

# ENVIRONMENT, NATURAL RESOURCES AND REGIONAL DEVELOPMENT COMMITTEE

## Inquiry into the management, governance and use of environmental water

Melbourne — 5 December 2017

### Members

Mr Josh Bull — Chair

Mr Simon Ramsay — Deputy Chair

Ms Bronwyn Halfpenny

Mr Luke O’Sullivan

Mr Tim Richardson

Mr Richard Riordan

Mr Daniel Young

### Witness

Dr Darren Baldwin (*via videoconference*).

**The DEPUTY CHAIR** — Welcome to the Environment, Natural Resources and Regional Development Committee's public hearing in relation to the inquiry into the management, governance and use of environmental water. The evidence is being recorded. The hearings are being filmed and broadcast live via the Parliament's website. All evidence taken today is protected by parliamentary privilege, therefore you are protected for what you say here today, but if you go outside and repeat the same things, those comments may not be protected by this privilege. We welcome you and thank you for making your time available to present to this inquiry today. Today's evidence is being recorded. You will be provided with proof versions of the transcript at the earliest opportunity. Transcripts will ultimately be made public and posted on the committee's website. We do invite you to make a short 5-minute presentation, Dr Baldwin, and then the committee will raise some questions from that presentation.

**Dr BALDWIN** — Thank you very much. First of all, I was previously employed by the CSIRO, based at the Murray-Darling Freshwater Research Centre. I now run my own consulting business, and I am a visiting adjunct professor at Charles Sturt University. I have been working in the area of water quality and ecosystem function in the Murray-Darling Basin since 1991. I have specifically been working on issues related to blackwater since 1997, and I have published over 30 scientific papers and other scientific reports on the topic. By way of disclosure, in both my past and current roles I have received funding from state government agencies, commonwealth government agencies, the Murray-Darling Basin Authority and also the Commonwealth Environmental Water Holder.

My evidence today is primarily around the first term of reference for the committee, although it does touch on the inquiry's third term of reference as well — the barriers for the use of environmental water. This can sound a bit difficult for some, but floods are a natural part of the way our lowland rivers function. By taking those floods out of the system we have caused a number of issues, one of which relates to blackwater. When the flood plain floods, it is a source of food to basically fuel the river. So dissolved organic carbon, which comes off the flood plain, is one of the two major sources of energy for the river system. The other one is algae. That carbon is taken up by microorganisms, which in turn are eaten by bigger organisms, which in turn ultimately make their way up to become food for fish.

But we have fundamentally changed the way our rivers have run, so it is not surprising that we do start seeing things like hypoxic blackwater. I differentiate between normal blackwater and hypoxic blackwater. 'Hypoxic' just means low oxygen. As I said before, the blackwater in itself is an important part of the way these ecosystems function. Hypoxia is not. Although, that being said, hypoxic blackwater has been recorded back from the 1860s. The main issue is we have taken away floods from our system. So prior to river regulation the flow on the Murray River downstream of the Darling was about 17 000 gigalitres a year. Now it is just above 5000 gigalitres a year, so essentially we have taken 12 000 billion litres of water out of the system.

Normally most of our flood plains would have flooded every year. Even during the millennium drought, modelling would have suggested that. For example, Perricoota, a forest in NSW on the Murray River, would have flooded at least once in two years, so large overbank floods were a natural part of the system. If you take those out, the first thing that happens is carbon is allowed to build up and build up and build up on the flood plain, and then when we get a flood, we have too much carbon coming into the system. What happens is the bacteria [inaudible] as they consume the carbon, they also consume oxygen. Too much carbon without oxygen [inaudible] can start to cause stress for fish and so on.

The other thing we have managed to do is change the time when floods happen. So in rivers like the Murray River and the Goulburn River we would naturally have had floods occurring with the winter rains and the snowmelt, so our main flood peaks would have been in late winter and early spring. Now we store that water within reservoirs, and high flows now in our river systems occur during summertime. Then if we get unusually wet summers, as we did in 2010 and 2016, we get hypoxia, because the water is much warmer. The reason the warmer temperatures lead to hypoxia is that the microbial respiration doubles — the rate it is taken up doubles — approximately for every 10-degree rise in temperature. Also the number of bacteria increase. As well as that, the rate at which that carbon can get leached out of the material increases. So by taking our floods out of the system we have built up a lot of carbon in the system, which is then periodically washed in, and it is periodically washed in in the warmer parts of the year. It is those times of the year when you are most likely to get hypoxia.

The third point I would like to make is around water managers and the management of environmental water. In the past there have been blackwater events, hypoxic blackwater events, caused by river regulation, but that was, like 15 to 20 years ago. River regulators and river managers now have a very good understanding of hypoxia and hypoxic blackwater. We have developed tools to allow for prediction of when hypoxic blackwater will occur. A good case in point was the 2015 environmental flooding of the Gunbower forest, which I believe the committee has been to. That was using the new infrastructure that was put onto the flood plain into the forest. We did a lot of work with North Central CMA staff modelling the risk of hypoxia occurring to try to optimise the environmental flow, and it was quite successful. There were successful outcomes for the environment, and the dissolved oxygen in the receding water did fall below 4 milligrams per litre. So that is basically all I wanted to say in my allotted 5 minutes.

**The DEPUTY CHAIR** — Thank you. I might just kick off with the first question, Dr Baldwin. I am interested to know what your assessment is of the current collaboration and communication that occurs between the different water authorities and the public in relation to environmental water use. We have heard from a number of witnesses this morning with different views about the different sectors with different interests in relation to irrigation use, urban use and environmental use. Can you just sort of give us a rough assessment of how you think that communication and collaboration is working between the different agencies and different interest groups?

**Dr BALDWIN** — Yes. I once had it described to me that water management in Australia is a wicked problem in that there is no simple solution. There are legitimate competing interests for water — consumptive use, environmental use and aesthetic use as well. I do not believe that the discussion has been robust enough to be able to capture all of those viewpoints, and I think part of that is because there is a misunderstanding in some quarters about the role of environmental flows. One of the issues we have with irrigation, for example, is that it is very much focused on a very specific site, and it does not necessarily look towards what the broader implications of irrigation are.

Similarly I do not think the case for environmental flows has been really well articulated by government. Also my personal view or professional view is that the focus on iconic species, like fish, birds and vegetation, actually is a disservice to environmental flows, because it does not address some of the fundamental processes occurring in the system. That is one of the reasons why as part of my submission I sent through a paper basically prosecuting the case for getting floods across the flood plains to create carbon for the environment.

I am not sure if I have fully answered your question, but I think the bottom line is that there needs to be a lot more communication. Certainly I have been involved with the New South Wales government to speak in public fora specifically about the relationship between flooding and fish production, for example, to try to give people an idea of the importance — as most fisherfolk know — of floods and what it means to the systems. We are never going to go back to pre-European or pre-water development, so I think we have to try to find some sort of a common ground, but I think environmental flows have a real part to play in that whole environmental context.

**Ms HALFPENNY** — I apologise, I was a little bit late, so asking a question you have already answered I suppose is my concern. Just in terms of research, one of the suggestions or proposals that has been put to this committee is that there ought to be real-time monitoring of rivers and waterways. Do you think that is necessary, I guess, if there is modelling that has already been developed? Do you think that is an important part of this understanding?

**Dr BALDWIN** — Look, I think it is critical. I have been doing some work with the Goulburn Broken CMA trying to understand historical occurrences of hypoxic blackwater in their catchment and particularly the Goulburn River. The real-time dissolved oxygen programs, for example, they have got in have been invaluable. A lot of the events in their catchment are quite flashy. We may be actually having an event there now following the rains in the Strathbogies, but they are certainly in a position to be able to monitor and react to it. So what I was doing with them was to try to give them some heads up about what are the likely triggers of blackwater in their system, and it turns out one of the main ones is intense rainfalls in the Strathbogies flooding Castle Creek and Seven Creeks.

**Ms HALFPENNY** — So do you think it is so critically important that some of the current allocation of funds ought to be diverted towards it, or is it something that we need additional resources for?

**Dr BALDWIN** — It is a bit of A and a bit of B. A lot of the data is not that useful until you need it, which is right in the middle of a blackwater event. The 2010 event happened over Christmas. The blackwater event in 2016–17 in the Goulburn River started on New Year's Day. So having access to data quickly often gives you some opportunities to work out what your management options are, some of which would be to just alert people that there is going to be a blackwater event. In other cases there is the opportunity to divert flows to try to dilute the water or to create flows to create refuges where fish can congregate, which I think you got a submission from Charles Sturt about. So I think that, yes, it is important. In this day and age with the technology and the price of this material I am surprised that we do not have more of it, but monitoring in particular is always the first that is cut in terms of finances. I also believe that there are not enough resources. Given the amount of money involved in environmental water, the dollar values, I am surprised that there is not more monitoring than there is.

**Mr RIORDAN** — I have asked my question of a couple of other presenters, and I guess it is along the line of the monitoring. In light of the fact that everyone accepts we cannot have things back the way they were before we had our irrigation systems, that people identify the need for the carbon in the system and that when it comes all at once there is a problem, there does not seem to be an ongoing process to monitor hotspots so we get a really good understanding of the build-up that occurs — for example, we may not have had a flood in a particular area for five or six years, and it has got X amount of red gum cover, or cropping or whatever the organic matter is that is building up there — so that we can have real information. Then the contrary to that is, or to work in with that is a process of perhaps burning, coal burning, or some other processes that help to mitigate that carbon load or make it more dissolvable or whatever the case may be. What are your thoughts on how we are progressing doing that?

**Dr BALDWIN** — I will answer in two parts, if I can. On the first one, the monitoring, I know Goulburn Broken CMA do yearly assessments of litter loads in Barmah-Millewa forest. We developed a rapid assessment technique to look at and to rapidly determine litter loads. It is quite time consuming. You can imagine that for something the size of Barmah-Millewa forest you would need more than one sample to get an idea of what the litter loads look like and how variable it is. So we actually have developed rapid assessment methods, and as I said it has been used routinely in Barmah-Millewa forest, not necessarily elsewhere. It is the red gum forests that generate most of the blackwater. Although flooding in farmland will generate it, it mostly comes from leaf litter.

In terms of burning, that has been suggested as an alternative a number of times. It has not been studied, although we have put in applications for funding on a number of occasions to look at it. But what we do know from fires in the upper catchment is that when you do flood burnt land, the water quality issues are quite severe downstream. You still have residual carbon, you tend to get a lot of turbidity because of the loss of vegetation and you also get noxious products associated with burning. So unless there was a clearer indication that it is not detrimental, I would not be recommending burning without some ongoing and real studies of it.

The other thing I should mention is that there have been attempts to burn some of the flood plains, particularly some of the wetlands. They are really hard to start. Under natural conditions prior to European settlement most of the riverine flood plains would have been wet for a large amount of time, so large fires would have been difficult to put through somewhere like Barmah-Millewa forest, for example.

**Mr RICHARDSON** — Thank you, Dr Baldwin, for coming in. I am interested in some of the barriers and issues that we are confronted with in terms of management and flexibility around environmental water. We have had submissions to this inquiry which have highlighted the need for greater flexibility and adaptation in the management of environmental water. I am wondering if you could talk about some of those barriers and how we might be able to create that flexibility in the Victorian jurisdiction.

**Dr BALDWIN** — Okay. Well, the stand-out for me is the constraints on flooding of the Goulburn River. There are about I think 16 000 hectares of forested flood plain downstream of Murchison. It is 12 000 or 16 000; I did the calculation just recently. What that means is — sorry, I will come back one premise. If you live on a flood plain and work on a flood plain, you should expect to be flooded. The reason why people farm flood plains — it is because it is rich, it is close to water and it is flat. It is a sort of truism that the people who most recognise this are the insurance companies.

Again it is a slight aside, but during the 2016 floods we were at the Morning Glory caravan park, and the adjacent Barmah caravan park was underwater; there were caravans with water up to their windows. In the

Morning Glory caravan park all of their unpowered sites are on the flood terrace and all of their permanent sites are up above the highest watermark. It is just the difference of learning to live on a flood plain. I think part of the issue is education. You can compare the way farmers in the southern basin look at floods with those in the northern basin; it is totally different. In the northern basin a flood comes across their land, and they see that they have got a crop — they can put a crop in on top of that — where in the southern basin if any water seems to come across the land, even though it is a flood plain, woe betide.

Getting back to your question, with the Goulburn River the constraints of not allowing flooding there mean that being able to use the small amount of environmental water they have to look at the whole system becomes more difficult because they cannot get the additional water down the Goulburn system without overbanking. I know New South Wales, for example, is trying to create a mosaic of flows — trying to use a minimum amount of environmental water coupled to slightly higher flows to maximise the fish breeding and carbon exchange and so on, but without additional water coming through from the Goulburn River it cannot be successful.

Two points, I suppose; they are interrelated. One, I think there needs to be a frank discussion about flood plains and that flood plains flood and that people need to adapt to that. That does not mean not living on the flood plain; it just means living appropriately. The other one is for the organisations to work in partnership to try to get water flows so that environmental water itself can actually get out onto the flood plain where it can do the most good. Pumping water into flood plain wetlands, for example, is not the best use of water, but in many ways that is the only way those wetlands will get water because of the amount of environmental flows — you cannot generate a flood with the amount of environmental water we have. You can see they will never get the flooding.

**The DEPUTY CHAIR** — Thank you, Dr Baldwin. Unfortunately we are out of time, but we do appreciate the time you have given us this afternoon. Thank you for your testimony and submission.

**Dr BALDWIN** — Thank you for giving me the opportunity to speak.

**Witness withdrew.**