Chapter 6

The impacts of climate change and the likely future availability of water in the Murray-Darling Basin

Introduction

6.1 The Department of the Environment, Water, Heritage and the Arts (DEWHA) stated in its submission that in recognition that climate change impacts on water inflows across the Basin may result in reduced water availability the Government is pursuing a water reform agenda to better prepare communities to adapt to climate change. DEWHA's submission notes that improved information is necessary to enable adaptation to climate change, and for that reason the Government has invested in the CSIRO's *Sustainable Yields Project.*[1]

6.2 The *Sustainable Yields Project* provides an assessment of the anticipated impacts of climate change by 2030 on the Murray-Darling Basin (MDB or Basin). This section of the report outlines the key findings of the *Sustainable Yields Project* in relation to the impacts of climate change on the MDB.[2] The committee notes that a number of submissions regard the *Sustainable Yields Project* as having the most accurate information and being the most comprehensive analysis of the impacts of climate change on the MDB.[3]

6.3 The chapter concludes with a brief discussion of the implications of reduced water availability water planning in the MDB.

Impacts of climate change on the Murray-Darling Basin

Surface water

6.4 In terms of the current surface water resources of the MDB, the *Sustainable Yields Project* report states:

> The current average surface water resource of the MDB…is 23,417 GL/year. Streamflow losses are naturally high across the MDB. In the absence of flow regulation and consumptive water use, only 14,493 GL/year (62 per cent of the total surface water resource) would reach Wentworth on the Murray River and only 12,233 GL/year (52 per cent of the total surface water resource) would reach the Murray mouth on average.

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1 *Submission 1A*, Part 1 of the Inquiry, p. 14.

2 For information on the CSIRO's Sustainable Yields Project see: http://www.csiro.au/partnerships/MDBSY.html.

3 See for example: Murray-Darling Basin Commission, *Submission 4*, p. 3; Queensland Department of Natural Resources and Water, *Submission 12*, p.6.

> Current surface water use … across … the MDB is 11,327 GL/year. This is 48 per cent of the available surface water resource and is a very high relative level of use. Because of the high natural losses in the MDB this level of use has reduced outflows through the Murray mouth by 61 percent.[4]

6.5 The *Sustainable Yields Project* report describes the impact of climate change by 2030 as 'uncertain' but goes on to outline the likely impacts on surface water availability:

> …surface water availability across the entire MDB is more likely to decline than to increase. A decline in the south of the MDB is more likely than in the north. In the south of the MDB, a very substantial decline is possible. In the north of the MDB, significant increases are possible. The median decline for the entire MDB is 11 percent…[5]

6.6 Dr Tom Hatton of the CSIRO noted that although the 11 per cent decline in surface water availability 'does not sound like a large number', it represents an 'ongoing major challenge':

> It is important to appreciate that is the mean annual flow at 2030 and that there will be droughts within that which will look more like what we have had in the last 10 years. They are fairly profound impacts.[6]

6.7 The CSIRO anticipates that under a median 2030 climate and associated decline in water availability, annual surface water use across the MDB would be reduced by four per cent, under current water sharing arrangements. Nearly two-thirds of this reduction would occur in the high water use regions of the Murray, Goulburn-Broken and Murrumbidgee. The relative level of surface water use, that is the ratio of surface water use to surface water availability, would increase from 48 per cent to 52 per cent.[7]

6.8 Reductions in water availability also reduce the reliability of surface water supply:

> The impacts of climate change on the reliability of 'water products' vary greatly between the products, regions and states. High reliability water

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4 CSIRO, *Water Availability in the Murray-Darling Basin: A report from CSIRO to the Australian Government* (*Sustainable Yields Project Report*), 2008, p. 28. The relative level of use is the ratio of surface water use to surface water availability, see *Sustainable Yields Project Report*, p. 32.

5 *Sustainable Yields Project Report*, 2008, p. 5.

6 *Committee Hansard*, 16 March 2009, p. 2.

7 *Sustainable Yields Project Report*, p. 38. Annual surface water use includes diversions for irrigation, rural stock and domestic use and urban town supply, the pipe and channel losses associated with this supply, and the eventual stream flow impacts of groundwater extraction. The assessment also includes additional farm dams and commercial plantation forestry. See *Sustainable Yields Project Report*, p. 32.

> products (including town water supplies) would generally not be affected. 'General security' and 'low reliability' type water products would be affected in terms of the average seasonal allocation and the fraction of years of 100 percent allocations. The greatest reductions in reliability would occur in regions where the relative level of surface water use is already high and where the climate change is expected to have the largest impact on water availability, and for water products that are already less reliable. Some of the largest reductions in reliability would thus occur in the Murray, Goulburn-Broken, Campaspe, Loddon-Avoca and Wimmera regions, and under the dry extreme 2030 climate [scenario].[8]

6.9 The CSIRO states that much of the impact of reduced surface water availability will be focussed in the high water use Murray, Goulburn-Broken and Murrumbidgee regions:

> Under a continuation of current water sharing arrangements, much of the impact of reduced surface water availability would be transferred to the riverine environments along the Murray River including the Lower Lakes and the Coorong. Flow at the Murray mouth would cease 47 percent of the time and severe drought inflows to the Lower Lakes would occur in 13 percent of years. Current surface water sharing arrangements in the MDB would generally protect consumptive water users from much of the anticipated impact of climate change but offer little protection to riverine environments…The Gwydir region is a notable exception as current arrangements would see the consumptive and non-consumptive water shares affected to a similar degree.[9]

Groundwater

6.10 Groundwater use currently represents 16 per cent of total water use in the MDB. In terms of the future availability of groundwater, the CSIRO found that current ground water extraction in seven 'groundwater management units' – namely the Condamine, Border Rivers, Lower Namoi, parts of the Lower Macquarie, parts of the Lower Lachlan, the Upper Lachlan and the Mid-Murrumbidgee – is unsustainable. There are also indications that the groundwater extraction in the Upper Murray may not be sustainable.

6.11 The CSIRO also note that under current groundwater management arrangements, groundwater use across the Basin could more than double by 2030 to exceed one-quarter of total average water use. This increase would be despite existing planning controls that will reduce groundwater extraction to below current levels in some areas.[10]

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8 *Sustainable Yields Project Report*, p. 8.

9 *Sustainable Yields Project Report*, p. 8.

10 *Sustainable Yields Project Report*, p. 10.

6.12 The committee also notes that contrary to the position put forward by the CSIRO, Mr John Clements of Namoi Water, outlined that farmers in the Namoi area were working hard to remain viable in the face of a sixty per cent drawback in groundwater:

> …we have a group of farmers who have responded well to change…We have had serious drawbacks of water, with 60 per cent of the groundwater - so 60 per cent of the investment basis for the businesses - clawed back and 30 per cent of the surface water clawed back. But our farmers are still viable, they are still profitable, and they have responded to change. We have taken on GPS technology. We are keeping stubble and incorporating it into the fields. We are getting our carbon up. We are getting our moisture retaining capacity up. We are reducing the number of operations we run over the country. These are the changes you carry out when you are living in a world of reduced water, be that due to policy or to drought, or to any other factor that people might want to bring into the equation.[11]

6.13 The CSIRO notes that climate change has the potential to impact on rainfall recharge into groundwater. However, the CSIRO states that in areas where rainfall recharge is predicted to be lower under a drier climate, other sources of recharge would support continued groundwater extraction. The CSIRO describes as 'minor' the impact of 2030 climate conditions on rainfall recharge and groundwater levels, compared to the impacts resulting from current and additional future extraction:

> Under the median 2030 climate only small changes in rainfall recharge would be expected across the MDB: small decreases in the south and small increases in the north …
>
> Overall, the impacts of climate change by 2030 on rainfall recharge and groundwater levels would be minor compared to either the impacts already caused by groundwater extraction or the additional impacts associated with expected additional future extraction. Climate change by 2030 will have only very small impacts on water exchange between aquifers and rivers and would have no net impact on these exchanges across the MDB.[12]

Flow regimes and floodplain wetlands

6.14 The CSIRO notes that water resource development has altered the seasonal character of flow regimes in the MDB:

> …in the major southern rivers high winter flows are captured for irrigation release in the summer leading to seasonal inversion of flow downstream of major dams. Further downstream, past the major diversion points, flow seasonality is largely restored but the amplitude of the seasonal variation is greatly reduced due to consumptive use.[13]

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11 *Committee Hansard*, 10 March 2009, pp 15-16.

12 *Sustainable Yields Project Report*, pp 47, and 49.

13 *Sustainable Yields Project Report*, p. 52.

6.15 The *Sustainable Yields Project* report states that climate change by 2030 could have major additional effects on the seasonal patterns of flow. The greatest changes are likely at the high-flow times of the year:

> In the north, wet season flows may either increase due to increasingly extreme events or decrease due to an overall drying. In the south, flows are generally expected to be lower, particularly during the wet season.[14]

6.16 According to the CSIRO, water resource development has had a major impact on flooding regimes of many important floodplain forests and wetlands. Further, the CSIRO state that climate change would also impact on environmentally beneficial flooding. The CSIRO states that the impacts of climate change by 2030 would be smaller than water resource development, however, there is the potential for severe impacts:

> …when the incremental impacts of climate change are superimposed on the existing impacts from water resource development, the ecological consequences could be major. This is because important ecological thresholds may be crossed and resulting changes may well be largely irreversible. The population and wider ecosystem consequences of such changes could be catastrophic.[15]

6.17 The *Sustainable Yields Project* report also states that the median 2030 climate would increase the duration of the dry periods between important flood events for all the Living Murray Icon sites:

> There would only be relatively small increases in the average period between flooding for most Icon Sites, but the average period would double for Chowilla Floodplain and Lindsay-Wallpolla Islands to be about every 18 years – almost eight times the without-development period. The average annual volumes of environmentally beneficial floods would be close to halved for all the Icon Sites along the Murray River. On average they would only receive about one-tenth of the flooding volume they received under without-development conditions.[16]

6.18 The CSIRO's submission to the committee further illustrates this point:

> For example, in the case of the Barmah Forest on the Upper Murray River, the impacts of climate change are estimated to reduce the incidence of flooding from every one to two years under natural conditions, to one in four years under the best estimates of the impacts of climate change. This compares with a flood frequency of once every three and a half years on average currently under levels of water resource development and the historical climate.[17]

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14 *Sustainable Yields Project Report*, p. 52.

15 *Sustainable Yields Project Report*, p. 52.

16 *Sustainable Yields Project Report*, p. 53.

17 *Submission 2*, p. 5.

Run-off

6.19 The Murray-Darling Basin Commission (MDBC) also provided the committee with information on the impacts of climate change on run-off in the Murray-Darling Basin from its Risks to Shared Water Resources Program. That study projected that the likely impact of climate change on run-off in the Murray-Darling Basin was 1100 gigalitres/ annum in 20 years and 3300 gigalitres/ annum in 50 years. The committee also notes that the MDBC's submission describes these figures as 'highly uncertain'.[18]

6.20 The MDBC also provided the committee with some results from its South Eastern Australian Climate Initiative in relation to the impacts on run-off in the MDB:

> …in 2030 run-off, in the northern part of south eastern Australia is likely to change by between -25% and 20% with a median of -5%, while the southern part of South Eastern Australia has a likely change between -30% to 0% with a median of -15%.[19]

Planning for the impacts of reduced water availability

6.21 The committee heard from a number of witnesses who outlined how the MDB could be better managed to enable it to cope with the impacts of reduced water availability. For example, Dr Kerri Muller discussed building resilience into wetland systems:

> It is critical that we maintain the ecosystem services of our wetlands and our genetic diversity, particularly coming into climate change. We need to improve the resilience of our ecosystems to changes such as climate changes. It is something that we do have to look at: sharing water between wetlands but making sure that ecological processes and functionality are occurring at all levels.[20]

6.22 The committee also received evidence to the effect that the MDB needs to be reconfigured in order to adjust for the impacts of climate change.

6.23 The Wentworth Group of Concerned Scientists (Wentworth Group) described climate change as the 'double whammy' for the MDB, exacerbating a climate shift similar to the pre-1950s low rainfall pattern.[21] The Wentworth Group argue that extractions from the system need to reduced in order to:

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18 *Submission 4*, p. 2.

19 *Submission 4*, p. 3.

20 *Committee Hansard*, 10 September 2008, p. 14

21 *Submission 71*, Part 1 of the inquiry, p. 12. See also: Dr John Williams, Wentworth Group, *Committee Hansard*, 10 March 2009, pp 49-50.

> (1) correct our over-allocation during a period of plenty, (2) to be more sustainable under climate cycles we have experienced in the past and (3) to adjust to declining water availability under climate change.[22]

6.24 An analysis commissioned by the Wentworth Group suggests that consumptive use of water across the MDB will need to be cut by between 42 and 53 per cent in order maintain healthy rivers and provide high quality water to produce food.[23]

6.25 Mr Terence Korn, of the Australian Floodplain Association, favours a risk assessment approach, factoring in climate change, to determine which assets in the Basin should be saved:

> You really need to think about 50 years ahead and factor in climate change and make a risk assessment and say that these are the areas that we think we can save. My personal view is that you should have a triage approach to this and say that that area has had it, so you are not going to waste any money on that. It will just have to go by the wayside. Another area we might be able to do something with through the strategic process. And another area is basically untouched.[24]

6.26 Similarly, Professor Mike Young advocates downsizing and reconfiguring the river system. Part of this process would be to create a water sharing system that can adjust automatically to climate change:

> …we need, as part of this, a regime that enables adjustment to occur autonomously and a proper regime. The Murray-Darling Basin cap needs to be replaced, as we agree, with a national water initiative, with a regime that sets aside first the maintenance water and then a system that shares inflows. …You give the environment an equivalent share and you define the entitlement to the environment, in exactly the same way as you do for all users. Then if it gets drier, both sides know what they have to do, and we put in place a structure which does not impede change.[25]

6.27 Professor Young identified one of the problems with current water planning is that it has not coped with managing a changing resource:

> What we tend to do in Australia in water resources is to write documents this high and plans like this, which are so detailed that they do not work. Then, as we have discovered, we go through a long community process and we all agree to follow the plan. You will be told by representatives right around Australia that most of the water sharing plans in the Murray-Darling are currently suspended. They were written to give security in times of

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22 *Submission 71*, Part 1 of the inquiry, p. 1.

23 *Submission 71*, Part 1 of the inquiry, p. 1. See also: Mr Peter Cosier, Wentworth Group, *Committee Hansard*, 10 March 2009, p. 46.

24 *Committee Hansard*, 10 March 2009, p. 43.

25 *Committee Hansard*, 10 September 2008, pp 25-26.

> crisis. When the crisis came, we suspended them all because they did not work.[26]

6.28 In discussing the impacts of climate change on the MDB, the *Sustainable Yields Project* report notes that, under current surface water sharing arrangements in the MDB, consumptive users would generally be protected from the anticipated impacts of climate change. However, the report goes on to state that current surface water sharing arrangements offer riverine environments little protection from the anticipated impacts of climate change.[27]

6.29 The committee notes the evidence of Dr Bill Young of the CSIRO which highlighted that these comments in the *Sustainable Yields Project* report are not about the level of protection for the environment *per se*. Rather, the comments are specifically about the impact on consumptive use verses the environment at times of reduced water availability under climate change.[28]

6.30 The *Sustainable Yields Project* report states that the level of protection that riverine environments have from the impacts of climate change should be considered in the development of future water plans. Specifically, the report draws attention to the requirements of the National Water Initiative that water plans should consider the risk of climate change on the size of the water resource and the implications for sharing.[29]

6.31 The committee also notes the work of Professor Young on treating connected groundwater and surface water resources as a single system as a means of dealing with adverse climate change.[30] The *Sustainable Yields Project* report also makes suggestions about all groundwater use coming under the water entitlement system. However, the committee notes that the *Sustainable Yields Project* report makes these comments in relation to concerns about the impact of groundwater extractions on water availability, and not climate change impacts.[31]

Committee view

6.32 Climate change is only one of a number of factors which impacts water availability in the Basin. For example, factors such as the increased use of water from interception activities such as forestry plantations also need to be considered.

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26 *Committee Hansard*, 10 September 2008, pp 25-26. See also: Dr John Williams, Wentworth Group, *Committee Hansard*, 10 March 2009, pp 47-48.

27 *Sustainable Yields Project Report*, p. 8.

28 *Committee Hansard*, 16 March 2009, p. 9.

29 *Sustainable Yields Project Report*, p. 8.

30 Professor Mike Young and Mr Jim McColl, *Grounding Connectivity: Do rivers have aquifier rights?*, Droplet No. 13, 28 September 2008, tabled 13 March 2009.

31 *Sustainable Yields Project Report*, p. 10.

6.33 The committee notes the policies that the Australian Government has already put in place, such as *Restoring the balance in the Murray Darling Basin* and the *Sustainable Rural Water Use and Infrastructure Program*, to plan for a future of reduced water availability in the Basin. The committee also notes that the government has been waiting for the *Sustainable Yields Project* report.

6.34 The committee acknowledges the work of the CSIRO through the Sustainable Yields Project. However, there is concern that this report has not taken enough of a holistic view in being able to establish sustainable diversion limits.

6.35 The committee also notes the advice of Mr Freeman, Chief Executive of the Murray-Darling Basin Authority, about using the results of the *Sustainable Yields Project* as a basis for planning in the period until 2014, when the Basin Plan will take effect across parts of the Basin. Mr Freeman cites the 'big difference' between the sustainable yields in the CSIRO's work and the determination of a sustainable diversion limit for the purposes of the Basin Plan:

> They are quite different numbers. It is fair to say that you could start revisiting a plan in the context of the climate change scenarios that CSIRO have highlighted through their planning. That is correct. But how much of that water will be available for consumptive use is undetermined until we get the sustainable diversion limits. So I think you can see that the total water resource is reducing in certain scenarios. But a bigger issue is: how much of that will now be made available for consumptive purposes within the sustainable diversion limit?[32]

6.36 The committee recommends that any policies derived as a result of the *Sustainable Yields Project* be carefully examined and reviewed in light of the assessed impact on water availability, with particular consideration given to policy impacts on groundwater extractions.

Recommendation 10

6.37 The committee recommends that any policies derived as a result of the *Sustainable Yields Project* be carefully examined and reviewed in light of the assessed impact on water availability, with particular consideration given to policy impacts on groundwater extractions.

6.38 Further, the committee recommends that a study be conducted on the impact of decreased water availability, as a result of government policy, on food production areas along the MDB. The study should take into account other studies and results completed in this area.

Recommendation 11

6.39 The committee recommends that a study be conducted on the impact of decreased water availability, as a result of government policy, on food production

32 *Committee Hansard*, 13 March 2009, p. 53.

areas along the MDB. The study should take into account other studies and results completed in this area.