The Committee Manager

Standing Committee on Natural Resource Management (Climate Change)

Parliament House

Macquarie Street

Sydney NSW 2000

Submission

Legislative Assembly

Water Management Inquiry By the Natural Resource Management (Climate Change) Committee

Lower Lachlan Stock & Domestic and Basic Right Water Users

Author of this submission is Patricia Bartholomew with input from: Reed Bed and Riparian Group, Matt Ireson, Bob McFarland & Booberoi Creek Water Users

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Inquiry Terms of Reference

Issues of sustainable water management with particular reference to climate change impacts and, in particular, to report on the following terms of reference:

a) The likely impact of climate change on the availability of water resources under different climatic scenarios;
b) Approaches to the management of water resources by all water users including provision for environmental flows; and
c) Best practice in water conservation and management.

OVERVIEW OF GROUP

The Lower Lachlan Stock & Domestic and Basic Right Water Users is a fledgling group, having only been formed on the 11th February 2010. The group was formed out of the need for representation at a decision making level, for Stock & Domestic and Basic Right water users on the Lower Lachlan, in regards to the management of the Lachlan Regulated Water Source, and its many unregulated off shoots.
The group has support from NSW Farmers, The NSW Aboriginal Lands Council, and The Central Darling Shire Council as well as water users groups within the Lower Lachlan.

The Lower Lachlan River is at the time of this submission under a Temporary Water Order, [SPECIAL SUPPLEMENT WATER MANAGEMENT ACT 2000 Order under Section 324 (1) TEMPORARY WATER RESTRICTIONS Lachlan Regulated River Water Source PURSUANT to section 324 (1) of the Water Management Act 2000], which has seen flows from Wyangala Dam reduced so it will not flow past Condobolin, (except for pulses to supply the Lake Cargelligo Weir Pool for Town Supply for Lake Cargelligo, Tullibigeal and Murrin Bridge).

Landholders below Condobolin ,who relied on their Stock & Domestic or Basic Right Access to the Lachlan River, its effluent and anabranch creeks, the Cargelligo Lakes and Wetlands, piped water schemes, and the Reed Bed at the Terminus of the Lachlan, have been denied water for in some instances, even critical human needs. The villages of Euabalong, Euabalong West and Oxley have had to begin carting water for Town Supply, with residents on extreme water restrictions, while Ivanhoe and Booligal are now relying on bore water.

While it is known that the Lachlan Valley is currently in the grip of drought, with historically low inflows into the major storage, the Temporary Water Order is still allowing high security extraction for irrigation and Industry (10% of allocation) above Condobolin. This is contradictory to the Water Management Act 2000 which states that Town Supply, Stock and Domestic and Critical Human Needs have a higher category under the act than High Security and General Security water Access licenses.

Our group believes that it is not acceptable at a public policy level that water is not made available to Humans and Livestock, while it is being supplied for mining and irrigation.

a) *The likely impact of climate change on the availability of water resources under different climatic scenarios*

While the debate goes on about the science behind Human Induced Climate Change, there is no denying that the South West of NSW has been one of the hardest hit of any area in Australia, by the current drought. The Lachlan Catchment at present has the dubious title of the driest catchment on the driest continent. Inflows into the Lachlan Catchment have been historically low, with the normal pattern of winter rainfall having shifted south by some 150 km into the Southern Ocean [BoM].The area relies on winter and spring rainfall, which allows for water storage in the catchment's main storage Wyangala Dam, and prior to the implementation of Drought Contingency Plans, the natural water storage, Lake Cargelligo [which was regulated in 1902] to supply water for the lower Valley over the dryer and hotter summer months.
Since 2001, rainfall events have been coming as localized storm events in the summer, such as was seen in the floods of 2007 at Lake Cargelligo, with little general rain occuring during the winter and spring. The autumn break has not happened until as late as May in some years and not come at all in others. 2005 saw the break come in June with 250 mls falling, and then no follow up rain.
Strom events do not always show up when looking at long term average rainfall, as there is a huge difference in outcomes for the river, landholders and communities in getting 100mls of rain in the winter as opposed to the same amount in a summer storm event.

See Attachment 2

According to the CSIRO Murray-Darling Basin Sustainable Yields Project – a report to the Australian Government March 2008, The **recent** climate (1997 to 2006) was similar to the long-term average climate and the best estimate of climate change by 2030 would reduce surface water availability by 11 percent and surface water diversions by 8 percent. ***For future climate and current development*** Rainfall-runoff modelling with climate change projections from global climate models indicates that runoff in the Lachlan region is more likely to decrease than increase. The best estimate (median) is a 10 percent reduction in mean annual runoff by 2030. Extreme estimates (from different climate models under high global warming) range from a 34 percent reduction to a 17 percent increase in mean annual runoff. Under the best estimate 2030 climate there would be decreases of 11 percent reduction in water availability, 13 percent in end-of-system flows and 8 percent in surface water diversions. Under the wet extreme 2030 climate there would be increases of 6 percent in water availability, 9 percent in end-of-system flows and 4 percent in diversions. Under the dry extreme 2030 climate there would be decreases of 30 percent in water availability, 35 percent in end-of-system flows and 22 percent in diversions including a 2 percent reduction in high security town water supply. Under the best estimate 2030 climate there would be little change in rainfall recharge to groundwater; however, under the extreme 2030 climates there would be large changes in rainfall recharge. Net river losses would be largely unaffected by climate change. Under the best estimate 2030 climate the average period between winter–spring inflows to the Booligal Wetlands would increase by a further 24 percent reducing the frequency of waterbird breeding events. Under the dry extreme 2030 climate the average period between these inflows would increase by 87 percent with major ecological consequences including longer periods between waterbird breeding events and adverse effects on the vegetation used as breeding habitat by some waterbirds. The wet extreme 2030 climate would cause a 21 percent decrease in the average period between major inflows. Under the best estimate 2030 climate the average period between winter–spring flood events to the Great Cumbung Swamp would increase by an additional 24 percent adversely affecting the swamp vegetation and its use by waterbirds. Under the dry 2030 climate extreme the average period between these flood events would increase by 131 percent with substantial adverse consequences for swamp vegetation. The wet extreme 2030 climate would cause an 11 percent decrease in the average period between events.

The Lachlan River and its offshoots of lakes, wetlands and creeks is the only surface water source in the Lower Lachlan region. In nature (before regulation) the Lachlan would dry from the top down. I.e. there was water in the Reed Beds at the bottom end well after the Upper Lachlan had gone dry. Regulation has reversed the natural placement of water within the Valley. If surface water availability will be reduced by 11%, the amounts of water allocated for Town Supply and Stock & Domestic and Basic Right to the Lower Lachlan region needs to be adjusted up, accordingly.

For these reason our group believes that provision should be made for

- the secure storage of more water, regulated through Lake Cargelligo specifically for the transmission of Stock & Domestic water, and environmental water to the Lower Lachlan;
- The maintenance of a stock and domestic flow to the end of the Lachlan, predicated on a 30 megalitre minimum flow at Corrong Bridge between the months of November and March.
- Implementation of water saving measures such as piping channels that are used to supply Stock & Domestic water (**not naturally occurring creeks**)
- incentives to put in tanks & troughs rather than pumping through channels to earthen dams
- The conversion of all town supply licenses to High Security WALS:- currently the town supply for Lake Cargelligo, Tullibigeal & Murrin Bridge is only supplied by the Lachlan Shire Councils' General Security
- The category that Stock & Domestic already has under the Water Management Act (That is after Town Supply) be maintained.

b) *Approaches to the management of water resources by all water users including provision for environmental flows*

Local knowledge from long time Lachlan frontage landholders is an asset when approaching the management of water resources. In some instances property has been held by the same family for 3 or 4 generations and they hold a wealth of knowledge that could be used. Community consultation has become more like "The powers that be" rolling into communities and telling them how the river will be run, not consulting at all. There has been a perception that these meetings were just for irrigators, as they were convened by Lachlan Valley Water Users, an irrigators lobby group, so consequently a lot of Stock & Domestic and Basic Right water users did not attend. There needs to be far more informative and interactive consultation, taking into consideration the full length of the valley and all the different water user groups.

BORES

Upper and Mid Lachlan Bores

- The effects of expansion into bore irrigated agricultural and Industry developments and mining in the Upper & Mid Lachlan needs to be fully explored in relation to water availability in the Lower Lachlan. There is little or no research available into the recharge areas of bores in the upper reaches, but it is likely that these bores are sucking out from below the river bed, and could explain the "transmission losses" that directly affect the amount of water available to the Lower Lachlan.

Lower Lachlan Bores

- A priority for funding of the proposed bore 30kms west of Lake Cargelligo, and further investigations into the availability and quality of groundwater along the length of the Lower Lachlan should be fast tracked. The lack of available surface water has decreased the ability of this region to further develop a manufacturing hub, which up until the water shortages, had revitalized this community and the smaller communities of Tullibigeal, Euabalong and Euabalong West **(n.b)** there is a distinct hydrological and geographical difference between the Upper Lachlan and Lower Lachlan groundwater aquifers. To ensure the progress of the Lower Lachlan region in relation to Climate Change, it is imperative to explore every option. If necessary, technology such as desalination of saline groundwater could be an option either for emergency supplies for human consumption and Stock & Domestic, or alternatively used in the mining and manufacturing industries.

Stock & Domestic Bores

- Incentives such as grants should be offered to landholders, who normally draw water from the Lachlan River for their Stock & Domestic and Basic Right Access, to source alternate groundwater supplies that can be used as an emergency supply in dry seasons.

The Lower Lachlan Stock & Domestic and Basic Right Water Users believe that a thorough study be carried out to ascertain the nature of Upper and Lower Lachlan bores, their recharge areas and the effects of their expansion on water availability into the Lachlan system. As well as explore all the options available, and repercussions for the future use and reliance on groundwater.

MINING

- There are now three mines that directly and indirectly draw water from areas that flow into the Lachlan Catchment. Cadia Mine near Orange has dams on the effluent creeks that run into the Belabulah River (which feeds into the Lachlan below Wyangala), as well as extensive bore fields in this area. North Parkes Mines at Parkes in NSW which also draws water from bore fields (Parkes Water supply is supplemented by the Lachlan river , and Parkes Shire Council does supply water to the Mine) and Lake Cowal Mine near West Wyalong, which receives water down the Jemalong Channel (approx 17 megs per day). This is drainage water from the Jemalong Irrigation Corporation. Lake Cowal also uses water from bores.

The Lower Lachlan Stock & Domestic and Basic Right Water Users believe that the provision of water for Humans and Livestock should be prioritized above those of Irrigation and mining, certainly at a Critical Planning level. The mining Industry works within the constraints of a Boom/ Bust market, and as such should be able to shut down when River management cannot supply its commitments of Town Supply, Stock & Domestic Basic Right and critical human needs for the full length of the river.

TOWN SUPPLY

- All Local Government areas should be issued with High Security WALs for the supply of human needs water for every community within shire boundaries. This should be a priority. Parks and Gardens could still be watered from General Security WALS.
- BMP for Water efficiency should be implemented by all Shire Councils in the supply of Town Water. There has been enormous wastage of water in Lake Cargelligo due to an inefficient water filtration plant that has seen the water used in the filtration process as high as 7:1 Litres. This filtered water is then also supplied to Stock & Domestic Water users through a piped scheme, which is a terrible waste of water and other resources.
- Local Councils should be encouraged to start grey water and storm water recovery projects, as well as bring their current infrastructure up to scratch to limit water wastage.
- In Lake Cargelligo a raw water scheme needs to be looked at for Parks and Gardens and Stock & Domestic supply.

The Lower Lachlan Stock & Domestic and Basic Right Water Users believe that Town Supply should remain categorized as the top priority in the running of the river, throughout the <u>full</u> length of the River. We believe that town supply should be uniformly supplied by a High Security Access license, as well as exploring future emergency needs being supplemented by bore water. The township of Ivanhoe,(which is currently on an emergency bore), was supplied by Willandra Creek, and the townships of Euabalong, Euabalong West, Booligal and Oxley need to be given a secure, reliable Lachlan river allocation .

STOCK & DOMESTIC

CATEGORY OF S&D

- At this point in time Stock and Domestic supply is next after Town supply in priority of allocation, but there are plans to change this category.

Lower Lachlan Stock & Domestic and Basic Right Water Users oppose any move to change the category of Stock & Domestic under the Water Management Act.

- TRADEABILITY OF STOCK & DOMESTIC WATER
  Our group sees the push towards a free trade water market, in regards to Stock & Domestic Licenses as being totally detrimental to the environment, longevity of the economy of Lower Lachlan communities, and individual landholder's ability to carry on their business. Any moves to trade Stock & Domestic should be countered with a "No Go" Zone within the Lower Lachlan. We foresee that water entitlements could be sold or transferred out of the Lower Lachlan, which directly affects the amount of water that can be transmitted down to the bottom end users. Stock & Domestic Water should stay with the property to which it was allocated; otherwise there will be vast tracts of land made virtually unusable.

Lower Lachlan Stock & Domestic Water Users are opposed to the tradability of Stock & Domestic Water

ENVIRONMENTAL FLOWS

- Environmental flows are imperative to the Lower Lachlan Stock & Domestic and Basic Right Water Users, and we encourage a coordinated and holistic approach to their regime. Environmental flows should be entrenched into the actual physical management of the river, throughout its length, but more specifically environmental flows must reach the terminus at the reed bed known locally as the Great Kalare (The Great Cumbang Swamp). Unless the river is run to its extent, the climate change scenario will be self-fulfilling, I.e widespread environmental damage and communities without water. River management has to change away from punting on modelling for future inflows, and return to a reality-based plan. The Reed beds at the terminus of the Lachlan, the Red Gum wetlands at Booligal and the series of lakes and wetlands at Cargelligo are extensive, and intrinsically important for the health of the Lower Lachlan
- The supply of environmental water to Artificial Wetlands such as Lake Brewster and Ita Lakes is detrimental to the real wetlands and lakes. The loss of water trying to get water into the Ita Lake national Park was extreme. These Lakes never filled even on a big river, possibly only in a once in a life time flood event. The Lake Brewster project which has seen between $13 and $20 million dollars spent on it has, (depending on who you talk to) effectively side lined the real lake and wetland, in this section of the river, Lake Cargelligo. The Brewster Project was proposed by a group of Hillston irrigators (this information came from the Chairman of the

Lachlan CMA, Bob Gledhill) and was a joint project between many government agencies. It was also stated by Mr Gledhill, that because the community of Lake Cargelligo did not have any input into the project, it was not taken into consideration. This kind of management is not acceptable, obviously the prioritising of Lake Brewster would have a detrimental affect on allocation to Lake Cargelligo, from which a number of communities and landholders draw their water.

CURRENT MANGEMENT PRACTICE OF STATE WATER

- Since it became a corporation in 2004, State Water has tried to run the river as a business. A river is a geographical feature, not something that can be run as a business and our group believes that there has to be a shift away from this attitude or at least a cohesive plan taking in all elements of a river environment. For State Water, water taken up by trees, reeds and the river bed is classed as transmission losses. Evaporation, an essential part of the global water cycle, is also seen as a "loss". Without evaporation there is no precipitation, and a river is much, much more than a channel to funnel water to a "Customer". The creation of artificial wetlands, such as at Lake Ita National Park and Lake Brewster is compromising the real wetland areas indigenous to the Lachlan. The piping of natural creeks, and the approval for the damming of upper Lachlan effluent creeks, [which run in to the Belabulah River] and the imposition of a Temporary Water Order on the Lower Lachlan are contradictory to many pieces of legislation.

- The current Temporary Water Order on the Lower Lachlan has changed the category of Stock & Domestic and Basic Right in the Lower Lachlan to be below High Security extraction in the Upper and Mid Lachlan. This approach to water management is

- a) contradictory to the Water Management Act 2000 b

- b) is divisive and discriminatory

- c)is detrimental to the environment

- d) has caused financial hardship for one group of water users.

What is needed is a clear intent from The Office of Water to run the river to its full extent, with Towns, Stock & Domestic, and the environment given first priority. The water that is left after these allocations have been me, can then be "cashed" in by State Water on High Security and General Security licenses.

c)Best practice in water conservation and management

The management of the Lachlan (and all NSW rivers) has become so convoluted by the vast changes made in the switch from the Water Act 1912 to the Water Management Act 2000. This coupled with State Water becoming a corporation in 2004, has seen the erosion of Stock & Domestic and Basic Right water delivery, as well as the importance of environmental water, to the benefit of the High Security and General Security "paying Customer". While the low inflows caused by a decade long drought have not helped, the people of NSW need to have surety that their legal rights to water are not being eroded by stealth, and poor legislation.

The Lower Lachlan was put on reduced flows, well before the Wyangala Dam dropped to critical levels; this is contrary to the agreement that was made when Wyangala was first built.
The huge irrigation developments that occurred in the Lower Lachlan were never going to be sustainable, particularly with water intensive summer crops; quite simply the river is over allocated.

Mistakes such as the wrong classification of Booberoi Creek as an effluent Creek,[when in fact it is an anabranch], and the omission of Lake Cargelligo on the Lachlan Water Sharing Plan, and the neglect shown to perhaps one of the most significant features of the Lachlan's hydrology, The Terminal Reed Bed [Great Cumbang Swamp] have left the Lower end of the river constantly undermined and under supplied.

Fish kills of the magnitude seen in Lake Cargelligo in late 2009 is a clear visual of poor management and lack of communication between government agencies. Another fish kill, this time of the native fish species *golden perch* occurred a few years previous , shows that all is not well in the management of the river. The proliferation of European Carp has been ongoing in the Lower Lachlan for many years now, to the detriment of the River environment; only very recently has anything being done about it. This short sightedness and lack of action can also be seen in the growth of cubungi, bull rushes and tree suckers, which inhibit the flow of water in many of the river section and creeks. It is an issue that can be easily fixed, but never seems to be. Snags in the river, while supplying fish habitat, are also a direct result of the Carp undermining the banks.

Water conservation methods that deny one section of the river access to water are not an acceptable option. The drying of the river bed has cost water not saved it, which can be clearly seen now in the Lower Lachlan, with the promised Christmas rains being taken up by the dry bed, and never reaching the Brewster weir pool. These kinds of decisions clearly erode landholders Basic Right or what was known as Riparian Right to draw water from a water source. This right ensured that water was made available to river, creek and lake frontage landholders by virtue of ownership of that land. This erosion of the Basic Right needs to be addressed, as it has serious connotations for land valuations and rates, as well as the obvious lack of water for Town Supply, Stock & Domestic and Critical Human Needs in the Lower Lachlan.

The lack of water in the system has been caused by a number of reasons, not only the lack of inflow into the catchment, the Lower end flows were being reduced even when Wyangala was 100%.

better management approaches to water conservation and management of the river should include

- Irrigated Summer crops except for food crops on the Lachlan should be discouraged, perhaps with a higher cost for water during the hotter months
- Drip or micro spray irrigation should become the norm
- Irrigation channels should all be lined or piped

The Lachlan River must be allowed to recover through to the terminal reed bed, known locally as the Great Kalare Wetland at the end of the system, before any extractions apply. The security of the river must take precedence over all other options now and into the future.

The End

Signed:
Date:

ATTACHMENT 1

COMMENTS FROM LOWER LACHLAN LANDHOLDERS

Reed Bed & Riparian Group

"Lower Lachlan Reedbed & Riparian was formed to represent frontage landholders from Eurugubah to the end of the river, as well as the villages of Booligal and Oxley.
Our objective is the maintenance of a stock and domestic flow to the end of the Lachlan, predicated on a 30 megalitre minimum flow at Corrong Bridge between the months of November and March.
Experience has shown that a constant minimum flow will require less water than the flawed pulsing policy so beloved by river managers.
The additional water required to restart the river flies in the face of water savings, and the best example of this policy failure is illustrated by the panic release of September/October, some 30000 megs from the dam which trickled to a pathetic
halt at the Corrong Bridge, just after Xmas 2009.

L.L.R & R. is opposed to diversions or diversion policy that would compromise flows to the full length of the river.We remind government that Stock and Domestic supply is next after Town supply in priority of allocation.

Unless the river is run to its extent, the climate change scenario will be self-fulfilling, ie widepread environmental damage and communities without water. River management has to change away from punting on modelling for future inflows, and return to a reality-based plan."

Derek McFarland
Chairman
Reed Bed and Riparian Group

"With the river management this year (2009) dividing the catchment, it appears that the people downstream have lost a little trust in the decision makers. We need to clearly set the priorities of water management. I believe Stock & Domestic and Town Supply should have highest priority; then the Environment, High Security, then General Security. If climate change impacts continue, we need to provide alternative water supplies. Investigations into inefficient water users along the river need to be identified and changed. Eg some creeks have large S+D allocations which may need piping to gain water savings and the creeks to flow naturally in wet seasons.
When water is scarce the river looses its peaks and flows like a channel. As the river flows at a lower height we have seen problems such as cumbungi growth. Other problems have occurred from the dredging in the 1950s along Tooragany Creek, which now dries the river on "Eurugabah" more often. This needs to be fixed back to make water flow down river.
On a positive note we must all realize if the dam wasn't built the river would run dry more often. Therefore we need to manage this resource the fairest to all along the whole river."
Matt Ireson
Booligal NSW

"The management of the river where all emphasis has been built around "paying customers" and their demands, does not take into consideration the needs of the those that do not trade in water, such as Stock & Domestic and Basic Right Water users, or the importance of the riverine environment to supplying that water. Environmental flows should be the actual physical management whereby the river system is run and given a higher priority as far as flows and extraction are concerned.

Ever since Wyangala was built in the 1930's and later enlarged,the bottom end of the river has suffered has never really recovered. It has literally been sacrificed for the areas that have been developed e.g., the Hillston, Forbes, Jemmalong, Cowra areas and many other smaller areas; the river is simply not big enough to supply everything it has been asked to do.

The engineering developments in the floor of the Lachlan River (for example the Willandra Creek regulator) has changed the flow regime of the actual river. And this is the case with many of the pieces of infrastructure along the Lachlan. The Lachlan River is totally over committed and cannot meet the licensed demands that are available on it and also to supply all the towns, properties and communities right along the breadth of it."

Bob McFarland " Oxley Station", Hay NSW

ATTACHMENT 2

CSIRO Murray-Darling Basin Sustainable Yields Project – a report to the Australian Government March 2008

Water Availability in the Lachlan

Why has this report been produced?

The CSIRO Murray-Darling Basin Sustainable Yields Project resulted from the Summit on the Southern Murray-Darling Basin (MDB), convened by the then Prime Minister on 7 November 2006. The Project is providing governments with a robust, basin-wide estimate of water availability on an individual catchment and aquifer basis, taking into account climate change and other risks. The report for the Lachlan is now complete. Reports for the remaining regions and for the entire MDB will be released progressively through to early 2008. Information on how these results may be used in the development of a new sustainable diversion limit for the MDB can be found at www.environment.gov.au/water/mdb/yields.html.

The Lachlan region

The Lachlan region is in central western NSW and represents 8 percent of the total area of the MDB. The region is based around the virtually terminal Lachlan River. The population is around 90,000 or 4.7 percent of the MDB total, concentrated in the major centres of Cowra, Young, Parkes, Forbes, West Wyalong and Condobolin. The dominant land use is dryland pasture used for sheep and beef cattle grazing. There were 47,900 ha of irrigated cropping within the region in 2000 dominated by cereal, pasture and hay, with small areas of cotton, orchards, viticulture and horticulture. Less than 20 percent of the region retains native vegetation. The region includes the nationally significant Booligal Wetlands and the Great Cumbung Swamp on the lower reaches of the Lachlan River. The region uses 3.5 percent of the surface water diverted for irrigation in the MDB and 14.1 percent of the MDB groundwater resource. Wyangala Dam on the Lachlan River upstream of Cowra is the major water storage. Approximately two-thirds of irrigation water used is sourced from surface water diversions. Groundwater is extracted from alluvial aquifers in the western portion of the region to irrigate cotton crops and for stock and domestic use.

Key findings

- **Current** average surface water availability is 1139 GL/year and about 321 GL/year (or 28 percent) is used. This is a moderately high level of development and includes surface water diversions (292 GL/year) and eventual streamflow loss induced by current groundwater use. Groundwater use is about 236 GL/year or 45 percent of total water use.
- The **recent** climate (1997 to 2006) was similar to the long-term average climate.
- The best estimate of **climate change by 2030** would reduce surface water availability by 11 percent and surface water diversions by 8 percent.
- **Future development** of commercial plantation forestry is expected to be negligible. A 14 percent growth in farm dams by 2030 is expected which would reduce runoff by 2 percent. Groundwater extraction is expected to grow by 86 percent (to 440 GL/year) by 2030 to become around 63 percent of average total water use.

For historical climate and current development

The average annual rainfall for the region is 461 mm and modelled average annual runoff is 23 mm. Average surface water availability is 1139 GL/year and about 321 GL/year (or 28 percent) is used. This is a moderately high level of development and includes surface water diversions (292 GL/year) and eventual streamflow leakage to groundwater induced by groundwater use. Groundwater extraction from the Upper and Lower Lachlan alluvia is expected to eventually increase streamflow losses from the Lachlan River by about 50 percent over and above the natural streamflow leakage. Most of this additional loss will occur in the Upper Lachlan (while most of the natural loss occurs in the Lower Lachlan).

Groundwater extraction in 2004/05 is estimated to have been 236 GL representing 45 percent of total water use on average and 90 percent of total water use in years of minimum surface water diversion. Most of the extraction was from
the Upper Lachlan Alluvium (31 percent) and Lower Lachlan Alluvium (53 percent) groundwater management units (GMUs). For the Lower Lachlan Alluvium GMU extraction exceeded the long-term average extraction limit (LTAEL) due
to supplementary licences with entitlements that decrease to zero by 2018. The reduction in entitlements to the LTAEL
level is funded by the New South Wales and Australian governments under the 'Achieving Sustainable Groundwater Entitlements' program. Extraction from the Lower Lachlan Alluvium GMU cannot be maintained at the LTAEL. Recently,
the interim LTAEL was changed from 96 GL/year to 108 GL/year. Extraction is 71 percent of the 'effective recharge' (recharge excluding lateral inflow) and exceeds effective recharge 56 percent of the time. Extraction from the Upper Lachlan Alluvium GMU cannot be maintained at the LTAEL. The extraction limit is 117 percent of total groundwater recharge and extraction exceeds recharge 92 percent of the tim

Continued extraction at these levels would eventually lower watertables by up to 10 m in some parts of the lower aquifer
in the Lower Lachlan and by up to 20 m in some parts of the lower aquifer in the Upper Lachlan requiring responses from both groundwater users and groundwater managers in order to reduce extraction in areas of falling watertables. As a result of water resource development the average period between winter–spring floods entering the Booligal wetlands has increased from 6.2 years to 8.3 years. These changes are consistent with observed substantial reductions
in the frequency and size of waterbird breeding events. As a result of water resource development there has been a substantial increase in the average period between winter–spring flood events in the Great Cumbung Swamp from 1.2 years to 2.5 years. These changes are consistent with observed deterioration in vegetation condition in the swamp.

For recent climate and current development

Average annual rainfall and runoff for 1997 to 2006 were 8 and 24 percent lower than the long-term averages respectively. These differences are not statistically significantly due to high inter-annual variability and thus a scenario based on the last ten years was not modelled for the region.

For future climate and current development

Rainfall-runoff modelling with climate change projections from global climate models indicates that runoff in the Lachlan
region is more likely to decrease than increase. The best estimate (median) is a 10 percent reduction in mean annual runoff by 2030. Extreme estimates (from different climate models under high global warming) range from a 34 percent reduction to a 17 percent increase in mean annual runoff. Under the best estimate 2030 climate there would be decreases of 11 percent reduction in water availability, 13 percent in end-of-system flows and 8 percent in surface water
diversions. Under the wet extreme 2030 climate there would be increases of 6 percent in water availability, 9 percent in
end-of-system flows and 4 percent in diversions. Under the dry extreme 2030 climate there would be decreases of 30 percent in water availability, 35 percent in end-of-system flows and 22 percent in diversions including a 2 percent reduction in high security town water supply. Under the best estimate 2030 climate there would be little change in rainfall
recharge to groundwater; however, under the extreme 2030 climates there would be large changes in rainfall recharge.
Net river losses would be largely unaffected by climate change.
Under the best estimate 2030 climate the average period between winter–spring inflows to the Booligal Wetlands would
increase by a further 24 percent reducing the frequency of waterbird breeding events. Under the dry extreme 2030 climate the average period between these inflows would increase by 87 percent with major ecological consequences including longer periods between waterbird breeding events and adverse effects on the vegetation used as breeding habitat by some waterbirds. The wet extreme 2030 climate would cause a 21 percent decrease in the average period between major inflows. Under the best estimate 2030 climate the average period between winter–spring flood events to
the Great Cumbung Swamp would increase by an additional 24 percent adversely affecting the swamp vegetation and
its use by waterbirds. Under the dry 2030 climate extreme the average period between these flood events would

increase by 131 percent with substantial adverse consequences for swamp vegetation. The wet extreme 2030 climate
would cause an 11 percent decrease in the average period between events.

For future climate and future development

Groundwater extraction outside of the Upper and Lower Lachlan Alluvium GMUs is expected to increase more than three-fold by 2030. This would mean total groundwater extraction for the region would be 440 GL/year – an increase of
86 percent over 2004/05 extraction levels. Groundwater extraction would then represent, under the best estimate 2030
climate, 63 percent of total water use on average and 95 percent of total water use in years of minimum surface water diversion. For the Upper Lachlan Alluvium GMU extraction in the modelled area is projected to be 121 GL/year by 2030.

However, the maximum level of extraction that could be maintained from existing bores is about 67 GL/year. The total eventual impact of future groundwater extraction across the region would be an additional 30 GL/year reduction in streamflow. Of this impact, streamflow leakage and the larger individual inflow reductions were included in the river modelling. Negligible growth is expected in commercial forestry plantations by 2030, but farm dam storage capacity is projected to increase 14 percent reducing mean annual runoff by less than 2 percent. The additional groundwater extraction and future farm dams would reduce river inflows (under the best estimate 2030 climate) by 28 GL/year, of which about two thirds would be due to farm dams. There would also be an additional 6 GL/year increase in streamflow
leakage to groundwater in alluvial reaches due to projected increases in groundwater extraction. Diversions would reduce by an additional 2 percent to be 10 percent lower than current. End-of-system flows would reduce by a further 2 percent. The relative level of use would be 32 percent – 4 percent higher than the current level.

Where can I find out more about the project?

More information about the project can be found at www.csiro.au/mdbsy. This information includes the full terms of reference for the project, an overview of the project methods and the project reports that have been released to-date including the full report for this region. Enquiries: tel. 1300 363 400, enquiries@csiro.au.

The End