Standing Committee on State Development

Adequacy of water storages in New South Wales

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Terms of reference

That the Standing Committee on State Development inquire into and report on the adequacy of water storages in NSW, and in particular:

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

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

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

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,

e) water storages and management practices in other Australian and international jurisdictions,

f) any other matter relating to the adequacy of water storages in NSW.

These terms of reference were referred to the Committee by Hon Katrina Hodgkinson, MP, Minister for Primary Industries, and were adopted by the Committee on 28 May 2012.

Committee membership

The Hon Rick Colless MLC	The Nationals	*Chairman*
The Hon Mick Veitch MLC	Australian Labor Party	*Deputy Chairman*
The Hon Paul Green MLC	Christian Democratic Party	
The Hon Charlie Lynn MLC	Liberal Party	
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Chair's foreword

Over the previous two decades there have been many changes to the administration of water throughout New South Wales. In the year 2000, the *Water Management Act* separated the ownership of land and water resources, created water sharing plans and introduced regular environmental flows as releases of water from existing storages. Last year the Murray Darling Basin Plan foreshadowed the transfer of 2,750 gigalitres of water from the irrigation industry to environmental flows into the Darling and Murray Rivers, Lakes Alexandrina and Albert and the Coorong in South Australia.

During this period there has been substantial agricultural irrigation and industrial development in New South Wales, and the transfer of water away from these industries has caused considerable concern in regional communities, particularly during the recent severe drought in western New South Wales.

It was within this context that the terms of reference for this inquiry were referred to the Committee by the Minister for Primary Industries, the Hon Katrina Hodgkinson MP, in May 2012.

The terms of reference did not restrict the Committee's investigations to just water storages. We were also requested to investigate many issues surrounding the management of water in the storages and in rivers once it has been released for environmental and consumptive uses.

The beginning of the second decade in the new millennium saw the State inundated by flood water, with an estimated 6,500 gigalitres of water flowing through the Menindee Lakes Scheme over a three month period in 2011-2012. Capturing just 20 per cent of this flood water would provide extra storage equivalent to the full capacity of Copeton Dam on the Gwydir River system.

Any potential new long term storages would need to be located in upland areas where efficient storage (that is, a high ratio of storage capacity to full supply level surface area) can be achieved. Existing storages in lower areas in the Murray Darling Basin, in particular the Menindee Lakes and the Lower Murray Lakes in South Australia, have very low efficiencies because of shallow storage depths and very large surface areas. These storages need to be improved by a range of measures to effect substantial water savings by reducing evaporation.

The Committee inspected an excellent example of water savings by dividing Barren Box Swamp into three separate compartments, saving some 20 gigalitres of water annually. Potential savings from improvement works in the Menindee Lakes have been estimated to save up to 65 gigalitres per year.

We also heard about major advances that have been implemented in water use conservation measures in urban, industrial and agricultural uses. However, research into water conservation needs to continue, and programs such as the Computer Aided River Management (CARM) system should be rolled out across the State to improve the efficiency of water use and better timing of releases to meet the needs of environmental and consumptive users.

Currently, the State's water resources are managed through a variety of measures, of which water storages play an integral and complementary role alongside demand management systems, recycling and conservation. In a land of high climatic variability, this integrated, holistic approach is vital to ensuring the future water security of the State. However, it is also evident that opportunities exist to optimise the State's current water storage infrastructure and achieve significant water savings.

I therefore urge the Government to consider the recommendations in this report with a view to addressing the future needs of water users in New South Wales and to mitigate the impacts of the Murray Darling Basin Plan decision to remove 2,750 gigalitres of water from consumptive use.

On behalf of the Committee, I extend my gratitude to all the participants in this inquiry, including those who made written submissions, and the individuals who attended the public hearings and facilitated site visits across the State. We appreciate your efforts to provide the Committee with the benefit or your knowledge, as well as to share your concerns and ideas.

My thanks go to my fellow Committee members for their constructive and considered contributions to this inquiry. I would also like to thank Cathryn Cummins, Rachel Simpson, Angeline Chung, Stewart Smith, Madeleine Foley, Merrin Thompson, Rebecca Main and Natalie Udovicic of the Committee Secretariat for their work in supporting the Committee at various times throughout the inquiry process.

Hon Rick Colless MLC
Chairman

Summary of key issues

The key issue for this inquiry was whether the present water storage capacity of New South Wales is adequate to meet current water demands, as well as to secure against increased climatic variability in the future. During the inquiry, the Committee considered the water collection, storage, management and savings measures currently in use around the State. We also heard stakeholders' divergent views regarding the best approach to improving or increasing water storage capacity and witnessed innovative new approaches to demand management and on-farm practices during site visits to storage facilities and farms.

Central to the discussion of an adequate and reliable water supply is the balancing of often competing demands from urban, agricultural, industrial and environmental water users. This issue was raised throughout this inquiry. In this context, debate around the role, purpose and function of water storages emerged, with many stakeholders contending that the current demands on water storages, in particular, the addition of environmental allocations, are over and above the original purposes for which they were built. Further, many argued that increases in storage capacity have not been commensurate with the rise in end-user demands. We note that the role of water storages has a bearing on how future solutions to ensure water security are considered and assessed.

Role of water storages

The Committee believes that the primary role of most major water storages in New South Wales, at the time of their construction, was to conserve water for agriculture, stock and domestic use and therefore reduce the variability of water availability across the State. This inquiry has demonstrated that there are differing views among stakeholders on the main role of water storages. The Committee considers, therefore, that the primary purpose of a water storage should be clearly communicated to ensure that the range of stakeholders understand the reasons why the storage was constructed and how it is managed given the changing demands on water.

Flood mitigation, as an additional role of water storages, also emerged as a significant issue throughout this inquiry. The Committee shares irrigators' concerns that there may be negative implications for entitlement holders arising from a flood mitigation role for water storages. Such implications may include the need for the storage to have 'air space' or hold less water to allow flood waters to be slowed, which in turn would reduce the amount of water available for all end users. Air space in a water storage that allows for flood mitigation is effectively an extra use that takes water away from agriculture and industry.

The Committee also acknowledges the NSW Government's view that during times of significant flood, the level of mitigation a water storage can provide may be negligible due to high level flows. We understand that the NSW Government is currently reviewing the role that Warragamba Dam might play in flood mitigation, with this review to be completed by the end of the year. Due to the differing views among inquiry participants on the role of water storages, the Committee believes it would be in the best interest of the community to publish the outcomes of this review.

Urban, industrial and agricultural water

Regional councils have carried out significant work in the area of strategies to improve water security through undertaking studies to plan effectively for future water needs. The Committee believes this work is critical in helping to inform the debate on whether new water storages or augmentation of existing ones and/or improvements to management are necessary.

In particular, the Committee supports the efforts of councils and metropolitan water utilities in pursuing urban conservation measures such as stormwater harvesting and recycling waste water. The Committee believes that demand management practices are just as important as managing the supply or the delivery of water to all users. We recognise that, in terms of demand management practices for urban water users, 92 per cent of local water utilities have implemented water conservation plans to minimise wastage and educate end users in more efficient water use. The Committee encourages local water utilities to continue this work and the NSW Office of Water to continue its supportive role.

The Committee acknowledges that the NSW Government is supporting local water utilities to assess their future water security by developing the Assuring Future Urban Water Security Guidelines that will be released in the near future, and has recommended that the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures.

We also acknowledge that Sydney Water currently recycles 5.7 per cent of its waste water, with the potential to increase this to 14.75 per cent by 2015. However, given that the majority of urban waste water still goes out to sea, we believed there is significant potential for greater recycling, and further, that there may be substantial benefits from such measures including reducing the overall amount of water drawn for urban use from water storages, and also the production of more waste water recycling that could further support agriculture and industry.

Agricultural water accounts for over 80 per cent of water use in New South Wales. We consider, therefore, that this sector has a key role to play, along with governments, in ensuring future water security. We acknowledge the great work already achieved by the agriculture sector through improvements to irrigation systems and other on-farm practices, and believe this should be further supported and encouraged by both the NSW and Commonwealth Governments.

The Committee visited Keytah Farm where the irrigation trials that are currently underway are providing highly valuable information to farmers to enable them to make better informed decisions about their production methods. We believe these types of projects should be supported by both the agriculture industry and governments. We note that a further trial season at Keytah Farm has been made possible with funding from the Cotton Research Development Corporation.

In addition, the Committee strongly encourages individual famers to continue to adapt their practices to ensure efficient water use. The Committee believes that financial support from both the industry and from governments will continue to be critical in driving innovation in water use for agriculture. We recommend that the NSW Government financially support the agriculture sector to use more efficient water practices and encourage contributions from industry, and that the Commonwealth Government support research and development in this area.

The Committee notes the increasing use of buy backs as a tool to achieve water savings, particularly in the Murray Darling Basin, and believes that efficiency saving, rather than buy backs, should be the main focus for achieving the water savings required under the Murray Darling Basin Plan objectives. In

addition, the Committee is of the view that once the 2,750 gigalitres in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on State funded projects returning 100 per cent of water savings back to the irrigator, and that any State participation in federally funded programs for on-farm water savings should be based on irrigators retaining at least 50 per cent of the savings.

The Committee believes that a proposal from NSW Farmers to waive fixed water charges during exceptional drought conditions, when general security license holders may not receive any of their water allocation, is a sensible and fair approach. We therefore recommend that the NSW Government develop a statewide policy to this end.

The Committee received minimal evidence on issues surrounding the industrial use of water, however, we acknowledge that industry is also a competing end user for the water resource and consider that it should use water as responsibly as other users. Further, the Committee considers that industry has a role to play in minimising water use, for example, through using recycled water wherever appropriate.

Environmental issues

The Committee notes the concerns of inquiry participants regarding the potential negative impacts of water storages on the environment. We believe these impacts need to be balanced with the benefits of having water storages, including the longer term security of providing a water supply for consumptive purposes, for irrigation and therefore food security purposes, and potentially also for a level of flood mitigation in certain areas.

The Committee acknowledges that the NSW Government is undertaking a number of programs to address the potential negative impacts, including an active program to manage bank erosion, measures to aid fish passage through the construction of fish lifts and ladders and removal of weirs, and also the implementation of a cold water pollution strategy.

It was evident to the Committee that there was a level of concern about water storage releases in the Tumut area that we did not observe with other areas. This suggested the desirability of better practices and management for the Tumut River and Blowering Dam. The Committee has recommended that Tumut River and Blowering Dam be given a more constructive management regime, with a focus on the impact of water releases from the dam on the river.

The allocation of water for the environment was also a significant issue for this inquiry. With the implementation of environmental flows, the issue of the environment as a competing water entitlement holder emerged. The Committee was presented with numerous and serious concerns, especially among irrigators, relating to the amount of water allocated to the environment and the management of environmental flows. In particular, there was concern that the amount of water available for irrigators and other users has decreased, and also that, as there have been limited increases to the overall capacity of water storages since the implementation of environmental flows in 1997, the justification for the current level of environmental flows is debatable.

The Committee believes that the NSW Government needs to do more in this area to address the concerns of irrigators, and to this end, has recommended that the NSW Government review the environmental flow allocations for all valleys in New South Wales and lobby the Commonwealth Government to do the same in relation to the Murray Darling Basin Plan. We believe that this along

with the recommendations in Chapter 7 relating to future water solutions will go some way in addressing the concerns of New South Wales irrigators.

In addition to concerns with environmental flow allocations, the Committee believes that the priority given to environmental needs above water supply to industry and high security needs in regulated rivers under the *Water Management Act 2000* is not sufficiently balanced. While we recognise water for the environment is an important factor for the health of a river system, the Committee sees that water for industry that creates wealth, employment and provides food security for the nation should have greater priority. We recommended, therefore, that the NSW Government amend to *Water Management Act 2000* to reflect this emphasis.

The Committee also supports the NSW Government's efforts to clarify with the Commonwealth Government the issue of liability for environmental water releases made under the Murray Darling Basin Plan that inundate private land, and have recommended that the NSW Government obtain this clarification before the process of developing the water sharing plans that must comply with the Plan and be enacted by 2019.

Stakeholders also expressed concern regarding the high volume of water directed away from productive purposes in New South Wales in order to maintain the lower lakes of the Murray River in South Australia as fresh water lakes. The Committee believes that the impact on upstream users in New South Wales is detrimental and could be reduced by implementing alternative management options for the lower lakes, such as moving barrages upstream of the lakes and maintaining the lakes as estuarine. While we acknowledge that New South Wales has begun to address this issue in its submission on the Murray Darling Basin Plan, we believe further action is required to enable change to the management of the lower lakes and have recommended that the NSW Government make representations to the Commonwealth and South Australian Governments to change the current management of the lower lakes for the benefit of productive users in New South Wales.

We note that further measures that can address environmental impact concerns include the use of en-route downstream storages and the wider implementation of the Computer Aided River Management system, which are discussed below.

Storage management practices

An important component of storage management is the use of modelling systems to determine water requirements and thereby help predict future scenarios that may affect water availability. We note the concerns of inquiry participants regarding the current modelling systems and believe, as do many inquiry participants, that modelling systems need to have a predictive capability to help plan for the future. Further, the Committee acknowledges that predicting future water needs, especially in Australia's variable climate, is a significant challenge faced by storage managers.

In particular, the Committee was impressed with the new Computer Aided River Management system, developed by Water for Rivers and State Water. We recognise that there are numerous benefits associated with this system for all water users through the more precise delivery of water releases and therefore reduction in waste, or operational surplus. This can potentially mean accessing more water in the storages that can be used for the various users. The Committee recognises that the cost benefits are favourable and that investment by government is very worthwhile, given the anticipated gains in terms of improved storage management and increased access to water through more precise delivery methods. Currently used in the south of the State, the Committee is interested in exploring its

usefulness to other areas. While we note that there were some reservations from stakeholders in the Northern Rivers area about the applicability of the system there, we believe that as part of a broader roll out these issues could be addressed. The Committee has therefore recommended that the NSW Government fund and implement the CARM system across all river systems in the State.

The Committee also acknowledges that in order to support the roll out of the CARM system across the State, the metering project, currently piloted in the south of the State, would also need to be implemented in conjunction with the CARM system. This would provide the necessary accurate data on water usage that the CARM system requires to be so precise in its river management. Therefore, we recommended that the NSW Government roll out the water metering project across New South Wales, to support the statewide implementation of the CARM system.

Storage management can also be improved through efficiency measures such as those proposed for the Menindee Lakes. The Committee believes that improved efficiency in the management of the Menindee Lakes through augmentation works to minimise evaporation will have positive impacts for all water users. The Committee notes that such works in this area are less expensive than some other options, while avoiding the detrimental consequences of other proposals and also contributing substantial water savings. The Committee was made aware that plans and funding for these augmentation works are already being considered and has recommended that they should be finalised and implemented as soon as possible.

Dam safety

The Committee recognises the important role the Dam Safety Committee plays in protecting the State's water supply and also in endeavouring to minimise the risks associated with dams, for example by reducing the impact of significant floods on downstream communities.

However, as raised by some inquiry participants, the expenditure on upgrades for events that have a 1 in 200,000 probability of occurring in any year seems an unnecessary use of resources that are scarce and may be better utilised on other aspects of water management. We believe it is important to review the level of expenditure on the dam safety upgrade program to protect against events that are not likely to occur. The Committee supports the NSW Government in undertaking the review of the Dam Safety Committee and its relevant legislation. We recommend that the concerns raised in our inquiry be included in the review and that the outcomes of the review be made public.

An integrated approach to future water solutions

The Committee believes that future water security for New South Wales will be achieved most effectively and efficiently by pursuing an integrated approach. The Committee acknowledges the advice of many key stakeholders that dams are very expensive to build, operate and maintain, and while we firmly believe that dams play an integral and essential part of the water security strategy of the State, the Committee also acknowledges that there is potential to extend the use of current water resources through more cost effective and strategic means.

The Committee is open to new storages, subject to proper and comprehensive assessment of their costs, benefits, storage efficiency (that is, volume to surface area ratio), geological suitability of the site, environmental considerations, community expectations and other factors as appropriate. At the same time, we note that there is a multitude of options to better use water already captured in our dams and

believe that these deserve serious investigation and action. Further, the Committee believes that investing in a holistic and multifaceted approach will become increasingly important as demands on water increase in a land of large climatic variability.

In particular, the Committee believes that en-route storages have the potential to deliver a more flexible management approach in areas heavily regulated for productive and environmental purposes, which is worth investigating. We note the capacity of en-route storages to re-capture released or regulated water for later use in downstream areas which may otherwise flow unused through a system, thereby maximising water availability without the need for further extraction or the capital costs of a major storage. In particular, we see value in en-route storages as potentially beneficial to the management of the Murray Darling Basin, which has high demand from multiple users and prescribed limits on extraction.

The Committee also notes that en-route storages may reduce reliance on single, large reservoirs and provide greater flexibility in water supply and water management, which would be consistent with a more integrated approach in achieving future water security for New South Wales. We have recommended that potential options be investigated.

In addition, the Committee sees merit in the greater use of pipelines to improve efficiency by reducing water losses, and in providing flexibility by linking storages and catchment areas.

The Committee believes that all urban, industrial and agricultural water users in New South Wales have a responsibility to use water wisely and efficiently, and have recommended that as part of a multifaceted approach, government should take an active role in facilitating the responsible use of water. We also note the positive responses of users to strategies to reduce demand and to efficiency incentive programs, and we believe that such measures should form part of an integrated water management approach.

In particular, the Committee sees value in conserving and reusing water through recycling and stormwater harvesting initiatives, and commends the efforts of some local councils in implementing these programs. We believe that there is potential to significantly increase the amount of water captured through recycling and stormwater harvesting. To this end, we recommended that the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures, such as stormwater harvesting and recycling waste water.

We commend the key water agencies in New South Wales for their best practice methods and note that New South Wales and Australia are leaders in this field. Further, we believe that knowledge, innovation and technology in water management and conservation will continue to develop, providing us with more options into the future.

Throughout the course of this inquiry, the Committee noted the historical tension that exists between some water users and suggests that there is great commonality in their need to engage in sustainable use practices and promote river system health and function. The Committee acknowledges the role of regional water management committees in coordinating collaborative responses to issues in specific water management areas. We believe that there is merit in extending such a collaborative approach to a broader policy setting through the establishment of a statewide taskforce, to facilitate the sharing of information, to build and strengthen relationships between all water users and managers, and to drive innovation in this field.

Summary of recommendations

Recommendation 1 *Page 32*

That the NSW Government clearly communicate to stakeholders the purpose of all major water storages in New South Wales.

Recommendation 2 *Page 33*

That the NSW Government publish the outcomes of its review of the potential role for Warragamba Dam in flood mitigation.

Recommendation 3 *Page 51*

That the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures such as stormwater harvesting and recycling waste water.

Recommendation 4 *Page 61*

That the NSW Government:

- financially support the agriculture sector to use more efficient water practices and encourage contributions from industry and the Commonwealth Government to support research and development in this area, and
- ensure that after the 2,750 gigalitres in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:
    1. State funded projects returning 100 per cent of water savings back to the irrigator, and
    2. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.

Recommendation 5 *Page 62*

That the NSW Government develop a statewide policy of waiving fixed water charges during exceptional drought conditions.

Recommendation 6 *Page 75*

That the NSW Government review the management and impact of water releases from Blowering Dam on the Tumut River.

Recommendation 7 *Page 81*

That the NSW Government review the environmental flow allocations for all valleys in New South Wales and make representations to the Commonwealth Government for it to review the environmental flow allocations for New South Wales valleys in relation to the Murray Darling Basin Plan.

Recommendation 8 *Page 82*

That the NSW Government amend the principles of the *Water Management Act 2000* to ensure that the commercial water supply for towns and utilities and high security needs in regulated rivers are prioritised above environmental needs.

Recommendation 9 *Page 82*

That the NSW Government clarify with the Commonwealth Government the NSW Government's liability for environmental water releases made under the Murray Darling Basin Plan that inundate private land, in time to feed into the process of developing the water sharing plans that must comply with the Plan and be enacted by 2019.

Recommendation 10 *Page 100*

That the NSW Government fund and implement the Computer Aided River Management system across all New South Wales river systems.

Recommendation 11 *Page 100*

That the NSW Government implement the water metering project across New South Wales, to support the statewide implementation of the Computer Aided River Management system

Recommendation 12 *Page 109*

That the NSW Government:

- make representations to the Commonwealth Government to resolve who will provide funding for the augmentation works at the Menindee Lakes, and
- reaffirm and complete plans to enable construction to commence as soon as practicable.

Recommendation 13 *Page 111*

That the NSW Government make representations to the Commonwealth and South Australian Governments to initiate a review of the current management of the lower lakes of the Murray Darling Basin. This review should focus on returning the lakes to an estuarine system by building barrages upstream rather than at the mouth, thereby reducing the volume of water currently required and improving the productive and environmental outcomes for New South Wales.

Recommendation 14 *Page 120*

That the NSW Government, in undertaking the review of the New South Wales Dam Safety Committee and its relevant legislation, take into consideration the concerns raised in this inquiry and that the outcomes of the review be made public.

Recommendation 15 *Page 148*

That the NSW Government investigate the potential of strategically placed en-route storages to extend water use and provide flexibility in water delivery in some river systems, particularly in the Murray Darling Basin.

Recommendation 16 *Page 153*

That the NSW Government commit to continuing an integrated water management and conservation policy, and that it foster responsible use of water in urban, industrial and agricultural settings.

Recommendation 17 *Page 154*

That the NSW Government ensure that new storage proposals are comprehensively assessed in terms of costs, benefits, storage efficiency, geological suitability of the site, environmental considerations, community expectations and other factors as appropriate.

Recommendation 18 *Page 154*

That the NSW Government establish an Integrated Water Management Taskforce comprised of representatives of each of the key water user groups and government, with the following roles:

- to drive innovation in responsible water conservation, use and management, and
- to build collaborative relationships and promote the sharing of knowledge and expertise between and within water user groups across New South Wales.

Recommendation 19 *Page 154*

That the NSW Government commit to investing in water efficiency research and development, to inform an integrated, best practice approach to water management, and to further advances in this area.

Acronyms

CARM	Computer Aided River Management
Centroc	Central NSW Regional Organisation of Councils
GL	Gigalitre
MDBA	Murray Darling Basin Authority
MDBP	Murray Darling Basin Plan
ML	Megalitre
MWP	Metropolitan Water Plan
RAMROC	Riverina and Murray Regional Organisation of Councils
REROC	Riverina Eastern Regional Organisation of Councils
SCA	Sydney Catchment Authority
SDL	Sustainable Diversion Limits

Conversions

1,000,000 Litres = 1 Megalitre

1,000 Megalitres = 1 Gigalitre

Chapter 1 Introduction

This chapter provides an overview of the inquiry process, including the processes the Committee used to facilitate stakeholders' participation. It also includes a brief outline of the structure of the report.

Conduct of the inquiry

Terms of reference

1.1 The terms of reference for this inquiry were referred to the Committee by the Hon Katrina Hodgkinson MP, Minister for Primary Industries, on 28 May 2012.

1.2 The terms of reference required the Committee to inquire into and report on the adequacy of water storages in New South Wales, including the capacity of existing water storages to meet agricultural, urban, industrial and environmental needs. In addition, they required the Committee to examine models for determining water requirements, and proposals for the construction and/or augmentation of water storages in New South Wales. The terms of reference are reproduced in full on page iv.

Submissions

1.3 The Committee called for submission through advertisements in *The Sydney Morning Herald*, *Daily Telegraph*, *Weekly Times* and *The Land*. The Committee also wrote to key stakeholders inviting them to participate in the inquiry.

1.4 The Committee received 110 submissions and two supplementary submissions from a range of stakeholders, including the NSW Government, Local Government and Shires Association, NSW Farmers, the Nature Conservation Council of NSW, Monash Water for Liveability, along with numerous councils and local and regional organisations and groups.

1.5 A full list of submissions is contained in Appendix 1. These submissions are available on the Committee's website: www/parliament.nsw.gov.au/statedevelopment.

Public hearings

1.6 The Committee held five public hearings over the course of the inquiry. Three public hearings were held at Parliament House, with the remaining two held in Wagga Wagga and Moree.

1.7 The Committee received evidence from a number of relevant government organisations, including the NSW Office of Water, State Water and the Sydney Catchment Authority. The Committee also heard from key stakeholders such as the NSW Irrigators' Council, the Australian Water Association and regional organisations of councils.

Site visits

1.8 The Committee conducted five days of site visits to locations around the State.

1.9 On 29 August 2012 the Committee inspected water storage facilities in the Shoalhaven and Southern Highlands, including Bamarang Dam and Water Treatment Plant, Tallowa Dam and the Wingecarribee Reservoir. The Committee was also briefed on water storage issues for the Shoalhaven region.

1.10 On 30 August 2012 the Committee travelled to Goulburn to inspect the Highlands Source Pipeline and Pumping Station, as well as Pejar and Sooley Dams. The Committee was also briefed on water storage issues for the Goulburn area.

1.11 On 30 October 2012 the Committee travelled to Orange to be briefed on water storage issues relevant to the region, including stormwater harvesting and the Macquarie-Orange Pipeline Project. The Committee also inspected a number of stormwater harvesting sites, including the Ploughman's Wetland.

1.12 On 31 October 2012 the Committee inspected water storage facilities in Griffith, including Barren Box Swamp and two on-farm irrigation sites. The Committee then travelled to Wagga Wagga to inspect the Computer Aided River Management system (CARM) on the banks of the Murrumbidgee River.

1.13 On 5 March 2013 the Committee travelled to Copeton Dam near Inverell to be briefed on the recent dam safety upgrades and downstream water management strategies. Later the same day the Committee conducted a visit of inspection to Keytah Farm near Moree to be briefed on a trial of comparative irrigation practices for cotton.

1.14 The Committee is grateful for the time and expertise shared by the individuals and organisations who contributed to these visits.

Report structure

1.15 Chapter 2 provides the background to this report by presenting an overview of the water storage system in New South Wales and its management. It explains the present water storage system and recent reforms, as well as the allocation and cost of water. It sets out the roles of the key agencies involved in managing this system as well as Commonwealth requirements, and outlines the present assessment process for new and augmented storages. This chapter also starts the discussion central to this inquiry on the adequacy of water storages in New South Wales to meet the future needs of competing users.

1.16 A topical issue throughout the inquiry was the different roles that water storages should play, including reducing the variability of water availability, providing flood mitigation, and storing water for competing end users. Chapter 3 explores the views of inquiry participants in regard to these various roles.

1.17 Chapter 4 considers how the competing urban, agricultural and industry uses of water are being managed by the NSW Government and explores a number of conservation measures being pursued by the various water users to help ensure more efficient use of existing stores and to improve water security. It also explores additional means by which responsible urban and agricultural water use can be enhanced.

1.18 In Chapter 5 the potential impact that water storages have on the environment is examined. The chapter explores participants' views on the impact of water storage releases on the environment, including the variability of the releases and the effects of cold water releases on downstream river health. A key issue for the inquiry, the allocation of water for the environment, also known as environmental flows, is examined, as are participants' concerns surrounding the management of these flows.

1.19 Chapter 6 examines the storage water management practices pursued by NSW Government water agencies overseeing the operations of the State's water storages. There are a number of factors that can be addressed in order to improve the access to more water in storages including access to deep water and minimising evaporation. An important component of storage management is the use of modelling systems, which are also discussed in this chapter. Lastly, the chapter considers dam safety practices and the role of the NSW Dam Safety Committee.

1.20 Chapter 7 brings together the various issues discussed in this inquiry and provides potential solutions on the way forward to securing New South Wales' water supplies for all users. Proposals for new water storages and projects to augment existing storages are presented. It concludes with the Committee's recommendations for how best to secure a sustainable water supply for New South Wales into the future.

Chapter 2 Water storages in New South Wales

This chapter provides a background to this report by presenting an overview of the water storage system in New South Wales and its management. It commences by explaining the present water storage system and recent reforms, then the allocation and cost of water. It sets out the roles of the key agencies involved in managing this system as well as Commonwealth requirements. This chapter also starts the discussion central to this inquiry on the adequacy of water storages in New South Wales to meet the future needs of competing users.

Present water storages

2.1 There are numerous water storages across the State. For the purposes of this report, a water storage is defined as a hydrological feature in which water is stored. Surface water storages include natural and man-made lakes, reservoirs and lagoons and also water held behind weirs and dams.[1] Ground water storages include aquifers and bores.

2.2 The map in Figure 1 on the following page indicates the location of the water storages and also the various agencies responsible for the management of the water storages.

2.3 The NSW Government sees its role as being to ensure the efficient management of New South Wales' current water storages to meet agricultural, urban and environmental needs in both dry and wet periods. The NSW Government advised:

> NSW's current water planning and management policies, for both urban and rural shortages, are in line with the 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).[2]

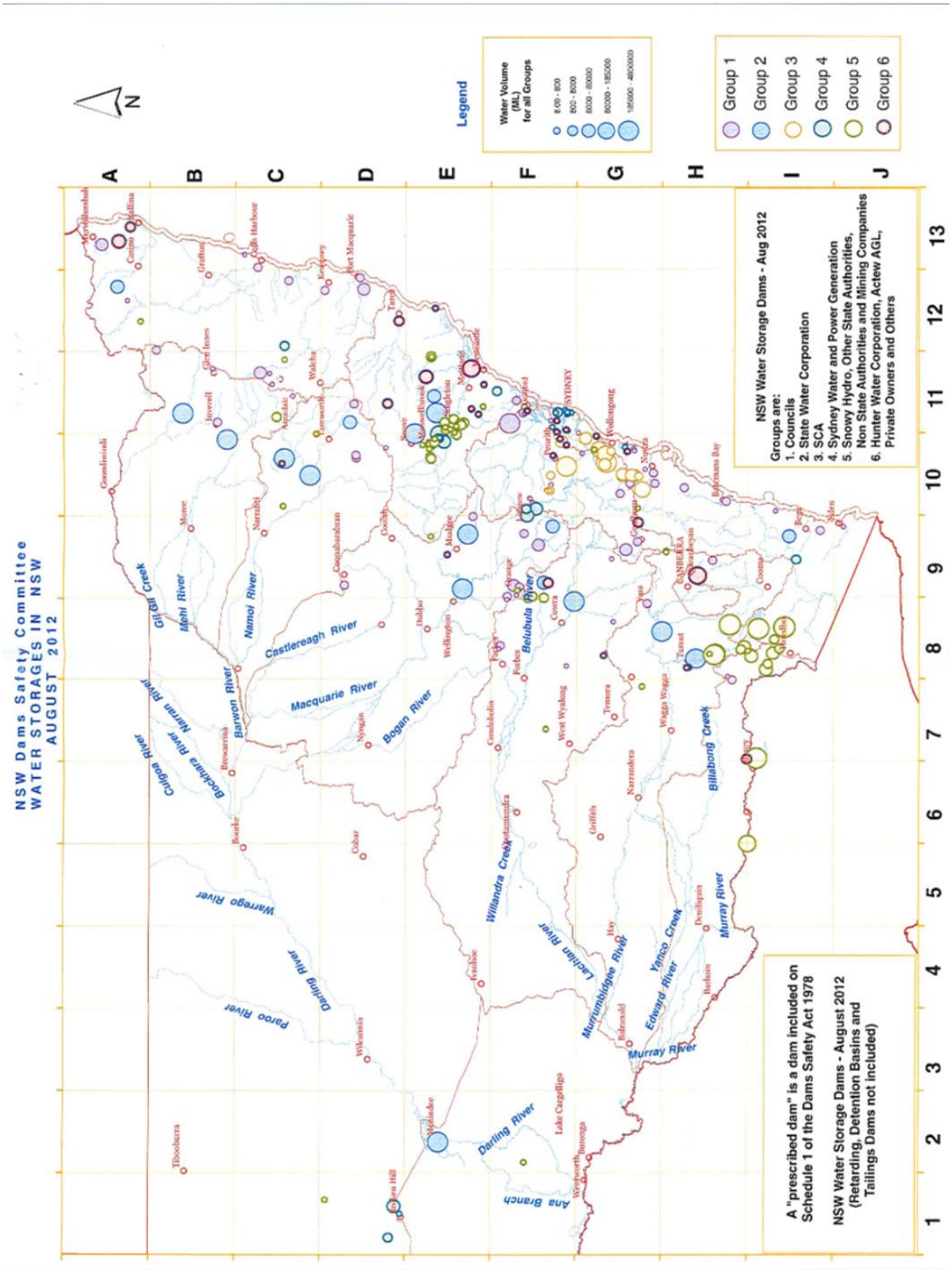
2.4 These policies are consistent with the key national principles and intergovernmental agreements such as the National Water Initiative, the National Urban Water Planning Principles and the Murray Darling Basin Plan, which are outlined later in this chapter.[3]

1 Bureau of Meteorology, accessed 27 May 2013,<www.bom.gov.au/water/waterstorage/glossary.shtml>.

2 Submission 13, NSW Government, p 2.

3 Submission 13, p 2.

Figure 1 Water storages in New South Wales and responsible agency[4]



[4] Tabled document, NSW Dam Safety Committee, *Water storages in New South Wales and responsible agency*

2.5 From the 1990s New South Wales has been going through a process of ongoing water reform, as indicated by Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries:

> In New South Wales we went through a process of water reform from the mid nineties right through until now where we recognised that possibly the allocation of water for consumptive purposes had in certain circumstances gone beyond the capacity to keep the rivers themselves healthy and productive to the state where you could continue that economic productivity … So we entered a process of water reform, which included the development of water sharing plans which provided water for the environment and community groups worked out what was necessary to maintain the health and productivity.[5]

2.6 A key aspect of the reforms was the creation of the NSW *Water Management Act 2000*, which regulates water planning and access rights, including a licence system, the provision of water for the environment and the operation of a water market.[6]

2.7 According to the NSW Government submission to the inquiry, water storages are now operated to achieve the water sharing outcomes required by 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.[7]

Allocation of water

2.8 The amount of water allocated to water users in New South Wales is determined annually under a system of water sharing plans and water allocation rules. The NSW Government explained that statutory planning rules determine priorities for sharing water between different users. These plans are developed by regional Water Management Committees under the guidance of the NSW Office of Water, and are approved by the Minister for Primary Industries (with the concurrence of the Minister for the Environment).[8]

2.9 Under these water sharing plans, water for different purposes is allocated to general and high security licence holders depending on the volume of water available for use.[9]

2.10 All extraction for commercial purposes must be licensed by the NSW Office of Water and the licence specifies the maximum volume that can be extracted. However, annual extractions are also determined by allocation announcements.[10]

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5 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 3 May 2013, p 3.

6 Montoya, D, *Water: Regulatory Frameworks in Rural NSW*, Briefing Paper 4/2010, NSW Parliamentary Library, p 16.

7 Submission 13, p 8.

8 Submission 13, pp 5-6.

9 Submission 13, pp 5-6.

2.11 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, that is, general or high security.[11]

2.12 The *Water Management Act 2000* sets out the priorities for supply. Water to maintain the fundamental health of the system and supply basic landholder rights has first priority. In terms of consumptive licensed users, local water utilities, major utilities and domestic and stock access have priority over all other consumptive users.[12]

2.13 In regulated rivers such as the Gwydir, Namoi, Macquarie, Lachlan, Murrumbidgee, Murray-Lower Darling, Hunter and Border Rivers,[13] high security licence holders such as towns, permanent plantings and some industry, have priority over general security licences, which are mainly used for annual cropping and other industry needs. Supplementary water access has the lowest priority.[14]

2.14 During periods of severe water shortage, the following priority order is prescribed under the Water *Management Act 2000*:

1. The domestic supply for towns and utilities and basic landholder rights
2. *Environmental* needs
3. Commercial supply for towns and utilities and high security needs in regulated rivers
4. Other licensed needs.[15]

2.15 Through the water sharing plans, environmental needs are met through limits on extraction and through various environmental flow rules or provisions.[16] More detail on environmental flows can be found in Chapter 5.

2.16 Mr Harriss further explained how the system of water allocations operates in practice, advising that approximately 15 per cent of water is allocated for high security use, with the remaining 85 per cent allocated under general entitlements:

10 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 1, p 2.

11 Submission 13, pp 5-6.

12 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 1, p 2.

13 State Water Corporation, accessed 15 May 2013, <www.statewater.com.au/Customer%20service/Frequently%20asked%20questions>.

14 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 1, p 2.

15 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 1, p 2.

16 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 1, p 2.

> New South Wales has a two-tiered system of water allocation. High security is typically about 10 per cent to 15 per cent of the water use throughout the State. That is a very secure water product, if you like. It is virtually guaranteed in a repeat of all the climatic conditions we have had, albeit sometimes it might have to build up during the course of the season. The remaining 80 per cent to 85 per cent of the water is in general security, which means effectively that more water is available depending on the season. So if it is a wet season you have an allocation that is a proportion of your entitlement. In a wet season you can expect to get 100 per cent of that entitlement. In years like we have had where we have gone through severe drought there have been some valleys where there has been zero per cent water availability for general water irrigators for a number of years consecutively.[17]

2.17 The NSW Office of Water also has a policy that water storage will typically contain a minimum of two years' worth of supply to meet high security entitlements.[18]

The cost of water

2.18 In addition to a system of management for the allocation of water, New South Wales also has a system to manage the cost of water and water trading rights. Bulk water charges are regulated by the Independent Pricing and Regulatory Tribunal.[19]

2.19 There are two components to the price of water: a water management charge from the NSW Office of Water, and entitlement and usage charges from State Water. Both of these charges are calculated using the same formula:

> EC x E + U x W
>
> Where:
> - EC is a single entitlement (fixed) charge that retains the same value whether it is in dollars per megalitre of entitlement or in dollars per unit share
> - E is a licence holder's entitlement in megalitres or unit shares
> - U is a usage charge expressed in dollars per megalitre
> - W is a licence holder's water usage for that year in megalitres.[20]

2.20 Environmental flow allocations are subject to the same charges as water ordered for other purposes. Where an environmental flow is issued as an entitlement and is ordered by an environmental water holder, such as when an irrigation entitlement is ordered, it will have the same charges levied on it as if it were used for town water suppliers, or for industrial or irrigation use.[21]

2.21 A further element of the price on water is a trading system whereby licensed water holders can sell or lease all or part of their allocations on the water market. Mr Harriss advised the Committee that water rights are traded in instances where there is an 'economic incentive' for

17 Mr Harriss, Evidence, 20 August 2012, p 3.

18 Mr Harriss, Evidence, 20 August 2012, p 3.

19 Mr Harriss, Evidence, 20 August 2012, p 12.

20 Independent Pricing and Regulatory Tribunal, *Fact Sheet – Prices and bills for regulated river users 2012/13*, p 1.

21 Mr Harriss, Evidence, 20 August 2012, p 14.

the licence holder to sell or lease part of their allocation and can be a means to encourage conservative water use at desirable times:

> [T]here is a temporary market, an annual market, which can be particularly lucrative, particularly in dry sequences. For example, in the Murrumbidgee Valley where the price of water, the permanent sale of water might be $2,000 – I would say more like $1,500 than $2,000 a megalitre – during a drought that same megalitre for a lease arrangement would be selling for $400 a megalitre yet the bulk water charges were probably in the order of about $16 a megalitre, so there is an economic incentive for users to be conservative with their water use and to trade that water, either permanently or temporarily. Again we lead most parts of the world in our water trading arrangements.[22]

Principal New South Wales water agencies

2.22 A number of NSW Government agencies have a key role to play in the management of water and water storages.

NSW Office of Water

2.23 The NSW Office of Water in the Department of Primary Industries is responsible for the management of New South Wales's surface water and groundwater resources.

2.24 The Office of Water reports to the NSW Government for water policy and the administration of key water management legislation, including the *Water Management Act 2000* and the *Water Act 1912*.

2.25 The Office carries out the following functions:

- determines the volume of water available for allocation each year to towns, water users and the environment, particularly during times of severe water shortage
- ensures all users, including the environment, have access to sustainable water supplies
- develops statutory water sharing plans which set the rules for sharing water between users, and between users and the environment
- negotiates interstate and national water agreements particularly in view of the significant institutional changes occurring in the Murray-Darling Basin
- approves the extraction and use of water, and the policies and procedures for the permanent trade of water entitlements and the annual trade of available water
- coordinates the development of town and non-urban water policy
- monitors the quantity, quality, and health of our aquatic ecosystems and water extractions.[23]

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22 Mr Harriss, Evidence, 20 August 2012, p 12.

23 Department of Primary Industries, Office of Water, accessed 18 January 2013 <www.water.nsw.gov.au/About-Us/default.aspx>.

Metropolitan Water Directorate

2.26 The development and implementation of water supply plans for New South Wales's metropolitan areas, including greater Sydney and the lower Hunter, are managed by the Metropolitan Water Directorate within the Department of Finance and Services.

2.27 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 set out the measures to ensure a stable supply of potable water is provided to two of the State's most populous regions, while continuing to address river health in those rivers that are impacted by the water supply dams.[24]

2.28 The NSW Government advised that the 2010 MWP, which covers Sydney, the Illawarra and the Blue Mountains, focuses on four main strategies 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 per cent of Sydney's needs (90 billion litres a year)
- water efficiency reducing demand for water by households, government and business.[25]

2.29 The Chichester Dam, Grahamstown Dam and the Tomago Sandbeds are the Lower Hunter region's key water storages, supplying 95 per cent of the region's needs, with the remaining five per cent being supplied by two minor water sources in the Port Stephens area.

2.30 These dams are either small and/or shallow, and the region's storage system is more prone to water loss via evaporation than other storage systems such as Sydney's and can therefore pose a risk to the region's security of supply in times of severe drought. To address these issues and plan for long-term, sustainable supply, the Committee was advised that 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.[26]

Sydney Catchment Authority

2.31 The NSW Government indicated that greater Sydney's water supply is managed primarily by the Sydney Catchment Authority (SCA) and Sydney Water.

24 Submission 13, p 3.

25 Submission 13, pp 3-4.

26 Submission 13, p 4.

2.32 The SCA operates two 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 gigalitres and supply water to over 4.6 million consumers in Sydney, the Illawarra, Shoalhaven, Blue Mountains and Southern Highlands. A table setting out the capacity of water storages managed by the SCA is provided in Appendix 6.

2.33 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. According to the NSW Government, cumulatively, these sources make the Sydney storage system one of the largest in the world in per capita terms.[27]

2.34 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, provided an overview of how water is collected and distributed:

> The storages collect water from the river systems of six catchments, these being the Warragamba, Upper Nepean, Woronora, Shoalhaven, Blue Mountains and Prospect. When needed, water is transported mostly by gravity via an interconnected network of rivers, pipes and canals to water filtration plants that treat the water for distribution.[28]

2.35 Figure 2 on the following page provides is a diagrammatic representation of the greater Sydney's water supply system.

State Water Corporation

2.36 The NSW Government advised that outside of metropolitan Sydney, most major dams and water management infrastructure are operated by the State Water Corporation (State Water).[29]

2.37 Mr Brett Tucker, Chief Executive Office, State Water, provided an overview of the role and responsibilities of State Water:

> State Water Corporation is the State Government-owned entity responsible for running the regulated rivers in the State other than the greater metropolitan Sydney catchment and Hunter catchment… We control some 20 major storages in this State, 280 weirs and regulators which are in the stream as part of the control network. We have some 6,500 customers, ranging from riparian stock and domestic suppliers right through to large irrigation corporations, energy companies, local government areas and everything in between.[30]

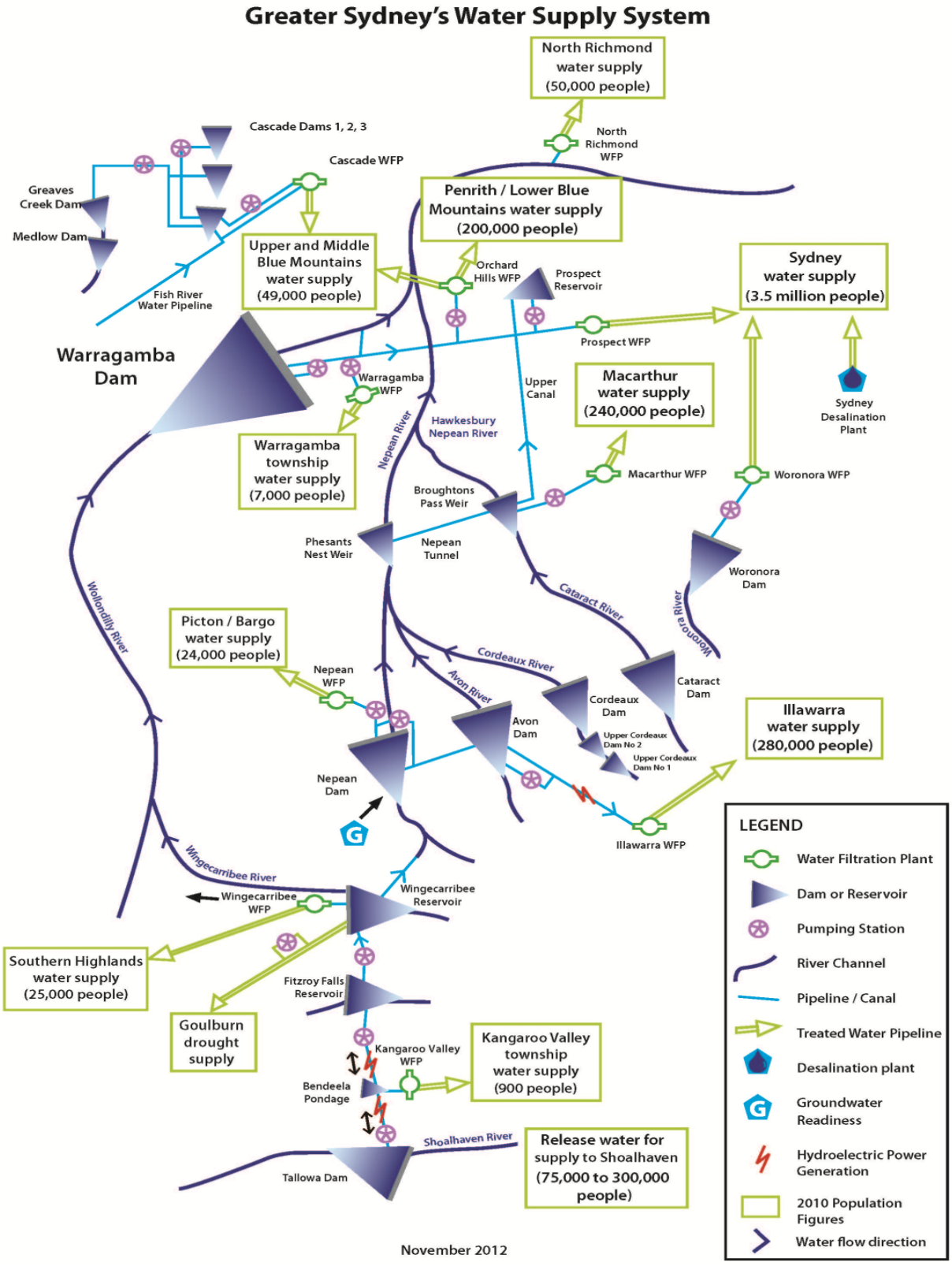
27 Submission 13, p 3.

28 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, Evidence, 20 August 2012, p 36.

29 Submission 13, pp 4-5.

30 Mr Brett Tucker, Chief Executive Office, State Water Corporation, Evidence, 20 August 2012, p 22.

Figure 2 Greater Sydney's Water Supply System[31]



31 Tabled document, Sydney Catchment Authority, Greater Sydney's Water Supply System.

2.38 The capacity of State Water's major rural dams is currently 18,751 gigalitres. These dams supply water for irrigation, environmental, domestic and industrial uses. As a result of heavy rainfall, as at August 2012, nearly all State Water dams were full, or close to full.[32] A table setting out the major NSW rural water storages operated by State Water and their capacities can be found in Appendix 7.

2.39 The Committee was advised that during the last drought, from about 2001 until 2010, 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.[33]

2.40 State Water is currently running the following key asset related programs:

- The dam safety program, aimed at lifting major storages to contemporary safety standards, with a focus of seven initial storages. Stage one is likely to be completed by mid 2014.[34]
- The metering program, which is currently operating in the south of the State as two pilot projects. As of August 2012, there were 900 meters in the ground with another 350 to 400 to be installed. Metering provides technologies that can drive both on-farm and off-farm efficiencies and improvements in management in coming years.[35]

2.41 State Water's Computer Aided River Management (CARM) modelling system brings the use of those meters together into an integrated real time management tool for running rivers.[36] CARM is discussed in more detail in Chapter 6.

Local water utilities

2.42 The NSW Government indicated that water supply for urban needs in non-metropolitan areas is undertaken by 105 local water utilities, the large majority of which are operated by local councils.[37]

2.43 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.[38]

32 Submission 13, pp 4-5.

33 Submission 13, pp 4-5.

34 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

35 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

36 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

37 Submission 13, p 4 and NSW Office of Water website, accessed 28 May 2013, <www.water.nsw.gov.au/Urban-water/Local-water-utilities/default.aspx> .

38 Submission 13, p 4.

2.44 Water sourced for these local water utilities is as follows:

- 28 per cent is supplied by rivers regulated by State Water storages;
- 58 per cent is supplied from storage schemes mostly involving off river storage; and
- the remaining comes from unregulated rivers, rain water or extractions from groundwater.[39]

2.45 Forty five local water utilities manage surface water supplies with storage dams. These dams are in addition to those managed by State Water.[40]

2.46 The Local Government and Shires Association provided an overview of the role of local water utilities in regional New South Wales:

> Local Government plays an important role in water management and in the provision of water services to the community. Councils use water for their business activities and community services and continuously aim to improve the efficient use of this scarce resource. In regional NSW, councils also provide water supply and sewerage services. There are currently 106 local water utilities providing these services to communities in regional NSW, including 96 council-owned and operated local water utilities, four water supply county councils, and one water supply and sewerage county council. Local water utilities service almost 2 million people in regional NSW. This is a significant responsibility including ensuring supply security and drinking water quality through infrastructure provision, demand management and integrated water cycle management.[41]

State Development Committee viewing Pejar Dam, water supply for Goulburn[42]

39 Submission 13, p 4.

40 Submission 13, p 4.

41 Submission 38, Local Government and Shires Association, p 1.

42 State Development Committee site visit to Goulburn, 29 - 30 August 2012.

NSW Dam Safety Committee

2.47 The NSW Government explained that the NSW Dam Safety Committee was established under the *Dams Safety Act 1978* and regularly monitors and inspects the State's major dams, which are identified in Schedule 1 of the Act, to ensure they are compliant with current safety requirements.

2.48 The Dam Safety Committee described its role as follows:

- maintain a system of surveillance of prescribed dams
- examine and investigate the location, design, construction, reconstruction, extension, modification, operation and maintenance of the prescribed dams
- obtain information and keep records on dams
- formulate measures to ensure the safety of dams.[43]

2.49 A prescribed dam is a dam whose failure would have the potential consequence of threatening downstream life, causing extensive property or environmental damage or otherwise having a severe impact on the public welfare. There are currently about 380 prescribed dams. These include the major water supply and irrigation storage dams, mines tailings and storage dams and flood retarding basins in urban areas. [44]

2.50 The Dam Safety Committee advised that it expects the number of prescribed dams in New South Wales to continue to grow and also existing dams to require safety improvements to meet community expectations.[45]

2.51 Owners of non-compliant dams are required to take steps to upgrade these dams. The upgrade process also offers an opportunity to increase dam capacity and improve the efficiency of dam operations. For example, the Committee was advised that the safety upgrades and augmentation currently being carried out at Chaffey Dam near Tamworth will increase capacity to 100,000 mega litres. Other upgrades such as at the Burrendong Dam near Wellington and Blowering Dam near Tumut will improve flood management and optimise environmental outcomes.[46]

2.52 The Dam Safety Committee indicated that it is implementing a new risk based approach:

> In 2006 the NSW Government, on the initiative and instigation of the DSC, endorsed a 'Risk Management Policy Framework for Dam Safety'. This is now being progressively implemented by the DSC. A risk based approach to dam safety management and planning of dams has the potential for overall lesser capital costs for dam upgrades and remedial works than for only a purely prescriptive and standards-based management approach … The DSC risk policy framework, including the societal risk requirements for existing and new dams, is at the forefront of modern dam safety management practice nationally and indeed internationally.[47]

43 Submission 11, Dam Safety Committee, p 1.

44 Submission 11, p 1.

45 Submission 11, p 1.

46 Submission 13, p 9.

47 Submission 11, p 2.

2.53 The Dam Safety Committee is further discussed in Chapter 6.

Commonwealth water requirements

2.54 In addition to the management and allocation of water at the state level, there are a number of Commonwealth schemes that impact on the storage of water. This section briefly discusses the key initiatives in this regard: the National Water Initiative, the National Urban Water Planning Principles and the Murray Darling Basin Plan.

National Water Initiative

2.55 The National Water Initiative is a comprehensive strategy being implemented by the Commonwealth Government to improve water management nationwide. The NSW Government is a partner in the initiative, which was endorsed by the Council of Australian Governments (COAG) in 2004. The key aims of the initiative are to:

- expand the permanent trade in water to enable its more efficient use and recovery in order to achieve improved environmental outcomes
- encourage investment in the water industry through more secure water access entitlements and improved access to information
- make water planning more transparent and comprehensive to deal with the interaction between surface water and groundwater systems and the provision of water to meet specific environmental outcomes
- address over-allocated river systems as quickly as possible, in consultation with affected stakeholders, and manage adjustment.[48]

2.56 The NSW Government, through the Office of Water, has contributed to various programs and policies related to the initiative, including input into policy guidelines for best practice water planning and management, water accounting, a common national registry system to improve licence information and water trading, and the development of a national hydrological modelling platform. [49]

National Urban Water Planning Principles

2.57 The National Urban Water Planning Principles were adopted by COAG in 2008 and are in place across all 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

48 NSW Trade and Investment Annual Report 2010-11, p 29.

49 NSW Trade and Investment Annual Report 2010-11, p 29 and NSW Trade and Investment Annual Report 2011-12, p 28.

- 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.[50]

2.58 The NSW Government advised the Committee that the water planning approach for metropolitan Sydney complies with these principles. For example, in accordance with the principles, the MWP is reviewed periodically so that it can be adapted to address new challenges and take account of the latest data, techniques and research. In addition, the adaptive management planning approach for the MWP considers the costs and benefits of a full portfolio of water supply along with demand options, consistent with the Planning Principles.[51]

2.59 In addition, the NSW Government indicated that the principles will form the basis of the review of the MWP and will be used to guide the development of the LHWP. [52]

Murray Darling Basin Plan

2.60 The Murray Darling Basin Plan being developed by the Murray Darling Basin Authority is an overarching plan for that entire Basin. It sets new extraction limits, known as sustainable diversion limits (SDLs), for each river catchment and aquifer system and also overall trading rules.[53]

2.61 The Basin Plan was signed into law by the Commonwealth Parliament in November 2012. It includes enforceable limits on the quantities of surface water and groundwater that can be taken from the Murray-Darling Basin. The SDLs are set initially at 2,750 gigalitres less than current diversions in the rivers across the Basin, which is to provide additional water for the environment by 2019.[54]

50 Submission 13, p 10.

51 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 5, p 5.

52 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 5, p 5.

53 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 6, p 6.

54 NSW Office of Water website, accessed 23 May 2013, <www.water.nsw.gov.au/Water-management/Law-and-policy/National-reforms/Basin-Plan/murray-darling-basin-plan>.

2.62 As inland New South Wales makes up the largest proportion of the Murray-Darling Basin, most New South Wales river valleys have experienced significant buyback of water licences and removal of water from agricultural production, particularly in the southern valleys, as the Commonwealth proceeds to obtain the volumes required to meet the SDLs.

2.63 The Basin Plan's SDLs will have to be complied with from 2019 and the MDBA will have the role of accrediting New South Wales plans against the requirements of the Plan. New South Wales will therefore need to revise all of its water sharing plans for inland areas from 2019.[55] The Murray Darling Basin Plan and its potential impact are discussed in Chapter 5.

Assessment process for new or augmented storages

2.64 A key issue for this inquiry concerns whether new storages are required or existing ones should be augmented in order to meet the State's water demands into the future. This section sets out the various principles and the criteria for these decisions in the urban and rural context. The Committee examines participants' views on these issues in Chapter 7.

2.65 According to the NSW Government, planning conditions in New South Wales require that all proposals for a new dam or weir require assessment and approval under both State and Commonwealth legislation. To be considered viable, any new storage would also have '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'. Proposals for new or augmented storages may also be subject to different planning and assessment requirements depending on whether they are in urban or rural areas.[56]

Urban storages

2.66 The NSW Government informed the Committee that proposals for the construction 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 National Urban Water Planning Principles. Key features of the planning process include:

- an adaptive management framework 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

55 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 6, p 6.

56 Submission 13, p 9.

- 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.[57]

Rural storages

2.67 According to the NSW Government, any proposals for new water storages in rural areas would require the 'standard process for major developments including feasibility, cost benefit analysis and environmental impact assessment, and would also be subject to state and Commonwealth planning and environmental legislation'.[58] In its submission, the NSW Government specifically outlined the considerations of location, cost and existing policy settings in relation to rural water storages.

2.68 With regard to location, the NSW Government informed the Committee that the efficacy of rural water storages is highly dependent on their location and ability to meet other geographical requirements.[59]

2.69 The cost analysis of new proposals for rural storages is based on the capacity of the Government and water users to pay for new infrastructure through increased water charges or through increased subsidisation of State Water's capital costs.[60]

2.70 Existing policy settings also set limits on proposals for new water storages. New South Wales is party to the Murray Darling Basin Plan, which 'aims to strike a balance between making water available for productive and environmental uses by introducing new sustainable diversion limits'.[61] Accordingly, any new proposal is considered in light of both community needs and the requirements of the proposed Basin Plan.[62] For example, New South Wales is subject to a cap on extraction in the Murray Darling Basin and, under the Basin Plan, extractions will be further constrained which will preclude increased water use.[63]

A key issue for the inquiry: reliable water supply

2.71 A key issue for this inquiry is balancing the often competing agricultural, urban, industrial and environmental water needs and ensuring there is a reliable water supply to meet these needs now and into the future. The importance of this issue was expressed by a number of inquiry participants. For example, Regional Development Australia – Orana commented that:

57 Submission 13, p 9.

58 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4.

59 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4.

60 Submission 13, p 10.

61 Submission 13, p 10.

62 Submission 13, p 10.

63 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4.

> To provide for the long term economic development and social needs of our region we need a consistent and reliable supply of water for our cities and towns, power generation, irrigated agriculture, our mines and the environment.[64]

2.72 Similarly, NSW Irrigators' Council argued that there are number of reasons as to the urgency of ensuring a secure water supply for the future:

> There are several factors contributing to the urgency of ensuring we have a safe and secure supply of water into the future:
>
> - the predicted population growth in NSW will put pressure on urban water supplies,
> - the management of environmental assets not only in NSW but in surrounding States will put pressure on environmental and productive water supplies,
> - producing food and fibre for an increasing local population and the positioning of Australia as Asia's food bowl will put pressure on irrigation and industrial water supplies, and
> - the uncertainty of variable climate and weather patterns in the future could put pressure on every sector that uses water.
>
> The implications of these pressures could be severe if we do not address the needs of each sector and our ability to deliver a workable solution which will better regulate supplies and avoid or mitigate the impacts of future drought and population growth.[65]

2.73 The NSW Irrigators' Council suggested that since there have been no new water storages over recent times, options to secure water for the future may be limited:

> The building of additional water storages has been a high risk political topic over the past 30 years. In that time period however, having not pursued any new projects we have limited our options for the future. If there is not a change in attitude in the short to medium term, we will face a future which is characterised by water shortages and the flow-on effects from that will impact on every Australian.[66]

2.74 Similarly, Namoi Water highlighted that 'What we do with the stored water and the priority in which it is used should be informing our consideration of storage requirements, its funding and also future management.'[67]

2.75 Dr Richard Sheldrake, Director-General, Department of Primary Industries, proposed that, while most beneficial locations for dams have been utilised, there is capacity to improve water use efficiency by end users:

> [T]here is a wider conversation to be had about water security and water use by end users. We are all aware that water is a scarce commodity in our landscape and the evidence that much of the easy water has already been captured in our dams and storage systems. However, there is significant capacity to improve water use efficiency by end users to increase the productive outputs from the water resource.[68]

64 Submission 12, Regional Development Australia – Orana, p 2.

65 Submission 97, NSW Irrigators' Council, p 3.

66 Submission 97, p 7.

67 Submission 94, Namoi Water, p 5.

68 Dr Richard Sheldrake, Director-General, Department of Primary Industries, Evidence, 20 August 2012, p 2.

2.76 These issues will be further explored in the remainder of the report. The next chapter discusses the role of water storages.

Chapter 3 Role of water storages

A topical issue throughout the inquiry was the different roles that water storages should play, including reducing the variability of water availability, providing flood mitigation and storing water for competing end users. This chapter explores the views of inquiry participants in regard to these various roles.

Reducing variability

3.1 Only a few inquiry participants commented on the role water storages play in reducing the variability of water availability. All these participants saw a role for water storages to reduce the variability of water supply due to the Australian climate. For example, Southern Riverina Irrigators asserted that, 'Australia is a land of extremes and river regulation and dam storages have enabled those extremes to [be] flattened, thus providing more regular and secure supplies'.[69]

3.2 Similarly, the Australian Water Association commented that 'Australia's climate is characterised by highly variable rainfall and river flows. To provide secure water supplies for agricultural, urban and industrial purposes numerous dams and weirs have been constructed'.[70]

3.3 Regional Development Australia – Orana noted that because of the variability of climates in Australia a 'consistent reliable water supply to irrigated agriculture will take out some of the variability for the region.'[71] It went on to argue that the capacity to reduce variability should be enhanced:

> [O]ur capacity to take out the highs and lows must be increased holistically through the use of water efficiency, clever water saving and some strategic engineering of dams and weirs to prevent our rivers drying up for long periods, our towns carting water in from outside and our iconic Macquarie Marshes and river systems failing.[72]

3.4 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, affirmed this role by commenting that one of the roles of water storages is to secure water supply in an incredibly variable climate.[73]

3.5 Similarly, Mr Brett Tucker, Chief Executive Officer, State Water Corporation, spoke of the need to ensure water storages can deal with Australia's unpredictable variability in hydrology:

> The other feature that is important to understand about Australian hydrology is that it is not just the variability that we deal with but the unpredictable nature of that variability. Variability can be modelled and constructed against. We have the largest amount of storage per capita in the world. You have to build much larger dams in Australia to get the same water security as anywhere else. The fact that our variability is unpredictable makes it difficult to model what is the upper threshold of storage

69 Submission 91, Southern Riverina Irrigators, p 3.

70 Submission 101, Australian Water Association, p 3.

71 Submission 12, Regional Development Australia – Orana, p 1.

72 Submission 12, pp 2-3.

73 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 20 August 2012, p 18.

> required. Ultimately you get back to what is the right combination of storage and demand management techniques to get you through those extreme years.[74]

Flood mitigation

3.6 The role that water storages can play in mitigating or reducing the impact of floods was a more debatable issue, with some inquiry participants identifying specific dams that they considered should be providing capacity for flood mitigation. Other inquiry participants expressed concern that, if water storages were to play a greater role in flood mitigation, there would be a detrimental impact on the amount of water stored for consumptive and productive purposes.

3.7 In evidence, Mr Harriss explained that the view of the Office of Water is that while existing water storages provide some capacity to reduce the impact of flood events, flood mitigation is not among their primary purposes:

> Flood mitigation in New South Wales, by the way, is not one of the primary purposes of dam construction. All the dam construction in inland New South Wales is principally for water storage and conservation, recognising that we go through extended dry periods. Every dam does provide some mitigation capacity depending on how much water is in it at the time of a rain event, but certainly we typically have not used those dams for flood mitigation.[75]

3.8 Instead, Mr Harriss described water storages as providing 'opportunistic flood mitigation capacity', highlighting that water managers are keen to capture as much water as possible to ensure water security over the longer term:

> I think they also have the purpose of flood mitigation simply because even if they are full they have some attenuating role so they can take the peak off, but they all provide an opportunistic flood mitigation capacity. As a water manager when I see a flood go past I want to see those dams full at the end of it because we might go into the next drought tomorrow.[76]

3.9 Similarly, Mr Tucker observed that all storages operated by State Water have some secondary mitigation capacity, as evidenced by the role that Burrinjuck Dam played in reducing to some extent the impacts of the March 2012 floods in southern New South Wales:

> It is worth mentioning too that whilst we do not have designated flood mitigation zones, all of our storages to some extent have flood mitigation capacity. During the floods earlier this year, in the case of Burrinjuck, the peak inflows during that event were something like 320,000 megalitres a day, whereas our peak outflow was only 230,000 or 240,000 megalitres a day. So had we not had that storage in the upper catchment, the consequences for Gundagai and Wagga Wagga would have been far more severe than what we were able to buffer as a consequence of using Burrinjuck, albeit without a designated flood mitigation zone.[77]

74 Mr Brett Tucker, Chief Executive Officer, State Water Corporation, Evidence, 20 August 2012, p 25.

75 Mr Harriss, Evidence, 20 August 2012, p 3.

76 Mr Harriss, Evidence, 20 August 2012, p 4.

77 Mr Tucker, Evidence, 20 August 2012, p 26.

3.10 While many storages have some mitigation capacity, Mr Harriss argued that the volume of water that passes with some floods renders the mitigation capacity of storages irrelevant:

> Quite frankly, in New South Wales with the volumes of water we get in some of our major floods the dams are irrelevant. At the beginning of this year we had a flood that passed through the Menindee Lakes in far west New South Wales, I think we ultimately passed 12 times the volume of Sydney Harbour through those dams over a period of three months.[78]

3.11 The Hon Richard Bull, Chairman, Water for Rivers, noted the challenges of planning to mitigate flood events, observing that ultimately it is difficult to plan for exceptional weather events:

> Honestly, it is very difficult to do anything against floods. They are part of the natural system and they come and go. All planning and operations have to be based on what we can describe as normal years and normal weather events. We cannot do much planning for exceptional weather events.[79]

3.12 Mr Harriss highlighted the tension between the two potential roles of dams in storing water while simultaneously lessening the impacts of flood events. He used the Lake Hume Dam as an example to observe that releasing water for flood mitigation purposes contradicts the role of storages in protecting communities from drought:

> Lake Hume at the moment is at 97 per cent … We have just come through a drought where Hume Dam got down to about 2 per cent and Dartmouth 22 per cent and some people legitimately ask the question: Why are we making pre-releases for flood mitigation when we might go into another drought tomorrow? It is all about getting a balance.[80]

3.13 In his submission, Dr Stuart Khan, Senior Lecturer, School of Civil and Environmental Engineering at the University of New South Wales, also noted this tension, suggesting that the management objective of storage operators should be to identify the optimum balance these two roles:

> Many water supply reservoirs are required to serve two somewhat contradictory roles. These are:
>
> A. Maintain adequate water storage to buffer seasonal and longer-term variability in natural water availability.
>
> B. Mitigate the effect of flooding on downstream communities during circumstances of extremely high run-off and river flow.
>
> These two roles can apply to both on-stream and off-stream storages. The first role (A) generally requires that the management of a reservoir would be optimised to store as much water as physically possible. However, the second role (B) requires that the reservoir be managed so as to maintain a significant volume of 'available' storage capacity for flood mitigation. Accordingly, some competition between these two roles

78 Mr Harriss, Evidence, 20 August 2012, p 4.

79 The Hon Richard Bull, Chairman, Water for Rivers, Evidence, 1 November, 2012, p 22.

80 Mr Harriss, Evidence, 20 August 2012, p 3.

> is inevitable and the management objective should be to identify the optimum balance between the two objectives.[81]

3.14 Mr John Skinner, Project Director, Water for Rivers, suggested to the Committee that implementation of the Computer Aided River Management (CARM) modelling system across New South Wales may assist to better manage this tension by providing greater capacity for storage operators to make informed decisions about responses to flood events:

> CARM is a hydraulic model. Not only is it for water delivery but it also becomes a platform for sound water resource management. We have applied this in the catchments and tributaries, so we are better able to get early warning of what is happening. We are harnessing that for regulated rivers, but it is also an extremely valuable tool when there is a flood situation. They are now extending the hydraulic model beyond the dams to get a better idea of what is flowing into them. If there is an opportunity or an allowance for prerelease, they have the smarts to be able to make an informed decision.[82]

3.15 The CARM system is discussed in detail in Chapter 6.

Should dams have an ongoing role in flood mitigation?

3.16 Some inquiry participants argued that dams should not be expected to play an ongoing role in mitigating floods. For example, the NSW Irrigators' Council (NSWIC) argued that as the original purpose of water storages was not to provide flood mitigation, the users of those storages would be disadvantaged if the operating procedures for the storage were permanently changed:

> With the recent flooding in NSW, there has been increasing discussion around the use of dams as a flood mitigation measure. This is a perfectly acceptable practice, if the dam or storage facility was designed to accommodate flood water in the first instance and there are management practices in place to facilitate this use. We do however need to point out that a majority of dams in NSW were not built for flood mitigation and any move to use them as such will have considerable negative implications for entitlement holders and will be vigorously opposed by NSWIC. Any capacity for flood mitigation must be new capacity and not impact on existing users.[83]

3.17 During evidence, Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, clarified that his organisation would not object to water storage being used to provide flood mitigation in an emergency situation, but that changes to the management of dams would not be supported:

> Should there be, say, an extreme flood coming down and everybody has identified that there is a potential for it to negatively impact on landholders in all of the area, would everybody disagree to a dam being used for flood mitigation in an emergency situation? Absolutely not, but on a regular basis where entitlements and allocations are held there would be direct third party impacts by changing the management regulations and the management of those dams.[84]

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81 Submission 25, Dr Stuart Khan, p 2.

82 Mr John Skinner, Project Director, Water for Rivers, Evidence, 1 November, 2012, p 22.

83 Submission 97, NSW Irrigators' Council, p 6.

84 Mr Mark Moore, Policy Analyst, NSW Irrigators Council, Evidence, 16 November 2012, p 12.

3.18 The Inland Rivers Network expressed concern that the provision of flood mitigation by water storages produces a 'perverse incentive' for development to occur on flood plains, with potentially catastrophic consequences during extreme flood events:

> Flood mitigation augmentation in large dams creates a perverse incentive for floodplain development in downstream areas. These areas are nevertheless subject to drown out in extreme weather events causing major issues with insurance, rescue and community safety.[85]

3.19 The Caldera Environment Centre suggested that while a water storage could mitigate part of the impacts of flooding, it was unlikely that an entire flood event could be prevented, and argued strongly that the dual purpose of water storages was misguided:

> A dam can stop a portion of a single flood. The usual purpose of dams as a water storage is invalidated if they are to be used as flood protection. A dam can catch a single flood but then it will spill over; and it is unlikely that a rural NSW community will empty their dam in the expectation that there is another flood coming. It should therefore be seen as improper and misleading for government authorities and representatives including members of parliament to claim dual use for proposed future dams.[86]

Support for the flood mitigation role

3.20 By contrast, a number of stakeholders including the Local Government and Shires Association were supportive of water storages playing a role in flood mitigation, arguing that planning for flood mitigation should routinely be part of managing water storages:

> Recent controversy about the flood mitigation function of water storages such as the controversy around the management of Wivenhoe Dam during the Queensland floods in 2010/11 and over releases from the Snowy Mountain system during floods in the Murray and Murrumbidgee catchments in 2011, clearly indicate that processes need to be in place to ensure the flood mitigation function of water storages is taken into account when planning for and managing water storages.[87]

3.21 The Wakool Landholders Association also considered that water storages should play a role in flood mitigation, proposing that the Wakool district would benefit from the construction of a flood mitigation dam:

> The Wakool district is situated on the floodplain and considering the increased risks of flooding due to the activities of the Commonwealth Water Holders, we are completely exposed. Therefore a storage to mitigate flooding impacts, although a small impact … would benefit our area. This approach would have numerous benefits and create some degree of security for our area.[88]

85 Submission 78, Inland Rivers Network, p 10.

86 Submission 49, Caldera Environment Centre Inc, p 13.

87 Submission 38, Local Government and Shires Association, pp 1-2.

88 Submission 17, Wakool Landholders Association, p 1.

3.22 A number of inquiry participants identified two specific New South Wales water storages as having the potential to provide flood mitigation: Warragamba Dam near Sydney, and Blowering Dam near Tumut.

3.23 In relation to Warragamba Dam, Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority (SCA), explained in evidence that, 'Warragamba Dam is a water supply dam only; it is not a flood mitigation dam and it has no capacity to do that other than when the water level is reduced'.[89]

3.24 Dr Khan expressed concern regarding the potential for major flooding in Western Sydney given that Warragamba Dam is not managed to provide flood mitigation capacity:

> Not all water supply reservoirs are operated with a flood mitigation capacity. Despite being one of the largest water storages in the world, Lake Burrogorang (Warragamba Dam) is one such example. The full operating storage of Lake Burrogorang is 2027 gigalitres (GL). At the time of writing, the storage level was at 99.9% of capacity … Lake Burrogorang has been subject to some very large and sudden inflows, such as that which caused the very sharp increase in storage in July 1998. In the lead-up to that event, storage levels were relatively low and sufficient additional capacity was available to prevent a very large flood from occurring in Western Sydney … If the inflow event of July 1998 was repeated today (July 2012), there would be no capacity to hold back any additional water. The approximately 1000 GL of water that were captured in 1998 would instead overflow down the Warragamba spillway in 2012. This is almost twice the volume of water contained in Sydney Harbour (560 GL).[90]

3.25 Dr Khan argued that the existence of the Sydney Desalination Plant should allow the storage level of Warragamba Dam to be permanently lowered, reducing the risk of flooding in Western Sydney without any detrimental impact on the security of Sydney's water supply:

> [T]he knowledge that the Sydney desalination plant is available and could be relatively quickly brought online (and expanded to full capacity) should enable Lake Burrogorang storage levels to be lowered by more than 600 GL with a high level of confidence that Sydney's water supply security will be maintained. The major advantage of such a change would be the significantly reduced risk of a major flooding event in western Sydney.[91]

3.26 Dr Khan further suggested that the existence of 'virtual reservoirs' such as desalination plants and highly treated recycled water may provide opportunities to reduce the levels of other water storages, thus providing greater flood mitigation capacity across New South Wales:

> Alternative sources of municipal water supply including seawater desalination and direct potable reuse of highly treated municipal effluents provide an opportunity to maintain or even increase the flood mitigation capacity of some reservoirs without jeopardising water supply security. The potential or continual availability of water from these sources represents an increased 'virtual' storage capacity.[92]

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89 Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority**,** Evidence, 20 August 2012, p 38.

90 Submission 25, pp 3-5.

91 Submission 25, p 7.

92 Submission 25, p 5.

3.27 Mr Tanner advised that following the March 2012 flood events, when the Warragamba Dam gates were opened, the SCA together with other relevant agencies was investigating strategies for the dam to provide flood mitigation:

> Part of the response to the March 2012 spill events is that we, and some of the other agencies, are together looking at what can be done for flood mitigation downstream in the Hawkesbury-Nepean Valley and permanently or temporarily lowering water levels, or changing gate operations slightly through to raising dams. All those options are on the table.[93]

3.28 Ms Sarah Dinning, A/Chief Executive, SCA, provided further detail on the review of the flood mitigation capabilities of Warragamba Dam, which in mid 2012 was still in its early stages:

> It is very early days. We are just working with the SES in particular scoping the terms of reference and who will be looking at what. So we have still got some time to go. We are working with [the Department of] Planning and other agencies to set up that review. All those options will have to be developed. Whether it is making some air space in the dams, there has to be a cost-benefit analysis, because then there is a loss of drinking water, infrastructure costs [and so on].[94]

3.29 In response to further minor flooding in the Hawkesbury-Nepean valley in February 2013, the Minister for Primary Industries, the Hon Katrina Hodgkinson MP, announced that the NSW Government had commenced this review of flood management arrangements for the valley, including the option of raising the Warragamba Dam wall by 23 metres to help limit floods. The review is also considering whether the use of alternative operating procedures at the dam might assist in mitigating flood impacts downstream. The review is due to be completed by the end of 2013.[95]

3.30 The second water storage identified during the inquiry as having the potential to provide greater flood mitigation benefits was Blowering Dan, near Tumut. Tumut Shire Council suggested that the March 2012 floods would have been worse for downstream communities if Blowering Dam had been at capacity at that time:

> Unlike western areas that receive days and sometime weeks notice of flood warnings, Tumut Shire receives very little notice as there is a short lead time from when heavy rain in the catchment area reaches the shire … The flood in March this year severely impacted on the Brindabella, Goobarragandra and Tumut Valleys. Flooding in the Tumut Valley was caused predominantly from water in the Goobarragandra River. Fortunately, there was some airspace in Blowering Dam that aided in flood mitigation. If Blowering Dam had been spilling at the time, this added water would have compounded the flood impact.[96]

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93 Mr Tanner, Evidence, 20 August 2012, p 40.

94 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, Evidence, 20 August 2012, p 40.

95 Hannam, P, 'Warragamba flood sparks call to open gates earlier', *Sydney Morning Herald*, 26 February 2013.

96 Submission 106, Tumut Shire Council, p 2.

3.31 During evidence to the Committee, Ms Trina Thomson, Mayor, Tumut Shire Council, commented that, despite upgrades to the Blowering Dam wall, insufficient consideration had been given to mandating that the dam always have a set amount of airspace available to permanently provide flood mitigation capacity:

> [W]e upgraded the dam wall to cater for extreme circumstances. That wall was barely finished when we had the floods. In 2010 we had significant flooding in September, October and December. By the time the December floods came, the spillway was actually spilling. That created unbelievable pressures on our community because when the dam is spilling it has absolutely no opportunity to be there for flood mitigation … we need to have the dam managed appropriately so that it does not impact on our communities as it did in December 2010 when we had a compound of the dam actually spilling and significant rain events. It is not a matter of not providing water during drought; it is a matter of managing that dam so that there is an air space. At this point, even though 88 per cent is the recommended technical level, there is nothing that binds it to do that.[97]

Storing water for competing end users

3.32 Another role that water storages play is storing water for competing end users, which requires storage managers to balance the varying needs of these competing users when conflict arises. End users include people, agriculture, industry and the environment.

3.33 While there was no debate amongst inquiry participants that a key role for water storages is to store water for end users, there was debate on how best to balance the competing needs of the various end users. For example, Mr Moore, of the NSW Irrigators' Council, identified the competing users that vie for storage capacity:

> Throughout the drafting of the Murray Darling Basin Plan, the competing pressures for water resources between people, the environment and industry became very evident and continue to generate a great deal of debate. What we all need is adequate storages and the optimal management of them.[98]

3.34 Murrumbidgee Valley Food and Fibre Association suggested that the competition between people, the environment and industry for water resources has reduced the capacity of existing water storages to meet the needs of all users:

> Currently, these growing sectors are a competitor for existing storage space in our dams. This has led to a political and legislative 'redefinition' of the historical purpose of some of our larger water storage facilities in NSW, particularly in the MDB [Murray Darling Basin]. This 'redefinition' has impacted on the ability to adequately supply the requirements of irrigated agriculture and even more particularly the requirements of broad acre irrigated agriculture in NSW.[99]

3.35 Southern Riverina Irrigators observed that the competing demands for water required that a solution be found other than the transfer of water rights from one user to another:

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97 Ms Trina Thomson, Mayor, Tumut Shire Council, Evidence, 1 November 2012, p 3.

98 Mr Moore, Evidence, 16 November 2012, p 10.

99 Submission 74, Murrumbidgee Valley Food and Fibre Association, p 4.

> In terms of predicted population growth, there is a growing trend to expect future human water needs can be sourced from the same level of dam storages. This will undoubtedly place pressure on other water users. Added to population pressure, is the view that the environment requires a greater share. The competing interests for water, may require multiple and smarter solutions than just transferring water from one current use to another.[100]

3.36 Another example of the competing users of water storages was raised by the Boating Industry Association of NSW (BIA), which suggested that recreational boaters and fishers should be allowed access to water storages:

> Increasing population places pressure on traditional boating and fishing waterways which may be relieved through enabling of appropriate activity in NSW water storages. The BIA believes that provision of access to water storages for appropriate boating and fishing activity, and enabling of relevant infrastructure, would result in improved and more equitable recreational opportunities for the public, thereby delivering improved commercial, economic and employment outcomes.[101]

3.37 Some inquiry participants were concerned that the primary purposes of some water storages had changed over time, resulting in conflict between users. For example, the Gwydir Valley Irrigators Association commented on the competing pressures being placed on Copeton Dam to be a storage for both irrigation and environmental purposes:

> Importantly, Copeton Dam now stores more than 251,320 [megalitres] ML or 18% of the total dam's capacity for the environment, having reduced irrigator's access or procurement from willing sellers. The reduction in storage capacity for irrigation purposes will decrease the irrigation production capacity of the Gwydir valley and there is anecdotal evidence already with many farms returning to dry land production at a reduced yield return. This is the reality of a substantial Commonwealth Government water buy-back programme that by reducing the total water available for irrigation, it will inevitably place further pressure on the nation to meet food and fibre requirements.
>
> Clearly there is now the additional competing pressure placed on dams which were intended for irrigation development, to also be environmental dams. This has come at the cost of our communities who received no direct benefit from such a paradigm shift in policy that affects communities and economy.[102]

3.38 The Gwydir Valley Irrigators Association further observed that some storages across New South Wales may 'also have intense pressure placed on them through increasing urban demands and mining, especially open cut coal mining'.[103]

100 Submission 91, p 3.

101 Submission 103, Boating Industry Association of NSW Ltd, p 3.

102 Submission 93, Gwydir Valley Irrigators Association, p 7.

103 Submission 93, p 7.

3.39 The Murrumbidgee Valley Food and Fibre Association (MVFFA) also remarked upon the ability of water storages to meet the competing needs of different water users, particularly the irrigation and environment sectors. It warned against altering the purpose of such storages without also upgrading them:

> Our existing storage facilities were clearly built as human and community resources to mitigate problems associated with our drought prone climate. MVFFA would submit that any attempt to redefine the purpose of these storage facilities without also upgrading them is doomed to fail, as that approach requires a 'trade off' between sectors and also requires the storages and regulatory systems to supply requirements that they simply were not designed for.
>
> Flood mitigation, environmental flows and increasing urban/industrial/mining demands have all been demonstrated as quantifiable demands, but our existing storage capacities were not designed to cater for or adequately supply these added requirements. If we are to successfully optimise the supply of water to these different and developing sectors in the future, MVFFA would submit we need to upgrade our existing storage capacities and source extra storage options.[104]

Committee comment

3.40 The Committee believes that the primary role of most major water storages in New South Wales, at the time of their construction, was to conserve water for agriculture, stock and domestic use and therefore reduce the variability of water availability across the State.

3.41 Given that this inquiry has demonstrated that there are differing views among stakeholders on the main role of waters storages, the Committee considers that the primary purpose of a water storage should be clearly communicated to ensure that the range of stakeholders understand the reasons why the storage was constructed and how it is managed given the changing demands on water.

Recommendation 1

That the NSW Government clearly communicate to stakeholders the purpose of all major water storages in New South Wales.

3.42 An additional role to this primary purpose may be flood mitigation. However, the Committee acknowledges the NSW Government's view that during times of significant flood, the level of mitigation a water storage can provide may be negligible due to high level flows.

3.43 The Committee notes that the extent to which water storages should provide flood mitigation was a significant issue throughout this inquiry. We understand that the NSW Government is currently reviewing the role that Warragamba Dam might play in flood mitigation, with this review to be completed by the end of the year. Due to the differing views among inquiry participants on the role of water storages, the Committee believes it would be in the best interest of the community to publish the outcomes of this review.

[104] Submission 74, p 6.

Recommendation 2

That the NSW Government publish the outcomes of its review of the potential role for Warragamba Dam in flood mitigation.

3.44 The Committee shares irrigators' concerns that there may be negative implications for entitlement holders arising from a flood mitigation role for water storages. Such implications may include the need for the storage to have 'air space' or hold less water to allow flood waters to be slowed, which in turn would reduce the amount of water available for all end users. Air space in a water storage that allows for flood mitigation is effectively an extra use that takes water away from agriculture and industry.

3.45 The role of water storage has a bearing on how future solutions to ensure water security are considered and assessed. This is addressed further in Chapter 7.

Chapter 4 Urban, agricultural and industrial water

This chapter considers how the competing urban, agricultural and industrial uses of water are being managed by the NSW Government and explores a number of conservation measures being pursued by the various water users to help ensure more efficient use of existing stores and improve water security. It also explores additional means by which responsible urban and agricultural water use can be enhanced. The environment is also a competing water user and will be discussed in the following chapter.

The water allocation system

4.1 The system of water allocation in New South Wales was outlined in Chapter 2. In summary, the amount of water allocated to water users is determined annually under a system of water sharing plans and water allocation rules. The NSW Government explained to the Committee that statutory planning rules determine priorities for sharing water between different users, with priority being given to urban domestic consumption.[105]

4.2 Mr David Harriss, Commissioner, NSW Office of Water, argued that the system of allocation utilised in New South Wales is one of the world's best because it is responsive to the amount of water available in any given year:

> That as far as I am concerned is one of the world's best water allocation policies because it facilitates climate variability and it is adapted to climate change. In NSW you have those industries that need water every year including secondary industries, horticulture and permanent plantings. They will get their water every year, but more opportunistic crops such as cereal crops, cotton and rice have more water available in wet years and less water available in dry years. Quite frankly that is a good policy setting.[106]

4.3 Aspects of the operation of water sharing plans and the system of water allocations were discussed by various inquiry participants. Contrary to Mr Harriss's view, a number of participants raised concerns about the responsiveness of the current system to climate variability. For example, the Inland Rivers Network advocated for a more conservative system of water allocations to facilitate better planning for the possibility of long-term drought conditions:

> The current management of allocations based on automatic increases related to dam inflows does not allow for long-term drought security planning. Climate change is predicted to increase the severity of drought impacts, as experienced in the millennium drought.
>
> More conservative management of water allocation announcements will provide improved long term security of water supply. Managing storages such as Burrendong Dam on a 2 year drought cycle has caused a high risk water management culture that threatens water security during times of prolonged drought.

105 Submission 13, NSW Government, pp 5-6.

106 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 20 August 2012, p 3.

> The function of water sharing plans needs to be managed more conservatively than [is] currently practised …[107]

4.4 By contrast, Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association, suggested that the water allocation system had become 'overcautious', to the detriment of general security irrigation:

> At the moment, in my type of farming, general security irrigation, even though everything is full – the dams have been spilling, the rivers have been flooding – we are on 64 per cent allocation. I guess it has all become overcautious, and perhaps overcomplicated.[108]

4.5 Ms Buller also questioned the reliability of the timing of the delivery of allocations, observing that while irrigators need a clear indication of the amount of water being delivered and the timing of that delivery, this certainty is often not forthcoming:

> [We] have planting windows. When spring hits, especially out there – it used to be semi-arid, that is why it has got irrigation there – if it does not rain, farmers like both of us need to have water to water our crops. For the broadacre irrigators to start off with, that is our winter crops like wheat, canola, oats, hay crops and our pastures. If you do not have an allocation, you cannot do that, and you have to watch them die. The next thing, but not very long after that, is when we have to do planting and work out how much summer crop we are putting in … We need to have the water earlier than that and have a clear indication otherwise it is very difficult for us to plant.[109]

4.6 Mr Tony Perry, General Manager, Central Tablelands Water County Council, suggested that there should be a complete review of licensing, as he advised that even if their local water supply, Lake Rowlands, was augmented to increase its capacity, the allocation to the Council would not necessarily increase:

> One of the things that is of concern to me is that I got a letter from the Minister some time ago – I am not sure if it was early this year or late last year – regardless if we got approval to increase Lake Rowlands, we would not get approval to increase our allocation. The allocation is completely locked across the whole of the Lachlan Valley. If we required further urban licensing – we have actually had our licence reduced from 4,500 megalitres to 3,150 megalitres – and we were to enlarge Lake Rowlands, any extra allocation for urban use would have to come at the expense of someone else in the valley. That is a bit of a problem.[110]

Committee comment

4.7 The Committee notes these concerns raised by inquiry participants regarding the way water allocations are managed. The NSW Office of Water has a challenging task in managing allocations for competing users in such a variable climate as Australia. The Computer Aided

107 Submission 78, Inland Rivers Network, p 7.

108 Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association, Evidence, 16 November, 2012, pp 24-25.

109 Ms Buller, Evidence, 16 November, 2012, p 25.

110 Mr Tony Perry, General Manager, Central Tablelands Water County Council, Evidence, 16 November 2012, p 38.

River Management (CARM) system, discussed in detail in Chapter 6, has the potential to address these challenges.

Urban water

4.8 As noted in Chapter 2, under the water sharing plans and water allocation rules, country town and urban water supplies are given the highest priority for water use and allocation. Urban water is water that is used in cities, towns and suburbs within both metropolitan and regional New South Wales. Urban water is delivered to consumers by water utilities including Sydney Water, Hunter Water and numerous local government water utilities in regional areas.[111]

4.9 In relation to urban water, inquiry participants voiced opinions about strategies to improve water security, the interconnection of supply, water conservation measures, the importance of demand management practices, and the need to plan for growth. Each is discussed in turn below.

Strategies to improve water security

4.10 A number of stakeholders addressed strategies to improve water security, that is, ensuring sustainable access to an adequate quantity of potable water.

4.11 Despite the assurance of water supply through these priority allocations, local water utilities across regional New South Wales told the Committee that they are assessing the long term viability of water demand and supply, and developing strategies to improve water security. The Local Government and Shires Association outlined the work being undertaken by local water utilities in this regard:

> Many local water utilities in regional NSW are undertaking comprehensive demand analysis as well as analysis of the yield of their supply sources in the context of integrated water cycle management. With the assistance of the NSW Office of Water, utilities are also looking at the impact of climate change on their supply sources, in particular, on the secure yield of their water storages.[112]

4.12 Shoalhaven Water outlined the planning being undertaken in the Shoalhaven area, with the development of an Integrated Water Cycle Management Strategy which combines plans to better integrate water supply, sewerage treatment and stormwater management with new approaches to demand and supply management:

> As part of the Office of Water's Water Supply and Sewerage Best Practice Management Shoalhaven Water prepared an Integrated Water Cycle Management Strategy. The strategy identified the preferred options for development of urban water services (water supply, wastewater and stormwater) at Shoalhaven City … The integrated scenarios incorporate combinations of various demand management measures and an increasing movement towards the integration of water supply, sewerage treatment and stormwater management through cumulative inclusion of

111 Submission 13, p 4 and NSW Office of Water website, accessed 28 May 2013, <www.water.nsw.gov.au/Urban-water/Local-water-utilities/default.aspx>.

112 Submission 38, Local Government and Shires Association, p 3.

> rainwater, stormwater, greywater and reclaimed water use. The supply side approach is common to all scenarios, drawing on surface water extractions from the Shoalhaven River, Danjera Creek and Porters Creek, with system capacity requirements sized to suit the town water demands for each scenario.
>
> Council formally adopted its Integrated Water Cycle Management Strategy in June 2008. The focus of Shoalhaven water supply planning is now directed at enhancing the north-south system transfer capacity.[113]

4.13 Coffs Harbour Water also informed the Committee of planning work being undertaken in the Coffs Harbour region and in conjunction with the neighbouring Clarence Valley Council:

> Coffs Harbour City Council has a 5,600 ML [megalitre] storage dam, Karangi Dam, as well as a share in the Shannon Creek Dam 30,000 ML, which is part of the Regional Water Supply Scheme, in partnership with Clarence Valley Council. The combined storage was designed to reliably supply water to meet the medium project annual demand to 2021 of 22,766 ML/a [per annum]. More efficient use of water by the community and population growth less than those predicted have extended the design life of the scheme well beyond 2021 … There is a Regional Water Supply Operational Plan that will ensure optimisation of the bulk water supply to the region. The region also has an award winning Water Efficiency Plan in place.[114]

4.14 Some inquiry participants highlighted the increasing prevalence of regional-level water strategies. For example the Central NSW Councils (Centroc) highlighted that Centroc members have worked collaboratively on a number of water-related projects:

> Water security is a priority of the Centroc board and members have worked collaboratively identifying the infrastructure and non-infrastructure activities that need to take place to secure water supplies for the urban communities of the region to 2059 in the context of climate change.[115]

4.15 Centroc advised that the key collaboration was to develop the Centroc Water Security Study, which identified options to secure regional water. Centroc outlined the key findings of the study:

> The Study identified that existing urban water supplies, even with significant activity in demand management, would be unable to meet the needs of most communities in Central NSW. It therefore made a series of recommendations including the development of a network of dams and pipes across the region … Of note is that the design of the Centroc Regional Water Security Project removes the reliance of communities in Central NSW on the State run dams. This means that the considerations of particularly agriculture and the environment can be better managed when urban water use no longer has to be factored in.[116]

4.16 Centroc further advised that the study identified three key actions which would, if undertaken, provide water security for the Centroc region, as follows:

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113 Submission 63, Shoalhaven City Council, pp 7-8.

114 Submission 102, Coffs Harbour Water, p 1.

115 Submission 27, Centroc, p 4.

116 Submission 27, pp 4-5.

- emergency works for example the Orange Pipeline, a review of the Fish River Scheme and the Lake Cargelligo Pipeline
- action in demand management, as is currently being implemented through the Centroc Water Utilities' Alliance
- development of the Centroc Regional Water Security Project – a network of dams and pipes including the augmentation of Lake Rowlands.[117]

4.17 The proposed augmentation of Lake Rowlands is outlined in Chapter 7.

4.18 Namoi Water indicated that a regional level socioeconomic study has been undertaken for its area. The Namoi Regional Organisation of Councils Water Working Group commissioned a report, *Namoi 2030*, which provides information relating to the impacts of population growth, future development within the catchment, climate change and the impact of the Murray Darling Basin Plan. Ms Jon-Maree Baker, Executive Officer, Namoi Water, advised:

> In respect of the Namoi, we have recently completed a socioeconomic study titled "The Value of Water" … Agricultural employees make up 15 per cent of employed persons in our valley. The study particularly looked at what would happen in respect of rainfall and climate change and also the basin plan. By 2030, we will have 0.4 per cent lower rainfall and 13 per cent access to our entitlement based on the potential changes in the basin plan. This leads to an annual decline in agricultural production … The flow-on effects are experienced across the local economy. In respect of this inquiry, I believe it is critical to look at the future of water and the challenges that will be faced by the time frame in respect of water storage.[118]

4.19 The NSW Government is also involved in supporting local water utilities to assess their future water security. The NSW Office of Water has developed guidelines for local water utilities on 'Assuring Future Urban Water Security' and adapting to the impact of variable climatic patterns on the yield of their water supply. The guidelines were informed by a pilot study conducted by the NSW Office of Water that determined the impact of variable climatic patterns on 11 non-metropolitan New South Wales water supplies using projections of daily rainfall and evapotranspiration from 15 global climate models, estimations of streamflows from daily rainfall run-off models and daily simulation of 106 years of storage behaviour to determine the secure yield for each utility until 2030.[119]

4.20 The guidelines, to be released shortly, will enable all New South Wales local water utilities to assess their future secure yield. The pilot study and preparation of the guidelines have been overseen by a steering group involving the CSIRO, the National Water Commission, NSW Public Works, the Local Government and Shires Association, the NSW Water Directorate and the NSW Office of Water.[120]

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117 Submission 27, p 6.

118 Ms Jon-Maree Baker, Executive Officer, Namoi Water, Evidence, 6 March 2013, p 19.

119 Answers to supplementary questions, 17 September 2012, Department of Primary Industries, Question 3, p 4.

120 Answers to supplementary questions, 17 September 2012, Department of Primary Industries, Question 3, p 4.

Interconnection of supply

4.21 A feature of many strategies to improve water security is the interconnection of supply, often through the use of pipelines linking water supplies in different geographic areas. When questioned whether the councils in the Riverina Eastern Regional Organisation of Councils (REROC) had considered undertaking a regional level and collaborative approach to water, Ms Julie Briggs, Executive Officer, REROC, advised that the majority of water supply in the REROC region was already closely linked:

> We have two county councils in our region, so water supply is not individual. The only councils in our region running their own water are Tumbarumba, Gundagai and Tumut. Cootamundra is reticulating some water into its urban areas through an arrangement with Goldenfields. With the two county councils we find that water is managed on a regional basis … Goldenfields is feeding water to nine communities and they are all interconnected. Interconnection is already occurring. The water going to Junee then goes on to Temora and then to Cootamundra and Bland. They are all interconnected and that works very successfully.[121]

4.22 This interconnection of supply is well demonstrated in the greater Sydney area. Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority, explained that the 21 dams that supply the greater Sydney area are all interconnected.[122]

4.23 Another example of the use of pipelines to link supply is the Highlands Source Projects, which involved the construction of an 81 kilometre pipeline from Wingecarribee Reservoir near Bowral to Goulburn. This pipeline assists to secure Goulburn's water supply by linking Goulburn to the Sydney Catchment Authority (SCA) water supply.[123]

4.24 The pipeline is designed to transfer 5 ML of water a day when needed, with the potential to increase transfers to 7.5 ML if necessary, such as during extreme drought conditions. The project was funded jointly by Goulburn Mulwaree Council and the State and Federal Governments.[124]

4.25 A similar pipeline project is currently being explored by Orange City Council. The proposed Macquarie Orange Pipeline would be a 37 kilometre below ground water pipeline, originating downstream of Long Point on the Macquarie River and finishing at Orange's Suma Park Dam.[125]

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121 Ms Julie Briggs, Executive Officer, Riverina Eastern Regional Organisation of Councils, Evidence, 1 November 2012, pp 16-17.

122 Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority**,** Evidence, 20 August 2012, p 37.

123 Hon Katrina Hodgkinson MP, Minister for Primary Industries and Minister for Small Business, 'Minister opens Highlands Source Project', Media release, 21 October 2011, accessed 9 January 2013, <www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/412895/20111021-MINISTER-OPENS-HIGHLANDS-SOURCE-PROJECT.pdf>.

124 Goulburn Mulwaree Council, *Water for Goulburn – Highlands Source Projects: Fact Sheet One*, p 1, accessed 9 January 2013, <www.goulburn.nsw.gov.au/images/documents/goulburn/mig/15797-3webfs.pdf>.

125 Orange City Council, *Macquarie to Orange Pipeline Project: Information Sheet 1 - Water Security Options for Orange*, p 4, accessed 9 January 2013, <www.watersecurity.orange.nsw.gov.au/client_images/1104125.pdf>.

4.26 It is estimated that the average annual extraction from the Macquarie River would be approximately 1,616 ML per year, with an average long term extraction of 0.5 per cent of flows. The project has an estimated of cost $47 million, and would be jointly funded by Orange City Council and the State and Federal Governments.[126] It is currently being assessed by NSW Planning and Infrastructure.[127]

State Development Committee viewing Bamarang Dam and Water Treatment Plant, Shoalhaven[128]

126 Orange City Council, *Macquarie to Orange Pipeline Project: Information Sheet 1 - Water Security Options for Orange*, p 4, accessed 9 January 2013 <www.watersecurity.orange.nsw.gov.au/client_images/1104125.pdf>.

127 Orange City Council, accessed 23 May 2013, <www.watersecurity.orange.nsw.gov.au/site/index.cfm?display=290353>.

128 State Development Committee site visit to Shoalhaven, 29-30 August 2012.

Highlands Source Pipeline Pumping Station – interconnection of supply to Goulburn[129]

Wingecarribee Reservoir, Bowral now connected to supply water to Goulburn[130]

129 State Development Committee site visit to Shoalhaven, 29-30 August 2012

130 State Development Committee site visit to Shoalhaven, 29-30 August 2012

Urban water conservation measures

4.27 A number of inquiry participants supported greater use of water conservation measures in urban areas to reduce the reliance of these areas on water from centralised water storages and thereby contribute to improving water security. Participants highlighted a range of measures that are currently being pursued, such as stormwater harvesting and waste water recycling, and suggested that water sensitive measures should be supported by the implementation of policies and planning instruments that mandate the use of a water sensitive approach in urban development.

4.28 The Caldera Environment Centre Inc noted the recent major advancements in the field of water conservation, highlighting the Sydney Olympic Park precinct as an example of how a community can successfully integrate water conservation measures with urban lifestyles:

> Major capital cities and most regional areas have made major advancements in the past 20 years in the realm of water conservation. Technology developed during that time in response to the water shortages is now available and ready to be utilised in urban areas to provide alternative supply to urban areas. The Sydney Olympic Park Authority has provided an excellent example of how a master planned community can develop a water saving culture, and demonstrates that recycled water is safe and cost effective.[131]

4.29 In addition to those strategies councils are pursuing to improve their water security outlined earlier, a number of local councils are exploring further options to secure their long-term water supplies. As part of these efforts, local councils are implementing schemes such as stormwater harvesting as a means to reducing reliance on centralised water storages. For example, some of the REROC group of local councils including West Wyalong and Tumbarumba have implanted stormwater and effluent recycling schemes, as indicated by Ms Briggs:

> A number of our councils have looked at stormwater harvesting. We have also looked at it from a regional perspective and we are undertaking regional projects. We have recently done a series of reports on a world with less water scenario, which also addresses stormwater harvesting projects that can be undertaken in the region. Virtually every council in the region does extensive effluent recycling.[132]

4.30 Orange City Council has also implemented significant stormwater harvesting programs for Blackmans Swamp Creek and Ploughmans Creek. The Committee had the opportunity to hear about these programs when it visited Orange.

4.31 The Blackmans Swamp Creek Stormwater Harvesting Scheme represents the first large scale, indirect-to-potable stormwater harvesting project in New South Wales. It is capable of providing between 1300 and 2100 ML of additional water into Orange's raw water supply each year from the city's stormwater system, meeting up to 40 per cent of the city's total water needs.[133]

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131 Submission 49, Caldera Environment Centre Inc, p 1.

132 Ms Briggs, Evidence, 1 November, 2012, p 15 and answers to questions on notice taken during evidence 1 November 2012, Riverina Eastern Regional Organisation of Councils, Question 1.

133 Orange City Council, accessed 22 May 2013, <www.orange.nsw.gov.au/site/index.cfm?display=147115>.

4.32 The Plougmans Creek scheme will transfer a portion of the storm flows from the Ploughmans Creek catchment into Suma Park Dam where it will supplement Orange's raw water supplies with around 800 ML each year.[134]

4.33 The Committee is aware of urban water conservation projects in the greater Sydney area, with both Sydney Water and Hunter Water undertaking projects to recycle waste water. For example, Sydney Water currently recycles around 27 billion litres (27 GL) of water a year in the greater Sydney area for household use, irrigation, agriculture and industry. By 2015, Sydney Water is expecting to increase this to 70 billion litres (70 GL) a year.[135]

4.34 A specific example comes from Wollongong, where Sydney Water recycles about 40 per cent of the city's waste water on an average day, which is one of the highest recycling rates of any Australian city. Sydney Water then supplies most of the recycled water to BlueScope Steel's Port Kembla steelworks. The Port Kembla Coal Terminal, Wollongong Golf Club and Wollongong City Council are also using recycled water.[136]

4.35 Based on information provided on its website, Sydney Water collects 1.3 billion litres (1.3 GL) of wastewater from over 1.7 million homes and businesses in Sydney, the Illawarra and the Blue Mountains every day. This amounts to 474.5 GL of waste water per year. Based on the figure of recycled water noted above, 27 GL, this indicates that Sydney Water currently recycles around 5.7 per cent of its waste water, which may increase to 14.75 per cent by 2015 if it recycles 70 GL per year.[137] Much of the remainder of the waste water goes out to sea.

4.36 Similarly, Hunter Water recycles around 5 billion litres (5 GL) each year and supplies it for:

- residential use - including three land developments at Thornton North, Gilleston Heights and Coorangbong North
- irrigation use - including local golf courses, a local trotting track and the Kurri TAFE using approximately 469 ML of recycled water per year
- industrial use - including Eraring Power Station and the Oceanic Coal Washery using approximately 2061 ML of recycled water per year
- agricultural use - including local farmers, woodlots and the Karuah Effluent Reuse Enterprise using approximately 341 ML of recycled water per year.[138]

4.37 A number of inquiry participants suggested that water sensitive measures should be supported by the implementation of policies and planning instruments that mandate the use of a water sensitive approach in urban development. For example, the Byrrill Creek Land Care Group,

134 Orange City Council, accessed 22 May 2013, <www.orange.nsw.gov.au/site/index.cfm?display=158554>.

135 Sydney Water, accessed 22 May 2013, <www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq2/~edisp/dd_046179.pdf>.

136 Sydney Water, accessed 22 May 2013, <www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq2/~edisp/dd_046181.pdf>.

137 Sydney Water, accessed 30 May 2013, <www.sydneywater.com.au/SW/water-the-environment/how-we-manage-sydney-s-water/wastewater-network/wastewater-treatment-plants/index.htm>.

138 Hunter Water, accessed 22 May 2013, <www.hunterwater.com.au/Water-and-Sewer/Wastewater-Systems/Wastewater-Treatment-Works/>.

Save Byrrill Creek Group and Northern River Guardians advocated that 'in new large urban growth areas NSW Government legislation should unequivocally mandate' the following features:

- recycled water for toilets and outdoor garden use (dual reticulation)
- stormwater harvesting
- water sensitive urban design
- rain water tanks with a large capacity, such as 10,000 litres.[139]

4.38 Mr Roger Graf suggested that, '[W]e can start harvesting a water supply by capturing from new developments the roof water to create within the township a dam specifically for 'grey water' supply to the whole community'.[140] Mr Graf commented that he was 'at a loss as to why these initiatives are not introduced as mandatory for all developments which [have] housing for greater than 1,000 homes'.[141]

4.39 The Caldera Environment Centre advised that if urban areas were able to increasingly source water through use of conservation measures such as water recycling, 'water demand (from dams) in urban areas across the state of NSW could be decreased with a comparable investment in water recycling technologies retrofitted to established urban areas instead of the large capital cost of a new dam."[142]

4.40 Monash Water for Liveability also highlighted the importance of utilising stormwater as a new water source in urban areas which, if managed effectively, would enhance the resilience of urban water supplies whilst simultaneously providing environmental benefits:

> Urban stormwater treatment and harvesting represents a significant opportunity to provide a major new water source for use by urban centres, while simultaneously helping to protect valuable waterways from excessive pollution and ecosystem degradation. Harvested stormwater, if treated to potable standard, could also provide an alternative source of water integrated with a centralised water supply scheme, as is the case in a number of cities including the city of Singapore and Orange, NSW … Urban stormwater is a readily available and under-utilised resource in cities and towns that can be cost-effective. Increased stormwater harvesting and use as part of a portfolio of water supplies can build resilience while also supporting enhanced liveability.[143]

4.41 Monash Water for Liveability identified three key benefits of pursuing a water sensitive approach to urban water planning and management:

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139 Submission 68, Byrrill Creek Land Care Group and Save Byrrill Creek Group, p 2; Submission 69, Northern Rivers Guardians, p 1.

140 Submission 1, Mr Roger Graf, p 1.

141 Submission 1, p 1.

142 Submission 49, p 1.

143 Submission 105, Monash Water for Liveability, p 8.

- Economic benefits would arise from the avoidance or delay of infrastructure costs, such as network augmentation or works to increase the capacity of water storages, as the population of urban areas grows.[144]
- Using alternate water supplies such as stormwater harvesting and wastewater recycling would secure urban water supplies into the future.[145]
- Pursuing a water sensitive approach would allow cities and towns to direct additional water resources towards supplying industry and the environment.[146]

4.42 In evidence, Mr Harris from the Office of Water recognised the importance of such an approach to urban water supply when he commented that, 'Recycling water for domestic purposes and industrial use within the major metropolitan areas is going to be a thing of the future, without a doubt.'[147]

A focus on demand management practices

4.43 Demand management practices aim to reduce water use through measures such as capturing stormwater run-off, installing domestic water tanks, implementing water restrictions and conducting public education campaigns. A number of the strategies discussed in the previous section can be considered demand management practices. Measures to reduce the amount of water used by urban consumers are generally implemented and pursued by local water utilities in metropolitan and regional New South Wales.

4.44 The importance of demand management practices was highlighted by a number of inquiry participants as being a key component of good water management that can reduce the amount of water that is consumed and potentially eliminate or at least reduce the need for additional storage capacity. For example, the Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, argued that not enough attention is given to demand management strategies as a means to achieve effective water use, highlighting the range of options available there:

> There is considerable focus on the 'supply-side' of the equation for providing water to industry, agriculture and urban communities. It is critically important to consider the 'demand-side' and reduce NSW's per capita water use … There are many other demand reduction strategies … that are relevant around the world, including improving efficiencies of water infrastructure in urban areas (i.e reduction of leakages) and increasing use of grey water. In urban areas, reduction in demand can also be achieved through a focus on local supply (rainwater tanks; urban runoff capture). There are many innovative ways for improving efficient use of water without building new storages or increasing the capacity of water storages in NSW.[148]

144 Submission 105, p 6.

145 Submission 105, p 1.

146 Submission 105, p 12.

147 Mr Harriss, Evidence, 3 May 2013, p 14.

148 Submission 26, Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, pp 10-11.

4.45 The Nature Conservation Council of NSW similarly emphasised the role that effective demand management can play in improving the efficiency of water use now and into the future:

> It is critical that Government gives due regard to the significant progress made on demand management and the efficiency of water use as a means of meeting water supply demand for both existing and new endeavours. The opportunity to enhance the efficiency of use of the water resource will most definitely be through demand management measures and pricing. The water resource is not infinite and it is apparent that water needs to be appropriately valued and used conservatively in a region of highly variable rainfall such as NSW.[149]

4.46 Monash Water for Liveability argued that demand management practices that encourage water conservation within the community are a critical means of 'enhancing the resilience of water supplies across NSW':

> Water conservation measures that influence societal expectations and behaviours in relation to water use are critical to the resilience of future water systems and the future development of system storages in NSW water infrastructure. The scope of these interventions is broad and includes strategies such as community education, public participation, community co-design and co-management of future supply infrastructures and services, water restrictions and a host of other strategies identified by the community for the community … In addition to investigating new water storage options, the very effective public awareness campaign on the scarcity of water and the importance of water conservation practices during the recent drought should not be overlooked as an integral part of enhancing the resilience of water supplies across NSW.[150]

4.47 According to the NSW Office of Water, it encourages good demand management practices by local water utilities through its *NSW Best-Practice Management of Water Supply and Sewerage Framework*. The key elements of this framework include:

- Integrated Water Cycle Management
- strategic business planning
- pricing and regulation of water supply, sewerage and trade waste
- water conservation and demand management
- drought management
- performance monitoring.[151]

4.48 The NSW Office of Water advised that local water utilities are required to examine a range of demand management initiatives including:

- implementation of permanent water savings measures to minimise wastage
- active intervention, such as appropriate retrofit, rebate and building code programs

149 Submission 104, Nature Conservation Council of NSW, pp 2-3.

150 Submission 105, p 11.

151 Answers to supplementary questions, 17 September 2012, Department of Primary Industries, Question 4, p 5.

- water pricing reform
- community education
- effluent and stormwater re-use.[152]

4.49 The NSW Office of Water undertakes performance monitoring and benchmarking of local water utilities to collect data in order to determine the present situation and assess future water supply and sewerage needs for non-metropolitan New South Wales. This ensures an appropriate focus for and targeting of programs to assist local water utilities.[153]

4.50 The *2011-2012 NSW Water Supply and Sewerage Performance Monitoring Report* by the NSW Office of Water highlighted that 92 per cent of the State's local water utilities have implemented a sound water conservation plan through the use of demand management practices.[154] The Office's *2011-12 Water Supply and Sewerage NSW Benchmarking Report* outlined the various demand management practices that local water utilities have been implementing, including:

- public education programs
- effluent reuse
- The schools-based Waterwise program
- rainwater tanks subsidy
- retrofit program
- free showerhead exchange
- building code program
- rebate on water efficient appliances
- stormwater reuse schemes
- park irrigation controls
- free garden mulch
- water restrictions
- separate metering for multi-unit developments.[155]

152 Answers to supplementary questions, 17 September 2012, Department of Primary Industries, Question 4, pp 4-5.

153 NSW Office of Water, accessed 3 June 2013, <www.water.nsw.gov.au/Urban-water/Country-Towns-Program/Best-practice-management/Performance-monitoring/Performance-monitoring/default.aspx>.

154 NSW Office of Water, *2011-2012 NSW Water Supply and Sewerage Performance Monitoring Report,* p 9.

155 NSW Office of Water, *2011-12 Water Supply and Sewerage NSW Benchmarking Report,* Table 8C, pp 153 -155.

The need to plan for growth

4.51 The NSW Office of Water advised the Committee that it has a policy to maintain a minimum of two years urban water supply within storages, with the possibility of suspending water sharing plans in the event that urban water supplies are under significant pressure. Towns are also able to purchase additional water supplies if allocations are considered to be inadequate, as explained by Mr Harriss:

> Our towns have high security entitlements which are generally adequate for all of their domestic requirements and if they want additional water for industrial development they have to purchase that on the market like anyone else does. We have a policy to look after high-security entitlements in towns for a minimum of two years wherever possible. In the worst instance, if all else fails, we can suspend water-sharing plans and go back to our legislation through the *Water Management Act*, which has a priority for water supply in extreme water shortages, and the first priority for that is the domestic component of town water supplies … We do all of our planning on a conservative basis and we assume the worst previous inflow sequence over that period.[156]

4.52 Despite cities and towns having high priority allocations, some inquiry participants were concerned that the size of these allocations was insufficient to allow towns to grow, both in terms of population size and industry base. For example, Mr Paul Braybrooks, Chairman, REROC, and Councillor, Cootamundra Shire Council, was concerned that a provision for growth should be factored into allocations for town water supplies:

> Often in the water debate the needs of towns seem to be lost. While REROC appreciates that urban water represents only a very small proportion of the total water take, it remains its most vital role, that is, water for human needs … Town water is not only used by residents but by manufacturing and other small industries, which underpin the economic life of rural and regional New South Wales. It is imperative that town water supplies are not only guaranteed but there is also some provision for growth.[157]

4.53 Mr Terence Hogan, Chair, Riverina and Murray Regional Organisation of Councils (RAMROC), and Mayor, Jerilderie Shire Council, expressed similar concerns that if a town required water above its allocation, it would have to purchase additional water:

> Towns and cities have a high-security allocation, but it has a limit. Of course, there is a limit to all the categories, whether it be general-security or high-security water. If you want to encourage industry that needs high-security water you have to go to the marketplace to buy it, and it is not cheap. There is some opportunity to do that. However, there is not an extra pool sitting somewhere; it is a finite amount at the moment. If you want some, you have to buy it. If it was an industry that could afford and needed high-security water you would go into the marketplace and buy it.[158]

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156 Mr Harriss, Evidence, 20 August 2012, p 9.

157 Mr Paul Braybrooks, Chairman, Riverina Eastern Regional Organisation of Councils, and Councillor, Cootamundra Shire Council, Evidence, 1 November 2012, p 12.

158 Mr Terence Hogan, Chair, Riverina and Murray Regional Organisation of Councils, and Mayor, Jerilderie Shire Council, Evidence, 1 November 2012, p 38.

4.54 In regard to towns purchasing additional water supplies, REROC indicated that, 'we understand that some councils are already augmenting their town water supplies by purchasing High Security water which they can then utilise to support economic development'.[159]

4.55 Utilising his experience at Albury City Council as an example, Mr Ray Stubbs, Executive Officer, RAMROC, indicated that through reducing water usage via conservation measures, some towns might be able to cater for short term growth without having to purchase additional allocations:

> When I was in Albury the entitlement was about 13,000 megalitres a year. From time to time we were getting close to that annually. Through a series of conservation measures … the general average usage is now about 7,000 megalitres to 8,000 megalitres as against 13,000 megalitres. The paper mill had a special licence and pumped directly from the river. Part of the strategy was to have that bank of water available within its entitlement to cater for new industry growth. Eventually, if we have a whole lot of industry in the city, they may have to buy some water. However, at the moment they have some capacity.[160]

4.56 One inquiry participant suggested that the system of water licences should be amended to afford towns greater capacity to trade their high security entitlements with the NSW Government or with other towns. Dubbo City Council expressed concern that the system of licences and dam operating rules means that the stated highest priority given to town water usage is not realised in practice, and argued that changes to the system should be made:

> Council could buy general or high security water licences on the water market, but these may be reduced to zero or a fraction of their face value in dry years, when they are needed. It is not possible to buy, or to sell, water licences of town water security.
>
> The system of water licences should be amended so that towns can purchase town water licences from the Crown, and sell to other towns or back to the Crown … publicly owned water storages are failing to support the growth of towns as they were originally intended to on account of restrictive water licensing arrangements. The benefits of an effective water market are not available to the town water sector.[161]

Committee comment

4.57 The Committee acknowledges that regional councils have carried out significant work in the area of strategies to improve water security through undertaking studies to plan effectively for future water needs. This work is critical in helping to inform the debate on whether new water storages or augmentation of existing ones and/or improvements to management are necessary. This topic is further discussed in Chapter 7.

4.58 The Committee supports the efforts of councils and metropolitan water utilities in pursuing urban conservation measures such as stormwater harvesting and recycling waste water. The Committee believes that demand management practices are just as important as managing the

159 Submission 109, Riverina Eastern Regional Organisation of Councils, p 2.

160 Mr Ray Stubbs, Executive Officer, Riverina and Murray Regional Organisation of Councils, Evidence, 1 November 2012, p 37.

161 Submission 4, Dubbo City Council, pp 1-2.

supply or the delivery of water to all users. We recognise that, in terms of demand management practices for urban water users, 92 per cent of local water utilities have implemented water conservation plans to minimise wastage and educate end users in more efficient water use. The Committee encourages local water utilities to continue this work and the NSW Office of Water to continue its supportive role.

4.59 We acknowledge that Sydney Water currently recycles 5.7 per cent of its waste water, with the potential to increase this to 14.75 per cent by 2015. However, given that the majority of urban waste water still goes out to sea, there is significant potential for greater recycling. The Committee believes there may be substantial benefits from such measures including reducing the overall amount of water drawn for urban use from water storages and also the production of more waste water recycling that could further support agriculture and industry.

4.60 There is no doubt that there is a need to plan for urban growth. The Committee acknowledges that the NSW Government is supporting local water utilities to assess their future water security by developing the Assuring Future Urban Water Security Guidelines that will be released in the near future.

4.61 The Committee recommends that the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures.

Recommendation 3

That the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures such as stormwater harvesting and recycling waste water.

Agricultural water

4.62 Agricultural water sits alongside urban water and industrial water as a key aspect of water use. The Committee was advised that, while the urban use of water has the highest priority, agriculture constitutes over 80 per cent of total water use in New South Wales.[162] In relation to irrigation, a primary purpose for agricultural water, the NSW Government indicated that it is pursuing a range of systemic improvements.

4.63 In its submission, the NSW Government noted the work being undertaken to modernise irrigation infrastructure to reduce water losses, especially from evaporation:

> 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.[163]

[162] Mr Harriss, Evidence, 3 May 2013, p 14.

[163] Submission 13, p 8.

4.64 Dr Richard Sheldrake, Director-General, Department of Primary Industries, advised that research has indicated that such modernisation programs have the potential to save significant volumes of water:

> In 2007 a review of potential water savings in the northern inland basin of New South Wales by Bailey and others estimated the loss on-farm that could be saved by investment in existing modern technologies could equate to approximately 450 gigalitres. To put that level of saving into perspective the volume equates to more than that capacity of Keepit Dam on the Namoi River.[164]

4.65 Dr Sheldrake argued that, 'To capture that efficiency we need investment on farms and ongoing investment in research and development'.[165]

4.66 The NSW Government also highlighted the role that it keeps playing in achieving ongoing improvements in water efficiency in the irrigation sector through research, development and training in new technologies:

> 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.[166]

4.67 Inquiry participants identified two key issues in regard to the use of water for agricultural purposes: firstly, the role that on-farm irrigation practices can play in achieving efficient water usage; and secondly, the role that government can play in encouraging and supporting farmers to convert to efficient irrigation practices. These are discussed in turn below.

Adapting on-farm practices

4.68 A number of inquiry participants identified new methods of on-farm irrigation as a key means to achieve efficient use of water resources. For example, the Inland Rivers Network encouraged the pursuit of alternative irrigation practices to minimise water losses, particularly in regard to the water intensive cotton and rice industries:

> The agricultural industry is the largest user of water in Australia … The cotton and rice industries need to move away from wasteful flood irrigation to more efficient water use through drip or subsurface irrigation. This will improve drought management and long term security for production. It will also remove the pressure from the current level of water storage in inland NSW and leave more water for other purposes.[167]

164 Dr Richard Sheldrake, Director-General, Department of Primary Industries, Evidence, 20 August 2012, p 2.

165 Dr Sheldrake, Evidence, 20 August 2012, p 2.

166 Submission 13, p 8.

167 Submission 78, p 5.

4.69 Mr Terence Hogan, Chair, RAMROC, and Mayor, Jerilderie Shire Council, explained that irrigators had long been seeking to achieve more efficient use of water due to the pressures of drought conditions:

> As an irrigator I have been making these changes for at least 25 to 30 years … I can tell you that many years ago with the onset of the drought, if we had not made those changes and efficiencies, I would not be here talking to you. We would be gone, financially.[168]

4.70 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, outlined the different types of on-farm irrigation practices that are being pursued by Council members:

> A great deal of change has taken place. Our members are looking at everything, with the value of water as it is right now, and participating in any of the government programs to assist in improving their on-farm efficiency. They are looking at everything from drip irrigation to lateral moves, centre pivots – anything that will be a more efficient use of the water resource.[169]

4.71 At the same time, Mr Moore advised that while such innovative practices generate water savings, these savings can be off-set by increased costs in other areas, most notably in energy bills:

> However, one of the consequences of that which has been highlighted in recent times is the cost of running those particular operations. Where you have some water savings you have now got increased energy costs … It is now paying for energy costs and some are in some ways questioning whether it was an appropriate move to make, seeing what their water savings are compared to what their bills will be going forward and the increased costs potentially associated with that.[170]

4.72 In spite of these costs, Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, indicated that farmers were pursuing constant innovation to achieve greater efficiencies in their water use practices:

> [I]t does come with substantial costs in other forms which some of them might not have necessarily been aware of when they first implemented it. But irrigators know the value of their water resources and without this water resource they would not be able to produce, so to be more water efficient will be at the centre of their attention.[171]

4.73 Mr Moore highlighted that while there can be hidden costs to new irrigation practices, other cost savings can also be realised in addition to more efficient water usage. Mr Moore noted, for example, that one of the biggest savings arising from a bankless channel is that this system can be utilised and run by a much smaller number of people, leading to large labour savings.[172]

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168 Mr Hogan, Evidence, 1 November, 2012, p 40.

169 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 13.

170 Mr Moore, Evidence, 16 November 2012, p 13.

171 Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 13.

172 Mr Moore, Evidence, 16 November 2012, p 14.

4.74 Mr Michael Murray, National Water Policy Manager, Cotton Australia, indicated that Cotton Australia supported changing irrigation methodologies if it can be shown that there are substantial water savings to be made and noted that irrigators will adopt the practices themselves:

> We would certainly support it and irrigators will do that anyway. As mentioned before, there is a great and strong economic argument, given the importance of it and the expense of an irrigation entitlement to make sure that is used as most efficiently as possible. [173]

4.75 NSW Farmers suggested that farmers be encouraged via incentives and other means to construct private on-farm storages, which would have the dual benefit of reducing reliance on the State's water supply whilst simultaneously providing some flood mitigation capacity:

> NSW Farmers submits that in discussing the impacts of climate variability on water storages, consideration be given to the potential for private on-farm storage to augment public supply, and thereby reduce flooding impacts. Public policy should encourage the careful consideration of the construction of additional stock and domestic dams by introducing appropriate tax incentives, grants, subsidies and the immediate removal of any artificial, administrative restrictions.[174]

4.76 Inquiry participants advised that storage efficiency can be assessed by the volume to surface area ratio of a storage. For example, a shallow water storage with a greater surface area will be prone to more evaporation and less efficient than a deeper water storage with a smaller surface area.

4.77 The NSW Irrigators' Council suggested replacing shallow on-farm storages with deeper shared storages to minimise water losses that occur through evaporation:

> With the large number of small, shallow storages we are increasing the impact of evaporation and in some cases seepage from these works. Having one or several strategically placed, deep storages which replaced these small storages, could potentially save a great deal of water without increasing the amount that is extracted or held in storage. This is not a policy position, but rather an idea that could assist in extending the use of water in NSW. [175]

4.78 Namoi Water also contended that storing water in deeper systems would minimise losses and improve efficiency:

> There is considerable private storage in the lower section of the catchment and this is typically shallow storage used in season for irrigation, however there may be potential for investigation of using storage in deeper systems at the headwaters providing a saving in evaporation and delivery efficiencies. [176]

4.79 NSW Farmers also advocated for farmers in coastal areas of the New South Wales to be permitted to collect and store a greater amount of rainfall run-off than is currently allowed:

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173 Mr Michael Murray, National Water Policy Manager, Cotton Australia, Evidence, 6 March 2013, p 6.

174 Submission 95, NSW Farmers, p 7.

175 Submission 97, NSW Irrigators' Council, p 7.

176 Submission 94, Namoi Water, p 4.

> Harvestable rights allow landholders in most rural areas to collect a proportion of the runoff on their property and store it in one or more farm dams up to a certain size. Currently, rural landholders can build dams on minor streams that capture up to 10 percent of the average regional rainfall run-off on their property without requiring a licence. Whilst this 10 percent limit is appropriate for some parts of the state, NSW Farmers believes the limit should be raised in coastal areas.[177]

4.80 Whilst acknowledging the efforts of individual farmers in pursuing water-wise practices, Dr Sheldrake also highlighted the potential role for whole of industry-level involvement in the research and development of efficient water usage practices:

> [I]f we want to tackle the opportunities that are there across all our cotton irrigation farms or all our rice farms, individual rice growers are not going to have the wherewithal to do it themselves, on their property. They will continue using practices that are best and they will minimise the amount of water. Farmers are smart people and they will reduce the amount of water as much as they possibly can. But if it is about undertaking research and development to get a significant next-step-up gain, they are not in a position to do that as individuals. They are in a position to do that as an industry as a whole.[178]

4.81 The Committee had the opportunity to visit Keytah Farm, a cotton farm west of Moree, that has taken part in irrigation trials run by the Gwydir Valley Irrigators Association, intended to better inform local farmers on the benefits or otherwise of different irrigation systems. The case study for Keytah Farm is presented below.

Case study: Improving irrigation in the Australian cotton industry – the Keytah Project[179]

The Keytah project led by Gwydir Valley Irrigators Association (GVIA) is a comparison project that examines the trade-off between energy efficiency and water efficiency.

This grower-led trial was designed to provide accurate comparative information on the water use efficiencies of four relatively common irrigation systems used across Australia and around the world. The information will then help growers make more educated decisions on their irrigation practices, in turn maximising their productivity per megalitre.

The four systems and the size of the trial area were drip irrigation (11.43 hectares), bankless channel (32.53 hectares), furrow irrigation (85.69 hectares) and two lateral moves (122.95 and 122.99 hectares each).

Each system was trialled over two seasons: 2009-2010 and 2011-2012. Maintaining consistent management of each irrigation system meant that plant variety, planting techniques, plant spacing, fertiliser, herbicide and insecticide management were all consistent.

177 Submission 95, p 7.

178 Dr Sheldrake, Evidence, 20 August 2012, p 11.

179 Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association, Evidence, 6 March 2013, p 31 and answers to questions taken on notice during evidence 16 November 2012, NSW Irrigators' Council, Question 1, p1.

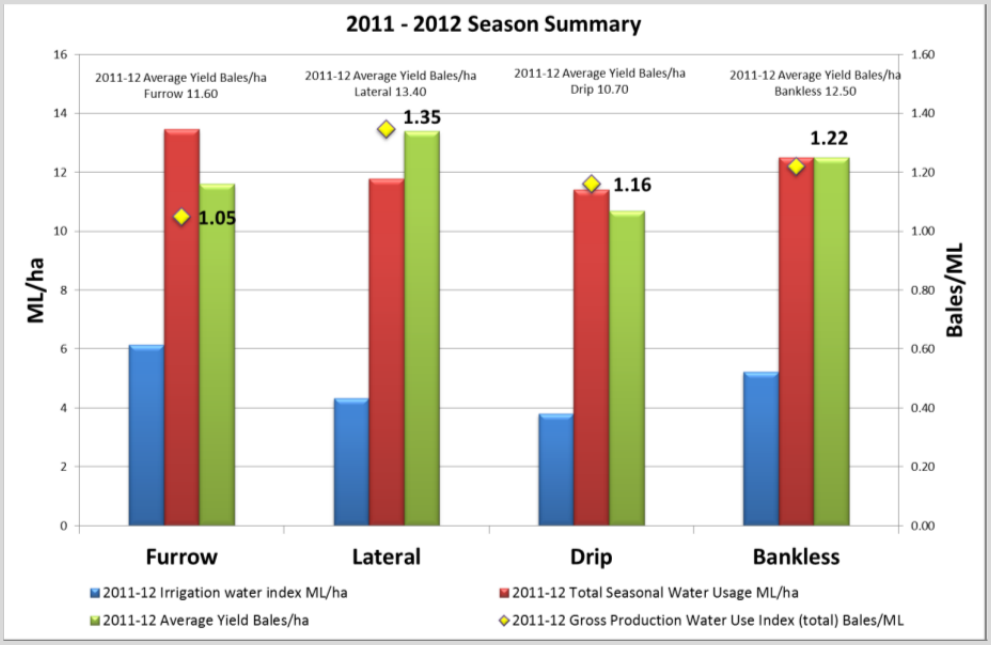
As this is only one trial and the sample size is quite small, these results are not considered conclusive. However, this information is helping to build the profile of each system and with continued support, will assist farmers to match their soil, land and crops to the system which will produce the best results as efficiently as possible.

The trial has demonstrated a successful grower-led industry-driven program, providing practical information to allow growers to make a decision on water use efficiency options and how to factor in energy and labour costs.

While not conclusive, the results produced in the graph below demonstrate that lateral move followed by bankless channel irrigations methods may result in more yield per hectare with lower water use than the more common furrow irrigation method.

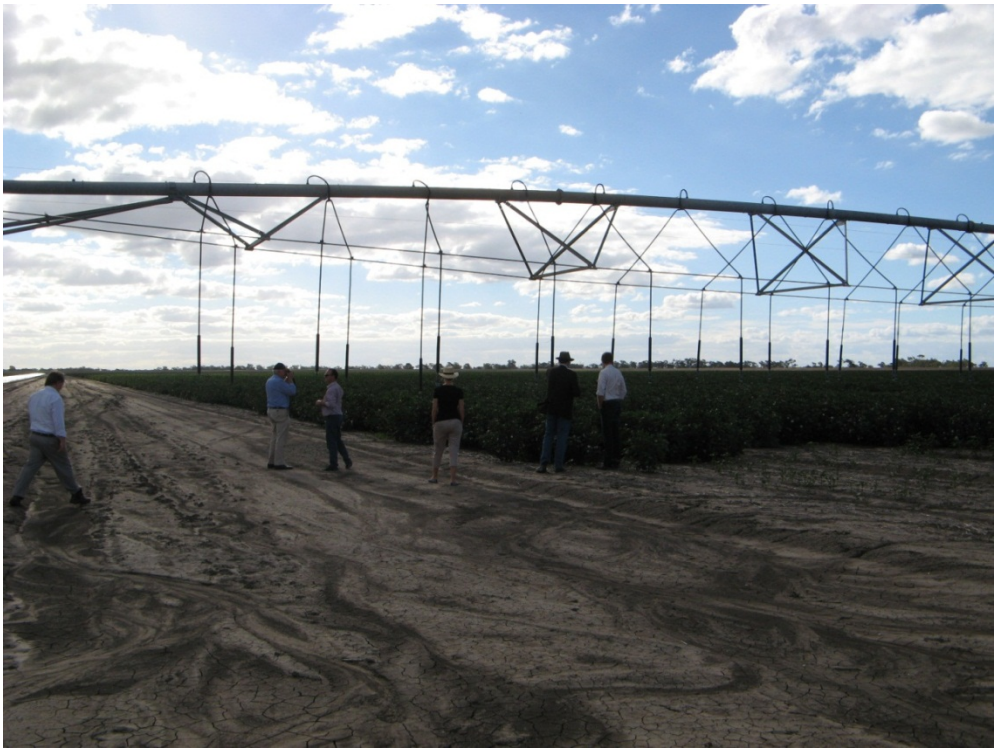
There is a further trial season in 2013-14 with funding from the Cotton Research Development Corporation.

Figure 3 The 2011-2012 season summary: the water applied and used by the crop for each system is presented with its average production output



Lateral move irrigator in Keytah Farm irrigation trial, Moree[180]

State Development Committee viewing Keytah Farm irrigation trial, Moree[181]



180 State Development Committee site visit to Moree, 5 March 2013.

181 State Development Committee site visit to Moree, 5 March 2013.

Encouraging change

4.82 Numerous inquiry participants argued that aside from the benefits of water savings, financial assistance from government can provide an incentive for farmers to modernise irrigation infrastructure. They advocated for governments to offer a variety of financial assistance packages to enable farmers to select the best funding model to suit different types of farming operations.

4.83 Dr Sheldrake advised that the Department of Primary Industries assists the delivery of on-farm infrastructure investment programs on behalf of the Commonwealth Government, with two different types of programs available:

> Currently the department is involved in delivering on-farm infrastructure investment programs in the northern basin for the Commonwealth Government. The project delivers 50 per cent of the water savings to the environment. Under a different program all of the savings could remain with industry.[182]

4.84 A key program delivered by the Department of Primary Industries is Sustaining the Basin: Irrigated Farm Modernisation (STBIFM). The Commonwealth Government provides $83 million from the Water for the Future initiative for this program.[183]

4.85 STBIFM is aimed at improving the long term sustainability of regional communities by allowing irrigators to maintain or improve productivity, adapt to reduced water availability and provide water back to the environment through upgrading irrigation infrastructure in the NSW Border Rivers, Gwydir, Namoi/Peel and Macquarie/Cudgegong water management areas.[184]

4.86 STBIFM, which will run up to October 2017, also aims to achieve water savings by improving on-farm water use efficiency and reduce the direct extraction of water from the regulated river water sources of each valley. Round one resulted in 32 successful applications and round two applications are currently being assessed by the Department.[185]

4.87 Ms Buller of the Murrumbidgee Valley Food and Fibre Association expressed support for providing a mix of funding models to enable farmers to select the best model to suit their individual circumstances,[186] as did Mr Moore from the NSW Irrigators' Council, who commented that farmers are adept at assessing which funding model will be best suited to their individual circumstances:

> Farmers have now been exposed to so many different programs they are able to identify the costs involved, what are the savings and what does that mean to my

182 Dr Sheldrake, Evidence, 20 August 2012, p 2.

183 Department of Primary Industries, accessed 22 May 2013, <www.dpi.nsw.gov.au/agriculture/resources/water/irrigation/sustaining-the-basin>.

184 Department of Primary Industries, accessed 22 May 2013, <www.dpi.nsw.gov.au/agriculture/resources/water/irrigation/sustaining-the-basin>.

185 Department of Primary Industries, accessed 22 May 2013, <www.dpi.nsw.gov.au/agriculture/resources/water/irrigation/sustaining-the-basin>.

186 Ms Buller, Evidence, 16 November 2012, p 24.

> overall business. Farmers will make that individual assessment as to what is best for them and what they will be changing to.[187]

4.88 Ms Buller further explained that government funding often allows agricultural producers to undertake work that might otherwise be deferred or not undertaken at all because of the upfront costs involved:

> A lot of people were able to do work that they have been wanting to do for quite some time with the assistance of [government funding for on-farm savings measures]. It was things like putting in laterals and bankless channels and all that sort of stuff. They have been valuable for that reason because a lot of farmers want to do those efficiency works and know that they can be valuable, but the upfront costs, especially when we have been through a very vulnerable time, were too prohibitive.[188]

4.89 In regard to which model of funding has been most popular within the agricultural community, Mr Moore considered that the 50:50 model, whereby half the projected water savings in equivalent water entitlements are permanently transferred to government and the remaining 50 per cent are retained by the farmers, has the most support within the agricultural community:

> The 50:50 model seems to be quite supported … Where there are savings retained within their operations which gives them some leeway to move and still has that benefit for the environment. That model has worked and seems to work quite well. There are other models that potentially have not been probably as successful. The 50:50 model seems to be the one that people subscribe to and potentially some of the programs that have been oversubscribed have been that 50:50 model.[189]

4.90 The NSW Irrigators' Council advised that, while the 50:50 model is popular, a range of funding schemes would be better for irrigators than a one size fits all scheme:

> Future funding programs need to be proportionate to the risk involved … Council cannot identify one funding model that is better than all others. Due to the sheer number of variables involved, there is no one model which could be utilised to deliver optimal benefits for the environment, water users or the government. Each project should be evaluated on its own merits, the ratio of funding to water return needs to be based on several factors associated and hence a 'one size fits all model' would be inappropriate. We therefore recommend that a range of schemes will be necessary to cover the breadth of operations, types of infrastructure and geographical differentials.[190]

4.91 While numerous stakeholders expressed support for the continuing modernisation of on-farm irrigation practices, Mr Stubbs, RAMROC, voiced doubt that significant savings could continue to be achieved through such modernisation:

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187 Mr Moore, Evidence, 16 November 2012, p 19.

188 Ms Buller, Evidence, 16 November 2012, p 23.

189 Mr Moore, Evidence, 16 November 2012, p 19.

190 Answers to questions taken on notice during evidence 16 November 2012, NSW Irrigators' Council, Question 5.

> [T]here have been some projects on farm and off farm. One thing I often wonder about is how much of that low-hanging fruit is already got, and how much capacity is there to really get a whole lot more savings out of that infrastructure money.[191]

4.92 Mr Jonathon Phelps, Chairman, Namoi Water, suggested that government funding should be available for on-farm trialling of water savings projects:

> [I] think more importantly, they need to also be funding those sorts of projects as well, helping farmers get into that sort of infrastructure that they would not normally do because of constraints with their own budgets. But if you can encourage it through a financial incentive to actually upgrade works, at the end of the day that should turn into extra production for the local economies. There are things that have been going on recently, and down in the south, where people are foregoing water for money—there is a financial incentive there to do that—so that is a trade-off. That way you keep the actual production. By trading water and increasing efficiency you are at least keeping production as it is, and hopefully increasing it. So that is an environmental trade-off, efficiency gain and hopefully no loss in production.[192]

4.93 Ms Jon-Maree Baker of Namoi Water commented on the take-up of an existing program through which government funding was available, the Achieving Sustainable Groundwater Entitlements program:

> I think we have had a number of examples in this valley where through the Achieving Sustainable Groundwater Entitlements program there was funding made available for irrigators to actually fund infrastructure, which was highly successful. That was through a structural adjustment process—even though they did not actually hand water back, they actually retained that water because they were losing so much in terms of their groundwater system. That had a high level of uptake. So in terms of the current program that has been rolled out in the northern basin, the uptake in terms of the lower and upper Namoi has been nil in the first tender round. So that indicates that either the value that is prepared to be paid for the actual water is not high enough or that the criteria is actually restricting growers from participating in that program. There are some issues in terms of the current infrastructure.[193]

Committee comment

4.94 In light of the fact that the majority of water use in New South Wales, over 80 per cent, is by the agricultural sector, the Committee considers that this sector has a key role to play, along with governments, in ensuring future water security.

4.95 We believe that the great work already achieved by the agriculture sector through improvements to irrigation systems and other on-farm practices is playing a significant role in assuring water security for this sector and should be further encouraged and supported by both the NSW and Commonwealth Governments.

4.96 Irrigation trials like that on the Keytah Farm we visited provide highly valuable information to farmers to enable them to make better informed decisions about their production methods.

191 Mr Stubbs, Evidence, 1 November 2012, p 40.

192 Mr Jonathon Phelps, Chairman, Namoi Water, Evidence, 6 March 2013, p 24.

193 Ms Baker, Evidence, 6 March 2013, p 24.

These types of projects should be supported by both the agriculture industry and governments. We note that a further trial season at Keytah Farm has been made possible with funding from the Cotton Research Development Corporation.

4.97 In addition, the Committee strongly encourages individual famers to continue to adapt their practices to ensure efficient water use. The Committee believes that financial support from both the industry and from governments will continue to be critical in driving innovation in water use for agriculture. The Committee recommends that the NSW Government financially support the agriculture sector to use more efficient water practices and that it encourage contributions from industry and the Commonwealth Government to support research and development in this area.

4.98 The Committee agrees that the main focus for achieving water savings required under the Murray Darling Basin Plan objectives should be efficiency savings rather than buy backs.

4.99 The Committee is of the view that once the 2,750 GL in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:

2. State funded projects returning 100 per cent of water savings back to the irrigator, and
3. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.

Recommendation 4

That the NSW Government:

- financially support the agriculture sector to use more efficient water practices and encourage contributions from industry and the Commonwealth Government to support research and development in this area, and
- ensure that after the 2,750 gigalitres in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:
  4. State funded projects returning 100 per cent of water savings back to the irrigator, and
  5. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.

Fixed water charges during drought conditions

4.100 Another aspect of agricultural water use raised by one group was the fixed water charges for general security licence holders. NSW Farmers expressed concern that the fixed component of the water price applies even during exceptional drought conditions when general security license holders may not receive any of their water allocation. NSW Farmers illustrated this scenario by outlining the situation that arose in the Lachlan Valley during the millennium drought:

> Wyangala Dam in the Lachlan Valley reached record lows in late 2009, with zero in-flows causing the dam to drop to less that 5% capacity. Wyangala Dam is the only dam on the Lachlan River system to feed the Murrumbidgee River, which in turn feeds the Murray River … By 2009, general security water users had received zero allocations for five of the prior six years. Fixed water charges are applied irrespective of the level of water allocation received, meaning that irrigators were still expected to pay in full the fixed charge of their tariff, even without a drop of water being delivered.[194]

4.101 The Committee heard that in this instance, NSW Farmers lobbied successfully for the fixed water charges to be foregone:

> NSW Farmers was successful in lobbying for these charges to be waived, with Lachlan Valley general security licence holders' fixed water charges waived, and fees also waived for general security regulated licence holders across the state that received a zero allocation for three consecutive years.[195]

4.102 In order to address this issue on a permanent basis, NSW Farmers advocated for the implementation of a statewide policy of waiving fixed water charges during exceptional drought conditions, stating, 'As part of planning for future droughts, NSW Farmers believes a permanent, statewide policy must be implemented to waive fixed water charges when exceptional drought conditions prevail'.[196]

Committee comment

4.103 The Committee believes that the proposal from NSW Farmers is a sensible and fair approach and recommends that the NSW Government develop a statewide policy of waiving fixed water charges during exceptional drought conditions.

Recommendation 5

That the NSW Government develop a statewide policy of waiving fixed water charges during exceptional drought conditions.

Industrial water

4.104 The third key area of water use is for industrial purposes. The Committee received limited evidence on the capacity of water storages to meet industrial need, with the evidence received focusing largely on the mining industry.

4.105 Mr David Harriss of the NSW Office of Water advised that from the Department of Primary Industries' perspective, mining businesses are required to hold appropriate water licences for their current or anticipated needs:

194 Submission 95, p 8.

195 Submission 95, p 8.

196 Submission 95, p 8.

> From our administrative perspective a mine is no different from any other user and we insist that a mine have a licence for the water it takes whether it wants to take it accidentally, by interception or otherwise. A mine has to have the same sort of licence. For example, if the expansion of a mine in the central west means that it will take additional volumes of water, we expect the operators to go to the market and buy that water, and they have done so previously.[197]

4.106 Mr Harriss indicated that the mining industry may be permitted to access brackish or saline water from aquifers, so long as the water was appropriately treated:

> There is a number of mining activities further west in the State where we believe there is probably some water available, particularly in the brackish and saline aquifers. They have been hardly touched and they are extensive and deep. We cannot see any reason not to allow access to some of those saline or brackish aquifers. The issue is how miners treat that water.[198]

4.107 Forbes Shire Council acknowledged that while the mining industry was an important contributor to the region's economic health, the water demands of the mining industry require a reliable supply of water which may be difficult to guarantee in times of drought:

> Mining has also become a very important contributor to the Lachlan region with mines providing a much needed boost to local economies through job creation, housing and industry boosts. These mines require large amounts of water. The recent drought highlighted the importance of a reliable water supply to these communities and the dangers to these communities economically when these mines became concerned over their viability should water become difficult to procure.[199]

4.108 Concern was expressed by Regional Development Australia – Orana regarding the potential impact of the coal seam gas industry on ground water supplies:

> The mining industries in our region use large amounts of water, mainly ground water which impacts on aquifers and this eventually leads to reduced river flows. The coal seam gas industry will eventually come on stream and this industry will extract and use, safely, a large amount of ground water. This water may provide some opportunity to recycling but most will evaporate in ponds.[200]

4.109 The Caldera Environment Centre argued that water for industrial purposes should be prioritised below water for consumptive and agricultural uses, with industrial water users encouraged to make greater use of recycled water:

> Water should be prioritised for human consumption and agricultural uses in preference to industrial uses; industrial uses such as mining should have stronger regulations against water use … The use of dam water for industrial purposes is not to be condoned. Use rights should be exclusively for human and agricultural uses. Current industrial water demand could be managed with greater improvement and incentives towards onsite water capture, reuse and recycling.[201]

197 Mr Harriss, Evidence, 20 August 2012, p 18.

198 Mr Harriss, Evidence, 20 August 2012, p 18.

199 Submission 47, Forbes Shire Council, p 2.

200 Submission 12, Regional Development Australia – Orana, p 2.

201 Submission 49, p 6.

4.110 In its submission, the NSW Government indicated that in addition to water sharing planning, the competing needs of agriculture versus industrial requirements are addressed through the new Strategic Regional Land Use Plans. This occurs via the identification of 'Strategic Agricultural Land' so that proposed mining projects go through the new 'gateway process', which provides an independent scientific and upfront assessment of the impacts of mining. Also, the new Aquifer Interference Policy outlines water licensing requirements and defines minimal impact considerations for industrial activities that impact on aquifers.[202]

Committee comment

4.111 The Committee received minimal evidence on issues surrounding the industrial use of water, however, we acknowledge that industry is also a competing end user for the water resource and consider that it should use water as responsibly as other users. The Committee considers that industry has a role to play in minimising water use, for example through using recycled water wherever appropriate.

[202] Answers to supplementary questions, 17 September 2012, Department of Primary Industries, Question 1, p 3.

Chapter 5 Environmental issues

This chapter discusses the potential impact that water storages have on the environment. It explores participants' views on the environmental impact of water storage releases on the environment, including the variability of the releases and the effects of cold water releases on downstream river health. A key issue for the inquiry, the allocation of water for the environment, also known as environmental flows, is examined, as are participants' concerns surrounding the management of environmental flows.

Impact of water storages on the environment

5.1 Inquiry participants were divided in regard to the impact of water storages on the environment. Some participants were of the opinion that water storages have benefits for the environment. For example, the NSW Farmers Association – Griffith Branch argued that water storages have a positive impact on the flow of rivers, particularly in times of drought:

> There is a perception that dams are bad for the environment. It is actually the opposite. If we had not had the Snowy River Scheme the Murray and Murrumbidgee Rivers would have ceased to flow during the decade of drought we have just experienced. These dams improved the flow and reliability of water heading west.[203]

5.2 Southern Riverina Irrigators acknowledged that water storages have had a range of impacts on the environment, but suggested that the positive impact of storages was often ignored or unrecognised:

> Undoubtedly river regulation and major dam storages have impacted on the environment. The presumption today is that the impacts are all negative. This assumption deserves closer scrutiny as the benefits of prior policy decisions and major Government investments can often be overlooked by modern generations, who are accustomed to having secure water supplies. Water storages and their associated benefits are taken for granted.[204]

5.3 The Murrumbidgee Valley Food and Fibre Association suggested that 'wisely constructed water storage and conservation works are demonstrably a benefit to native flora and fauna as modern water conservation techniques provide a safe and secure habitat for native wetland species'.[205]

5.4 In addition, Griffith City Council argued that while water storages may have some impact on the environment, these impacts need to be balanced against the benefits gained in other areas, including food security and the generation of hydro-power:

> Unfortunately, in some sections of the community, dam storages are viewed to have excessive, negative environmental impacts. This view has not been balanced against the various economic and social benefits that can be derived which include:
> - flood mitigation;

203 Submission 73, NSW Farmers Association – Griffith Branch, p 5.

204 Submission 91, Southern Riverina Irrigators, p 3.

205 Submission 74, Murrumbidgee Valley Food and Fibre Association, p 8.

- source of environmental flows in dry times;
- food security;
- hydro-power;
- recreation and tourism.[206]

5.5 On the other hand, a number of inquiry participants argued that water storages have a significant detrimental environmental impact, including cold water pollution, loss of fisheries and increased salinity. In its submission, the Nature Conservation Council of NSW summarised the adverse impacts that, in their view, are caused by water storages:

> Dams adversely affect the natural flow of rivers and create major hydrological, ecological, biological, geomorphological and physical problems. Many short and long term negative impacts have been demonstrated on native fish, crustaceans, molluscs, algae and water quality. Water storage and regulation does not only impact on the ecology of our rivers but also some agricultural activities such as floodplain graziers through reduced and altered wetland/floodplain watering.
>
> Some of the most significant impacts of water storage include changed flow regimes, coldwater pollution, fish migrations, loss of natural watering of wetlands and floodplains, increased salinity and acidity. Fish species have already been eliminated from hundreds of kilometres of various rivers due to regulation by storages.[207]

5.6 The Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, argued that there are a multitude of environmental costs associated with water storages, including the loss of fisheries and reduced productivity of downstream agricultural land:

> There is widespread scientific evidence from Australia and around the world of the significant costs of building dams on downstream communities and ecosystems … The environmental costs of dams were once thought inconsequential. However the whole scale loss of fisheries, sediment transfer and floodplain inundation has serious consequences not only on the river, wetlands and land, but also financial cost to communities … The physical impact of the dam on downstream river functioning is also problematic and often difficult to assess until decades later. Silt, sediment and nutrients from upstream river flow or large floods are crucial for replenishing fertile soils. Dams prevent this happening, curtailing downstream agricultural productivity.[208]

5.7 Similarly, the No Tillegra Dam Group highlighted the negative impacts of water storages on fish migrations, sedimentation of river systems and upstream ecosystems:

> The environmental consequences of large dams are numerous and varied, and includes direct impacts to the biological, chemical and physical properties of rivers and riparian (or 'stream-side') environments. The dam wall itself blocks fish migrations, which in some cases and with some species completely separate spawning habitats from rearing habitats. The dam also traps sediments, which are critical for maintaining physical processes and habitats downstream of the dam (including the maintenance of productive deltas, barrier islands, fertile floodplains and coastal wetlands).

206 Submission 19, Griffith City Council, p 3.

207 Submission 104, Nature Conservation Council of NSW, p 2.

208 Submission 26, Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, pp 7-8.

> Another significant and obvious impact is the transformation upstream of the dam from a free-flowing river ecosystem to an artificial slack-water reservoir habitat. Changes in temperature, chemical composition, dissolved oxygen levels and the physical properties of a reservoir are often not suitable to the aquatic plants and animals that evolved with a given river system. Indeed, reservoirs often host non-native and invasive species (e.g. snails, algae, predatory fish) that further undermine the river's natural communities of plants and animals. [209]

5.8 The No Tillegra Dam Group further suggested that water storages have a negative impact on the environment downstream of storages, arguing:

> The alteration of a river's flow and sediment transport downstream of a dam often causes the greatest sustained environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow … even subtle changes in the quantity and timing of water flows impact aquatic and riparian life, which can unravel the ecological web of a river system.[210]

5.9 The Inland Rivers Network identified the following negative environmental impacts of large water storages in inland river systems:

- the seasonality of water delivery is changed through hampering the natural flow volumes of river systems
- loss of the natural flow regime
- water quality impacts, including cold water pollution, deoxygenation of water, blue green algal blooms and salinity
- changes to river channels, including bank slumping, erosion and turbidity
- degradation of water dependent vegetation and fauna populations.[211]

5.10 Some inquiry participants further argued that the interruption to river flows caused by water storages results in disruption to the natural cycles of ecosystems, including drought conditions. The Byrrill Creek Land Care Group, Save Byrrill Creek Group, and Northern River Guardians suggested that:

> Dams are not constructed to help the environment, but to cater for human use and abuse. The argument that a dam is necessary to supply water to critical habitats in times of drought ignores the entire meaning of 'natural system'. If the natural ecosystem is in decline, it is not because of natural variation but rather land clearance and the excessive extraction of water for human consumption over the past two centuries. Some systems need a drought as part of their cycle.[212]

5.11 In response to some of these concerns the NSW Government advised the Committee that as part of its approach to managing the environmental impact of water storages, fish ladders

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209 Submission 66, No Tillegra Dam Group, p 2.

210 Submission 66, p 2.

211 Submission 78, Inland Rivers Network, pp 2-5.

212 Submission 68, Byrrill Creek Land Care Group and Save Byrrill Creek Group, p 2 and Submission 69, Northern River Guardians.

have been installed along the Nepean River to aid the unencumbered passage of fish along the waterway:

> 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.[213]

5.12 On 29 August 2012, the Committee inspected water storage facilities in the Shoalhaven and Southern Highlands, including Tallowa Dam and its fish lift, which is considered the largest fish lift of its kind in Australia. It transports fish over the dam wall in a 2,500 litre bucket. According to the Sydney Catchment Authority, the fish lift helps to protect 10 native fish species by allowing them to migrate between the lower and upper Shoalhaven River.[214]

Fish lift at Tallowa Dam[215]

213 Submission 13, NSW Government, p 8.

214 Sydney Catchment Authority, accessed 28 May 2013, <www.sca.nsw.gov.au/recreation/tallowa-dam>.

215 State Development Committee site visit to Shoalhaven, 29-30 August 2013.

State Development Committee viewing fish lift at Tallowa Dam[216]

5.13 Two specific issues emerged as areas of concern for stakeholders: the variability of water releases and cold water releases. The evidence the Committee received on them is discussed in turn below.

Variability of water releases

5.14 Some inquiry participants expressed concern regarding the impact on riverbanks of the variability of releases from water storages as compared to the natural flow rates of rivers. These concerns were expressed primarily in relation to the impact of water releases from Blowering Dam into the Tumut River.

5.15 Tumut Shire Council argued that the high variability of releases from Blowering Dam 'have drastically altered the natural flow regime of Tumut River, resulting in accelerated erosion and adverse impacts on the eco-system'.[217] The Council outlined the enormous degree of flow variability:

> During the irrigation season, Tumut River levels fluctuate enormously, based on the demand of irrigators. River flows vary from as low as 600 ML per day to 9,300 ML

216 State Development Committee site visit to Shoalhaven, 29-30 August 2013.

217 Submission 106, Tumut Shire Council, p 1.

> per day. This enormous variation generally occurs over a relatively short period of time, resulting in saturated riverbanks collapsing into the river.[218]

5.16 Ms Trina Thomson, Mayor, Tumut Shire Council described the flow regime of the Tumut River as being 'turned upside down' as a consequence of the water releases:

> It runs very high, fast and cold in summer, very low and warm in winter. It is not sustainable either for the ecosystem or the environmental factors, but also in relation to the erosion that is occurring.[219]

5.17 Ms Thomson went on to propose that greater consideration be afforded to the impact of variable flows on communities close to Blowering Dam, also noting that native habitats and fish populations find it difficult to survive in such erratic conditions:

> We believe that what needs to happen is the same as with transport: You need to have the consideration for the first mile just as you have for the last mile. That is the point I would really like to push today.
>
> We have strong needs and the river plays an integral part in the wellbeing, health and economy of our community. At the moment our river is really being denigrated and is struggling to survive … native fish struggle to survive, as does a lot of the natural habitat. From our perspective, some of the major concerns are the draw-down rates.[220]

5.18 Providing a government perspective, Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, acknowledged that some river bank erosion can occur as a consequence of high flow events in the summer months. Mr Harris advised that variable flow rates were not the only cause of such erosion, and that the Department had an active management program to reduce the effects of erosion:

> [W]e have high flows in summer. We have about typically 9,000 megalitres a day in the capacity of the Tumut River. It goes trundling down there for months on end. That does cause some erosion. We had works done, a report done about 10 years ago which demonstrated, however, it was not the only contributing factor. A lot of land clearing down at the edge of the river is also a contributing factor to erosion, and that is the same case in the Murray River downstream of Hume Dam.
>
> But they are not naturally high-power streams but because of river regulation and the need to deliver large volumes of water throughout the course of the summer and autumn they have become high-power streams and subject to erosion. But as I said, we are having active management programs with different riverbank erosion works, revegetation, deep piles, all those sorts of things to try to mitigate some of that erosion.[221]

5.19 Inquiry participants identified a number of potential solutions to address the issue of variable river flows along the Tumut River. Tumut Shire Council noted that despite a program or

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218 Submission 106, p 3.

219 Ms Trina Thomson, Mayor, Tumut Shire Council, Evidence, 1 November 2012, p 6.

220 Ms Thomson, Evidence, 1 November 2012, p 2.

221 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 20 August 2012, p 5.

works plan being developed to mitigate the impacts of the highly variable river flows, current funding levels allocated to the plan were insufficient to undertake the necessary works:

> The process of developing a Works Plan to mitigate erosion caused by the regulated flows commenced in 2005 when the State Government undertook a comprehensive review of environmental factors. This led to the development of a ten year Works Plan that was eventually approved by the then Minister for Water, Phillip Costa, in 2010/11.
>
> The plan acknowledges that Tumut River is a major natural asset that is valued greatly by the community for its economic, environmental, aesthetic, social and recreational values. The plan recommended that $1.8 million be spent per year on works to mitigate erosion. The actual amount being spent is in the order of $600,000 per year, well short of what is required.[222]

5.20 Tumut Shire Council went on to suggest that an increase in bulk rural water charges could potentially assist to address this funding shortfall:

> Council believes that the NSW Office of Water has lodged submissions to the Independent Pricing and Regulatory Tribunal on bulk rural water charges as a means of raising revenue to fund works on the Tumut River in accordance with the Works Plan. Funding to implementation of the Works Plan should be significantly increased. Irrigators should be major contributors through bulk rural water charges.[223]

5.21 Ms Thomson argued that it was crucial to implement less variable flows from Blowering Dam, explaining that highly variable flows cause bank collapse along the route of the river to the detriment of landholders:

> We need that drawdown to be consistent. It is one of the most crucial things. When you fill the river up to its absolute capacity and it saturates the bank and then you drop the flow significantly in two or three days the banks do not cope – they collapse. Landowners use that land. The same thing happens the next time it rises. It saturates the bank and we lose more land.[224]

5.22 To address this Tumut Shire Council suggested amending the drawdown regime from Blowering Dam to bring it into line with the approach used at Hume Dam, which is based on water level rather than flow rate:

> A more natural draw-down rate would allow excess water to drain from the banks and reduce the likelihood of banks collapsing. It is Council's understanding that the current rule applied to draw-down in the Tumut River is 500 ML/day/hour. Council believes that a new draw-down rule should apply, based on water level not flow rate, such as occurs at Hume Dam, which Council believes is 150mm variation per day.[225]

5.23 Mr Paul Braybrooks, Chairman, Riverina Eastern Regional Organisation of Councils (REROC), and Councillor, Cootamundra Shire Council, recommended the use of weirs along

222 Submission 106, p 3.

223 Submission 106, p 3.

224 Ms Thomson, Evidence, 1 November 2012, p 7.

225 Submission 106, p 3.

rivers to permit staged, slower releases from water storages, in addition to potentially providing capacity to mitigate against flooding events:

> [S]torage management should be approached on a consultative basis to ensure that water is released at optimum times for production as well as for environmental benefits. Over the years REROC has raised the issue of using weirs along the Murrumbidgee River as part of the water storage solution. Weirs could serve several purposes allowing water to be released more slowly from water storages. It is our understanding that water currently released for irrigation comes down the Tumut River at a very fast pace … We believe that the strategic use of weirs could mitigate this by allowing staged releases that would lessen the speed of the water, resulting in less impact upon the habitat. We believe also that weirs could provide some mitigation for floods, capturing excess water en-route.[226]

5.24 Ms Thomson also noted that the use of en-route storages along the river system may assist to reduce the significant changes in flow that currently occur:

> [I]f we had a consistent flow rate it would be better not only for the downstream users who would have access to their water year round; it would reduce the amount of requirement in relation to ensuring that we have Blowering at maximum. So I believe that if there was that downriver storage then we would be able to have the air space required … If the downstream storage could be incorporated to reduce the rise and fall and the dramatic changes in that flow, I believe that that would go a long way to reducing the impacts.[227]

5.25 The issue of en-route storage is considered in greater detail in Chapter 7.

5.26 Another method of decreasing the variability of river flows may arise from the implementation of the Computer Aided River Management (CARM) system along the Tumut River. Mr Neville Smith, Chief Executive Officer, Water for Rivers, described the ability of CARM to regulate river flows:

> We believe that CARM would reduce to some degree the higher flows in the Tumut area through the summer months. The flow being released would be better matched to orders at particular destinations. The other part of that is that irrigators take their water when they have booked to take it and they take the amount they booked … In our view there is some direct benefit from CARM for those tight parts of the river.[228]

5.27 CARM is further discussed in Chapter 6.

Cold water releases

5.28 The second area of stakeholder concern in regard to releases from water storages related to the impact of cold water releases from water storages on downstream river health. For example, Tumut Shire Council was also concerned about the impact of cold water releases from Blowering Dam on the Tumut River:

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226 Mr Paul Braybrooks, Chairman, Riverina Eastern Regional Organisation of Councils, and Councillor, Cootamundra Shire Council, Evidence, 1 November, 2012, pp 11-12.

227 Ms Thomson, Evidence, 1 November 2012, p 5.

228 Mr Neville Smith, Chief Executive Officer, Water for Rivers, Evidence, 1 November, 2012, p 23.

> Water is fed into Tumut River from the base of Blowering Dam, resulting in extremely low water temperatures … Council has expressed concern about the impacts of cold water releases on the Tumut River aquatic ecosystem. Cold water pollution has also severely restricted the use of Tumut River for recreational purposes.[229]

5.29 Ms Thomson outlined the Council's concerns in this regard explaining, 'When water is released from the bottom of the dam the temperature is significantly lower, so the impact on the river system and ecosystems is significant'.[230] She indicated that these lower temperatures impact significantly on native fish populations, which cannot survive in the lower temperature environment.[231]

5.30 Ms Thomson suggested that a solution to the problem of cold water releases would be to vary the location from where water is released from a storage, although she ackowledged that this would be costly to implement:

> I understand that one of the ways of addressing that is looking at mid-storage release. That involves drawing down water from different areas in the dam so that the water is not as cold. However, it is an extremely expensive process and is probably cost prohibitive.[232]

5.31 The Total Environment Centre (TEC) also advocated for the use of variable off-takes, releasing water from different areas or levels in a dam, as a means of limiting the effects of thermal pollution (or cold water pollution) on aquatic systems:

> TEC strongly believes that water storages should be operated in a manner that is consistent with the maintenance of health aquatic ecosystems. In particular timing of environmental flows and other releases should mimic natural patterns. Care should be taken to minimise the effects of thermal pollution through construction and operation of variable off-takes.[233]

5.32 The submission from Tumut Shire Council noted that the NSW Government was investigating the feasibility of implementing variable off-take levels at state dams, but that no timetable had been developed for Blowering Dam:

> Council acknowledges that the Government has developed a strategy to manage the impacts of cold water releases from State dams by investigating options for installing multilevel off-takes over the next 30 years. Blowering Dam has been identified as a priority for investigation in stage 2 but there has been no advice as to when the investigation will commence.[234]

5.33 The NSW Office of Water advised the Committee that the NSW Government is investigating the causes and effects of cold water pollution, and how to manage its impacts. In July 2012, the Cold Water Pollution Interagency Group released the report *NSW Cold Water Pollution*

229 Submission 106, p 4.

230 Ms Thomson, Evidence, 1 November 2012, p 8.

231 Ms Thomson, Evidence, 1 November 2012, p 9.

232 Ms Thomson, Evidence, 1 November 2012, p 8.

233 Submission 18, Total Environment Centre, p 3.

234 Submission 106, p 4.

Strategy: Report on the implementation of stage one. The report indicated that the NSW Government has made significant progress in implementing its cold water pollution strategy. Major achievements include:

- completion of works at two major dams – Tallowa and Jindabyne Dams
- investigation of upgrades at two others – Burrendong and Keepit Dams
- legislative amendments to the *Water Management Act 2000* to formalise the regulation of cold water pollution
- completion of guidelines for the monitoring and assessment of cold water pollution outcomes
- a governance structure that includes regulators, operators and natural resource management agencies to guide implementation.[235]

5.34 The report indicated that Blowering Dam is a high priority dam for addressing cold water pollution and may be considered in the stage two works. However, no time frames were provided.[236]

Committee comment

5.35 The Committee notes the concerns of inquiry participants regarding the potential negative impacts of water storages on the environment. We believe these impacts need to be balanced with the benefits of having water storages, including the longer term security of providing a water supply for consumptive purposes, for irrigation and therefore food security purposes, and potentially also for a level of flood mitigation in certain areas.

5.36 The Committee acknowledges that the NSW Government is undertaking a number of programs to address the potential negative impacts, including an active program to manage bank erosion, measures to aid fish passage through the construction of fish lifts and ladders and removal of weirs, and also the implementation of a cold water pollution strategy.

5.37 We note that further measures that can address environmental impact concerns, such as the use of downstream storages and the Computer Aided River Management system, are discussed in Chapters 6 and 7.

5.38 It was evident to the Committee that there was a level of concern about water storage releases in the Tumut area that the Committee did not observe with other areas. This suggests the desirability of better practices and management for the Tumut River and Blowering Dam. The Committee recommends that Tumut River and Blowering Dam be given a more constructive management regime, with a focus on the impact of water releases from the dam on the river.

235 NSW Office of Water, *NSW Cold Water Pollution Strategy: Report on the implementation of stage one,* July 2012, pp 9-12 and p 28.

236 NSW Office of Water, *NSW Cold Water Pollution Strategy: Report on the implementation of stage one,* July 2012, p 27.

Recommendation 6

That the NSW Government review the management and impact of water releases from Blowering Dam on the Tumut River.

Environmental flow allocations and management

5.39 A focus of significant debate in this inquiry concerned whether or not environmental flows are beneficial and the management of these flows. Environmental flows are releases from water storages aimed specifically at providing benefits to downstream river health.

5.40 The NSW Office of Water stated that, as environmental awareness grew in the 1990s, it was recognised that toxic blue-green algal blooms, loss of native fish and waterbird populations, rising salinity and other adverse environmental outcomes would become more prevalent in New South Wales unless water was shared in an equitable manner between extractive users, such as urban consumers, irrigators and farmers, and the environment. These problems were particularly apparent in regulated rivers, that is, a river where downstream flows are regulated by a major storage or dam to supply irrigation water, as described in the *Water Management Act 2000*.[237]

5.41 Mr Harriss advised that when the dams were originally constructed in New South Wales it was for the purpose of water storage and conservation. Mr Harriss advised that releases from the dams are now also for environmental purposes:

> We have had to consider changing the releases from the dams to provide for the health and productivity of the river and the environmental outcomes that are now sought. They certainly were not built to provide that level of environmental flows. They were built to provide flows but mainly for consumptive purposes. All we are doing is changing the purpose of the release of those flows.[238]

5.42 By 1997, the NSW Government had introduced environmental flow rules in the regulated Gwydir, Namoi, Macquarie, Lachlan, Murrumbidgee and Hunter River valleys, as well as the Barwon-Darling River. Environmental rules were generally designed to provide water for the environment across a range of flow events, from floods to very low flows.[239]

5.43 These environmental flow rules now form the basis of environmental water provisions within statutory water sharing plans prepared under the *Water Management Act 2000*. The NSW Office of Water advised that the ecological benefits of these flow rules include reduced algal blooms, increased wetland biodiversity, more abundant native fish and more natural ecosystem processes.[240]

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237 NSW Office of Water, accessed 23 May 2013, <www.water.nsw.gov.au/Water-management/Monitoring/Regulated-rivers/Regulated-rivers/default.aspx>.

238 Mr Harriss, Evidence, 3 May 2013, p 8.

239 NSW Office of Water, accessed 23 May 2013, <www.water.nsw.gov.au/Water-management/Monitoring/Regulated-rivers/Regulated-rivers/default.aspx>.

240 NSW Office of Water, accessed 23 May 2013, <www.water.nsw.gov.au/Water-management/Monitoring/Regulated-rivers/Regulated-rivers/default.aspx>.

5.44 The *Water Management Act 2000* recognises the need to allocate water for the environmental health of rivers and groundwater systems. The Act provides water for the environment in two ways: planned environmental water and adaptive environmental water.[241]

5.45 The Act sets out a priority order for water sharing under its water management principles, as follows, with the environment as the top priority:

> 6. Sharing of water from a water source must protect the water source and its dependent ecosystems, and
> 7. Sharing of water from a water source must protect basic landholder rights, and
> 8. Sharing or extraction of water under any other right must not prejudice the principles set out above.[242]

5.46 When questioned on how environmental water flows are allocated, Mr Harriss advised that '[e]nvironmental flows have the same characteristics as any other licence' and have to be ordered by the licence holder in accordance with the water sharing plans and allocation policies:

> The environmental manager, whether it be the Office of Environment and Heritage or whether it be the Commonwealth Environmental Water holder, will order his or her water in a pattern that best suits their needs, just as an irrigator will order their water in a pattern that suits their needs. Then State Water and ourselves will collectively try to make the arrangements to deliver that water to meet all purposes and within existing constraints at the present stage … in terms of the environmental flows, when they are released from regulated storages and they are regulated entitlements, they come with the same characteristics and we deliver them within the constraints, as we deliver any other entitlement.[243]

5.47 The Office of Environment and Heritage manages the environmental water for a number of valleys in New South Wales, particularly where there are significant wetlands and substantial holdings of environmental water. These include the following valleys:

- Gwydir
- Macquarie
- Lachlan
- Murrumbidgee
- Murray and Lower Darling.[244]

5.48 In evidence, Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, highlighted the work undertaken by the Authority to enable environmental flows in the Sydney catchment area:

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241 NSW Office of Water, accessed 23 May 2013, <www.water.nsw.gov.au/Water-management/Water-sharing-plans/Environmental-rules/Environmental-rules/default.aspx>.

242 *Water Management Act 2000*, sections 5 (3) and 9 (b).

243 Mr Harriss, Evidence, 20 August 2012, pp 5-6.

244 Office of Environment and Heritage, accessed 27 May 2013, <www.environment.nsw.gov.au/environmentalwater/index.htm>.

> Since 2004 the Sydney Catchment Authority has spent almost $80 million on infrastructure to enable environmental flow releases and fish passage to produce the environmental health of the Hawkesbury, Nepean and Shoalhaven rivers. In 2011-12 the SCA released 570 billion litres in environmental flows to assist in improving downstream river health, and a further 2,270 billion litres of uncontrolled releases occurred when the dams spilt.[245]

5.49 In addition to water allocations for environmental flows, Mr Harriss advised that governments have been recovering water for the environment through infrastructure projects and the purchase or acquisition of water entitlements at market price, indicating that the process is quite expensive.[246]

Participants' concerns

5.50 Some inquiry participants were critical of the approach taken to the management of environmental flows or the need for such flows at all during certain times.

5.51 There was concern among some inquiry participants that there is no real need for environmental flows, especially during high flows or flooding. In his submission, Mr Robert Mepham expressed the view that the management of environmental flow releases from water storages could be improved, particularly in times of flood:

> Environmental flows need to be better managed, as recently water was released from Copeton Dam into an already flooded Moree water course (wetlands area), causing flooding of crops resulting in damage running into millions of dollars. This water is therefore being wasted as well as causing unnecessary destruction.[247]

5.52 Mr Ronald Pike argued that there is no need for environmental releases in the Murray Darling Basin as there has been an increase in the number of floods in the area:

> The claim that there have been less floods in the Murray Darling Basin since we built the dams is false. It was always false. We can argue and hypothesise as to why that might be, and I think the answer is very simple, but there have been nearly twice as many floods since we built the dams as there were in the recorded time before. Please look at my submission. There is nothing more important than that fact. For government to be interfering and saying they are going to try to manufacture a flood, first of all they cannot do it. It is physically impossible. Secondly, what do they think they are doing? There are not less floods; there are actually more. Hasn't anybody looked at the television in the last few years? The claim that we need to release water for "the environment" is and always has been false. It is not right.[248]

5.53 Southern Riverina Irrigators also commented on the loss of valuable water supplies when environmental flows were released into the Murray River system during a period of high water flow:

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245 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, Evidence, 20 August 2012, p 36.

246 Mr Harriss, Evidence, 3 May 2013, p 2.

247 Submission 71, Mr Robert Mepham, p 1.

248 Mr Ronald Pike, Evidence, 3 May 2013, p 29.

> In the NSW Murray system, Snowy Hydro licence conditions include minimum annual releases volumes. Despite excessively high flow events down the Murray system, required release rules meant that water was released and under current rules there was no ability to limit those releases. As a result substantial negative third party impacts occurred and in addition, valuable water supplies were sent down the river that could have been retained in storage to secure future water supplies.[249]

5.54 Mr Harriss indicated that the decision to make water releases for environmental flows after the natural system has produced significant flows is predominantly made by the environmental water manager:

> It would then be up to the environmental water manager to call on the release of that water, just as an irrigator who might have had a whole lot of rain on a property might not call on the use of that water in any particular year—they might choose to carry it over. The environmental water holder will in future be operating just like any other irrigator: We have had 15,000 gigalitres in the environment; do I need to call on any more water? They might choose not to or they might choose to. One of the issues we have now is that if you have a small high flow the environmental water user might choose to make releases to complement that flow or to piggyback on top of that flow. That is fine, that is their call, provided that—again I get back to New South Wales's submission to the Basin Plan—does not have any third party impacts or does not inundate from regulated flows privately-owned land.[250]

5.55 In relation to the management of environmental flows, some inquiry participants raised issue with the impact that the 'banking' of environmental water allocations could have on other water users. For example, the Riverina Eastern Regional Organisation of Councils (REROC) were concerned that the retention of unused environmental flow allocations takes up significant space within New South Wales water storages, effectively reducing the storage capacity of water for other users such as irrigators:

> We also have some concerns in relation to the impact on storage capacity of water held for environmental purposes. Currently water is held on behalf of the Murray Darling Basin Authority (as part of The Living Murray Program), the New South Wales Office of Environment and Heritage, the Victorian Environmental Water Holder and Commonwealth Environmental Water Holder (CEWH). It is our understanding that the water is primarily held in NSW water storages. As the CEWH's holdings in particular increase, we are concerned that where the CEWH does not use its entire allocation it will 'bank' the unused allocations in the NSW storages taking up valuable air space. It is only in limited circumstances that the CEWH is able to sell its allocations or entitlements back into the system and we are unclear as to whether or not there is a ceiling on the amount of water that can be banked for environmental purposes. If there are competing demands for the storage of banked water, as irrigators are also able to bank unused allocations, then all the user's needs must be accommodated in the current storages. It is unclear whether current storages have the capacity to meet these demands.[251]

249 Submission 91, p 6.

250 Mr Harriss, Evidence, 3 May 2013, p 17.

251 Submission 109, Riverina Eastern Regional Organisation of Councils, pp 2-3.

5.56 The Gwydir Valley Irrigators raised concerns with the discrepancy between what irrigators can bank of their water allocations and what 'the environment' can bank. For example, the Gwydir Valley Irrigators can bank 150 per cent of their water allocations (to be used at a later time), however, 'the environment' is permitted to bank 200 per cent of its allocation. The Gwydir Valley Irrigators recommended that all licence holders, including environmental licence holders, should have the same rules and conditions and suggested that environmental licence rules be reverted back to the same rules as irrigators.[252]

5.57 Namoi Water raised concerns with environmental flow allocations, in particular for supplementary access[253] for irrigators. Ms Jon-Maree Baker, Executive Officer, Namoi Water, commented that the major impact in the Namoi in terms of environmental allocation is the 90:10 rule, which limits supplementary access for four months of the year, where 90 per cent of the water is allocated to the environment and 10 per cent for other users. Ms Baker advised that the river management committee agreed to a 50:50 split in the original water sharing plan, however, the Minister instead approved the 90:10 division.[254]

5.58 The issue of water allocation levels for environmental flows has played out significantly through the development of the soon to be implemented Murray Darling Basin Plan (MDBP). As outlined in Chapter 2, the Commonwealth's MDBP sets new extraction limits, known as sustainable diversion limits (SDLs), for each river catchment and aquifer system and also overall trading rules.[255]

5.59 The MDBP became law in November 2012 and the enforceable SDLs are set initially at 2,750 gigalitres less than current diversions in the rivers across the Basin to provide additional water for the environment, and which are to be achieved by 2019. The Murray Darling Basin Authority will have the role of accrediting New South Wales plans against the requirements of the plan. New South Wales will therefore need to revise all of its water sharing plans for inland areas from 2019.[256]

5.60 In evidence, the Gwydir Valley Irrigators questioned the requirements for environmental water allocation under the MDBP. Ms Zara Lowien, Executive Officer, stated:

> Gwydir Valley Irrigators has quite consistently questioned the requirements under the Basin Plan for environmental water. The 20 per cent, or near 20 per cent, that is reserved for the environment in the dam is a combination of water sharing plan water as well as what has been purchased under the recovery programs for the Murray Darling Basin Plan … Our position is that the water they have is more than sufficient to meet the in-stream health and that there needs to be an assessment of whether or

252 Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators, Evidence, 6 March 2013, p 33.

253 Supplementary access is available when there are flows that exceed any immediate water needs and any specific environmental requirements as set out in the environmental flow rules. This water may then be made available to licence holders on regulated rivers. Any water extracted is not debited against the licence holders regulated allocation and therefore supplements their normal regulated allocation.

254 Ms Jon-Maree Baker, Executive Officer, Namoi Water, Evidence, 6 March 2013, p 26.

255 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 6, p 6.

256 Answers to supplementary questions 17 September 2012, Department of Primary Industries, Question 6, p 6.

> not it has over acquired what they require for environmental purposes and our view is that they have. The water sharing plan itself with its both planned environmental water and the environmental contingency allowance we believe, met the requirements of the environment during the drought already, has proven performance and we question why there needs to be water above and beyond that.[257]

5.61 Ms Lowien argued that there were issues with the way the modelling was undertaken in the Gwydir Valley to determine the environmental allocations for the MDBP:

> And we have asked the NSW Government on a number of occasions in our submission for the Basin Plan to strongly work with the Murray Darling Basin Association on the modelling for the Gwydir Valley; my point being they modelled what they had purchased not what they needed. The northern basin, as part of the Murray Darling Basin Plan, has the opportunity to participate in the northern review and what we require is assistance in providing the information and potentially doing some of the modelling through the State based network to prove that the amount of water is larger than what is required.[258]

5.62 Also Ms Lowien commented that their water sharing plan is coming up for review after being in place since 2004 and suggested that part of this review could consider the impact of the current allocation of 20 per cent for environmental purposes.[259]

5.63 The NSW Office of Water discussed an issue arising out of the MDBP, that of the potential for the NSW Government to be liable for compensation if flooding occurs on private land after it complies with the release of environmental flow requirements under the MDBP. Mr Harriss commented on this issue:

> Provision of environmental flows under the Basin Plan to meet some downstream requirements is to increase the rate of release to 42 megalitres a day, which will significantly inundate areas of private land. New South Wales has said, "We do not agree with that" unless you can work out some agreement with the landowners, whether it be easements or whatever, that will enable the flooding of private land from the release of environmental flows. We are never going to stop floods. We do not intend to stop floods. In fact, they provide some positive outcomes for that floodplain land. But where you are making releases from regulated flows, which inundate private land, then we believe that the third party issues have to be addressed.[260]

5.64 The Committee heard that there is the potential for the NSW Government to be in a position that if it did not release the flows, it may be in breach of its contract with the environmental manager, and if it did release the flows, it may have a significant negative effect on downstream users who may seek some form of compensation for property damage. Mr Harriss reported that the NSW Government is attempting to address this issue with the Commonwealth.[261]

257 Ms Lowien, Evidence, 6 March 2013, p 33.

258 Ms Lowien, Evidence, 6 March 2013, p 33.

259 Ms Lowien, Evidence, 6 March 2013, p 33.

260 Mr Harriss, Evidence, 3 May 2013, p 17.

261 Mr Harriss, Evidence, 3 May 2013, p 18.

5.65 On the other side of the debate, the Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, was of the opinion that not enough consideration is given to the proper management of environmental flows, due to a lack of understanding about the needs of the environment:

> Unlike consumptive demand, far less is known about environmental water requirements. Environmental water requirements are essential for maintaining function and health of aquatic ecosystems. Healthy aquatic ecosystems provide valuable services such as water filtration, recreation and fisheries, and are globally worth an estimated $15 trillion each year. Environmental water requirements are inadequately represented in current water management. This has resulted in insufficient water availability, resulting in widespread decline of ecosystem health. The first step in defining environmental requirements is to assess the composition and condition of species, using flora and fauna inventories, habitat mapping, and field studies. Water requirements then need to be defined for each ecosystem and its key processes … Once water requirements have been defined, they need to be integrated into current management.[262]

Committee comment

5.66 The Committee was presented with numerous and serious concerns, especially among irrigators, relating to water allocations for environmental flows and the management of these flows. This leads us to believe that the NSW Government needs to do more in this area to address the concerns of irrigators.

5.67 The amount of water available for irrigators and other users has decreased with the implementation of these environmental flows. There is also the concern that, as there have been limited increases to the overall capacity of water storages since the implementation of environmental flows in 1997, the justification for the current level of environmental flows is debatable.

5.68 The Committee therefore recommends that the NSW Government review the environmental flow allocations for all valleys in New South Wales and lobby the Commonwealth Government to do the same in relation to the MDBP. We believe that this along with the recommendations in Chapter 7 relating to future water solutions will go some way in addressing the concerns of New South Wales irrigators.

Recommendation 7

That the NSW Government review the environmental flow allocations for all valleys in New South Wales and make representations to the Commonwealth Government for it to review the environmental flow allocations for New South Wales valleys in relation to the Murray Darling Basin Plan.

[262] Submission 26, pp 4-5.

5.69 In addition to concerns with environmental flow allocations, the Committee believes that the priority given to environmental needs above water supply to industry and high security needs in regulated rivers under the *Water Management Act 2000* is not sufficiently balanced. While we recognise water for the environment is an important factor for the health of a river system, the Committee sees that water for industry that creates wealth, employment and provides food security for the nation should have greater priority. To this end we recommend that the NSW Government amend to *Water Management Act 2000* to reflect this emphasis.

Recommendation 8

That the NSW Government amend the principles of the *Water Management Act 2000* to ensure that the commercial water supply for towns and utilities and high security needs in regulated rivers are prioritised above environmental needs.

5.70 The Committee also supports the NSW Government's efforts to clarify with the Commonwealth Government the issue of liability for environmental water releases made under the MDBP that inundate private land. We recommend that the NSW Government obtain this clarification before the process of developing the water sharing plans that must comply with the Plan and be enacted by 2019.

Recommendation 9

That the NSW Government clarify with the Commonwealth Government the NSW Government's liability for environmental water releases made under the Murray Darling Basin Plan that inundate private land, in time to feed into the process of developing the water sharing plans that must comply with the Plan and be enacted by 2019.

Chapter 6 Storage management practices

This chapter examines the storage water management practices pursued by NSW Government water agencies overseeing the operations of the State's water storages. An important component of storage management is the use of modelling systems to determine water requirements and thereby help predict future scenarios that may affect water availability. This chapter examines the current models used by NSW Government agencies and considers inquiry participants' views with these systems. Of particular focus in this chapter is the discussion of the new Computer Aided River Management system used in the south of the State and its applicability to other areas. Other storage management practices to improve access to more water in storages, including use of deep water and minimising evaporation are outlined. Lastly, the chapter considers dam safety practices and the role of the NSW Dam Safety Committee.

Modelling systems

6.1 According to the NSW Office of Water, it uses a range of modelling techniques to understand how river and groundwater systems behave. The models help predict what will happen in a variety of scenarios, including water sharing, compliance and the effects of climate variability, and factors that affect water availability.[263]

6.2 The NSW Office of Water advised that the complexity of modelling approaches can vary from very simple conceptual models through to very detailed and data rich approaches. Models can be applied at scales varying from very small scale specific sites or study levels, through to regional scales. The utility of any model is constrained by basic limitations in knowledge and the availability of data to build the model. The Office of Water has observed that, 'Models cannot generate knowledge; they only combine what we know into useful forms'.[264]

6.3 The NSW Government advised the Committee that there are a number of models currently used by different water agencies for determining water requirements for the agricultural, urban, industrial and environmental sectors. These include:

- NSW Office of Water - Integrated Quantity and Quality Model (IQQM)
- Sydney Catchment Authority (SCA) Water Headworks Network (WATHNET)
- SCA Reservoir Management System (SCARMS)
- Sydney Water specific demand forecast models.[265]

6.4 Detailed descriptions of these models can be found below.

263 NSW Office of Water, accessed 4 June 2013, <www.water.nsw.gov.au/Water-Management/Modelling/default.aspx>.

264 NSW Office of Water, accessed 4 June 2013, <www.water.nsw.gov.au/Water-Management/Modelling/default.aspx>.

265 Submission 13, NSW Government, p 6.

Models used to determine water requirements and manage water storages[266]

Integrated Quantity and Quality Model (IQQM)

The NSW Office of Water 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.

SCA Water Headworks Network (WATHNET)

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 the Independent Pricing and Regulatory Tribunal (IPART). According to the SCA, work is currently being undertaken to incorporate economic modelling into the WATHNET model, which will enable short term and long term supply options to be optimised.

SCA Reservoir Management System (SCARMS)

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 Metropolitan Water Plan (MWP). Sydney Water's demand forecast model is independently reviewed by IPART as part of its operating licence and price setting regulatory processes.

State Water Corporation short and long term modelling

Short term forecasts, 12-24 months: State Water considers past consumer behaviours by analysing historical water usage for each valley and the associated water availability. Short term customer demand (water requirements) is estimated by extrapolating current water availability from monthly available water determinations released by the NSW Office of Water. This information is then compared to State Water's estimate of water allocation at anticipated crop planting and traditional peak irrigation dates, as well as the likely demands of non-irrigation customers.

266 Submission 13, pp 6-7; Answers to supplementary questions on notice, Sydney Catchment Authority, Question 3b, pp 8-10; Answers to supplementary questions on notice, 14 September 2012, State Water Corporation, Question 1, p 5; Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 3 May 2013, p 6; eWater, accessed 4 June 2013, <www.ewater.com.au/products/ewater-source/>.

In addition to this, State Water investigates the status of on-farm and industry storages, estimates water use out of customers' storages, and identifies when customers are likely to initiate the next season and associated water usage via communications with key customers. State Water also reviews annual Environmental Water Plans produced by the Office of Environment and Heritage, as well as the Commonwealth Environmental Water Holder. These plans outline Environmental Water Holders' water requirements for the next 12 months. Finally, consideration is also given to the Bureau of Meteorology's three-month climatic outlook and how this may impact future usage.

Long term forecasts, over 24 months: Predicting water demand for longer than 24 months is a considered as indicative only. This estimate is calculated by looking at three types of data: long term weather forecasts, IQQM Modelling, and historical water usage data for the last 20 years. Long term weather forecasts are used to create a model which enables water delivery to create scenarios on future water events that may take place. These long term weather forecasts also highlight potential La Nina and El Nino patterns which can have significant impacts on future weather conditions.

eWater Source

eWater is developing a national modelling platform. eWater Source is an Australian-wide collaboration effort backed by the Commonwealth Government. It is built to meet the myriad of climatic, geographic, water policy and governance settings across the country. It is Australia's first national river basin scale water modelling system, and represents a substantial step forward in managing water resources. The Source modelling platform allows users to build on, rather than replace existing models. It was developed to take a holistic approach to water management including human and ecological impacts. This includes integrating policy, addressing water savings and sharing for a whole river and connected groundwater systems including cities, agricultural and environmental demands.

The SCA is participating in the eWater Source modelling platform, where work has commenced to integrate models under the eWater modelling framework as part of the National Hydrology Modelling Strategy. This will improve model transparency between stakeholders. Both the NSW Office of Water and Sydney Water have adopted the Source modelling platform, with Sydney Water using Source for the Hawkesbury Nepean downstream modelling project. Exchange of data and explanation of modelling results is more efficient if agencies have a common modelling platform.

6.5 The remainder of this section considers a number of issues including concerns some inquiry participants have with the current modelling systems, the challenges of modelling in a variable climate and the need to use modelling systems to effectively plan for the future. The new Computer Aided River Management system is also discussed in detail.

Concerns with the Integrated Quantity and Quality Model

6.6 Some inquiry participants suggested that the NSW Office of Water's IQQM should be recalibrated to provide more accurate and reliable results. For example, Griffith City Council considered that it would be timely to reassess the framework used by the model to take into account changes in population and economic activity:

> The IQQMs need to be recalibrated to ensure they are as accurate as possible. Minimal updating has been done since the Water Sharing Plans were commenced. It is critical to the entire population of NSW (especially regional NSW) that a comprehensive State audit/study is done on the actual true productive water usage needs of NSW under various climatic conditions and recalibrated to account for increased population and economic activity.[267]

6.7 The Gwydir Valley Irrigators Association argued that the IQQM should be altered for use in different geographic areas to reflect their unique circumstances and water usage patterns:

> IQQM could be used to assess the impact to storage capacity of specific policy changes however each valley model will need to be recalibrated in light of the changes in water use behaviour and competing water use demands to provide more accurate information on our present situation.[268]

6.8 The Inland Rivers Network identified a number of potential ways to improve the IQQM, including:

- increased investment in water modelling
- the need to address variability rather than long term averaging
- making models available for independent peer reviews
- improved accountability and transparency relating to model inputs and interpretations
- examining the agricultural use inputs in models
- making publicly available any updated models.[269]

6.9 The NSW Irrigators' Council (NSWIC) was concerned that IQQM cannot be used as a predictive tool to anticipate future water needs and allow for long-term planning of water resources:

> We understand that IQQM provides information on the impacts of water resource management and policy decisions, but it cannot be used as a predictive model to anticipate future needs. NSWIC supports the use of IQQM, however we consider it necessary to recalibrate this model to incorporate the changes in environmental use behaviour. This would provide more accurate information on our present situation. However the need for modelling of our future demands remains essential.[270]

6.10 Similarly, Cotton Australia pointed to the lack of forecasting ability of the IQQM system:

> Cotton Australia is reasonably comfortable with the Integrated Quality and Quality Model (IQQM) that is used by the NSW Office of Water (NOW) as the primary model for determining and managing Water Sharing Plans.

267 Submission 19, Griffith City Council, p 5.

268 Submission 93, Gwydir Valley Irrigators Association, p 8.

269 Submission 78, Inland Rivers Network, pp 6-7.

270 Submission 97, NSW Irrigators' Council, p 5.

> However, it was not designed as a model to forecast future requirements and water demand growth across sectors, and specialist models would be required.[271]

6.11 Namoi Water also raised issue with the inability of IQQM to play a predictive role, highlighting the data now available through technological advances, which is not able to be made use of by the model:

> Models for determining water requirements must include research into the effectiveness of current reform processes and efficiency calculations of current storage and delivery mechanisms. The NSW Integrated Quantity Quality Model or in irrigators terms the "Impossible to Query or Quantify Model" is a tool that can and should only be used for the purpose for which it was designed and it is currently not a predictive model. Models must be firstly fit for purpose, the must also be able to be calibrated with accurate data and have function to allow regular updates. Today's telemetry technology allows for updates of water use every 5 or 15 minutes to be data logged and therefore run through programs to provide effective decision making tools to both the industry and the government.[272]

6.12 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, addressed the criticisms raised by inquiry participants concerning the IQQM system, suggesting that any model should support rather than drive water management:

> We are always challenged on our models because models are numeric models and if you change an algorithm within a model you get a completely different answer. It is almost like unless you can work through that model with a pencil and paper people will not have absolute confidence. What we have tried to give is confidence over the 20 to 25 years that we have been using that to say that this is the best model we have got and we recognise that it is only a model, but we do use those for planning and operational purposes. But there is always talk about moving to more contemporary models … I think it is fair to say that in the Office of Water we tend to use them as a supporting mechanism and have them supporting us and not us supporting the model so much. We do not want the modelling to be wagging the dog.[273]

6.13 Further to this, Mr Harris defended the IQQM system as a valuable model used to provide information to stakeholders to enable better business decisions about their use of water, based on different scenarios:

> On many occasions we have made information about the modelling available to those stakeholder groups who have provided that criticism. At the same time we still use it and it is still a very valuable model … Progressively over the last couple of decades we are providing more and more information to users to enable them to make business decisions. That is not for us to forecast how much water is going to be available by the end of the year but to give the users an appreciation of under different circumstances how much water is likely to become available. Then they can make their appropriate business decisions. Whether they carry over water, whether they sell water, whether they use water, how much land they plant for a particular crop, they can make that as a business decision. I think that is fundamental.[274]

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271 Submission 100, Cotton Australia, p 7.

272 Submission 94, Namoi Water, p 3.

273 Mr Harriss, Evidence, 3 May 2013, p 6..

274 Mr Harriss, Evidence, 3 May 2013, p 6.

Modelling in a variable climate

6.14 A number of inquiry participants highlighted the difficulties faced by NSW Government agencies in undertaking modelling, largely due to the variability of climatic conditions. Other participants identified a need for rigorous independent assessments of models to ensure confidence in the models used.

6.15 Mr Brett Tucker, Chief Executive Officer, State Water, warned that while allowances for variability can be built into models, the unpredictability of that variability can cause problems with achieving accurate results:

> The other feature that is important to understand about Australian hydrology is that it is not just the variability that we deal with but the unpredictable nature of that variability. Variability can be modelled and constructed against. We have the largest amount of storage per capita in the world. You have to build much larger dams in Australia to get the same water security as anywhere else. The fact that our variability is unpredictable makes it difficult to model what is the upper threshold of storage required. Ultimately you get back to what is the right combination of storage and demand management techniques to get you through those extreme years.[275]

6.16 The Nature Conservation Council of NSW highlighted that the reliability of models can be limited by the model inputs, such as the time length of flows or rainfall, with reliability likely to decrease if climate change results in greater variability of weather patterns:

> Models for estimating water demand and supply are only as good as the period of flow records and experience in water use for that purpose in that specific area. The adequacy of models have been generally limited by these factors and now there is a growing recognition that rainfall seems to reflect long term cycles of wet and dry years which will be more complicated by the predictions for climate change. These models need to be used very cautiously and not in isolation.[276]

6.17 Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association, also acknowledged the difficulties of modelling in the Australian climate from an agricultural perspective, noting the extreme conditions that can occur:

> I guess for agriculture and its future needs and actually for the environment, especially in Australia, it is so ephemeral. It is a more variable figure and depends on things other than just volume. We have such a drought-prone climate, but then, as we have just recently learned, it can do the exact opposite as well. It makes modelling it a little more difficult, I guess, but you need to have some more of that done.[277]

6.18 Some inquiry participants advocated for rigorous independent assessments of models to improve confidence in their accuracy. The Byrrill Creek Land Care Group, Save Byrrill Creek Group and Northern River Guardians suggested that at least two independent companies be engaged to compile and analyse the data utilised by models:

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275 Mr Brett Tucker, Chief Executive Office, State Water Corporation, Evidence, 20 August 2012, p 25.

276 Submission 104, Nature Conservation Council of NSW, p 3.

277 Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association, Evidence, 16 November, 2012, p 24.

> Models are by no means a fail-safe method of correct calculation. Models can be adjusted to reflect a required outcome. At least two different companies should be independently engaged to separately collect and analyse statistics. If the base statistics are inaccurate for population growth and consumption of water then models are useless.[278]

6.19 Mrs Josephine New was of a similar opinion, highlighting that during the assessment process for the Tillegra Dam proposal, significant questions were raised regarding the modelling used to assess the need for construction of the dam:

> We would like to see thorough modelling which is undertaken by an independent body or at least presented to for assessment by an independent body. The previous modelling undertaken by Hunter Water was found by other scholars to be lacking in a relevant modelling method. The modelling should take into account methods of water collection and management of the future, using a forward thinking model.[279]

Future planning and predictive capability

6.20 A concern among inquiry participants in regard to the modelling methods used to determine water requirements in New South Wales was the apparent lack of predictive modelling and future planning. These concerns were held about other models beyond the IQQM discussed earlier in this chapter.

6.21 Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority, highlighted the need to ensure modelling accounted for population growth:

> We work with Sydney Water to look at the demands, and the population based on the Department of Planning figures, and we work in with Sydney Water to work out what the long-term demand would be, not just for greater Sydney but, it is important, each nodal point within Sydney. Is Sydney growing faster in the north-west suburbs, south-west suburbs?[280]

6.22 The NSW Irrigators' Council argued that there is an urgent need to develop a predictive model that can utilise available data on the current water usage being tracked by meters and river gauges:

> We again contacted State Water and NSW Office of Water to ask about predictive modelling. In both cases the reply was the same, no predictive modelling for consumptive water uses has been undertaken … Current usage is being tracked via meters and river gauges, but this information is not going into any models which could assist us in understanding what the outcome is from factors such as climate variability, transfer of entitlement away from productive use or pressure from increasing population. With this type of work not been undertaken, we have no way of

278 Submission 68, Byrrill Creek Land Care Group and Save Byrrill Creek Group, p 3; and Submission 69, Northern River Guardians, p 1.

279 Submission 59, Mrs Josephine New, pp 1-2.

280 Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority**,** Evidence, 20 August 2012, p 39.

> understanding what the future holds … As a matter of urgency, the departments must start work on developing a predictive model for water use in New South Wales.[281]

6.23 The Australian Water Association recommended investment in modelling capacity in the following areas, including predictive modelling:

- improved predictive modelling and real time decision support systems for water reservoirs to assist both the rural and urban water industries to manage the impacts of climate change on water quantity and quality
- monitoring and modelling of the impacts of innovative approaches to increasing the security of supply in the face of climate change
- monitoring and modelling of the impacts of increased frequency and severity of storms on infrastructure performance.[282]

6.24 Many inquiry participants argued that there needs to be a greater emphasis on planning for future water needs. This issue was also raised in Chapter 4, in particular by regional councils.

6.25 Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, argued for modelling that enables New South Wales to determine how much water it needs, that can then help make decisions on how to meet that demand:

> [T]here is not sufficient enough modelling for those water resources going into the future so we are not talking here about the next couple of years. The question of whether we need the construction of a new dam or whether we need more on-farm infrastructure to be able to mitigate seepage and evaporation, I think comes down to the fundamental question of how much water will we actually need within the State. What we have found so far is that there has not really been enough modelling done on that to answer that particular question in the first instance, and then to go into how do we get the best bang for our buck and how we should be sharing those costs on-farm and potentially to larger-scale constructions as well.[283]

6.26 In its submission to the inquiry, the NSW Irrigators' Council was concerned that models for determining future water needs for agriculture, industry and the environment are insufficient and that agencies' planning for the State's future water needs is also inadequate:

> We are extremely concerned to learn that the models for determining agriculture, industrial and environmental future water requirements are insufficient in many areas within the Murray Darling Basin. We have also discovered that neither the NSW Office of Water nor State Water Corporation, the entities responsible for operating and managing the water resources in NSW, have done significant modelling of, or planning for the future water requirements in NSW … The differences between inland and coastal systems also needs to be considered, with modelling in coastal areas undertaken that shows how demand for water from non-agriculture sectors (specifically urban and industrial) will affect the agriculture sector.[284]

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281 Answers to questions taken on notice during evidence on 16 November 2012, NSW Irrigators' Council, Question 6, p 8.

282 Submission 101, Australian Water Association, pp 8-9.

283 Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 11.

284 Submission 97, p 5.

6.27 The NSW Irrigators' Council further argued that modelling needs to account for continued growth and demand:

> Current water storages reflect a finite resource. Modelling needs to determine whether this capacity will be adequate in 50 to 100 years with continued growth and demand. Without this modelling and understanding of the pressures the system will be under into the future, we must then be resigned to the fact that we will manage with what we have and that this state has already reached its full storage and therefore productive capacity.[285]

6.28 Similarly, the Riverina Eastern Regional Organisation of Councils (REROC) raised concerns about State Water's longer term modelling for demand, indicating that projected growth is not factored in:

> Our understanding is that State Water currently determines demand for up to 24 months using History of Use data, environmental water needs, long term weather forecasts and IQQM modelling. We note that the modelling does not appear to include projections for populations and industrial growth … our member councils are actively pursuing growth strategies for both population and industry, however the modelling undertaken by State Water does not appear to take this into consideration.
>
> We believe that given the growing competition for storage space that it is imperative that State Water have at its disposable modelling capacity which can take into account current demands for water as well as future projections of what water may be needed to fulfil urban and industrial growth.[286]

6.29 In evidence, Mr Paul Braybrooks, Chairman, REROC, and Councillor, Cootamundra Shire Council, also called for predictions beyond two years that take account of industrial and population growth and suggested that State Water should gain this information from local water authorities:

> We are saying that some of that information would certainly be available through local water authorities, which do integrated water cycle management. They have to do some future growth predictions. As such, it is a shame that they do not consult the local water authorities to get some indication of what is likely to be the demand beyond two years.[287]

6.30 Ms Phyllis Miller, Chair, Central NSW Councils, and Councillor, Forbes Shire Council, argued for forward planning when considering water needs, giving the example of a proposed mine in the area that will require access to water and should be planned for proactively:

> I believe that as a group of councils, and knowing what is happening out there, that needs to be fed into State Water when it is doing some water studies. We know that we are growing out there but we are always on the back foot. A mine comes, and then we start to work out: how will we get the water to the mine. Instead of looking forward now, we have got hopefully a two-year gap, I suppose, before the new mine at Blayney gets underway. We should all be working on that now. How will we deliver

285 Submission 97, p 11.

286 Submission 109, Riverina Eastern Regional Organisation of Councils, p 3.

287 Mr Paul Braybrooks, Chairman, Riverina Eastern Regional Organisation of Councils, and Councillor, Cootamundra Shire Council, Evidence, 1 November, 2012, p 15.

> water to this mine? That is the type of thing to which we are more reaction than proactive in how we are going forward.[288]

Water monitoring

6.31 As the NSW Office of Water advised the Committee earlier in this chapter, the effectiveness of a modelling system is reliant on the quality of data put into the model. The NSW Office of Water collect water data through river gauges and meters. Effective water management requires accurate and reliable information on the amount of water extracted by water users. The accurate monitoring of water extraction from New South Wales rivers and groundwater sources is essential for the fair and equitable sharing of the State's water. Under the conditions and terms of their licence or approval, water extractors, including irrigators and farmers, may be required to have a meter fitted to their extraction works.[289]

6.32 As noted in Chapter 2, State Water is implementing a metering program. It is currently operating in the south of the State as two pilot projects. As of August 2012, there were 900 meters in the ground with another 350 to 400 to be installed. Metering facilitates technologies that can drive both on-farm and off-farm efficiencies and improvements in management in coming years.[290]

6.33 Mr Harriss advised that while initially farmers were not keen to participate in the metering program it has since received significant support from those stakeholders:

> We are rolling out a $221 million metering project which is including telemeters. State Water on our behalf is undertaking a pilot project in the Murray which includes the unregulated part of the Murray, some of the regulated parts of the Murray and also the groundwater. We then intend to roll out that program across the State. We have rolled it out on the Hawkesbury-Nepean. It was very unpopular when it was mooted but now it is probably the most supported exercise that I think we have ever undertaken. Everyone loves their meters. They can now manage their water. They know how much they divert over the year and they can see the potential for selling it in the future.[291]

6.34 Inquiry participants highlighted the importance of water monitoring to collect data that will ultimately improve modelling. For example, Mr Braybrooks emphasised the importance of monitoring river water in the Murrumbidgee area:

> [W]e note that one of the recommendations of the Pratt report relates to a more efficient and extensive water monitoring system. The reality is that unless you are aware of what is going on and you monitor you will always have an issue with flooding on a river like the Murrumbidgee River. It will always happen and it will happen repeatedly. The river has flooded since time immemorial and that has caused major issues since the arrival of white men and European settlement. Unless we monitor it

288 Ms Phyllis Miller, Chair, Central NSW Councils, and Councillor, Forbes Shire Council, Evidence, 16 November 2012, p 35.

289 NSW Office of Water, accessed 4 June 2013, <www.water.nsw.gov.au/Water-licensing/Metering/Metering/default.aspx>.

290 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

291 Mr Harriss, Evidence, 20 August 2012, pp 20-21.

> better we will not be able to predict it or deal with the social and financial devastation that results from flooding.[292]

6.35 NSW Farmers argued that with better information systems in place, 'real time' analysis would be possible which would lead to more precise river management and better planning for the future:

> NSW Farmers submits that one of the greatest barriers to planning for future water needs is the limited information systems currently in place across the country. Better information systems for water management, ordering, delivery and so-on via telemetry, automation and the like would assist real-time analysis of current water demands and consequently, planning for the future. Improved real-time water information is needed to support more precise river management and to ensure accurate water accounting and an open and transparent water market.[293]

6.36 Murrumbidgee Valley Food and Fibre Association also highlighted the benefits of using 'real time' data in modelling to reduce the wasting of water:

> A further frustration is that modelling needs to be regularly updated with 'real time' data if it is to be used successfully and realistically as a management tool. Otherwise it is likely that poor decisions that result in the waste of storage capacities will be made. An overriding consideration in modelling and water management is that it needs to be current and flexible.[294]

Computer Aided River Management

6.37 During the inquiry, the Committee heard about a new way of improving storage practices through a system called Computer Aided River Management (CARM).

6.38 Since 2011, Water for Rivers[295] has worked in partnership with State Water and Murrumbidgee valley communities to develop and implement a sophisticated river management system, CARM, that has revolutionised regulated storage management and water delivery on the Murrumbidgee River.[296]

6.39 According to Water for Rivers, the CARM system applies technology to measure water flow, demand and use and report in 'real time' all the inputs required to manage a regulated river system. These inputs include tributary inflows, water extraction, crop types and crop area including future water demand, soil moisture, long range weather forecasting, and future water orders. All this information is fed, in 'real time', into a hydrodynamic river model that provides the river operator with a powerful tool to deliver the right amount of water to the right place at the right time with minimal wastage.[297] Figure 12 explains how the CARM system operates.

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292 Mr Braybrooks, Evidence, 1 November, 2012, p 16.

293 Submission 95, NSW Farmers, p 6.

294 Submission 74, Murrumbidgee Valley Food and Fibre Association, p 5.

295 Water for Rivers is a company set up by the Australian, New South Wales and Victorian Governments to recover environmental water for the Snowy and Murray Rivers.

296 Submission 89, Water for Rivers, p 2.

297 Submission 89, p 2.

6.40 Mr Tucker, State Water, highlighted the benefits to storage management practices that the CARM system offers:

> First, I briefly touched on Computer Aided River Management. One of the outcomes from a better match of supply and demand is that you get to hold the water in storage for the longest possible time before release. If you look at the example of the Murrumbidgee, where CARM is being rolled out, we feel that potential opportunities there are something like 80,000 to 100,000 megalitres of water [per annum] that would otherwise have been released through a batch processing type river run model [the previous model used] versus Computer Aided River Management and real time … The secret is only to release as much as is absolutely necessary to meet the downstream orders and no more—but not so little that you put too much risk on the supply … Just-in-time water supply, absolutely. That is the concept. [298]

6.41 Mr Tucker elaborated on the system:

> At the moment we manage our storages with what is called batch processing. We take a batch of water orders, we take a batch of meter readings, perhaps monthly. Computer Aided River Management will convert all of that to real time, as well as real time weather information, and give us much better capacity to manage supply and demand balance but also flood mitigation capacity in the years that we have just been through and in 2010.[299]

6.42 According to State Water, the CARM system relies on the metering project, discussed earlier, as it integrates the data collected from the water meters into a real time management tool for running rivers.[300]

Benefits of the CARM system

6.43 According to Water for Rivers and State Water, the benefits of the CARM system are numerous, including in terms of to the environment, reduced wastage, and even less impact on public infrastructure in some areas.

6.44 The benefits of the CARM system to the environment include:

- precise delivery of environmental flows, including for the sustainable diversion limits associated with the Murray Darling Basin Plan
- improved water levels in wetlands at the right time
- the potential for releases to cause less erosion.[301]

6.45 Water for Rivers explained the significant benefits to the environment from the use of the CARM system:

> The environment is becoming the biggest 'customer' of water held in storage. We have been able to demonstrate how CARM can precisely deliver environmental water

298 Mr Tucker, Evidence, 20 August 2012, p 24.

299 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

300 Mr Tucker, Evidence, 20 August 2012, pp 22-23.

301 Mr Tucker, Evidence, 20 August 2012, p 24.

> to where it is needed, as well as reducing the volumes of water required to be released to target particular wetlands.[302]

6.46 Mr John Skinner, Project Director, Water for Rivers, expressed confidence in benefits from the system in addressing erosion and aiding riparian vegetation:

> CARM [enabling] a better management of the level in the river, rather than constant wetting and drying as the river level goes up and down, we would be a lot more precise in the release so hopefully keep a more constant level in the river. I am sure that helps with erosion. I am sure that will help with riparian vegetation as well.[303]

6.47 The Committee heard that a further significant benefit of the CARM system is the reduction in operational surplus when water is released from storages due to the ability of the system to be precise. Water for Rivers explained how this has increased access to more water in storages:

> The implementation of CARM has resulted in better matching water releases to meet demands while capturing water previously released and lost in the system. This water is often referred to as 'operational surplus'. Modelling work undertaken by NSW Office of Water (August 2012) has indicated that an annual average of 200 GL of operational surplus is now being kept in storage. This stored operational surplus water is available to be redirected for a specific purpose, eg a credit towards meeting environmental watering targets. This benefit is significant as it has delivered approximately $400 million in value benefit to NSW for minimal cost (compared to the high cost of building new storages).[304]

6.48 Mr Tucker further explained the benefits of the system, by highlighting the reduction in evaporation through using CARM and also the benefits for public infrastructure at areas like Mundarlo Bridge at Gundagai:

> You do reduce evaporation and you have less water going into anabranch creeks and runners unnecessarily. Some of the wetlands we are talking about are at risk of being too wet rather than too dry so in-time river management is quite crucial. It is important from a public infrastructure point of view. In the case of the Murrumbidgee the critical Achilles heel of the valley is Mundarlo Bridge at Gundagai, where anything more than 32,000 megalitres a day floods public roads and the bridge. Our operators have to operate within a narrow band of tolerance and computer-aided river management can assist.[305]

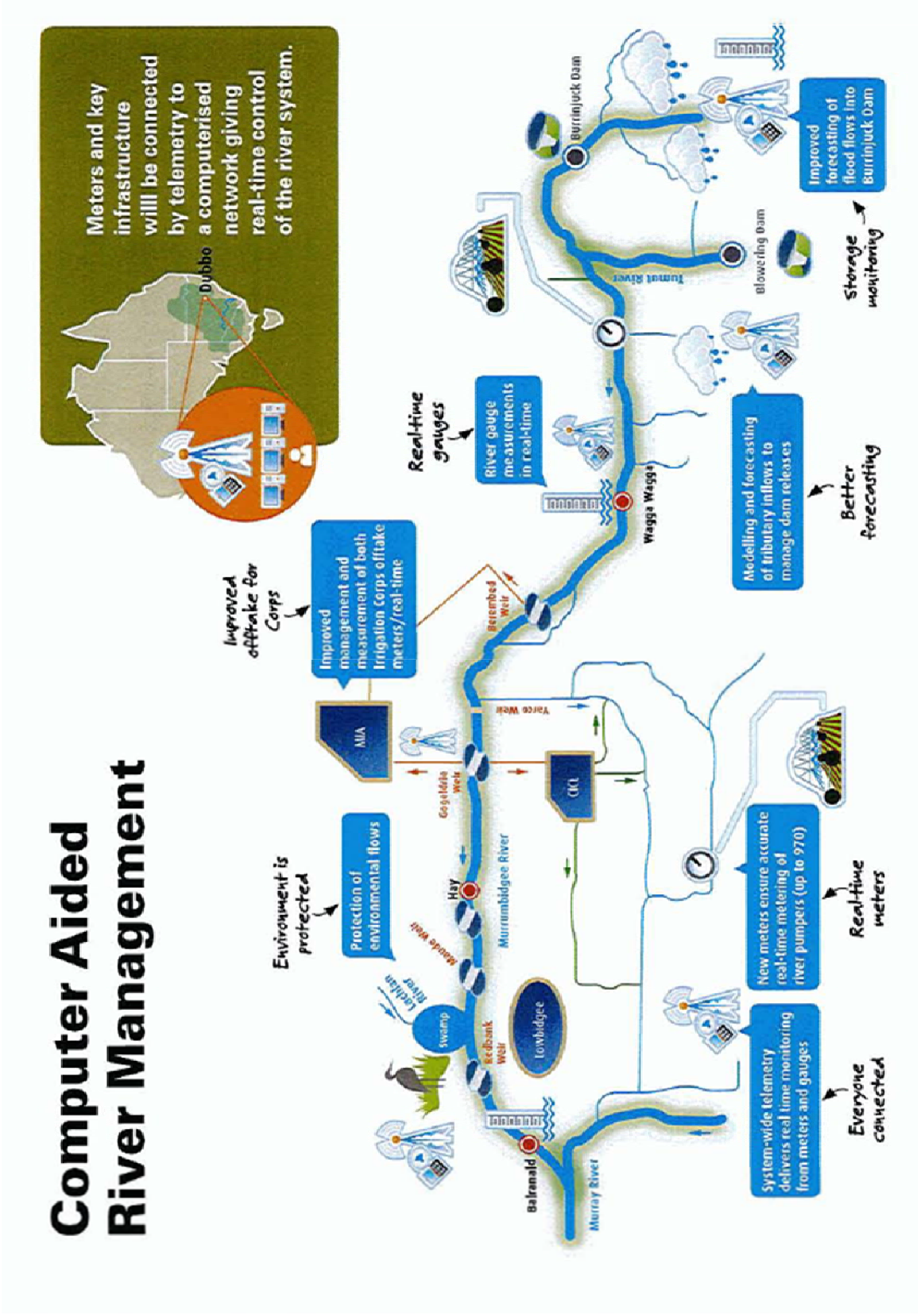
302 Submission 89, p 2.

303 Mr John Skinner, Project Director, Water for Rivers, Evidence, 1 November 2012, pp 26-27.

304 Submission 89, p 2.

305 Mr Tucker, Evidence, 20 August 2012, p 24.

Figure 4 Computer Aided River Management[306]



306 Submission 89, Attachment 1.

6.49 Water for Rivers proposed that use of CARM across the State could enable New South Wales to meet its future water needs:

> [W]e are of the firm view that implementation of the Computer Aided River Management (CARM) project across all regulated river systems would ensure that NSW could meet its balanced water resource needs well into the future. It goes without saying that water is a finite resource. Future climate predictions indicate that competition for water will be stronger. However, Australia does need to continue to produce food and fibre and manage the health of its rivers. Water for Rivers has demonstrated that efficiencies gained at all levels of the water usage and delivery system through 'real time' management will ensure there is more water available for future use.[307]

6.50 The Committee acknowledges that State Water was awarded the top honour at the Australian Water Association's 2012 New South Wales Water Awards, for the CARM system in the innovation and infrastructure category.[308]

Implementation across New South Wales

6.51 The success of CARM in the Murrumbidgee River system has prompted State Water and Water for Rivers to promote the benefits to other areas in New South Wales and seek its roll out of the system in other rivers.

6.52 The Hon Richard Bull, Chairman, Water for Rivers, advised the Committee that it is their intention to extend the CARM system across New South Wales:

> It is our intention to extend CARM across New South Wales. We have the support of the NSW Government to do that. However, we still have to overcome some funding issues with the Commonwealth and of course developing a final business plan for the NSW Government too.[309]

6.53 Mr Bull indicated that a roll out across the State would take approximately three years.[310]

6.54 According to State Water, the cost benefit ratio of implemeting the CARM system across New South Wales is favourable:

> Preliminary cost estimates place the cost of rolling CARM out to the rest of NSW at $40 million. This cost assumes there is already a telemetered metering solution in place that the CARM technology can take advantage of as real time management is critical to indentifying savings. Preliminary modelling indicates at least 100 GL (gigalitres) of operational savings water would be made available through this rollout excluding water already identified in the Murrumbidgee. Based on these estimates, and an assumed value of $1,000/ML [megalitres], the project is expected to have a benefit cost ratio up to 2.5.[311]

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307 Submission 89, p 1.

308 State Water, accessed 11 June 2013, <www.statewater.com.au/About+us/News+and+events/Media+releases+2013/statewatershinesatawards>.

309 The Hon Richard Bull, Chairman, Water for Rivers, Evidence, 1 November 2012, p 20.

310 The Hon Mr Bull, Evidence, 1 November 2012, p 23.

311 Answers to questions taken on notice during evidence, Mr Brett Tucker, Chief Executive Officer, State Water Corporation, Question 1, p 1.

6.55 The importance of the new metering project, discussed earlier in the chapter, also being rolled out to support CARM implementation was emphasised by Mr John Skinner, Project Director, Water for Rivers:

> A national water meter initiative is being rolled out to replace and standardise water meters. Ideally, CARM would be rolled out with that and it would provide significant benefits. It obviously depends on meters being accurate. If that information is not there then there is insufficient data to operate and manage the system. We have demonstrated on the Murrumbidgee River that there is a 20 per cent impost added to the cost of the meters. So it would be $40 million.[312]

6.56 Mr Skinner also advised the Committee that the roll out of the CARM system across the State would complement many other water savings initiatives that are currently being funded.[313]

Stakeholder views on using CARM in the North West Rivers

6.57 The Committee heard from stakeholders in the North West Rivers area of the State that while the CARM system does seem beneficial to river and water management they had some concerns regarding its application to their area. For example, Ms Jon-Maree Baker, Executive Officer, Namoi Water, called for the predicted water savings under CARM to be demonstrated as feasible:

> The CARM project really as a concept certainly offers a lot of benefits and we would be supportive of technology that can probably take us through to the next level. I think the issue with CARM is that it needs to be demonstrated that for the savings that they are proposing in northern system that they can actually be generated. Because, like the metering project at the moment, the Government has essentially signed us up to savings that may not necessarily eventuate in terms of a business case. What we would like to see with CARM is perhaps further investigation of that in the northern system to see whether or not those savings are actually feasible … I think essentially the rivers are run quite similarly. Obviously we are not on a snow-melt system or ephemeral so those differences I think need to be further explored in that investigative process. So what works on the Murrumbidgee is not necessarily going to be as effective in the Namoi.[314]

6.58 Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association, identified a number of potential benefits of the system:

> I think the important thing with CARM is that whilst it does provide a high level—my understanding of the rollout in the south is it is providing opportunity to better understand river dynamics, which I think is important, and potentially reduce delivery losses—which means that there could be reliability improvement for all users. I think it may have a role in managing and communicating flood risk and impacts. A big win that could come out of it is the possibility for real-time market activity. At the moment it is two or three days and we could have possible on-selling of water within a stream that has already been delivered and potential for reduced delivery times.[315]

312 Mr Skinner, Evidence 1 November, 2012, p 21.

313 Mr Skinner, Evidence 1 November, 2012, p 24.

314 Ms Jon-Maree Baker, Executive Officer, Namoi Water, Evidence, 6 March 2013, p 23.

315 Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association, Evidence, 6 March 2013, p 23.

6.59 However, Ms Lowien went on to raise some concern with the applicability of CARM in the north because of the low reliability of the river system there and proposed a more cautious process of testing and piloting it:

> The big concern that our association has with CARM at the moment is that it is not even tried and tested in the south yet, the information is still being put together and the trial has not completed. Our system is highly variable and very different to the southern system and we are not sure that the savings and benefits are going be as evident for the investment in the north because of the way our system naturally occurs. A significant point for that is that we have a low reliability, so we have a high variability of flow and in some cases State Water do not have the opportunity to deliver water, yet you have a huge investment in a river management system that may not get used for one or two years during a drought, for example. That needs to be considered. I think if we have the opportunity to look at the information and test the results and potentially pilot it there are some benefits there but at the same time we do not want to discount the good work that State Water do with currently running our river with the information they have got now. [316]

Committee comment

6.60 The Committee acknowledges that a significant challenge faced by storage managers is predicting future water needs, especially in Australia's variable climate. An important component of storage management is the use of modelling systems to determine these water requirements to help predict future scenarios that may affect water availability.

6.61 We note the concerns of inquiry participants regarding the current modelling systems and believe, as do many inquiry participants, that modelling systems need to have a predictive capability to help plan for the future.

6.62 The Committee applauds the work undertaken by Water for Rivers and State Water in the development of the CARM system. We recognise that there are numerous benefits associated with this system for all water users through the more precise delivery of water releases and therefore reduction in waste, or operational surplus. This can potentially mean accessing more water in the storages that can be used for the various users.

6.63 We note the comment made by Water for Rivers:

> Regardless of the argument of whether or not new storages should be commissioned, it is imperative that we improve the management of our existing water storages and regulated water delivery systems across the state. CARM is a proven tool, owned by State Water and the NSW Government, and should be applied across all river valleys, to maximise system efficiencies. [317]

6.64 The Committee recognises that the cost benefits are favourable and that investment by government is very worthwhile, given the anticipated gains in terms of improved storage management and increased access to water through more precise delivery methods.

316 Ms Lowien, Evidence, 6 March 2013, p 23.

317 Submission 89, p 3.

6.65 While we note that there were some reservations from stakeholders in the northern rivers area about the applicability of the system in their area, we believe that as part of a broader roll out these issues could be addressed. The Committee recommends that the NSW Government fund and implement the CARM system across all river systems in the State.

Recommendation 10

That the NSW Government fund and implement the Computer Aided River Management system across all New South Wales river systems.

6.66 The Committee also acknowledges that in order to support the roll out of the CARM system across the State, the metering project, currently piloted in the south of the State, would also need to be roll outed in conjunction with the CARM system. This would provide the necessary accurate data on water usage that the CARM system requires to be so precise in its river management. Therefore, we recommend that the NSW Government roll out the water metering project across New South Wales, to support the implementation of the CARM system.

Recommendation 11

That the NSW Government implement the water metering project across New South Wales, to support the statewide implementation of the Computer Aided River Management system

Storage management practices in greater Sydney area

6.67 The Committee received evidence on how the Sydney Catchment Authority (SCA) manages its storages, and heard details of a project to access more of its water reserves.

6.68 The NSW Government advised that the SCA pursues a three-pronged strategy in managing the storages under its control:

> The SCA 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.[318]

6.69 According to the SCA, water quality with its reservoirs can vary depending on the depth of the reservoir, the season, the temperature, rainfall and inflows from the catchment area. The SCA manages its water storages to optimise the quality of water supplied to customers by:

[318] Submission 13, p 7.

- conducting sophisticated water quality modelling, supported by an expansive monitoring network throughout the catchment and storages
- carefully selecting water, including off-take choice (accessing water at different levels or locations) within reservoirs, and blending water from various sources
- actively managing storages, including artificial destratification (mixing layers of water) at some locations.[319]

6.70 To maximise water quantity and minimise spills, the SCA advised that it uses decision making tools such as drawdown curves:

> The SCA has decision tools (drawdown curves) to minimise spills from the dams. This provides the maximum system yield whilst ensuring all demands are met. As a general rule, they are used to ensure that the dams have an equal likelihood of spilling at any time and have been updated to reflect recent changes in system configuration, including the Nepean and Warragamba Deep Water Pumping and the Sydney Desalination Plant.[320]

6.71 The NSW Government advised that the approach Hunter Water takes to storage management is to achieve a balance between minimising operating costs and minimising the frequency and duration of periods of water restrictions.[321] It further explained that Hunter Water's management protocol also allows it to respond to operational issues such as water quality events in the storages to minimise impact on the community.[322]

Accessing deep water

6.72 One aspect of improving storage management practices is enabling access to draw on water from different levels of the dam, in particular deep water.

6.73 The SCA advised the Committee that work had been undertaken to increase the amount of water that can be accessed from storages. Mr Ian Tanner, Group General Manager, Assets and Major Projects, SCA, reported that recent works to facilitate access to the deep water reserves at Warragamba and Nepean Dams had enabled an additional 200 gigalitres of water for use:

> When Warragamba Dam was built the outlets were about 30 metres above the riverbed … So there was about 170 gigalitres of water that we could not access, it was below the lowest pipe. We got together with the engineers and worked out how it was best able to access that water. We actually put divers down there for two weeks in the dark, diamond - cutting a big hole in the bottom of the dam where we have accessed that through into a new lower level outlet, a new low-level pumping station, and once the water gets down to a certain level we can now access that extra 170 gigalitres and that 170 gigalitres is about the same size as our second biggest dam: Avon. We did the same thing at Nepean Dam and we got an extra 30 gigalitres there. Each site was

319 Answers to supplementary questions, 14 September 2012, Sydney Catchment Authority, Question 3, pp 7-8.

320 Answers to supplementary questions, 14 September 2012, Sydney Catchment Authority, Question 3, pp 7-8.

321 Submission 13, p 7.

322 Submission 13, p 7.

> around $50 million or $60 million so for $120 million, which is not very expensive for a 200 gigalitre source of water, we improved our efficiency, if you like, which is the difference between total capacity versus what we can actually get hold of, we went from 87 per cent to 97 per cent. Our dams are very efficient and there is not a lot of water left that we can't actually access.[323]

6.74 Mr Tanner explained that in accessing these deep water reserves, testing was done to ensure that water quality was within expected limits:

> The biggest issue is water quality and ability to treat it to the Australian drinking water guidelines. With Warragamba Dam being so deep it turns over. Just about every year there is a complete turnover of the water. We have very cold deoxygenated water at the bottom and as winter comes the top waters get colder and colder and the waters mix, so every year it is generally mixed. We have tested those waters and the quality was fine and within the constraints or the limitations of the downstream water filtration plant at Prospect.[324]

6.75 A related aspect of storage management practices is the use of variable off-takes to allow storage managers to release water from different levels of the water storage. This issue was discussed in Chapter 5.

Minimising evaporation

6.76 This section examines a further key aspect of water management: strategies to minimise evaporation. A cause of concern for a number of inquiry participants was the loss of water through evaporation that can often occur from water storages across the State. Depending on the surface area and depth of storages, evaporation losses can amount to a significant volume of water. Minimising evaporation in water storages can increase the amount of water available for use. Good storage management practices have a role in minimising evaporation.

6.77 Mr Tanner of the SCA advised that evaporation is the cause of the greatest losses from the SCA system:

> Evaporation is the biggest loss. It is around 100 gigalitres a year on average in the whole system. If there could be a solution to stopping evaporation that would save a lot of problems.[325]

6.78 The No Tillegra Dam Group also highlighted the problem of evaporation, noting that these losses account for significantly more water than the savings made through water conservation measures:

> Dams are prone to massive water loss through evaporation. Approximately 30,000 megalitres are lost to evaporation annually from Hunter Water's current reserves. This loss far outweighs the combined savings of all water conservation measures, which is about 4000 megalitres a year. Consumers are constantly asked to use their water wiser,

323 Mr Tanner, Evidence, 20 August 2012, p 43.

324 Mr Tanner, Evidence, 20 August 2012, p 43.

325 Mr Tanner, Evidence, 20 August 2012, p 41.

> yet water authorities do not maintain their assets to avoid water loss nor do they use their resources to the maximum benefits.[326]

6.79 The Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, identified a number of strategies to minimise losses through evaporation, including only making bulk water releases during times of reduced evaporation, utilising ground water storage potential and exploring the use of storage covers:

> Storage evaporation is a major cause of water supply loss in regulated rivers which will increase with temperatures under climate change. Water efficiency measures are effective for reducing losses and increasing water supply in surface water systems. Bulk releases of water from the storage can help minimise losses downstream. Water releases should occur in months when evaporation is lowest. To minimise evaporation from the storage surface, groundwater storage may provide potential to store large volumes of water with reduced evaporation losses. Another option is to use storage covers, serving as water retention facilities and roofs for solar panels … There are also potential opportunities for aquifer recharge where evaporation rates are considerably less than from surface water storages.[327]

6.80 A case study of a water storage successfully augmented to minimise evaporation is the Barren Box Storage, near Griffith.

Case study: Barren Box Storage and Wetland[328]

Barren Box Storage and Wetlands was a successful project in water savings and environmental improvement in which irrigators, government, environmentalists and the local community worked together.

Before its redevelopment, the 3,200 hectare (ha) shallow site (6 kilometres in diameter located 30 kilometres north-west of Griffith) was an inefficient storage basin with high water loss through evaporation. In June 2005, the NSW Government approved the $29 million redevelopment of Barren Box to improve the storage efficiency and to restore the majority of the site to its natural ephemeral wetland state.

The project had many elements including splitting the site into three cells, via 9 kilometres of internal embankments, the widening of the Wah Wah Main Channel, construction of an en-route storage and the rehabilitation of 52 per cent of the site to its natural ephemeral wetland ecosystem.

The project was completed in July 2006 and was awarded the prestigious Environment and Heritage Award in the Sydney Engineering Excellence Awards and was showcased at the Sydney Powerhouse Museum throughout 2007.

326 Submission 66, No Tillegra Dam Group, p 6.

327 Submission 26, Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, p 7.

328 Murrumbidgee Irrigation Ltd, accessed 29 May 2013, <www.mirrigation.com.au/Environment/Barren-Box-Storage-and-Wetland>.

Barren Box Storage is now the main irrigation and drainage water recycle point for the Murrumbidgee Irrigation Area. Water savings of 20,000 megalitres (ML) per annum are now returned to the Snowy and Murray Rivers, and the sale of the water savings paid for the improvements.

The **active** storage cell is 1,230 ha (38 per cent of the site) and has a water storage volume of 24,500 ML. The **intermediate** storage cell is 320 ha (10 per cent of the site) and has a water storage volume of 4,500 ML. The **wetland** cell is 1,650 ha (52 per cent of the site) and being ephemeral, remains mostly dry.

6.81 Two particular areas emerged as a focus for debate during the inquiry regarding measures to minimise evaporation: the Menindee Lakes in far western New South Wales, and Lake Alexandrina, at the mouth of the Murray River in South Australia. These are considered in turn below.

Menindee Lakes

6.82 The Menindee Lakes is a chain of shallow lakes connected to the Darling River to form a storage system that supplies water to Broken Hill, the lower Darling and water users along the Murray River in New South Wales, Victoria and South Australia under the Murray Darling Basin Agreement.[329]

6.83 The levels of evaporation experienced at the State Water owned Menindee Lakes, were highlighted by some inquiry participants as being of particular concern. The Lakes have been investigated as a key area requiring reform water saving initiatives in the management of the Darling River, and have been a focus of investigation into water management practices in the Murray Darling Basin.

6.84 Several inquiry participants proposed changes to the current management of Menindee Lakes to improve efficiency and decrease losses through evaporation. Calls for the future water security for the town of Broken Hill, which draws water from Lake Menindee, were also raised. The NSW Office of Water informed the Committee of the proposals being considered jointly by the NSW and Commonwealth Governments, for the future management of the Lakes.

6.85 The NSW Irrigators' Council contended that, '[M]anagement practices, regardless of the storage should include minimisation of losses as a primary objective'. It outlined its specific concerns with regard to the Menindee Lakes:

> For example, the Menindee Lakes are not a very efficient storage facility. Menindee has very complicated management arrangements with control switching between NSW Office of Water and the Murray Darling Basin Authority depending on the volume in storage, it also has significant environmental value and is the essential water supply for Broken Hill, stock and domestic water users, irrigation users and an additional supply for South Australia.

329 NSW Office of Water, accessed 3 June 2013, <www.water.nsw.gov.au/Water-management/Basins-and-catchments/Menindee-Lakes/Menindee-Lakes>.

> These large open shallow lakes have high evaporation rates and due to the need to draw them down in parallel to maintain pressure for releases, the surface area and hence evaporation are never reduced. Any changes to address inefficiency could have a positive outcome for all water users who rely on the storage.[330]

6.86 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, described the current management practice at Menindee Lakes and the consequent high risk of evaporation:

> Because of the way the lakes are managed and how they are situated, they are drawn down in parallel so the actual space that is exposed never really changes so there is a great deal of evaporation that takes place. There is discussion about putting in a stop between Menindee and Cawndilla, reducing the amount of water that would then come into Cawndilla but maximising the usage of Menindee.[331]

6.87 Representatives of Namoi Water expressed support for water saving reforms at the Menindee Lakes in light of what they view as a disparity in requirements between northern and southern users in the Murray Darling Basin. Mr Phelps, Chairman, Namoi Water, commented:

> It annoys us upstream when we have been asked to be more efficient here, there, and everywhere else, that when you get down to Menindee–There are such losses down there. This year alone when the dams are full 770 gigalitres of water were lost in evaporation. That is equivalent to basically our Split Rock and Keepit Dam … On average it is 400 gigalitres a year.[332]

6.88 Namoi Water argued that action was needed to reduce the rates of evaporation from the Menindee Lakes, noting that options had been identified but not yet put into effect:

> Management practices can be improved, Menindee Lakes are a major area for action, not further review. [I]t is estimated that some $60 million dollars has been spent studying the Lakes to develop potential reform options however there has been little infrastructure improvements to the lakes in the last three decades.[333]

Water supply for Broken Hill

6.89 Essential Water and the Broken Hill City Council raised concerns with regards to water quality and water security, and highlighted that reforms to the Menindee Lakes must consider the impact on water supply to Broken Hill and surrounding communities. In addition, they underscored the need for infrastructure upgrades.

6.90 Essential Water, which supplies water to Broken Hill, Menindee, Sunset Strip and Silverton described the area as 'the most arid in the State':

> Eight years in every ten, town water supply is dependent on water sourced from the Darling River and pumped along a pipeline more than 116km to Broken Hill. These unique operational circumstances, combined with drought conditions, cause salinity and other water quality problems in the raw water that Essential Water must treat.[334]

330 Submission 97, p 6.

331 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 12.

332 Mr Jonathon Phelps, Chairman, Namoi Water, Evidence, 6 March 2013, p 28.

333 Submission 94, Namoi Water, p 4.

334 Submission 51, Essential Water, p 1.

6.91 The Broken Hill City Council similarly described water sourced from the Darling River as 'often the most saline and turbid supply in the Murray Darling Basin'[335] and outlined its preferences for the management of supply:

> In terms of a dedicated quality water supply for Broken Hill, utilisation of the deeper storages (Lake Tandure/Lake Wetherell) in concert with local storages in Broken Hill (Stephens Creek and Umberumberka) continues to be supported. A revisiting of the possible extension or duplication of the Umberumberka storage based around the excellent catchment and quality water supply is encouraged.[336]

6.92 Essential Water informed the Committee of water saving infrastructure employed at Stephens Creek Dam to reduce evaporation, recommending that additional levees be installed to further reduce such losses through within the area:

> In order to reduce losses due to evaporation, two levees have been constructed in the Stephens Creek reservoir basin. The partitions enabled control of the stored water in 'pools' that have a lower surface area to volume ratio. The levees have served to increase the overall effectiveness of the reservoir by keeping as much as possible of the water captured during rain events stored in these pools and created a lower surface area to volume ratio.
>
> The construction of additional levees within the current reservoir area would further improve the catchment and storage of water from smaller rainfall events. While further localised storage would be more efficient by lowering the surface area to volume ratio, it is a costly exercise.[337]

6.93 Essential Water also noted the need for improvements to the Stephens Creek Dam and the Imperial Lake Dam as a consequence of recommendations from the Dam Safety Committee.[338] In particular, Essential Water recommended that the main pipeline from Menindee to Stephens Creek, constructed in 1952, be replaced due to 'major failure events' arising from the pipe's deterioration. They also suggested that part of the original pipeline from Umberumberka to Broken Hill will need to be replaced, having been installed approximately 100 years ago:

> The communities of Broken Hill, Sunset Strip, Silverton and Menindee are dependent on pipelines, remote pumping stations and Supervisory Control and Data Acquisition [SCADA] to maintain water supply … Replacement of these important pipelines will require significant capital expenditure in the next 20 to 30 years, but is essential for long term water security.[339]

6.94 Namoi Water suggested that to overcome the issue of evaporation at Menindee, a purpose built storage should be constructed to provide a reliable supply of water for Broken Hill and to minimise the amount of water that is stored in the Menindee Lakes system:

335 Submission 44, Broken Hill City Council, pp 3-4.

336 Submission 44, pp 3-4.

337 Submission 51, p 4.

338 Submission 51, p 5.

339 Submission 51, pp 4-5.

> The supply of water to Broken Hill must be a priority, our request is that a purpose built storage be commissioned to ensure Broken Hill has a reliable backup water supply in dry climate sequences. This should reduce the need to limit water from Northern Valleys to be evaporated in the shallow lakes system. Some 1400 gigs of Northern Water is delivered to Menindee and in terms of supply for the Broken Hill township of 6 gigs [gigalitres] there is a call of 250 gigs [gigalitres] of water required in Menindee Lakes system.[340]

Proposed works for the Menindee Lakes

6.95 With regards to the proposed infrastructure and management changes to the Menindee Lakes, the Broken Hill City Council suggested that there is a 'strong argument for a channel out of the bottom of Lake Cawndilla back to the Darling River, with the addition of other or improved channels to access otherwise "dead" water and a regulator'. It suggested that the benefit of this proposal is that 'all of the water can be accessed downstream because Lake Cawndilla is more efficient and deeper than Lake Menindee'.[341]

6.96 However, the Council expressed concerns regarding two proposals for the Menindee Lakes: the Darling River Water Saving Project, which 'suggested operational use of reverse osmosis or managed aquifer recharge proposals'; and a proposal for rapid draw down of Lake Menindee and Lake Cawndilla to 100GL. It went on to highlight the potentially detrimental consequences that each may have for their community:

> Council is concerned that the earlier DRWSP [Darling River Water Savings Project] … will add significant and unsustainable costs to water users … While Council welcomes the reported draft findings of significant groundwater resources in the Menindee Lakes area and notes that a closed aquifer may well be one of the most efficient systems, the arguments against it (for other than drought supply activation only) are supported because of the cost of water and the social effects, including job losses, if the Menindee Lakes are closed down or operations largely curtailed.[342]

> Council has strong concerns regarding the proposal of rapid draw down of Lake Menindee and Lake Cawndilla to 100GL which would adversely affect the security of Broken Hill's water supply. Reducing the use of Lake Menindee and Lake Cawndilla (without targeted infrastructure works) would result in the lakes becoming a dry habitat and would not result in savings as the ability to draw water out of the lakes would diminish. The only way to make savings of 200GL will be to by-pass Lakes Menindee and Cawndilla; and that this by-pass is not environmentally, economically or socially acceptable.[343]

6.97 The Committee was informed that the NSW Office of Water is currently undertaking joint studies with the Commonwealth to determine an acceptable proposal to achieve water savings by reducing evaporation losses at the Menindee Lakes storage. According to the NSW Government, work to date suggests that there is an opportunity to achieve annual average savings of about 65 GL through a combination of works and operational changes:

340 Submission 94, p 4.

341 Submission 44, pp 4-5.

342 Submission 44, p 4.

343 Submission 44, pp 4-5.

> Essentially the proposal is to limit the use of the most downstream lake, Lake Cawndilla, and to introduce rule changes to allow for more efficient operation of the remaining lakes. There is potential to use local groundwater as a drought security reserve for Broken Hill. [344]

6.98 Mr Harriss of the NSW Office of Water explained that the 'rule is that if you can store them preferentially in the upstream lakes rather than have it spread out over the four you can make substantial evaporation savings'. Mr Harriss estimated a saving of between 35 to 75 gigalitres of water through an investment of $100 million:[345]

> We have undertaken investigations over the past 20 years and identified six different kinds of structures and works programs that could be implemented. The one that the Office of Water has promoted for a while includes a block bank between the two bigger lakes—Lake Menindee and Lake Cawndilla. That is the area where it joins and it involves increasing the outlet capacity at the Menindee Lakes outlet regulators. In a drought period there would be smaller inflows and the water would be stored in Lake Menindee and drawn on quickly from there rather than spread out across Menindee and Cawndilla … When Lake Menindee fills and then Lake Cawndilla fills, way back through the river, Lake Cawndilla will drain back through Lake Menindee until it reaches the sill level. We would not want to compromise the capacity of Lake Cawndilla to drain back to Lake Menindee.[346]

6.99 In relation to other infrastructure proposals, Mr Harriss informed the Committee that a Barren Box style scheme, which is presented as a case study earlier in this section, was considered for Lake Menindee but found to be unsuitable:

> We looked at that as part of the investigations, but the soil is not suitable for that kind of activity. It must be remembered that Lake Menindee is probably 12 kilometres across. Once there is a bit of wind, the wave action would damage the integrity of any sort of structure.[347]

6.100 According to the NSW Government, as of August 2012, the Commonwealth was considering funding the augmentation works as the water savings could be allocated to the environment and assist in meeting the reduced sustainable diversion limits under the Basin Plan.[348]

6.101 The NSW Government also emphasised that its requirements for a preferred option for Menindee Lakes are that the changes will not impact on the reliability of supply to downstream users, nor have any major impacts on the Lakes' environment, and that the supply to Broken Hill will be assured.[349]

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344 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4

345 Mr Harriss, Evidence, 20 August 2012, pp 7-8.

346 Mr Harriss, Evidence, 20 August 2012, p 20.

347 Mr Harriss, Evidence, 20 August 2012, p 20.

348 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4

349 Answers to questions taken on notice during evidence 20 August 2012, Department of Primary Industries, Question 2, pp 3-4

Committee comment

6.102 The Committee believes that improved efficiency in the management of the Menindee Lakes through augmentation works to minimise evaporation will have positive impacts for all water users. The Committee notes that such works in this area are less expensive than some other options, while avoiding the detrimental consequences of other proposals and also contributing substantial water savings. The Committee is aware that plans and funding for these augmentation works are already being considered and believes they should be finalised and implemented as soon as possible.

Recommendation 12

That the NSW Government:

- make representations to the Commonwealth Government to resolve who will provide funding for the augmentation works at the Menindee Lakes, and
- reaffirm and complete plans to enable construction to commence as soon as practicable.

Lake Alexandrina

6.103 The Committee heard that water management of Lake Alexandrina, located in South Australia and part of the Murray Darling system, has attracted some criticism from upstream users who have expressed the view that maintaining the lake as a fresh water lake rather than as an estuary unnecessarily diverts fresh water away from productive uses and incurs significant losses in evaporation.

6.104 Mr Raymond Stubbs, Executive Officer, Riverina and Murray Regional Organisation of Councils, commented that, 'It takes a lot of water to get down into Lake Alexandrina, only to see it evaporate'.[350] His colleague, Mr Terrence Hogan, Chair, Riverina and Murray Regional Organisation of Councils, contended that maintaining Lake Alexandrina as a freshwater lake is an unsustainable practice:

> [A]s the second driest continent in the world I do not think we can afford the luxury of continuing to evaporate that sort of water. It would be lovely if we could, but water is a limiting resource, as we all know. Food requires huge amounts of it, so into the future that luxury will not be available.[351]

6.105 Representatives of the Murrumbidgee Valley Food and Fibre Association held similar views. Ms Virginia Tropeano, Committee Member, asserted that Lake Alexandrina is supposed to be an estuary, and contended that while there would still be evaporation if it were maintained as an estuary, 'it would not be wasted fresh water'. Further, she asserted that 'there needs to be an inquiry conducted into the lower lakes because they are so important to the whole issue of

350 Mr Raymond Stubbs, Executive Officer, Murray Regional Organisation of Councils, Evidence, 1 November 2012, p 39.

351 Mr Terrence Hogan, Chair, Riverina and Murray Regional Organisation of Councils Evidence, 1 November 2012, p 39.

the Murray Darling Basin'.[352] Ms Buller, President, Murrumbidgee Valley Food and Fibre Association, echoed these views, describing Lake Alexandrina as 'another dam' and informing the Committee that the Murrumbidgee Irrigation Area does not support maintaining Lake Alexandrina as a freshwater lake. [353]

6.106 Mr Phelps expressed a similar view that a review of the management of Lake Alexandrina would be welcome, informing the Committee that on average, evaporation losses from Lake Alexandrina are '400 gigalitres a year'.[354]

6.107 Mr John Ibbotson contended in his submission that the lower lakes should be reverted to 'their natural estuarine state', and argued that keeping the lakes fresh 'has a negative environmental impact, particularly during droughts, not only for the Murray Mouth Lakes but for other parts of the Basin where available water could be used more effectively'.[355] Mr Ibbotson recommended that the 'most environmentally sensible, quickest and cheapest project would be to "end" the Murray between Wellington and Pomana Island' by building a barrage. He explained:

> This would be a structure whose height was just above the high water level of the lake. The barrage would be made wide enough so that the volume of water going over it would be the same as if it didn't exist. Its main function would be to stop brackish water from the lake going upstream, without stopping water flowing into Lake Alexandrina from the river. Gates on the barrage would allow additional river water to flow into the lake if the lake was below high water level and river water was available. It would also continue the conveyance of salt, nutrients and sediment into Lake Alexandrina but at a slower rate. The tidal flows would then flush them out into the ocean. [356]

6.108 Mr Harriss commented on the amount of water required to maintain Lake Alexandrina, contending that:

> [Q]uite clearly … to get the volumes that were required for the lower reach of the river were quite aspirational and cannot be reached during periods of regulated flow; it would have to be by putting releases on top of and over and above probably flood flows or high river flows in one or more of the tributaries. [357]

6.109 He informed the Committee that the concern of the NSW Government 'was the impact on secondary industries that depend on that production, particularly in water-dependent economies', and added that this issue was a fundamental component of the New South Wales submission on the Murray Darling Basin Plan.[358]

352 Ms Virginia Tropeano, Committee Member, Murrumbidgee Valley Food and Fibre Association, Evidence, 16 November 2012, p 28.

353 Ms Buller, Evidence, 16 November 2012, p 29.

354 Mr Phelps, Evidence, 6 March 2013, p 28.

355 Submission 88, Mr John Ibbotson, p 2.

356 Submission 88, p 4.

357 Mr Harriss, Evidence, 3 May 2012, p 2.

358 Mr Harriss, Evidence, 3 May 2012, p 2.

Committee comment

6.110 The Committee notes with concern the high volume of water directed away from productive purposes in New South Wales in order to maintain the lower lakes of the Murray River in South Australia as fresh water lakes. The Committee believes that the impact on upstream users in New South Wales is detrimental and could be reduced by implementing alternative management options for the lower lakes, such as moving barrages upstream of the lakes and maintaining the lakes as estuarine. The Committee notes that New South Wales has begun to address this issue in its submission on the Murray Darling Basin Plan but believes further action is required to enable change to the management of the lower lakes with the concurrence of the Commonwealth and South Australian Governments.

Recommendation 13

That the NSW Government make representations to the Commonwealth and South Australian Governments to initiate a review of the current management of the lower lakes of the Murray Darling Basin. This review should focus on returning the lakes to an estuarine system by building barrages upstream rather than at the mouth, thereby reducing the volume of water currently required and improving the productive and environmental outcomes for New South Wales.

Dam safety practices

6.111 A further factor in the management of water storages is ensuring their safety and that of the community. This section looks at dam safety practices for New South Wales. It examines the role of the Dam Safety Committee, safety requirements for prescribed dams, what is being done about non-prescribed dams and outlines State Water's dam safety program. Inquiry participants' concerns relating to the value of this program are also presented.

6.112 As discussed in Chapter 2, the NSW Dam Safety Committee (DSC) has responsibility under the *Dams Safety Act 1978* (the Act) to monitor and inspect the major dams identified in the Act to ensure compliance with current safety requirements. Mr Brian Cooper, Chairman of the DSC, outlined the requirements for a prescribed dam under the Act:

> It has to be considered a large dam, which means it has a height of greater than 15-metres, and it has to have a consequence category of low or higher. We have a number of consequence categories that are determined by the population at risk downstream of the dam were that dam to fail. Regardless of how good the dam is, if the dam were to fail and lives downstream were at risk then it would be prescribed. The prescription would be extreme, high, significant or low. If a dam falls within any of those categories then it would be a prescribed dam and appears on schedule 1 of the New South Wales *Dams Safety Act 1978*.[359]

6.113 Mr Cooper explained that the DSC recently changed from a prescriptive regulator to using a risk-based assessment framework:

[359] Mr Brian Cooper, Chairman, Dams Safety Committee, Evidence, 20 August 2012, p 48.

> [W]hen we brought in the risk-based framework, we changed from being a prescriptive regulator where we had a whole bunch of rules that owners had to abide by, to being a goals-based regulator, which means that they would come to us telling us what they planned on doing and then we would advise them accordingly as to whether we thought that they would satisfy normally acceptable requirements …[360]

Safety requirements for prescribed dams

6.114 The DSC website states that a dam structure is adequately safe if it complies with the DSC's requirements and conforms to accepted good practice. Each dam is individually assessed by considering the following relevant matters:

- structural adequacy and stability
- leakage control
- adequate flood capacity
- effective operation, maintenance and emergency management practices
- regular surveillance and dam safety reviews.[361]

6.115 Once assessed, a dam is assigned one of two consequence categories:

- Sunny Day: the dam may fail without any attendant natural flooding, or
- Flood: the dam may fail in association with a natural flood.[362]

6.116 Within these two consequence categories, a dam can then be classified as one of the following levels: Extreme; High A; High B; High C; Significant; Low; or Very Low.[363]

6.117 Mr Steven Knight, Executive Engineer, DSC, advised that all owners of prescribed dams are required to have a dam safety emergency plan that outlines the steps to be taken in the event of failure, noting that the State Emergency Service (SES) is involved in emergency planning for dams that have been assessed as being of high or extreme consequence if a failure were to occur. Mr Knight explained:

> We [the DSC] set our requirements of that through our guidance sheets for what the dam safety emergency plans should entail, and each dam owner which has a prescribed dam needs to have a dam safety emergency plan. If they are only a significant consequence category they can be a modified or lesser standard of dam safety emergency planning, but all the high and extreme categories, it is a fairly substantial document and management process for that. That is worked out with the

360 Mr Cooper, Evidence, 20 August 2012, pp 49-50.

361 NSW Government, Dams Safety Committee, *Water Supply Dams*, accessed 3 February 2013 <www.damsafety.nsw.gov.au/Dams/Requirements/watersupply.shtm>

362 NSW Government, Dams Safety Committee, *Guidance Sheet - Consequence Categories for Dams*, DSC3A, June 2010 updated November 2012, p 3, accessed 3 February 2013, <www.damsafety.nsw.gov.au/DSC/Download/Info_Sheets_PDF/Dam/DSC3A.pdf>

363 NSW Government, Dams Safety Committee, *Guidance Sheet - Consequence Categories for Dams*, DSC3A, June 2010 updated November 2012, p 3, accessed 3 February 2013 <www.damsafety.nsw.gov.au/DSC/Download/Info_Sheets_PDF/Dam/DSC3A.pdf>

> dam owners, designated designer and closely with the SES … The SES for the high consequence and extreme category dams are the principal authority for managing the emergency planning if there is an incident, but we get notified and we have to keep the Minister informed of developments as they proceed.[364]

6.118 If a dam is deemed to be unsafe the DSC liaises with the dam owner and elicits a dam improvement program following studies by the owner's consultants to determine appropriate upgrade options and to recommend a practicable and cost effective solution.[365] Under the provisions of the *Dams Safety Act 1978,* the DSC is permitted to direct that works be undertaken to ensure dam safety.

6.119 Dr Amit Chanan, Executive Manager Operations, State Water Corporation, explained that most states in Australia utilise the safety threshold set out in guidelines prepared by the Australian National Committee on Large Dams:

> It is based on the committee's deliberations as well as the national level committee, which is called the Australian National Committee on Large Dams. The Australian National Committee on Large Dams determines the guidelines and the States essentially follows those guidelines. There are similar bodies in Queensland and Victoria that also do the same: they follow the guidelines of the Australian National Committee on Large Dams.[366]

6.120 According to the DSC, the main safety improvements typically required for existing dams include:

- filters to reduce the risk of piping failure of earthfill and earth and rockfill dams
- increased flood passing capacity by adding auxiliary spillways, increasing the discharge capacity of existing spillways, increasing the dam height or combinations of these works
- strengthening of older concrete gravity and arch dams to handle modern dams' engineering/industry acceptable stability and condition criteria with respect to hydraulic, uplift and structural actions, including vertical post-tensioned ground anchors, buttressing the downstream dam face, drainage works and other foundation treatment.[367]

Non-prescribed dams

6.121 In terms those dams not prescribed under the Act, Mr Cooper warned that the DSC was concerned about safety issues arising from urban development close to areas that contain former farm dam sites:

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364 Mr Steven Knight, Executive Engineer, Dams Safety Committee, Evidence, 20 August 2012, p 54.

365 Answers to supplementary questions, 12 September 2012, Dam Safety Committee, Question 2b, p 4.

366 Dr Amit Chanan, Executive Manager Operations, State Water Corporation, Evidence, 20 August 2012, p 31.

367 Answers to supplementary questions, 12 September 2012, Dam Safety Committee, Question 2b, p 4.

> [W]ith the extent of growth of large urban areas on the outskirts of Sydney a number of farm dams are being absorbed into new developments and are often being converted into flood retarding basins or retention basins. A lot of these farm dams were built to standards that would be well below what we would normally require for a dam imposing risk to downstream communities … We worry a number of those dams are not getting through to us as being prescribed.[368]

6.122 Mr Knight explained that while the DSC attempts to maintain a regular cycle of dam inspections for prescribed dams, it relies upon information sources such as local councils or prospective owners to identify non-prescribed dams that may pose a safety risk:

> We try to inspect a lot of our prescribed dams enough per year so that over a five or six year period we hope to get to see most of them. And we certainly concentrate on the highest risk dams … But not the non-prescribed ones, unless we knew of something that was maybe a problem, such as Chinaman's Dam [near Young]. We are relying really on councils and dam owners or prospective dam owners to provide us with information.[369]

6.123 According to the DSC, it has liaised over the last two years with all local councils to identify dams that are currently not prescribed. This process has resulted in the prescription of a further 20 dams.[370]

6.124 To enhance the DSC's awareness of potentially dangerous non-prescribed dams, Mr Cooper advised that it is pursuing other options including the possibility of using internet based tools such as Google Earth to identify and locate dams that may need to be prescribed.[371]

State Water's dam safety program

6.125 The Committee had the opportunity to visit Copeton Dam, near Inverell, on 5 March 2013 to view dam safety upgrade works, as outlined in the case study below.

Case study: Copeton Dam fuse plug[372]

A $60 million dam safety upgrade project, funded by the NSW Government, was undertaken at Copeton Dam. The dam is located on the Gwydir River, 60 kilometres upstream of Bingara. The original dam was completed in 1973 and has a storage capacity of 1,364,000 ML.

The safety upgrade project began in 2010 and was completed in April 2013. It involved the construction of a four bay, 250 metre-wide, fuse plug spillway to enable the dam to withstand the biggest floods now considered statistically possible for the region. The upgrade ensured that the dam complies with standards set by the NSW Dams Safety Committee that reflect improved knowledge of extreme weather and rainfall since the dam was built.

368 Mr Cooper, Evidence, 20 August 2012, p 48.

369 Mr Knight, Evidence, 20 August 2012, pp 55-56.

370 Mr Knight, Evidence, 20 August 2012, p 56.

371 Mr Cooper, Evidence, 20 August 2012, p 56.

372 State Water, accessed 29 May 2013, <www.statewater.com.au/Current+Projects/Dam+Safety+Upgrades/Copeton+upgrade>.

The fuse plug spillway is only triggered in the unlikely event of an extreme flood, and works by safely overtopping and washing away in sections to reduce the water level of the dam and protect the main dam wall, thereby providing better protection for downstream communities.

The permanent storage capacity and normal water releases were not affected by the upgrade. In addition to the new fuse plug spillway, the upgrade resulted in a new road and new facilities for Copeton Waters State Park.

State Development Committee viewing Copeton Dam safety upgrade[373]

373 State Development Committee site visit to Copeton Dam, 5 March 2013.

Works at the Copeton Dam safety upgrade[374]

6.126 Copeton Dam is one of seven State Water operated dams that have recently completed or are currently undergoing safety upgrades to meet the guidelines set by the DSC. These dams also include Blowering Dam, Burrendong Dam, Chaffey Dam, Keepit Dam, Split Rock Dam and Wyangala Dam. Descriptions of the work being undertaken at these dams can be found in Appendix 8.[375]

6.127 Mr Tucker, of State Water, advised that these dams were being upgraded to enable them to withstand a one in 200,000 year event, with the potential for further augmentation if required:

> In terms of the standard that we are elevating them to, the highest priority dams were designed typically for one in seven to 10,000 year event. We are augmenting those to get to something like one in 200,000; between a 100,000 and 200,000 year event. If we were to proceed with stage two, we are talking about augmentation to get to one in a million year event, so quite a substantial increase in the security of the storage.[376]

6.128 Dr Chanan advised that the majority of dams operated by State Water have been assessed by the DSC as being extreme hazard dams, meaning that, if these storages were to fail the consequences for downstream communities would be great:

374 State Development Committee site visit to Copeton Dam, 5 March 2013.

375 Answers to questions taken on notice taken during evidence 20 August 2012, Mr Tucker, State Water Corporation, pp 2-3

376 Mr Tucker, Evidence, 20 August 2012, p 29.

> The New South Wales Dams Safety Committee, depending on the consequence of a dam, has a rating of the dams … Most of our dams are extreme hazard dams because they are large dams and there are population centres downstream so most of our upgrade programs are driven by those regulatory requirements.[377]

6.129 Dr Chanan outlined how State Water, in conjunction with the DSC, determines which dams require safety work to be undertaken, and indicated that once the current program of upgrades was complete a further portfolio risk assessment of State Water operated dams would be undertaken to determine the program of future works:

> Essentially our dam safety program is based on a portfolio risk assessment approach. We look at all the dams we own; we look at what are the highest risk dams and then we invest in bringing the security level up … Right now we are doing a portfolio risk assessment again, given that we have invested money in seven of the highest priority. It is scheduled to finish by about the end of September-October [2012], which will then give us a feel for what is the level of risk associated with dams at the completion of stage one and then we will develop a program of works for the future.[378]

Concerns with the dam safety program

6.130 During the inquiry, some concern was expressed that the safety requirements set by the DSC were unnecessarily high and as a result costly. For example, Mr Paul W Heinrichs, a civil engineer with approximately 40 years experience in the dams/water supply industry, questioned the stringency of the guidelines set by the DSC, arguing that the significant financial costs of upgrades could be better spent in other areas:

> [T]he economic expenditure on upgrading dams to very low risks, up to 1 in 1,000,000 risk is a costly exercise and the money could possibly be better spent on provision of new dams, or on other areas of high risk such as traffic lights, hospitals, safer roads.[379]

6.131 Mr Heinrichs was also concerned that local councils were not represented on the DSC, even though nearly one-third of all storages are owned by local councils:

> [I]t is unfair that Councils in NSW who own 30% of the Committee's prescribed dams do not have an expert representative on the Committee to ensure Councils' interests are addressed, particularly when small regional councils are required to 'stump up' considerable amounts of money to upgrade the safety of their dams to protect very small populations at risk, and for little or no real return.[380]

6.132 The Gwydir Valley Irrigators Association (GVIA) was also concerned about the DSC safety requirements, particularly in relation to the recent safety upgrades at Copeton Dam. Like Mr Heinrichs, the Association questioned the necessity and extent of the upgrades, and was sceptical of the benefits that would be achieved following completion of the safety works:

> [T]he GVIA is extremely concerned with the decision made by State based dam safety committees to alter the risk management framework of all NSW dams. This decision has resulted in a $60 million project to upgrade the Copeton Dam spillway to include

377 Dr Chanan, Evidence, 20 August 2012, p 30.

378 Dr Chanan, Evidence, 20 August 2012, p 29.

379 Submission 86, Mr Paul W Heinrichs, p 3.

380 Submission 86, p 3.

> four safety fuse plugs to manage 1:2,000, 1:5,000, 1:10,000 and 1:20,000 year flood events. Prior to the upgrade the dam already had the capacity to release water for a 1:7,500 year flood event …
>
> The benefits from the upgrade have been stated that the new plugs will ensure the integrity of the dam wall and maintain the dam at 80% capacity in a worst-case scenario. Although a promising gesture, the fact that daily dam inflows will need to be greater than the 1.3 million ML capacity of Copeton for the fuse plugs to be triggered means that there would already be unprecedented and devastating flooding in the region … begging the question what was the purpose then of a $60 million safety upgrade and how the continued roll-out of such programs can be acceptable in terms of government costs.[381]

6.133 In evidence, Ms Lowien, of the Gwydir Valley Irrigators Association, also raised this issue:

> The only benefit that we have been told of the triggering of the fuse plugs is that it keeps 80 per cent of the dam in storage, rather than losing the entire dam wall. There would be so much impact downstream to the point that the modelling indicated 16 or 17 metres through the township of Moree, which would be devastating enough anyway before the fuse plugs were triggered. Our concern is that the New South Wales Dams Safety Committee made that recommendation at stage 1. When we move to stage 2, the concern is that that cost of any further upgrades to any further risk situations would be borne by water users whereas currently it has been public funds for public benefits … We are questioning the value of that investment.[382]

6.134 Mr Cooper clarified the approach of the DSC in regard to setting such high safety requirements, explaining that they are based on the probability of an event occurring in any one year:

> [W]e have got to really think in terms of probability, rather than in term period. The mindset with using a term like the 'term period' is that if it happens yesterday then we wait another 200,000 years or so before it happens again. Whereas, in fact, it is a probability of that event happening in any one year. Someone wins Lotto every week and there they have odds of one in a million or one in five million or so, but still someone wins Lotto. So those odds come up and they are not impossible odds, even though they might seem extreme.[383]

6.135 Given the cost of safety upgrades required by the DSC, Mr Knight acknowledged a need to be pragmatic about how prescribed dam owners allocate their funds, using State Water as an example:

> State Water has been very good in doing portfolio risk assessment a couple of times over the years, including one they are doing at the moment. We accept that within their portfolio they can assign where they should put their best dollar values for the next phase. It does not have to be that each dam has to go through one phase after the other. The next phase will be going through the remaining highest risks across their portfolio and we encourage that so they can spread their dollar value over quite a

381 Submission 93, p 9.

382 Ms Lowien, Evidence, 6 March 2013, p 34.

383 Mr Cooper, 20 August 2012, p 49.

> long time horizon providing we are encouraged that they have that plan actively in process.[384]

6.136 Similarly, Mr Cooper recognised that many local councils find it financially difficult to undertake safety upgrades of dams, particularly older dams, and suggested that there should be a mechanism to provide councils with sufficient funding to undertake the required dam safety upgrades:

> [A]most half the dams that the New South Wales Dams Safety Committee regulates under the New South Wales Dam Safety Act are owned by local government. A number of these dams are very old, some more than 100 years old, and they are presenting increasing risk to downstream communities and are on lists to be upgraded. A lot of the councils find it difficult to afford the upgrade costs because the upgrade costs often represent a very significant amount of their annual budgets and a lot of councils also have small rating bases. While we do not consider affordability in our requirements for certain dam safety standards, we realise it is a fact of life and one of the issues is that there should be some mechanism to make it easier to provide the funding for these upgrades by local government.[385]

6.137 As one existing way to alleviate the financial burden of required safety upgrades, Mr Knight advised that the DSC permits a reasonable amount of time to complete the work, including by encouraging staged upgrades:

> [W]e certainly look at staged upgradings for some of these dams to reduce the impact of coming up with big up-front dollar costs and to go straight to the final solution. We really do emphasise staged upgradings and give the dam owners some reasonably lengthy horizons to meet that, providing they make a substantial immediate increase.[386]

6.138 In the event that the owner of a prescribed dam fails to meet reasonable goals for the safety requirements of the DSC, Mr Knight described what actions the Minister for Primary Industries or the DSC can pursue:

> [W]e can go all the way through to a section 18 where the dam owner is on significant notice: he has to do something almost immediately. We have only ever issued four section 18s since the Dams Safety Committee came into being … The only other thing we can do is if the Minister would declare a state of emergency. If it really was an emergency and something was failing straightaway or on the verge of failing and we could prove that, under the Act, if the dam owner is doing nothing … [t]hen we can go in and organise remedial works ourselves and then claim them back through the dam owner.[387]

384 Mr Knight, Evidence, 20 August 2012, p 56.

385 Mr Cooper, Evidence, 20 August 2012, p 48.

386 Mr Knight, Evidence, 20 August 2012, p 54.

387 Mr Knight, Evidence, 20 August 2012, p 54.

Review of the Dam Safety Committee

6.139 Mr David Harriss, NSW Office of Water, advised the Committee that as of May 2013, the NSW Government was undertaking a review of the legislation that applies to the DSC and its operations. Mr Harriss explained that the review is to examine:

> [W]hat is the best risk management strategy that can be applied so as not to compromise the most contemporary dam safety standards, but to recognise that there are a lot of competing interests for limited resources, and that any decision to upgrade dam safety to a certain level should be undertaken in consideration of some of the other demands on those resources.[388]

6.140 The Committee was provided with further information regarding the review, which is expected to be completed by the end of 2013:

> NSW Trade and Investment is leading the review into the *Dams Safety Act 1978* and the Dams Safety Committee. This is a three stage review which commenced in January 2013. Stage one is being undertaken by independent consultants and is close to completion [as at 24 May 2013]. Stage two involves community consultation and stage three involves implementation of the review recommendations. I am advised that at this point in time the review is expected to be completed by December 2013.[389]

Committee comment

6.141 The Committee recognises the important role the DSC plays in protecting the water supply and also in endeavouring to minimise the risks associated with dams, for example by reducing the impact of significant floods on downstream communities.

6.142 However, as raised by some inquiry participants the expenditure on upgrades for events that have a 1 in 200,000 probability of occurring in any year seems an unnecessary use of resources that are scarce and may be better utilised on other aspects of water management. We believe it is important to review the level of expenditure on the dam safety upgrade program to protect against events that are not likely to occur. The Committee supports the NSW Government in undertaking the review of the DSC and its relevant legislation and recommends that the concerns raised in our inquiry be included in the review and that the outcomes of the review be made public.

Recommendation 14

That the NSW Government, in undertaking the review of the New South Wales Dam Safety Committee and its relevant legislation, take into consideration the concerns raised in this inquiry and that the outcomes of the review be made public.

388 Mr Harriss, Evidence, 3 May 2013, p 5.

389 Answers to questions taken on notice during evidence 3 May 2013, Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, p 1.

Chapter 7 Future water storage solutions

This chapter examines stakeholders' views regarding the future security of the State's water supply, in particular whether this is best achieved through additional storages or through the employment of alternative measures. First is a discussion of the assessment process for new dam proposals, then an examination of arguments in favour of increasing supply through new storages, and some proposals for new dams or augmentation works. Next the chapter provides an overview of arguments against new storages, including suggestions for how to optimise the use of the State's existing water resources. Finally, the chapter examines the benefits of an integrated approach, including the success of some current practices, as well as stakeholder suggestions for water management, collection, reuse and conservation.

Issues to be considered in assessment of new proposals

7.1 As noted at several points in this report, an important issue for this inquiry is whether the State's future water needs should be met via new or augmented water storages. In Chapter 2 we provided factual information on the assessment process for new water storages. In this section we examine participants' views about the assessment of such proposals.

7.2 Several inquiry participants raised concerns regarding the assessment process for the construction of new storages or augmentation of existing ones, arguing that any consideration of major water storage construction should involve detailed assessment and analysis. While several stakeholders outlined their criteria for assessment, others identified areas they believe require improvement, with some specific examples provided by shires in areas recently considered for new developments.

7.3 NSW Farmers expressed the view that a 'comprehensive review of existing storage infrastructure and opportunities for extension and improvement is long overdue'. However, it also expressed doubts over the expertise within New South Wales and Australia to adequately identify and prioritise investment in new major water storage infrastructure. It recommended that the first step in addressing the water storage solutions in New South Wales be to commission 'a comprehensive climatic, physiographic, hydrological and engineering study to identify risks, opportunities and cost effective infrastructure solutions'.[390] NSW Farmers argued that any new or augmented storages should be considered in terms of potential flood mitigation, water security and the provision of clean energy, as well as current and projected stakeholder demands.[391]

7.4 While Cotton Australia stated that it would welcome additional water resources being made available to cotton growers, it also proposed assessment requirements for considering new or augmented storages, asserting that for Cotton Australia to support a proposal it must:

- be cost effective (or part of genuine State development policy, with no expectation of full cost recovery by water users)
- be environmentally sustainable

390 Submission 95, NSW Farmers, pp 5-6.

391 Submission 95, p 7.

- have no uncompensated impacts on existing water entitlement holders
- be within the framework of current or amended water sharing plans.[392]

7.5 Psi Delta contended that the first assessment of any new storage assets should be a 'basic financial viability assessment' to determine whether it can meet for its operating costs and interest and make some contribution to repaying capital. Psi Delta suggested that the second test for projects which do not meet the initial criteria should be whether they provide 'quantifiable economic and social benefits that justify government contributions'.[393]

7.6 The Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales also expressed the view that new developments need to be carefully calculated and assessed, including in terms of their purpose, capacities and life-span. They argued that assessment should determine the likely yield, long-term impacts of yield and climate change impacts to ensure that dams achieve their proposed function.[394]

7.7 Ms Jennifer Bennett, Executive Officer, Central NSW Councils (Centroc), also advocated for in-depth assessment of new proposals, asserting that reputable scientific study would 'be more compelling' for the community in considering and supporting new proposals. Ms Bennett cited the Centroc Water Security Study as an example, stating:

> [T]here is a lot of science behind it, the modelling is stochastic. It took them, I think, two days every time they wanted to run the model. There was an enormous amount of work involved in it. There has been also a triple bottom line overlay, where we looked at the social, environmental and economic value over the top of that.[395]

7.8 The Dungog Shire Council was critical of the assessment process for the Tillegra Dam project, and contended that there are 'lessons' to be learned from the experience, which it described as having 'left behind a number of legacies' for the community of Dungog Shire:

> There were deficiencies identified by many leading commentators in relation to the systems utilised by Hunter Water to measure yields, the cost benefit analysis utilised was not best practice, there was strong community opposition, there was ongoing concerns as regards site suitability from a geological perspective to name but a few of the concerns. [396]

7.9 Further, Dungog Shire Council asserted that the Tillegra project was inherently flawed as it failed to examine existing practices and what could be done to change the way people and industry consumed water, especially with regard to the management of water use or reuse once delivered from a water storage.[397]

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392 Submission 100, Cotton Australia, p 5.

393 Submission 92, Psi Delta, p 3.

394 Submission 26, Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, p 9.

395 Ms Jennifer Bennett, Executive Officer, Central NSW Councils, Evidence, 16 November 2012, p 38.

396 Submission 15, Dungog Shire Council, p 3.

397 Submission 15, p 2.

7.10 The Dungog Shire Council recommended that both an appropriate presentation of information to the community and a collaborative approach is required in order to effectively engage community support. The Council also stated that the consultation process 'should extend well beyond those deemed to be immediately affected and include those communities who will benefit from the water storage,'[398] and expressed hope that other dam proposals within the Dungog area, which may be included in the 2013 Lower Hunter Water Plan, will be informed by their experience.[399]

7.11 The Tweed Shire Council also raised concerns with the assessment process for new water storages, with particular emphasis on overlapping and conflicting legislation and policy instruments, which it contended impede the approval process and incur greater costs to the community. It identified the *Environment Planning and Assessment Act (1979)* (hereafter EPA Act) and the *Water Management Act (2000)* and 'other legislation' as problematic in this regard, and called for a whole of government approach to refine the processes required to gain environmental, construction and operational approvals. The Council contended that approvals gained under one Act are not binding under another, resulting in duplicated, conflicting and open-ended conditions and requirements. Further, it asserted that the 'very significant investment in trying to obtain these approvals and the very long period involved, places all projects of this nature at risk of never being realised'.[400]

7.12 Another concern raised by the Tweed Shire Council related to the implementation of the new statewide Local Environment Plan (LEP) template, which includes changes to the planning approvals process for public infrastructure development, such as water storages. The Council asserted that 'these changes expose Council and the Tweed community to significant additional cost and delay risks without any additional benefit in terms of more stringent Environmental Impact Statement studies, greater public consultation, a more rigorous assessment process or any additional approval scrutiny'.[401]

Environmental impacts

7.13 Other inquiry participants raised concerns regarding the potential environmental costs of new or augmented water storages and called for these impacts to be carefully considered during the assessment of any proposal. The Nature Conservation Council of NSW, for example, stated that, 'Any proposal for construction or augmentation of water storages must ensure that enough water will be available to meet both the environmental and human needs as well as the cost efficiency/feasibility objectives'.[402] It also suggested that future storages should include variable level offtake facilities and fish passage facilities, and highlighted the impact of using storages for flood mitigation, as was discussed in detail in Chapter 5.[403]

7.14 Similarly, the Caldera Environment Centre stated, 'The impact of building a new, or even augmenting an old, water storage has a massive impact on the immediate local ecology of the

398 Submission 15, pp 3-4.

399 Submission 15, p 5.

400 Submission 35, Tweed Shire Council, p 6.

401 Submission 35a, Tweed Shire Council, pp 1-2.

402 Submission 104, Nature Conservation Council of NSW, p 4.

403 Submission 104, p 4.

environment and needs careful scrutiny prior to any decision being made'.[404] It included vegetation removal, species loss, erosion and sedimentation, and carbon emissions from construction, as some of the likely environmental impacts.[405]

7.15 Mr Brian Doherty also emphasised the need for environmental impact assessments for new water storage development proposals, arguing that, 'Ecological costs cannot be overlooked or isolated from the social and financial as ecological degradation will have social and financial impacts over time'. [406]

7.16 A number of participants made suggestions for minimising environmental impacts through the employment of alternative technologies. These are explored later in this chapter under 'an integrated approach'.

Who should pay?

7.17 The financial costs associated with the construction, operation and maintenance of new or augmented storages were raised by numerous inquiry participants, with the majority agreeing that dams are very expensive to build and to maintain. Currently, water storages are largely financed by users via a user pays system where some capital costs can be recouped through water charges. Mr David Harriss, Commisioner, NSW Officer of Water, advised the Committee that 'the National Water Initiative requires that the cost of water management be borne by the users':

> [U]sers should pay wherever possible. Where that is not possible, cross-subsidisation from other sectors should be transparent. In our view that effectively means that the beneficiaries—that is largely the water users—should bear the costs, particularly of the operation and maintenance of that infrastructure, and that can be quite substantial.[407]

7.18 In rural areas this has resulted in the majority of costs being borne primarily by licensed access users, often irrigators. However, some inquiry participants highlighted that dams and other storages provide multiple services to a variety of users, and suggested that responsibility for meeting costs be shared equitably among all beneficiaries.

7.19 In evidence, Dr Richard Sheldrake, Director-General, Department of Primary Industries, asserted that 'construction of further storages will come at considerable cost', and underscored the question of which beneficiaries should meet that cost:

> Who should bear those costs? Who are the beneficiaries and who will be asked to pay? Dam construction has multiple objectives, including flood mitigation, providing water security for urban populations, industrial, agricultural and the environment.[408]

404 Submission 49, Caldera Environment Centre Inc, p 10.

405 Submission 49, p 12.

406 Submission 87, Mr Brian Doherty, p 2.

407 Mr David Harriss, Commissioner, NSW Office of Water, Department of Primary Industries, Evidence, 3 May 2013, p 9.

408 Dr Richard Sheldrake, Director-General, Department of Primary Industries, Evidence, 20 August 2012, p 2.

7.20 The Gwydir Valley Irrigators Association stated that they would support new developments 'provided that the cost of building, maintaining and operating them is not solely borne by water access licence holders, especially when there are now clearly additional beneficiaries from their development'. It further contended that this is especially important for dams that will have multiple purposes including meeting environmental entitlements, flood mitigation and other discretionary uses like sport and recreation.[409]

7.21 Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, suggested that the user base of water storages needs to be reevaluated to include 'environmental contingency allowances and stock and domestic water holders' as currently 'they do not pay any charges for deriving those services from State Water'.[410]

7.22 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, similarly proposed that 'there should be some way of recovering the cost from all benefactors of dam storage or utilisers of the water within it'. Mr Moore expressed the view that improving the efficiency, security and storage capacity of the State was 'worth looking at' but contended that 'it would be almost impossible for irrigators … in most areas to be able to bear the cost of additional charges … of a new dam'.[411]

7.23 Psi Delta shared the view that irrigators would be unlikely to be able to pay for the construction of new or augmented storages. It stated that 'irrigators now pay for their share of the upkeep and operating costs' of dams that were built using public funds, and reasoned that, 'Were these same dams to be built today the apportionment of capital costs to irrigators would be significant and possibly unaffordable to many of the irrigators in the cotton, rice, fruit and dairy industries'.[412]

7.24 Psi Delta reported that 'applying the Council of Australian Governments principle that the user pays is difficult when it comes to new water projects' as the affordability of water is 'determined by commodity prices and these are subject for the most part to international markets'.[413] It suggested that a potential offset is to 'develop demand for water through developing markets for those who will use the water and help improve their competiveness through improvements in technology'.[414] Psi Delta emphasised the importance of 'field-based' market research to identify 'who will take up water from a project' rather than relying solely on economic analysis and modelling, asserting that major water storage projects should only proceed after 'sufficient demand has been contracted'. It gave the example of Paradise Dam in Queensland where the strong economic report upon which the decision to build was based, 'was not reflected in the take-up which is occurring over a protracted period'. [415]

409 Submission 93, Gwydir Valley Irrigators Association, pp 9-10.

410 Ms Stefanie Schulte, Economic Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 17.

411 Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, Evidence, 16 November 2012, p 18.

412 Submission 92, p 2.

413 Submission 92, p 2.

414 Submission 9, p 2.

415 Submission 92, p 3.

Should storage capacity be increased?

7.25 Opinion was divided amongst inquiry participants as to the need for new or augmented storages. While some participants argued strongly for the construction of new or augmented storages, others were of the view that existing ones were sufficient and that water should be used more efficiently to ensure adequacy of supply.

In support of increased capacity

7.26 A number of stakeholders expressed the view that an increase in water storage capacity is imperative to meet future growth in population and industry, ensure agricultural productivity, and provide security against irregular climatic conditions in Australia. Mr Terence Hogan, Chair, Riverina and Murray Regional Organisation of Councils, and Mayor, Jerilderie Shire Council, argued that since 'the construction of additional water storages has come to a virtual halt', water storage capacity should be increased through a variety of means to meet future growth needs:

> Water is the key to our future and the current situation of the Murray Darling Basin Plan must now be a catalyst for a far greater harnessing of storage of our precious water resources by way of new water storages and/or diversion schemes from northern Australia and/or coastal river systems, by innovation technology research and development, and by the ongoing development of effective river and irrigation management systems.[416]

7.27 The Gwydir Valley Irrigators Association (GVIA) expressed support for the construction of new water storages so long as appropriate approval mechanisms were followed and any new storages were environmentally sustainable:

> [T]he GVIA supports the construction of new dams provided there has been proper and due assessment of the need and costs associated with the proposal and that policy is amended to allow for this increased water capacity without third party impacts. Any new dams should also be environmentally sustainable in the long-term.[417]

7.28 NSW Farmers – Griffith Branch also reported that its members are 'highly supportive of the construction of dams to service the increasing need for productive water',[418] and went on to state:

> [W]e would like more water to help provide food and fibre for the demands of the world's growing populations. We need more available water storages rather than the buying back of water, stable visionary government policy and less bureaucracy so that we can be optimally productive.[419]

416 Mr Terence Hogan, Chair, Riverina and Murray Regional Organisation of Councils, and Mayor, Jerilderie Shire Council, Evidence, 1 November, 2012, p 33.

417 Submission 93, pp 2-3.

418 Submission 73, NSW Farmers Association – Griffith Branch, p 1.

419 Submission 73, p 1.

7.29 Cotton Australia argued that without an increase in storage capacity, competition between agricultural, industrial, urban and environmental needs would intensify, with agriculture receiving an insufficient water supply to meet its potentially expanding needs:

> NSW faces a choice of either increasing its total water storage, and in doing so increase the amount of water available for extractive use, or see a steady decline in water available for irrigated agriculture, as it shifts to meet urban, industrial and environmental needs … If NSW wishes to maintain (and hopefully grow) its irrigated agriculture sector, it must increase its storage capacity, and in doing so restore the amount of water available for irrigated agriculture.[420]

7.30 The Wakool Landholders Association supported the construction of additional storages, suggesting that agricultural water entitlements could not be further reduced to meet the demands of other water users:

> It has been a long held view of our association that more storages are the answer to the Basin Plan. We cannot keep taking more water from rural Australia without impacting on communities and food production … It has been a fault of recent governments not to augment our storages. The growth of towns and cities in Australia has not been considered and has created enormous stress on the current water storages especially in dry times. We cannot afford to just keep cutting entitlements in order to satisfy urban concerns.[421]

7.31 Ms Jon-Maree Baker, Executive Officer, Namoi Water, was concerned about the impact of the growth of the mining industry on current storage adequacy in their region:

> I guess the question is, is the current storage adequate to meet current needs? In respect of our valley, we obviously have an expanding extractive industry, so potentially we will have 27 coal mines, eight coal seam gas fields that will result in a drawdown of groundwater systems above five metres and potentially 2 to 4 per cent reduction in surface water flow as at Narrabri gauge. The impact of those expanding industries is of concern as to whether or not we have adequate water storage in the valley. It probably needs further assessment as to how industrialised activities impact on water quality in respect of making sure that the water that we currently have access to is protected in respect of no third-party impacts from those other industries expanding.[422]

7.32 Some inquiry participants considered that increased storage capacity would be necessary even if water conservation measures continued to be implemented across the State. The NSW Irrigators' Council observed that, '[E]ven with widespread measures to conserve water with improvements in irrigation technology, river management and dam upgrades, we are not sufficiently bridging the gap between need and availability'.[423]

7.33 Similarly, Mr Tony Perry, General Manager, Central Tablelands Water County Council, suggested that additional storage capacity is required regardless of the successful implementation of any water conservation measures:

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420 Submission 100, pp 5-6.

421 Submission 17, Wakool Landholders Association, p 1.

422 Ms Jon-Maree Baker, Executive Officer, Namoi Water, Evidence, 6 March 2013, p 21.

423 Submission 97, NSW Irrigators' Council, p 10.

> The Central West cannot operate any longer over the next 40 to 50 years without extra water storage. We are encouraged by this State Government's view that they have overturned that no new dams policy because I think it is recognised that you just cannot carry on with conservation measures. As good as they are, we need more water storage.[424]

7.34 Mr Moore, NSW Irrigators' Council, supported the construction of new water storages, observing that while dam levels are currently high, Australia's irregular climatic conditions mean that water supplies will inevitably reduce again:

> We find ourselves in a situation where our dams are full or close to being full – the last I checked they were just over 80 per cent. But, as history shows, this will not last and our water resources will likely again be in short supply. The NSW Irrigators' Council supports the construction of new dams and the associated sharing of water resources amongst all types of water users to ensure there are benefits for everyone.[425]

7.35 Ms Virginia Tropeano, Committee Member, Murrumbidgee Valley Food and Fibre Association, suggested that the recent experience of the millennium drought had highlighted the insufficient capacity of water storages in the State:

> The question of whether New South Wales has adequate water storage was overwhelmingly obvious during the millennium drought we have just endured. Irrigated agriculture was stopped in its tracks. General security irrigators had no water to grow crops and high security irrigators only had sufficient water to keep their permanent plantings alive. We all had to dig in our heels and live off our reserves in order to survive … If Australia is to become the food bowl of Asia and New South Wales is to participate in the opportunities that are expected to arise we must have more water storage so irrigated agriculture can grow. If we do not it will stagnate and die.[426]

7.36 A need to increase water storage capacity to meet the demands of agricultural producers was identified by a number of inquiry participants including the Wine Grapes Marketing Board who argued that the capacity of current storages requires urgent review:

> The existing water storages were designed and developed at a time when development in irrigation activities across New South Wales was emerging. Without these storages many of the State's cities, towns and regions would not have flourished to become economically beneficial to the State. The recent drought has shown that the capacity of these storages needs urgent review and expansion to enable existing permanent plantings and investment in irrigation infrastructure to support annual production to remain viable.[427]

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424 Mr Tony Perry, General Manager, Central Tablelands Water County Council, Evidence, 16 November 2012, p 32.

425 Mr Moore, Evidence, 16 November 2012, p 10.

426 Ms Virginia Tropeano, Committee member, Murrumbidgee Valley Food and Fibre Association, Evidence, 16 November, 2012, pp 20-21. A similar observation was made by Griffith City Council (see Submission 19, Griffith City Council, p 4).

427 Submission 52, Wine Grapes Marketing Board, p 3.

7.37 Mr Harriss, NSW Office of Water, however, expressed the opposite view, contending that the recent drought demonstrated that the ideal locations for water storages in New South Wales have already been utilised. He explained:

> The dams in inland New South Wales filled and spilled in 2000 and the next time that happened was 2010. That meant the existing storages captured every bit of inflow during those 10 years. A new piece of infrastructure would have been of no value or consequence because it would not have captured any further inflows. That meant we would have invested the capital cost and the ongoing operations and maintenance costs of that infrastructure with no perceivable gain.[428]

Proposals for additional storage

7.38 Several inquiry participants who advocated for the construction of new or augmented storages in order to increase water storage capacity identified potential sites for additional storage around the State. The following section outlines several of the proposals presented to the Committee. Other proposals for additional storages which would not increase capacity, but are proposed to improve efficiency, are discussed later in the chapter under 'Better use of existing water supply'.

Lower Hunter

7.39 Dr Amit Chanan, Executive Manager Operations, State Water Corporation, informed the Committee that Lostock Dam on the Paterson River has 'spare capacity … to supply the Hunter', and outlined some of the options to increase its capacity being explored in mid 2012 as part of the Lower Hunter Water Strategy:

> Provided it comes as the lowest hanging fruit there are a few options that we are looking at. Potentially we could raise [Lostock Dam] by 5 metres, which would mean that its current capacity of 20 gigalitres will be increased to about 33 gigalitres. The other option is to raise it by 16.5 metres. That will raise it from its current 20 gigalitre capacity to 76 gigalitres. The larger option would cost about $145 million or thereabouts and would ensure the Hunter water supply until about 2050 when implemented in conjunction with other water-saving and demand-management programs.[429]

Snowy Hydro

7.40 Mr Steve Briggs, civil engineer, proposed the construction of several dams in the Eden Monaro area to supplement the Snowy Scheme and 'drought proof 15 percent of the continent. Mr Briggs explained that his proposal would provide drinking water for all the towns between Wagga, Albury-Wodonga, Mildura and Canberra, allowing them to grow unimpeded, while also enabling all the existing water to be used for farm irrigation and riparian flows.[430]

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428 Mr Harriss, Evidence, 3 May 2013, pp 8-9.

429 Dr Amit Chanan, Executive Manager Operations, State Water Corporation, Evidence, 20 August 2012, p 33.

430 Submission 36, Mr Steve Briggs, p 1.

7.41 Southern Riverina Irrigators recommended that the NSW Government review existing Snowy Hydro storages, asserting that 'this may provide opportunities to maximise and increase water supplies without jeopardising existing uses'. [431]

Clarence

7.42 Proposals for a new dam on the Clarence River were made by several inquiry participants. Mr David Coffey proposed the 'Western River Diversion Scheme' which would result in the diversion of water to the Murray Darling Basin from some of the tributaries of the Clarence River:

> This is a scheme which is capable of diverting over one million megalitres of water on a regular annual basis into the Murray Darling System via the Dumaresq River which forms the border between NSW and Queensland. It obtains this water from tributaries of the Clarence River, stores them in a very large reservoir in a valley 50 km east of Glen lnnes and gravitates this water through a tunnel under the Great Dividing Range to the Beardy River, upstream of its junction with the Dumaresq.[432]

7.43 Mr John Ibbotson also proposed the construction of a dam on the Clarence River, located at the Clarence Gorge:

> You put a dam across the Clarence Gorge, and it backs up the water for 50 kilometres, 60 kilometres in each direction, and effectively every piece of water that falls in the Clarence catchment, which is about 2,200 square kilometres, ends up coming through that one spot.[433]

7.44 Mr Ibbotson contended that such a dam would have capability to include a hydroelectricity plant to pump the water through a pipeline to the Severn River, adding that it would also assist in flood mitigation in the Clarence Valley.[434]

7.45 A scheme for the diversion of water from coastal rivers to western rivers was also proposed by Mrs Joan Douglas, who asserted that not only would this 'practically drought proof Australia', but also 'take the pressure off the towns of Lismore and Grafton' during times of flooding.[435]

Chowilla Dam

7.46 The NSW Irrigators' Council proposed the construction of Chowilla Dam to capture unregulated flows from the Kiewa, Broken, Ovens, Goulbourn, Campaspie, Loddon and Avon Rivers which flow into the Murray below the Hume. It argued the dam would be a unique site, covering approximately 1,000 square kilometres across three States, with a potential capacity of over 5 million megalitres.[436]

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431 Submission 91, Southern Riverina Irrigators, p 4.

432 Submission 2, Mr David Coffey, Attachment 1, p 1

433 Mr John Ibbotson, Evidence, 3 May 2013, p 28.

434 Mr Ibbotson, Evidence, 3 May 2013, pp 26-28.

435 Submission 54, Mrs Joan Douglas, p 1.

436 Answers to questions on notice taken during evidence 16 November 2012, Mr Mark Moore, Policy Analyst, NSW Irrigators' Council, p 5.

Lake Mejum

7.47 The NSW Irrigators' Council also proposed the development of Lake Mejum, near Narrandera in the Murrumbidgee Valley, which it claimed is also supported by the Shires of Balranald, Carrathool, Griffith, Hay, Jerilderie, Leeton, Murrumbidgee, Narrandera and Urana, the Councils of Murrumbidgee and Southern Riverina, the Lowbidgee League and the Ricegrowers' Association of Australia. It advised that these bodies had jointly prepared a report on the proposal which 'covers the history of this site, the benefits which could be derived from it and the costs associated with the plan':[437]

> This site differs from others in that there would be piping and pumping requirements to utilise it. With today's high energy costs, the plan would require further work to alleviate the additional costs associated with operating it. Although there are these additional costs, the ability to store up to 450,000 ML would be of great benefit not only in drought years but consistently for the local environment and town use. [438]

Murray Gates

7.48 Several participants expressed support for the Murray Gates project, located upstream of the junction of the Murray River and the Swampy Plain River. For example, Mr Denis Tinkler, Southern Riverina Irrigators, suggested that a dam upstream of the Hume would have significant benefits:

> I understand it is an ideal dam site. It is a three million megalitre storage but it has an annual yield of 300,000 megalitres … it appears to me that if you are going to build storages you build them as high up the hill as you can and have them in a spot where the water is as deep as it can possibly be. That is common sense.[439]

7.49 The NSW Irrigators' Council also supported the development of the Murray Gates project which they propose would have a 'storage capacity of approximately 444GL' and could capture and store water released from other storages as well as unregulated water.[440]

Shoalhaven

7.50 Mr Paul W Heinrichs, a civil engineer, advocated, among other proposals, the construction of the Welcome Reef Dam on the upper Shoalhaven River. According to Mr Heinrichs, '[H]ad this dam been built in the 1980s there would have been no need for the expensive desalination plant with its constant demand for extra power, and its outfall source of polluting concentrated brine'. [441] Cotton Australia also expressed the view that a dam on the Shoalhaven River should be reconsidered. [442]

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437 Answers to questions on notice taken during evidence 16 November 2012, Mr Moore, NSW Irrigators' Council, p 6.

438 Answers to questions on notice taken during evidence 16 November 2012, Mr Moore, NSW Irrigators' Council, p 6.

439 Mr Denis Tinkler, Southern Riverina Irrigators, Evidence, 1 November, 2012, p 28.

440 Answers to questions on notice taken during evidence, 16 November 2012, NSW Irrigators' Council, p 5.

441 Submission 86, Mr Paul W Heinrichs, p 2.

442 Submission 100, pp 6-7.

Lake Rowlands

7.51 Central Tablelands Water County Council proposed the enlargement of Lake Rowlands Dam, located on the Coombing Rivulet, a tributary of the Belubula River, to increase capacity from 4,500 to 26,500 megalitres, which they argued would address a key recommendation of the Centroc Water Security Study, to improve security. It urged that planning for this work commence as a priority.[443]

7.52 Mr Tony Perry, General Manager, Central Tablelands Water County Council, reported that the proposal includes 'the augmentation of a new dam wall about 2.5 kilometres downstream, which is the site of a very deep natural gorge' and explained its credentials in catchment location and security in times of drought:

> From an environmental and energy point of view, it is extremely well located. It is an extremely good catchment. Over the seven or eight years of the last record drought, our consumers across the Central County Council area, which is supplied from Lake Rowlands, were on restrictions for six months … which was quite remarkable. So it is an extremely good catchment … it gravitates everywhere and it was identified as the best option to provide water security for the whole of the Central West. You just cannot carry on supplying the Central West without extra water storages.[444]

7.53 Mr Perry emphasised that the proposal at Lake Rowlands 'is not to look after Central Tablelands County Council, it is to look after water security for the Central West'. In addition, Mr Perry advised that Council's water users could not finance the new dam, arguing instead that 'it has got to be a regional, State and Commonwealth project'.[445]

Dixons Long Point

7.54 The Mid-Western Regional Council proposed that a new dam be built at Dixons Long Point, part of the Macquarie River system, halfway between Mudgee and Orange:

> The Mid-Western Regional Council … believes that during times of prolonged drought the water systems of the Murray Darling Basin would be better managed with more dam storage facilities … Council believes that one of the options could be a new dam facility at Dixons Long Point ... Such a dam storage facility could also assist in water security for Orange and other townships close to the storage facilities.[446]

North Coast

7.55 Rous Water called for the construction of additional storage on the North Coast to meet future demand and secure the long term supply. Among a suite of proposed options for consideration as part of the 'Future Water Strategy' is the construction of the Dunoon Dam on Rocky Creek.[447]

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443 Submission 48, Central Tablelands Water County Council, pp 3-4.

444 Mr Perry, Evidence, 16 November 2012, pp 31-32.

445 Mr Perry, Evidence, 16 November 2012, p 37.

446 Submission 43, Mid-Western Regional Council, p 1.

447 Submission 6, Rous Water, p 3. Rous Water provides bulk water supply services for approximately 100,000 people with the Lismore, Byron, Ballina and Richmond Valley local government areas.

Bathurst

7.56 The Bathurst Regional Council informed the Committee that it has commenced preliminary investigations into the further augmentation of Chifley Dam on the Campbell's River, the Council's town water supply dam, in response to 'growth expected in the region and anticipated changes to the safe yield of dams due to climate change effects'.[448]

Forbes

7.57 While it did not specify an exact site, the Forbes Shire Council expressed the view that additional storage is needed to protect its community during times of drought:

> While Wyangala Dam has quite a large storage volume, in drier times, usage can deplete the Dam quickly if inflows are sustained at the low levels experienced during the recent drought period. Additional storage is likely to provide additional security for the water supply for both townships and other users along the length of the river.[449]

Tumbarumba

7.58 The Tumbarumba Shire Council proposed the 'restoration of the 2300ML Mannus Dam, located on the Mannus Creek, following damage that occurred in the October 2010 flood' as a possible solution to securing the Tumbarumba town water supply which it claimed is inadequate for the needs of the community:

> Water security in Tumbarumba during drought is a major concern for Tumbarumba Shire Council. Flow in the Burra and Tumbarumba Creeks appears to be declining. Under present conditions it is apparent that the existing supply does not comply with requirements of the 5:10:10 Rule.
>
> Tumbarumba's demand is 350-400ML and the current system can only supply 140ML. As such there is a shortfall of approximately 260ML.[450]

7.59 The Tumbarumba Shire Council indicated that 'preliminary design and environmental studies have been underway for the past 12 months'.[451]

Other proposals

7.60 Other inquiry participants suggested multiple options for the construction of new storages in New South Wales. The Griffith City Council, for example, provided several potential sites which have already undergone considerable research and detailed planning, and called on the NSW Government to conduct a feasibility study for the implementation of these dams and any other related schemes:

- Construction of the Gateway Dam on the Murray River
- Lake Mejum storage

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448 Submission 37, Bathurst Regional Council, p 1.

449 Submission 47, Forbes Shire Council, p 2.

450 Submission 50, Tumbarumba Shire Council, pp 1-2.

451 Submission 50, pp 1-2.

- By 1975 some 14 dam sites had been examined on the Murrumbidgee River and its major tributaries, 13 of these were located above Gundagai
- Appropriate sites for dams on the Murray, Clarence, Kiewa and Buffalo Rivers
- Transfer excess flows from Clarence Catchment west to Darling River (The 80m Contour Dam)
- Increased capacity of existing storages.[452]

7.61 NSW Farmers – Griffith Branch similarly suggested a range of sites, though it acknowledged that the decision to build more dams must occur in consultation with engineers, hydrologists and communities:

- Dams on some of the Queensland rivers that run into the Darling
- Near Holbrook on the Billabong Creek
- Shoalhaven River
- East of Wagga Wagga
- East Coast of Australia - plenty of area to recapture this resource
- Completing the Chowilla Dam
- Dams below the Hume Dam
- Increasing other dams storage capacity
- East of Narrandera
- Dams near Tarcutta, Jugiong, Kyamba Creeks.[453]

Opposition to specific proposals

7.62 Some inquiry participants opposed to the construction or augmentation of water storages raised concerns regarding specific locations and urged against the construction of new storages or augmentation works in those areas. The Committee also received a significant response from stakeholders opposed to proposals that have been considered in recent years, namely, the Byrrill Creek and Clarrie Hall proposals for the Tweed Shire, and the Tillegra Dam and Native Dog options for the Hunter Valley. Views in relation to these specific proposals are presented in turn below.

Clarence

7.63 The Committee heard that there was strong opposition to proposed new storages on the Clarence River. Ms Judith Melville, for example, was opposed to any proposal to dam or divert water from the Clarence River:

> Any recommendation to increase water storage capacity, investigate further water extraction or water diversion from the Clarence River catchment cannot be supported on environmental or economic grounds and, is not supported by empirical evidence and/or established science.[454]

452 Submission 19, Griffith City Council, pp 6-7.

453 Submission 73, p 5.

454 Submission 90, Ms Judith Melville, p 8.

7.64 Similarly, Mr and Mrs Bricknell, residents of the Clarence Valley, asserted that any damming or diversion of the Clarence River and its tributaries '[e]cologically … would be a disaster, as has been proven with diversions of other rivers'.[455]

7.65 Indeed, proponents of schemes to dam the Clarence also noted that such proposals are unpopular at a community level. For example, Mr David Coffey commented on the widely held and 'vocal "no dams at any cost" view',[456] while Mr Ibbotson noted the 'very strong community feeling' which resulted in "The mighty Clarence – Not one drop" campaign.[457]

7.66 Mr Harriss advised the Committee that investigations into the construction of a dam on the Clarence River have 'shown that it would be both uneconomic and have significant environmental impacts'. He explained that the catchment area would necessitate construction lower down the River which would result in prohibitively high pumping and tunnelling costs:

> In the coastal ranges further north around the Clarence to get that catchment area to fill the dam you have to have the dam located further down to get enough water so it cannot be at the top. Further down you locate that dam, the higher the pumping cost to get the water back over the top or the tunnelling cost to get it through the dam. For that reason it has shown that it would not be economically beneficial to construct a dam to divert water from the coastal side into the western side …[458]

Shoalhaven

7.67 The Shoalhaven City Council raised concerns regarding proposals for a new dam on the Shoalhaven River. It urged the Committee 'in the strongest terms that the inquiry should reject any proposal to resurrect the Welcome Reef Dam project'.[459] The Council contended that 'key strategic water planning documents for Sydney demonstrate that a new dam on the Shoalhaven River is not required nor is it on a planning agenda from a technical perspective'. The Council included an excerpt from the 2004 Metropolitan Water Plan in support of its position:

> There is no need for a twelfth dam. Another dam would be very costly from a financial and environmental perspective with an estimated cost of over $2,000 million for Welcome Reef Dam. The same dam would be very shallow with a large surface area, meaning that evaporation rates would be extremely high and increase the potential for toxic blue-green algae outbreaks. It would take nearly 10 years to build and fill under average conditions and up to 30 years if current drought conditions continue. A new dam would not make the most of the existing infrastructure and so it is far more effective to extend our current system as proposed in this Plan.[460]

Tweed Shire

7.68 The Tweed Shire Council informed the Committee that since 2010, it had identified or recommended two preferred options for increasing water storage capacity :

455 Submission 107, Mr B and Mrs C Bricknell, p 1.

456 Submission 2, pp 2-3.

457 Mr Ibbotson, Evidence, 3 May 2013, p 26.

458 Mr Harriss, Evidence, 20 August 2012, p 12.

459 Submission 63, Shoalhaven City Council, p 12.

460 Submission 63, pp 9-10.

- increasing the capacity of the existing Clarrie Hall Dam at Doon Doon Creek; and
- building a new water storage on Byrrill Creek.[461]

7.69 Tweed Shire Council expressed concern that the Byrrill Creek option has been specifically prohibited through the Water Sharing Plan for the Tweed River despite a proposal for a dam at the site having been 'public knowledge' and part of the Council's Local Environment Plan since the mid-1980s. Further, the Council informed the Committee that it has purchased the majority of property likely to be inundated by a future dam. Consequently, it advocated that the decision to prohibit construction of a new water storage on the Byrrill Creek be reconsidered:

> Council has requested this decision be reconsidered. Council is not asking the government to support the proposed dam on Byrrill Creek. As with all new dams or dam raisings a robust and transparent environmental assessment process will be required to ensure the most appropriate decision is made. Council's concern is that Byrrill Creek was singled out from all other (third order or higher) streams within the Tweed River Area for prohibition of a water supply work approval in the Water Sharing Plan without any due and transparent assessment process.[462]

7.70 At the same time, a number of submissions from groups and individuals opposed to the construction of any new dams on the Tweed expressed particular concerns regarding the augmentation of Clarrie Hall Dam or a new storage at Byrrill Creek.

7.71 The Australian Labor Party (ALP) – Murwillumbah Branch expressed opposition to new the storage proposals, asserting that 'current water storages in the Tweed Shire are adequate' and that 'Clarrie Hall Dam will adequately supply the Tweed Shire until 2035'.[463] It also raised doubts regarding the basis and philosophy of the proposals:

> Both these proposals are based on what we believe to be a potentially disastrous combination of inaccurate data on which the projected water demand is based, together with a mentality that any dam is a good thing. [464]

7.72 The Caldera Environment Centre expressed a similar view, that current water storages are adequate for the Shire and suggested that alternative options had not been considered:

> In the Tweed Shire the existing water storages will be able to satisfy demand up until 2035 and population growth is slowing … which means that expected demand forecasts will be delayed. The Tweed Shire Council has implemented minimal water saving or recycling technologies, and is now considering the need to augment its water supply through increasing existing dam capacity or construction of a new dam.
>
> Existing storages are fine, and adequate to meet current needs, however, they need to be complemented by 21st century water saving technologies and public education that aims to increase social acceptance of water recycling technologies. This will prevent

461 Submission 35, p 1.

462 Submission 35, p 5.

463 Submission 82, ALP – Murwillumbah Branch, p 1.

464 Submission 82, p 2.

> the need to augment water supplies by increasing existing dams or building new ones.[465]

7.73 The Byrrill Creek Land Care Group and Save Byrrill Creek Group also contended that current storages on the Tweed are adequate and will continue to be sufficient for the future if combined with water saving technology for new urban developments. [466] Further, they asserted that there would be a 'huge public outcry' for environmental reasons if construction at Byrrill Creek were approved:

> With 45 threatened fauna species, 26 flora species, and 2 Endangered Ecological Communities recorded in the Byrrill creek locality, of which 24 are listed in the Federal [*Environment Protection and Biodiversity Conservation Act 1999*], we would like to point out that the approval will be challenged every step of the way. In the end it will be thrown out by the Federal Government, just as the Traveston Dam was.[467]

7.74 The Tweed Heads Environment Group informed the Committee that it 'agrees that Council and its ratepayers require certainty regarding the additional secure yield' but cautioned that attempting to provide that yield via the construction of a single water storage would be 'risky' in terms of both guaranteed supply and cost: [468]

> Building an expensive proposed Byrrill Creek Dam in the same drought prone Tweed River Catchment as the algae prone Clarrie Hall Dam in a climate changing environment is very risky … The reuse of Tweed urban reclaimed water, occurring elsewhere in Australia, can provide a secure water future for the Tweed Shire, and should be put in place.[469]

Hunter Valley

7.75 The Committee understands that the proposal to construct Tillegra Dam, announced by the NSW Government in 2006, was formally rejected in 2010 on environmental grounds.[470]

7.76 According to the No Tillegra Dam Group, the Tillegra Dam proposal and indeed any proposal for a new dam in the Hunter would contravene the objectives of the Lower Hunter Regional Strategy, the NSW State Plan and the *Water Management Act 2000*:

> The current Lower Hunter Regional Strategy's key objectives include maintaining and improving biodiversity, protection of natural and rural assets, promoting growth through provision of housing and jobs and providing for growth. Hunter Water's Tillegra Dam proposal contravened at least four of these objectives, namely, maintaining diversity, improving diversity, protection of natural assets and protection of rural assets. This would be so for other dam proposals in the Hunter, and particularly so in the Tillegra precinct.

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465 Submission 49, p 7.

466 Submission 68, Byrrill Creek Land Care Group and Save Byrrill Creek Group, p 4.

467 Submission 68, p 4.

468 Submission 39, Tweed Heads Environment Group Inc, p 9.

469 Submission 39, p 9.

470 *LA Debates* (1/12/2010) 28733-28734.

> A new dam in the Hunter would be contrary to the NSW State Plan (PriorityE4) which requires: better outcomes for native vegetation, biodiversity, land, rivers and coastal waterways. Dams in the Hunter would also be contrary to the *Water Management Act 2000*, which places priority on the protection or restoration of water dependent ecosystems as well as protecting, preserving, maintaining or enhancing the important river flow dependent ecosystems of the catchment's water sources.[471]

7.77 The No Tillegra Dam Group also expressed concern about the proposed Native Dog Creek Dam, arguing that, 'because this dam is virtually on the same site as Tillegra Dam, it would have the same environmental and socio-economic impacts as the original Tillegra Dam proposal'.[472] Similarly, the Total Environment Centre criticised the close proximity of the Native Dog Creek Dam to the proposed Tillegra site, arguing that it would have similar environmental impacts to Tillegra Dam and is not required for the same reasons.[473]

7.78 The Hunter Environment Lobby echoed these views, stating that it 'supported the NSW Government decision to not approve the Tillegra Dam because of likely significant impacts on the Hunter Estuary system'. Specifically, it cautioned that the proposed Native Dog Creek Dam is likely to have a similar detrimental impact of reducing the remaining freshwater flows to the estuary system, which would then 'have negative economic impacts on the estuary fishing and prawning industry and on the internationally significant wetlands and migratory bird habitats'.[474]

7.79 Ms Bettina Damme expressed opposition to the construction of any new dams in the Hunter area, citing her concern for the potentially threatening environmental impacts:

> We do not need new dams in the Hunter area. Dams change the natural flow of rivers and in doing so affect the ecosystems. This will lead to the disappearance of our aquatic wildlife. This will also have a detrimental effect on the animals who rely on the floodplains and also lead to the destruction of trees and our precious wetlands.[475]

7.80 Other inquiry participants were critical of the impact that the consideration of the Tillegra Dam has had upon the local community. Mr Harold Johnston commented that:

> The Tillegra Dam is now off the agenda and the reasons are many and well documented … any proposal anywhere else in the State needs to be given full consideration of community impacts well before land acquisition, engineering feasibility etc etc so that no other community has to endure that which Dungog has been forced to endure by a state owned corporation.[476]

7.81 Similarly, Mr Tom Boorer observed that the Tillegra Dam 'has been rejected on almost every count that exists' and was critical of the reconsideration of a scheme which had been 'discredited, and found wanting' multiple times, and which had, in his view, a negative impact on the Dungog community.[477]

471 Submission 66, No Tillegra Dam Group, p 3.

472 Submission 66, p 7.

473 Submission 18, Total Environment Centre, p 2.

474 Submission 46, Hunter Environment Lobby Inc, p 2.

475 Submission 72, Ms Bettina Damme, p 1.

476 Submission 20, Mr Harold Johnston, p 1.

477 Submission 85, Mr Tom Boorer, p 1.

7.82 The No Tillegra Dam Group suggested that future water storage solutions for the Lower Hunter would be through water conservation and demand management rather than through building new dams:

> Analysis by Institute for Sustainable Futures (ISF) found that by implementing water conservation and demand management programs, similar to those currently in place in Sydney, all future water needs of the Lower Hunter region can be adequately met for, at least, the next 40 years. This alternative analysis maintains acceptable levels of water security without requiring new dams, while still accounting for the high-end prediction of population growth in the Lower Hunter region.[478]

7.83 The Hunter Environment Lobby also suggested that '[I]n the unlikely event that future shortfalls in water supply occur in the Hunter Region, then the cheapest and most effective way to respond is through more effective demand management measures and more efficient water usage'.[479]

Better use of existing water supply

7.84 Like certain stakeholders in the Clarence and Hunter Valley areas, a number of other inquiry participants strongly contended that there is no need to build new water storages or increase the capacity of existing ones. Instead they argued that better management of existing water resources would be a more effective and efficient way to increase the amount of water available for consumptive, industrial and irrigation purposes, citing the significant social, environmental and financial costs of constructing new dams.

7.85 The Nature Conservation Council of NSW advised that its water policy calls for no further construction of dams on waterways.[480] Similarly, the Inland Rivers Network stated that it does not support the construction new large water storages and instead argued that the improved management of efficient water use 'including the cessation of wasteful flood irrigation practices' would be a more cost effective approach.[481] Further, the Inland Rivers Network contended that the construction of additional storages would contravene the State's commitments under the NSW State Plan and the Murray Darling Basin Plan, noting that constraints within the Basin river systems are a key factor in delivering environmental flows. The Network also argued that the current level of water storage in New South Wales is adequate.[482]

7.86 The No Tillegra Dam Group suggested that rather than construct new storages, greater effort should be made to explore lower impact options to ensure sufficient water supplies:

> Dams cause significant economic, environmental and social costs. These costs include the financial burden to water rates payers, the debt burden on a State owned enterprise, the loss of river ecosystems and serious threats to biodiversity. Other

478 Submission 66, p 2.

479 Submission 46, p 2.

480 Submission 104, p 2.

481 Submission 78, Inland Rivers Network, p 2.

482 Submission 78, p 2.

> options, therefore, should be explored, based on the lowest impact for the required water.[483]

7.87 Similarly, the Hunter Environment Lobby argued that existing water storages are adequate for current and future needs, underscoring the already poor state of the Hunter River:

> [N]ew dams will cause significant environmental damage and provide no long-term economic and social benefits. The Hunter River is already over allocated and has suffered significant environmental damage from the combined impacts of large water impoundments, increased usage by the power and mining industries and damage to rivers and groundwater systems caused by coal mining operations.[484]

7.88 The ALP – Murwillumbah Branch also opposed the construction of additional water storages, contending that 'dams have unintended consequences and defy logic'. It argued that the 'idea of locating water supply in huge dams is obsolete and ineffective',[485] and highlighted several factors in support of the view that large scale water storages are no longer a viable option, including the:

- initial cost
- possibility of environmental degradation and species threat
- land resumptions necessary for construction
- concerns around public health
- lack of environmental flows in waterways
- potential for catastrophic failure.[486]

7.89 Similarly, the Total Environment Centre opposed the construction or augmentation of water storages on the basis that dams represent 'outmoded thinking' on water supply when attention should instead be focussed on 'recycling, water use efficiencies and demand management'.[487]

7.90 A significant number of individual contributors to the inquiry advocated against increasing the capacity of water storages in New South Wales through the construction or augmentation of storages.[488] Mr Ken Kneipp, for example, argued that 'dams should be a last resort' for several reasons, including:

- water saving measures have broad community support
- dams have a high impact on native vegetation and fauna and dislocate communities who are forcibly removed to facilitate construction
- dams are expensive and represent 1950s planning and technology

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483 Submission 66, p 1.

484 Submission 46, p 1.

485 Submission 82, p 4.

486 Submission 82, p 3.

487 Submission 18, p 2.

488 See for example Submission 23, Ms Sally Corbett, p 1; Submission 53, Mr Tom Colley, p 1; Submission 57, Name suppressed, p 1; Submission 59, Mrs Josephine New, p 1; Submission 61, Ms Carol Pasenow, p 3; Submission 65, Mr Richard Stanford, p 1; and Submission 77, Name suppressed, p 2.

- water saving measures have proved highly successful in managing water consumption. Sydney is a prime example.
- constructing more dams is contrary to the *Water Management Act 2000*
- rivers in NSW are threatened and most are under moderate to severe strain. We simply cannot dam every river.[489]

7.91 Mr Brian Doherty asserted that large dams carry 'unacceptable social, financial and ecological costs' and that consequently the 'current trend is to decommission them'. He expressed support for water conservation and demand management strategies whose costs are low by comparison.[490] Ms Linda Bowden advocated for alternative water management methods on the basis that they bring greater benefits to communities through the creation of sustainable employment:

> Dams don't create jobs … Whilst it is true that the construction of dams create short-term jobs, it is equally true that jobs are lost when large agricultural areas are purchased for a dam site. Should the Government look at alternative water capture methods and upgrades, thousands of long term, sustainable jobs are generally created in industries such as water tank construction, plumbing, electricians, delivery services, hardware services, pumps and other related machinery, as well as supporting apprenticeships and ongoing labouring jobs.[491]

7.92 Mr Harriss, NSW Office of Water, acknowledged that new water storages are expensive to build, operate and maintain and advised that a key determining factor is whether the expense of building a new dam will deliver a true cost benefit. Mr Harriss argued that the focus should be on 'maximising the benefits provided by the existing infrastructure and augmenting existing infrastructure before we build new infrastructure'.[492]

7.93 En-route storages and the strategic linking of storages or supply emerged as alternatives to new water storages that could enhance water capacity without increasing water extraction. Each of these is examined below.

En-route or on line storages

7.94 En-route storages were recommended by many inquiry participants as a viable water management option to extend the water capability of some areas of the State without further extraction. Such storages generally do not increase the catchment area or capture unregulated water, and unlike large dams, are not located upstream or at the headwaters of a river system. Rather, they are located along a river system, downstream from an existing larger storage, and are designed to re-capture water that has been released. En-route storages can include smaller dams, weirs, lakes and pools. The various advantages identified in respect of en-route storages are discussed below.

489 Submission 34, Mr Ken Kneipp, p 1.

490 Submission 87, p 3.

491 Submission 64, Ms Linda Bowden, p 1.

492 Mr Harriss, Evidence, 3 May 2013, p 8.

Reducing water transmission losses

7.95 The NSW Irrigators' Council strongly advocated for the consideration of en-route storages on the basis that they allow water that has already been released to be re-captured 'so it can still fulfil its productive capacity':[493]

> This type of storage could be utilised when water is being delivered from a dam and an event occurs which either fulfills or cancels the need of those who ordered the water. By "parking" the ordered water in storage it may then be used more efficiently by meeting future requirements instead of flowing unused through the system.[494]

7.96 Indeed, Mr Moore, supported the flexibility provided by en-route storages as short term solutions for recapturing released water. He commented that 'ordering water is something that happens on a constant basis … it might not take very long for that water to be moved on and fulfil another order'.[495]

7.97 Griffith City Council highlighted that in the length of time it takes for ordered water to reach its destination, variables in weather can render the order unnecessary. They argued that strategic en-route storages would provide flexibility in the delivery system by allowing excess water to be held over and then sent down the river at a later time.[496] Ms Virginia Tropeano echoed these views, commenting that:

> It takes five to six days for water that is released from Burrinjuck to get to the Murrumbidgee Irrigation Area, which is a fair length of time and anything can happen weather-wise in the meantime. If water can be parked on the way it will have less distance to travel and the management would be better.[497]

7.98 Mr Paul Braybrooks, Chairman, REROC, and Councillor, Cootamundra Shire Council, also supported the consideration of en-route storages as an efficient water management tool, arguing that this approach would reduce water transmission losses, as water could be released from dams and parked in weirs awaiting use.[498]

Evaporation

7.99 Some inquiry participants noted that evaporation can be relatively high with en-route storages as they are generally shallow and have a higher surface area to volume ratio. However, these stakeholders contended that rather than being a problematic or prohibitive factor, such evaporation associated can contribute positively to the availability of water in a local system. Ms Virginia Tropeano, for example, argued that evaporation is not a loss of water, but rather a relocation of it:

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493 Answers to questions on notice taken during evidence 16 November 2012, Mr Moore, NSW Irrigator's Council, p 5.

494 Submission 97, NSW Irrigators' Council, p 7.

495 Mr Moore, Evidence, 16 November 2012, pp 14-15.

496 Submission 19, Griffith City Council, p 7.

497 Ms Tropeano, Evidence, 16 November, 2012, p 22.

498 Mr Paul Braybrooks, Chairman, Riverina Eastern Regional Organisation of Councils, and Councillor, Cootamundra Shire Council, Evidence, 1 November, 2012, p 12.

> Water that evaporates … goes up into the atmosphere and falls somewhere else as rain. I know that after the construction of the Coleambally irrigation area the rainfall at Lockhart went up 100 millilitres because you have that extra area of rice paddocks for the evaporation to come off. I do not think that evaporation is necessarily water lost. If there are no deep water sites I still think sites need to be considered because evaporation is not lost, you get rain somewhere else.[499]

7.100 Ms Buller echoed these sentiments but cautioned that evaporation should not be used 'as an excuse not to do something', contending that some water storage is better than none:

> It is the degree of evaporation. For instance, if you had a 140,000 megalitre storage facility and you lost 40,000 megalitres to evaporation, you would still have 100,000 megalitres of water that you can wisely use. No-one likes to lose any but that is still 100,000 megalitres better than zero.[500]

7.101 Mr Ron Pike asserted that 'there is no more important link in the chain of life than evaporation' and asserted that if en-route storages are not built 'then all of the excess water is lost to the sea where it evaporates anyway. This is a loss to production, a loss to the environment and a loss to the economy'.[501] Mr Pike emphasised that this is particularly important when considering en-route storages in the Murray Darling Basin, where he argued there are several eligible options for en-route storages on the plains.[502]

Flood mitigation

7.102 Other inquiry participants suggested that en-route storages could provide flood mitigation. Mr Paul Braybrooks reported that 'when there was an anticipation of a flood event, you would create quite an air space in these to allow the slowing of the floodwater as it came down the river to be held back for a short time'.[503] Ms Tropeano expressed a similar view and contended that flood mitigation should occur on a whole-of-valley basis with various constructions en-route:

> If a flood is happening it takes a fair while for the water to come down and water can be released from other storages if you have smaller storages on the way down. That will create air space for the floodwater as it comes down and will slow it down. Instead of the floodwater racing down it will be slowed down and the storages would allow it to be dealt with and managed more successfully.[504]

7.103 Ms Julie Briggs, Executive Officer, REROC, advised the Committee that she supports the construction of en-route storages for the 'primary purpose' of 'flood mitigation and to slow down the river'.[505]

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499 Ms Tropeano, Evidence, 16 November, 2012, p 28.

500 Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association, Evidence, 16 November, 2012, p 28.

501 Submission 3, Mr Ron Pike, p 21

502 Submission 3, p 21

503 Mr Braybrooks, Evidence, 1 November, 2012, p 14.

504 Ms Tropeano, Evidence, 16 November, 2012, p 22.

505 Ms Julie Briggs, Executive Officer, Riverina Eastern Regional Organisation of Councils, Evidence, 1 November, 2012, p 15.

Slow release of water to reduce the impact of fast high flows

7.104 Inquiry participants also commented on the ability of en-route storages to reduce the rate at which water flows through a system with regards to planned releases of irrigation water, and argued that such storages could minimise the impact of fast high flows associated with the provision of ordered water from larger dams. Ms Briggs, for example, suggested that en-route storages could also provide the ability for State Water to release irrigation water in stages instead of all at once.[506]

7.105 Indeed the REROC suggested that en-route storages, specifically the construction of weirs, may alleviate problems for users along the Tumut River:

> Weirs could serve several purposes, firstly allowing water to be released more slowly from water storages. It is our understanding that water that is currently released for irrigation comes down the Tumut River at a very fast pace … We believe the use of weirs would mitigate this by allowing releases to occur in a staged way which would lessen the speed at which the water was released from the dam resulting in less impact on fish habitat.[507]

7.106 Ms Buller shared the view that en-route storages could provide a solution to users along the Tumut River, commenting that they 'will help mitigate the problem because not so much water will have to be sent down straight out of Blowering in massive amounts'. She also suggested that this approach would be beneficial to lower parts of the Murrumbidgee and Murray Rivers:

> In a lot of ways the lower Murrumbidgee and parts of the Murray are damaged even more seriously than the Tumut River … by exactly the same thing—high flows and sudden low flows and the banks collapse, the red gums fall in and that creates more problems and it just goes on and on. It is created by severe fluctuations. If you do not have en-route mitigations to look after those situations the problem will keep happening.[508]

Proposals

7.107 Some inquiry participants suggested locations for en-route storages. Namoi Water proposed the construction of a weir or low level diversion channel in the Talyawalka/Teryaweynya Creek system.[509] Lachlan Shire Council proposed a minor weir west of Condobolin on the Lachlan River[510] and a new weir halfway between Jemalong and Lake Cargelligo.[511] Cotton Australia suggested that, 'There may be some capacity to build new dams within the Murray Darling Basin if they are designed to improve the efficiency of current water use rather than allow for increased extraction'. [512]

506 Ms Briggs, Evidence, 1 November, 2012, p 14.

507 Submission 109, Riverina Eastern Regional Organisation of Councils, p 4.

508 Ms Buller, Evidence, 16 November, 2012, p 22.

509 Ms Jon-Maree Baker, Executive Officer, Namoi Water, Evidence, 6 March 2012, p 22

510 Submission 16, Lachlan Shire Council, pp 1-3.

511 Submission 16, p 3.

512 Submission 100, pp 6-7.

7.108 Other stakeholders including Mr Ron Pike, the NSW Irrigators' Council and the Murrumbidgee Valley Food and Fibre Association, recommended the construction of en-route storages downstream of Burrinjuck Dam on the Murrumbidgee River, and identified a site east of Narrandera as particularly suitable. Further, Mr Pike contended that, '[W]e must have downstream storages on our major regulated rivers'.[513]

Linking supply

7.109 As another alternative to building or augmenting dams, some stakeholders contended that it is possible to increase yields and maximise the State's water capacity by strategically linking storages and even catchment areas. For example, NSW Farmers suggested that significant savings could be achieved by upgrading supply infrastructure and replacing delivery channels with piping.[514] The Central NSW Councils proposed a supply and distribution network of pipes 'around the Central West to drought-proof it so that we can support whatever industry is out there'.[515]

7.110 Mr Tom Mollenkopf, Chief Executive, Australian Water Association, explained the importance of linking supply to ensure future water security through investment in infrastructure:

> Another big contributor to water security, from an infrastructure perspective, is it is not just about the dams, it is about the conveyance mechanisms and grids. We have seen some very helpful things done in regional Australia linking towns with nearby catchments where in one catchment you might have a less reliable rainfall or less storage capacity and it is important to link across to neighbouring catchments. We all know it can be pouring with rain in St Leonards and you can be sunning yourself on the beach at Bondi. The ability to interconnect catchments is important as is maintaining those systems.[516]

7.111 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority (SCA), also informed the Committee that the SCA is involved in long term water supply planning that seeks to maximise supply through the interconnectivity of catchment areas, as demonstrated through the improved connection between the Nepean and Avon dams:

> Future water supply options could include increases in transfer capacities within the supply ... and new links between the storages to optimise storage operations and increase yields. During the last drought the SCA improved the link between the Nepean and Avon dams so that the previously vulnerable Illawarra supply zone now has better access to additional supplies from the fast responding Nepean Dam and the Shoalhaven system.[517]

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513 Submission 3, p 12; Answers to questions on notice taken during evidence, 16 November 2012, NSW Irrigator's Council, p 5; Ms Tropeano, Evidence, 16 November, 2012, p 21.

514 Submission 95, p 6.

515 Mr Garry Styles, Central NSW Councils, Evidence, 16 November 2012, p 37.

516 Mr Tom Mollenkopf, Chief Executive, Australian Water Association, Evidence, 16 November 2012, p 4.

517 Ms Sarah Dinning, A/Chief Executive, Sydney Catchment Authority, Evidence, 20 August 2012, p 37.

7.112 Shoalhaven Water explained the connectivity between the Shoalhaven catchment and the Sydney catchment:

> Flows from the Shoalhaven can also be used to supplement Sydney's water supply during a drought. This is achieved by pumping water from Tallowa Dam to Wingecarribee Reservoir in the Southern Highlands. From there it is released and flows down the Wollondilly River to Sydney's Warragamba Dam, or the Nepean River to Nepean and Avon dams, which supply the people of the Illawarra with water.[518]

7.113 The Sydney Catchment Authority informed the Committee that this connective pipeline, which enables the transfer of water from Shoalhaven to the Sydney catchment at Wingecarribee Reservoir, was key to the provision of water to Sydney during the recent drought:

> Between April 2003 and March 2009, 837,674 ML was transferred from the Shoalhaven Scheme to Wingecarribee Reservoir (27% of the amount of water SCA supplied to Sydney Water over this time). The energy cost (excluding GST) was $47,730,442 with an average cost per ML (excl GST) of $57.[519]

7.114 Other inquiry participants suggested that pipelines could provide key infrastructure to enable the diversion of coastal water to inland regions. Mr Ray Stubbs, Executive Officer, Riverina and Murray Regional Organisation of Councils, informed the Committee that there is potential to convey water from Shoalhaven to the Murrumbidgee and Lachlan systems:

> With regard to Shoalhaven, the Tallowa Pipeline Company, which we referred to in our submission, has briefed us about its proposal. It has been undertaking investigations over a long period and it believes that it can tap surplus flows that in its view are being wasted. That involves a couple of hundred gigalitres a year and moving it into the Murrumbidgee and Lachlan systems. Again, we are not experts, but all of these schemes—be it there or on the Clarence River—should be examined.[520]

7.115 Further, in their submission, the Riverina and Murray Regional Organisation of Councils urged the NSW Government to consider this proposal, asserting that it has 'the potential and capacity to substantially contribute towards the environmental and healthy river requirements of the Murray Darling Basin system, as well as maintaining sufficient water resources for urban requirements and for food production and associated processing and transport industries'.[521]

Further options to enhance water capacity

7.116 Finally, a number of inquiry participants suggested other measures to extend the State's existing water capacity. Mr Doherty, for example, proposed that the development of more efficient desalination technology may eliminate the need to construct water storages:

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518 Submission 63, Shoalhaven Water, p 4.

519 Answers to questions on notice taken during evidence 20 August 2012, Sydney Catchment Authority, Question 1, p 2.

520 Mr Ray Stubbs, Executive Officer, Riverina and Murray Regional Organisation of Councils, Evidence, 1 November 2012, p 37.

521 Submission 29, Riverina and Murray Regional Organisation of Councils, p 2.

> Open dam storages are inherently inefficient. The resource literally evaporates. Dams are also rainfall dependent which makes them a poor source of reliable supply especially when we are moving into a period of greater climatic uncertainty. Luckily most Australian cities are located close to the coast so urban supplies can benefit from desalination options … there needs to be Government support for developing flexible desalination technologies that can respond to changing demand requirements.[522]

7.117 The Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales, suggested that rather than construct any additional storages, water saving measures could be achieved through a change in rules that prescribe limits to individual storage volumes in dams:

> Storages are rarely full and there are opportunities to better utilise the airspace. Currently, the volume of water that individual water users can store in a dam is restricted. This results in low dam volumes, because many irrigators needing to store large volumes of water have transferred their water to private off-river storages. These off-river storages are expensive to construct and are situated on floodplains where significant evaporation losses. An alternative water management option is to remove the restriction on individual volume in the dam, allowing users to accrue as much water as they require. This makes better use of existing storage space and reduces evaporation losses for irrigators.[523]

Committee comment

7.118 The Committee believes that while dams play an integral and essential part of the water security strategy of the State, there is potential to extend the use of current water resources through more cost effective and strategic means.

7.119 In particular, the Committee believes that en-route storages have the potential to deliver a more flexible management approach in areas heavily regulated for productive and environmental purposes, which is worth investigating. We note the capacity of en-route storages to re-capture released or regulated water for later use in downstream areas which may otherwise flow unused through a system, thereby maximising water availability without the need for further extraction or the capital costs of a major storage. In particular, we see value in en-route storages as potentially beneficial to the management of the Murray Darling Basin, which has high demand from multiple users and prescribed limits on extraction.

7.120 The Committee also notes that en-route storages reduce reliance on single, large reservoirs and provide flexibility in water supply and water management. This would be consistent with a more integrated approach in achieving future water security for New South Wales, as discussed in the following, final section of this report.

7.121 In addition, the Committee sees merit in the greater use of pipelines to improve efficiency by reducing water losses, and in providing flexibility by linking storages and catchment areas.

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522 Submission 87, p 2.

523 Submission 26, pp 6-7.

Recommendation 15

That the NSW Government investigate the potential of strategically placed en-route storages to extend water use and provide flexibility in water delivery in some river systems, particularly in the Murray Darling Basin.

An integrated approach

7.122 Throughout this inquiry, stakeholders have been unanimous in expressing the belief that a secure and resilient water supply is essential to the prosperity of the State. However, their views on how future water security should be achieved have diverged. While some have argued strongly either for or against the construction of additional water storages, some have suggested that currently, water demands are met through a range of measures and have advocated that the future for New South Wales rests firmly in the continued and enhanced integration of water saving, capturing, storage and river management options (for example, the Computer Aided River Management (CARM) system) to provide a holistic and effective approach to water management in both urban and rural contexts.

7.123 The Caldera Environment Centre, for example, argued that, 'No one water supply or storage option is itself adequate and a variety of options need to be considered in tandem in order to ensure the sustainability of the water supply'.[524] Further, it argued that while '[d]ams are certainly part of the overall water supply matrix' they 'should not be seen in isolation from other water saving and recycling technologies, but as one input among many'.[525]

7.124 Similarly, Monash Water for Liveability argued that the resilience of urban water systems is at its strongest when multiple water sources are accessed through a range of infrastructure solutions. It also contended that the way we plan, design and manage water systems and services 'must move beyond traditional approaches to a "water sensitive" approach':[526]

> The way in which we utilise and manage water storages, in both urban and rural settings, is intrinsically linked to the wider water system. A holistic approach is therefore required when reviewing the adequacy of water storages to meeting current and future needs. This holistic approach needs to consider contemporary strategies for securing higher levels of water supply security and resilience that are based around a diversity of water sources and distributed storages as important elements of system-wide storages and water efficiency.[527]

7.125 Mr Mollenkopf of the Australian Water Association argued that a variety of water management options are necessary for the State's water security because sites for new dams in New South Wales are limited:

> New South Wales has very limited options. From the point of view of our next supply argumentation or water security measure, that is why those other portfolio responses are critical. I mentioned dam recycling and water efficiency. What I did not mention is

524 Submission 49, p 11.

525 Submission 49, p 2.

526 Submission 105, Monash Water for Liveability, p 1.

527 Submission 105, p 3.

> some of the really interesting things being done with cities as catchments … Stormwater recycling and also on-site capture and treatment.[528]

7.126 Mr Ron Pike, however, expressed a contrary view, contending that, 'There are hundreds and hundreds of sites to economically and efficiently build dams in New South Wales'.[529] Mr Pike advised that further storages would 'increase the volume of stored water and improve stream flow reliability for all users'.[530]

Securing against increasing climatic variability

7.127 Throughout the inquiry, stakeholders cited the impact of increasing climatic variability on the security of the State's water supply, with some suggesting that this presents a strong argument against reliance on single water storage options.

7.128 The Nature Conservation Council of NSW argued that dams themselves are no assurance of secure water supply as they are fundamentally rainfall dependent. However, combined with demand management programs, they have the capacity to meet our existing needs.[531] Monash Water for Liveability suggested that, 'The introduction of integrated water management strategies together with the adoption of water sensitive planning, design and management can reduce urban water demands from centralised water reservoirs and increase resilience to future variability and uncertainty.'[532] The Wine Grapes Marketing Board also expressed the view that in the face of challenges due to climate variations, 'More predicative models of weather need to be utilised to reduce potential wastage. If better technologies in forecasting and ordering of consumptive water is coupled with online storage methods changes directly related to climate change losses can be minimised'.[533]

Strategies

7.129 The Total Environment Centre advocated strongly for investment in recycling water for industrial and agricultural use, more efficient production processes, capping and piping of irrigation networks, improved demand management, and reform of pricing structures as incentives for both efficiency and investment in water efficiency.[534] The Caldera Environment Centre also called for greater investment in 'water saving and water recycling technologies' arguing that they are more financially and ecologically sustainable than building new dams.[535]

7.130 The Nature Conservation Council of NSW called for the investigation of innovative demand management and recycling to make the most effective use of our existing water infrastructure, and outlined a range of strategies to this end:

> The most practicable option for future water supply development would be augmentation of existing schemes through recycling systems that use the existing

528 Mr Mollenkopf, Evidence, 16 November 2012, p 6.

529 Mr Ron Pike, Evidence, 3 May 2013, p 22.

530 Submission 3, pp 24-25.

531 Submission 104, p 3.

532 Submission 105, p 1.

533 Submission 52, p 4.

534 Submission 18, p 4.

535 Submission 49, p 12.

> storages as holding and cleansing reservoirs. Investment in reticulation systems that would collect stormwater and wastewater for treatment and return to storages would be worthy of close examination. Even recycling for potable water supply has been safely practised in many overseas countries very successfully over a long time however community reaction is ill-informed and emotional in Australia. This is the key to future development of water resources in NSW.[536]

7.131 Rous Water advised the Committee that alongside the proposed Dunoon Dam, it would be considering a suite of options to ensure a secure water supply for its communities into the future:

- desalinisation
- groundwater
- stormwater harvesting for potable and non-potable use
- indirect potable reuse and non-potable reuse of wastewater
- regional water access within the Richmond Regulated Water Source.[537]

7.132 The Tweed Heads Environment Group outlined their suggestions for an integrated approach to water management in an urban setting:

> [F]urther improvements to water security for urban communities should be approached using a comprehensive and consistent 'integrated urban cycle water management' (IUWCM) strategy which includes 'fit for purpose' water use, the promotion of alternative water sources, and the deployment of decentralised systems, where deployment is cost effective.
>
> The water sensitive cities project (WSC) concept embraces a range of water management techniques, including stormwater harvesting, flood management, urban water recycling and reuse programs, urban rainwater harvesting and urban water use efficiency programs.[538]

7.133 Mr Brian Doherty contended that, 'There is great scope to use our existing water supplies more wisely in order to meet demand' through a variety of measures such as onsite collection and storage, domestic and industrial water saving technologies, separating potable and non-potable supply use, and options for reuse and reprocessing'.[539]

7.134 Mr Harry Johnson suggested that greater use could be made of rainwater tanks as a viable option for reducing reliance on centralised water storages for non-potable uses in both domestic and non-domestic settings:

> [R]ainwater tanks could be manufactured and installed at homes, schools, hospitals, offices and factories … Rainwater tanks are, in effect, mini-water storages that capture rainwater exactly where it falls. Stored rainwater is now used directly on-site for gardens, outdoor washing uses, toilets and washing machines. The stored rainwater

536 Submission 104, p 4.

537 Submission 6, p 2.

538 Submission 39, Tweed Heads Environment Group Inc, p 6.

539 Submission 87, p 1.

> would be used for non-potable uses only and thus there would be no expensive treatment cost as well as a minimal on-site distribution cost.[540]

7.135 Mr Terence Hogan, Chair, Riverina and Murray Regional Organisation of Councils, and Mayor, Jerilderie Shire Council, suggested that, '[I]nnovative solutions involve looking at the big picture, whether that is water diversion, water storages or other means, better management, Water for Rivers or CARM-type projects'. He advocated that innovation 'should be fostered and nurtured to see if we have some better solutions'.[541]

7.136 The NSW Irrigators' Council expressed the view that Australia is a leader in irrigation methods and technologies, and suggested that, 'The sharing of information and knowledge between groups and individuals is what will drive further innovation in the industry'.[542] Mr Harriss confirmed that Australia and New South Wales are considered leaders in water management:

> We are frequently identified and used as case studies around the world … They have looked at how we have gone through the recent drought and … have said that it is these innovations which have put Australia well ahead of anyone else and as a consequence people are coming in and saying, "Tell us how it works."[543]

7.137 Some inquiry participants noted a correlation between increasing use of innovative technologies and behavioural changes in demand management practices. In their joint submission, the Byrrill Creek Land Care Group and Save Byrrill Creek Group argued that '21st century water saving technologies and public education that aims to increase social acceptance of water recycling technologies … will prevent the need to augment water supplies by increasing existing dams or building new ones and ensure NSW is encouraging sustainable solutions for the future'.[544] The Nature Conservation Council echoed these views, adding that, 'Building expectations of communities that water supply will be continually expanded is flawed'. Instead they contended that:

> Communities need to adapt to variations in security of supply. There will always be uncertainties and risks that need to be clearly understood and put up front in any assessment of water use schemes.[545]

7.138 The Wilderness Society Newcastle similarly noted the adaptability of communities to changes in water management and the integration of new technologies:

> We maintain that sustainable alternatives in water conservation and demand management strategies are often more cost effective, socially, economically and environmentally. BASIX [Building Sustainability Index], recycling and other such sustainable initiatives will reduce the need for large water supply storages in the future. Already, initiatives based on these principles are undermining the assumed necessity of dams, and permanent 'water wise' rules throughout most Australian cities, and surveys

540 Submission 108, Mr Harry Johnson, p 1.

541 Mr Hogan, Evidence, 1 November, 2012, p 39.

542 Answers to questions on notice taken during evidence 16 November 2012, Mr Moore, NSW Irrigator's Council, p 6.

543 Mr Harriss, Evidence, 3 May 2013, p 20

544 Submission 68, p 1.

545 Submission 104, p 3.

> around the country have shown that low-level water restrictions have very high levels of community support.[546]

7.139 Mr Harriss commented on the changing behaviour and attitudes around the State towards water and their positive impact on demand management practices:

> I think there are behavioural changes by people in both rural areas and urban areas and our industries are becoming more and more efficient, not just through the institutional arrangements but water use efficiency technology. By way of example—you have probably heard the example quoted many times—the water use in Sydney despite an increase in 1.5 million people is probably the same as it was in the early 1970s. It shows that people are adopting water use efficiency technology and there has been a change of mindset that you do not waste water. Water is now, by the way, particularly in rural New South Wales, a commodity. It is a highly valuable commodity so people no longer just waste it. If you can trade or if you can carry it over and it is of an economic or financial value to you, you will do that. That is what has really changed the mindset of people as to the manner in which water is used.[547]

7.140 Representatives of the NSW Government advised the Committee on the integrated approach currently practiced by the leading NSW water agencies in managing the State's water resources. Further, they expressed the view that the benefits of investment in improved efficiency may outweigh investment in increased capacity in the form of new storages. Dr Sheldrake of the Department of Primary Industries advised that 'although dams are a fundamental part of Sydney's water supply', New South Wales has developed a 'portfolio of resources' in order to use the water more efficiently.[548]

7.141 Noting that dams are very expensive in terms of capital costs and ongoing operation and maintenance, Mr Harriss recommended that the 'priority for New South Wales is to use that infrastructure as effectively and efficiently as possible in the first instance rather than investing further in up to millions of dollars in capital expenditure':[549]

> They are quite expensive to build and to operate and maintain. The question for government is whether that expense will deliver a true cost benefit. Our argument has been that we should look at maximising the benefits provided by the existing infrastructure and augmenting existing infrastructure before we build new infrastructure.[550]

Committee comment

7.142 The Committee believes that future water security for New South Wales will be achieved more effectively and efficiently by pursuing an integrated approach. The Committee acknowledges the advice of many key stakeholders that dams are very expensive to build, operate and maintain. We also note the NSW Government's advice that the most effective

546 Submission 45, The Wilderness Society Newcastle, p 3.

547 Mr Harriss, Evidence, 3 May 2013, p 16.

548 Dr Sheldrake, Evidence, 20 August 2012, p 13.

549 Mr Harriss, Evidence, 20 August 2012, p 13.

550 Mr Harriss, Evidence, 3 May 2013, p 8.

catchment areas in the State have already been identified and utilised. Other participants gave evidence that further efficient sites are still available.

7.143 The Committee is open to new storages, subject to proper and comprehensive assessment of their costs, benefits, storage efficiency (that is, volume to surface area ratio), geological suitability of the site, environmental considerations, community expectations and other factors as appropriate. At the same time, we note that there is a multitude of options to better use water already captured in our dams and believe that these deserve serious investigation and action. Further, the Committee believes that investing in a holistic and multifaceted approach will become increasingly important as demands on water increase in a land of large climatic variability.

7.144 The Committee believes that all urban, industrial and agricultural water users in New South Wales have a responsibility to use water wisely and efficiently, and that as part of a multifaceted approach, government should take an active role in facilitating the responsible use of water. We also note the positive responses of users to strategies to reduce demand and to efficiency incentive programs, and we believe that such measures should form part of an integrated water management approach.

7.145 In particular, the Committee sees value in conserving and reusing water through recycling and stormwater harvesting initiatives, and commends the efforts of some local councils in implementing these programs. We believe that there is potential to significantly increase the amount of water captured through recycling and stormwater harvesting. To this end, in Chapter 4 we recommended that the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures such as stormwater harvesting and recycling waste water.

7.146 We commend the key water agencies in New South Wales for their best practice methods and note that New South Wales and Australia are leaders in this field. Further, we believe that knowledge, innovation and technology in water management and conservation will continue to develop, providing us with more options into the future.

7.147 The Committee notes the historical tension that exists between some water users and suggests that there is great commonality in their need to engage in sustainable use practices and promote river system health and function. The Committee acknowledges the role of regional water management committees in coordinating collaborative responses to issues in specific water management areas. We believe that there is merit in extending such a collaborative approach to a broader policy setting through the establishment of a statewide taskforce, to facilitate the sharing of information, to build and strengthen relationships between all water users and managers, and to drive innovation in this field.

Recommendation 16

That the NSW Government commit to continuing an integrated water management and conservation policy, and that it foster responsible use of water in urban, industrial and agricultural settings.

Recommendation 17

That the NSW Government ensure that new storage proposals are comprehensively assessed in terms of costs, benefits, storage efficiency, geological suitability of the site, environmental considerations, community expectations and other factors as appropriate.

Recommendation 18

That the NSW Government establish an Integrated Water Management Taskforce comprised of representatives of each of the key water user groups and government, with the following roles:

- to drive innovation in responsible water conservation, use and management, and
- to build collaborative relationships and promote the sharing of knowledge and expertise between and within water user groups across New South Wales.

Recommendation 19

That the NSW Government commit to investing in water efficiency research and development, to inform an integrated, best practice approach to water management, and to further advances in this area.

Appendix 1 Submissions

No	Author
1	Mr Roger Graf
2	Mr David D Coffey
3	Mr Ron Pike
4	Dubbo City Council
5	Mr John H Jury
6	Rous Water
7	Mr P A Perkins
8	Ms Robyn Dove Dove
9	Mr Glenn Wall
10	Confidential
11	NSW Dams Safety Committee
12	Regional Development Australia - Orana
13	NSW Government
14	Williams River Care Association
15	Dungog Shire Council
16	Lachlan Shire Council
17	Wakool Landholders Association
18	Total Environment Centre
19	Griffith City Council
20	Mr Harold Johnston
21	Mr John & Mrs Rosie Hayes
22	Ms Annie Nielsen
23	Ms Sally Corbett
24	Ms Vicki Perizzolo
25	Dr Stuart Khan
26	Australian Wetlands, Rivers and Landscapes Centre, University of New South Wales
27	Central NSW Councils (Centroc)
28	Murray Shire Council
29	Riverina and Murray Regional Organisation of Councils (RAMROC)
30	Mr George Paras
31	Ms Amanda Albury
32	Mr Robert E Rutkowski, Esq

No	Author
33	Ms Marjorie Allen
34	Mr Ken Kneipp
35	Tweed Shire Council
36	Mr Steve Briggs
37	Bathurst Regional Council
38	Local Government and Shires Association of NSW
39	Tweed Heads Environment Group Inc
40	Mr Robert French
41	Mr Artur Baumhammer
42	Mr Laurence Jones
43	Mid-Western Regional Council
44	Broken Hill City Council
45	The Wilderness Society Newcastle
46	Hunter Environment Lobby Inc
47	Forbes Shire Council
48	Central Tablelands Water County Council
49	Caldera Environment Centre
50	Tumbarumba Shire Council
51	Essential Water
52	Wine Grapes Marketing Board
53	Mr Tom Colley
54	Mrs Joan Annette Douglas
55	Ms Carol Collins
56	Confidential
57	Name suppressed
58	Mr Stephen Hicks
59	Mrs Josephine New
60	Name suppressed
61	Ms Carol Pasenow
62	Mr Graham Holt
63	Shoalhaven City Council
64	Ms Linda Bowden
65	Mr Richard Stanford
66	No Tillegra Dam Group

No	Author
67	Mr Menkit Prince
68	Byrrill Creek Land Care Group and Save Byrrill Creek Group
69	Northern Rivers Guardians (NRG)
70	Ms Wendy White
71	Mr Robert Mepham
72	Ms Bettina Damme
73	NSW Farmers Association - Griffith Branch
74	Murrumbidgee Valley Food and Fibre Association Inc (MVFFA)
75	Mr Jonathan Shelley
76	Mr Sean Corrigan
77	Name suppressed
78	Inland River Networks
79	Mr Sampathawaduge Wimal Hemraj Sethsiri Fernando
80	Ms Becky Harper
81	Confidential
82	Australian Labor Party - Murwillumbah Branch
83	Mr Ronald H Silver CEP
84	Mr Robert Caldwell
85	Mr Tom Boorer
86	Mr Paul W Heinrichs
87	Mr Brian Doherty
88	Mr John Ibbotson
89	Water for Rivers
90	Ms Judith M Melville
91	Southern Riverina Irrigators
92	Psi Delta
93	Gwydir Valley Irrigators Association
94	Namoi Water
95	NSW Farmers Association
96	Confidential
97	NSW Irrigators' Council
98	Ms Prue Bodsworth
99	Ms Lorraine Yudaeff
100	Cotton Australia

No	Author
101	Australian Water Association
102	Coffs Harbour Water
103	Boating Industry Association of NSW Ltd
104	Nature Conservation Council of NSW
105	Monash Water for Liveability
106	Tumut Shire Council
107	Ms B Bricknell & Mrs C N Bricknell
108	Mr Harry Johnson
109	Riverina Eastern Regional Organisation of Councils (REROC)
110	Hon Daryl Maguire MP, Member for Wagga Wagga

Appendix 2 Witnesses at hearings

Date	Name	Position and Organisation
Monday, 20 August 2012 **Macquarie Room**	Dr Richard Sheldrake	Director-General, Department of Primary Industries
Parliament House	Mr David Harriss	Commissioner, NSW Office of Water
	Mr Stewart Webster	Principal Director, Investment Appraisal, Statistical Analysis & Research, NSW Trade & Investment
	Mr Brett Tucker	Chief Executive Officer, State Water Corporation
	Dr Amit Chanan	Executive Manager Operations, State Water Corporation
	Ms Sarah Dinning	Acting Chief Executive, Sydney Catchment Authority
	Mr Ian Tanner	Group General Manager, Assets and Major Projects, Sydney Catchment Authority
	Mr Brian Cooper	Chairman, Dam Safety Committee
	Mr Steve Knight	Executive Engineer, Dam Safety Committee
Thursday, 1 November 2012	Cr Trina Thomson	Mayor, Tumut Shire Council
Pacific Lounge, Wagga RSL **Wagga Wagga**	Mr Ken Fletcher	Environmental Officer, Tumut Shire Council
	Cr Paul Braybrooks	Chairman, Riverina Eastern Regional Organisation of Councils (REROC), and Councillor, Cootamundra Shire Council
	Ms Julie Briggs	Executive Officer, REROC
	The Hon Richard Bull	Chairman, Water for Rivers
	Mr Neville Smith	Chief Executive Officer, Water for Rivers
	Mr JohnSkinner	Project Director, Water for Rivers
	Mr Denis Tinkler	Southern Riverina Irrigators
	Cr Terence Hogan	Chair, Riverina and Murray Regional Organisation of Councils (RAMROC) and Mayor, Jerilderie Shire Council
	Mr Ray Stubbs	Executive Officer, RAMROC

Date	Name	Position and Organisation
Friday 16 November 2012 **Macquarie Room** **Parliament House**	Mr Tom Mollenkopf	Chief Executive, Australian Water Association
	Mr Mark Moore	Policy Analyst, NSW Irrigators' Council
	Ms Stefanie Schulte	Economic Policy Analyst, NSW Irrigators' Council
	Ms Debbie Buller	President, Murrumbidgee Valley Food and Fibre Association Inc (MVFFA)
	Ms Virginia Tropeano	Murrumbidgee Valley Food and Fibre Association Inc (MVFFA)
	Cr Phyllis Miller OAM	Chair, Central NSW Councils (Centroc) and Councillor, Forbes Shire Council
	Ms Jennifer Bennett	Executive Officer, Centroc
	Mr Garry Styles	Executive Manager, Centroc and General Manager, Orange City Council
	Mr Tony Perry	General Manager, Central Tablelands Water County Council
Wednesday, 6 March 2013 **Moree Services Club** **Moree**	Mr Michael Murray	National Water Policy & Queensland Water Policy Manager, Cotton Australia
	Mr David Aber	General Manager, Moree Plains Shire Council
	Mr David Wolfenden	Group Manager, Water and Waste, Moree Plains Shire Council
	Ms Jon-Maree Baker	Executive Officer, Namoi Water
	Mr Jonathan Phelps	Chairman, Namoi Water
	Ms Zara Lowien	Executive Officer, Gwydir Valley Irrigators Association
	Mr Darren Hart	Regional Manager, PrimeAg Australia Limited, Moree, Gwydir Valley Irrigators Association
Friday, 3 May 2013 **Jubilee Room,** **Parliament House**	Mr David Harriss	Commissioner, NSW Office of Water
	Mr Ronald K Pike	
	Mr John Ibbotson	

Appendix 3 Site visits

Wednesday, 29 August 2012
Shoalhaven, New South Wales

The Committee and the Hon Don Harwin MLC, President of the Legislative Council travelled to Nowra, New South Wales where they met with Ms Carmel Krogh, Director, Shoalhaven Water, Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority and Mr Russell Pigg, General Manager, Shoalhaven City Council for a briefing on the water storage facilities in the Shoalhaven area and the relationship between Shoalhaven Water and the Sydney Catchment Authority.

After the briefing the Committee was taken on a tour to inspection of the following sites:

- Bamarang Dam and Water Treatment Plant
- Tallowa Dam
- Bendeela Pondage and Recreational Area
- Wingecarribee Reservoir

Thursday, 30 August 2012
Goulburn, New South Wales

The Committee conducted a tour of inspection of the Highlands Source Pipeline Pumping Station, Wingecarribee Reservoir, accompanied by representatives of Goulburn Mulwaree Council, Cr Geoff Kettle, Mayor, Cr Bob Kirk, Deputy Mayor; Mr Chris Berry, General Manager and Mr Grant Moller, Manager Water Services.

Following this, the Committee conducted a tour of inspection of Pejar and Sooley Dams, after which the Committee attended the Goulburn Mulwaree Council Chambers where Mr Moller provided a briefing on water supply and water storage facilities in the Goulburn Mulwaree area.

Tuesday, 30 October 2012
Orange, New South Wales

The Committee travelled to Orange and was welcomed by the Mayor, Cr John Davis, Mr Chris Devitt, Technical Services Director; Mr Wayne Beatty, Water and Sewerage Services Manager and Mr Allan Reeder, Communications Officer, of Orange City Council. Mr Devitt provided a briefing on the water storage facilities in Orange, and the stormwater harvesting schemes implemented by the Council. Mr Nick Redmond, Manager Corporate and Community Relations, also joined the meeting. From here the Committee were taken on a tour of inspection of the Blackman's Swamp Creek and Ploughman's Creek Stormwater Harvesting Schemes.

At the conclusion of the tour, the Committee reconvened at the Orange City Council chambers for further briefings by Mr Devitt and then by Mr Martin Haege, Director and Environmental Engineer, Geolyse.

Wednesday, 31 October 2012
Griffiths and Wagga Wagga, New South Wales

In Griffith, the Committee met with Ms Iva Quarisa, Irrigation Officer, NSW Department of Primary Industries Ms Karen McCann, Biodiversity Coordinator, Murrumbidgee Irrigation, who then escorted them on a tour of inspection of the Barren Box Swamp. Following this, the Committee were joined by Mr Xavier Malloy and Mr Matt Malloy on a tour of lateral move irrigation practices at the Malloy property. The Committee then conducted a tour of bankless channel irrigation practices at the Cameron property, accompanied by Mr Craig Cameron.

Following this the Committee visited Wagga Wagga and met with representatives from NSW Office of Water, Mr Ray Boyton, Manager, Water Monitoring and Mr Digby Jacobs, Team Leader, Southern River Management at the Wagga Wagga river monitoring site. The Committee observed the use of water monitoring equipment to measure flows in the Murrmibidgee River and water levels in bores, accompanied by representatives from the NSW Office of Water, Mr Adam Wiggins, Mr Geoff Quinn, Mr Paul Pavlik, Mr Boyton and Mr Jacobs.

Tuesday, 5 March 2013

Inverell and Moree, New South Wales

The Committee travelled to Copeton Dam, near Inverell, where they met with Mr Michael Jeffrey, General Manager, Major Projects; Mr Craig Cahill, Manager, Water Delivery Northern Valleys and Mr Duncan Wilson, Copeton Dam Safety Upgrade Site Coordinator, all representatives of State Water Corporation. The Committee were then given a briefing and tour of the safety upgrades of Copeton Dam.

Following this the Committee visited Keytah Farm, near Moree, where they were met by Mr Nick Gillingham, Manager, Keytah Farm and Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association. The Committee was briefed on Keytah's farming systems and achievements in water use efficiency. Ms Lowien and Mr Gillingham then accompanied the Committee on a tour of inspection of Keytah Farm, showcasing irrigation efficiencies on the farm, the system comparison trial and water monitoring and scheduling.

Appendix 4 Answers to questions on notice

The Committee received answers to questions on notice from:

- Dam Safety Committee
- State Water Corporation
- Sydney Catchment Authority
- NSW Office of Water, Department of Primary Industries
- NSW Irrigators' Council
- Riverina Eastern Regional Organisation of Councils (REROC)
- Murrumbidgee Valley Food and Fibre Association (MVFAA)
- Australian Water Association
- Tumut Shire Council

Appendix 5 Tendered documents

Monday, 20 August 2012

Public hearing, Macquarie Room, Parliament House

1 Diagram of Water Supply Schematic, December 2011, *tendered by Ms Sarah Dinning, Acting Chief Executive, Sydney Catchment Authority*

2 Map of Sydney Catchment Authority Drinking Water Catchments, *tendered by Ms Sarah Dinning, Acting Chief Executive, Sydney Catchment Authority*

3 Diagrams of NSW Water Storage Dams (not including Retarding/Detention Basins or Tailings Dams), *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

4 Document on NSW Dam Safety Committee – Current Prescribed Dams in NSW – 2012, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

5 Document entitled Table 4 – Dams Modified for Safety Upgrading (since 1996), *Mr Steve Knight, Executive Engineer, Dam Safety Committee*

6 Document entitled Table 5A – Status of upgrading activities for dams under DSC review *Mr Steve Knight, Executive Engineer, Dam Safety Committee*

7 Map of Prescribed Dams in NSW July 2012, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

8 Map of Water Storages in NSW, August 2012, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

9 Document DSC New South Wales Guidance Sheets Register, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

10 Dam Safety Committee Annual Report 2010/2011, *Mr Steve Knight, Executive Engineer, Dam Safety Committee*

11 Map of Location of State Water dams and weirs, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

12 Map of Sydney Catchment Authority's drinking water catchments, *tendered by Mr Steve Knight, Executive Engineer, Dam Safety Committee*

Wednesday, 29 August 2012

Site visit meeting, Shoalhaven Entertainment Centre

13 Powerpoint presentation entitled 'Shoalhaven System Inspections – Shoalhaven City Council and Sydney Catchment Authority', *tendered by Ms Carmel Krogh, Director, Shoalhaven Water*

14 Document 'Storage Balancing Guide – Warragamba, Cataract, Cordeaux, Avon, Nepean and Woronora Dams', *tendered by Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority*

Thursday, 30 August 2012
Site Visit, Goulburn

15 Powerpoint presentation entitled 'Goulburn's raw water sources', *tendered by Mr Grant Moller, Manager Water Services, Goulburn Mulwaree Council*

Tuesday, 30 October 2012
Site Visit, Orange

16 Powerpoint presentation entitled 'Macquarie River to Orange Pipeline', *tendered by Mr Martin Haege, Director and Environmental Engineer, Geolyse*

Thursday, 1 November 2012
Public hearing, Wagga Wagga RSL, Wagga Wagga

17 Tumut Shire Council submission to inquiry together with photographs and DVD, *tendered by Cr Trina Thomson, Mayor, Tumut Shire Council*

18 Regional Wrap-up Report 2012 entitled 'Climate change, planning and development in the eastern Riverina, *tendered by Ms Julie Briggs, Executive Officer, Riverina Eastern Regional Organisation of Councils (REROC)*

19 Industry Water Use, Vulnerability and Adaptation Stage 2 Report, 23 June 2011, *tendered by Ms Julie Briggs, Executive Officer, REROC*

20 Climate and Water Resources Stage 1 Report, 21 June 2011, *tendered by Ms Julie Briggs, Executive Officer, REROC*

21 Business and Industry Water Consumption Discussion Paper 3, *tendered by Ms Julie Briggs, Executive Officer, REROC*

22 REROC Water Resources and Consumption Discussion Paper 2, *tendered by Ms Julie Briggs, Executive Officer, REROC*

23 Improving River Efficiency – A Computer Aided River Management system (CARM)for the Murrumbidgee River, Australia, *tendered by The Hon Richard Bull, Chairman, Water for Rivers*

24 Map of RAMROC Councils, *tendered by Mr Ray Stubbs, Executive Officer, Riverina and Murray Regional Organisation of Councils (RAMROC)*

Friday, 16 November 2012
Public hearing, Macquarie Room, Parliament House

25 Newspaper article from *The Daily Advertiser,* entitled 'Govt 'No' on Flood Control Dam Campaign, dated 17 February 1975, *tendered by Ms Debbie Buller, President, Murrumbidgee Valley Food and Fibre Association*

26 Publication 'Regional Development in Central West NSW: Water the Real Constraint – A case for the enlargement of Lake Rowlands Dam, *tendered by Mr Tony Perry, General Manager, Central Tablelands Water County Council*

Tuesday, 5 March 2013
Site visit, Keytah Farm, Moree

27 DVD entitled 'Irrigation Efficiency Trial 2009-2010', *tendered by Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association Inc*

28 Document entitled 'Improving Irrigation in the Australian Cotton Industry', *tendered by Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association Inc*

29 Gwydir Valley Irrigators Association Inc information document, *tendered by Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association Inc*

Appendix 6 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.

Source: Submission 13, NSW Government, Tab 1.

Appendix 7 Major NSW Rural Water Storages operated by State Water Corporation

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).

Source: Submission 13, NSW Government, Tab 1.

Appendix 8 State Water dam safety upgrade program

SWC top seven high risk dams	Likelihood of Dam Overtopping		Costs ($M)	
	Before Stage 1	Post Stage 1	Stage 1	Comment
Blowering	1:210,000	1:580,000	38.6	Stage 1 complete
Burrendong	1:72,000	1:147,000	35.5	Stage 1 partially complete
Chaffey Stage 1 (62GL) Chaffey Aug (100GL)	1:96,000	(62GL) 1:450,000 (100GL) >2,400,000	(62GL) 13.6 (100GL) 43.34	Stage 1 complete Stage 2 Augmentation in design
Copeton	1:16,700	1:403,000	55.9	Stage 1 in construction
Keepit WP1 + WP2	1:30,000	WP1 (1:47,000) + WP2 [to PMF]	110.5	Work Package 1 (WP1) complete WP2 detailed design to complete end 2012
Split Rock	1:116,000	>1:620,000	8.3	Stage 1 complete
Wyangala	1:34,000	1:122,000	57.8	Stage 1 partially complete

Dams Safety Upgrade descriptions

1. Blowering Dam

   Stage 1 Construction complete

   a. New 2m parapet wall on the dam crest
   b. Raise spillway walls to contain higher discharges
   c. Upgraded dam now passes the Probable Maximum Design Flood (PMPDF)

2. Burrendong Dam

   Stage 1 Construction partially complete and still ongoing

   a. Main embankment crest raising to maximum height of 1.8m (with or without parapet) – Stage 1a construction complete
   b. Stage 2a spillway upgrade - detailed design 70% complete
      i. Raise spillway walls to contain sub PMF outflow and spillway strengthening
      ii. Raise the spillway gate hoist bridge in accordance to crest – Current Stage 1b detailed design in progress
   c. Upgraded dam will pass the Probable Maximum Design Flood (PMPDF)

3. Chaffey Dam – Phase 1 upgrade + Augmentation

   a. Phase 1 (complete) – construction of 35 m auxiliary fuse plug spillway (1:10,000 AEP trigger)
   b. Future Phase 2 Augmentation from 62GL to 100GL currently in detailed concept design stage:
      i. Upgrade dam to comply with ANCOLD and DSC safety standards
      ii. Reduce risk by increasing spillway capacity to pass Probable Maximum Flood (PMF)
      iii. Increase storage capacity to 100GL by 6.5 m FSL raising
   c. Upgraded dam to be fully compliant and will pass the Probable Maximum Flood (PMF)

4. Copeton Dam

   Stage 1 Construction in progress

   a. 250m wide Fuse Plug (FP) auxiliary spillway at Diamond Bay (DB) – construction in progress
   b. Relocation of Copeton Waters State Park (CWSP) recreational facilities - completed
   c. Rerouting the existing Copeton Dam main road
   d. Upgraded dam will pass the Probable Maximum Design Flood (PMPDF)

5. Keepit Dam Work Packages 1 & 2

   Work Package 1 (construction complete)

   a. Earthen auxilliary fuse plug spillway at the right abutment of Keepit: excavation and construction plus construction of the coffer dam
   b. Auxiliary fuse plug spillway through the centre of the subsidiary dam: excavation and construction plus construction and removal of the coffer dam and other waste material
   c. Three new saddle dams, at the boat ramp, sailing club and caravan park

   Work Package 2 currently in detailed design (due to complete end 2012).

   d. Construction planned to start early 2014.
   e. Upgraded dam to be fully compliant and will pass the Probable Maximum Flood (PMF)

6. Split Rock Dam

   Stage 1 Construction complete

   a. New parapet wall on embankment
   b. Upgraded dam now passes the Probable Maximum Design Flood (PMPDF)

7. Wyangala Dam

   Stage 1 construction partially complete

   a. Spillway Chute Wall Raising - complete
   b. Radial Gate Raising & Locking System – design complete
   c. Bypass Road and Bridge – concept and detailed design complete
   d. Parapet Wall Crest Raising – design in progress – due to complete by end of 2012
   e. Upgraded dam will pass the Probable Maximum Design Flood (PMPDF)

Source: Answers to questions taken on notice taken during evidence 20 August 2012, Mr Brett Tucker, Chief Executive Officer, State Water Corporation, pp 2-3.

Appendix 9 Minutes

Minutes No. 12
Monday 28 May 2012
Standing Committee on State Development
Room 1153, Parliament House, 1.00 pm

1. Members present
Mr Colless *Chairman*
Mr Veitch *Deputy Chair*
Mr Green
Mr Lynn
Dr Phelps

2. Apologies
Mr Whan

3. Draft minutes
Resolved, on the motion of Mr Veitch: That draft Minutes No. 11 be confirmed.

4. Correspondence
The Committee noted the following items of correspondence received:

- ***
- ***
- ***
- ***

5. ***

6. ***

7. Consideration of terms of reference received from Minister for Primary Industries
The Chair tabled the following terms of reference for an inquiry received from the Hon Katrina Hodkginson MP, Minister for Primary Industries, on 28 May 2012:

That the Standing Committee on State Development inquire into and report on the adequacy of water storages in NSW, and in particular:

a) the capacity of existing water storages to meet agricultural, urban, industrial and environmental needs;
b) models for determining water requirements for the agricultural, urban, industrial and environmental sectors;
c) storage management practices to optimise water supply to the agricultural, urban, industrial and environmental sectors;
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;
e) water storages and management practices in other Australian and international jurisdictions;
f) any other matter relating to the adequacy of water storages in NSW.

Resolved, on the motion of Dr Phelps: That the Committee adopt the terms of reference.

8. Adjournment
The Committee adjourned at 2.20 pm until 1pm, Thursday 31 May 2012 in the Members Lounge.

Cathryn Cummins
Clerk to the Committee

Minutes No. 13
Thursday 31 May 2012
Standing Committee on State Development
Members Lounge, Parliament House, 1.10 pm

1. Members present
Mr Colless *Chairman*
Mr Veitch *Deputy Chair*
Mr Green
Mr Lynn
Dr Phelps

2. Apologies
Mr Whan

3. Draft minutes
Resolved, on the motion of Mr Veitch: That draft Minutes No. 12 be confirmed.

4. Inquiry into the adequacy of water storages in NSW
The Committee noted that its meeting on 28 May 2012, the Committee resolved to adopt the terms of reference for an inquiry into the adequacy of water storages in NSW

4.1 Advertising and call for submissions
Resolved, on the motion of Mr Lynn: That the closing date for submissions be Friday 3 August 2012.

Resolved, on the motion of Mr Green: That the inquiry and call for submissions be advertised in the following newspapers in the week commencing Monday 11 June 2012:
- Sydney Morning Herald
- Daily Telegraph
- Weekly Times
- The Land.

Resolved, on the motion of Mr Lynn: That the Chairman issue a media release announcing the establishment of the inquiry and call for submissions.

4.2 Invitation to stakeholders to make a submission
Resolved, on the motion of Mr Veitch: That the Committee write to the following stakeholders informing them of the Inquiry and inviting them to make a submission:

NSW Government
- Department of Premier and Cabinet
- Office of Environment and Heritage
- Department of Primary Industries
- NSW Office of Water
- Department of Local Government
- IPART

Water authorities and utilities

- Central Tablelands Water
- Cobar Water Board
- Dumaresq-Barwon Border Rivers Commission
- Hunter Water Corporation
- State Water Corporation
- Sydney Catchment Authority
- Sydney Water
- All 107 water utilities in NSW

Catchment Management Authorities

- All 13 Catchment Management Authorities in NSW

Local government

- NSW Local Government and Shires Association
- All local and shire councils
- All Regional Organisations of Councils

Other Australian jurisdictions

- Department of Sustainability and Environment (Victoria)
- Victorian Catchment Management Council
- Department of Water (Western Australia)
- State Natural Resource Management Office (Western Australia)
- Department of Water (South Australia)
- South Australian Natural Resources Management Council
- Department of Environment and Resource Management (Queensland)
- Department of Primary Industries, Parks, Water and Environment (Tasmania)
- Department of Natural Resources, Environment, The Arts and Sport (Northern Territory)
- Environment and Sustainable Development (ACT)

Other

- ACTEW Corporation
- Australian Conservation Foundation
- Macquarie River Food and Fibre
- Murray Darling Basin Authority
- Murray Lower Darling Rivers Indigenous Nations
- Nature Conservation Council of NSW
- Natural Resources Commission
- NSW Aboriginal Land Council
- NSW Business Chamber
- NSW Farmers Association
- NSW Irrigators Council
- NSW Minerals Council

- Pastoralists Association of West Darling
- Regional business chambers
- Regional Development Australia committees
- Snowy Hydro Ltd
- Universities – for example, the Institute of Land, Water and Society at Charles Sturt University
- Western Research Institute
- Yarkuwa Indigenous Knowledge Centre Aboriginal Corporation.

Resolved, on the motion of Mr Veitch: That members notify the secretariat of any stakeholders they wish to be invited to make a submission by COB Wednesday 6 June 2012.

4.3 Authorisation of publication of submissions

Resolved, on the motion of Mr Veitch: That the Committee authorises the publication of all submissions to the inquiry into the adequacy of water storages in NSW, subject to the Committee Clerk checking for confidentiality, adverse mention and other issues. Submissions identified as containing confidentiality, adverse mention or other issues will then be considered by the Committee.

4.4 Hearing and site visit dates

Resolved, on the motion of Mr Veitch: That the Committee conduct inquiry activities on the following dates:

- hearing at Parliament House – Monday 20 August
- regional visit – departing Tuesday 28 August, returning Thursday 30 August
- regional visit – departing Tuesday 30 October, returning Thursday 1 November.

5. Adjournment

The Committee adjourned at 1.25 pm until Monday 20 August 2012.

Cathryn Cummins
Clerk to the Committee

Minutes No. 14

Monday 20 August 2012
Standing Committee on State Development
Macquarie Room, Parliament House, 9.30 am

1. Members present

Mr Colless *Chairman*
Mr Veitch *Deputy Chairman*
Mr Green (*until 3.40 pm*)
Mr Lynn
Dr Phelps
Mr Whan

2. Public hearing – 20 August 2012

The witnesses, the public and media were admitted.

The following witnesses were sworn and examined:

- Dr Richard Sheldrake, Director-General, Department of Primary Industries
- Mr David Hariss, Commissioner, NSW Office of Water

- Mr Stewart Webster, Principal Director, Investment Appraisal, Statistical Analysis & Research, NSW Trade & Investment.

The evidence concluded and the witnesses withdrew.

The following witnesses from the State Water Corporation were sworn and examined:

- Mr Brett Tucker, Chief Executive Officer
- Mr Amit Chanan, Executive Manager Operations.

The evidence concluded and the witnesses withdrew.

The following witnesses from the Sydney Catchment Authority were sworn and examined:

- Ms Sarah Dinning, Acting Chief Executive
- Mr Ian Tanner, Group General Manager, Assets and Major Projects.

Ms Dinning tendered two documents:
- Water Supply Schematic
- SCAs Drinking Water Catchments

The evidence concluded and the witnesses withdrew.

The following witnesses from the Dams Safety Committee were sworn and examined:

- Mr Brian Cooper, Chairman
- Mr Steve Knight, Executive Engineer.

Mr Knight tendered the following documents:
- NSW Water Storage Dams (not including Retarding/Detention Basins or Tailings Dams)
- Current prescribed dams in NSW – 2012
- Table 4 – Dams modified for safety upgrading (since 1996)
- Table 5 – Status of upgrading activities for dams under DSC review
- Prescribed dams in NSW (July 2012) – map
- Water storages in NSW (August 2012) – map
- Dams Safety Committee (DSC) guidance sheet register
- Dam Safety Committee Annual Report 2010/11
- Location of State Water dams and weirs – map
- SCAs Drinking Water Catchments.

The evidence concluded and the witnesses withdrew.

The public hearing concluded and the media and public withdrew.

3. Previous minutes

Resolved, on the motion of Dr Phelps: That draft Minutes No. 13 be confirmed.

4. Correspondence

The Committee noted the following items of correspondence:

Received

- 18 June 2012 – from Mr Greg Davis, A/Director General, Western Australian Department of Water, declining the invitation to make a submission to the inquiry into the adequacy of water storages

- 19 June 2012 – from Mr Paul Anderson, General Manager, Eurobodalla Shire Council advising the Committee of Council's intention to make a submission to the inquiry into the adequacy of water storages
- 26 June 2012 – from Cr Geoff Kettle, Mayor, Goulburn Mulwaree Council, accepting the Committee's invitation to participate in the site visit to the Goulburn area on Thursday 30 August
- 29 June 2012 – from Mr Tim Mackney, Community and Natural Resources – Water, Tweed Shire Council, advising that Council intends to make a submission to the inquiry into the adequacy of water storages
- 5 July 2012 – From Ms Amanda Chadwick, Director – Water, IPART, advising that IPART will not be making a submission to the inquiry into the adequacy of water storages
- 10 July 2012 – From Mr Frank Zaknich, General Manager, Broken Hill City Council, to the Committee Chair, requesting clarification and additional information regarding certain recommendations in the economic and social development in central western NSW report
- 23 July 2012 – From Mr Stace Lewer, Asset Systems Engineer – Water and Sewerage, Wingecarribee Shire Council, outlining the key water sources for the Wingecarribee Shire
- 30 July 2012 – From Mr Angus Swindon, Secretary, advising that ANCOLD (Australian National Committee on Large Dams) will not be making a submission to the inquiry into the adequacy of water storages, but that it will circulate information on the inquiry to its' members
- ***

Sent

- ***
- ***
- ***
- 21 June 2012 – From the Chairman to the Hon Shelley Hancock MP, advising that the Committee will be in the Shoalhaven area for a site visit on Wednesday 29 August
- 21 June 2012 – From the Chairman to the Hon Pru Goward MP, advising that the Committee will be in the Goulburn area for a site visit on Thursday 30 August
- 21 June 2012 – From the Chairman to Clr Geoff Kettle, Mayor, Goulburn Mulwaree Council, inviting the Mayor and the Deputy Mayor to accompany the Committee during its site visit to the Goulburn area on Thursday 30 August.

Resolved, on the motion of Dr Phelps: That the Committee authorise the publication of the letter from the Hon Anthony Albanese MP, Minister for Infrastructure and Transport, dated 31 July 2012.

5. *

6. Submissions

6.1 Public submissions

Resolved, on the motion of Dr Phelps: That the Committee note that Submission Nos. 1-56, 57-59, 61-76, and 78-79 were published by the Committee Clerk under the authorisation of an earlier resolution.

6.2 Partially confidential submissions

Resolved, on the motion of Dr Phelps: That the Committee authorise the publication of Submission Nos. 57, 60 and 77 with the exception of the name and/or other identifying details of the author, which are to remain confidential.

6.3 Confidential submissions

Resolved, on the motion of Dr Phelps: That Submission Nos. 10 and 56 remain confidential.

7. Regional site visits

7.1 Regional site visit – 29-30 August 2012

The Committee noted that the site visit to the Shoalhaven and Goulburn areas will take place on Wednesday 29 and Thursday 30 August 2012.

Mr Green left the meeting.

7.2 Regional site visit – 30 October-1 November 2012

The Committee discussed options for site visit locations in October-November 2012.

8. Supplementary questions

Resolved on the motion of Mr Veitch: That for the duration of the inquiry, supplementary questions may be lodged with the secretariat up to two days following the receipt of the hearing transcript.

9. Questions on notice

Resolved on the motion of Dr Phelps: That for the duration of the inquiry, witnesses be requested to return answers to questions taken on notice and supplementary questions within 21 days of the date on which the questions are forwarded to the witness.

10. Acceptance and publication of documents tendered during the public hearing

Resolved on the motion of Mr Veitch: That the Committee accept and publish the following document tendered during the public hearing:

- Water Supply Schematic
- SCAs Drinking Water Catchments
- NSW Water Storage Dams (not including Retarding/Detention Basins or Tailings Dams)
- Current prescribed dams in NSW – 2012
- Table 4 – Dams modified for safety upgrading (since 1996)
- Table 5 – Status of upgrading activities for dams under DSC review
- Prescribed dams in NSW (July 2012) – map
- Water storages in NSW (August 2012) – map
- Dams Safety Committee (DSC) guidance sheet register
- Dam Safety Committee Annual Report 2010/11
- Location of State Water dams and weirs – map.

11. Adjournment

The Committee adjourned at 3.50 pm until 8.30 am, Wednesday 29 August 2012 at the Shoalhaven Entertainment Centre Foyer.

Cathryn Cummins
Clerk to the Committee

Minutes No. 15

Wednesday 29 August 2012
Standing Committee on State Development
Shoalhaven Entertainment Centre foyer meeting room, 8.30 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green (*until 1.30 pm*)
Mr Harwin (*participating member*, *until 1.30 pm*)
Dr Phelps
Mr Whan

2. Apologies

Mr Lynn

3. Participating member

The Chairman advised that Mr Harwin would be attending the meeting as a participating member.

4. Site visit to Shoalhaven water storage facilities

The Committee attended the Shoalhaven Entertainment Centre foyer meeting room and was met by the following:

- Ms Carmel Krogh, Director Shoalhaven Water
- Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority
- Mr Russell Pigg, General Manager Shoalhaven City Council.

Ms Krogh and Mr Tanner provided a briefing on the water storage facilities in the Shoalhaven area, and the relationship between Shoalhaven Water and the Sydney Catchment Authority.

Ms Krogh tendered the following document:

- PowerPoint presentation entitled 'Shoalhaven System Inspections – Shoalhaven City Council and Sydney Catchment Authority'.

Mr Tanner tendered the following documents:

- 'Storage Balancing Guide – Warragamba, Cataract, Cordeaux, Avon, Nepean and Woronora Dams'
- Water Supply Schematic – Sydney Catchment Authority.

The Committee conducted a tour of inspection of the Bamarang Dam and Water Treatment Plant accompanied by:

- Ms Krogh
- Mr Tanner
- Mr Mark Jennings, Service Coordinator, Shoalhaven Water.

The Committee conducted a tour of inspection of Tallowa Dam accompanied by:

- Ms Krogh
- Mr Tanner.

Resolved, on the motion of Mr Green: That the Committee conduct a site visit to Orange, Griffith and Wagga Wagga on Tuesday 30 October 2012 to Thursday 1 November 2012.

Mr Green and Mr Harwin left the meeting.

The Committee conducted a tour of inspection of the Bendeela Pondage and Recreational Area accompanied by:

- Ms Krogh
- Mr Tanner.

The Committee conducted a tour of inspection of the Wingecarribee Reservoir accompanied by:

- Ms Krogh
- Mr Tanner
- Ms Fiona Smith, Sydney Catchment Authority.

5. Adjournment

The Committee adjourned at 4.10 pm until 8.30 am, Thursday 30 August 2012 at the Wingecarribee Reservoir.

Cathryn Cummins
Clerk to the Committee

Minutes No. 16

Thursday 30 August 2012
Standing Committee on State Development
Wingecarribee Reservoir, 8.25 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chairman*
Dr Phelps
Mr Whan

2. Apologies

Mr Green
Mr Lynn

3. Site visit to Goulburn area water storage facilities

The Committee conducted a tour of inspection of the Highlands Source Pipeline Pumping Station, Wingecarribee Reservoir, accompanied by the following representatives of Goulburn Mulwaree Council:

- Cr Geoff Kettle, Mayor
- Cr Bob Kirk, Deputy Mayor
- Mr Chris Berry, General Manager
- Mr Grant Moller, Manager Water Services.

The Committee conducted a tour of inspection of Pejar and Sooley Dams accompanied by:

- Cr Kettle
- Cr Kirk
- Mr Berry
- Mr Moller.

The Committee attended the Goulburn Mulwaree Council Chambers where Mr Moller provided a briefing on water supply and the water storage facilities in the Goulburn Mulwaree area.

Mr Moller tendered the following document:

- PowerPoint presentation entitled 'Goulburn's raw water sources'.

4. Adjournment

The Committee adjourned at 12.35 pm until Tuesday 30 October 2012.

Cathryn Cummins
Clerk to the Committee

Minutes No. 17

Wednesday 19 September 2012
Standing Committee on State Development
Members Lounge, Parliament House, 1.05 pm

5. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chairman*
Mr Green
Mr Lynn
Mr Whan *(from 1.10pm)*

6. Apologies

Dr Phelps

7. Draft minutes

Resolved, on the motion of Mr Veitch: That Draft Minutes Nos. 14, 15 and 16 be confirmed.

8. Correspondence

The Committee noted the following item of correspondence received:

- ***.

The Committee noted the following items of correspondence sent:

- ***
- ***
- ***
- 6 September 2012 – From the Chairman to Ms Carmel Krogh, Director, Shoalhaven Water, thanking Ms Krogh for facilitating the Committee's visit to water storage facilities in the Shoalhaven area
- 6 September 2012 – From the Chairman to Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority (SCA), thanking Mr Tanner for facilitating the Committee's visit to SCA-operated water storage facilities in the Shoalhaven area
- 6 September 2012 – From the Chairman to Cr Geoff Kettle, Mayor, Goulburn Mulwaree Council, thanking Cr Kettle for facilitating the Committee's visit to water storage facilities in the Goulburn area.

9. Submissions

Resolved, on the motion of Mr Green: That the Committee note that Submission Nos. 80, 82-95, and 97-105 were published by the Committee Clerk under the authorisation of the Committee's previous resolution of 31 May 2012.

Resolved, on the motion of Mr Green: That Submission Nos. 81 and 96 remain confidential.

10. Answers to questions taken on notice

The Committee noted that answers to questions on notice from the following organisations were published by the Committee Clerk under the authorisation of the Committee's previous resolution of 1 June 2011:

- Dams Safety Committee
- State Water Corporation
- Sydney Catchment Authority
- Department of Primary Industries and the NSW Office of Water.

11. Publication of documents tendered during August site visits

Resolved, on the motion of Mr Lynn: That the Committee accept and publish the following documents tendered during the site visits to the Shoalhaven and Goulburn areas in August 2012:

- PowerPoint presentation entitled 'Shoalhaven System Inspections – Shoalhaven City Council and Sydney Catchment Authority', tendered by Ms Carmel Krogh, Director Shoalhaven Water
- 'Storage Balancing Guide – Warragamba, Cataract, Cordeaux, Avon, Nepean and Woronora Dams', tendered by Mr Ian Tanner, Group General Manager, Assets and Major Projects, Sydney Catchment Authority
- PowerPoint presentation entitled 'Goulburn's raw water sources', tendered by Mr Grant Moller, Manager Water Services, Goulburn Mulwaree Council.

12. Regional site visit and public hearing – Tuesday 30 October to Thursday 1 November

The secretariat circulated a draft schedule for the regional site visit to Orange, Griffith and Wagga Wagga from Tuesday 30 October to Thursday 1 November 2012.

Mr Whan joined the meeting.

Resolved, on the motion of Mr Lynn: That the Committee invite the following organisations to appear at the public hearing at Wagga Wagga on Thursday 1 November:

- Murrumbidgee Irrigation
- Murrumbidgee Valley Food and Fibre
- Riverina and Murray Regional Organisation of Councils (RAMROC)
- Riverina Eastern Regional Organisation of Councils (REROC)
- Southern Riverina Irrigators
- Tumut Shire Council
- Water for Rivers.

13. Adjournment

The Committee adjourned at 1.15 pm until 8.30 am, Tuesday 30 October 2012, at the Hawker Pacific Passenger Lounge, Ross Smith Avenue, Sydney Kingsford Smith Airport.

Cathryn Cummins
Clerk to the Committee

Minutes No. 18

Tuesday 30 October 2012
Standing Committee on State Development
Hawker Pacific Passenger Lounge, Sydney Airport, 8.30 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch *Deputy Chair*
Mr Green
Dr Phelps
Mr Whan

2. Apologies

Mr Lynn

3. Site visit to water storage facilities in Orange

The Committee attended the Orange City Council Chamber and was met by the following representatives from Orange City Council:

- Cr John Davis, Mayor
- Mr Chris Devitt, Technical Services Director
- Mr Wayne Beatty, Water and Sewerage Services Manager
- Mr Allan Reeder, Communications Officer.

Cr Davis welcomed the Committee to Orange.

Mr Devitt provided a briefing on the water storage facilities in Orange, and the stormwater harvesting schemes implemented by the Council.

Mr Nick Redmond, Manager Corporate and Community Relations, Orange City Council joined the meeting.

The Committee conducted a tour of inspection of the Blackman's Swamp Creek and Ploughman's Creek Stormwater Harvesting Schemes accompanied by:

- Mr Devitt
- Mr Beatty
- Mr Redmond.

The Committee returned to the Orange City Council Chamber.

Mr Martin Haege, Director and Environmental Engineer, Geolyse, joined the meeting.

Mr Devitt provided a briefing on the water storage issues across the region.

Mr Devitt tendered the following document:

- PowerPoint presentation entitled 'The Orange Revolution – A sustainable water model for inland Australia'.

Mr Haege provided a briefing on the Macquarie-Orange Pipeline Project.

Mr Haege tendered the following document:

- PowerPoint presentation entitled 'Macquarie River to Orange Pipeline'.

4. Adjournment

The Committee adjourned at 3.15 pm until 8.00 am, Wednesday 31 October 2012, at the Grand Motel, Banna Avenue, Griffith.

Cathryn Cummins
Clerk to the Committee

Minutes No. 19

Wednesday 31 October 2012
Standing Committee on State Development
Grand Motel, Banna Avenue, Griffith, 8.00 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green
Dr Phelps
Mr Whan

2. Apologies

Mr Lynn

3. Site visit to water storage facilities in Griffith and Wagga Wagga

The Committee was met by Ms Iva Quarisa, Irrigation Officer, NSW Department of Primary Industries.

The Committee conducted a tour of inspection of the Barren Box Swamp accompanied by:

- Ms Karen McCann, Biodiversity Coordinator, Murrumbidgee Irrigation
- Ms Quarisa.

The Committee conducted a tour of inspection of lateral move irrigation practices at the Malloy property, Griffith, accompanied by:

- Mr Xavier Malloy
- Mr Matt Malloy
- Ms Quarisa.

The Committee conducted a tour of inspection of bankless channel irrigation practices at the Cameron property, Griffith, accompanied by:

- Mr Craig Cameron
- Ms Quarisa.

The Committee proceeded to Wagga Wagga.

The Committee was met by the following representatives from the NSW Office of Water:

- Mr Ray Boyton. Manager, Water Monitoring
- Mr Digby Jacobs, Team Leader, Southern River Management.

The Committee observed the use of water monitoring equipment to measure flows in the Murrumbidgee River and water levels in bores accompanied by the following representatives from the NSW Office of Water:

- Mr Adam Wiggins
- Mr Geoff Quinn
- Mr Paul Pavlik
- Mr Boyton
- Mr Jacobs.

4. Adjournment

The Committee adjourned at 5.45 pm until 9.00 am, Thursday 1 November 2012, at the Pacific Lounge, Wagga RSL, Corner of Kincaid and Dobbs Streets, Wagga Wagga.

Cathryn Cummins
Clerk to the Committee

Minutes No. 20

Thursday 1 November 2012
Standing Committee on State Development
Pacific Lounge, Wagga RSL, corner of Kincaid and Dobbs Sts, Wagga Wagga, 9.00 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green
Dr Phelps
Mr Whan

2. Apologies

Mr Lynn

3. Public hearing

The witnesses, the public and media were admitted.

The following witnesses from Tumut Shire Council were sworn and examined:

- Cr Trina Thomson, Mayor
- Mr Ken Fletcher, Environmental Officer.

Cr Thomson tendered the following document:

- 'Submission to the NSW Legislative Council Standing Committee on State Development – inquiry into the adequacy of water storages', including photographs of Tumut River.

The evidence concluded and the witnesses withdrew.

The following witnesses from the Riverina Eastern Regional Organisation of Councils (REROC) were sworn and examined:

- Cr Paul Braybrooks, Chairman
- Ms Julie Briggs, Executive Officer.

Ms Briggs tendered the following documents:

- 'Climate change, planning and development in the eastern Riverina – Regional Wrap-Up Report', dated 2012
- 'REROC Industry Water Use, Vulnerability and Adaptation Stage 2 Report', dated 23 June 2011
- 'REROC Climate and Water Resources Stage 1 Report', dated 21 June 2011
- 'Businesses and Industry Water Consumption – Discussion Paper 3', dated 10 June 2011
- 'Water Resources and Consumption – Discussion Paper 2', dated 21 January 2011.

The evidence concluded and the witnesses withdrew.

The following witnesses from Water for Rivers were sworn and examined:

- Hon Richard Bull, Chairman
- Mr Neville Smith, Chief Executive Officer
- Mr John Skinner, Project Director.

Mr Bull tendered the following document:

- 'Improving River Efficiency – A CARM for the Murrumbidgee River Australia'.

The evidence concluded and the witnesses withdrew.

The following witness from Southern Riverina Irrigators was sworn and examined:

- Mr Denis Tinkler.

The evidence concluded and the witness withdrew.

The following witnesses from the Riverina and Murray Regional Organisation of Councils (RAMROC) were sworn and examined:

- Cr Terry Hogan, Chair
- Mr Ray Stubbs, Executive Officer.

Mr Stubbs tendered the following document:

- Map of RAMROC Councils.

The evidence concluded and the witnesses withdrew.

The public hearing concluded and the media and public withdrew.

4. Previous minutes

Resolved, on the motion of Mr Veitch: That draft Minutes No. 17 be confirmed.

5. Submissions

Resolved, on the motion of Mr Whan: That the Committee note that Submission Nos. 35A and 106-109 were published by the Committee Clerk under the authorisation of an earlier resolution.

6. Acceptance and publication of documents tendered during the public hearing

Resolved on the motion of Dr Phelps: That the Committee accept and publish the following documents tendered during the public hearing:

- 'Submission to the NSW Legislative Council Standing Committee on State Development – inquiry into the adequacy of water storages', including photographs of Tumut River.
- 'Climate change, planning and development in the eastern Riverina – Regional Wrap-Up Report', dated 2012

- 'REROC Industry Water Use, Vulnerability and Adaptation Stage 2 Report', dated 23 June 2011
- 'REROC Climate and Water Resources Stage 1 Report', dated 21 June 2011
- 'Businesses and Industry Water Consumption – Discussion Paper 3', dated 10 June 2011
- 'Water Resources and Consumption – Discussion Paper 2', dated 21 January 2011
- 'Improving River Efficiency – A Computer Aided River Management system (CARM) for the Murrumbidgee River Australia'
- Map of RAMROC Councils.

7. Witness selection – public hearing on Friday 16 November 2012
Resolved, on the motion of Mr Veitch: That, in addition to the organisations that the Committee has previously resolved to invite to appear at the public hearing on Friday 16 November 2012, Griffith City Council also be invited to appear.

8. Adjournment
The Committee adjourned at 1.05 pm until 9.00 am, Friday 16 November 2012, at the Macquarie Room, Parliament House, Sydney.

Cathryn Cummins
Clerk to the Committee

Minutes No. 21
Friday, 16 November 2012
Standing Committee on State Development
Macquarie Room, Parliament House, Sydney at 9:30 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green *(from 9.40 am)*
Mr Lynn (*until 12.15 pm*)
Dr Phelps
Mr Whan

2. Previous minutes
Resolved, on the motion of Mr Veitch: That Draft Minutes Nos 18, 19 and 20 be confirmed.

3. Correspondence
The Committee noted the following items of correspondence received:

- 5 November 2012 – from Ms Brianna Casey, Environment Policy Director, NSW Farmers, advising that representatives from NSW Farmers are unavailable to appear at the public hearing on Friday 16 November 2012
- 12 November 2012 – from Mr David Tull, Director, Utilities, Griffith City Council, advising that representatives from Griffith City Council are unavailable to appear at the public hearing on Friday 16 November 2012.

4. Submissions
Resolved on the motion of Dr Phelps: That the Committee note that Submission No. 110 was published by the Committee Clerk under the authorisation of the Committee's resolution of 31 May 2012.

5. Acceptance and publication of documents tendered during the October site visits

Resolved on the motion on Dr Phelps: That the Committee publish the following documents which were tendered during the site visit to Orange City Council on Tuesday 30 October 2012:

- PowerPoint presentation entitled 'Macquarie River to Orange Pipeline'
- PowerPoint presentation entitled 'The Orange Revolution – a sustainable water model for inland Australia'.

6. Future inquiry activities

Resolved on the motion of Mr Veitch: That the Committee conduct a site visit to the northern regions of NSW, including inland and potentially coastal areas, in the week beginning Monday 4 March 2013.

Mr Green joined the meeting.

Resolved on the motion of Mr Green: That the Committee hold a further public hearing at Parliament House on Friday 3 May 2013.

7. Public hearing

Witnesses, the public and the media were admitted.

The Chairman made an opening statement regarding the broadcasting of proceedings and other matters.

The following witness was sworn and examined:

- Mr Tom Mollenkopf, Chief Executive, Australian Water Association.

The evidence concluded and the witness withdrew.

The following witnesses from the NSW Irrigators Council were sworn and examined:

- Mr Mark Moore, Policy Analyst
- Ms Stefanie Schulte, Economic Policy Analyst.

The evidence concluded and the witnesses withdrew.

The following witnesses from the Murrumbidgee Valley Food and Fibre Association were sworn and examined:

- Ms Debbie Buller, President
- Ms Virginia Tropeano, committee member.

Ms Buller tabled the following document:

- Newspaper article from *The Daily Advertiser*, entitled 'Govt. 'No' on Flood Control Dam Campaign', dated 17 February 1975.

The evidence concluded and the witnesses withdrew.

Mr Lynn left the meeting.

The following witnesses were sworn and examined:

- Cr Phyllis Miller, Chair, Central NSW Councils (Centroc) and Councillor, Forbes Shire Council
- Ms Jennifer Bennett, Executive Officer, Centroc
- Mr Garry Styles, Executive Manager, Centroc and General Manager, Orange City Council
- Mr Tony Perry, General Manager, Central Tablelands Water County Council.

Mr Perry tendered the following document:

- '*Regional Development in Central West NSW: Water the Real Constraint – A case for the enlargement of Lake Rowlands Dam*', prepared for Central Tablelands Water, Orange City Council and Newcrest Mining by the Western Research Institute, dated 6 November 2006.

The evidence concluded and the witnesses withdrew.

The public hearing concluded and the media and public withdrew.

8. Acceptance of publication of documents tendered during the public hearing

Resolved, on the motion of Mr Veitch: That the Committee accept and publish the following documents tendered during the public hearing:

- Newspaper article from *The Daily Advertiser*, entitled 'Govt. 'No' on Flood Control Dam Campaign', dated 17 February 1975
- '*Regional Development in Central West NSW: Water the Real Constraint – A case for the enlargement of Lake Rowlands Dam*', prepared for Central Tablelands Water, Orange City Council and Newcrest Mining by the Western Research Institute, dated 6 November 2006.

9. Adjournment

The Committee adjourned at 1:10 pm *sine die*.

Cathryn Cummins
Clerk to the Committee

Minutes No. 22

Tuesday 5 March 2013
Standing Committee on State Development
Universal Aviation Terminal, Sydney Airport at 8.00 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green
Dr Phelps

2. Apologies

Mr Lynn
Mr Whan

3. Inquiry into the adequacy of water storages in NSW

3.1 Site visit to Copeton Dam, Inverell

The Committee was met by the following representatives of State Water Corporation at the Copeton Dam Safety Upgrade Site Offices:

- Mr Michael Jeffery, General Manager Major Projects
- Mr Craig Cahill, Manager, Water Delivery Northern Valleys
- Mr Duncan Wilson, Copeton Dam Safety Upgrade Site Co-ordinator

Mr Cahill provided a briefing on water management practices in the northern valleys and Mr Jeffery provided a briefing on the dam safety upgrade program.

The Committee was then accompanied on a tour of Copeton Dam by the State Water Corporation representatives.

3.2 Site Visit to Keytah Farm, Moree

The Committee was met by

- Ms Zara Lowien, Executive Officer, Gwydir Valley Irrigators Association
- Mr Nick Gillingham, Manager, Keytah Farm.

Ms Lowien and Mr Gillingham briefed the Committee on Keytah's farming systems and achievements in water use efficiency.

Ms Lowien tabled the following:

- Gwydir Valley Irrigators Association Inc DVD entitled *Irrigation Efficiency Trial 2009-2010*
- Gwydir Valley Irrigators Association Inc document entitled *"Improving Irrigation in the Australian Cotton Industry"*
- Gwydir Valley Irrigators Association Inc information document

Ms Lowien and Mr Gillingham then accompanied the Committee on a site visit of Keytah showcasing irrigation efficiencies on the farm, system comparison trial and water monitoring and scheduling.

4. Adjournment

The Committee adjourned at 6.00 pm until 9.00 am, Wednesday, 6 March 2013, at the Moree Services Club, Albert Street, Moree.

Madeleine Foley
Clerk to the Committee

Minutes No. 23

Wednesday 6 March 2013
Standing Committee on State Development
Moree Services Club, Albert Street, Moree at 9.00 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green
Dr Phelps

2. Apologies

Mr Lynn
Mr Whan

3. Previous minutes

Resolved on the motion of Mr Veitch: That Draft Minutes Nos. 21 be confirmed.

4. Correspondence

The Committee noted the following item of correspondence sent:

- From the Chairman to Mr Richard Torbay MP, Member for Northern Tablelands, advising that the Committee will be conducting a site visit to Copeton Dam on 5 March 2013
- From the Chairman to the Hon Kevin Humphries MP, Member for Barwon, advising that the Committee will be conducting a site visit and public hearing in Moree on 5 and 6 March 2013.

5. Answers to questions

The Committee noted the following answers to questions on notice received:

- Thursday 1 November 2012
  - Riverina Eastern Regional Organisation of Councils
  - Tumut Shire Council

- Friday 16 November 2012
  - NSW Irrigators Council
  - Murrumbidgee Valley Food and Fibre.

6. Inquiry into the adequacy of water storages in NSW - Public hearing

The witnesses, the public and media were admitted.

The following witness from Cotton Australia appeared via teleconference and was sworn and examined:

- Mr Michael Murray, National Water Policy & Queensland Water Policy Manager

The evidence concluded and the witness withdrew.

The following witnesses from Moree Plains Shire Council were sworn and examined:

- Mr David Aber, General Manager
- Mr David Wolfenden, Group Manager, Water and Waste.

The evidence concluded and the witnesses withdrew.

The following witnesses from Namoi Water were sworn and examined:

- Ms Jon-Maree Baker, Executive Officer
- Mr Jonathan Phelps, Chairman.

The evidence concluded and the witnesses withdrew.

The following witnesses from Gwydir Valley Irrigators Association Inc were sworn and examined:

- Ms Zara Lowien, Executive Officer
- Mr Darren Hunt, Vice-Chair.

The evidence concluded and the witnesses withdrew.

The public hearing concluded and the public withdrew.

7. Publication of tendered documents

Resolved on the motion of Mr Veitch: That the Committee accept and publish the following documents tendered by Ms Lowien during the site visit to Keytah Farm on 5 March 2013:

- Gwydir Valley Irrigators Association Inc - DVD entitled *Irrigation Efficiency Trial 2009-2010*
- Gwydir Valley Irrigators Association Inc document entitled *"Improving Irrigation in the Australian Cotton Industry"*
- Gwydir Valley Irrigators Association Inc information document

8. Adjournment

The Committee adjourned at 12.15 pm *sine die*.

Madeleine Foley
Clerk to the Committee

Minutes No. 24
Friday, 3 May 2013
Standing Committee on State Development
Jubilee Room, Parliament House, Sydney at 9:15 am

1. Members present

Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green (at 9.30 am)
Dr Phelps

2. Apologies

Mr Lynn
Mr Whan

3. Previous minutes

Resolved, on the motion of Mr Veitch: That Draft Minutes Nos 22 and 23 be confirmed.

4. Inquiry into the adequacy of water storages in NSW

4.1 Submissions

Partially Confidential

Resolved, on the motion of Dr Phelps: That the Committee note that supplementary submission No 88a was published by the Committee Clerk under the authorisation of an earlier resolution, with the exception of the names of third parties. Further, that the Committee keep confidential the names of third parties.

4.2 Answers to questions on notice

Resolved, on the motion of Mr Veitch: That the return time for answers to questions on notice be 14 days to accommodate the reporting date.

4.3 Reporting date

The Chair proposed that the deliberative meeting to consider the final report be held on Monday 24 June 2013, subject to the Secretariat canvassing members regarding their availability.

4.4 Public hearing

Witnesses, the public and media were admitted.

The following witness was examined on his former oath:

- Mr David Harriss, Commissioner, NSW Office of Water.

The evidence concluded and the witness withdrew.

The following witnesses were sworn and examined:

- Mr Ronald K Pike
- Mr John Ibbotson.

The evidence concluded and the witnesses withdrew.

5. Adjournment
The Committee adjourned at 12.30 pm *sine die*.

Madeleine Foley
Clerk to the Committee

Draft Minutes No. 25

Monday, 24 June 2013
Standing Committee on State Development
Room 1153, Parliament House, 11.00 am

1. Members present
Mr Colless, *Chairman*
Mr Veitch, *Deputy Chair*
Mr Green
Dr Phelps
Mr Whan

2. Apologies
Mr Lynn

3. Previous minutes
Resolved, on the motion of Mr Veitch: That Draft Minutes No. 24 be confirmed.

4. Inquiry into the adequacy of water storages in NSW

4.1 Correspondence
The Committee noted the following items of correspondence received:

27 May 2013 - To Secretariat from Mr John Ibbotson, attaching a document with information on the Clarence Gorge Dam.

Resolved, on the motion of Dr Phelps: That the attachment to the email to the Secretariat from Mr John Ibbotson dated 27 May 2013 remain confidential to the Committee.

4.2 Answers to question on notice
The Committee noted that answers to questions on notice and supplementary questions provided by the following organisation be published by the Committee under the authorisation of an earlier resolution:
24 May 2013 – NSW Office Water (from hearing on 3 May 2013).

4.3 Consideration of the Chair's draft report

The Chairman submitted his draft report entitled 'Inquiry into the adequacy of water storages in New South Wales' which, having been previously circulated, was taken as being read.

Chapters 1, 2 and 3 read.

Resolved, on the motion of Mr Whan: That Chapters 1, 2 and 3 be adopted *in globo*.

Chapter 4 read.

Resolved, on the motion of Mr Whan: That a new paragraph be inserted after paragraph 4.97 to read:

'The Committee agrees that the main focus for achieving water savings required under the Murray Darling Basin Plan objectives should be efficiency savings rather than buy backs.'

Resolved, on the motion of Mr Whan: That paragraph 4.98 be amended by omitting the words, 'Also, the Committee is of the view that, once the 2,750 GL in sustainable diversion limits for the Murray Darling Basin objective has been met, the 50:50 arrangement should be dropped and funding continued on the basis of 100 per cent of water savings going back to the irrigator.' and inserting instead, 'The Committee is of the view that once the 2,750 GL in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:
1. State funded projects returning 100 per cent of water savings back to the irrigator, and
2. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.'

Resolved, on the motion of Mr Whan: That the second dot point in Recommendation 4 be amended by omitting the words, 'ensure that after the 2,750 gigalitres Murray Darling Basin Plan objective has been met, funding arrangements provide for 100 per cent of all water savings to be returned to the agricultural sector.' and inserting instead 'ensure that after the 2,750 gigalitres in sustainable diversion limits for the Murray Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:
1. State funded projects returning 100 per cent of water savings back to the irrigator, and
2. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.'

Resolved, on the motion of Dr Phelps: That Chapter 4, as amended, be adopted.

Chapter 5 read.

Resolved, on the motion of Mr Green: That Chapter 5 be adopted.

Chapter 6 read.

Resolved, on the motion of Dr Phelps: That Chapter 6 be adopted.

Chapter 7 read.

Resolved, on the motion of Mr Whan: That Chapter 7 be adopted.

The Committee noted that the Committee Secretariat is empowered to correct any typographical, grammatical and formatting errors prior to tabling.

Resolved, on the motion of Mr Veitch: That the draft report, as amended, be the report of the Committee and that the Committee present the report to the House.

Resolved on the motion of Dr Phelps: That the transcripts of evidence, submissions, tabled documents, answers to questions on notice, minutes of proceedings and correspondence relating to the inquiry be tabled in the House with the report.

Resolved on the motion of Dr Phelps: That upon tabling, all transcripts of evidence, submissions, tabled documents, answers to questions on notice, minutes of proceedings and correspondence relating to the inquiry not already made public be made public by the Committee, except for those documents kept confidential by resolution of the Committee.

The Committee noted that the summary of key issues and Chair's foreword will be circulated to Members.

The Chair advised the Committee of his intention to table the report on Thursday 27 June 2013.

5. *******

6. *******

7. **Adjournment**
The Committee adjourned at 11:33 am *sine die*.

Natalie Udovicic
Clerk to the Committee