SENATE ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE

INQUIRY INTO THE WATER AMENDMENT (PURCHASE LIMIT REPEAL) BILL 2019

PUBLIC HEARING

12 MARCH 2019

MURRAY DARLING BASIN AUTHORITY - QUESTIONS TAKEN ON NOTICE

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Senator URQUHART: How do you respond to the concerns from the McBride family of Tolarno Station that there is strong evidence that the project would have a significant environmental impact?
Mr Mues: The project is still being fully defined by the New South Wales government. So I think it is probably premature at this stage. However, I think for the McBride family to say, 'We have an expectation that our concerns will be addressed,' is entirely fair and reasonable.
Senator URQUHART: Do you know how much design work is complete?
Mr Mues: I'm not intimate with the work of the New South Wales government, no.
Senator URQUHART: You don't know how much more is needed, then?
Mr Mues: Suffice to say that 'considerable' would be my expectation.
Senator URQUHART: How many are into construction?
Mr Mues: I do know that, like I said, the Living Murray project's construction is complete and they're operating. There are some other projects going forward, including, I think, the south-east flows. There are some other projects listed in our reconciliation report, which I'm trying to find the reference to as I go. It would be in the body of the report; I'm scanning the executive summary. There are some other projects. I know that a couple in South Australia which I can't remember by name have begun—are more progressed.
Senator URQUHART: If you could provide some more detail on notice in relation to that, that would be good.
Mr Mues: Yes, I will. I'll point out the relevant section of the report.

Answer:

State governments are responsible for the implementation of all SDL adjustment projects, including community consultation and communication of progress. The MDBA's current understanding of The Living Murray project is that construction is complete.

The remaining projects are in various stages of development. Further consultation with the community will be needed as states continue to refine and implement the projects, which may include cultural heritage studies and environmental approvals.

The MDBA's first annual report on the progress of the SDL adjustment programs did not go into project specifics at this stage, as the program at the broader level has to date focussed on settling governance and funding arrangements. Future reporting will look into individual project progress in more detail. General project detail can be found https://www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits/sdl-adjustment-proposals-state-projects, but as noted, states are responsible for providing details on project progress.

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Senator PATRICK: Can I ask you to take on notice to provide the committee with any documentation you've got in relation to a critique of Professor Wheeler's work in the literature study.
Mr Mues: We certainly can. I know we are preparing a draft report which draws together all of that socioeconomic work, and that draft does actually include a—
Senator PATRICK: Even if you just pull that out and provide that to the committee.
Mr Mues: summary of how we've responded to each of the recommendations. I'm happy to provide that on notice.

Answer:

The independent reviewer for the social and economic assessment of the effects of water recovery raised a number of matters for the consideration of the MDBA in undertaking that work, including those of Professor Wheeler. These matters have been addressed where it was been possible to do so or were not addressed where they were not relevant to assessing the effects of the Basin Plan water recovery. Each of these matters and the actions of the MDBA are provided in the following table.

Independent review findings and recommendations	**MDBA response**
How is the epistemic and stochastic uncertainty being addressed in the modelling and the outcomes communicated?	Matter addressed as recommended, with clear articulation of the assumptions employed, recognition of data limitations and use of multiple data sources to draw conclusions.
Provision of evidence for not including worker mobility in the community modelling	Matter considered and its inclusion found to be beyond the modelling capability. However, worker mobility was taken into account when interpreting the modelling outputs. The MDBA examined the extent of worker mobility between the southern Basin shires across the period 2001 to 2016. Key finding was the consistently large proportion of people (over 90 per cent of residents) who live and work in the same or adjacent shires with little change in the observed patterns of worker mobility across time.
Need to take account of farm and community adaptability	Matter addressed and included in the modelling where possible or applied to the interpretation of the modelling data. For the farm-level modelling, adaptability was considered through the changing crop mixes grown, noting the benefits of the combined on and off-farm irrigation infrastructure investment funding by farmers and from the water recovery programs was starting to be realised in the production data towards the end of the time period analysed. Given data limitations, interpretation of the modelling outputs required the use of multiple social and economic parameters which provide insights into community adaptive capacity.

Indicate the extent to which private benefits from infrastructure investment translate into community employment	Matter taken into account where it was possible to do so. Irrigators were found to be realising the potential benefits of on-farm and off-farm irrigation infrastructure investment, noting a considerable amount of that investment occurred after 2016 with the benefits to be fully realised in the future.
Address the issue of whether investment in health and education has greater effects on employment than irrigation infrastructure investment	Not relevant to modelling the effects of the Basin Plan water recovery. Further analysis would be required to distinguish the effects of different forms of government investment on employment, given the considerable increases, and in many communities, decreases to government services employment between 2001 and 2016.
Explain why the economic modelling for irrigated production isn't based on revenue	The MDBA examined the potential for using commodity prices, revenue and cost estimates in the early stages of the community modelling. It was not possible to build time series data sets of commodity prices which the MDBA would feel confident in using, given revenue (and profits) would need to be considered over multiple years to be useful as an indicator of changes in economic condition. Commodity prices, revenue and costs would be more appropriate for benefit-cost analysis where commodity prices (as well as cost, revenue and profits) could be fixed at a particular level.
Explain why long-term influences of irrigated production (commodity prices, terms of trade, technology) have not been taken into account	Matter partly addressed in the community modelling by explicitly capturing technology gains across time. Weak correlations between production and commodity prices (where they were available) limited the potential for improving the modelling capability by including those parameters.
Explain how the issue of sample selection bias has been addressed	Matter considered during the model development phase. The social and economic analysis and modelling has been specifically designed to understand the effects of water recovery on irrigation communities. This is assisted by considering the nature and scale of changes in non-irrigation communities and by including communities which have had very little water recovery through to those with considerable recovery. It should also be noted the basis of the community modelling is to consider the role of irrigated production in each community (based around the mix of crops grown and scale of irrigated production) and the subsequent effects of the scale, timing and methods of water recovery at an individual community level. Interpretation of the community modelling results was informed by the observed changes in communities with almost no irrigated production and no water recovery.

Explain how the paradox of irrigation efficiency and the rebound effect has been addressed (views raised in the literature review in relation to the Jevons effect associated with technology improvements and natural resource use)	Matter considered as not relevant to the recovery of water in the Murray Darling Basin. There is a cap on water diverted for consumptive use in the Basin which limits the potential for an increase in water use above the prescribed levels.
Statistical tests should be undertaken for endogeneity, collinearity, heteroskedacity and serial correlation or other relevant statistical tests for each of the models developed	Matter considered and addressed in the community modelling work. The relevant tests have been undertaken and are provided in the reports available on the MDBA website or will be released with the MDBA data and models.
Given the inclusion of milk production the year before in the dairy model, full regression analysis and relevant test statistics should be provided	Matter addressed during model development and as a consideration for further model refinement as indicated in MDBA report on modelling of milk production.
Provide reasons why the MDBA feels the dairy model is capable of explaining much of the causes of change to milk production	This has been addressed in the dairy production modelling report. Essentially, the models of milk production were developed for the period prior to Basin Plan water recovery. Those models were able to provide a reasonable estimate of milk production in the years after the water recovery (from 2008/09 to 2015/16).
Can additional effort be placed on gathering milk price data so this variable can be included in the dairy production model?	The MDBA placed considerable effort into attempting to gather milk price data using buyer forecasts in the previous year and milk prices paid in the year of production. Insufficient information was available to build a time series data set for this parameter which showed a significant correlation between prices and production.
Can the MDBA emphasise the level of investment made in community consultation to inform the social and economic modelling and evaluation?	Across 2010 to 2018, the MDBA consulted with farmers, industry groups, irrigation companies, local governments, community groups and others to build an understanding of the changing social and economic conditions for southern Basin communities. This knowledge was critical to developing the community models and interpreting the modelling results.

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Senator PATRICK: Can you provide the committee with the notes that were taken, not the report but the notes.
Mr Mues: I'll provide the meeting outcome notes on notice.
Senator PATRICK: Can you also please provide the committee with details of who the 15—
Mr Mues: The technical experts?
Senator PATRICK: experts were, please. I'd appreciate it.
Mr Mues: We can do that—no problems.

Answer:
Please refer to **Attachment A**.

Workshop on Streamflow Effects of Groundwater Sustainable Diversion Limits and Water Use Efficiency Projects in the Murray-Darling Basin

Summary of Outcomes

Report Prepared by Prof. Michael Stewardson
on behalf of the Advisory Committee on Social, Economic and Environmental Science for the Murray Darling Basin Authority

Workshop Date: 17 September 2018
Location: Park Royal Hotel, Melbourne Airport

Introduction

Context

The key feature of the Basin Plan for the Murray-Darling is the establishment of sustainable diversion limits (SDLs) for the basin's groundwater and surface water resources. The Basin Plan requires application of these SDLs across the basin from mid-2019. The purpose of the SDLs is to limit future growth in water use in the basin beyond sustainable levels, and to redress historic problems of overallocation and resulting environmental damage.

It is primarily the surface water resource that has been overallocated through past water resource developments. Since 2009, water has been recovered from consumptive users, to meet the Basin Plan surface water SDLs. This has required governments to invest in water entitlement purchases (reducing the size of the consumptive pool) and the roll out of water efficient infrastructure for irrigation on farms and water delivery across the basin. The scale of the overall hydrologic adjustment is large, requiring a reduction of 2075 Gl in mean annual take of surface water, which is about 20% of mean annual consumptive watercourse diversions that occurred prior to the Basin Plan.

Surface water recovered through water purchases and water use efficiency projects to meet the Basin Plan SDLs is protected as an environmental water entitlement. The Commonwealth Environmental Water Office (CEWO) has been established to support delivery of environmental water allocated against this entitlement. Much of this environmental water is delivered each year from water supply reservoirs and can be "actively" managed to achieve specific environmental outcomes such as fish- and bird-breeding events and the restoration of floodplain vegetation. Through active environmental water management, the CEWO has been able to target delivery of environmental water to achieve important environmental watering actions including maintaining baseflows, creating or augmenting flow freshes and contributing to out-of-channel inundation through a variety of water delivery mechanisms.

Although a cap had been placed on surface water diversions since 1995, the Basin Plan is the first time limits have been placed on groundwater extraction across the basin. For some time, it has been understood that surface water and groundwater

resources are linked to varying extents across the basin and that the two resources need to be managed in an integrated manner. In some regions, current groundwater use is less than the groundwater SDL so future increases in groundwater extraction are possible under the Basin Plan.

Concerns have been raised by Profs Grafton and Williams (Australian National University) that streamflows are declining as a result of this water recovery program. They have asserted that streamflow reductions are occurring (or will occur) as a result of: (i) reduced return flows to rivers because of improved water use efficiency; (ii) reduced groundwater discharge as a result of increased groundwater withdrawals; and (iii) a portion of water purchases for the environment that previously contributed to streamflows (i.e. was not consumed through irrigation use). They are concerned that these reductions in streamflows are so large that they will significantly diminish the benefits of water being recovered for environmental purposes.

Previous analysis by the MDBA, conducted some years ago, concluded that the risks of this were low. However, in light of the seriousness of the new claims, the MDBA commissioned Prof QJ Wang (The University of Melbourne), Dr. Glen Walker (Grounded in Water) and Dr. Avril Horne (The University of Melbourne) to undertake an updated review of these effects. The review team commenced their study in July 2018 and expect to deliver their final report to the MDBA in October.

The MDBA's Advisory Committee on Social, Economic and Environmental Science (ACSEES) has been established to provide scientific advice on social, economic and environmental matters underpinning the implementation of an adaptive Basin Plan and water management. Given this brief, ACSEES was asked to host a workshop to examine the preliminary findings of the review team and provide a critique of their methods prior to the finalisation of their report. To ensure that a rigorous review of their work to date could be conducted, ACSEES invited a number of relevant specialists to participate in the workshop.

Scope of Review

The initial scope of this review is outlined in Attachment 1, highlighting that the study focuses on effects of water use efficiency projects since 2009 when water recovery commenced to meet the Basin Plan SDLs. Also, the review considered two parts of the total increase in groundwater use that is allowed under the Basin Plan. The first part is an increase in groundwater use that was possible under the previous groundwater licensing arrangements operated by the State Governments. The second part is the additional increases in groundwater use that are allowed by the Basin Plan's groundwater SDLs.

Workshop Objectives

The objectives of the workshop hosted by ACSEES were to:

1. Provide a technical review of the preliminary methods, input data, analysis and interpretation of results by the project team;
2. Provide an assessment of risks related to effects on streamflow; and
3. Share available information and understanding of streamflow effects between the participating technical specialists and government agency staff.

The workshop also included a discussion of knowledge gaps and future research needs but this is not reported here.

At the end of each of the two main workshop sessions, each workshop participant was invited to comment on the preliminary review including the methods and data used in the review, the presentation and interpretation of preliminary results, and any other aspects they wished to comment on. In the final session, the chair facilitated a discussion to refine these comments in summaries to be reported as workshop outcomes (below). Technical specialists were given an opportunity to comment on this workshop report before it was finalised. The workshop agenda and participants are included in attachment 2 and 3.

Summary of Workshop Outcomes

Overview Comments

- There was a consensus that the review team is applying a rigorous analysis that makes use of best available data concerning water use efficiency projects, groundwater use trends and their effect on streamflows.
- Based on the project's preliminary results, the effects of increased groundwater use and water use efficiency projects on streamflows do not undermine the fundamental benefits of the Basin Plan SDLs and environmental water recovery program.
- There is convincing evidence that more water has been recovered than has been lost to streamflows.
- The preliminary results indicate possible future streamflow reductions of:
    - 250 Gl/year (upper limit) after a 40-year period of growth in groundwater use with most of this reduction contributed by increases allowed under extraction limits in place prior to the Basin Plan.
    - 150 Gl/year in the next 20 years as a result of water use efficiency projects.
- This suggests total reductions in streamflows of 400 Gl/year over the long-term (20-40 years) assuming the two effects are additive (yet to be confirmed). This is in the context of establishing an environmental water entitlement by 2019 with an average yield of 2075 Gl/year.

Comments on Review of Streamflow Effect of Possible Increased Groundwater Use Under the Revised SDL Regime

Workshop participants views on the overall approach

- The methodology used for the analysis is sound
- We note that the review team have adopted higher connectivity factors (CFs) between surface water and groundwater systems than used in previous assessments. This means that changes in groundwater use are likely to be more consequential for streamflow than hitherto assumed.
- Workshop participants endorsed the use of higher CF values. There was agreement that the adoption of a 40-year time-horizon was logical, given the ability to make major adjustments to policy in that time window, but that a longer-term view should also be considered.

There were some particular suggestions concerning the spatial scale of the study

- It was agreed that it would be desirable to represent smaller-scale variations in connectivity factors for particular aquifers, noting that connectivity can change significantly with distance from streams.
- The interpretation of effects on streamflows need to consider that small volumetric effects on streamflow may be have an important local effect if these reductions occur in small headwater streams.
- It was agreed that it would be desirable to present results at a valley scale as well as at the scale of the whole basin.

Other comments

- There needs to be agreement on definitions and consistency in the terminology describing past and future water resource developments as they relate to the Basin Plan and SDL implementation.
- The review's analysis was performed at a basin-scale to evaluate a basin-wide policy. The review team should acknowledge that there is on-going work and need for more detailed local scale analysis for ongoing local-scale management of the groundwater resource using multiple lines of evidence.
- As identified by the review team, there is uncertainty in trends and the spatial distribution of future growth in groundwater use. However, it needs to be recognized that local groundwater management arrangements are in place to address any unexpected changes in these aspects of groundwater use.

Comments on Review of Streamflow Effect of Water Use Efficiency Projects

- The analysis used by the review team appears to be robust and is based on a sound conceptualization of the many components of the farm and district-scale water balance.
- The greater risks are associated with reduced return flows from groundwater rather than reduced surface water return flows.
- There are some uncertainties acknowledged by the review team and in particular:
  - The various parameters used to calculate water balance components targeted by water use efficiency projects (noting some are more important than others)
  - Information concerning project details (e.g. the review team has not yet been provided with information on projects in South Australia)
  - The results presented at the workshop are preliminary, and further refinement on data inputs is to be completed.
- There is a need for a sensitivity analysis and sanity tests of results against baseflows.
- The selection of parameters used in the analysis need to be justified with explicit reference to available evidence.
- The hydrological effects at the farm and district are complex. For example, effects of water recovery on rainfall-runoff relations. Further investigations of these effects are recommended.

Explanation for Different Estimates of Streamflow Effects

The following comparisons are not an outcome of the workshop but are provided here to assist understanding of differences in results from Grafton and Williams and the current review. We make the point that there is no definitive document that provides the analysis methods and results of Grafton and Williams analysis. We have used the best available information at the time of this report.

Streamflow Effect of Possible Enhanced Groundwater Use Under the Revised SDL Regime

To date, Profs Grafton and Williams have not provided any written details of their analysis of effects of groundwater sustainable diversion limits on streamflows. During meetings with MDBA staff Prof Grafton has indicated an estimate of 1000 Gl/year reduction in streamflows as a result of increased groundwater use and that this was calculated using a connectivity factor of 0.6 applied to a potential increase in groundwater use of approximately 1500 GL. This is in contrast to the preliminary estimate of 250 Gl/year provided in the current review. The different calculation methods and hence results are presented in the table below. We emphasise, that details of the Grafton and Williams calculations and results are currently not available so we base our comparison of results on the information conveyed to us via MDBA staff after they met with Prof Grafton. We respectfully acknowledge that Profs Grafton and Williams may not have conveyed all the details during this meeting or may have updated their analysis since that time.

Aspect of analysis	***Grafton and Williams***	***Updated Assessment***
1. Mean Connectivity Factor	0.6	0.2
2. Consideration of variability in Connectivity Factors across the MDB	This is not documented but CF seems to be assumed to be uniform across MDB based on a verbal account of the calculation method.	Variability in connectivity is considered based on available information from groundwater studies.
3. Method of estimating increased groundwater use	Not recorded	Estimates are based on potential increases over 40 years assuming an upper limit estimate on growth in groundwater use of 4% per year and considering two components: growth in groundwater use that was possible under the previous groundwater licensing arrangements operated by the State Governments; and additional increases in

		groundwater use that are allowed by the basin Plan's groundwater SDLs
4. Estimated increase in groundwater use	1500 Gl/year	985 Gl/year

Streamflow Effect of Water Use Efficiency Projects

Profs Grafton and Williams (in their submission to the South Australia Royal Commission on The Murray Darling Basin Plan) report net water returned to the environment as a result of water use efficiency programs of between 0 and minus 140 Gl/year. In this analysis, they report that these projects have resulted in a 700 Gl/year recovery of environmental water. This means that the Grafton and Williams estimate of steamflow reductions as a result of these water use efficiency is between 700 Gl/year and 840 Gl/year projects. This is significantly higher than the preliminary estimate of a 150 Gl/year streamflow reduction presented by the review team at this workshop. The different calculation methods and hence the reason for differences in results are summarised in the table below.

Aspect of analysis	***Grafton and Williams***	***Updated Assessment***
1. Detail of physical water accounting method	Coarse theoretical water account	Detailed physical water account differently configured for the different types of projects and irrigation districts
2. Consideration of irrigation decommissioning / land retirement	Not considered	Included
3. Consideration of water metering savings	Not considered	Included
4. Consideration of high levels of surface drainage diversion for irrigation which was actively encouraged for water quality management and taken up by irrigators prior to 2009	Not considered	Included
5. Consideration of NSW legislation preventing farm irrigation runoff	Not considered	Considered
6. Consideration of effects from seepage/recharge reduction	Not considered	Included using connectivity factors

7. Level of site-specific project detail considered	Uses an aggregated analysis. No project-level detail is considered.	Analysis is done project by project, using best available input data
8. Accounting for credited return flow (net use diversion) of some drains (especially in NSW)	Not considered	Flagged for interpretation of results, but not taken out of the modelled results.

Streamflow Effects of Environmental Water Purchases

To date, Profs Grafton and Williams have not provided any written details of their analysis of effects of environmental water purchases on streamflows. During meetings with MDBA staff Prof Grafton has indicated that they estimate a total effect of purchase equal to 240 Gl/year in reduced streamflows. This is calculated assuming 20% of total water purchased previously contributed to streamflow either because a portion of these entitlements was not previously fully utilised by the original entitlement holder, or possibly because the use of this water included some return flow component. It is unclear if the Grafton and Williams analysis includes both components or just the former and how the 20% factor was derived.

This aspect was not included in the original scope of the updated review but the review team is planning to provide an updated analysis and estimate of these effects in their final report.

Attachment 1: Statement on Scope of Review Project

Prof QJ Wang, Dr. Glen Walker and Dr. Avril Horne have been contracted to undertake a review of the Effect of Groundwater Sustainable Diversion Limits and Water Use Efficiency Projects on Streamflows. The scope of this project is defined by specific questions as follows:

1. Is it likely that Basin Plan increases in groundwater SDL have material effects on returns to river flows?
    a. How are Groundwater return flows accounted for in the surface water SDL?

2. Is it likely that irrigation efficiency projects, carried out to achieve Basin Plan recovery targets, have had a material effect on river flows?
    a. Through reduction of surface returns
    b. Through reduction of groundwater returns flows

3. What's the overall effect, in terms of timing and volumes, of the irrigation efficiency projects, with consideration of:
    a. accounting of 'net use' etc
    b. river connectivity with surface water / groundwater return flows
    c. post 2009 water trade
    d. buyback

For the sake of clarity, questions that are outside the scope of this investigation are:

1. What is the potential reduction in return flows pre-Basin Plan? and
2. What are the appropriate 'utilisation' factors to apply to the water recovery for accounting purposes?
3. What is the total volume of water recovery required to achieve Basin Plan objectives; and whether changes in return flows effect on this volume

Attachment 2: Workshop Agenda

Workshop on return flows.

Date – Monday, 17th September

Time -10-4:00 pm

Venue – Parkroyal Melbourne Airport (near airport) – Bendigo/Wangaratta Room

WiFi details

- Name:Meet@Parkroyal
- Password:PROYAL2018

Workshop purpose

1) Review approach for assessing impact of groundwater extractions
2) Review approach adopted for assessing the risk to return flows
3) Identify future priority needs to mitigate risks?

Agenda

Time	Item
9.30 am	Arrival (tea/coffee)
10:00 am	Welcome and workshop introduction: Mike Stewardson, ACSEES and workshop facilitator
10.20 am	Overview of independent review QJ Wang
10:30 am	Impact of groundwater extractions on river flow volume Glen Walker
12:00 pm	Lunch
12:45 pm	Impact of irrigation efficiency projects on return flows to rivers QJ Wang
2:15 pm	Implications for Basin Plan implementation and outcomes, and further work Colin Mues
3:00	Afternoon tea
3:30	Wrap up and next steps Mike Stewardson
4:00	Workshop close

Attachments 3: Workshop Participants

Workshop Participants

1. Michael Stewardson (ACSEES and The University of Melbourne – Chair
2. Peter Alexander (GHD Pty Ltd)
3. Simon Baker (Vic. Department of Environment, Land, Water and Planning)
4. Matt Bethune (Murray-Darling Basin Authority)
5. Francis Chiew (CSIRO)
6. Evan Christen (ex csiro/ACIAR)
7. Barry Croke (Australian National University)
8. Richard Evans (Jacobs)
9. James Fuller (University of Adelaide) [Observer only]
10. Sue Hamliton (NSW, Department of Primary Industries)
11. Greg Holland (Jacobs)
12. Avril Horne (University of Melbourne)
13. Kristanne Mahony (Murray-Darling Basin Authority)
14. Adrian McKay (Qld. Department of Natural Resources, Mines and Energy) [Attended by phone]
15. Richard McLoughlin (Department of Agriculture and Water Resources)
16. Wayne Meyer (University of Adelaide)
17. Colin Mues (Murray-Darling Basin Authority)
18. Pradeep Sharma (Murray-Darling Basin Authority)
19. Mike Stewardson (University of Melbourne)
20. Carla Tadich (Murray-Darling Basin Authority)
21. Rob Vertessy (ACSEES)
22. Glen Walker (University of Melbourne)
23. QJ Wang (University of Melbourne)
24. Andrew Wheeler (Department of Agriculture and Water Resources)

Other Invited Participants (who declined to attend)

1. Quentin Grafton (Australian National University)
2. John Williams (Australian National University)
3. Sarah Wheeler (University of Adelaide)
4. Steve Barnett (Govt of SA)
5. John Hornbuckle (Deakin University)