Submission No 13

INQUIRY INTO ADEQUACY OF WATER STORAGES IN NSW

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Adequacy of water storages in NSW

NSW GOVERNMENT RESPONSE TO THE LEGISLATIVE ASSEMBLY STANDING COMMITTEE ON STATE DEVELOPMENT INQUIRY INTO THE ADEQUACY OF WATER STORAGES IN NSW

NSW's current water planning and management policies, for both urban and rural storages, are in line with current *NSW 2021* goals which seek to secure potable water supplies (Goal 21) and help protect our rivers (Goal 22) at minimum cost to water consumers (Goal 5).

These policies are also consistent with key national principles and intergovernmental agreements such as the National Water Initiative, the COAG endorsed National Urban Water Planning Principles and the Murray Darling Basin reforms currently being negotiated between the Basin States, the Commonwealth and the Murray Darling Basin Authority.

The attached submission responds to the Inquiry's terms of reference and discusses current NSW Government practices and policies which are in place to ensure the efficient management of NSW's current water storages to meet agricultural, urban, and environmental needs in both dry and wet periods. The submission also outlines the issues which need to be addressed and the processes the NSW Government follows when considering new water storage proposals or the augmentation of existing structures in both an urban and rural setting.

Key issues discussed include:

- Current capacity of NSW's water storages in both urban and rural areas and its ability to meet the various uses including agricultural and urban uses and water for the environment

- Practices employed by key water infrastructure operators such as State Water and the Sydney Catchment Authority to improve efficiency and optimise supply for users, including the environment

- Issues to consider, and processes to follow when assessing the viability of new water storage proposals or augmentations

In most regions of NSW it is consumers who ultimately bear the cost of investment in and ongoing operation of water supply and demand measures through IPART-regulated water prices (or in the case of the Murray-Darling Basin after 2014, the Australian Competition and Consumer Commission regulated prices). As such, any new suggestions for the construction and/or augmentation of water storages before this inquiry should give consideration to public benefit compared to economic cost.

a) The capacity of existing water storages to meet agricultural, urban, industrial and environmental needs

The capacity of NSW's existing water storages to meet demand for agricultural, urban, industrial and environmental uses is determined by a variety of issues including climatic conditions, water sources and other land use considerations.

A list of water storages managed by State Water, Sydney Catchment Authority and Crown Lands and their operating capacity is attached at Tab 1.

Urban sector

The development and implementation of water supply plans for NSW's key metropolitan areas, greater Sydney and the lower Hunter are managed by the Metropolitan Water Directorate within the Department of Finance and Services. The Directorate is responsible for leading the whole-of-Government process to prepare and review the Sydney Metropolitan Water Plan (MWP) and the Lower Hunter Water Plan (LHWP). Together these two plans outline the measures required to ensure a stable supply of potable water is provided to two of NSW's most populous regions - while continuing to address river health in those rivers that are impacted by the water supply dams.

Both the MWP and the LHWP are developed in close consultation with the community and in accordance with the COAG endorsed National Urban Water Planning Principles (NUWPP). The principles advocate a periodic review of each plan to ensure it takes account of the latest data, techniques and research. The MWP is currently undergoing its third review process. This current review will focus on examining a range of options required to meet the Sydney region's water needs for the next 50 years.

Greater Sydney

Greater Sydney's water supply is managed primarily by the Sydney Catchment Authority (SCA) and Sydney Water. The SCA operates 2 weirs and 18 dams, including Warragamba Dam which is a drinking water supply dam and the key source of greater Sydney's drinking water. Together the SCA's dams and weirs have a total capacity of 2,700 GL and supply water to over 4.6 million consumers in Sydney, the Illawarra, Shoalhaven, Blue Mountains and Southern Highlands. Sydney Water (along with some small local water supply operators) provides water to the retail market, including industrial, commercial and residential users. The Sydney Desalination Plant provides an additional source of non-rainfall dependent water. Cumulatively, these sources make the Sydney storage system one of the largest in the world in per capita terms.

Planning for Sydney's drinking water resources is addressed in the MWP, which covers Sydney, the Illawarra and the Blue Mountains. The most recent iteration of the MWP, which was finalised in 2010 outlines provisions to:

- provide a secure supply of water to meet the medium-term needs of a growing city, while keeping long-term goals in mind (a key concern for the community)
- protect the health of rivers impacted by the water supply dams
- ensure water supplies are adequate during drought
- minimise costs to the community (in-line with the Government's commitment to putting downward pressure on the cost of living for NSW households (*NSW 2021* – Goal 5).

The 2010 plan focuses on four main areas to secure water until at least 2025:

- dams continuing to provide most of Sydney's drinking water
- recycling reducing demand for drinking water
- desalination which can supply up to 15% of Sydney's needs (90 billion litres a year)
- water efficiency reducing demand for water by households, government and business.

Together with the plan's adaptive approach, these key measures prepare greater Sydney for drought, variable rainfall, potential impacts of climate change, and a growing population.

Lower Hunter
The Chichester Dam, Grahamstown Dam and the Tomago Sandbeds are the Lower Hunter region's key water storages supplying 95% of the region's needs, with the remaining 5% being supplied by two minor water sources in the Port Stephens area. These dams are either small and/or shallow, and the region's storage system is more prone to water lose via evaporation than other storage systems such as Sydney's. The Lower Hunter region's supplies can deplete up to three times faster than Sydney's Dams. This rate of evaporation can pose a risk to the region's security of supply when the region is experiencing severe drought.

To address these issues, and plan for long-term, sustainable supply, the Metropolitan Water Directorate is leading the development of the new Lower Hunter Water Plan (LHWP). The LHWP development process will examine all demand and supply options for the region including new dams and/or dam augmentations (with the exception of the previously rejected Tillegra Dam), desalination, increased recycling, and inter-catchment transfers. The Directorate will consult closely with other NSW agencies and community stakeholders in the development of the Plan.

Non-metropolitan Urban
Water supply for urban needs in non-metropolitan areas of NSW is undertaken by local water utilities, the large majority of which are operated by local councils. The NSW Government provides technical and financial assistance to these utilities through the Country Towns Water Supply and Sewerage Program administered by the NSW Office of Water. The total expenditure on the Country Towns Water Supply and Sewerage program since 1996 is over $935 million. This has enabled the completion of 464 water supply and sewerage projects that have delivered enhanced public health, improved environmental outcomes and greater security of services. The NSW Government's total commitment to this program is $1.2 billion with the program scheduled to run until 2016-17.

Water sourced for these local water utilities includes:
- 28 percent supplied by rivers regulated by State Water storages;
- 58 percent supplied from storage schemes mostly involving off river storage; and
- the remaining from unregulated rivers, rain water or extractions from groundwater.

There are 45 local water utilities that manage surface water supplies with storage dams. These dams are in addition to those managed by State Water.

Agricultural sector
Outside of Metropolitan Sydney, most major dams and water management infrastructure are operated by State Water. The capacity of State Water's major rural dams is currently 18,751 GL. These dams supply water for irrigation, environmental, domestic and industrial uses. As a result of recent heavy rainfall, nearly all State Water dams are full, or close to full.

During the last drought, no major rural storage emptied completely although many dams reached low levels and supply was restricted. In particular a number of valleys had zero or very low additional allocations for general security irrigation for significant periods and many had reduced allocations for high security irrigation. When the drought broke in early 2010, most dams either filled or returned to high levels within a year.

Management of capacity and access to water along rural regulated rivers is flexible as a result of water trading, which allows entitlement holders to either permanently sell a water licence or trade an annual allocation. Trading allows the water to flow to where it has the most value in any given year, allowing water entitlement holders to be flexible about how they manage their business, and adapt to changes in climatic conditions.

Environmental Sector

Safeguarding water for environmental needs is achieved through a variety of arrangements including water sharing plans, water planning documents, intergovernmental agreements and policy settings for water managers as operators such as the Sydney Catchment Authority and State Water.

For instance, in Sydney the MWP makes provisions for protecting the health of the major river systems that supply Sydney's catchment system. Furthermore, a key consideration in the current MWP review is an investigation of options for environmental flow releases from Warragamba Dam. These investigations are part of a suite of options for protecting the health of the Hawkesbury Nepean River system given projected population growth and urban development.

Current water sharing plans also include environmental flow rules to protect environmental flows from extraction. In 2011/12 the SCA released 548 GL in environmental flows. This was in addition to 2,175 GL in uncontrolled releases when dams spilled. Under the proposed Murray Darling Basin Plan, water sharing plans across the Basin will need to reflect new sustainable diversion limits which will ensure that suitable volumes of water are made available and managed for environmental needs.

General arrangements in place to manage capacity

Statutory planning rules

The rules for sharing water and setting priorities for water supply for different purposes are set out in statutory water sharing plans developed by regional Water Management Committees under the guidance of the NSW Office of Water. Plans are approved by the Minister for Primary Industries with the concurrence of the Minister for the Environment.

Since 1995 there has been a cap on diversions across all surface water systems in NSW within the Murray Darling Basin and no further surface water entitlements for commercial purposes have been granted.

Water allocations

The water allocation is the proportion of the licensed entitlement that is actually made available for use in a given period. The volume of water made available to an entitlement holder varies from year to year depending on water availability and the type of licence held (general or high security). Annual allocations at the start of the year are determined based on the water held in storage, how much unused water is carried over from the previous year,

and technical assessment of expected flows into dams and downstream based on historical flow records.

When allocating water, first priority is given to towns, followed by domestic (household) and stock use, then high security industry and irrigation licences and finally general security licence holders. In the vast majority of years these groups, except general security, receive 100% allocations with supply guaranteed to high security licences at all times, except during periods of extreme water shortages. General security allocations are calculated at the start of the water year (July) as a relatively conservative percentage of available supply and increase during the year as supply is assured. On regulated river systems water is primarily used for irrigation, with around 90% of entitlement holders owning general security licences.

b) Models for determining water requirements for the agricultural, urban, industrial and environmental sectors

The following models are used in NSW for determining water requirements for the agricultural, urban, industrial and environmental sectors:

- NSW Office of Water - Integrated Quantity and Quality Model;
- NSW Office of Water - Best-Practice Management of Water Supply and Sewerage Guidelines;
- NSW Office of Water - Local Water Utility NSW Security of Supply basis;
- SCA Water Headworks Network (WATHNET);
- SCA Reservoir Management System (SCARMS);
- Sydney Water specific demand forecast models

Integrated Quantity and Quality Model (IQQM) – the NSW Office of Water (NOW) uses the IQQM to simulate river system behaviour for periods ranging up to hundreds of years. It is designed to examine long-term behaviour under various management regimes, including modelled environmental flow requirements. The water quantity module of IQQM simulates all the processes and rules associated with the movement of water through the river system. It is also capable of simulating water quality processes such as salinity, temperature and other constituents. In addition, climate generation models are available as separate modules within IQQM.

Best Practice Management of Water Supply and Sewerage Guidelines – these guidelines were developed by NOW to assist local water utilities to plan and manage water supply and sewerage services. As part of their water conservation and demand management planning, NSW local water utilities are required to analyse their historical water demand and prepare forecasts of future demand for use in their 30 year Integrated Water Cycle Management planning, including the impacts of climate change.

Local Water Utility 5/10/20 rule – Local water utilities in regional NSW employ the '5/10/20 rule' which aims to have the utility operate so that:

a) the duration of restrictions does not exceed 5% of the time; and

b) the frequency of restrictions does not exceed 10% of years (i.e. 1 year in 10 on average); and

c) the severity of restrictions does not exceed 20%. Systems must be able to meet 80% of the unrestricted water demand (i.e. 20% average reduction in consumption due to water restrictions) through a repetition of the worst recorded drought, commencing with the storage drawn down to the level at which restrictions need to be imposed to satisfy a) and b) above.

SCA Water Headworks Network - WATHNET is a water supply simulation model capable of representing a system of storages, transfer links (including natural rivers, pipes, and pumps) and demand centres serving urban, rural and environmental customers. The SCA uses this model to determine the water available for the urban (including industrial) sector in greater Sydney and other Sydney Catchment Authority customers. The WATHNET model is independently audited by IPART.

SCA Reservoir Management System - SCARMS provides a dynamic reservoir management tool and decision support system for daily operations and long term strategic planning. It provides a platform for monitoring, modelling and forecasting water quality and lake behaviour, enabling the SCA to determine the best place to draw water from to manage water quality.

Sydney Water – demand forecast models – Sydney Water determines the water requirements for greater Sydney using its own demand forecast models. Sydney Water has recently developed a new economic-based demand model, which was used to forecast demand as part of its submission to IPART for the next four year price path. Work is now under way to determine medium-long term demand for use in the review of the MWP. Sydney Water's demand forecast model is independently reviewed by IPART as part of the operating licence/price setting regulatory processes.

c) Storage management practices to optimise water supply to the agricultural, urban, industrial and environmental sectors

Urban Water

The Sydney Catchment Authority operates its dams and the bulk water supply network to maximise storage outcomes and water quality for supply of bulk water to Sydney Water. The storage management practices adopted by the SCA incorporate the following three components:

1. supplying the best quality water;
2. maximising water quantity and minimising spills; and
3. balancing water quality vs water quantity.

The SCA has developed drawdown curves that aim to minimise spills from the dams. This provides the maximum system yield whilst ensuring all demands are met. As a general rule, the drawdown curves aim to ensure dams have an equal likelihood of spilling at any time. These drawdown curves have been updated to reflect recent changes in system configuration, including the Nepean and Warragamba Deep Water Pumping and the Sydney Desalination Plant.

Similarly, Hunter Water's operation protocol provides a balance between minimising operating costs and minimising the frequency and duration of periods of water restrictions. The protocol also allows Hunter Water to respond when required to operational issues such as water quality events in the storages to minimise impact on the community. Additionally, Hunter Water is exploring a range of programs to optimise its existing supply system.

To optimise the availability of water for the environment most dams in Sydney's water supply system have been modified over the last decade to allow for variable environmental flow releases to help protect downstream river health. The SCA gauges and monitors inflows to

the dams and releases these variable environmental flows in line with agreed rules incorporated in its water management licence under the water sharing plan.

Furthermore, new environmental flow release works including fish ladders were installed downstream of the storages at eight weirs on the Nepean River and new fishways were constructed at ten weirs. These works cost $31.3 million and were completed in 2010. As a result, continuous fish passage has now been returned to 90 kilometres of the Hawkesbury-Nepean River.

Rural Water

In areas such as the Murray-Darling Basin capacity and management of water use is being optimised through the delivery of irrigation infrastructure modernisation programs. These programs have focused on improving the efficiency of water delivery infrastructure and on-farm irrigation infrastructure to reduce losses through evaporation and improving metering infrastructure and practices and the efficient delivery of stock and domestic water supplies.

A further significant focus of the NSW Government is to improve water security for bulk users and assist in balancing competing demands through improved water-use efficiency in the irrigation sector.

Activities being undertaken to achieve this include:

- research and development to improve the stock of information on water use best practice; and
- extension and training for irrigators to facilitate technology adoption.

NSW's regulated river systems and storages are operated to minimise system losses and maximise water availability. Storages are operated to achieve the water sharing outcomes required by the statutory water sharing plans, including meeting high priority needs such as town water supplies, domestic household and stock water requirements, high security industrial and irrigation entitlements, with a high degree of reliability in all but the most extreme conditions. In some valleys this requires water to be set aside in storage for a number of years to overcome periods of historically low inflow sequences.

For instance, the major rural water supply storages in NSW capture water and release it downstream where it is pumped from the river by licence holders. Downstream water users, including the environment, can be guaranteed a delivery of water because water held in storage, which is reflected in individual water accounts, can be ordered and delivered when required. Good practice is to maximise the use of the most upstream structures for water storages. This is because these water storages tend to be the most efficient as they:

- are likely to be deeper and in cooler climates resulting in lower evaporation losses; and
- provide better operational flexibility as water can be delivered to a variety of locations.

Water orders are submitted to dam operators who calculate the required volume of release. Included in this calculation is an assessment of where tributary inflows might be occurring at the time and the best combination of infrastructure required to deliver the water efficiently i.e. using the dam, weirs or off-river storages downstream. In-stream losses are minimised by ensuring accuracy of releases and flow measurement, keeping flows within channel, combining orders for delivery and optimising the use of rainfall and tributary inflows across the system.

Other reforms and measures

Dam safety requirements
The NSW Dams Safety Committee was established under the *Dams Safety Act 1978* and regularly monitors and inspects NSW's major dams (which are identified in schedule 1 of the Act) to ensure they are compliant with current safety requirements. Owners of non-compliant dams are required to take steps to upgrade these dams. The upgrade process can also offer an opportunity to increase dam capacity and improve the efficiency of dam operations. For instance, the safety upgrades and augmentation currently being carried out at Chaffey Dam will increase capacity to 100,000 mega litres. Other upgrades at storages such as the Burrendong Dam and Blowering Dam will improve flood management in the areas and optimise environmental outcomes.

d) Proposals for the construction and/or augmentation of water storages in NSW with regard to storage efficiency, engineering feasibility, safety, community support and cost benefit

Under NSW planning conditions, all proposals for a new dam or weir require assessment and approval under both State and Commonwealth legislation. In addition to these approvals, to be a viable proposal, any new storage needs to demonstrate that it provides a net public benefit, is cost effective, is suitable to the location and environment, and is compliant with existing policy settings governing water storage and supply in a given area.

As part of the Government's commitment to *NSW 2021* goal 3 (drive economic growth in regional NSW) and goal 19 (secure potable water supplies) the Department of Trade and Investment, Regional Infrastructure and Services is currently investigating potential water storage and augmentation projects which could offer improved economic growth to regional communities. Any proposals identified through this work will be subject to closer examination including feasibility studies and inter-agency and public consultation.

Augmentation proposals in metropolitan areas
Proposals for the construction and/or augmentation of water storages in metropolitan areas such as Sydney and the Lower Hunter are examined via the water planning process, which is guided by the COAG endorsed National Urban Water Planning Principles. Key features of the planning process include:

- an adaptive management framework (based on real options approach) that emphasises the flexibility of systems and the benefits and costs of deferring decisions to take account of new information and technology as it develops;
- a focus on portfolio analysis (the mix of options) rather than analysis of individual options;
- a focus on portfolio costs rather than unit costs of individual options;
- consideration of risk in the evaluation framework;
- scenario analysis that presents the security and reliability performance of alternative portfolios of measures;
- investigation of environmental flow releases from storages to help protect river health;
- an Independent Water Advisory Panel to review the planning process and outcomes; and
- a comprehensive community engagement strategy for each plan.

A number of possible new water storages or water storage and network augmentations were considered for the 2004 and 2006 plans for greater Sydney. Similarly, the range and timing of supply options will again be considered in the current review of the MWP and as part of the development of the LHWP.

Augmentation options in non-metropolitan areas

A variety of issues and concerns need to be considered when investigating the viability of a new rural storage option. These include:

- Location – the most effective rural water storages have specific geographical requirements, i.e. they are located at the headwaters of river systems in the upstream catchments where a relatively small structure can impound a large volume of water. In these locations, evaporation and seepage losses are relatively low and gravity aids water delivery. Most of NSW's major inland river systems already have between one and three major rural water storages located on them.
- Cost - the capacity of the Government and water users to pay for new infrastructure through increased water charges or increased subsidisation of State Water's capital costs needs to be considered.
- Existing policy settings – NSW is party to the 2008 Agreement on Murray Darling Basin Reform which, through the development of the Basin Plan, aims to strike a balance between making water available for productive and environmental uses by introducing new sustainable diversion limits. Any new augmentation proposal would need to be considered in light of both community needs and the requirements of the proposed Basin Plan.

e) Water storages and management practices in other Australian and international jurisdictions

The National Urban Water Planning Principles were adopted by COAG and are in place across Australian jurisdictions. The principles state that optimal urban water planning should:

- deliver urban water supplies in accordance with agreed levels of service
- base urban water planning on the best information available at the time and invest in acquiring information on an ongoing basis to continually improve the knowledge base
- adopt a partnership approach so that stakeholders are able to make an informed contribution to urban water planning, including consideration of the appropriate supply/demand balance
- manage water in the urban context on a whole-of-water-cycle basis
- consider the full portfolio of water supply and demand options
- develop and manage urban water supplies within sustainable limits
- use pricing and markets, where efficient and feasible, to help achieve planned urban water supply/demand balance
- periodically review urban water plans.

Tab 1

Inquiry into the adequacy of water storages in NSW

Tab 1

Major NSW Rural Water Storages -operated by State Water Corporation

River Valley	Storage Dam	Capacity Megalitres (ML)
Border Rivers	Glenlyon Dam, Stanthorpe (Qld)	254,000
	Pindari Dam, Inverell	312,000
Lower Darling	Menindee Lakes, Broken Hill	1,731,000
Gwydir Valley	Copeton Dam, Inverell	1,361,000
Namoi Valley	Keepit Dam, Gunnedah	425,000
	Split Rock Dam, Manilla	397,000
	Chaffey Dam, Tamworth	61,000
Macquarie Cudgegong	Burrendong Dam, Wellington	1,188,000
	Windamere Dam, Mudgee	368,000
	Oberon Dam, Oberon	45,000
Lachlan Valley	Wyangala Dam, Cowra	1,220,000
	Carcoar Dam, Carcoar	36,000
Murrumbidgee Valley	Burrinjuck Dam, Yass	1,026,000
	Blowering Dam, Tumut	1,631,000
Murray Valley	Dartmouth, Mitta Mitta (Vic)	3,908,000
	Hume Dam, Albury	3,038,000
	Lake Victoria, Wentworth	677,000
Hunter Valley	Glenbawn Dam, Scone	750,000
	Glennies Ck Dam, Singleton	283,000
	Lostock Dam, Gresford	20,000
Coastal Area	Toonumbar Dam, Kyogle	11,000
	Brogo Dam, Bega	9,000
Total		**18,751,000**

Source: NSW Office of Water – submission for Inquiry into the adequacy of water storages in NSW (2012).

Capacity of the Sydney Catchment Authority's storages

Delivery System	Storage	Total Capacity (ML)[1]	Operating Capacity (ML)[2]	Efficiency	Catchment Area (km2)
Warragamba	Warragamba	2,031,000	2,027,000	99.8%	9,051
	Prospect	48,200	33,330	69.1%	10
Upper Nepean	Cataract	97,370	97,190	99.8%	130
	Cordeaux	93,640	93,640	100.0%	91
	Upper Cordeaux 1	775	775	100.00%	Included in Cordeaux
	Upper Cordeaux 2	1,180	1,180	100.00%	Included in Cordeaux
	Avon	214,360	214,360[3]	100.00%	142
	Nepean	68,100	67,730	99.5%	320
Woronora	Woronora	71,790	71,790	100.0%	75
Shoalhaven	Tallowa	90,000	35,300[4]	40.9%	5,750
	Bendeela	1,200	900	75.0%	Included in Tallowa
	Fitzroy Falls	22,920	9,950	43.4%	31
	Wingecarribee	25,880	24,130	93.2%	40
Blue Mountains[5]	Lower Cascade	305	305	100.0%	3
	Middle Cascade	167	167	100.0%	2
	Upper Cascade	1,791	1,791	100.0%	2
	Medlow	326	326	100.0%	5
	Greaves	301	301	100.0%	7
Total		**2,769,305**	**2,680,165**	**96.8%**	**15,659**

Source: Sydney Catchment Authority–Submission for Inquiry into the adequacy of water storages in NSW (2012).

[1] The total capacity of a reservoir is the amount of water it can hold when full. Operational restrictions may reduce the amount of useable water that the SCA can supply to its customers.
[2] Operating capacity is the maximum amount of water that can be extracted by existing infrastructure.
[3] Different operating rules to those that currently apply would be necessary to access this water.
[4] Different operating rules to those that currently apply would be necessary to access this water.
[5] This does not include Woodford Dam in the Blue Mountains system. Sydney Water's Linden water filtration plant was decommissioned in 2001 and the storage at Woodford Dam is no longer included as part of the SCA's water supply system.

Woodford remains a prescribed dam under the *Dams Safety Act 1978* and the SCA is still responsible for its maintenance.

Department of Primary Industries - Crown Lands Redundant Dams

Dam Name	Description	Year built	Catchment area (km2)	Inspection regime	Storage/ Catchment	Use
Moore Creek Dam, Moonbi, Upper Moore Creek	19m high concrete arch dam "Prescribed Dam" by Dam Safety Committee	1898	52	Monthly	Reservoir silted up. Catchment 65km2	Occasional bushwalking in vicinity but no public access
Sheeba 1 Dam, Hanging Rock near Nundle, Burnt Hutt Creek	Homogenous earthfill embankment (12m to 20m high)	1888	2.6	Bi-monthly	Significant siltation with trees against upstream face reported (c1998)	Local recreational use, swimming fishing, camping
Sheeba 2 Dam, Hanging Rock near Nundle, Burnt Hutt Creek	Homogenous earthfill embankment (10m to 20m high)	1888	2.7	Bi-monthly	as above	
West Gosford 1, Narara, Fountain Creek	6.5m concrete gravity structure	1901, 1903	2.4	Quarterly	some siltation	Occasional visitors, bushwalkers
West Gosford 2, Somersby, Fountain Creek	6.6m concrete arch dam	1925	2.2	Quarterly	some siltation	Occasional visitors, bushwalkers
Junction Reefs Dam, near Mandurama, Belubula River	19m high concrete masonry buttress dam "Prescribed Dam" by Dam safety Committee	1898	731	Quarterly	substantial siltation	Unique design with State heritage listing
Gallymont Dam, near Mandurama, Gallymont Creek	6m high masonry gravity dam	not known	20.1	Quarterly	substantial siltation	Occasional use by adjoining farm reported
Burraga, near Burraga, Thompsons Creek	10.5m concrete gravity arch	not known	24.7	Quarterly	n/a	Non-potable supply to near-by community, popular local fishing, picnic and camping area
Dargan Upstream Dam,	Concrete arch dam	early 1900s	n/a			

Dargan, Dargans Creek						
	Quarterly	n/a	access via railway easement. Dam and environs popular for adventure activity - rock climbing, canyons, etc due to proximity to Sydney.			
Dargan Downstream Dam, Dargan, Dargans Creek	Arch structure of straight wall sections	early 1900s	6.5	Quarterly	n/a	
Bargo Dam, near Buxton, Bargo River	13m concrete gravity-arch dam	1898, 1910, 1947	66	Quarterly	n/a	Occasional picnic & camping, trail bikes
Bethungra Dam, near Bethungra, Wandalybingel Creek	12.4 m concrete gravity dam. High risk dam preferred remediation options up to $3.6 M.			Twice weekly	siltation	Popular local recreational use, picnics, swimming fishing, camping.
DeBurgh Dam, near Burrinjuck, Carrolls Creek	5m high concrete gravity-arch dam	1908	19.1	Monthly	siltation	Used by adjoining land owner for garden & sheep

Source: NSW Department of Primary Industries Catchment and Lands – submission for Inquiry into the adequacy of water storages in NSW (2012).