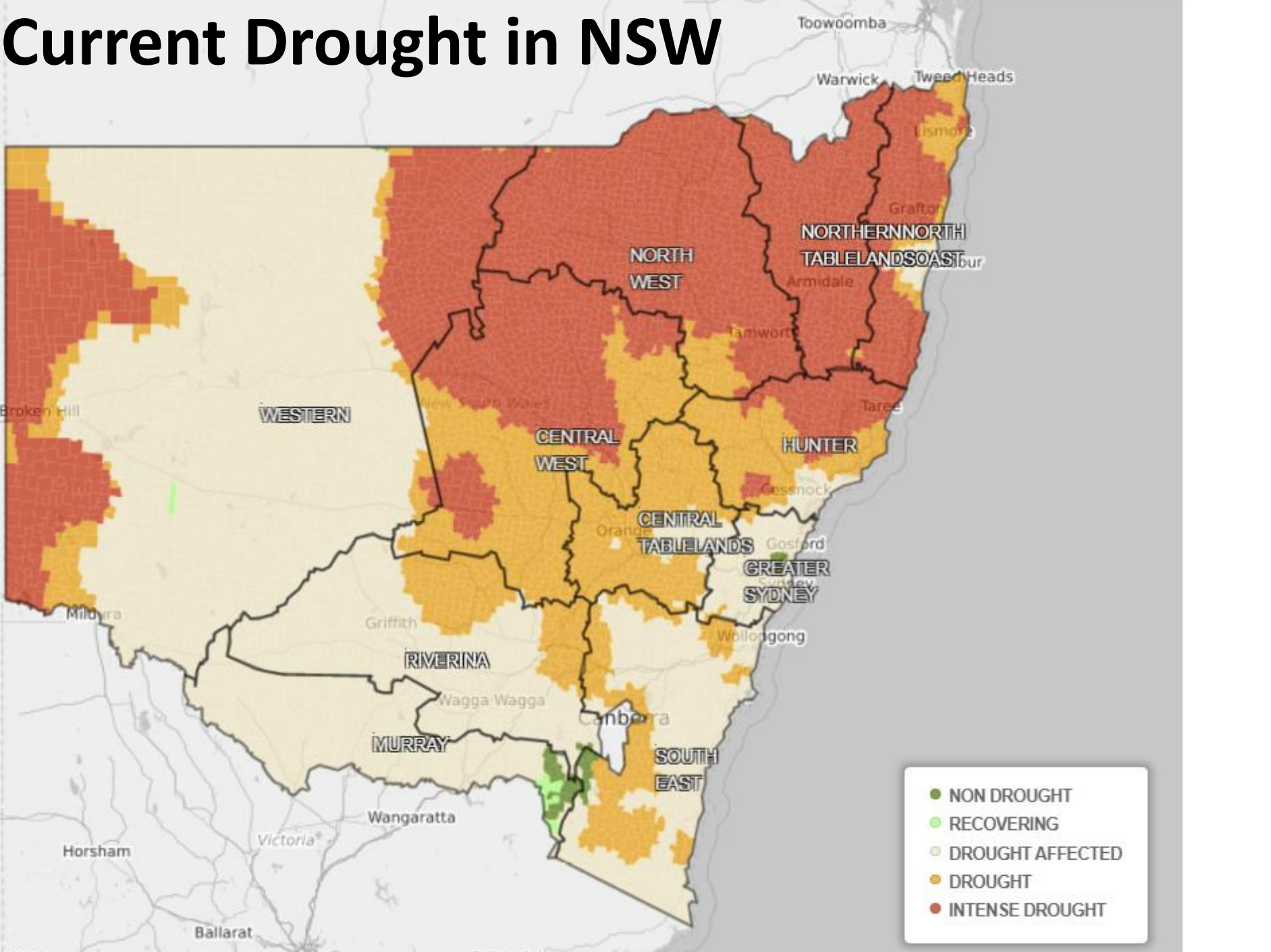
- NSW water sharing plans are valid for 10 years from their commencing date.
- Amendments to water sharing plans are made throughout their life to ensure they comply with changing legislation and to facilitate their implementation.
- Near the end of the 10-yr term, a formal review is completed by to identify the necessary alterations to deliver better outcomes for all water users, including the environment.





Drought Management in NSW

Current Drought in NSW

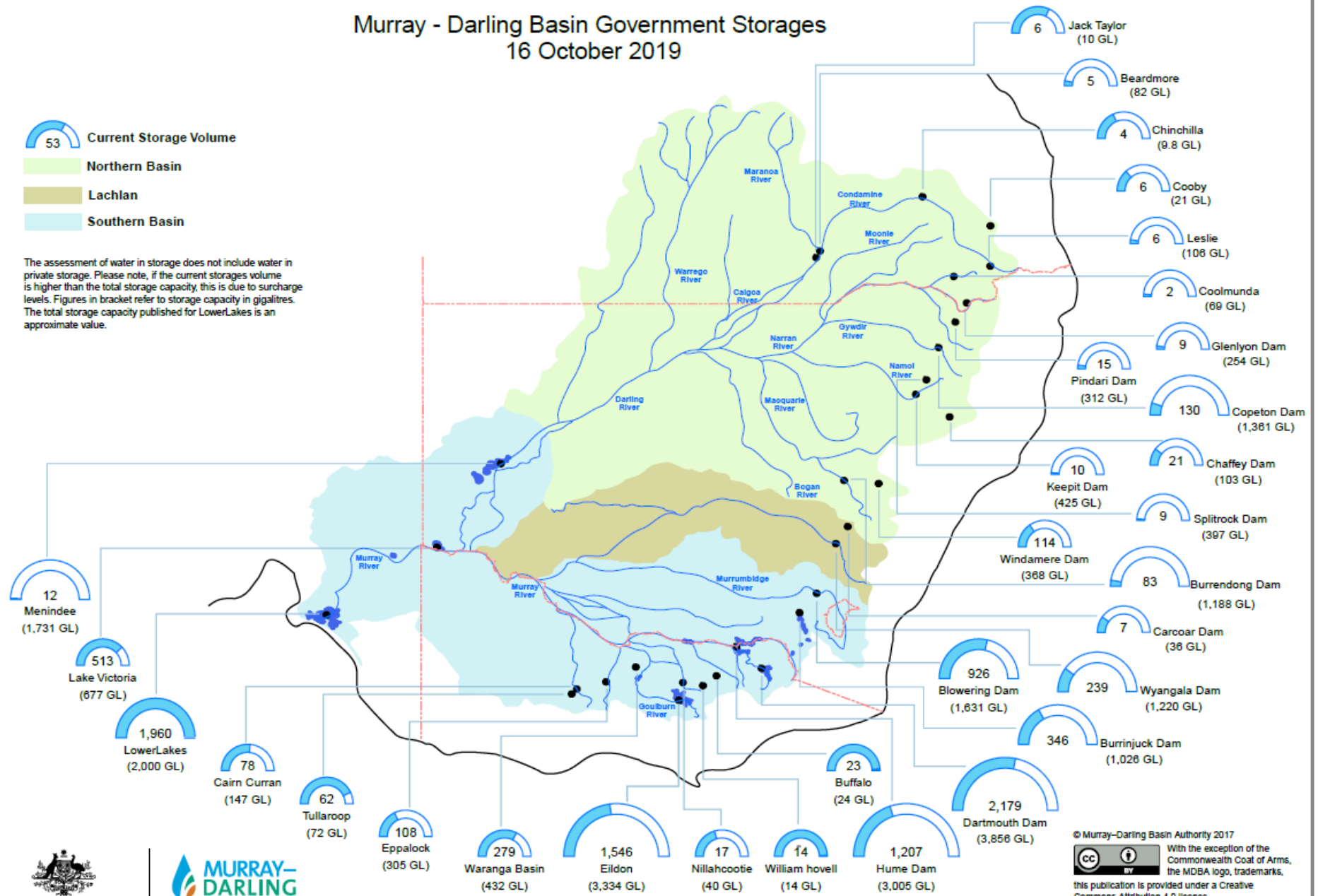


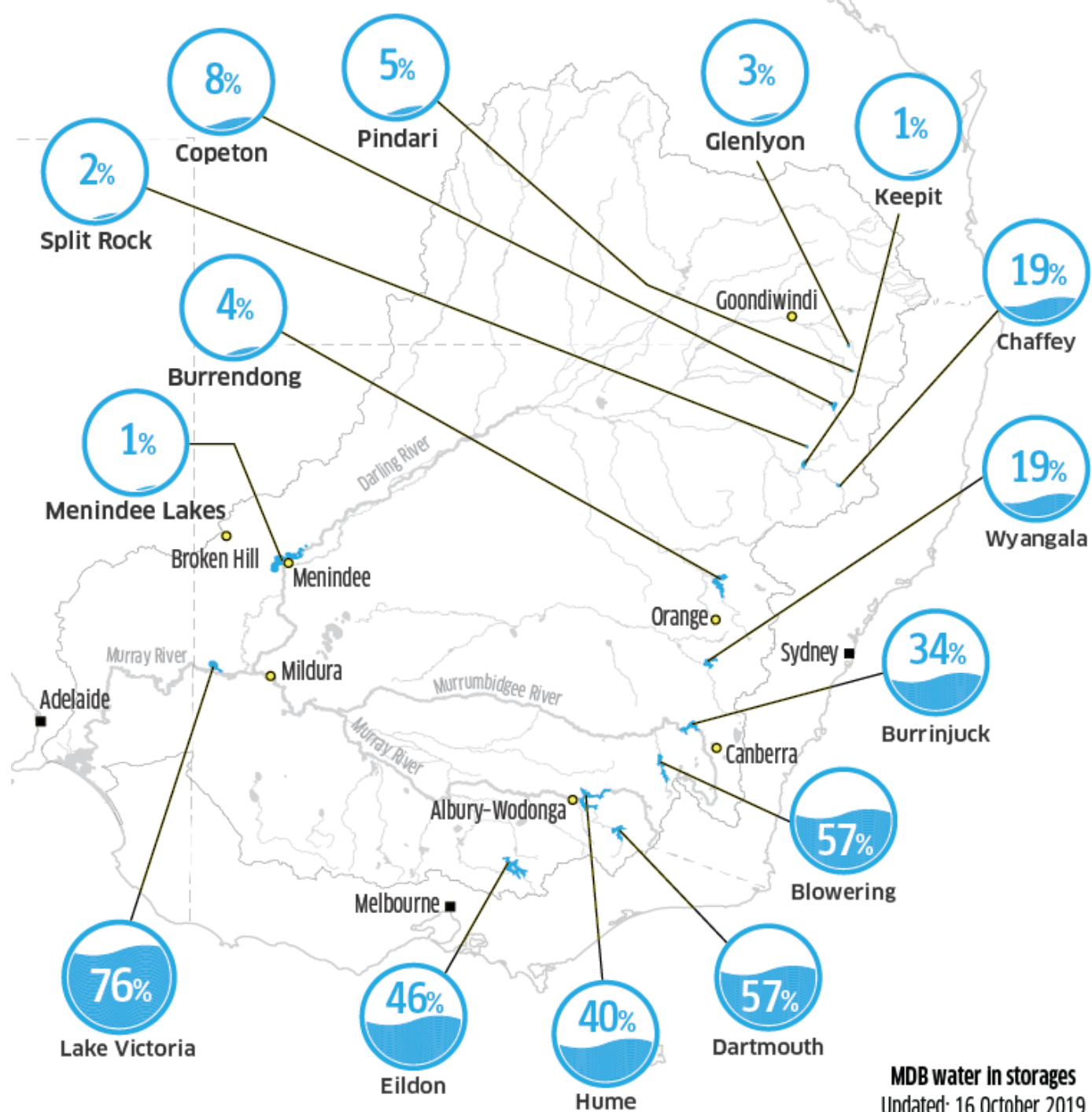
Water in Storages at present

Murray - Darling Basin Government Storages
16 October 2019

53 Current Storage Volume
 Northern Basin
 Lachlan
 Southern Basin

The assessment of water in storage does not include water in private storage. Please note, if the current storages volume is higher than the total storage capacity this is due to surcharge levels. Figures in bracket refer to storage capacity in gigalitres. The total storage capacity published for LowerLakes is an approximate value.





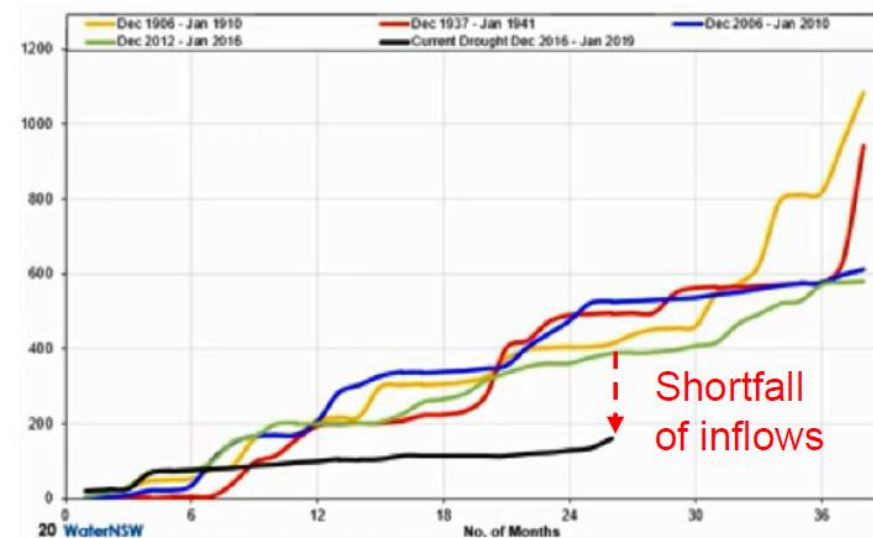
Extreme Events Policy

Normal rules

- Assume some future inflows
- Shares the small risk of more severe conditions between high priority and low priority needs

What happens if inflows don't arrive?

- In the Millennium drought we switched off the rules and managed adaptively
- Now we're providing more clarity while retaining adaptability





Extreme Events Policy

Guiding principles

The market will continue to operate for as long as possible during extreme events



The local requirements for critical human water needs will be recognised and prioritised



Licence holders within licence categories should be treated equally



Certainty should be maximized



Every attempt will be made to maintain the operation of the statutory water sharing plans



Management strategies will be fit for purpose



Local stakeholder consultation should inform management responses so that they are fair



Learnings from previous extreme events will inform the development and implementation of IRGs



Connectivity of systems should be considered







Hierarchy of water prioritise in drought

Priority	Take/type of use
1	<ul style="list-style-type: none">● Critical human water needs:<ul style="list-style-type: none">- core human consumption requirements- non-human consumption requirements that a failure to meet would cause prohibitively high social, economic or national security costs
2	<ul style="list-style-type: none">● Needs of the environment
3	<ul style="list-style-type: none">● Stock● High security licences● Commercial and industrial activities authorised by local water utility● Water for electricity generation on a major utility licence● Conveyance in supplying water for any priority 3 take
4	<ul style="list-style-type: none">● General security
5	<ul style="list-style-type: none">● Supplementary

Extreme Event Stages

- Policy sets 4 stages for managing extreme events

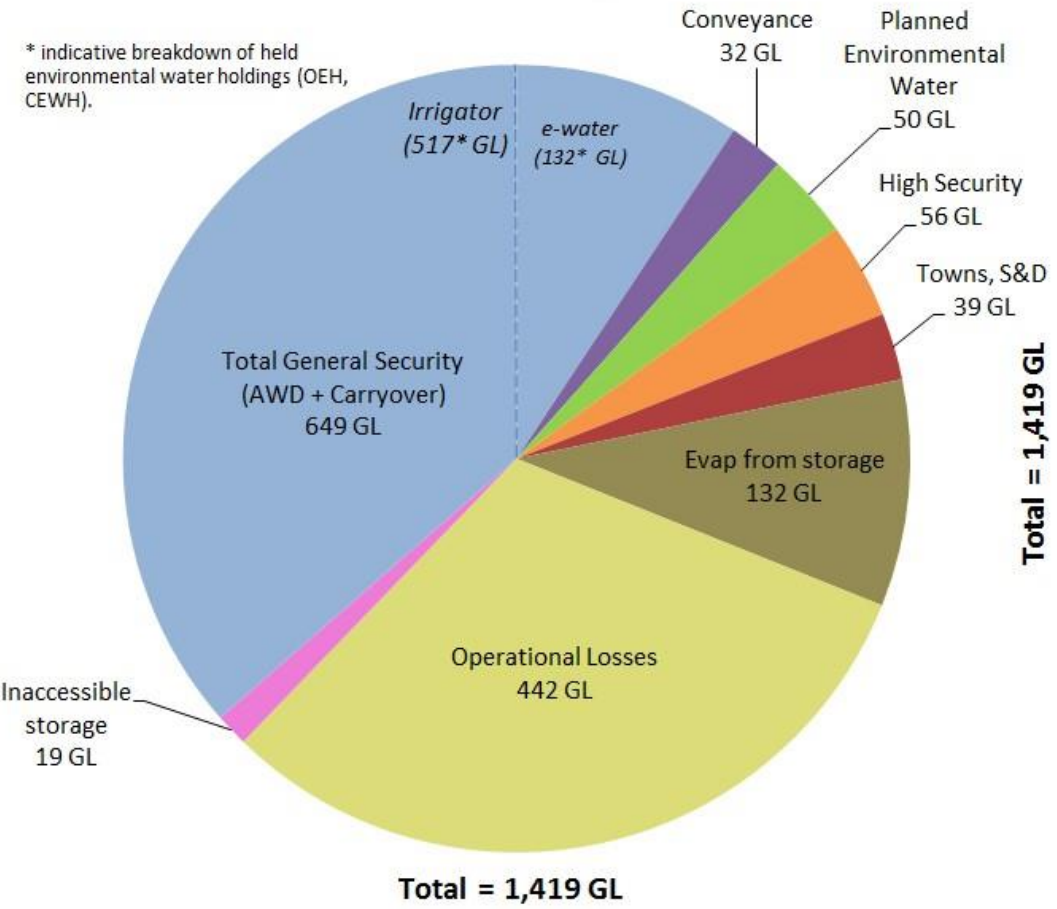
Stage	Water quantity	Water quality
Stage 1  Normal management	Deliver water as normal	Raw water can be treated with usual methods
Stage 2  Emerging drought/ water shortage	Restrictions on water delivery for general security licences Potential or actual impacts on groundwater Potential for aquifer subsidence	Minor adjustments to treat raw water
Stage 3  Severe drought/ water shortage	Restrictions on water for: <ul style="list-style-type: none"> • High priority licences • General security licences Unacceptable groundwater impacts	Major adjustments are needed to treat raw water
Stage 4  Critical drought/ water shortage	Water only available for critical human needs. Risk to long term availability of the groundwater resources	Not possible to treat raw water with standard processes to meet health values and drinking guidelines

Lachlan Resource Assessment (Stage 1)

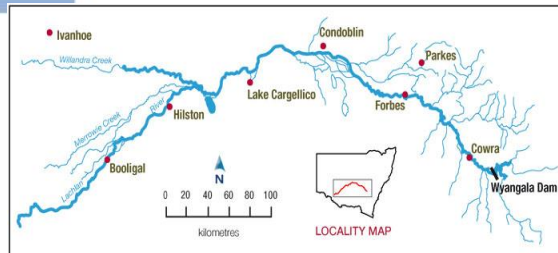
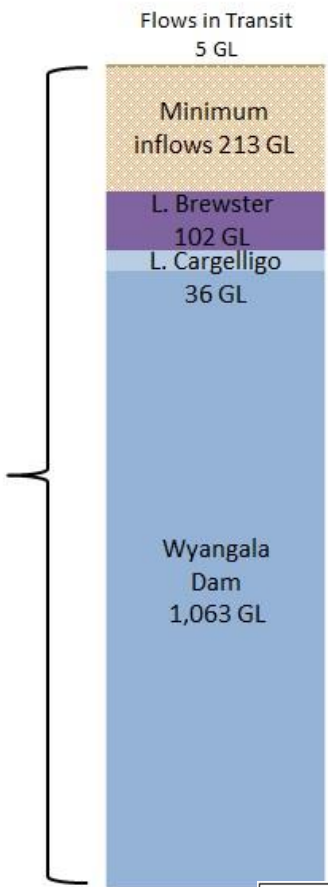
Resource Distribution August 2017 to May 2019

Lachlan Valley

* indicative breakdown of held environmental water holdings (OEH, CEWH).



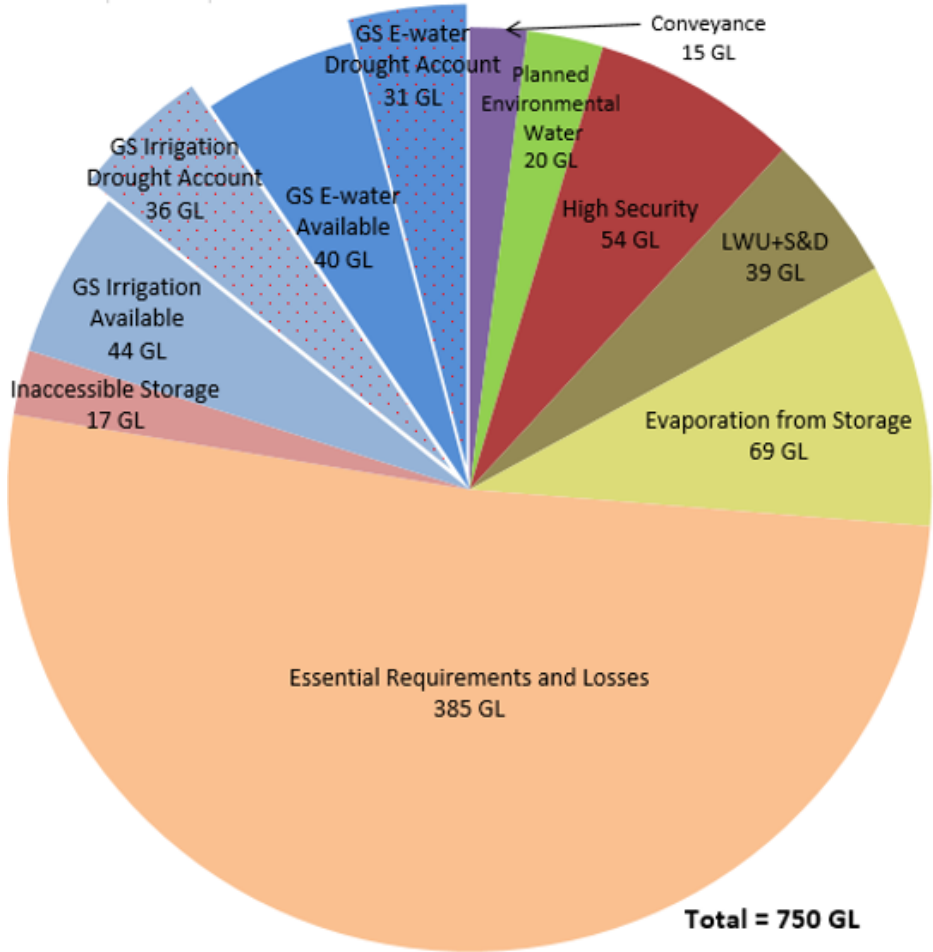
Supply Distribution



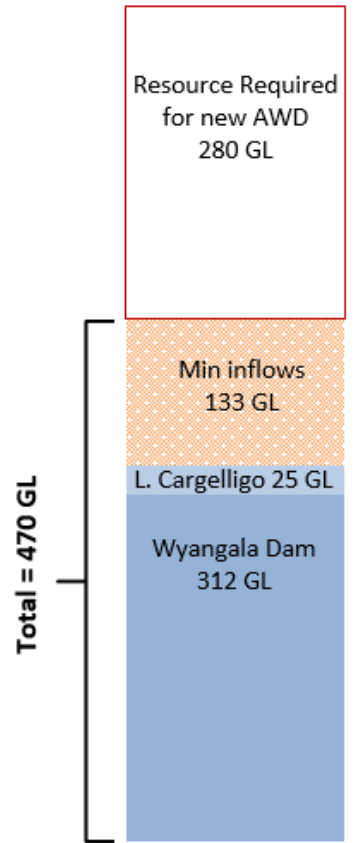
Lachlan Resource Assessment (Stage 3)

Resource Distribution: August 2019 to May 2021

Lachlan Valley



Supply Source ⁽⁹⁾



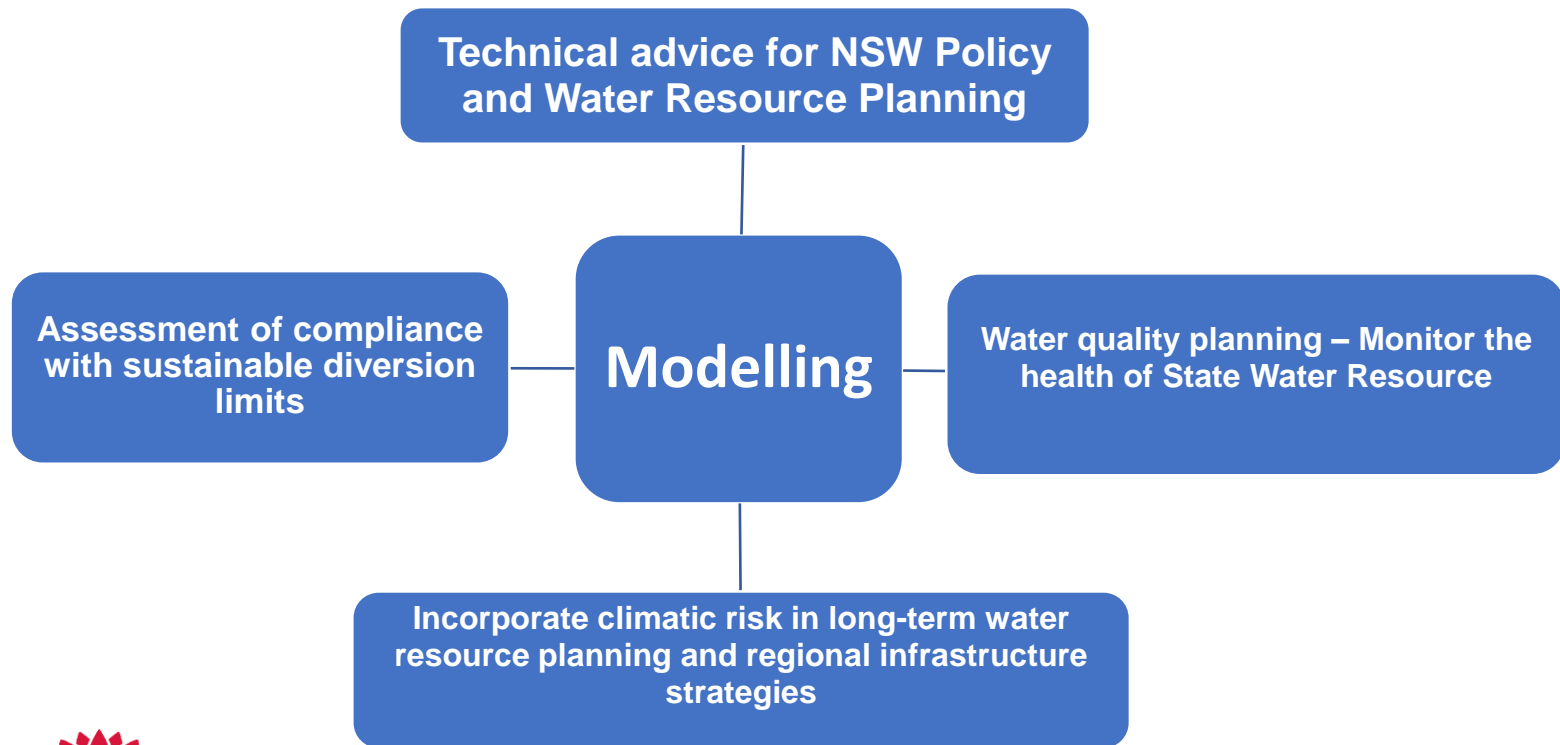
Resource Required for new AWD
280 GL



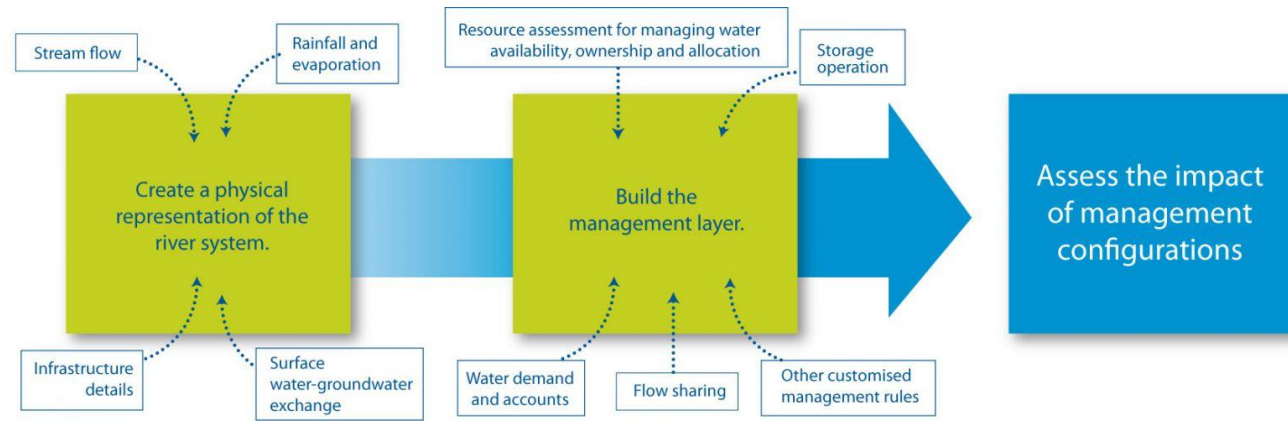
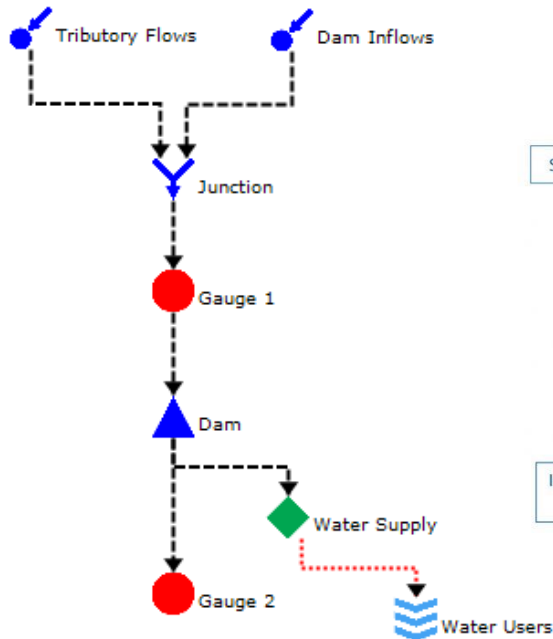
Modelling in Water Management in NSW

NSW Modelling- Why?

- Meet a range of accountabilities under NSW and Federal legislations for Statutory Water Planning

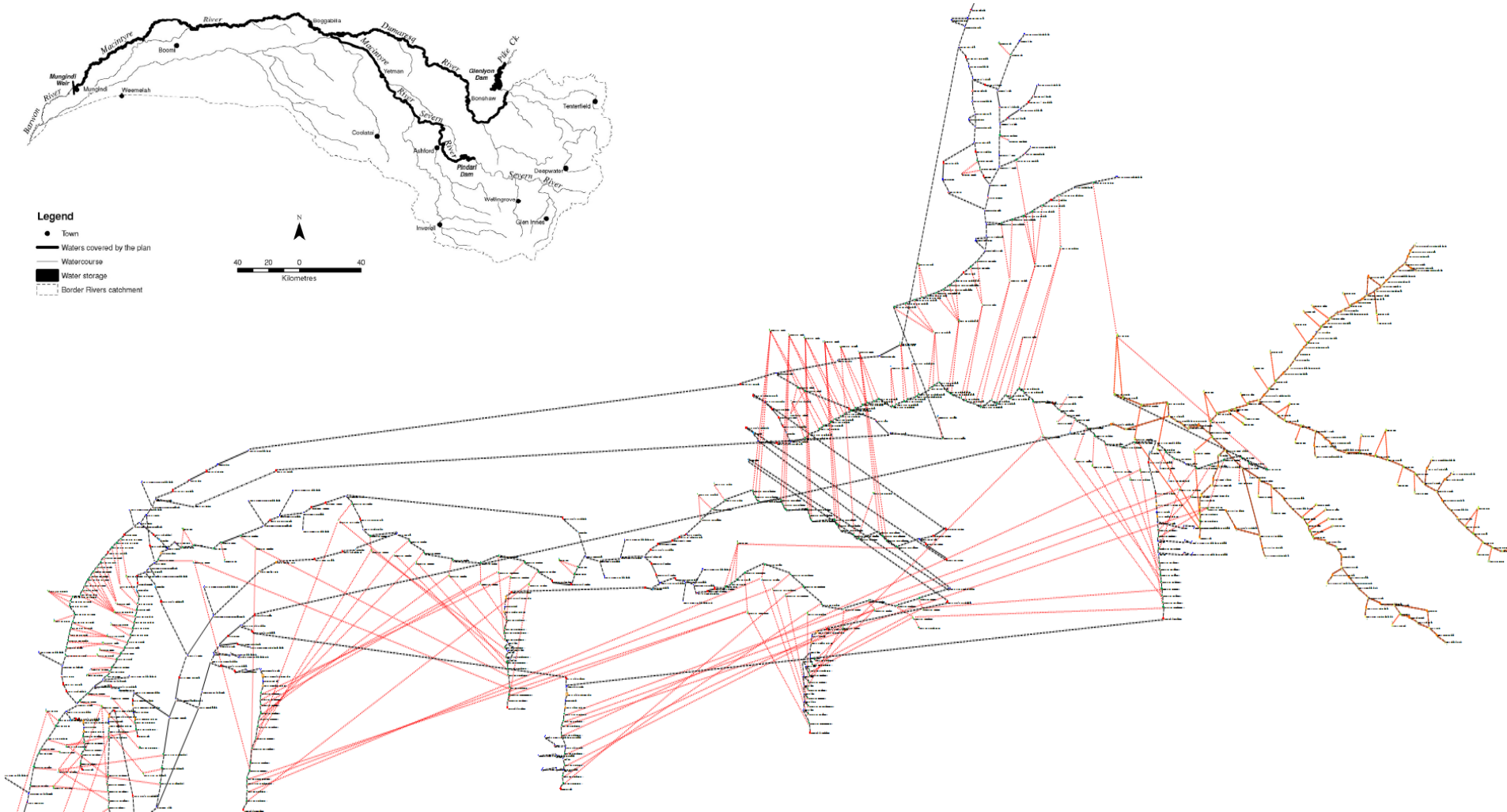


River system planning model



An Example: Border River System Model

Figure 1: NSW Border Rivers Water Management Area



Thank you for you attention.