Submission to the Murray Darling Basin Authority on the Proposed Basin Plan

Namoi Councils Water Working Group

April 2012

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Table of Contents

1 INTRODUCTION

This submission is made to the Murray Darling Basin Authority (MDBA) by the Namoi Councils Water Working Group (NCWWG) in respect to the proposed Basin Plan released by the Murray Darling Basin Authority (MDBA) in November 2011.

This submission focuses on the Namoi Region specifically and the downstream contribution required from the Namoi to meet the environmental water requirements of the Barwon Darling. It also makes recommendations in regard to further work that needs to be undertaken by the MDBA and NSW and identifies potential works and measures that should be further explored to assist in "bridging the gap" between the current (or baseline) diversions and the proposed sustainable diversion limits.

The NCWWG previously provided a submission to the MDBA on the Guide to the proposed Basin Plan. On review of the proposed Basin Plan and associated documentation, we note and appreciate that a number of these have been addressed. However, there are a number that remain outstanding. These outstanding issues and concerns remain important to the NCWWG and the Namoi Regional community and we have therefore raised these again in this submission and would appreciate the MDBA's response.

In making this submission we have also made reference to a number of the recommendations outlined in both the House of Representatives Standing Committee on Regional Australia Committee Report: *Of drought and flooding rains – Inquiry into the impact of the Guide to the Murray Darling Basin Plan in Regional Australia* and the Australian Government's response to the Committee's report, particularly in regard to those recommendations relating to placing a priority on the development and implementation of works and measures and water use efficiencies over water purchases.

The NCWWG welcome the opportunity to make this submission to the MDBA. As outlined in our previous submission the focus needs to be on a "Healthy Working River" and particularly the involvement of local communities as a key plank of this concept. As outlined in previous submissions, engagement with regional and rural communities is extremely important. While we note that this has improved somewhat since the Guide process, we are still not getting what is needed in terms of one on one which to clarify and gain a better understanding of the development of the environmental water requirements (EWRs) and sustainable diversion limits (SDLs). We seek better communication with and access to MDBA modellers and the MDBA policy decision makers – together.

We see this as essential in being able to deliver practical solutions on-ground for the sustainable management of the Basin's water resources. It is clear that we are living and operating in a modified riverine environment and will not return to a natural pre-development condition. However there is scope to develop innovative solutions that will deliver better management and a healthy working river. Some of these are outlined in this submission.

1.1 Namoi Councils Water Working Group

The Namoi Councils is an alliance of five councils and the Namoi Catchment Management Authority (CMA).

The Namoi Councils Water Working Group (NCWWG) reports to and makes recommendations to the Namoi Councils on water policies and reforms that impact on the Namoi regional economy. In addition, it seeks to identify and leverage both Australian and NSW State Government

funding (including structural adjustment monies) for the benefit of Local Government Areas in the Catchment.

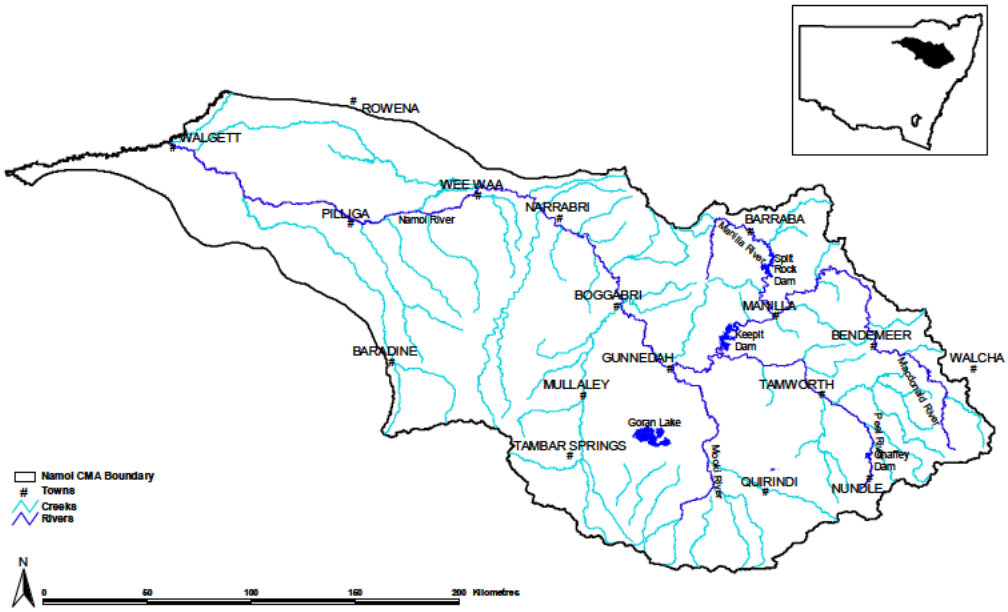
The NCWWG membership comprises of representatives of Tamworth Regional Council, Narrabri Shire Council, Namoi Water, Namoi Catchment Management Authority (CMA), a major agricultural and industrial water user, mining industry and two Local Government representatives with technical skills. The group is chaired/convened by the Namoi CMA.

2 BACKGOUND

2.1 The Namoi River Catchment

The Namoi River Catchment of the Murray Darling Basin (MDB) is located in north western NSW and represents 3.8 per cent of the total area of the MDB. It consists of three distinct systems: the main Namoi River system, the smaller Peel River system and the Manilla River/Upper Namoi River system. The Namoi region also includes Lake Goran, which is located next to the Liverpool Plains which is listed as a wetland of national importance.

Namoi CMA Catchment Map



The population of the region is approximately 100,000 or 4.6 percent of the Murray Darling Basin total which is concentrated in the towns of Tamworth, Gunnedah, Narrabri, Boggabri and Wee Waa (Namoi CMA 2009).

The river is an area of spiritual and cultural significance for the Gamilaroi people.

The Namoi River system provides a wide range of aquatic habitats and is ecologically important. The floodplain downstream of Narrabri contains large areas of anabranches and billabongs. When flooded, these areas are considered to be important and work on similar rivers has established that they provide large amounts of dissolved organic carbon, which is essential to aquatic ecosystem functioning (Thoms et al., 2005).

The only wetland of listed national importance in the Namoi Region is Lake Goran (EA, 2001), which is located adjacent to the Liverpool Plains. The lake is at the end of an internal drainage basin that does not connect to the Namoi River.

The western part of the Namoi, that is the area that falls within the Darling Riverine Plains Bioregion, is an important example of an inland drainage system where the streams flow into an arid region. The wetlands of this bioregion are the most important wetland habitats in the

inland regions of the state. They provide essential habitat for bird and fish breeding events in otherwise dry environments (Namoi Conservation Strategy 2008).

The Namoi Catchment is a major agricultural, industrial and domestic user of water. Water is a highly utilised resource within the Namoi Catchment from both surface and groundwater.

The region uses 2.6% of the surface water diverted and it has one of the highest levels of groundwater development in the Murray Darling Basin and is 15.2% of the Murray Darling Basin total groundwater use (CSIRO 2007). Water security and quality is a critical need for all the major urban, peri urban and stock and domestic users.

Split Rock Dam on the Manilla River and Keepit Dam on the Namoi River are the two main storages in the Namoi River Valley with Chaffey Dam on the Peel River principally supplying Tamworth city with water supply and minor irrigation supply.

The economy of the Namoi Catchment is highly dependent upon primary production with the dominant landuse being agriculture (cattle, sheep, dryland cropping and irrigated cotton). Irrigated agriculture account for 48% of the gross value of agricultural production in the Namoi Catchment (Namoi CMA, CARE Report 2006). It is important to note that mining, intensive agriculture, for example poultry, and urban water needs have also risen.

The Gunnedah Basin has been estimated by the NSW DPI to have 13.1% of the total coal reserves in NSW. The region is poised for large scale expansion of coal mining and coal seam gas extraction and this needs to be better accounted for in at the catchment scale in all levels of planning to ensure impacts are minimised and opportunities are maximised.

The Namoi region is not foreign to water reform and the people of the Namoi region have played an active and valuable role in contributing to the development of an environmental flow policy, water quality objectives, farm dams policy, floodplain harvesting policy, water sharing plans, the Achieving Sustainable Groundwater Entitlements (ASGE) Program and the National Water Initiative over the last 15 to 20 years. This involvement has been a critical component in the delivery of successful on-ground implementation of integrated natural resource management.

2.2 The Namoi Valley in relation to the Barwon-Darling River and the Menindee Lakes Storage

Prior to the large algal bloom in the Barwon-Darling in 1991, the regulated tributaries of the Barwon-Darling and the Barwon-Darling itself were treated and managed as independent water sources. There were no statutory or policy obligations to consider connectivity of the tributaries and the Barwon-Darling River. The regulated Namoi Valley was managed to maximise the delivery of regulated and "off-allocation" supplies.

Following the unprecedented Barwon-Darling algae event of 1991 a policy "The interim Unregulated Flow Management Plan for the North West" was implemented in mid-1991. This plan imposed an obligation to manage unregulated flow from the Namoi Valley (and other tributaries) and within the Barwon-Darling itself to provide flows in the Barwon-Darling, in specified periods and flow conditions. The objective of the plan was to:

- maintain basic stock and domestic supplies along the length of the Barwon-Darling at all times

- provide a flow of 2,000 ML/day in the Darling River at Wilcannia for 5 consecutive days during October to April, inclusive, providing flows of this quantity have not already been reached during the preceding three months within October to April period, and

- provide a flow of 14,000 ML/day in the Darling River at Brewarrina for 5 consecutive days, or 10,000 ML/d in the Darling River at Bourke for 5 consecutive days, during the period September to February inclusive, providing two such flow events have not already occurred during that period in that water year

This was the first time that there was an obligation to manage water use in the valley to meet downstream water requirements. The provisions of this plan were included in Water Sharing Plan (WSP).

Prior to the implementation of the WSP in 2004 there were only a limited number of instances when these provisions of the plan were applied. The long-term reduction in water availability due to this Barwon-Darling commitment was not comprehensively assessed but is assumed to be small because of the relative infrequent application of the provisions.

The WSP implemented two further connectivity provisions:

- Clause 15 of the Plan mandated that in the months of June, July and August, a minimum daily flow which is equivalent to 75% of the natural 95th percentile daily flow for each month, shall be maintained in the Namoi River at Walgett except when the sum of the water stored in Keepit Dam and Split Rock Dam is less than 120,000 megalitres.

- Clause 49 of the Plan provides rules when supplementary access could be permitted

These provisions will result in more water flowing from the Namoi Valley than occurred prior to the Plan.

The major Darling Basin drought commencing in 2001 resulted in extremely low levels of storage in the Menindee Lakes Storage. The highest priority water requirement supplied by the storage is for the city of Broken Hill. The storage was depleted in 2001 to the point where supply from Menindee could not be guaranteed and there was a real possibility of having to transport water to supply the city from a remote source or alternatively evacuate the city. A policy to manage extractions from unregulated flows in the Darling Basin for the purpose of maintaining supply to Broken Hill was implemented. The impact of this was the restriction or prohibition of extractions from unregulated flow anywhere in the basin specifically for the water supply for Broken Hill. Extractions were managed until there was sufficient water in storage to guarantee supply for a period of 21 months. The impact of this was the banning of extractions on several occasions until the storages recovered to the extent that Broken Hill's supply was considered secure. Restrictions were mainly imposed within the Border Rivers Valley as this was the principle source of flow during this period and along the Barwon-Darling. The policy did allow for management of Namoi Valley unregulated flows.

3 THE BASIN PLAN AND WHAT IT MEANS FOR THE NAMOI VALLEY

The proposed Basin Plan outlines the following for the Namoi Region:

- The estimated Baseline Diversion Limit (BDL) is 508 GL/yr long term average.
- The "local" Sustainable Diversion Limit (SDL) is 498 GL/yr long term average.
- Approximately 5 GL/yr of the targeted local reduction amount volume of 10 GL/yr has already achieved through the purchase of 6.203 GL of Namoi general security entitlement at an average cost of $2,050/ML.
- An unknown volume of contribution to the shared reduction volume of 143 GL/yr long term average from the northern Basin designated as X_7. The ratio of shared volume to total BDL for the northern Basin.
- The total estimated BDL for the northern basin is 3,858 GL/yr and 508 GL/yr for the Namoi BDL, i.e. 13% of the estimated BDL for northern Basin.
- Some SDL resource units in the Northern Basin have exceeded their local contribution and as a result, 26GL will contribute to the shared reduction of 143 GL i.e. leaving 117 GL to be recovered and distributed across the more connected valleys of the Northern Basin.

4 THE NAMOI REGION - MEETING THE IN-VALLEY ENVIRONMENTAL WATER REQUIREMENTS

The method used by the MDBA to determine the Environmentally Sustainable Level of Take (ESLT) for the water resources of the Murray Darling Basin is outlined in Figure 4.1.

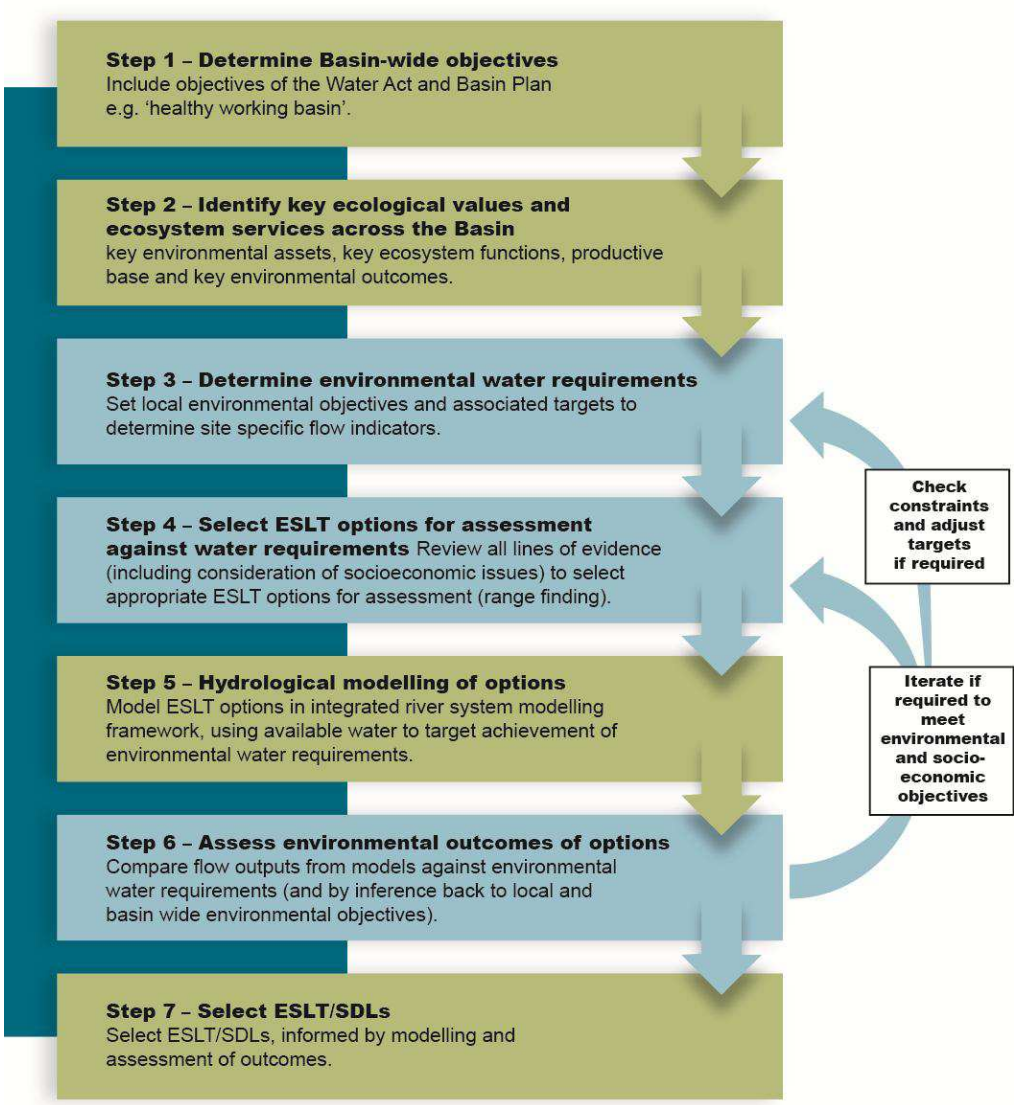


Figure 4.1 Outline of Method used to determine the Environmentally Sustainable Level of Take (ESLT). (Source: MDBA 2011c)

An important input to the method is the assessment of environmental water requirements at indicator sites. The MDBA is preparing reports detailing the assessments of environmental water requirements for the proposed Basin Plan. However the 2 key reports relating to the Namoi, i.e. the Barwon Darling River (in-channel flows) and the Lower Namoi River (in-channel flows) are not yet released/available so we have not been able to undertake an assessment of these. The MDBA have indicated these will be released soon and made available via their website.

In regard to Step 2 of the methodology, the ecological targets for the Namoi-Peel system were focussed on the Lower Namoi.

The environmental water requirements (EWRs) for the Namoi were defined by using 7 hydrologic indicator sites (HIS) in the Namoi and Peel Rivers (MDBA 2012a). Refer Table 4.1 and Figure 4.2.

The EWRs for the Namoi were defined as;

- in-channel flows (freshes) at only one site, i.e. in the Lower Namoi River at Bugilbone (73); and,
- baseflow requirements at 6 of the 7 sites i.e. all HIS except Pian Creek (75).

Flows were analysed at the remaining HIS, i.e. Pian Creek at Waminda (75), but no defined EWRs were derived at this site.

The initial analysis showed there was a significant shortfall in baseflow requirements at only 2 sites, i.e. downstream of Chaffey Dam (HIS 69) and downstream of Keepit Dam (HIS 71). Therefore baseflow demands were only included at these sites.

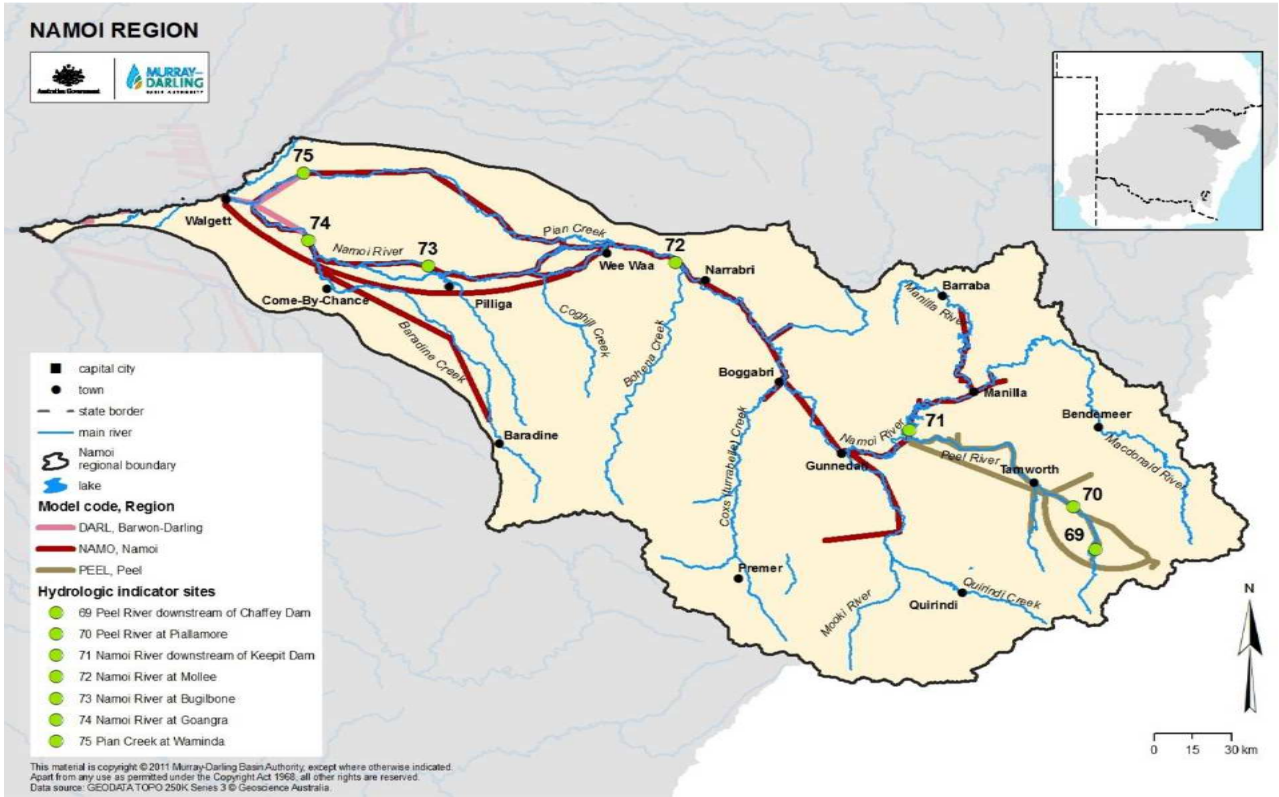


Figure 4.2: Spatial extent of the model used by the MDBA to determine ESLT and the location of the hydrologic indicator sites (Source MDBA 2012a)

Hydrologic Indicator Site		EWRs defined	Demand
69	Peel River downstream of Chaffey Dam	Baseflow requirements only.	Base flow demand – significant shortfall identified.
70	Peel River at Piallamore	Baseflow requirements only.	Nil. No significant shortfall.
71	Namoi River downstream of Keepit Dam	Base flow requirements only	Base flow demand – significant shortfall identified.
72	Namoi River at Mollee	Base flow requirements only	Nil. No significant shortfall.
73	Namoi River at Bugilbone	Both in-channel flows (freshes) and baseflow requirements	Demand timeseries to meet 3 threshold-duration rules.
74	Namoi River at Goangra	Base flow requirements only	Nil. No significant shortfall.
75	Pian Creek at Waminda	Flows were analysed but no defined environmental water requirements were derived	Nil.

Table 4.1 Namoi Region hydrologic indicator sites

The modelling methodology is provided in Hydrology Report (MDBA 2012a – pge 81). A few of the key points adopted in this approach include;

- All WSP environmental water rules for the Namoi are maintained in the Basin Plan Scenario. The Basin Plan EWR included at Bugilbone is in addition to the WSP.
- No downstream demand for the Barwon-Darling was included in the model, but the additional reduction in diversions required for the Barwon Darling was achieved by adjusting irrigation demand so that diversions matched the targeted reduction in diversions.
- Assumed the total reduction of 34GL/yr in consumptive use from the baseline diversions was from Namoi only – i.e. none from Peel. Also that it was from purchasing general security entitlements from all irrigators on a pro-rata basis i.e. the entitlement volume of each irrigator was reduced by an equal proportion. The corresponding irrigation demands were reduced to achieve the long term average reduction in diversions to the targeted level.

4.1 Modelling Results

Modelling results showed the defined EWR in the Lower Namoi can be met with the modelled 33 GL/y reduction in long term average consumptive use (MDBA 2012a). This modelled reduction consisted of a reduction of 10 GL/y for in-valley environmental water requirements and 23 GL/y as assumed contribution towards the shared component for the northern basin.

Outcomes of the modelled scenario include (when compared to baseline conditions);

- an increase in end of system flow of 18.4GL/yr long term average.
- A significant portion of the available environmental water remains unused and remains in storage

- There is an increase in the long term average storage volume of Split Rock Dam (i.e. 32% increase) and Keepit Dam (7%)

The MDBA state that the performance against the environmental flow indicators could be improved by a more active management of the available water. Additional work to explore options for more active management of the available water for both environmental and consumptive outcomes is supported. They also go on to say that any long term changes to storage volumes to storage volumes will depend on the environmental watering rules adopted and the process by which water fro the Barwon-Darling is sourced from the contributing valleys. They conclude that the increased storage capacities may not be reflective of post Basin Plan water recovery conditions, thus creating further uncertainties as outlined in the section below.

4.2 Key Issues regarding SDL Implementation

4.2.1 Further Work - A Final SDL – Certainty

A final SDL has not been determined by the Proposed Basin Plan. For example, the distribution of the shared downstream contribution of 143 GL for the northern basin valleys has as yet not been determined and may not be finalised until the outcomes of the 2015 review are known. Without that determination, a final SDL for the Namoi cannot be set. Even once that determination is made the final SDL will rest on the volume of recovery in the Namoi from the buyback, water use efficiency programs and the implementation of works and measures.

It's one thing to model predicted (assumed) distributions, but until perhaps 2019 or very close to it, the final SDL for the Namoi (and other MDB Valleys) will not materialise. This creates uncertainty for licence holders and the wider community particularly in regard to investment in regional and rural communities.

However, it may greatly assist the Namoi community, if a decision could be made in the very near future as to the maximum volume that is being targeted for recovery i.e. for both the Namoi's internal environmental assets and the downstream shared contribution to meet the environmental watering requirements for the Barwon-Darling.

The Namoi estimated BDL is 13% of the total Baseline Diversion Limit (BDL) for the Northern Basin. Therefore Namoi contribution to the shared reduction amount on this basis would be a maximum of 13% of the 143 GL/yr i.e. 18.6 GL/yr long term average.

At present, MDBA have made assumptions in the hydrological modelling that Namoi will contribute 23 GL/year long term average to the 143 GL/year downstream shared volume for the Barwon-Darling as well as meeting its own internal environmental watering target of 10 GL/year long term average. To provide certainty, the total recovery in the Namoi needs to be firmed up in the near future.

It is acknowledged that the MDBA have identified in Section 5 of their hydrology report (MDBA 2012a) that further modelling activities could be undertaken in the future including;

1. Inclusion of demand time series for requirements in the Barwon-Darling system.

2. Improvement of environmental water accounting by including it in models, rather than restricting environmental demands outside of the model. This is not a major limitation of the modelling undertaken as environmental demands are limited to water allocated to the environmental entitlements under baseline conditions.

3. Include flow access rules of Interim Unregulated Flow Management Plan for the North West in models to assess their contribution to meeting the environmental objectives of the Basin Plan.

4. The results are indicative of one possible suite of environmental benefits due to changes in the flow regime for the given level of reduction in diversions. Additional work could be undertaken to test a number of different environmental delivery patterns to explore the uncertainty in the results and the potential for optimisation.

This additional work, particularly the inclusion of the Interim Unregulated Flow Management Plan for the North West should be undertaken and completed ASAP.

4.2.2 SDL Methodology – process diagram

As outlined in our previous submission it is recommended the MDBA develop a detailed process diagram that clearly outlines the steps, inputs, assumptions and outputs of the SDL methodology including the judgement calls and the basis for these.

The figure included in the ESLT doc (MDBA 2011c) provides a good overview at the MDB level but further detail is required at the local level, particularly in regard to Step 3, Step 4 and Step 5 is required. That is, what was were the steps, inputs, assumptions and judgement calls made for the specific arrangements in the Namoi. A single "Namoi" specific document outlining how the methodology was applied to the Namoi would be helpful.

4.2.3 Baseline Diversion Limit

There still remains some concern in regard to the baseline numbers used by the MDBA when compared to the NSW Water Sharing Plan (WSP) numbers and it is still difficult to ascertain what is and isn't included in the estimates used by the MDBA to determine BDL. The Namoi community has concerns that the data used as the basis for the "current situation in the Namoi has not been tested, verified or ground-truthed with local on-ground experts and that it has just simply been accepted by MDBA as accurate and fit for use. These same issues were raised in our previous submission to the MDBA on the Guide and are still not resolved.

As outlined previously, the Namoi local communities were involved in the development and implementation of local water sharing plans and understand how the long term average diversion limits currently used by the Basin state jurisdictions under these plans were derived including the assumptions made in the models and the limitations of the data inputted to the models. Therefore they are able to determine with some degree of confidence the potential long term reliability of supply on which to base planning decisions and identify opportunities for improved water efficiencies. However, these same community members are still finding it

extremely difficult to reconcile these current plan limits with the BDLs included in the proposed Basin Plan.

The numbers are different and the MDBA have indicated that there are good reasons for this, i.e. for example there is a longer time series for the data. However it is not clear to the community how these were calculated i.e. what's "in" and what's "out", what assumptions have been made and whether these assumptions differ and if so why. Therefore it is difficult to determine whether the "starting point" accurately reflects the current on-ground situation and is appropriate to use as the basis for determining SDLs and applying new sharing arrangements. There is no clear and transparent evidence that the appropriate checks and balances have been included in this process.

The MDBA document "*Comparison of water course diversions estimates in the proposed Basin Plan with other published estimates – Supporting information for the preparation of the proposed Basin Plan" (2011d)* attempts to reconcile the numbers and explain the linkages between the WSP numbers and the Guide numbers. However, the numbers still do not reconcile and the NCWWG seeks further discussions with and access to both the MDBA policy makers and MDBA modellers – together - to better understand the figures and information used and assumptions made. An improved understanding of the baseline will greatly assist in ensuring people have confidence and trust in the process and improve our ability development practical solutions.

The currency and accuracy of the base information is a major concern as if it is not current, it will not accurately reflect the current state of play or condition of the Basin water resources/environment and therefore there is a high risk that the decision making process is being mis-informed and actions may actually lead to perverse outcomes.

4.2.3.1 Floodplain Harvesting

One particular area of concern for the Namoi is that the BDL in the proposed Basin Plan does not appear to include an accurate volume for floodplain harvesting activities in the Namoi. We understand that an assumption has been made in terms of the volume attributed to floodplain harvesting which is 14GL. However this does not accord with on-ground estimates of floodplain harvesting. This was a "plug in" figure used at the time of the WSP development. However, there was general acceptance that this was an estimate only and more accurate figures are currently being determined and negotiated with the NSW Office of Water via the implementation of the NSW Floodplain Harvesting Policy. NCWWG estimate floodplain harvesting could be in the vicinity of 80-100GL/yr long term average.

4.2.3.2 Unregulated Diversions

The estimate used by the MDBA for unregulated diversions (including basic rights) is provided in Table S3.1 of the Plain English Summary of the proposed Basin Plan (2011a). However this estimate of 78 GL/yr long term average appears to be extremely low. The NCWWG estimate that in reality this is likely to be 130GL/yr long term average. It is difficult to understand what has and hasn't been included.

4.2.3.3 Interception Activities

It is understood that the modelling used by the MDBA is based on the state river system models and these do not recognise some interception activities i.e. for example farm/hillside dams in

the upper catchments and the impact of plantations etc. The MDBA advise that they have made allowance for these interception activities and included a volume for interception activities in the BDLs. However, it is difficult to understand how the figure of 160 GL/y for interception by run-ff dams in the Namoi has been arrived at, particularly given what is physically on-ground in the Namoi Region. This is another issue requiring clarification and explanation. There is a concern that these figures have not been ground-truthed or validated for accuracy and water may be double counted.

4.2.3.4 End of system flows

There remains uncertainty as to how end of system flows have been determined or calculated in the modelling used by the MDBA to determine surface water SDLs.

Once again the NCWWG seeks further discussions with the MDBA to clarify how end of system flows are considered and accounted in the current methodology.

The Cap Independent Audit Group (IAG) recommended further work is required on the Namoi cap model. This is likely to deliver a different end of system flow. This additional work needs to be completed and incorporated into the Basin Plan process.

4.2.4 Cap to SDL Transition – no rollover of cap credits

A number of Cap Valleys currently have Cap credits. It is understood that at the commencement of a Water Resource Plan (WRP), a register of 'take' for an SDL must record a cumulative balance of zero.

The cumulative accounting attaching to Cap management allow individual valleys (and States and Territories) within the MDB to manage diversions within Cap over the long term (100 years plus) with the use of hydrologic models.

At the end of the 2010/11 water year, cap credits for the NSW Valleys collectively totalled 3,582GL with the Namoi-Peel Valley having a cap credit of 246GL (NOW Nov 2011). These credits have resulted from the implementation of cap management regimes over the last 15 yrs to ensure total diversions remain under cap.

It is recommended that the credits (and debits), accumulated under Cap, transition to the new SDL arrangements in 2019. It is acknowledged that some adjustment may be necessary to ensure a fit with the new arrangements.

This would allow for a continuation of an effective long term management of diversion limits in a variable climate, without penalising past good management. This continuation of accounting, which avoids a start-stop-reset approach also earns the regulator credibility in recognising prior management to a diversion limit.

4.2.5 Water Buyback

There is some concern that recovery of water for environmental purposes under the buyback program will be concentrated in the Lower Namoi around Wee Waa and Narrabri which could

have a marked socio-economic impact not only on the townships of Narrabri, Wee Waa and small villages in the Lower Valley but on the Lower Namoi Community as a whole with flow on affects to Gunnedah and Tamworth.

We recommend that a similar sensitivity analysis to that undertaken in the Condamine Balonne be carried out in the Namoi.

4.2.6 Environmental Water Management and Delivery

The continued absence of an environmental watering plan is a concern and makes it extremely difficult to comment on whether the proposed Basin Plan is practical at the local level and will deliver the environmental outcomes aspired to. The NCWWG are keen to work with the MDBA and NSW to deliver a balanced plan, but the continued absence of an environmental watering plan makes it difficult to provide meaningful and relevant assistance.

There are a number of ways water can be better managed to benefit the environment while still delivering water for consumptive use. Environmental water management and delivery, just like water for irrigation, needs to be efficient. Rural communities continue to have little confidence in the Commonwealth Environmental Water Holder (CEWH) ability to manage the significant volumes of environmental water proposed to meet the identified environmental water requirements. The lack of an environmental watering plan also makes it difficult to gain community confidence in the Government's ability to effectively manage the held environmental water to maximise environmental outcomes and minimise impacts on consumptive users. The involvement of local river operators and other local input and expertise is essential in the development of any environmental watering plan. Namoi CMA is well placed to coordinate the management and delivery of government held water at the local Namoi Catchment level. The local involvement of NRM bodies in this regard should be further explored. Case studies on the implementation of environmental water management should be fully resourced and employ good governance and local input

In this submission the NCWWG have identified a few examples of environmental works and measures that would warrant further investigation in terms of the potential environmental benefits and would encourage governments to pursue these as a priority.

4.2.7 Chaffey Dam Enlargement

A component of the agreement to enlarge Chaffey Dam is an additional 5GL/yr environmental contingency allowance. Has this been considered in the determination of the SDL?

4.2.8 Research & Development - New technology

The NCWWG would suggest to the MDBA that most opportunities for on-farm water use efficiencies in the Namoi have been implemented via past water reforms and best management practices by the majority of irrigated farms and although there may still be some opportunities to recover water via on-farm efficiencies, this will be limited.

However, is it suggested that Research and Development (R&D) and its adoption remains a key missing link in the proposed Basin Plan and in the SEWPaC programs. R&D could well drive new technologies that further improve water use efficiency as well as identify and investigate new innovative methods and options particularly regarding environmental water management, irrigation modernisation and river operations.

With the suggested decline in water available for production, it will be necessary to produce more food and fibre per megalitre – this will necessitate advances in technology and knowledge.

It is recommended that the MDBA recognise the importance of R&D in the better management of the Murray Darling Basin and support funding and resourcing in this area to assist in mitigating the impacts of the proposed Basin Plan

5 NORTHERN CONNECTED BASIN - MEETING BARWON-DARLING ENVIRONMENTAL WATER REQUIREMENTS

5.1 Northern Basin Vs Southern Basin

There are fundamental differences in hydrology, between the northern and southern parts of the Basin and this limits the ability to achieve environmental outcomes in the River Murray System by actively managing inflows from the north. Large flows from the north generally occur sporadically as a result of floods and there is little capacity to manage volumes and timing until the flows reach Menindee Lakes, where still only the small to medium floods can be influenced.

In consideration of this and as stated in the hydrologic modelling report (MDBA 2012a) the shared reduction volume proposed by the MDBA in the Northern Basin is to satisfy the environmental needs of those in the Barwon-Darling System, and, the MDBA states (MDBA 2012a) that the reductions in key tributaries in the northern connected Basin *"....do not include any specific recovery to meet environmental water requirements for the River Murray and Lower Darling"*.

From a modelling perspective the northern connected system ends with inflows into the Menindee Lakes. Outflows from Menindee Lakes and through the Lower Darling and the Great Darling Anabranch are modelled implicitly as part of the southern Murray River system (MDBA 2012a).

5.2 Northern Basin Requirements

The environmental water requirements were defined at five of the six identified hydrologic indicator sites in the Barwon Darling Region. This included in-channel fresh flows at Bourke and Louth while overbank flows were defined at Wilcannia. 3 fresh flow indicators were defined at Bourke and Louth and a further 3 high or overbank flow indicators (i.e. commence to flow threshold) were defined for Wilcannia. In addition, baseflow requirements were defined at four sites: Wilcannia, Bourke, Walgett and upstream of Menindee Lakes.

As the Barwon-Darling system relies on its tributaries for a significant proportion of its inflows, therefore the SDLs reductions in diversions for the key tributaries in the northern connected Basin are comprised of both an in-valley (or local) component to meet local environmental water requirements and a shared (or downstream) component to meet those EWR requirements of the Barwon-Darling system. However, as outlined earlier, they do not include any specific water recovery to meet environmental water requirements for the River Murray and Lower Darling (downstream of the Menindee Lakes).

The hydrology report (MDBA 2012a) state that the level of reduction of consumptive use modelled in each valley was based on the proposed in-valley SDL and, for connected valleys, a contribution to the shared component assumed to be approximately pro rata of total diversions.

Given that the Paroo, Warrego, Moonie and Nebine valleys have low water use as compared to water availability and the current flow regimes are similar to without development conditions the MDBA did not model further consumptive use reductions in these valleys. In the case of the Warrego, Nebine and Moonie unallocated water given to the Commonwealth will remain unallocated and continue to meet environmental water requirements (MDBA 2012a).

A total reduction of 20 GL/y was targeted from the Barwon-Darling unregulated system, with additional contributions from the connected river valleys as part of the shared reduction in the

northern basin. Most of the Barwon-Darling environmental targets were not met, highlighting a need for a more strategic event management based approach. The desired environmental outcomes in the Barwon-Darling can only be achieved through water recovery coupled with changes to event access and management.

5.3 Distribution of the shared reduction

The Plain English summary of the proposed Basin Plan at Schedule 2 states "*Table S2.1 summarises the content of Schedule 2 to the proposed Basin Plan. Shared reduction amounts are designated 'X', as the precise quantity contributed by each SDL resource unit will not be known until the total shared reduction amount (143 GL/y in the northern Basin and 971 GL/y in the southern Basin) has been recovered".*

The targeted reduction for each valley in the BP-2800 scenario is outlined in Table 5.1 including the in-valley and shared components which has been adapted from Table 1 in the Hydrology Report (MDBA 2012a) - The table includes an adjusted volume for Condamine Balonne as a result of some initial sensitivity testing which has been undertaken to explore alternative water recovery volumes and strategies. The results of this sensitivity analysis led to a further increase of 50 GL in SDL for Condamine – Balonne system and consequently a total proposed reduction of 2,750 GL across the Basin has been proposed by the draft basin plan.

Region	In-valley As per draft BP (GL/yr)	Total Targeted in model (GL/yr)	Total achieved in model (GL/yr)	D/S contribution (GL/yr)	Distribution (contribution to D/S) (GL/yr)	Estimated BDL as a % of Total BDL
Paroo *(not connected to Nthn Basin)*	0	0	0	0	N/A	0.3%
Warrego	8	8	7	-1	0%	3%
Nebine	1	1	1	0	0%	1%
Condamine - Balonne	100	150*	149*	49	34%	25%
Moonie	0	3	3	3	2%	2%
Intersecting Streams	0	0	0	0	0%	3%
Border Rivers	15	43	41	26	18%	16%
Gwydir	42	52	52	10	7%	12%
Namoi	10	34	33	23	16%	13%
Macquarie-Castlereagh	65	84	84	19	13%	19%
Barwon-Darling	6	20	20	14	10%	5%

TOTAL	247	395	390	143		

**includes adjusted Condamine Balonne SDL*

Table 5.1 Targeted Reduction in diversion volume under the BP-2800 Diversion Reduction (GL/yr) Scenario for Northern Basin

The modelling methodology is provided in Hydrology Report (MDBA 2012a – Section 5.7.5).

The current modelling scenario outlined above does source Bourke environmental water requirements from the Gwydir system (MDBA 2012a). However the MDBA hydrology report goes on to state that future scenarios will not source Barwon Darling requirements from the Gwydir as the modelling showed negative impacts on the in-valley EWRs and that there is a low level of connectivity between the Gwydir and Barwon-Darling.

Given this the targeted contributions in the proposed Basin Plan are based on Table S2.1 in the Plain English Summary (MDBA 2011a), which shows that in the northern Basin the Gwydir and Warrego-Paroo-Nebine catchments do not make a contribution to the shared reduction volume.

Therefore the distribution of the 143GL/yr assumed in the current modelling scenario will change.

5.4 Further Work

At present, MDBA have made assumptions in the hydrological modelling that Namoi will contribute 23 GL/year long term average to the 143 GL/year downstream shared volume for the Barwon-Darling as well as meeting its own internal environmental watering target of 10 GL/year long term average. To provide certainty, the total recovery in the Namoi needs to be firmed up in the near future.

It is acknowledged that the MDBA have identified in Section 5.7.7 of their hydrology report (MDBA 2012a) that further modelling activities could be undertaken in the future including;

1. The modelling carried out for the Barwon-Darling system achieved a reduction in diversions by increasing pumping thresholds, and is therefore not consistent with the proposed Water Recovery program to bridge the gap between baseline diversions and proposed SDLs. However, the modelling is dependent on the water shepherding approach and their inclusion in the models. This is proposed to be undertaken as part of the proposed 2015 review. However the approach adopted is reasonable for assessing environmental outcomes for a given level of reduction using buyback approach.

2. Future Basin Plan scenarios will not source Bourke environmental water requirements from the Gwydir system because:

    i. The inclusion of the Bourke demand timeseries into the Gwydir model resulted in a negative impact on the in-valley indicators specified for the Gwydir Wetlands.

    ii. Analysis undertaken by Pietsch (2006) indicates that many of the streams that make up the distributary system of the Lower Gwydir contain reaches with low channel capacities resulting in frequent overbank events. For instance the bank-full capacity of the Mehi River can be is as low as 430 ML/d. It is likely that the low channel

capacities result in high floodplain losses and low delivery efficiencies between Copeton Dam and the end-of the system.

3. The complexity of including Barwon-Darling demands into up-steam models coupled with the limited timeframes, only allowed for the methodology to be undertaken for the Bourke flow indicators. Extending this process to include the Louth flow indicators could be undertaken as part of future Basin Plan modelling scenarios.

4. A longer term priority would be to work in conjunction with the NSW Office of Water, to update baseline models so as to include the Interim Unregulated Flow Management Plan for the North West as the current model is likely to underestimate the achievement of desired flows.

Note in regard to number 4 it is strongly recommended that this work be undertaken as a matter of priority and not be held off until the 2015 SDL review as indicated in the MDBA hydrology report (MDBA 2012a).

In section 5.5 of the hydrology report, MDBA state that due to time constraints a demand timeseries for requirements in the B-D system was not included as part of modelling of the BP-2800 scenario in the Namoi nor was it included for the Border Rivers due to technical issues.

They go on to state *"However, further utilisation of the recovered environmental water presented in the BP-2800 scenario provides confidence that further improvements in these flow indicators could be achieved using water delivered from the Namoi."*

5.5 Meeting the Shared Reduction Amount – Issues and Ideas

5.5.1 Volume delivered to Menindee from North

In Section 5.7.6 (MDBA 2012a) *"in the BP-2800 scenario, the environmental water sourced from the tributary models increased inflows into Barwon-Darling by 237 GL/y, which is 8.6% more than baseline flows.....The net effect at Menindee Lakes was an increase in long term average inflows of 198 GL/y, which is an increase of 11.5% as compared to baseline conditions."*

The increased inflows of 198 GL/y into Menindee occur as an unintended consequence of both meeting the watering requirements within the northern basin river valleys and meeting the Barwon-Darling environmental watering requirements.

This unintended inflow to Menindee exceeds the total shared contribution from the northern river valleys by 38.5%.

It is understood that a considerable number of environmental watering targets are instream and therefore end of system flows will necessarily be enhanced. However, it is suggested that with improved river operations and river management together with the implementation of works and measures, that the shared contribution could be reduced. Works and measures would also provide a more efficient approach to environmental watering of the Talyawalka and Teryaweyna Creek system. This is further discussed in Section 5.5.2 below.

Even though it is fully understood that the additional 198 GL/year into Menindee Lakes is an unintended consequence of meeting both the northern basin valleys' environmental watering requirements as well as the watering requirements of the Barwon-Darling, it is suggested that offsets against this additional volume may be considered for the northern basin valleys.

For instance, one such offset may be to completely remove the necessity to embargo access in dry times to supplementary flow events in the northern basin to secure Broken Hill's water supply, or if critically needed at times, then pay compensation to northern basin irrigators for the right to access this water. The implementation of an emergency water supply for Broken Hill may, of course, negate this.

Another potential offset may be to provide any water savings, up to the 198 GL/year, from the options (if implemented) that are being investigated currently to reduce evaporation losses from the Menindee Lakes system. This is further discussed in Section 6 of this submission.

Any potential savings distributed to the Northern Basin will necessarily reduce the total 143GL/yr shared reduction and potentially lead to a shortfall in meeting the identified Barwon Darling EWRs. This shortfall may be negated by the implementation of works and measures which more efficiently meet the watering requirements of the Talyawalka and Teryaweynya system.

5.5.2 Works to reduce the volume required at Wilcannia

Of the all the site specific flow indicators specified proposed by the Basin Plan the indicators specified at page 206 of the document *"The proposed 'environmentally sustainable level of take' for surface water of the Murray–Darling Basin: Method and outcomes",* the ones requiring the greatest volume are those to be measured at the Darling River at Wilcannia. The flow targets are for the sustainability of the Barwon Darling River floodplain: Talyawalka / Teryaweynya Creek system. (Section 9.7 of that document describes environmental outcomes for the Barwon-Darling River.) The principle environmental asset target of this measure is the flooding/replenishment of the Talyawalka watercourse system which is a major anabranch system that includes numerous lakes, wetlands and floodplains that offtakes upstream of Wilcannia and returns downstream of the town of Menindee. The Teryaweynya creek system is an effluent system of the Talyawalka Creek that supplies a discrete terminal wetland/lake system.

In brief, the flow indicators require:

- 30 000 Ml/d for 21 days in a year (in 45% of years)
- 30 000 Ml/d for 30 days in a year (in 15% of years)
- Total "in-flow" of 2350 GL (minimum flow of 30 000 Ml/d) in 8% of years

Flows commence to flow into the Talyawalka at a flow of about 23 000 ML/d at Wilcannia. The inflows occur through a number of floodplain creeks that progressively increase with increasing river flows. It is possible to increase the proportion of flows into the system by constructed infrastructure such as:

- A weir that is used solely for the purpose of inducing above bank flow levels at lower flows currently required to cause inflows. It should then be possible to provide similar volumes of flows into the Talyawalka with less flow in the Darling River. One of the dis-benefits of a weir is the disruption to fish passage during diversion periods. However, this may not be a major issue, depending on other opportunities for fish migration.

- A low level diversion channel that allows flows to leave the river without the need for a weir. One of the problems in the this area if the extremely low slopes (of the order of 1 in 100 000) which would require an low level offtake to be constructed a long distance upstream of the current effluent location so that the channels that currently supply the Talyawalka can be utilised.

While such a proposal would require further work to determine the feasibility of a proposal, there is a precedent of sorts where works to supply major wetlands in the Koondrook Perricoota floodplain water project on the Murray River.

5.5.3 Alternative Measures to meet the environmental objectives of the Northern Basin

It may be practical to meet the environmental outcomes that are targeted by this volume by ways other than the untargeted acquisition of entitlements - thus reducing the 143GL volume.

"The proposed 'environmentally sustainable level of take' for surface water of the Murray–Darling Basin: Method and outcomes" (page 206) (MDBA 2011c) specifies indicators that largely cannot be contributed entirely, or even be targeted by the use of regulated flow releases from Namoi headwater storages. The targets relate to flows that are generated by unregulated flows. The use of regulated flows available from high and general security entitlements to meet these targets is generally not feasible. MDBA have acknowledged this. By the time that unregulated flows occur, there is little opportunity to accurately supplement the flows by storage releases to target the environmental flow indicators. In the case when the unregulated flows occur upstream of Keepit Dam, there may be some opportunity to prolong releases, however it will be difficult to accurately target flows as far downstream as Wilcannia, given the likely contribution from large areas of the Darling basin.

5.5.4 Existing northern Basin flow contributions from North West Flow Plan

As outlined in Section 2.2 the Namoi is subject to the provisions of the North West Flow Plan. The existing provisions of the North West Flow Plan (Namoi Water Sharing Plan clause 49 (6)) are consistent with the proposed Basin Plan site specific flow indicators for the Bourke gauge. (page 206 of the ESLT Document MDBAc). Thus some Namoi flows have already been reserved to meet this objective.

It is believed that the provisions of the North West Flow Plan have not been included in the hydrologic modelling of the Namoi Valley Border Rivers and Barwon Darling. This may demonstrate that the Namoi is already contributing to the northern Basin shared reduction volume, that is, the shared down stream contribution, currently at 23 GL/yr long term average should be reduced accordingly.

However it also fair to say that the current NSW WSP model does not include the North West Flow Plan parameters. The MDBA have highlighted in "future work" for both the Namoi and the Barwon-Darling that they will include the North West Flow Plan in future modelling scenarios. This should be done prior to SEWPaC conducting any further buyback programs in the Northern Basin required to meet downstream contributions.

5.5.5 Optimisation of supplementary flow access

The northern basin is characterised by unregulated flows, off-river diversions, and privately owned storages, some of which are extremely large.

As outlined previously, the acquisition of regulated flow entitlements will not be particularly useful in meeting many of the Darling River site specific flow indicators, and the best opportunity to achieve the targets maybe the management of supplementary access across the Northern Basin. It may be more beneficial to review the current management rules such as the access rules at Clause 49 of the Namoi Water Sharing Plan. The NCWWG believes there may be an opportunity to better target the Barwon Darling River flows by changing the volume that may be accessed in each event that is specified in sub clause 49 (11) of the Namoi Water Sharing Plan:

> *"The volume of water that may be made available for extraction under supplementary water access licences in the Lower Namoi Regulated River Water Source during each supplementary water event should not exceed:*
>
> *(a) 10% of the supplementary event volume occurring between 1 July and 31 October during the supplementary water event, and*
>
> *(b) 50% of the supplementary event volume occurring between 1 November and 30 June during the supplementary water event."*

For example, if the Darling River targets have been achieved in a satisfactory manner in the immediate past, or a large flood has recently occurred, there may be an opportunity to allow more supplementary access in the Namoi during a subsequent flow event, without compromising the Darling River environmental assets.

5.5.6 Improved River Operations and environmental water management and delivery

Improved river operations and water management delivery should also be further investigated this may include for example Computer Aided River Manager (CARM) currently being developed by State Water or the River Manager Program through e-Water. Better communication through remotely sensed meters, weir operation and remotely sensed gauges and remote operation of structures also have the ability to improve water management and more efficiently deliver water, be that for consumptive or environmental purposes.

5.5.7 Menindee Lakes – without development scenario

It is understood that the MDBA have used the Natural Hydrologic Behaviour of the Menindee Lakes System – Stage 2 Data Extraction and Simulation Report prepared by Bewsher Consulting (2000) as the basis to determine the pre and post development for Menindee Lakes System for the purposes of the Basin Plan.

This report drew on estimated natural flow conditions in the Darling River at the Menindee Town Gauge which was provided by the MDBC from work done in the 1990's.

The NCWWG have some questions regarding the pre-development scenario and would appreciate meeting with the MDBA to better understand this modelling.

6 MENINDEE LAKES - POTENTIAL WORKS FOR WATER SAVINGS

6.1 The Menindee Lakes Storage Scheme

The Menindee Lakes is a series of natural lakes within the Travellers lakes system with a surface area of approximately 45,000 hectares when full. In the 1950s and 1960s the NSW government constructed the Menindee Lakes water storage scheme, by connecting the natural ephemeral lakes and the Darling River by a series of weirs, regulators, channels and levees. As outlined in Bewsher (2012) the key purpose was to:

1. provide secure water supply to Broken Hill;
2. provide water for irrigation and farm supplies in the lower Darling River;
3. meet stock and domestic water requirements along the Great Darling Anabranch; and,
4. supplement the River Murray System, including the supply to South Australia.

The Menindee Lakes water storage system essentially consists of 4 major lakes and covers 453 square kilometres. It holds 1,730 GL when full and can be surcharged to 2,050 GL during floods. (NSW Office of Water).

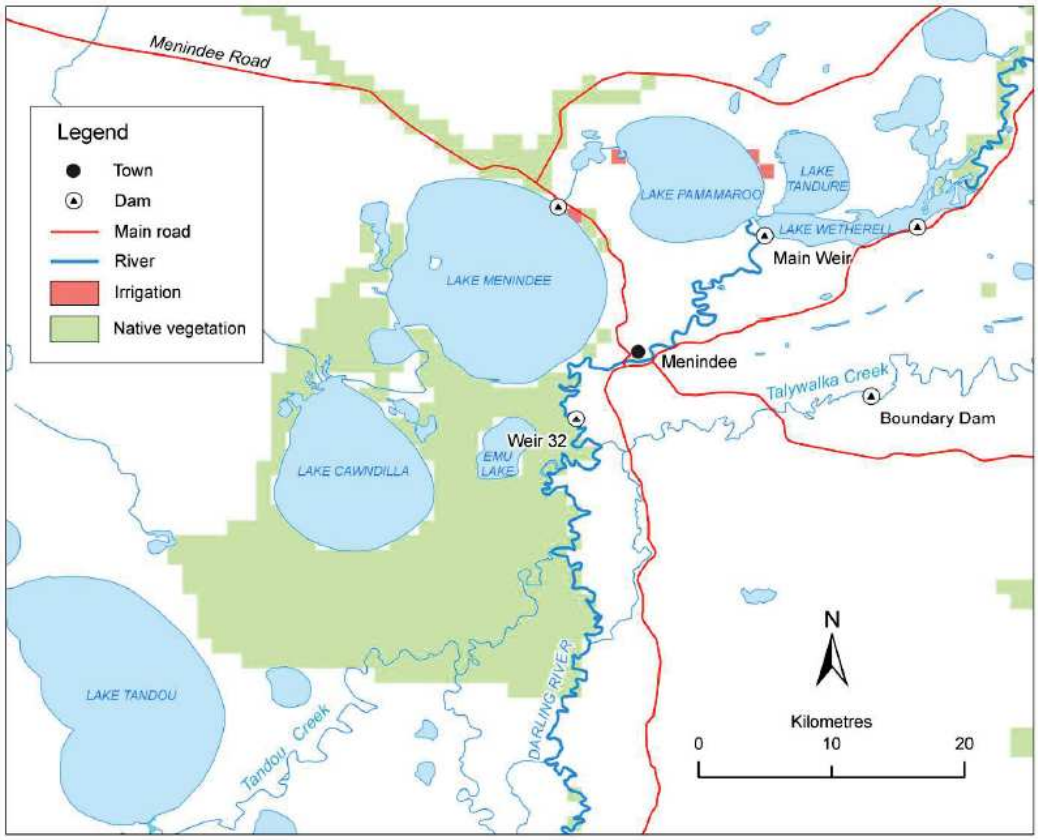


Figure 6.1: The Menindee Lakes System in Western NSW. (Source: Bewsher 2012)

The long-term evaporation from the lakes is about 430 GL per year. If the lakes were full for an entire year evaporation may consume over 600 GL with their current configuration and management.

The Menindee Lakes Storage is leased to the MDBA and its management is prescribed by the Murray-Darling Basin Agreement. The management of the lakes is at the direction of the MDBA while the lakes store more than 480 GL, at which volume control passes to NSW and does not revert to MDBA until the storages increase to 640 GL (480/640 rule). While the storages are under the control of NSW the water stored and inflows can be used exclusively by NSW to meet its requirements. This NSW storage "reserve" was intended to enable NSW to meet its demands during severe drought periods. It included supply to Broken Hill, environmental requirements, irrigation in the Lower Darling and water supply to the Great Darling Anabranch. In recent years, while the lakes are controlled by the MDBA, apart from meeting the requirements of NSW in the Lower Darling, water is released to meet the combined needs of NSW, Victoria and South Australia within the Murray Basin. This would primarily be meeting the flow entitlement of South Australia. While not contained in the agreement, an additional release commitment, called the Additional Dilution Flow, authorised by the Murray-Darling Basin Ministerial Council, is made when the lakes contain more than 1,300 GL (and the upper MDBA storages store more than 2000 GL). The purpose of this release is to reduce salinity levels primarily within South Australia.

It should also be noted that the original reasoning of the difference between 640 and 480 GL thresholds for jurisdiction management change was to avoid the situation when the lakes were refilling after being below 480 GL that there would not be a continuous reversion of management from one jurisdiction to the other, if the volume fluctuated about 480 GL. This would allow the efficient use of Lake Pamamaroo when the capacity of Lake Wetherell was exceeded. The use of a single threshold, as suggested in the CSIRO Report (185/185) may be a counterproductive simplification.

A chronology of events, policy decisions and investigations relating to Menindee Lakes is provided in Appendix A.

6.2 Summary of Investigations to achieve water savings

As outlined in the Chronology included in Appendix A, there have been a number of investigations undertaken on the Menindee Lakes System to identify practical, cost-effective and environmentally responsible means of reducing evaporation in the Menindee Lakes System. These have involved a mix of structural options (i.e. changes to existing infrastructure) and non-structural options (i.e. changes to water management operations).

A summary the major investigations undertaken since 1998 is outlined below with a summary of the key options considered in each of the investigations dating back to the 1950's provided in Table 6.1, including a summary of the impacts.

6.2.1 1998 Menindee Lakes Storages - Structural Options Feasibility Study, Stage 1 (DPWS)

A draft management plan was prepared by the Department of Land and Water Conservation and the Menindee Lakes Advisory Committee in 1998.

In December 1998 the NSW Department of Public Works and Services (DPWS) released a preliminary report that included basic designs and costings for 10 structural options aimed at improving the operational efficiency of the scheme. These options formed the basis for the Menindee Lakes. A number of the poorer structural options were eliminated on the basis of

unacceptable environmental or cultural heritage impacts with the design of the remaining options further refined to improve their cost-effectiveness.

6.2.2 2002 Menindee Lakes Structural Options Feasibility Study - Supplement 1

In March 2002, the NSW DPWS provided NSW State Water with a preliminary design and costings for the Cawndilla Lake Alternative Option. This Option 11 – Cawndilla Lake New Open Type Regulator and channel to Darling River was an alternative option to that referred to in their previous 1998 report.

6.2.3 2002 Menindee Lakes Structural Options Feasibility Study, Supplement 2

In July 2002, the NSW DPWS provided NSW State Water with preliminary design and indicative cost estimates for a revised option to replace Option 1 (DPWS 1998).

6.2.4 Menindee Lakes Ecological Sustainable Development Project

The Menindee Lakes Ecological Sustainable Development (ESD) Project was initiated to address the significant information shortfall identified in the draft management plan prepared in 1998. The project was funded by the Natural Heritage Trust with an overall budget of $2.6M. The objectives of the ESD project were to

- identify and quantify the existing operational impacts;
- identify the impacts/benefits of new structures or alternative water management practices
- ensure stakeholder input and support
- refine the 1998 Draft Management Plan for Menindee Lakes; and,
- develop a comprehensive database of information as an aid for future decision making.

In 2002, the Menindee Lakes Ecological Sustainable Development Project identified that relatively minor efficiency improvements, of approximately 10 GL per year could be achieved through structural works costing around $30million.

6.2.5 Darling River Water Savings Project

The Darling River Water Savings Project commenced in 2007, to identify opportunities for substantial water savings in the Darling River System, including the Menindee Lakes. This project, which was jointly funded by the NSW and the Commonwealth Governments, focused on achieving water savings based on an integrated approach of structural works, river and storage operating strategies and water market activities. Key objectives included;

- To improve the overall flexibility in river and water storage management to better meet the needs of water users and the environment
- To protect the environment and riverine ecology
- To protect water quality and water security for water users

- To contribute to economic development in the region.

Part A of the project, completed in 2007 by Maunsell in association with Webb McKeown & Associates and Hassall & Associates, identified 6 potential structural works options and included the option of more rapid drawdown of the volume in the Lakes when under NSW control, coupled with an alternative water supply. The 6 options were identified but not tested in Part A.

Part B of the project commenced in 2008 and was completed in 2010 by Sinclair Knight Merz (SKM) in association with GHD Hassall and Rob Learmonth. Part B considered the 6 options identified in Part A. It was also identified that substantial savings could be generated by either storing less water, by reducing the use of Lake Menindee and/or Cawndilla, and/or more rapid draw down of the volumes in the Menindee Lakes when they would have been in NSW control. A set of 6 options were presented for further consideration by Government. All options included a cost for an alternative water supply for Broken Hill, assuming that the need for an alternate water supply would be the same for all options.

6.2.6 Menindee Lakes MOU

In July 2010, the Australian and NSW Governments entered into a Memorandum of Understanding (MOU) to guide the implementation of the Australian Government's 2007 commitment to a Menindee Lakes project and for the cooperative investigation and subsequent implementation of key water reform initiatives in NSW, including improved security of Broken Hill's water supply, protecting local environment and heritage and changes to the Menindee Lakes operational arrangements. This agreement followed on from the completion of the Darling River Water Savings Project Part B.

However in June 2011 NSW advised that it considered the MOU had ceased to have effect and there were no conclusion as to the final recommended changes or inter government agreement as to any proposals that may be implemented, or the associated funding.

6.2.7 Darling Water Savings: Options for Environmental Filling

The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) commissioned CSIRO to manage and report on the hydrological modelling required by the MOU. This hydrological modelling was overseen by the Hydrological Modelling Working Group (HMWG), a technical group established by the Menindee Lakes Project Joint Steering Committee. A final report was delivered in 2010 and further work was subsequently undertaken to supplement the HMWG report with a report submitted to the Menindee Lakes Joint Steering Committee in December 2010. The committee recommended further work should be carried out explore changes in operation rules that would have a positive impact on identified indicators and investigate the potential for maintaining the Lake Wetherell floodplain vegetation by reducing the frequency of surcharging the lake. This further work was undertaken by CSIRO and presented in the report released May 2011 – Darling Water Savings: Options for Environmental Filling, No Impacts, Version 2.

The most recent study by CSIRO described above is a recent development designed to minimise impacts. However it is uncertain if the results have been independently assess and verified.

Table 6.1 Summary of Investigations and Studies regarding Menindee Lakes System – opportunities for efficiencies and water savings

Option	Description	Savings (GL/yr)	Cost	Comments
1950's Various Studies of Menindee Lakes and other Lakes at nearby Broken Hill				
Reduction of Lake Evaporation	– Investigation of the application of cetyl alcohol films to the water surface. – Investigation of the application of polystyrene beads	Estimate of savings not calculated.	N/A	These investigations did not identify practical and environmentally acceptable means of reducing evaporation.
1994 Water Management Improvement –Proposals Under Investigation				
Improved Operation of the Lakes	– Accelerated low-level drawdown of lakes Menindee and Cawndilla – install pumps and cuttings. – Access to dead storage. – Hydraulic separation of Lakes Menindee and Cawndilla – Installation of block banks on the Lake Wetherell floodplain. – Altering the storage distribution within the Lakes using alternative operating procedures. – Increased releases from the Lakes to the Darling River to control algae and maintain fish habitat.	Estimate of savings not calculated.	N/A	• Need to increase regulator capacities to allow more rapid evacuation of Menindee and Cawndilla. • Allow Menindee and Cawndilla to be held at different levels. • Temporarily blocking off the smaller lakes connected to the Lake Wetherell floodplain during low to moderate filling of Wetherell may reduce evaporative losses. • At first glance, the changing of operational procedures to determine the optimum storage distribution for a given total volume in the Lakes, may seem a trivial exercise. However, the procedure is complicated by the gravity conveyance system between the Lakes, lack of knowledge about inflows and demands, and other operational constraints. • The magnitude, duration and effectiveness of algal flushing flows is dependent on the location of the bloom in the River. • A revised computer model of the Lakes and the Lower Darling was utilised.
1998 Structural Options Feasibility Study, Stage 1 (DPWS)				
Option 1 Reduced Use of Cawndilla	– Cawndilla-Menindee regulator & temporary block bank – The purpose of a block bank between Menindee and Cawndilla is to exclude water from Lake Cawndilla (which it normally enters via Cawndilla Creek) until Lake Menindee is completely full, thus reducing the evaporation area during that period. – Three possibilities for final release of water into Lake Cawndilla have been considered. – Open-type structures as well as conduit-type structures to provide for 5000ML/D and 12000ML/D were sketched and costed.	Estimate of Savings not calculated.	$4.5M to $7.5M	• The temporary block bank option which would be breached when Menindee was filled was considered not acceptable as the resultant scour from the uncontrolled breach would be environmentally unacceptable. • A further variant suggested provision of a 10,000ML/D discharge capacity by siphons over the top of the embankment. This discharge alternative was not pursued as the concept was subject to settlement problems. • Principal Environmental Benefits - Lake Cawndilla would remain drier for longer and more frequently, resulting in increased habitat for terrestrial flora and fauna and protection of Spectacle Lake and Eurobilli Lake and associated woodlands • Principal Environmental Costs - significant construction impacts, increased height of Lake Menindee would eliminate fringing woodland, resulting in more permanent flooding of Lake Speculation, and an increase in foreshore erosion; potential increase in salinisation.
Option 2 Reduced Residence Time in Menindee	– Enlarge Lake Menindee outlet to Darling River. – The purpose of this option is to provide sufficient outlet capacity to singularly supply the maximum flows of the Darling River, with overflow into the Anabranch. This will permit a much quicker emptying of Lake Menindee (as well as Lake Cawndilla if they are interconnected).	Estimate of Savings not calculated.	$3.9M to $4.1M	• Two structures were investigated, sketched and costed – a deep seated conduit type structure with a total maximum discharge of 10,000ML/D and an open type structure. • There are two locations for this option, the existing outlet and Little Menindee Creek nearby. • Principal Environmental Benefits – Speculation Lake would be more ephemeral: reduction in the potential for salinisation; larger capacity for downstream delivery of e-flows. • Principal Environmental Costs – Construction impacts; localised erosion; erosion of banks of Lake Menindee; rapid emptying is detrimental to lake bed vegetation.
Option 3 Avoid Loss of Dead Storage to Evaporation in Menindee	– Excavate channel in the lake-bed of Lake Menindee. – The purpose of this option is to drain the dead storage from the lowest portion of the lake and cater for the enlargement of the outlet proposed in Option 2 above.	Estimate of Savings not calculated.	$9.1M	• The proposed channel joining the lowest part of Lake Menindee is required to return the outlet to its original capacity and cater for enlargement as proposed in Option 2 above. • Channel should avoid the possibility of a fish kill by providing an escape channel to the outlet regulator and hence to the Darling River. • This option is perceived to have no impact on terrestrial flora and fauna. However, the local biota would benefit indirectly through the opportunity provided for better environmental management of other (secondary and tertiary) storage-bodies.
Option 4 Rapid Drainage of Lake Cawndilla	– Cawndilla-Menindee regulator – Increase Cawndilla outlet and channel – The purpose of this option is to allow quick drainage of Lake Cawndilla when it is separated from Lake Menindee by the embankment and regulator described in Option 1.	Estimate of Savings not calculated.	$6.1M to $61.6M	• Both conduit-type and open-type regulators were costed. • Three discharge options were considered – 12,000ML/D, 5,000ML/D and the existing capacity of 2,000ML/D (with the inclusion of a channel (2,000ML/D) to the Darling. • Principal Environmental Benefits - potential for increasing the amount of dry lake-bed habitat in Lake Cawndilla (and Lake Menindee, if they're connected), and therefore the establishment of vegetation communities. • Principal Environmental Costs - substantial construction impacts; loss of existing habitat; introduction of weed species; death of a large area of woodland

Option	Description	Savings (GL/yr)	Cost	Comments
				east of Cawndilla Channel.
Option 5 Rapid Drainage of Lake Menindee	– Pump Lake Menindee to Lake Pamamaroo. – The purpose of this option is to allow transfer of water from Menindee to Pamamaroo when the level in the latter lake is higher. – Two pumping options were considered – 5,000ML/D (10 pumps) and 1,000ML/D (2 pumps)	Estimate of Savings not calculated.	$3.3M to $8.9M	• Limited consideration given to the generation of hydro-electric power. • Principal Environmental Benefits - the provision of two-way transfer of water increases the management options; reduced threats of erosion; reduced threat of salinisation. • Principal Environmental Costs - loss of woodland communities that fringe Lake Pamamaroo; substantial construction impacts; increased erosion.
Option 6 Reduced Use of Cawndilla	– Cawndilla-Menindee regulator and pump Cawndilla to Menindee. – This option is to consider methods of returning large volumes of water to Lake Menindee from Lake Cawndilla when it has been filled by excess released from Lake Menindee by the block bank/regulator systems described in Option 1. This option considers the addition of pumps at the Menindee-Cawndilla block bank (possibly mobile pumps from Option 5).	Estimate of Savings not calculated.	$7.8M to $12.9M (additional cost of pumping installation and cost of pumps)	• This process will allow quicker emptying of Lake Cawndilla and thus reduce the evaporation area. • An alternative supply to the Anabranch may be required if Lake Cawndilla is dry more often after the regulator is installed. • Lake Cawndilla can only be drained to the 'cease to flow' level of the inter-connecting Cawndilla Creek system, leaving a residual volume of 152,000 ML in the lake. • Principal Environmental Benefits – • Principal Environmental Costs -
Option 7 Reduction (near elimination) of Transmission Losses	– Anabranch Options – Pipeline, Pumps on Darling River, Weir on Darling River. – The purpose of the pipeline option is to replace replenishment flows down the Anabranch with a piped supply for stock and domestic purposes, thus eliminating the current transmission losses.	Estimate of Savings not calculated.	$40M to $80M (Pipeline) $2.9M (pumps) $1.7M (Weir)	• At that time, replenishment flows were up to 50,000 ML/annum (depending on availability from Lake Cawndilla) with transmission losses estimated at up to 95%. • Option 7 (pipeline) provides for a capacity of 5,000 ML/annum, supplied over 100 days. • Principal Environmental Benefits – would allow the Anabranch to dry out completely and follow more natural drying/wetting patterns; increased habitat for terrestrial flora and fauna; lower water-table levels along the Anabranch. • Principal Environmental Costs - significant construction impacts; disturbance to riparian vegetation; potential for the fragmentation of habitat.
Option 8 Raise Levels in Menindee and Cawndilla	– Foreshore Protection for Menindee, Cawndilla and Pamamaroo. – This option is intended to raise the storage levels in Lakes Menindee, Cawndilla and Pamamaroo to original design levels, thus creating additional storage and yield of water.	Estimate of Savings not calculated.	$17.2M	• Permanent protection measures being considered include tipped rock revetment, gabion revetment and mortar filled nylon revetment mattresses. • Principal Environmental Benefits – decreased levels of erosion; potential for reducing the duration/extent of flooding of ephemeral lakes; potential habitat in newly-created revetments. • Principal Environmental Costs - substantial construction impacts; likelihood of higher water-table levels surrounding Lakes Menindee, Cawndilla and Pamamaroo, with associated problems such as increased salinity; increased height of Lake Menindee would eliminate fringing woodland, resulting in more permanent flooding of Lake Speculation, and increased foreshore erosion(of unprotected areas).
Option 9 Drain Dead Storage in Lake Cawndilla	– Channel and pumping to Lake Cawndilla outlet regulator; or – Channel from Menindee to Cawndilla (cost prohibitive – eliminated).	Estimate of Savings not calculated.	$1.7M	• The purpose of this option is to drain the 'dead storage' from the lowest portion of Lake Cawndilla and avoid its loss through evaporation. • The proposal consists of a 4km channel with a 9m basewidth. • Principal Environmental Benefit – complete or near-complete drying of Lake Cawndilla would mimic natural conditions (depending on rate of drying), and return lake to more ephemeral state. • Principal Environmental Costs - water-level in Lake Cawndilla would probably drop too quickly to benefit vegetation communities; loss of refuge during drought.
Option 10 Evaporation Reduction-Small Lakes	– Regulators on ephemeral lakes adjoining Lake Wetherell – The embankments required to close off the lakes are extensive in both length (possibly up to 2 to 3km) and height(maximum 9.7m, 5.5m and 5m respectively). – The regulators are large structures with maximum discharges of 4,700ML/D, 1,600ML/D and 1,470ML/D. – The purpose of this option is to avoid the filling of the ephemeral lakes, because of their large evaporative area, until all other storages are full, and thereby allow more natural wetting and drying cycles and heights.	Estimate of Savings not calculated.	$7.1M (Tandure) $1.3M (Bijijie) $1.5M (Balaka)	• Proposals have been developed for the three largest ephemeral lakes (Lakes Tandure, Bijijie and Balaka). • Principal Environmental Benefit - creation of a system that better mimics the natural cycle of wetting and drying • Principal Environmental Cost - substantial construction impacts, such as roading, bulldozing and grading.
2002 Structural Options Feasibility Study, Supplement 1 (DPWS)				
Option 11 Rapid Drainage of Lake Cawndilla to Darling River	– Cawndilla Lake new open type regulator and channel to the Darling River. – The Option is to provide an additional regulated outlet from Cawndilla Lake including an associated channel from the south east margin of the lake to the Darling River following an easterly route as provided by State	Estimate of Savings not calculated.	$23.26M to $29.21M	• This report develops the Alternative Option, referred to as Options 11a and 11b for the respective outlet flow capacities of 4000ML/day and 6000ML/day. • Option may have considerable impact on the local environment - disturbance of aboriginal artefacts and heritage sites; lake dead storage volumes and associated impact on flora and fauna; introduction of lake water to the Darling River and the impact on river water quality and flora and fauna.

Option	Description	Savings (GL/yr)	Cost	Comments
	Water. – The total length of channel is 12.4km including approximately 1.13km of drainage channel in the lake bed;			
2002 Structural Options Feasibility Study, Supplement 2 (DPWS)				
Revised Option 1 Morton-Boulka Weir and Regulator	– This option replaced Option 1 above (DPWS 1998) – This report develops a revised Option 1, which is comprised of three sub-options, namely: - ▪ Option 1A - A new fixed crest rockfill weir; ▪ Option 1B - A retrofitted open type regulator with vertical lift gates; and ▪ Option 1C - A retrofitted open type regulator with tilting gates. This option only includes the provision of a cost estimate for the purpose of comparison with Option 1B.	Estimate of Savings not calculated.	$4.75M (Weir) $5.22M (Regulator with Lift Gates) $5.99M (Regulator with Tilting Gates)	• Additional issues that needed to be considered included - the flow capacity of the regulator is to be maximised; freeboard on the gates is to be limited to the minimum ; no new levees are permitted to be constructed; a fish passage structure to be included in the cost estimates. • A Revised Option 1 may impact on the local environment - potential for disturbance of aboriginal artefacts and heritage sites; the significant modification of the natural flow between the two lakes and associated impact on flora and fauna; and modification of established storage level patterns giving rise to the potential for an increase or decrease in water flows to downstream creeks and rivers with possible consequent water quality and flora and fauna impacts.
Revised Option 2 Menindee Lake Outlet Regulator	– Provide a preliminary design and an indicative cost estimate for the removal of the existing Menindee Lake outlet conduit type regulator and replace it with an open type regulator of increased capacity. – This option replaced Option 2 above (DPWS 1998) – Revised Option 2, comprises two sub-options: ▪ Option 2A - A new open type regulator with a capacity of 10,000ML/day; ▪ Option 2B - A replacement conduit type regulator that is similar to the existing structure and maintains the current capacity of 5000ML/day.	Estimate of Savings not calculated.	$8.74M to $8.88M	• The outlet will be located in the same position as the current structure to minimise environmental and cultural heritage impacts • The regulator includes the provision of a fish passage structure in the cost estimate. • A Revised Option 2 may impact on the local environment- potential for disturbance of aboriginal artefacts and heritage sites; introduction of an increased quantity of lake water into lower Menindee Creek and subsequently into the Darling River with possible impacts on water quality, downstream channel bank stability and flora and fauna.
Option 12 Penellco Channel Costing Review	– This option is related to but did not replace Option 4 above (DPWS 1998) – Provision of additional order of costings to address revised design requirements from those previously used in Option 4, namely: - revised route to utilise the existing Penellco channel; widening of the Penellco channel; flow in the Penellco channel in each direction; make allowance for flood passage; provide adequately for fish passage; – Two options were considered, 12A - 2000ML/D capacity system and 12B – 6000ML/D capacity system.	Estimate of Savings not calculated	$33.74M (Option 12A) $94M (Option 12B)	• Option 12A retains existing Cawndilla Regulator. • Option 12 may impact on the local environment - potential for disturbance of aboriginal artefacts and heritage sites; extensive channel works, particularly for Option 12B, including the removal of trees, channel widening, the disposal of spoil and the removal of snags; modification of established flow patterns down Tandou Creek; the need to avoid channel water from entering the wetlands located immediately to the east of and mid way along the Cawndilla outlet channel; possible consequent water quality and flora and fauna impacts.
2002 Menindee Lakes Ecological Sustainable Development Project				
	Structural Works including; – Improving the outlet capacity of Lake Menindee to the Darling River – Installation of a small block bank regulator between Lake Menindee and Lake Cawndilla to retain small and medium inflows in Lake Menindee; and, – Pumping the residual pool of Lake Menindee to Lake Pamamaroo	10 GL	$30M	• An Environmental Impact Statement (EIS) was completed for these works in 2005. However no further progress has been made.
2005 studies/URS study – unable to locate this study				
Darling River Water Saving Project – Part A				
Option A1 Decreased use of Lake Menindee	– Bypass channel in Lake Menindee – Improve outlet regulator at Lake Cawndilla	147 GL*	$25**M	• * The actual saving are estimated to be lower as environmental filling was not considered in Part A modelling • ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and

Option	Description	Savings (GL/yr)	Cost	Comments
	– Access to residual pools			other high security water users, costing between $85M and $400M • This option was eliminated in the Part B study due to high costs and concerns about sedimentation • Major local impacts - extended drying cycle in Lake Menindee; reduced availability of Lake Menindee for recreation; periodic loss of water frontage at Sunset Strip; reduced use of Lake Menindee; disturbance to Kinchega National Park due to the construction of a new Cawndilla outlet and channel to the Darling River.
Option A2 Decreased use of Lake Cawndilla	– Levee and regulator separating Lake Menindee and Lake Cawndilla – Increased Menindee outlet capacity – Access to residual pools	59 GL*	$18M**	• * The actual saving are estimated to be lower as environmental filling was not considered in Part A modelling • ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and other high security water users, costing between $85M and $400M. • Major local impacts - extended drying cycle in Lake Cawndilla; archaeological impacts at Menindee Outlet; archaeological impacts at Morton Boolka.
Option A3 Decreased use of Lakes Menindee and Cawndilla	– Increased Menindee outlet capacity and new channel to Darling River, or, – Increased Cawndilla outlet capacity and new channel to Darling River	180 GL*	$26M**	• * The actual saving are estimated to be lower as environmental filling was not considered in Part A modelling • ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and other high security water users, costing between $85M and $400M. • Major local impacts - extended drying cycle in Lake Menindee; extended drying cycle in Lake Cawndilla; Extended periods with loss of water frontage at Sunset Strip.
Option A4 Reduced use of Lake Menindee and half of Lake Menindee	– Partition Lake Menindee (NW-SE) – Additional Menindee outlet regulator – Access to residual pools	128 GL*	$97M**	• * The actual saving are estimated to be lower as environmental filling was not considered in Part A modelling • ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and other high security water users, costing between $85M and $400M. • Major local impacts - extended drying cycle in the lower Lake Menindee cell; extended drying cycle in Lake Cawndilla; significant archaeological impact within Lake Menindee; potential disturbance to Kinchega National Park, depending on outlet works selected. • This option was eliminated in the Part B study due to prohibitive costs and poor quality soils
Option A5 Reduced use of half of Lake Menindee	– Partition Lake Menindee (NE-SW) – Additional Menindee outlet regulator – New Cawndilla outlet regulator – Channel to Darling River – Access to residual pools	60 GL*	$87M**	• * The actual saving are estimated to be lower as environmental filling was not considered in Part A modelling • ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and other high security water users, costing between $85M and $400M. • Major local impacts - extended drying cycle in the lower Lake Menindee cell; significant archaeological impact within Lake Menindee; significant archaeological impact within Lake Cawndilla; disturbance to Kinchega National Park due to the construction of a new Cawndilla outlet and channel to the Darling River. • This option was eliminated in the Part B study due to prohibitive costs and poor quality soils
Option A6 More rapid drawdown of volumes when in NSW control	– New Cawndilla outlet regulator – Channel to Darling River – Access to residual pools	138 GL	$26M**	• ** Estimated cost is as at 2007 when report was completed. It was also estimated that structural works would be required to provide for Broken Hill and other high security water users, costing between $85M and $400M • Major local impacts - significant archaeological impact within Lake Cawndilla; disturbance to Kinchega National Park due to the construction of a new Cawndilla outlet and channel to the Darling River.
Darling River Water Saving Project – Part B (March 2010)				
Option B1 Never fill Lake Menindee and Lake Cawndilla	– Pamamaroo drainage channel – Rapid drawdown to 150GL – Alternate supply for Broken Hill	248	$32.9M*	• *Includes $31M for Alternative Broken Hill water supply. • Lakes Menindee and Lake Cawndilla are kept permanently dry, use of existing outlet structures plus minor engineering structures. 640/480 GL rule changed to 150/100 GL rule. • Environmental Impacts - Conversion of Lakes Menindee and Cawndilla into dry land habitat (loss of wetlands). Significant impacts on Lakes. Improved riverine habitat downstream of lakes. • Significant impacts on Aboriginal community, particularly no water in Lake Menindee.
Option B2 Environmental Fill of Menindee and Cawndilla	– As above in B1 but rapid drawdown to 200GL	125	$32.9M*	• *Includes $31M for Alternative Broken Hill water supply. • Reduced operational use of Menindee & Cawndilla, environmental fill, use of existing outlet structures plus minor engineering structures. 640/480 GL rule changed to 210/200 GL rule. • The hydrologic modelling adopted an environmental filling pattern that would require either Lake Menindee and/or Lake Cawndilla to be filled periodically

Option	Description	Savings (GL/yr)	Cost	Comments
				once in every 5 to 7 years on average. • Environmental Impacts - Return to more ephemeral regime in Lake Menindee and Lake Cawndilla utilising assumed environmental filling. Changed ecosystem in Lake Menindee and Lake Cawndilla. Improved riverine habitat downstream of lakes.
Option B3 Environmental Fill of Menindee and Cawndilla	– As per B2 plus increased outlet capacity of Menindee/Cawndilla (opt)	125	$101.9M*	• *Includes $31M for Alternative Broken Hill water supply. • Reduced operational use of Lake Menindee and Lake Cawndilla, environmental fill, considerable engineering works. 640/480 GL rule changed to 210/200 GL rule. • The hydrologic modelling adopted an environmental filling pattern that would require either Lake Menindee and/or Lake Cawndilla to be filled periodically once in every 5 to 7 years on average. • Environmental Impacts - Same as Scheme 2 with increased flexibility in managing water in Lake Menindee and Lake Cawndilla for environmental outcomes.
Option B4 Environmental Fill of Cawndilla	– As per B2 plus Menindee/Cawndilla bank and regulator	61	$49.6M*	• *Includes $31M for Alternative Broken Hill water supply. • Reduced operational use of Lake Cawndilla. Some engineering works. 640/480 GL rule changed to 210/200 GL rule. • The hydrologic modelling adopted an environmental filling pattern that would require either Lake Menindee and/or Lake Cawndilla to be filled periodically once in every 5 to 7 years on average. • Environmental Impacts - Return to more ephemeral regime in Lake Cawndilla utilising assumed environmental filling with Lake Menindee remaining relatively unchanged; changed ecosystem in Cawndilla; improved riverine habitat downstream of the Lakes.
Option B5 Environmental fill of Cawndilla	– As per B4 plus increased outlet capacity for Menindee/Cawndilla (optional)	74	$101.9M*	• *Includes $31M for Alternative Broken Hill water supply. • Reduced operational use of Lake Cawndilla. Considerable engineering works. 640/480 GL rule changed to 210/200 GL rule. • The hydrologic modelling adopted an environmental filling pattern that would require either Lake Menindee and/or Lake Cawndilla to be filled periodically once in every 5 to 7 years on average. • Environmental Impacts - Same as Scheme 4 with increased flexibility in managing water in Lake Menindee and Lake Cawndilla for environmental outcomes.
Option B6 Environmental fill of Cawndilla	– As per B5 but no change to NSW draw down	34	$101.9M*	• *Includes $31M for Alternative Broken Hill water supply. • Reduced operational use of Lake Cawndilla. Considerable engineering works. 640/480 GL rule unchanged. • The hydrologic modelling adopted an environmental filling pattern that would require either Lake Menindee and/or Lake Cawndilla to be filled periodically once in every 5 to 7 years on average. • Environmental Impacts - Same as Scheme 5.
Menindee Lakes MOU				
Commonwealth and NSW Governments ageed to investigate water savings options for Menindee Lakes including Broken Hill alternative water supply (July 2010)	Both governments agreed that any changes to the current operations must consider 3 major issues: – Provision of an agreed alternate secure water supply for Broken Hill – No adverse impact on the water security of existing entitlement holders' downstream of Menindee – No adverse impact on the environment.	N/A	N/A	In June 2011, the NSW Government terminated the agreement because the Commonwealth proposal did not meet the conditions listed above. NSW Government found that: • the Broken Hill community opposed the groundwater supply due to cost and water quality issues. • the reliability of supply to users downstream of Menindee Lakes would have been affected in dry years. • two of the Menindee Lakes would have had to be shut down resulting in significant environmental and social impacts.
Darling Water Savings: Options for Environmental Filling (November – December 2010 CSIRO - Podger)				
Options B1 and B2 above were Reviewed	– closing off Lakes Menindee and Cawndilla and changing the 640/480 rule to a 150/100 rule (i.e. Option B1) – implementing the proposed environmental refilling rules for Lakes Menindee and Cawndilla and changing the 640/480 rule to a 210/200 rule (Option B2)	248 125	Costs as above for B1 and B2	• The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) commissioned CSIRO to manage and report on the hydrological modelling required by the MOU. • This hydrological modelling was overseen by the Hydrological Modelling Working Group (HMWG), a technical group established by the Menindee Lakes Project Joint Steering Committee.
Re-analysis of B1 and B2	– CSIRO found that a combination of 10GL of General Security and 290GL of Supplementary Access licence and a 180/180 rule achieved the desired objectives.			• CSIRO recommended that options B1 and B2 be re-analysed to consider proposed limits on diversions and to determine the impact of lower NSW operating rule thresholds and climate change scenarios on downstream users.
New Modelling + Revised Environmental Filling Rules-B2	– CSIRO investigated a range of environmental filling scenarios and included revised MDBA environmental filling rules in the models. The	165		• Following on from the initial work above, the Hydrological Modelling Working Group (HMWG) agreed on a set of indicators for the modelling - to represent lake flooding and 'no impact' - and recommended that CSIRO extend their analysis to explore the likelihood of the Lakes being unable to deliver water.

Option	Description	Savings (GL/yr)	Cost	Comments
	scenarios were compared against the agreed indicators and the impacts in drought and flood years were also evaluated. – 150/150 Rule. – Menindee outlet capacity increased to 14,400ML/D – Latest model configuration.			• Water savings were partially consumed by downstream users and the remainder flowed to South Australia. • Minor downstream impacts were evident. • Note – the various filling patterns used by CSIRO differ from the environmental filling pattern used in the Part B Study. • Supplementary Report 1 submitted to Menindee Lakes Joint Steering Committee (MLJSC) on 3 December, 2010.
Darling Water Savings: Options for Environmental Filling, No Impacts, Version 1 (Dec 2010. CSIRO - Podger)				
B2-Investigate changes to Operational Rules and Reduction to Frequency of Surcharging Lake Pamamaroo	– 185/185 Rule – Lake Menindee outlet increased to 14,400ML/D – Broken Hill water supply secured. – Latest model configuration. – Revised MDBA environmental filling rules.	175 (LTCE)		• Following review of the Supplementary Report 1, the MLJSC agreed that further work should be carried out to: – Explore changes in operation rules that would have a positive impact on all indicators, and – Investigate the potential for maintaining the Lake Wetherell floodplain vegetation by reducing the frequency of surcharging the lake. • Although there were a number of positive impacts there were also some very minor downstream impacts, including - NSW Murray mean November allocations are 1% less; the percent of months that the combined storage volume of Lakes Wetherell and Pamamaroo are less than 100 GL is increased from 6 to 15%; the drawdown of Lakes Wetherell and Pamamaroo during dry periods is greater; percentage of years that flows to South Australia are reduced below its entitlement under the Murray-Darling Basin Agreement is increased by 1%; 95%ile salinity at Morgan increases from 773 EC by 17 EC.
Darling Water Savings: Options for Environmental Filling, No Impacts, Version 2 (May 2011. CSIRO - Podger)				
B2 as above – Impacts 'Removed'.	– 185/185 Rule – Lake Menindee outlet increased to 14,400ML/D – Broken Hill water supply secured. – Latest model configuration. – Revised MDBA environmental filling rules. – Additional changes required to remove impacts.	174 (LTCE) across the lakes		• This report considers additional changes to the Version 1 report above, that would be required to ensure that the minor impacts indicated are removed or compensated by other means. • To achieve 'removal' of impacts 28GL of NSW General Security Murray entitlements would need to be purchased and retired. • The model predicted that there would be some very minor downstream salinity impacts. • The licence associated with these savings is 125.6 GL/y (LTCE) of extraction at Weir 32 at a maximum rate of 25,000 ML/D when Lake Victoria is spilling and Weir 32 spills are above 1000 ML/D with a maximum annual limit of 347 GL. This is equivalent to a 101 GL/y (LTCE) licence at the South Australian Border.

6.3 Sharing Water Savings from Menindee

Over recent years, there have been improvements to water management in Menindee Lakes which has resulted in water savings. One such example is the Darling Anabranch which resulted in the issuing of an additional 47.8GL general security water licence in the Lower Darling for the Living Murray Program. NSW Office of Water advised in a recent letter to the Chair of the Namoi Peel Customer Service Committee (CSC) that the changed operating arrangements of the Menindee Lakes, implemented since construction of the pipeline supply to the Anabranch increased the reliability to general security users in the Lower Darling.

In both instances savings were allocated to the South – one for environmental purposes and one for consumptive purposes. It could be argued that some of these savings should have been attributed to the North to alleviate the need to embargo access to supplementary flows in the northern valleys to supply Broken Hill and other downstream stock and domestic requirements in dry times.

The NCWWG also understands that NSW has put forward an option to the Commonwealth for the improved management and efficiency of the Menindee Lakes as a water storage scheme. The Northern Valleys should be considered in regard to sharing any savings made as a result of this option.

It is also unclear where the point of measurement is for debiting the water account associated with the additional 250GL of Lower Darling Supplementary Entitlement purchased from Tandou for The Living Murray Program. That is, is the point of measurement comparative to the original access point or is it measured at another point further downstream in which case it would have impacts on the northern valley, above that of the original entitlement.

6.3.1 Suggested strategy as basis for sharing north – south

From the options outlined in previous studies, and as a guide it is estimated that realistic savings from the Menindee Investigations could be in the range of 34 GL/year to 174 GL/year.

It is suggested that any savings obtained from Menindee options be shared on a pro rata basis between the northern basin and the southern basin.

This can be done a number of ways. One way of estimating those shares would be on the basis of the ratio of shared reductions in each basin, i.e. South (2,289 GL/yr) to the North (390 GL/yr) which would result in about 17% to the Northern Basin.

6.3.2 Suggest basis for sharing between Northern valleys

Any savings that can be attributed to the northern basin could then be shared between individual valleys by apportioning them on the basis of the BDL factored to take into account each one of the northern valleys "connectivity" with the Barwon Darling River. This is a measure of the proportion of that valleys flow that "on average" reaches the Barwon-Darling. The methodology weights the valleys by multiplying the BDL with the valley's connectivity factor resulting in a weighted BDL. This has been applied to those valleys identified in the proposed

Basin Plan as being able to contribute to the downstream environmental water requirements. The table below illustrates the concept:

Valley	BDL (GL/year)	Connectivity	Weighted BDL (GL/yr)	Proportion of savings %
Condamine Balonne (Qld)	978	0.43	420.54	19.26
Intersecting streams (NSW)	114	0.43 (assumed)	49.02	2.25
Moonie (Qld)	84	0.98	82.32	3.77
Border Rivers (Qld)	320	0.92	294.4	13.48
Border Rivers (NSW)	303	0.92	278.76	12.77
Barwon-Darling	198	1.00	198	9.07
Namoi	508	1.00	508	23.27
Macquarie-Castlereagh	734	0.48	352.32	16.14
Total	3,239	5.3	2,183.36	100

In conclusion the volume of potential savings that would be attributed to the Namoi by applying this method would range from 1.35GL/yr to 6.88GL/yr.

7 SUMMARY OF ISSUES AND IDEAS

This section provides a summary of the key concerns, recommendations and suggestions outlined in our submission.

1. Baseline Diversion Limit

a. The information used and assumptions made in the development of the BDL remains unclear. What has and has not been included and how this reconciles with information used in the WSP process still needs to be clarified, particularly in regard to floodplain harvesting, unregulated diversions, interception activities and end of system flows.

b. Better communication with and access to both MDBA policy makers and MDBA modellers – together – is required to better understand the figures used and assumptions made.

c. It is strongly recommended that the further hydrological modelling work identified in this submission and in the MDBA's hydrology report, particularly the inclusion of the Interim Unregulated Flow Management Plan for the North West, be undertaken and completed ASAP and not be held off until the 2015 SDL review as suggested in the MDBA's hydrology report.

   This additional work is required to accurately reflect the current water management regime and determine the maximum volume that is being targeted for recovery i.e. for both the Namoi's internal environmental assets and the downstream shared contribution and provide certainty to local businesses and communities.

   This further work should be completed prior to SEWPaC conducting any further buyback programs in the Northern Basin.

2. SDL Process Diagram

The NCWWG requests the MDBA prepare a detailed process diagram, Namoi specific, that clearly outlines the steps, inputs, assumptions and outputs of the SDL methodology. Further detail is required at the local level in regard to Step 3, Step 4 and Step 5 of the ESLT methodology.

3. Cap to SDL Transition - Recognition of Cap credits

It is recommended that credits (and debits), accumulated under cap, transition to the new SDL arrangements in 2019. It is acknowledged that some adjustment may be necessary to ensure a fit with the new arrangements.

4. Water buyback – sensitivity analysis

It is recommended that a similar sensitivity analysis to that undertaken in the Condamine-Balonne be carried out in the Namoi.

5. Environmental Water Management & Delivery - coordination

The involvement of local NRM bodies in the coordination of the management and delivery of government held water at the local catchment level be further explored. The efficient use, management and delivery of environmental water is paramount.

6. Chaffey Dam Augmentation - ECA

The MDBA confirm if the additional 5GL/yr environmental allocation set aside following augmentation of Chaffey Dam has been considered in the determination of the SDL and meeting the environmental water requirements in the Namoi and downstream.

7. Importance of R&D

The MDBA recognise the importance of R&D in the better management of the MDB and support funding and resourcing in this area to assist in mitigating the impacts of the proposed Basin Plan. Given the proposed decline in water available for production it will be necessary to produce more food and fibre per megalitre. This will necessitate advances in technology and knowledge.

8. Offsetting the 198 GL/yr into Menindee

In light of the additional 198 GL/yr estimated inflow to Menindee as a result of meeting the northern basin valley's environmental watering requirements, it is requested that investigations into offsets against this additional volume be undertaken and considered for the northern basin valleys. One such offset that should be investigated is to remove the necessity to embargo access to supplementary flow events in the northern basin, in dry times, to secure Broken Hill's water supply, or, if it is critically needed at times, then compensation should be payable to northern basin irrigators for the right to access this water. The implementation of an emergency water supply for Broken Hill may, of course, negate this.

9. Works and measures

Investigate works and measures to more effectively and efficiently deliver water to meet environmental water requirements. Undertake feasibility study for potential infrastructure options for the Tallyawalka and Tereweyna creek system. Improved river operations and water management delivery should also be investigated including improved communication through remotely operated meters and gauges.

10. Optimisation of supplementary flow access

The NCWWG suggest there may be an opportunity to better target the Darling River flows by changing the volume that may be access in each event that is specified in the Namoi River WSP. For example, if the Barwon Darling River targets have been achieved in a satisfactory manner in the immediate past, or a large flood has recently occurred, there may be an opportunity to allow more supplementary access in the Namoi during subsequent flow events, without compromising the Darling River environmental assets. Further work is requested to be undertaken in this area.

11. Broken Hill Water Supply

The current investigations regarding Broken Hill water supply are not conclusive. It is not clear whether supply should be from Menindee Lakes alone or Menindee Lakes plus MAR. Government needs to finalise investigations and implement the most cost effective option to remove the need from the north to supply additional water, particularly for Broken Hill.

Northern Valleys should then be unencumbered, without diminution, to access to supplementary flows.

12. Menindee Lakes – sharing water savings

The Menindee Lakes need to be managed more efficiently with a focus on reducing the local environmental and cultural impacts together with the delivery of better quality water downstream, particularly in regard to reducing salinity. Government needs to finalise a cost effective option to realise optimum savings in the MLS. The Northern Valleys should be considered in regard to the sharing of savings made.

The NCWWG have some questions regarding the MLS pre-development scenario used by the MDBA for the purposes of the Basin Plan and seek meeting with MDBA modellers to better understand the figures used and assumptions made.

8 REFERENCES

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APPENDIX A WATER MANAGEMENT AND REFORM - CHRONOLOGY OF EVENTS, POLICY DECISIONS AND INVESTIGATIONS RELATING TO MENINDEE LAKES AND THE NAMOI RIVER CATCHMENT

Date	Event/Decision/Investigation
1877	Bywash Dam and Floodgates erected by Albemarle, Tintinology and Terryawynia Stations as a joint effort.
1885	Department of Public Works carried out a survey of the Darling River and recommended construction of 23 locks and weirs between Wentworth and Bourke to provide higher water levels to assist river navigation.
1886	Report in the "Silver Age" states: "As a result of the Water Commission's visit to the Darling, operations are to be commenced at Pamamaroo Lake, for the purpose of impounding the overflow waters of the river at that point…"
1887	The creeks leading out of Menindie Lake had been sandbagged by the ranks of the unemployed to keep the lake full, and during this operation a surveying team had been sent to the area to examine the storage possibilities.
1890	Flood inundates Menindee township
1892	Assessment of River between Walgett and Wentworth by Chief Engineer for Water Conservation. Recommended construction of 50 locks and weirs.
1894	The idea of using the Menindee Lakes for water conservation was first proposed.
1894	Act of Parliament authorises a private company to store water at Lake Menindee and irrigate the bed of downstream Lake Cawndilla. Proposal was not carried out.
1895	Work on an experimental lock and weir was commenced at Bourke.
1896	*NSW Water Rights Act*
1896	Scheme for locking the Darling between Bourke and Brewarrina was referred to the Parliamentary Committee on Public Works. Committee concluded that the scheme should not proceed at that time.
1900	Western Lands Commission Inquiry.
1901	Exclusion of the Commonwealth from "management" of the State's water resources but involvement in navigation as this involved trade
1901	Western Lands Act declared.
1902	*Water and Drainage Act* giving powers to government to fund and build works
1906	Initial Murray Agreement drafted
1911	Menindie residents present petitions to Government for water conservation and irrigation measures to be carried out. A survey was again carried out, however, the Government was unwilling to finance the project at that time.
1912	Introduction of both the *NSW Water Act* and the *Irrigation Act* which established the WC&IC
1913	Committee's report on Inter-State water management submitted to Governments
1914	First Murray River Agreement signed by the four Governments
1915	*River Murray Waters Agreement* ratified by the four Governments

Date	Event/Decision/Investigation
1915	The NSW Public Works Department was assigned accountability as the NSW Constructing Authority role to implement the River Murray Commission's works program for NSW works.
1917	River Murray Commission established to manage the regulation and storage of flows – First meeting of the Commission
1918	Township of Menindee name changed from "Menindie".
1923-24	Water conservation measures feasibility study carried out.
1925	River Murray Commission assumed responsibility for delivery of water to the States.
1926	Local water trains run from Menindee to Broken Hill.
1932	Petition from Menindee residents to the Minister for Works requesting a weir at Menindee. Representatives from the Western Lands Board, WC&IC and the Department of Agriculture investigated the proposal, but felt that installation and maintenance costs were prohibitive.
1937	Petition presented to the Minister for Agriculture regarding provision of a weir at Menindee. While the Government contributed no funds, they did finally approve the construction of a sandbag weir of 3 feet in height to the constructed across the river.
1938	Agreement between Broken Hill Water Board & NSW State Govt to build a storage at Menindee and pump water to Broken Hill providing an unfailing water supply. Before construction began, war broke out and no work commenced. At the end of the war, a decision was made to start the Snowy Mountains Scheme. Premier of South Australia, Tom Playford, challenged the building of the Snowy Scheme, believing it would at times deprive South Australia of water. A compromise was reached whereby the early version of the Menindee storage was modified and enlarged with South Australia receiving an allocation secured by the Menindee Storage and the Murrumbidgee River
1940	Government approves (but provides no funding) for construction of a sandbag weir, 3 feet in height, across the river.
1941	Drought conditions
1942-43	Town weir built between the steamer wharf and the bridge.
1945	NSW legislation enacted authorising WC&IC to construct a series of from 35 to 45 weirs along the course of the Darling River
1945	Announcement that Broken Hill - Menindee pipeline will soon be commenced
1946	Survey Work for the Broken Hill – Menindee pipeline commences
1949	Menindee Water Conservation Bill read in the New South Wales Parliament.
1949	*Menindee Water Conservation Act* was passed by NSW Parliament authorising the construction of the Menindee Lakes Storage Scheme. Established the WC&IC to construct weirs, levee banks, regulators, bridges and other structures necessary for converting the dry lake beds into large and effective water storages.

Date	Event/Decision/Investigation
1949	Formal announcement that the State Government planned to build a water conservation scheme at Menindee.
end 1949	Work on the WC&IC Menindee Lakes Storage Project commenced with the first sod turned. Town water reticulation project finished.Work continued satisfactorily despite many difficulties encountered as a result of the prevailing high river during 1949 & 1950
1949 & 1950	Floods during construction - work continued despite difficulties encountered as result of high river
1952	Suspension of Menindee Scheme construction works due to demands of other works having a priority
1957	Recommencement of Menindee Scheme construction works.
1960	Construction of Major Works Completed
1961	Opening of the outlet regulator and channel at Cawndilla.
1962	Embankment at Cawndilla Outlet Regulator fails – maximum operating level was dropped to store1,800,000 ML
1962	The Premier of NSW approached the Commonwealth Government to have the Menindee Lakes Scheme managed and operated within the River Murray Waters Agreement provisions for a period of 7 years.
1963	The four governments agreed to the Menindee Lakes Storage Agreement for a 7 year period and modifications to NSW Rights.
1963	New South Wales Government agreed to lease the storage in perpetuity to the River Murray Commission (part of former MDBC) to be managed in harmony with the River Murray
March 1964	Assent of the *Menindee Lakes Storage Agreement Act 1964 (NSW)* *An Act to ratify an agreement entered into between the Prime Minister of the Commonwealth and the Premiers of the States of New South Wales, Victoria and South Australia for the sharing of the waters of the River Darling stored in the Menindee Lakes; and for purposes connected therewith.*
April 1964	Commencement of the *Menindee Lakes Storage Agreement Act 1964 (NSW)*
1968	Construction of Total Works of the Menindee Storage Scheme completed. Total cost of the works to completion (December 1968) was $11,269,817
1960's	Topogrpahic Surveys Completed when Menindee Lakes storage scheme was constructed. These surveys provide numerous spot heights from which approximate contours were generated
1974	Role of NSW Constructing Authority was transferred from the NSW Public Works Department to the NSW Water Resources Commission.
1977	NSW Resources Commission under the provisions of the Water Act applied an embargo on the issue of new irrigation licences to contain diversion by NSW from the Murray River. The embargo was extended to the Lower Darling system below Menindee Lakes.
1978	The Commission agreed in-principle to continuous accounting for sharing the Murray Water Resources.
1979	South Australia's increased entitlement became operational, equity policy for restrictions applied and NSW gained ceded water from Victoria and Dilution Flow Policy was

Date	Event/Decision/Investigation
	applied.
1979	South Australia raised the possibility of limiting diversions from streams in the Murray Darling Basin
1980s	Embargo on issuing of new water licences in regulated rivers
1985	Ministerial Council was established at a meeting of government Ministers in Adelaide and is operation is specified in the Murray-Darling Basin Agreement
January 1987	Amendment of the Menindee Lakes Storage Agreement Act 1964 - Miscellaneous Acts (Water Administration) Amendment Act 1986 - Assented to 18/12/86
1987	Replacement of the River Murray Waters Agreement with the Murray Darling Basin Agreement. The Murray Darling Basin Commission established to replace the River Murray Commission which had been operative since 1916 and the Murray Darling Basin Ministerial Council formally established under statute.
1987	Additional Dilution Flow - as part of the MDB salinity and drainage strategy, it was agreed that SA would be entitled to additional water to mitigate the impacts of surface water salinity. This volume, an extra 3,000ML/day known as additional dilution flow (ADF) is supplied through the predicted savings resulting from "Harmony Operation". The average annual volume of the ADF is 340 GL per year but it varies widely from year to year depending on the prevailing conditions. (MDBC 2002)
1988	Introduction of "Harmony Operation" of Menindee Lakes and Lake Victoria - by MDBMC Harmony operation involves transferring water from Menindee Lakes to Lake Victoria if flow in the River Murray is insufficient to maintain suitable storage volumes in Lake Victoria. Evaporation loss is greater in the Menindee Lakes than in Lake Victoria, as a result water from Menindee Lakes is used in preference to Lake Victoria under a set of detailed operating procedures.
1988	MDBMC adopts the Salinity & Drainage Strategy for the River Murray System. States were only assigned salinity debits fro those measures and works implemented by the States after January 1988. Harmony Operation of Menindee Lakes and Lake Victoria was a component of this Strategy
1988	Murray Darling Basin Commission replaces River Murray Commission The MDBC was given a new brief and broader responsibility to manage the catchments surrounding the rivers, with a new emphasis on catchment management
1989	The MDBC approved, in principle, adoption of Continuous Accounting with a commencement date of 1 December 1989 and at that date, NSW and Victoria were deemed, by the MDBC, to have equal shares of water in all MDBC managed major storages, namely Dartmouth, Hume, Lake Victoria and Menindee Lakes, in the river weirs and in transit in the river.
1991	Large Algal Bloom in the Barwon-Darling - unprecedented. Prior to this the regulated tributaries of the Barwon Darling and the Barwon Darling itself were treated and managed as independent water sources. There were no statutory or policy obligations to consider connectivity of the tributaries and the Barwon Darling River.
Mid 1991	The Interim Unregulated Flow Management Plan for the North West was implemented. This plan imposed an obligation to manage unregulated flow from the Namoi Valley (and other tributaries) and within the Barwon Darling itself to provide flows in the Barwon Darling in specified periods and flow conditions. This was the first time that there was an obligation to manage water use in the valley to meet downstream water requirements.

Date	Event/Decision/Investigation
1992	Murray Darling Basin Agreement 1992 - replaced River Murray Waters Agreement of 1915 water sharing agreement which is part of the overall Murray Darling Basin Agreement 1992 guarantees certain minimum flows to South Australia, irrespective of the needs of water users upstream. NSW and Vic are licensed to extract a certain amount of water but Sth Australia is the only state that is guaranteed a minimum monthly flow (entitlement) under the MDBA.
1994	Operation of Lake Victoria as a water storage was restricted in response to concerns over damage to significant cultural heritage and Aboriginal burials exposed on the Lakes foreshores.
1994	Menindee Lakes - Water Management Improvement - Proposals under investigation
1994	Council of Australian Governments (CoAG) Water Reform Agreement and Framework
Jul-95	MDBMC agreement to Cap diversions in the Murray Darling Basin. Immediate moratorium introduced on further increases in diversions.
1995	NSW Minister for Land and Water Conservation announced a review of the operations of the Menindee Lakes. This lead to the formation of the Menindee Lakes Advisory Committee a draft management plan, an issues paper, an ecologically sustainable development project, an EIS report, the State of the Darling report, and more recently, the Darling River Water Savings Project Report.
1995	NSW Government announces Rural Water Reform Package – Stage 1
1996	River Management Committees began to be established in each Valley
1997	Cap on Diversions in the Murray Darling Basin formally established.
1997	NSW Government announces Rural Water Reform Package – Stage 2
Oct 1997	Draft Indicative Environmental Flow Rules endorsed by NSW Cabinet for major regulated rivers in NSW. Community based water management committees established to review indicative flow rules for each major river in NSW.
March 1998	Environmental Flow Rules for the major regulated rivers of NSW, including the Namoi, recommended to Government by River Management Committees.
April 1998	NSW Water Policy Statement
June 1998	NSW Water Management Committees established to develop river and groundwater management plans.
Dec 1998	Draft Management Plan for Menindee - This Plan was finalised in early 2000
1998	DPWS Study – Menindee Lakes Storages – Structural Options Feasibility Study, Stage 1 - 10 Structural Options identified
1999	NSW Farm Dams Policy announced

Date	Event/Decision/Investigation
Oct 1999	Menindee Lakes Ecological Sustainable Development (ESD) Project commenced
April 2000	Review of the Operation of the Operation of the MDBA Cap on Diversions – review confirmed cap should stay.
Dec 2000	NSW *Water Management Act 2000* assented
2000	Prime Minister, Premier and Chief Ministers at the Council of Australian Governments endorsed a National Action Plan for Salinity and Water Quality
2000	Menindee Lakes ESD - first consultancies commenced
2001	Major Darling Basin Drought commenced. Resulted in extremely low levels of storage in the Menindee Lakes Storage. The storage was depleted to the point where supply from Menindee could not be guaranteed and there was a real possibility of having to transport water to supply the city of Broken Hill from a remote source or alternatively evacuate the city. A policy to manage extractions from unregulated flows in the Darling Basin for the purpose of maintaining supply to Broken Hill was implemented. The impact of this was the banning of extractions on several occasions until the storages recovered to the extent that Broken Hill's supply was considered secure. Restrictions were mainly imposed within the Border Rivers Valley as this was the principle source of flow during this period and along the Barwon Darling. The policy did allow for management of Namoi Valley unregulated flows.
March 2001	Water Management Committees established in NSW as advisory committees under the Water Management Act (NSW) to provide advice on the development of water sharing plans (WSPs) including Bulk Access Regimes (BARs) for priority water sources in NSW – included the Namoi.
March 2002	DPWS Study – Menindee Lakes Storages – Structural Options Feasibility Study - Supplement 1
July 2002	DPWS Study - Menindee Lakes Storages – Structural Options Feasibility Study - Supplement 2
Aug-02	Menindee Lakes ESD completed
Nov 2001 - Mar 2002	Resurvey of Lake Wetherell Capacity by Theiss Services under the Menindee Lakes ESD Project - included some 212 kilometres of the Darling River and adjacent Lakes such as Lake Tandure, Bijijie, Balaka and Malta.The capacity results showed a significant deviation from the capacity established from the 1960 survey - the 2002 survey indicated a capacity of some 20% less at full supply with much higher deviations (all in the negative) at lower levels. Operation of the lakes over the 30 years seemed to indicate the originally estimated lake volume may be over-estimated, resulting in significant water management difficulties.
2003	Gazettal of 35 Water Sharing Plans under the *Water Management Act 2000*
May-03	$5 Million NSW Water Innovation Fund Announced by NSW Minister for Infrastructure Planning and Natural Resources. Priority list for funding included Menindee Lakes Operational Efficiencies and Structural Works - $14M identified as project cost to undertake "investigation" to achieve estimated 12GL of savings.
Aug 2003	COAG Communiqué - COAG reaffirmed commitment to implementing the 1994 Water Reform Framework and agreed to 2 intergovernmental agreements i.e. the National Water Initiative and arrangements for investing $500 M over 5 years to address water over allocation in the Murray Darling Basin
Sept 2003	DRAFT Darling Anabranch Management Plan Business Plan

Date	Event/Decision/Investigation
Oct 2003	Supplementary access was not available to the tributary flows in October because of urgent need for water at Menindee Lakes. Access to supplementary water was available in January and March 04.
Dec 2003	NSW Border Rivers banned from pumping. NSW Irrigators in Border Rivers experienced frustrating times in December when they were banned from pumping from Barwon Darling System to allow Menindee Lakes to recover from critically low levels. Meanwhile their Qld counterparts extracted off allocation water from the other side of the river
31-Dec-03	Flows to the Lower Darling River downstream of Menindee ceased to protect town water supply for Broken Hill and Menindee
2003/04	Broken Hill requirements not secure until rain of January 2004 rainfall and flow event in Darling Tribs made way to and increased storage levels in Menindee Lakes. Various works and pumping measures were undertaken to reduce losses and extend water supplies. Additional restrictions were placed on u/s NSW irrigators to ensure these flows reached the lakes No GS or HS allocation announcements in Lower Darling until January 04 rain. Permanent plantings received limited access until end of December 2003 to reduce risk of trees and vines dying.
January 2004	EIS for Darling Anabranch for Stock and Domestic Pipeline and re-instatement of environmental flowsProposed S&D water supply scheme to produce average annual water savings of 47GL per year. Part of this will be allocated for the provision of an environmental flow regime for the Anabranch, leaving a net out-of-Anabranch estimated water saving of between 25 and 28 GL per annum, including an end of system flow of 4GL (based on whole-of-system modelling undertaken by MDBC). The environmental flow for the Anabranch averages between 23 and 26 GL per year. The report also stated that indirectly, additional water savings may be achieved from the introduction of greater flexibility in the management of the Menindee Lakes System
31-Jan-04	After rainfall events in Nthn NSW & Qld, flows over Weir 32 recommenced at 150ML/d to provide S&D supplies from Menindee to Ashvale and to protect remaining water in residual pools
6-Feb-04	Releases were increased to 300ML/day
17-Feb-04	Releases were increased to 700ML/day
June 2004	National Water Initiative signed.
July 2004	Water Sharing Plan for the regulated Namoi River Water Source commenced – total of 31 WSPs commenced.
2004/05	Completion of remedial repairs to Lake Pamamaroo Inlet - downstream chute concrete regulator on Pamamaroo regulator
July 2005	Agreement on MDB Cap on Barwon Darling
2005	URS EIS - Menindee Lakes Structural Works
2005	Dept of Commerce - Supplementary 4 - structural works - base maps provided by DIPNR
January 2007	*"National Plan for Water Security"* announced by Howard Govt - $10 Billion Investment program over 10 years to implement the NWI. Included $3billion for water buyback and $6billion for updating irrigation infrastructure

Date	Event/Decision/Investigation
Sept 2007	Commonwealth *Water Act 2007* assented
2007	Darling River Savings Project – Part A
March 2008	Commonwealth *Water Act 2007* commenced
March 2008	COAG MoU on Murray Darling Basin Reform – all governments agreed in-principle.
2008	Darling River Savings Project – Part B commenced
April 2008	"Water for the Future" announced by Rudd Govt – $12.9 billion investment program replaced the "National Plan for Water Security". Included; $3.1 billion invested in Restoring the Balance in the Murray Darling Basin to purchase water entitlements; $5.8 billion invested in Sustainable Rural Water Use and Infrastructure to increase water use efficiency and upgrade irrigation infrastructure
July 2008	COAG Agreement and IGA on Murray Darling Basin Reform – in-principle allocation of Commonwealth funding to Basin States and territories – subject to due diligence and 3 part test for Commonwealth investment.
Sept 2008	NSW Government purchased Toorale Station - Australian Govt financial contribution in return for Toorale Station water entitlements – to extract from Warrego and Darling Rivers and rights to harvest from the floodplain – estimated to return long term average annual volume of 20GL, peaking up to 80GL in flood years.
March 2009	Commonwealth Govt announce up to $16 million in additional funding for further investigations into regional GW resources and the potential for managed aquifer recharge. Based on findings from Phase One of the Broken Hill Managed Aquifer Recharge Project undertaken by Geoscience Australia which indicates considerable potential for an aquifer storage system. The findings of Phase Two were to be incorporated into Part B of the Darling River Water Savings Project
19 Jan 2010	Joint media statement - water agreement – Lower Lakes to receive at least 148GL from NSW floods - NSW Premier - Kenneally & SA Premier Mike Rann
2010	Darling River Savings Project – Part B completed
July 2010	Commonwealth and NSW Governments sign MOU for the cooperative investigation and subsequent implementation of key water reform initiatives in NSW including Broken Hill's urban water supply and Menindee Lakes operational arrangements.
October 2010	Guide to the proposed Basin Plan Released by the MDBA
Oct 2010	House of Representative Inquiry announced into Impact of the Guide to the Murray Darling Basin Plan. New House of Representatives Standing Committee on Regional Australia established (chaired by Tony Windsor, MP) – first task to inquire into the impact of the Guide to the Murray Darling Basin Plan and report back to Parliament
Nov 2010	Senate inquiry announced into the management of the Murray Darling Basin and the development and implementation of the Basin Plan – to be conducted by the Senate Rural Affairs and Transport References Committee (Chair Bill Heffernan)
Nov-Dec 2010	CSIRO Darling Water Savings reports 1 to 3 – Options for Environmental Filling – under the MOU between NSW and the Commonwealth.
May 2011	CSIRO Darling Water Savings report No. 4 – Darling Water Savings: Options for Environmental Filling, No Impacts, Version 2.

Date	Event/Decision/Investigation
June 2011	NSW terminated MOU for the cooperative investigation and subsequent implementation of key water reform initiatives in NSW including Broken Hill's urban water supply and Menindee Lakes operational arrangements.
June 2011	Release of the Standing Committee on Regional Australia's Report "Of Drought and Flooding Rains: Inquiry into the impact of the Guide to the Murray Darling Basin Plan in Regional Australia".
4 July 2011	NSW Water Minister Katrina Hodgkinson media release - revised option for Menindee Lakes - estimated 34 - 80 GL/yr savings
Nov 2011	Australian Government response to the Standing Committee on Regional Australia Inquiry into the Impact of the Guide to the Murray Darling Basin Plan. Response included an announcement that the Aust Govt would not conduct any further open tenders in the Sthn connected MDB until 2013.
Nov 2011	MDBA Released Proposed Basin Plan
Jan 2012	Bewsher Report- Review of Hydrologic Investigations Carried Out Under the Menindee Lakes MOU.