



Healthy Rivers Ambassadors

*Promoting a healthy, working
Murray Darling Basin for the future*

BRIEFING BY GOYDER INSTITUTE SCIENTISTS

16 December 2016

In attendance:

Goyder Institute: Michele Akeroyd,

The University of Adelaide: Todd Wallace

SARDI: Jim Cox, Qifeng Yi,

HRAs: Rosa Hillam, Anne Jensen (apology Emily Jenke)

CCSA: Craig Wilkins

Invited: Matt Turner (NFSA)

Tone of meeting

- casual presentation & discussion, some overview powerpoints (see *copies circulated to HRA by Julia Winefield*), punctuated by lots of questions
- SARDI group very willing to provide technical information on any question
- willing to check briefing notes for HRAs post-presentation
- willing to help craft statements for HRAs to use

In a Nutshell

- 2750 GL/y environmental water meets few targets in the Plan, at low levels of certainty; ie this compromise volume does not deliver most ecological outcomes in the Plan
- modelling for Plan used 2800 GL/ for analysis, so slightly over-estimates outcomes
- evaluation of delivery of environmental outcomes for 2750 GL/y assumes that all constraints have been met/removed/relaxed (so over-estimates extent of delivery)
- 3200 GL/y **with relaxed constraints** meets all targets except one at high flows (17 out of 18)
- 3200 GL/y **with** constraints meets 13 out of 18 targets
- 2800 GL/y **with** constraints meets 11 out of 18 targets
- additional 450 GL/y meets an additional 7 targets (ie 2750 GL/y meets 10 targets)
- 3200 GL/y benefits the whole Basin, not just the downstream end

Overview

Jim Cox gave a brief overview of key steps in the development of Basin Plan and inputs from Goyder Institute (GI) (see *powerpoints*):

- GI provided review of Guide (2009) and supporting studies to SA government for their response
- Definition of sustainable diversion limits (SDLs) is 'volume of extraction that will not have negative impacts on natural environments and functions of rivers, waterways, groundwater and wetlands of MDB = very useful quote against claims of negative social & economic impacts
- Post-Guide, GI provided science for environmental water requirements (EWRs), science input for SDLs, peer review and expert panels, identification of knowledge gaps
- There are 28 technical reports supporting the Plan
- CSIRO conducted a social & economic impact study (Jeff Connor)
- 2 key reports: CSIRO (2011) – review of Guide & whether SDLs meet EWRs; LaMontagne *et al.* (2012) – review of Plan (*detailed references in powerpoints*)

Key Points

- ideal environmental requirement of 7,600 GL (as shown in Plan – see *diagram below*); source of 7,600 GL figure either Keith Walker or Wentworth group (*AJ checking with Barry Hart*)
- options considered in the Guide were 3000, 3500 and 4000 GL, ie a compromise of about half of ideal environmental needs
- impact of each of these scenarios was modelled at 173, 203 and 232 GL/y reduction in available diversions
- 2011 review assessed whether SDLs meet EWRs and water quality targets
- Todd Wallace emphasised that large flows to meet environmental requirements can only be delivered by piggy-backing on high unregulated flows, need a minimum natural flow of >45,000 ML/d for effective overbank flows to inundate large areas of floodplain
- for example, if 60,000 ML/d flows for 60 days is needed to maintain ecosystem health, this equates to 3600 GL, but the system does not have capacity during regulated low flows to store and deliver such a large volume for environmental flows (only if piggy-backed on high flows)
- current assessments of environmental needs are based on historic natural flow regimes and recommend flows needed to maintain base condition of ecosystem in healthy state
- however, ecosystems not currently in good condition, many in very poor condition due to accumulated salt and reduced watering, so will need extra water to assist recovery over several years to return to healthy condition -- provision has not been made for water needed for recovery back to healthy condition
- ecosystems under ongoing stress, from reduced freshwater sources from elimination of small floods, rising saline groundwater and increased movement of salt through floodplains
- under Basin Plan, SA no longer has a minimum entitlement of 1850 GL; instead get normal progression from 3,000 ML/d winter flows to 7,200 GL/d summer flows (adds up to same volume)

Goyder findings on Guide

- potentially increased flows to Lower Murray
- potential to meet EWRs for Chowilla and Coorong, Lower Lakes & Murray Mouth (CLLMM) at 4000 GL/y only
- EWRs only met as annual volume by 4000 GL/y for Chowilla, but necessary timing, frequency and duration is unlikely under any scenario at Chowilla
- outer community of black box at higher elevations on floodplain is at risk under all scenarios
- bottom line: even 4000 GL/y is not enough, especially as ecosystems are in degraded state

Goyder Findings on Plan & Supporting Documents

- GI coordinated Expert Panel assessment, review of MDBA reports for SA government
- Plan provides 2750 GL/y return (and assumes 'return to river' operation so same volume is re-used, ie total is less)
- models used 2800 GL/y to assess scenarios (only scenario which was tested)
- 2800 GL/y vs 'do nothing' evaluated
- Chowilla, CLLMM and main channel SA icon sites evaluated, main channel including gorge and wide valley above Overland Corner
- found limitations in delivering environmental outcomes to the Lower Lakes at low flows
- floodplain salinity and climate change are not factored into modelling
- no tools to evaluate salinity impacts as a result of changes in flow regime and accumulation of salt on floodplains
- MDBA is assuming climate change will be picked up in reviews, not included in modelling
- Quifeng Yi noted need to ensure benefits to fish habitats are delivered, appropriate flows for flow-cue spawners and flows to ensure growth
- need to fine-tune barrage operations to benefit fish, need more gates to be electronically operated for rapid response to tides and flows
- need pulse flows, not steady flows to deliver environmental outcomes, need magnitude, frequency, duration to deliver appropriate flow regime
- ecosystem is complex, need to manage expectations about what can be delivered by environmental flows, can't create floods
- more environmental outcomes are delivered by manipulating natural flow events to maximise benefits
- spring pulse preferred timing
- small pulses unlikely to generate significant salt inputs
- large saline spikes occur on recession of large natural floods (like this year)
- need to manage return flows for continued environmental outcomes, coordinate environmental flows through reaches and whole length of rivers
- Commonwealth Environmental Water Holder (CEWO) long term monitoring project to gather evidence of benefits from environmental watering at basin and reach scale

Findings on 2800 GL/y Modelling

- improved connectivity for fish
- good for vegetation, especially red gums & black box <70,000 ML/d, but need increased duration and frequency for recovery from current stressed condition
- reduced benefits at low flows in Lower Lakes, higher salinity
- improved connectivity to Coorong
- improved depth at Murray Mouth

Risks of Proposed 2750 GL/y

- 2800 GL/y only partially meets EWRs
- environmental outcomes not delivered for medium or high flows
- red gum and black box EWRs not met, will lead to contraction of distribution
- saline degradation of floodplain as not flushed frequently enough
- accumulation of salt during dry periods
- extreme conditions will still occur in drought and ecosystems will have declining resilience to withstand the impacts
- Plan has salinity targets, but high salt load in floodplain soils due to changed water regime not included in modelling
- EWR metrics don't take into account changed salt transport and groundwater conditions

Constraints

- Lower Murray Valley and Lower Darling operating rules
- Protection of infrastructure on floodplain (eg Wentworth Caravan Park)
- Protection of crops on floodplain
- Capacity to deliver flows/volumes, eg Barmah Choke (limits delivery capacity but supports Barmah-Millewa Forest ecosystem)
- Need to resolve/remove/reduce constraints to deliver EWRs
- Check what MDBA constraints project seeking to address? (*mentioned by Minister Hunter*)

Current Conditions

- current flood comes 5 years after last flood of similar magnitude, floodplain in improved condition (but need this scale of flooding more frequently to maintain health, 1 in 3-5 y)
- if gap >5-10 y to next flood, floodplain condition will have declined
- need > 45,000 ML/d for over-bank flows onto floodplain
- floodplain needs multiple, short, high frequency events to return to good condition
- could take 25 years to recover from Millenium drought
- then will be resilient enough to withstand drought conditions

'Black Water' event

- 'black water' resulted from flooding of vast areas of floodplain in the mid- and upper Murray which had not been flooded for 20 years, and had accumulated large masses of detritus which washed into the rivers
- decomposition process consumed most oxygen, with readings <2mg/L for many weeks in the upstream catchments and mainstream in SA (normal is ~8mg/L)
- water was re-oxygenated by mid-December, readings in SA 9.2 mg/L on 16 December
- fish kills occurring due to de-oxygenated 'black' water – keep in perspective, 25% kills of Murray cod in 2010-2012, ie 75% survived
- dissolved oxygen loggers were installed in 2014-16 at Locks 6,5,4, data is on WaterConnect website

Chowilla regulator

- regulator can use 40,000 ML/d to simulate 100,000 ML/d
- good for vegetation
- issues for fish passage
- favours carp over native species
- native species need flowing conditions
- regulators don't deliver equivalent environmental outcomes compared to natural floods:
 - ❖ good at increasing soil moisture storage
 - ❖ capacity to mimic environmental cues and conditions limited
 - ❖ don't provide equivalent conditions for dispersal of seed and eggs
 - ❖ natural rate of recession is <2 cm/d, hard to deliver with regulators
 - ❖ in instances where waterbirds start to breed and inundation stops, then may have done harm through wasting physiological resources, but likely to be on a limited scale

Interesting Details of Local Importance

- at Lock 4 difference between 4,000 ML/d winter flows and 7,000 ML/d summer flows is ~0.5 m
- continuation of SIS under threat, seen as meeting salinity targets in mainstream, ignoring beneficial impacts on floodplain
- SIS requires pumping forever, need long-term funding (Pike River project does not have future funding to continue pumping)
- don't need to have all seedlings survive from floods every 2-3 years, would be too many trees!
- Tom Chesson, former head of Australian Irrigators and supporter of increased SDLs, now appointed by Barnaby Joyce as the 'Carpinator'

Issues to lobby on

1 Full 3200 GL/y needed

- Full amount needed to deliver all but one target

2 Funding

- insufficient investment in science to understand complexity or responses
- Very limited funds for monitoring outcomes from Chowilla regulator (~\$68 million to build, limited funds to demonstrate whether it achieves targets)
- No specifically designated funds to operate or monitor the works at Katarapko Island or Pike River, after multi-million \$ construction to manage flow regimes
- No monitoring funds at project scale for delivering CEWO water, although basin-scale funding via LTIM and EWKR programs
- More monitoring funds were available in drought years, should be balanced
- Proposed model to include and quarantine funds for monitoring (eg MDB Fishways project, Darling Anabranh pipeline)
- Funding at 0.05% of capital costs would be adequate, especially considering commercial value of environmental water being delivered

3 Timing of Review of Environmental Water

- Review of achievement of environmental outcomes through return of water is too early to see full results
- After severe effects of Millennium drought, stressed mature trees can take at least 5 years of good conditions (possibly up to 10 years) to recover, before becoming productive again

Questions back to Goyder

- Is Murray mouth open 90% of time target met in all scenarios?
- What is the one target not met at 3200 GL?
- Sam ? (Lower Lakes irrigator) is calling for Lake Albert-Coorong link – please provide summary of why this is not a good idea
- Can you provide a graph tracking the low DO water event through SA?

Future contact

- GI very happy to hold further briefings, 'first conversation of many!'
- Willing to provide more detailed information on specific questions
- Will review our proposed statements to rebut upstream arguments
- For future discussions, send specific questions in advance, so scientists can check background reports

HRA Comments

- *Fantastic informative discussion, very helpful*
- *Use statements from 'in a nutshell' to make arguments against increasing SDLs*
- *Use quote on definition of SDLs, ie no negative impacts on ecosystems*
- *On her recent tour, Rosa learnt that groundwater contains salt and how the salinity interception scheme works to prevent salt from entering the River*
- *She also learnt that irrigators contribute salt through their activities*
- *Need to tell stories between River communities along whole length of rivers*

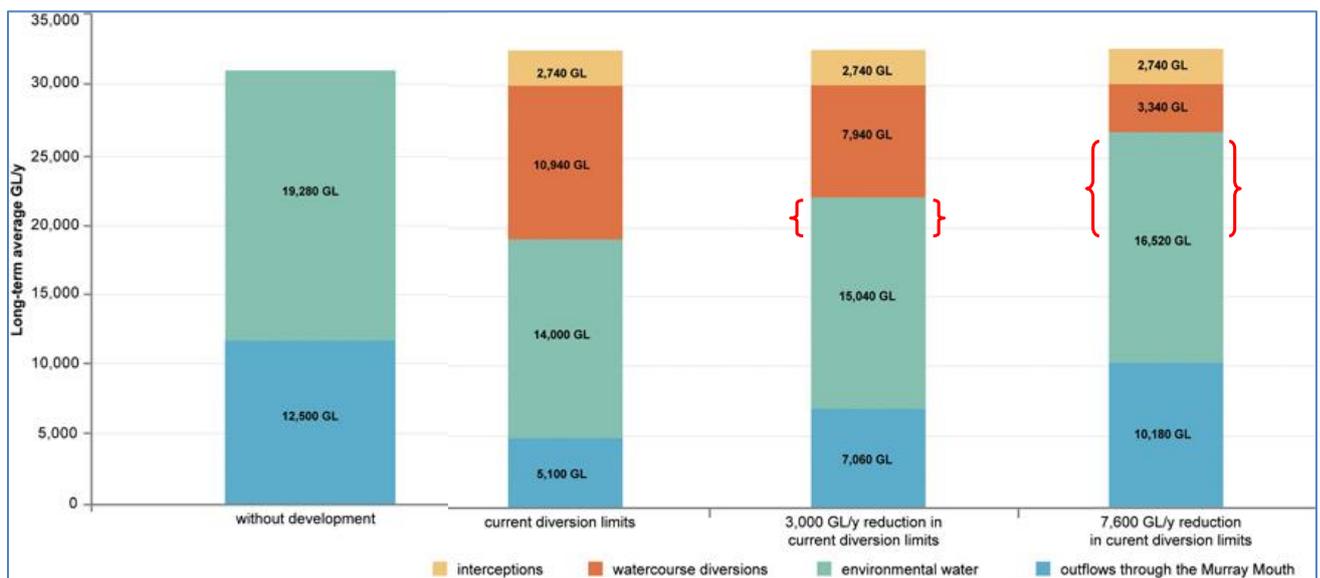


Diagram from Basin Plan showing four scenarios of water use: conditions (without development), current diversions, option to return 3,000 GL/y and option for environmental optimum return of 7,600 GL/y