MURRAY REGIONAL STRATEGY GROUP

MURRAY VALLEY JOINT STAKEHOLDER SUBMISSION

January 2020

Inquiry into management of the Murray–Darling Basin

(KEELTY REVIEW)

Murray River Council, Edward River Council, Murrumbidgee Council, Murray Valley Private Diverters (Inc), Ricegrowers Association Limited, Yarkuwa Indigenous Knowledge Centre, Murray Irrigation Limited, West Corurgan Irrigation, Speak Up Campaign (Inc), Southern Riverina Irrigators (Inc)

Berriquin Irrigators Council, Deniboota **Landholders** Association, Denimein **Landholders** Association, Wakool **Landholders** Association, West Berriquin Irrigators)

Submission supported by:

YACTAC
Yanco Creek and Tributaries Advisory Council Inc.

Murray River Action Group (MRAG)
Hume to Yarrawonga

Upper Goulburn Landholders Group

The Murray Regional Strategy Group acknowledges the Traditional Owners of the Murray Valley. Their connection to the lands and waters supported the occupation of this country for tens of thousands of generations. The evidence of this occupation can be found throughout the landscape and shows that the resources of the Central Murray supported large numbers of people with connected trade and kinship systems. The Murray Valley Indigenous community maintains strong connection to their lands and waters and have always been open to be involved in decisions that affect how their country is managed.

Failure to adequately consult local Indigenous communities about the management of the Murray Darling Basin means that a critical voice is not heard. It is only the local community that understands the important cultural areas, the food medicine and fibre resources and the interdependence between culture and environment and their impact on everyday health and wellbeing.

The Murray Darling Basin Authority adopted Indigenous Engagement Principles in 2011 and many communities feel the spirit of these principles has not been applied in practice and their voices continue to be ignored.

The Murray regional Strategy Group supports all of our regional communities and encourages all those people affected by the impact of Water Policies to be heard and to be listened to.

Opening Statement:

The Water Act 2007 was described to the public as legislation to balance social, economic and environmental factors for water management in the Murray Darling Basin. While the objectives of the Act acknowledge these values, the body of the Act does not. [i]

The Murray Darling Basin Authority (MDBA) Regulatory Impact Statement (RIS 2012)[ii] severely underestimated the social and economic consequences of the Basin Plan. This is in part related to how the Basin Plan produces economic inequities in geographical areas of the Basin. It is also how the MDBA reports on the social and economic impacts for regions most affected.

There has been no feasibility assessment of the consequences of the Water Act 2007 or Basin Plan, impacts of removing impediments to trade, or enacting the Constraints Management Strategy to achieve higher Basin Plan flow volume targets for the Murray River, measured at the Coorong, Lower Lakes, Murray Mouth (CLLMM) in South Australia.

The Water Act 2007 utilised Section 51 (xxxvii) of the Australian constitution which enabled the Federal Government to use international environmental agreements as a mechanism to obtain new powers over water from the States. [iii]However, the Basin Plan also delivers inequitable environmental weightings across the Basin.

The Murray Darling Basin Authority (MDBA) was established as an independent authority. Documented decisions suggest that the MDBA's decisions have not been truly independent, nor consistent with a 'whole of basin' approach or reflective of achieving the objectives of the Water Act 2007 - *A balance of social, economic and environmental outcomes.*

Instead, the Water Act 2007 and current Basin Plan, ensures there has been a concentration of physical water recovery for the 'environment' in the Southern Basin. Primarily in the Murray system (NSW/Vic), the Goulburn River (Vic) and the Lower Darling. Social and economic impacts are not confined to a reduction in irrigation entitlements used for regional agriculture. Impacts extend to pricing and supply of Water Markets, stranded assets in irrigation regions and how the Murray River system will be operated in future and associated third - party impacts.

Australia's water policy affecting the Murray Darling Basin is influenced by the River Murray Agreement, internal State water management decisions, the Water Act 2007 and the Murray Darling Basin Plan. As such, the Murray Darling Basin Agreement cannot be considered in isolation.

Both the Murray-Darling Basin Agreement (*River Murray Agreement*) and the Murray Darling Basin Plan have over recent years led to major inequities in water management in the Southern Basin. NSW Murray Valley General Security (GS) has incurred higher impacts because of Murray Darling Basin Agreement requirements to South Australia and changes to inflows from the Northern Basin.

The Murray-Darling Basin Agreement currently is enabling;

- A reduction *in-flow* contributions from the Northern Basin's Darling River system to the Menindee Lakes, to be subsidised from water resources in the Southern Basin with specific effects on NSW Murray General Security water property rights

- Negative ecological impacts of (SA) infrastructure changes affecting the Coorong, Lower Lakes and Murray Mouth to be offset by increased flow demands on the Murray River

- Cumulative changes, including additional drought/or urban water reserves, environmental outcomes, and river operational changes within Objectives/Operating Plans, to reduce consumptive pool, with risks applied to General Security licenses

The Water Act 2007 and Murray Darling Basin Plan establishes;

- The Murray Darling Basin's Baseline Diversion Limit (BDL) modelled at 13,623 (GL) per year (*surface water volume estimates*)[iv]
    1. Basin Plan set a new Sustainable Diversion Limit (SDL) of 10,873 (GL) per year
    2. A reduction of 2,750GL of surface water extractions
- Decisions on Basin Plan, environmental water recovery and Murray River operational changes, to occur prior to <u>finalisation</u> of licensing/metering in the Northern Basin (Qld/NSW)
- SA to increase its share of Basin Water:
    1. <u>Retention</u> of SA minimum entitlement flow of 1154GL + 696GL loss/dilution =(1850GL)
    2. <u>Continuation</u> of Pre-Basin Plan average flows (MDBA 4100GL average+ 5100GL long term average)
        - MDBA Live River data states Long term average is 5549GL per annum to SA since 1968 [v]
    3. I<u>ncreased</u> flows of 2000GL (3-yr rolling average, min of 650 GL/yr.) to SA barrages
- Murray River operations to be amended to allow higher volumes/flow rates above the natural capacity of the riverbanks (Constraints Management Strategy)
- MDBA and NSW Government documents confirm intent for both environmental and <u>operational water (irrigation orders</u>) below Barmah Choke, to utilise <u>Constraints Management Strategy</u>
- Water Act 2007 requirements for *'reduction in trade impediments* will have major impacts on water markets and additional system losses

The underlying premise for the Water Act 2007, Murray Darling Basin Plan and current implications of water management decisions to the River Murray Agreement, are of sufficient concern and extent, to trigger:

A Federal Royal Commission into the
Murray Darling Basin Plan and Murray Darling Basin Authority

In the absence of that option, it is important this Inquiry into the Management of Murray – Darling Basin and the River Murray Agreement enables a full and open approach to understanding the impacts of changing distribution in flows

Summary of Broader Issues /Opportunities

National Water Initiative (2004) enshrined property rights for water entitlements:

Cumulative changes to River Murray Agreement, River Murray Operations and the Water Act 2007 and Murray Darling Basin Plan have undermined the Property Rights of General Security entitlements in the NSW Murray Valley, Murrumbidgee and Northern Victoria (low reliability)

A full review is required with water returned on a proportional basis to the consumptive pool.

- Amend Water Act 2007 to allow necessary changes adopting more contemporary information
    1. Revision of science
    2. Re- balance of economic, social and environmental values
    3. Revise mandatory conditions aimed to 'free up' trade restrictions on water
- Moratorium on Federal Funding of Basin Plan until a full review
- Federal freeze on 450GL *'up water'*
- Pause Basin Plan timelines to enable review, incorporate new knowledge into Basin Plan
- Review Basin Plan science and models which established basis for water recovery for the environment and set new flow targets to South Australia
- Revise structure and operations of the Murray Darling Basin Authority (MDBA)
- Moratorium on new irrigation developments where new demands exceed river system capacities
- Amend classification of environmental benefits to enable 'non entitlement' flow benefits to be recognised as environmental contributions, including irrigation flows
- Full implementation of NWI National meter standards/principles for irrigation extractions in the Murray Darling Basin
- Review Basin Plan inflow models (Northern Basin)
- Review Basin Plan inflow models (South Australia), account for SE of SA flows diverted to Southern Ocean (SA drainage schemes)
- Amend Basin Plan flow targets to South Australia (documentation, modelling)
    1. 80GL (80,000 ML/d) at SA border which relies on additional NSW/Vic Upper to Mid Murray River flows
    2. Review SDL Adjustment Mechanism Projects to incorporate amended objectives
- Incorporate into the Basin Plan and Murray River Agreement, sustainable localised solutions in SA, eg infrastructure for the Coorong, Lower Lakes and Murray Mouth (CLLMM). (proportionally distribute benefits to 'consumptive pool' NSW/Vic/SA)

1. Such investments to offset the new Basin Plan flow targets for South Australia and amend any related conditions in the River Murray Agreement that have required additional water from NSW Murray/Northern Victoria to SA.

- Conduct full cost benefit analysis to compare benefits of Living Murray infrastructure works and new flow targets for 18 environmental indicator sites.
- Revise Basin Plan SDL Adjustment Mechanism (Southern Basin) to enable;
    1. amendments to existing projects deletion of projects not supported
    2. Enable new projects and inclusion of complementary measures
- A full review on MDBA Base Flow metrics to ensure transparent understanding of how breaches are assessed, future risks with tolerance levels and the appropriateness of the metrics model in determining ecological health in the Basin
- Revision of the Constraints Management Strategy (CMS) to reflect realistic and agreed flow options to gain collaborative and timely support from affected stakeholders.
    1. Ensure River Murray commercial operations to remain within natural riverbank capacities
    2. Ensure public funded outcomes (CMS) <u>are restricted for environmental purposes only (not for commercial movement of water to bypass current trade and capacity restrictions)</u>
- Work collaboratively with affected stakeholders to enable delivery of environmental flows to specific catchment sites at realistic and agreed levels (Constraints Management Strategy)
- Review cumulative rule changes for River Murray operations, River Murray Agreement, Snowy Hydro License amendments (e.g. modelled requirements for additional conveyance reserves)
- Develop options to return water availability to the 'consumptive' pool– Southern Basin (Vic/NSW Murray system)

<u>Short Term;</u> Water availability: Supply and Demand

- Basin States Moratoriums for new irrigation developments on the Murray River downstream of Barmah Choke
- Develop new rules to ensure Net Trade to SA remain within designated trade zones to avoid breaches of system capacities and additional trade transfers incur losses. Water trade is increasing demands outside traditional trade zones usage, transmission losses to deliver water under current rules, are allowing the additional losses to be underwritten by Murray General Security (3rd party impacts to property rights)
- Debit Commonwealth Environmental Water Holder account for conveyance losses for environmental water transfers downstream of the Barmah choke (breaches of trade zone characteristics)
- Amend River Murray Agreement to enable South Australia's minimum entitlement flows to reflect Northern Basin inflows (review how Tier Level planning is applied to SA)
- Adjust South Australia's Basin Plan environmental flow targets to CLLMM to account for SA receipt of above average monthly flow volumes at SA border:

1. Additional volumes re-calculated and included in total resource assessment
2. 'Above average' flows' are enabling SA ability to vary its minimum monthly entitlement flow (1154GL) but flows benefits and details are 'non transparent'
3. Above average volumes (>1154GL) debited to environmental account

- Remove South Australia capacity to carryover on entitlements, as SA High Security entitlements receives priority and have minimum guaranteed flows
- A new clause in NSW Water Sharing Plans to allow under usage below SDL's limits to be recognised and SDL credit mechanism to apply (Rule should only apply to Southern Basin as Water Sharing Plans have account for 'connectivity impacts' to downstream users)
- Review Salinity and dilution flow requirements to SA on the basis that Murray River salinity has been substantially below < 800 EC target at Morgan for approximately 40 years.
    1. Remove SA Additional Dilution Flow rule from River Murray Agreement
    2. Amend delivery volumes to SA for (Loss/dilution flow 696GL) when SA receives substantially above minimum entitlement flows (1154GL)
    3. Remove Basin Plan 'limits of change' conditions that relate to salinity targets for Lake Alexandrina (SA) (1000EC 95% of years and 1500 EC 100% of years)
- Full and transparent disclosure of WAL trades to different zones
- Review MDBA' conversion formula methodology applied to Commonwealth Environmental Water Holder (CEWH) entitlements, to reduce impacts of Commonwealth water purchases (ensure CEWH entitlements = irrigation entitlements)
    1. Review how changes to characteristics of environmental water and increases water recovery/delivery/trade/ water prices impacts in Southern Basin
- Review MDBA/CEWH Environmental 'return flow' modelling to improve accuracy of 'loss factors' (20%) and calculation of 80% return flows – Hume to Murray Mouth
- Full disclosure/reporting of how (NSW/VIC) Barmah Millewa entitlements (forest return flows) will be re-credited by the MDBA to the consumptive pool if merged with other Environmental Flow entitlements. Note; BM return flows stipulated in NSW Murray WSP.
- Review Basin Plan methodology which assessed the quantity of environmental water required, frequency of inundation models. Avoid ecological damaged from over watering (bank slumping/inundation frequencies) – incorporate relevant science
- Utilise Adelaide's de-salinisation plan consistent with Federal Government funding criteria (50GL Murray River saving)
- Full implementation of Nationally Agreed metering/telemetry standards for Northern Basin and South Australia (levels of take and system flows)
- Inclusion of Full automation/metering on SA barrages to enable accurate accounting for 'end of system' outflows
- Full disclosure of all modelling used to inform Basin Plan flow targets
- Review basis of MDBA drought model and subsequent Snowy Hydro License amendment (2011), additional 225 GL new conveyance reserve (MDBA drought model, repeat of Millennium drought) – impacts on General Security
- Review MDBA's Dry Sequence Inflow Models

1.INFLOW/SUPPLY: NORTHERN BASIN

NORTHERN BASIN - IMPACTS TO INFLOWS
Murray Darling Basin Plan: Northern Basin (unregulated)

- Inflows = 13,547GL
- Interceptions =1,324GL
- Watercourse diversions = 2,571GL
- Total current diversions = 3895GL
- Water used by environment/losses=8,631GL

Darling River system inflows:

- Basin's mean annual runoff - 31.7% from 60.4% of its area. (*MDBC website 2010)*
- Darling River system flow contribution to South Australia (1850GL) historical average 39% (MDBC) 721GL annually (Thoms et al 2000)
- Darling River flows measured at Weir 32 (Lower Darling): **64% flow reduction** [vi]
    - 1974 – 1991 average discharge below Weir 32 on Lower Darling = 6939 ML
    - 1992 – 2019 average discharge below Weir 32 on Lower Darling = 2500 ML

Darling River management:

- Northern Basin extraction levels have expanded through: Floodplain harvesting, off river storages, amendments to extraction rules
- Water Sharing Plans have limited flow 'connectivity' requirements downstream to Menindee Lakes
- Decadal conflicts (Floodplain Graziers V Northern Basin irrigators) on the Darling system (Qld/NSW) create misinformation leading to negative public/political perceptions of irrigation issues in the whole Basin.
- Northern Basin State Governments (NSW/Qld) --(NWI) National Agreed standards, licensing, metering or extraction rules for Basin ecological health and equity incomplete
- 2019: NSW Natural Resources Commission (NRC); Review of Barwon Darling Water Sharing Plan Report notes:[vii]
    - 2007 estimates for off river storage volumes as 289GL Barwon Darling
    - 2007 estimates for off river storage volumes as 4039GL for upstream catchments of Barwon/Darling (NSW/Qld)

Basin Plan:

- Murray Darling Basin Authority (MDBA) state their models have accounted for extraction levels in the Northern Basin through their assessments of inflows (e.g. water retained/or lost in the landscape)[viii]
- MDBA models estimated 210GL for floodplain harvesting extractions but acknowledge concerns about accuracy (note NRC report 2019)
- Northern Basin Review: (reduction in downstream connectivity requirements)
    - environmental water recovery down 70GL (390GL to 320GL)
    - Shared downstream target to Menindee **reduced** from **143 GL to 41 GL**[ix]
- 2019: Federal Government announce funding package for meters AS4747 Standards Northern Basin (Qld/NSW)[x]
- 2020: Actual levels of 'take' in Northern Basin (Qld/NSW) unknown, Licensing and metering incomplete

Northern Basin Timelines:

(1992): NSW Government Department of Water Resources: **Interim Unregulated Flow Management Plan for the North West (June 1992**).[xi] The Plan was developed following a significant algal bloom in the Barwon Darling in November/December 1991. The interim plan proposed:

- Revise the management of unregulated flows to achieve immediate gains in river health without causing severe adverse impacts to water users
- Provide for fairer and efficient sharing of water between users, to protect flows to meet interstate obligations, and alert irrigators that access to unregulated flows will be limited
- The report notes (page 7); ***"the time for unfettered access to water is over"***

The 1992 report proposals aimed to establish:

- a basis for sharing unregulated flows between irrigators and better control of extractions
- improved monitoring & research programs
- an advisory committee & a performance reporting process
- The interim plan was to operate for the 1992/93 irrigation season with an intent for the interim plan to be replaced by a State Policy and by Valley management plans
- Off allocation pumping and B and C Class License operations will not be permitted unless the riparian flow targets are met

Post 1992: Northern Basin extraction levels continued to grow in the form of new development off river storages, expansion of existing and through amendments to extraction rules

1997 Murray River Agreement CAP on extractions Southern and Northern Basins 1993/94

- Northern Basin – CAP on extractions implementation timeframes extended for Queensland and Northern Basin (NSW), [xii]
- Queensland only fully entered into Cap arrangements in 2010 [xiii]
- Post 1997, Barwon Darling in regular breach of Basin CAP requirements[xiv]
- Post 1997, Barwon Darling merged with Lower Darling for CAP reporting purposes (Instances of non- CAP compliance continued)[xv]
- 2012, NSW revised CAP model for Barwon Darling, extraction rules were increased in Barwon Darling Water Sharing Plan (2012)[xvi]

2004 National Water Initiative (NWI): agreed standards, including Metering (Basin)[xvii]

- Metering incomplete across State
- Reliability of property rights across Basin not protected
- Federal Public Water Registry not delivered by 2019 (original date 2006)
- Range of examples confirm that Intergovernmental Agreement (NWI) not enacted
- 2019 – MDBA compliance report notes Qld as 32% metered, 68% not metered[xviii]

2008 (post) Northern Basin – Floodplain harvesting infrastructure

- Floodplain Harvesting not metered. Private storages efficiencies (eg increases embankments/ increase depths)

2009 Council of Australian Governments (COAG)

National Framework for Compliance and Enforcement Systems for Water Resource Management[xix]

- The standards to apply to meters installed after 1 July 2010.

2012: Barwon Darling Water Sharing Plan[xx]

- extractions rules amended
- Issues with CAP compliance (NSW CAP model)
- A Class license changes to allow irrigation extractions
- Additional amendments to license class conditions (including pump sizes, capacity to pump in lower flow conditions, ability to amalgamate licenses through trade and concessional conversions of a percentage of C class licenses to B Class)
- Irrigators licenses amended to allow 'unlimited carryover' – not applicable in other regions (note: NSW Water Sharing Plans do allow accrual, eg carryover but do not allow unlimited carryover)

2016: NSW invited applications for floodplain harvesting,[xxi]

- NSW Floodplain Harvesting Policy announced: framework for licensing floodplain harvesting extractions. Only works constructed on or before 3 July 2008, or for which a valid application under Part 2 or Part 8 of the Water Act 1912 or the Water Management Act 2000 was made on or before that date, are eligible for assessment under this policy.
- retrospective approvals could apply back to 2008
- Implementation of this policy will take place in five stages:
  - registrations of interest –to achieve authorisation of floodplain harvesting activities.
  - Determination of eligibility
  - Issuing work approvals – Eligible works and applications for such works will be assessed to determine their capability to harvest floodplain water. The Office will issue work approvals to individuals.
  - Licenses/approvals to be floodplain harvesting will be included in water sharing plans.
  - Existing water sharing plans will be amended to set the floodplain harvesting long-term average annual extraction limit, establish rules for the management of floodplain harvesting, and provide that floodplain harvesting access licences will be exercised in accordance with those rules.
  - For new plans, these actions will be taken as necessary at the time the plan is made

2017: MDBA Compliance Report includes:

- "Having only adopted the Cap on diversions in 2010, Queensland has had the least experience with developing a compliance culture"
- Report highlighted that 2/3 thirds of take in Queensland is not metered or measured
- "Overland flow harvesting is even more significant in Queensland than it is in NSW (where it is referred to as floodplain harvesting)"
- "NSW faces the challenges of having the greatest number of licences (over 21,000) and volume of take (5,700GL), and of having to cover the most extensive geographic area in the Basin"
- Report still notes figure of 210GL as the level of take/diversions for Northern Basin Floodplain Harvesting but notes uncertainties /reliability issues (compliance report page 19)

2017: NSW Government: Mathews Inquiry includes reference to:

- "*arrangements for metering, monitoring, measurement of water extractions especially in the Barwon-Darling system, are not at the standard required for sound water management expected by the community"*
- Increasing pressure from certain stakeholders to 'water down' key reforms, including reforms to water metering
- Need for improving transparency of information about water usage
- Arrangements for metering, monitoring and measurement of water extractions, especially in the Barwon-Darling River system, are not at the standard required for sound water management and expected by the community.
- Certain individual cases of alleged non-compliance have remained unresolved for far too long.
- There is little transparency to members of the public of water regulation arrangements in NSW, including the compliance and enforcement arrangements which should underpin public confidence.
- Noted the Four Corners program included allegations about a "secretive group with irrigator lobbyists to discuss the Murray-Darling Basin Plan".

2017-18 NSW roll -out of State-wide Metering Policy

- Northern basin timeframes delayed:
- Northern Basin Floodplain harvesting metering requirements determined as developing a system of 'measurement' over a progressive period into the future (indications were 10 yrs.)

2017 June: NSW Government submits Menindee Lakes project to MDBA/Federal Government as an SDL offset project for Southern Basin[xxii]

- Limited public consultation in Southern Basin and no transparent assessment of potential negative impacts to the reliability of NSW Murray Valley General Security entitlements
- SDL project creates environmental water entitlement of 106GL, but MDBA/NSW Government advice is that the 'created environmental entitlement' can be sourced outside of Menindee (eg Hume Dam on the headwaters of the Murray) – *further pressure on Murray system*

2018: Murray Darling Basin Authority Review of socio- economic impacts Northern Basin

- Reduces environmental water recovery by 70GL (390GL down to 320GL)
- Basin Plan: Shared downstream target to Menindee **reduced** from 143 GL to 41 GL
- Local reduction **increased** from 247 GL to 279 GL[xxiii]

2018/19 Broken Hill pipeline from Murray River completed ($467 million)

- Water entitlement established as part of Pipeline project sourced from NSW share of Murray River water resources, instead of drawing on Menindee Lakes

2019 NSW State-wide Metering Policy amended to 'enable' meters to be in private ownership

- NSW Murray Valley Private Diverters (Southern Basin) lobbied against private ownership and recommended public ownership be retained

2019: NSW still to complete Floodplain Harvesting Licenses

- levels of take remain unreportable

- Lack of transparency how/timelines the new system for licensing floodplain harvesting will be incorporarated into current Water Sharing Plans – likely to occur post Basin Plan, post water recovery for environment

2019: NSW Natural Resource Commission (NRC) Review of Barwon Darling Plan

- Describes the volume capacity for off river storages on the Barwon Darling as 289GL
- Describes the volume capacity for off river storages in upstream catchments (of Barwon Darling) as 4039GL

2019: NSW Government amends conditions on State-wide Metering Policy and announces intention for policy change (private ownership of meters)

- National Agreed standards for AS4747 Metering in the Northern Basin subject to 'watering down'.

2019: NSW Water Resource Plans – Northern Basin[xxiv]

- Northern Basin Water Sharing Plans do not have 'connectivity' or flow commitments to downstream plans or water users
- Northern Basin Water Resource Plans do not have 'connectivity' or flow commitments to downstream plans or water users

2019: MDBA Basin Plan Northern Basin downstream flow target to Menindee Lakes

- No clarity from MDB whether Basin Plan 'end of valley' flow target of 143GL will be enforced[xxv]. Northern Basin Review (2018) indicates it will not

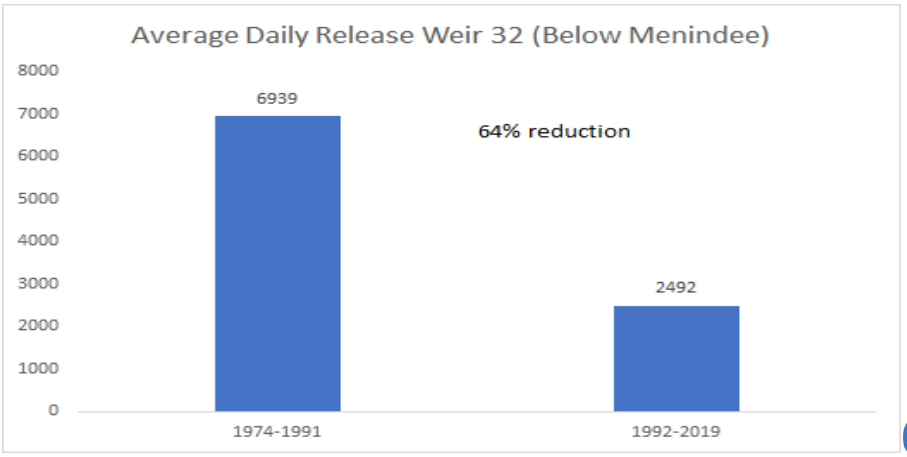
2019: Queensland Connectivity flows to Northern Basin (NSW) non transparent [xxvi]

2020 Northern Basin water extraction (Qld/NSW)

- lacks a system of a robust or comprehensive licensing, metering, monitoring, compliance and enforcement system[xxvii]

2020 NSW Government Metering Policy;

- Consultation to commence transition of public meters to private ownership
- Confirmation of State-wide private ownership of meters
- NSW Government confirmed that it would start the process to transition ownership of all government owned metering equipment to private ownership in 2020, and that it would consult with water users to develop a meter transition scheme.



64%

Image (SRI): information obtained MDBA Live River Data (2020)

2. INFLOWS/SUPPLY SOUTHERN BASIN

SOUTHERN BASIN - IMPACTS TO INFLOWS AND WATER AVAILABILITY

- Basin Plan: models Murray & tributaries (downstream of Wentworth, excluding Darling)
- Inflows = 15,959GL
- Interceptions = 1,017GL
- Watercourse diversions= 7,291GL
- Total current diversions=8,308GL
- Water used by environment/losses=2,341GL[xxviii]

Southern Basin Catchments inflows (Darling; Murray; Murrumbidgee; Goulburn Rivers systems)

- Upper Murray, Murrumbidgee and Goulburn river catchments account for 45.5 % of the Basin's total runoff from 11% of its area.
- Northern Basin inflows historically accounted for 39% (Thoms et al 2000)
- South East of South Australia inflows are diverted to Southern Ocean
- NSW Murrumbidgee, has limited end of system flow contributions (rules) compared to the Murray River. High flows, floods/and supplementary flows add to Murray inflows
- Water availability accounts for volumes in storage(s) plus inflows, reserves, state shares
- Snowy Mountain Scheme License has minimum Required Annual Releases; 1062GL NSW Murray; 1026GL NSW Murrumbidgee
- NSW/Victoria Water Sharing Plans have complex irrigation extraction rules to ensure 'connectivity' with downstream valleys/users and SA
- Southern Basin water sharing rules do not account for:
    1. loss of natural inflows from South East of South Australia
    2. or adequately account for loss of inflows Northern Basin
- River Murray Agreement requires NSW/Victoria to guarantee SA minimum entitlement flow (1850GL), prior to annual irrigation allocation announcements on water entitlements (NSW/Vic Southern Basin)
- **Pre- Basin Plan**: SA receives average flows 4000; 5100 GL annually
- **Post Basin Plan:** SA will receive an additional 2000 GL (over 3 year rolling average) [xxix]

Southern Basin River Management

- National Water Initiative (NWI) principles enshrined in 2004 Water Sharing Plans (NSW/Vic)
- NSW/Vic Southern Basin: majority of irrigation extractions metered to National Agreed AS4747 Standards including telemetry (NSW: Southern Basin Pilot Project)
- Extractions in South Australia (telemetry incomplete), (levels of self-reporting)
- Flows are measured to South Australian border but are then controlled by SA
- Flows over the South Australian barrages (end of system) are not metered
- Current interpretations of rules, indicate if Northern Basin inflows are insufficient at Menindee, NSW/Vic are delivering SA minimum entitlement flows
- Increased flow demands to SA (environmental + irrigation growth) above natural river capacities (multiple chokes) Mid Murray, Edward Wakool, Goulburn Rivers, create risks and inequities (supply, losses calculations, pumping restrictions)

Murray Darling Basin Agreement/Basin Plan:

- Cumulative rule changes, have reduced reliability of General Security licenses
- Basin Plan mandates 'limits of change' conditions for flow targets to SA Coorong, Lower Lakes, Murray Mouth (CLLMM)
- MDB CAP; Basin Plan SDLs - no recognition 'under-use' of water (NSWIC 2019)[xxx]
- Basin Plan requirements inserted in Murray Darling Basin Agreement: Objectives and Outcomes document

Southern Basin Timelines:

1914: River Murray Agreement

- Rules determine State shares, levels of security and yield on water entitlements in Victoria, NSW Murray, NSW Murrumbidgee, Lower Darling
    - NSW/Vic/SA: High Security, General Security entitlement, based on a system of announced annual allocations.

1868- 1974 South East of South Australia Drainage Scheme constructed

- Extensive drainage and land reclamation project to drain landscapes for agriculture and divert flows to the Southern Ocean
- 'Pre-European salinities in the Coorong's South Lagoon were typically 8,300 EC to 58, 333 EC. European settlement of South Australia and the Murray-Darling Basin has led to greatly reduced freshwater inflows to both ends of the Coorong. Construction of the South East drainage network, which commenced in 1860s, significantly limited flows from the South East" (SA Govt; 2009) [xxxi]

1939: Completion of South Australia Barrages as part of the Murray River regulation[xxxii]

- Lower Lakes converted to a freshwater lake system (11% estuary remains outside of barrage system)
- Barrage gates can be shut over sustained periods to maximise optimum operating levels of 0.75AHD above sea level
- Lower Lakes average evaporation rates (750GL) 750,000 ML to (900 -1000GL) per year
- Pre barrages "At this time, the area of the Lower Lakes affected by the tidal prism was 97.3 km2 "(Johnston, 1917).
    - Following construction of the current barrages in 1940, 90% of the tidal prism has now been removed. 11

Post 1939: Changes to tidal influence on Murray Mouth

- **1914**: tidal prism influencing the estuary and the Murray Mouth estimated at <u>16,900ML/day</u>
- **1987: Murray Mouth Advisory Committee**
    - *"A more recent estimate of the current tidal prism shows a tidal influence in the range of <u>2200ML and 643ML</u> per day"[xxxiii]*

Issue: South Australia supported by MDBA & Basin Plan objectives to achieve additional flows down the Murray River to replace tidal influences on the Murray Mouth in the absence of any other localised solutions

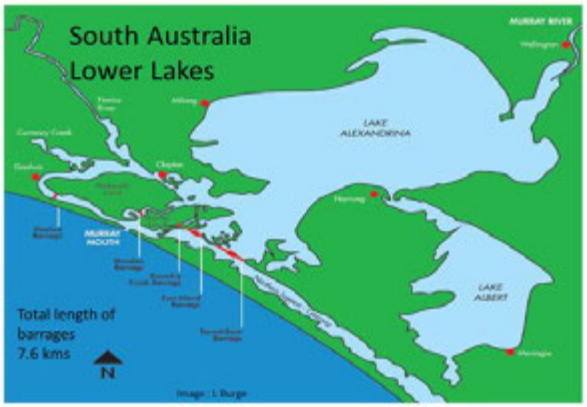


Image: SRI (2010); Barrages (x5) Total distance (7.6kms) Construction (1939)

Image: website Discover Murray Image: L Burge (Goolwa Barrage @ 0.75AHD above sea level)

1950's and 60's

- Menindee Lakes water storage developed and increased capacity to 1731GL

1979 River Murray Agreement Amended (Chowilla/Dartmouth Dam negotiations)

- SA entitlement increased from 1550 to 1850GL
- SA share of Murray water resources amended to provide equal shares (to NSW/Vic) in periods of special accounting (drought

1960s- 2016

- Inflows from Northern Basin to the Murray via Menindee lakes progressively reduced
- Rapid expansion irrigated agriculture, Floodplain harvesting diversions, direct pumping, off river storage/private water capture
- 1974 – 1991 average discharge below Weir 32 on Lower Darling = 6939 ML
- 1992 – 2019 average discharge below Weir 32 on Lower Darling = 2500 [xxxiv]

64% inflow reduction

1985 South Australia intent to list the Coorong, and sections of the Lower Lakes/Murray Mouth as a RAMSAR recognised wetland finalised[xxxv]

- When the CLLMM site was listed as a Wetland of International Importance in 1985, the typical salinity range in the South Lagoon had risen to between 90,000 EC and 230,000 EC.' 1
- 2006 report to RAMSAR, notes "at the time of listing Coorong had been in decline for more than 30 years" (e.g. approx. 1950s) (note: drainage diversions of natural flows to the Coorong continuing)

1990's Federal Government: policy discussions

- Move water use to high value crops
- Expansion of Managed Investment Schemes to agriculture

1994: The Barmah Millewa (BM) Forum (community reference group)[xxxvi]

- Final Report – Barmah Millewa Forest Water Management Plan - (11th February 1994).
    - developed recommendations for water requirements for the Barmah Millewa Forest. Committee recommendation 50,000 ML with in- forest infrastructure would enable efficient watering of forest areas/wetlands
- Government(s) ignored Barmah Millewa Forum findings (formal advisory group) and established own water requirements
    - Victoria 50,000 ML
    - NSW 50,000 ML
    - + an additional 25,000 ML each from Vic/NSW under special conditions
- BM Forest entitlements, rules have return flow requirements, flows from forests recredited to NSW /Vic consumptive resource pool
- Regional cross border water sharing plans (Victoria WSP) and NSW Murray/ Lower Darling WSP) enable BM entitlements to accrue within WSP plans. BM Environmental entitlements can be stored in Southern storages (Hume) up to approx. 700GL
- MDBA/CEWH intend to 'bulk together' environmental orders (risk for return flows)
- A further investment in channel upgrades, saw an additional 30,000 ML form part of the adaptive environmental water – in the NSW Murray Lower Darling Water Sharing Plan.

1997 Murray Cap on extractions implemented

- Southern Basin Cap requirements implemented in 2004 Water Sharing Plans

1997 South Australia - Upper South East Drainage and Flood Mitigation Plan. [xxxvii]

- Plans to drain landscapes due to 'modelled' risks of rising groundwater and risk of land salinisation
- Drainage schemes diverted water away from the Coorong out to Southern Ocean
- Commonwealth Funding condition of Upper SE Drainage & Flood Mitigation Plan only permits: a maximum discharge of 40,000 megalitres/year on ten-year rolling average into the Southern Coorong. (*Issue: Basin Plan replaces lost flows by increasing Murray River flows. SA Basin Plan SDL project intends to deliver an extra 26GL only to the Coorong)*
- Rule relates to Coorong, Lake Alexandrina and Albert Ramsar Management Plan Ecological Character description (site listed in 1985) note in (section 5.6)
    - *"to conserve the ecological character of the southern lagoon as a mostly hypersaline lagoon, manage the timing and volumes of discharge under the Upper South East Dryland Salinity and Flood Management Plan (USEDS & FMPs) into the Southern Coorong, is based on the approved discharge of 40,000 Megalitres/year as the mean of a rolling ten-year average with most discharge through winter and early spring"*
    - **Note:** Funding conditions were to maintain hyper- saline state – the ecological character description at the time Coorong was listed under RAMSAR in 1985)
- SA Upper SE of SA discharge:
    - *"The combined average annual discharge to the sea from the Blackford Drain, drain L and drain M = 136.4 GL. Discharge is variable and in high rainfall years very large volumes flow to the sea through these drains"13*
    - *In 2000 the combined total discharge was 449.9 GL.*

Department of Water, Land and Biodiversity (DWL&BC) as part of the water quality assessment under Upper South East Drainage (USE) Program, commissioned a report titled - ***A Palaeoecological Assessment of Water Quality Change in The Coorong, South Australia (November 2005)*** **Gell P.**

- Using diatom analysis and dating techniques the study determined the timelines for changing water quality conditions for the Coorong Lagoons. 46 The report's executive summary stated: '*Before European settlement the northern lagoon of the Coorong was dominated by tidal input of marine water. Marine flushing also strongly influenced the southern lagoon but less frequently or to a lesser extent. At no time in the 300 years before European settlement has the Coorong been noticeably influenced by flows from the Murray River.' 46*

ISSUE: SA/MDBA/Basin Plan replaces natural flows to the Coorong currently diverted to the Southern Ocean (South East Drainage Scheme and the Upper South East Drainage and Flows)

1999: Salinity:

Landscape salinity had become a major environmental policy issue in the mid 1990's, following wetter than average years. Two major reports that contributed to political elevation of salinity and guided responses.

- The Salinity Audit of the Murray Darling-Basin (Murray Darling Ministerial Council 1999)
- Prime Minister's Science, Engineering and Innovation Council (1999).

1999: Murray Darling Basin Commission (Ministerial Council) National Salinity Audit – 'using best available science', the audit predicted by 2050, 17 million hectares of land risked from dryland salinity (mainly WA).

- The National Action Plan website refers to *"the area of salt affected land in Western Australia is increasing at a rate of one football field per hour" and "if salinity is not effectively managed within 20 years, the salt content in Adelaide's drinking water may exceed World Health Organisation standards for desirable drinking water in two of every five days". 10*
- National Land & Water Resources Audit - Extent and impacts of dryland salinity in South Australia (Dec 2000), estimated agricultural land affected by dryland salinity as 421,000 ha in 2020 to 521,000 in 2050.

Post Salinity Statements: [xxxviii]

- The Australian Farm Institute *"… Individual research says the figure doesn't look right because the model that underlay it – basically - isn't what's happening in practice*".56
- In 2005, Professor Wayne Meyer, chief scientists at the CRC for Irrigation Futures in ABC Science …. '*there's no question that salinity fears have been exaggerated in some parts of Australia… this could be a short-term effect caused by environmental factors, but adds 'now is a good time to revisit the 2000 figures'*. '*We're five years down the track so it's probably time to have another look at that information … and it may well change'*. 56
- Murray Darling Basin Commission website:
  - Murray River at Morgan measurements of salinity levels within World Health Organisation (WHO) raw drinking water standards of 800 EC.
  - Consistent with the targets of the Murray Darling Basin 1987 Salinity and Drainage Strategy (800 EC).
- Salinity levels in the Murray River since the spike of 1982, have progressively fallen and remained well within the World Health Organisation's raw drinking water standard of 800 EC.
- MDBA report - Assessment of the salt export objective and salinity targets for flow management 2014-15 **Supplementary Material C[4]** identifies; significant decrease in salt load across the salt measuring points along the Murray River.
- March 2016 – Senate Select Committee (Basin Plan) *Refreshing the Plan*. During the inquiry Mr David Dreverman, Executive Director, River Management Division, MDBA stated that "a large proportion of the salt in the system comes from the landscape in South Australia:
- Senate Select Committee recommendations included:
- "The committee is not persuaded that the best means of dealing with salinity in the south-east of South Australia is to drain saline water into the river system and then dilute it through increased flow of fresh water. In addition, it considers there are options to increase surface flows from the south-east of South Australia directly into the lower

Coorong (a 'Coorong Surface Inflows Restoration Project') which could avoid at least some of these effects. **Supplementary Material C[5]**

ISSUE: Modelled predictions did not match subsequent salinity risks or impacts to Murray River, but salinity issues still drive South Australia's demand for more water and this is reflected in the Murray Darling Basin Plan models and objectives

2000 MDBC funded report *River Murray Barrages Environmental Flows – An Evaluation of Environmental flow needs in the Lower Lakes and Coorong*, Edited by Anne Jensen, Michael Good, Paul Harvey, Prudence Tucker and Martine Long.

The Scientific panel identified four key issues driving the serious degradation of environmental values in the Lower Lakes and Coorong. These are:

- *the reduced area of the estuary*
- *changed water regimes of the lakes and river*
- *freshening of brackish and saline habitats*
- *reduce habitat for aquatic plants*

ISSUE: Infrastructure recommendations not incorporated in MDBA Basin Plan (2010-2012)

2002: MDBC Commissioned Technical Report – *Options for Reducing the Risk of Closure of the River Murray Mouth* – *by* A Close. (5 options explored)

- MDBC/SA Option - increase flows to SA by 2000 ML day
- 2000ML x 365days = 730 GL (730,000 ML) SA objective to cover evaporative losses, enable sufficient water to maintain Lake Levels @ 0.75AHD, and create net outward flow against tide to reduce sedimentation in Murray Mouth (replacement of tidal influence)

Issue: Murray Darling Basin Authority adopted singular strategy in Basin Plan

2003: World Wildlife Fund convened the **Wentworth Group** of Concerned Scientists – Blueprint for a National Water Plan (July 2003) sought 'at least' 100 GL of water for the environment for five years (500GL, 1st step). Wentworth Group references feature heavily in MDA documents

2004 Basin States Ministerial Council: **Living Murray Initiative**

- to recover water for six icon sites on the Murray River – (investment of $700 million)

2004 The Living Murray Foundation report describes;

- "The River Murray estuary would have naturally offered a wide range of fresh, brackish, saline and hypersaline systems (Newman 2000). The Lakes would have fluctuated in level over a range of about 0.0 – 00.5m AHD (Australian Height Datum) giving water depths in average hydrological years of 1-2m (Newman 2000).43

- The Scientific Reference Panel subsequently determined that with **1500GL** and in river infrastructure improvements – would deliver a healthy working Murray River

2004 National Water Initiative (NWI) – (COAG) founding principle of the NWI was to achieve a balance between social, economic and environmental considerations. Under the NWI governments are required to:

- Prepare water plans with provision for the environment.
- Deal with over-allocated or stressed water systems.
- Introduce registers of water rights and standards for water accounting.
- Expand the trade in water, including cross-border trade.
- Improve pricing for water storage and delivery.
- Meet and manage urban water demands.

ISSUE:

- NSW Southern Basin Water Sharing Plans (2004) implemented NWI requirements
- Northern Basin not fully implemented/issues not resolved

2006 Millennium Drought - SA political campaign for more water is based on the following campaign themes

- SA is short of water
- Murray Mouth sedimentation – due to upstream extractions
- Murray River dead and dying – needs more water
- 2 million tonne salt needs to be exported out of the Mouth of the Murray (to ocean)
- Coorong system collapsing from upstream State's extraction levels
- Social and economic damage to South Australia in times of drought (eg Millennium drought)

ISSUE: There is sufficient basis and credible documentary evidence to refute the above claims

2007 Federal Government Water Act 2007

- established a new ***independent*** Murray Darling Basin Authority
- Federal Government used Constitutional External Affairs powers to gain power over water from the states – (using International Environmental Agreements, Water Act 2007 gave primary recognition to the environment)
- Water Act 2007 specifies provisions for SA RAMSAR recognised sites (Coorong), Murray Darling Basin Plan (2012), mandates flow regimes/outcomes. Note: no other Ramsar site in Basin has mandated flows
- Basin Plan sets parameters to change River Murray Agreement and State Shares through new environmental flow provisions to SA - 2000 GL (3 year rolling average).

2008 Sustainable Rivers Audit (SRA): Former MDBC Ministerial Council Sustainable Rivers Audit report released

- Report uses data gathered during period – 2004 to 2007 (Millennium drought period) on hydrology, fish & macroinvertebrates
- report notes – "1st step toward analysis of trends which will be a feature of later reports")
- Report states of 23 River catchment valleys only 1 considered in good health". Report refers to "*it is open to some uncertainty because it is estimated rather than measured"*.

ISSUE: SRA Report developed during the peak of the Millennium Drought (& a CSIRO Sustainable Yield Report) were used as base documents by the MDBA to establish subsequent flow targets for SA under the Basin Plan

2010 (May) South Australian Government technical report *Development of flow regimes to manage water quality in the Lower Lakes SA* *(2010/05)* 2010. Reports identifies flow regimes to achieve 700, 1000 and 1500 EC targets respectively. Report options:

1. 4850GL (700EC),
2. **2850GL (1000EC)**
3. 1850 GL (1500EC)

2010: (June) South Australian released 'Securing the Future – A Long Term Plan for the Coorong, Lower Lakes and Murray Mouth (CLLMM): Report summary identifies:

- "*large flows down the Murray River will maintain an open mouth and transport salts and other pollutants to the ocean via natural processes*"
- *'when flows are adequate to maintain the Lower Lakes at or near optimal operating range, minimal intervention is required'*
- *the return of adequate freshwater end-of-system flows (flows through the mouth) is essential for any improvements in the health of the site, as any other solution than freshwater would not preserve the current values*
- *4,700GL is needed to flow over the barrages annually (*Report notes average flows received but refers to the 'below average' years that are of concern) **Basin Plan is covering below average years)**

Report also refers:

- Lower Lakes salinity '*used to be less than 1000 EC units'*
- Refers to current projections Climate Change (IPCC) and impact on barrages a minimum sea level rise of 0.3 metres by 2050 and 1.0 metres by 2100.
- localised temporary events such as extreme tides (plus surges) as well as storm and wave effects, could raise water levels locally and temporarily, but nevertheless quite significantly". "Sea level rises could also threaten the barrages

Original image: River Murray Maps Wikipedia, commentary added

Basin Plan
Concentrates water recovery Murray River – Southern Basin to achieve additional 'end of system flows' – 2000GL to SA for the Coorong, Lower Lakes and Murray Mouth (2000 GL over a 3 year rolling average)

MDBA used a historical Basin Catchment map that excluded South East of South Australia.

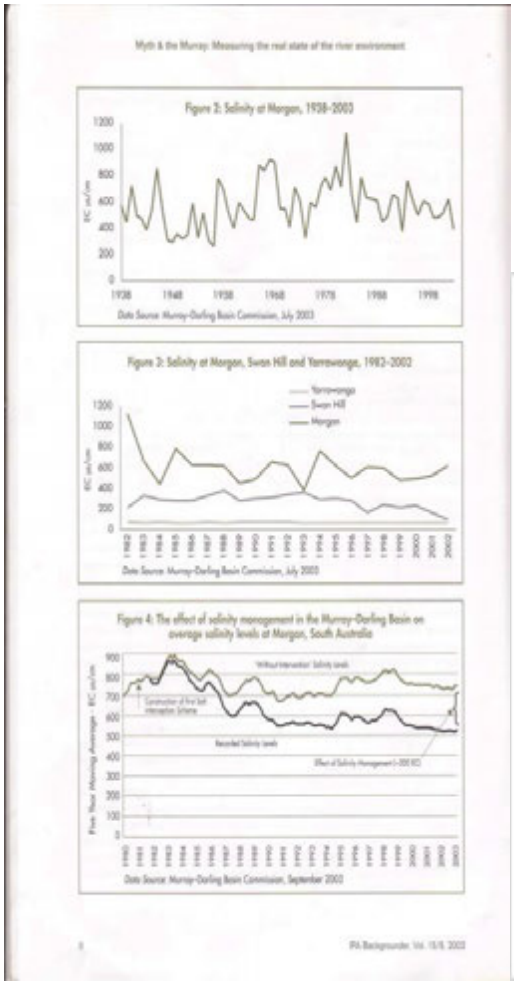
MDBA sets flow targets for the Coorong from NSW/Vic Southern Basin, and excluded any requirements for restoration of natural flows to the Coorong,now diverted by SA out to sea

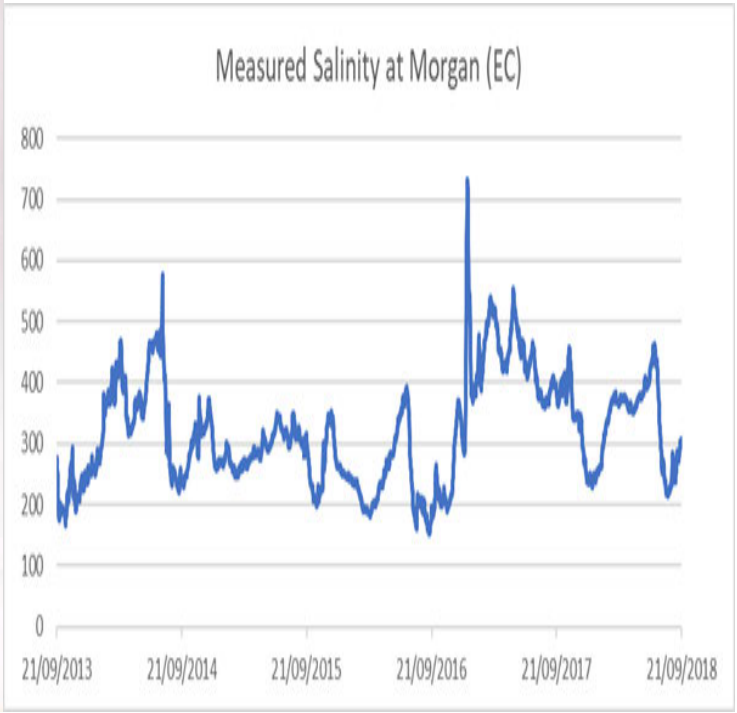
2010: MDBA (October) Guide to the Proposed Murray Darling Basin Plan

- South East of South Australia catchment not included in Basin Plan inflows

2012 MDBA Murray Darling Basin Plan (finalised)

- South East of South Australia catchment still not included in Basin Plan inflows (documented concerns – no change)
- 2750GL water recovery targets (Basin Wide); 2289GL (Southern Basin)
- MDBA decisions signal adoption of SA Government report: *Securing the Future -A Plan of Management for the CLLMM (2010)*
- MDBA adopts SA Government salinity targets and flow recommendations for Lake Alexandrina - *SA Technical Report: Development of Flow Regimes to manage Water Quality in the Lower Lakes (2010)*
- Basin Plan has specific mandated flow targets for the CLLMM which also places 'limits of change' impacts with any Sustainable Diversion Adjustment Mechanism (SDL projects).
    - 2000GL to CLLMM over a 3-year rolling average (minimum 650GL annually, 95% of years)
    - Lake Alexandrina salinity levels of 1000 EC 95% of years and 1500 EC 100% of years
    - Specifies scouring targets for the Murray Mouth using increased Murray River flows - 'mouth openness annual depth 1 meter (1.0mAHD – 90% yrs.) and 0.7m AHD, 95% yrs.)





2012 -17 Southern Basin Pilot Project (NWI Metering standards)

- Southern Basin – implemented NWI National Agreed Meter Standards
- AS4747 metering standards.
- Any water recovered through new metering standards transferred to the Federal Government (early phase SDL project). Landholders received no compensation for loss of water incurred through amended meter readings arising from the Southern Basin Pilot metering project.

2016: States deadline to submit SDL Project to be lodge with MDBA

- SDL Project requirement: 3 stages (pre-feasibility, feasibility, business case)
- Victoria had a number of existing projects, NSW limited
- States granted an additional year to develop projects/business cases
- Federal condition of funding – SDL projects to have support from stakeholders
- MDBA /Federal Government extension to timeline

2017 (30th June) State submitted SDL Projects to MDBA

- SDL Projects submitted as Business Cases, bypassing required stages requirements for Pre-feasibility, Feasibility, Business Case
- NSW and joint NSW/Vic SDL projects involving Hume Dam and Murray River operational changes, details/risks not consulted with stakeholders
- MDBA requirement: advised NSW Government NSW CMS project -Yarrawonga to Wakool Junction required flows for Murray River of 50,000 ML/d to obtain SDL score
- States submitted SDL and Constraints Management Projects without support of stakeholders (NSW; NSW/Vic joint projects
    - Projects include: Menindee; Yanco Creek, CMS, SDL, Hume Dam/River operations
- Yanco Creek Project, reduces tributary inflows to Murray River

Menindee SLD Project

- In 2019, Murray Valley stakeholders received advice that Menindee SDL project (106GL evaporative saving)- new environmental entitlement' created could be source/delivered from Hume Dam, as opposed to the Lower Darling?
- Consultation with NSW Murray General Security stakeholders on the Menindee Project limited.
- Impacts on Murray GS annual allocations from any proposed operational changes at Menindee or on the Murray River not transparent
    - Menindee SDL Business Case notes references to benefits for upstream Northern Basin
    - Menindee evaporative losses appear an important water saving measure, but evaporative losses in the Lower Lakes are not?

3.WATER SHARING

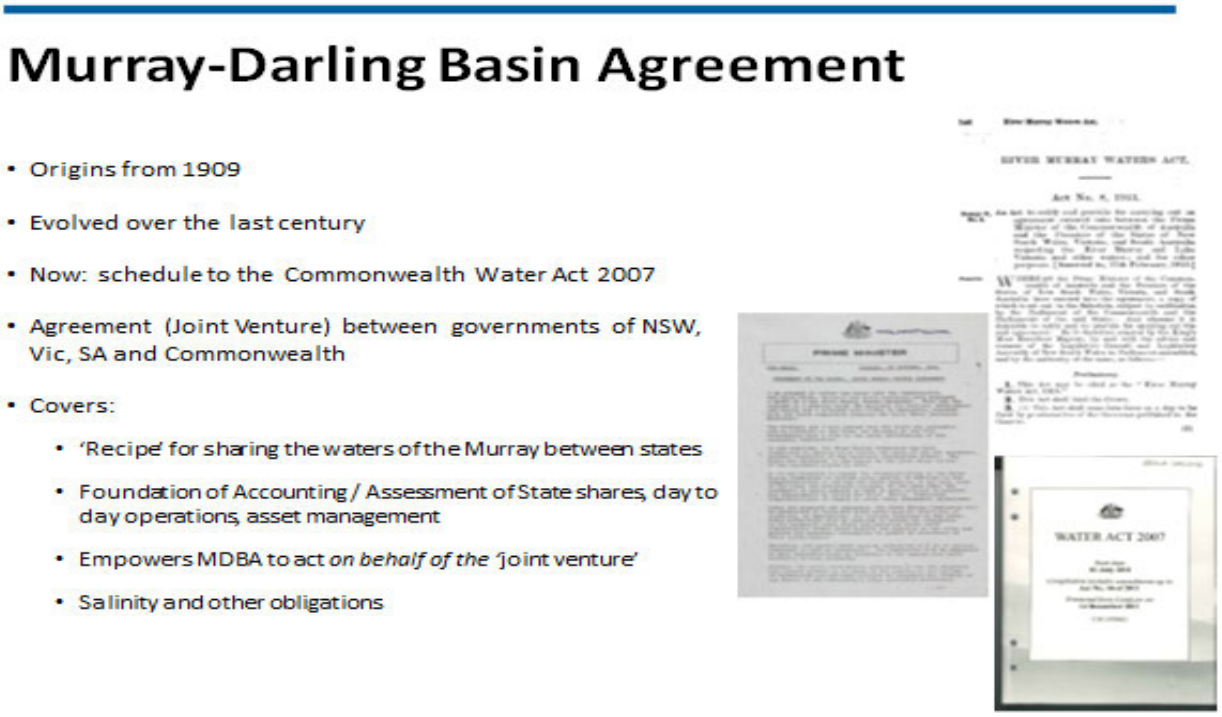


Image: MDBA

River Murray Agreement:

- Establishes rules for sharing/managing water in the Southern Basin
- Inflows above Hume and Water resources in Hume and Dartmouth dams are divided 50:50 between NSW and Victoria,
- Tributary Inflows below Hume are owned by Vic/NSW
- Over the long-term, Victorian tributaries deliver (3317 gigalitres) on average deliver to the Murray more than double that of the NSW tributaries (1543 gigalitres) (source MDBA; A Reynolds)
- Menindee Lakes shared 50:50 if levels are above 480 gigalitres (<below Menindee reverts to NSW control)
- If insufficient flows come from the Northern Basin to Menindee Lakes, present interpretations mean the Southern Basin are meeting South Australia's minimum entitlement flow until threshold levels Tier sharing arrangements are adopted

River Murray Agreement: guarantees South Australia Minimum Entitlement Flow; 1850GL[xxxix]

- Delivered as monthly flows but rules now mean SA can vary time of delivery
- Consumptive use of up to 1,154 GL per year (includes 204 GL for critical human water needs).
- Dilution and Loss of 696 GL per year (58 GL per month); and
- additional quantities for dilution as determined by the MDB Ministerial Council.

Joint Governance Framework

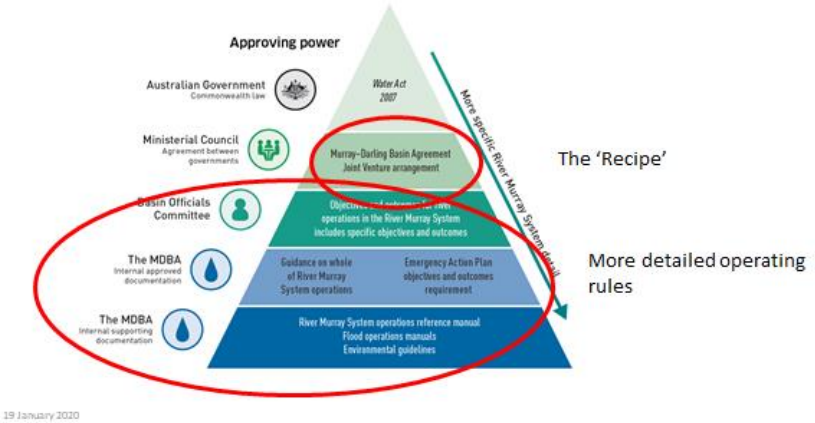
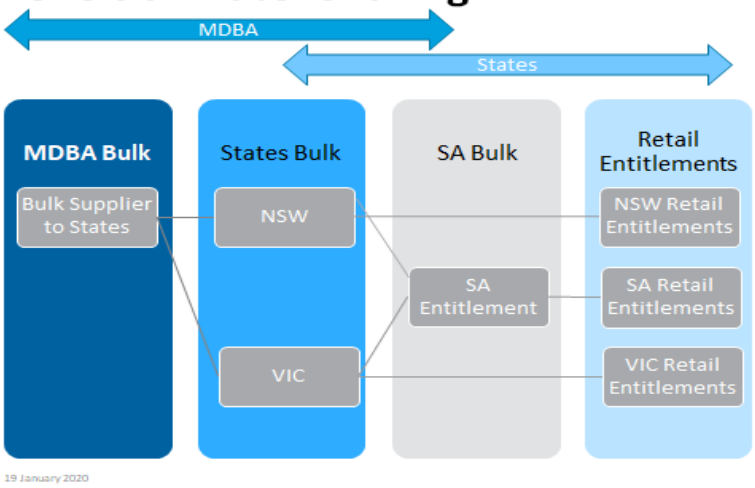


Image: MDBA

Levels of water sharing



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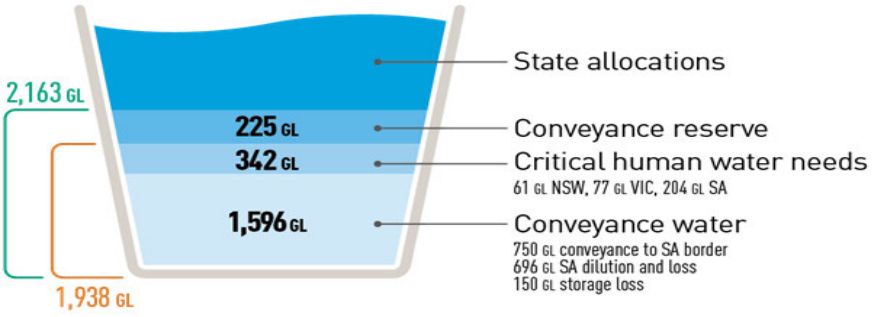
River Murray System Needs



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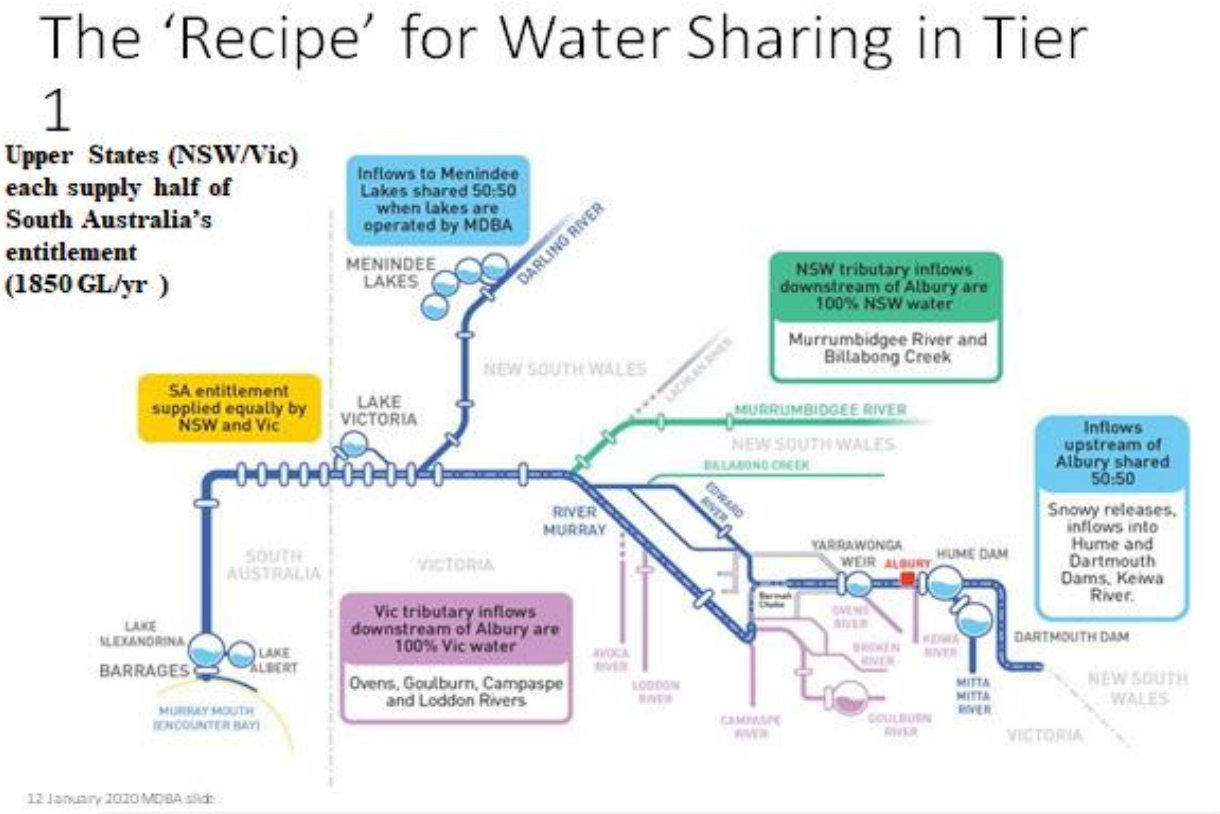
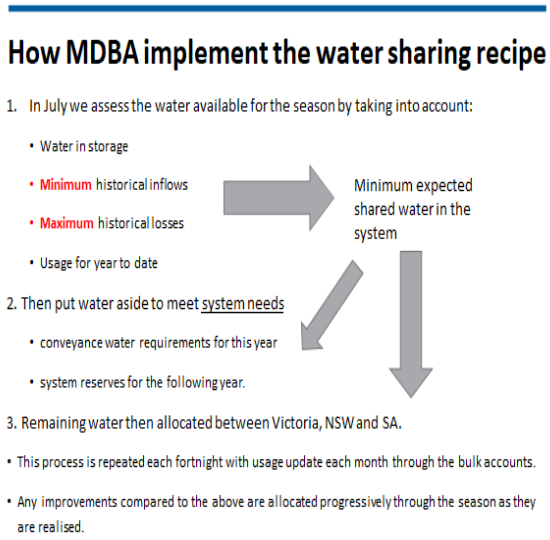
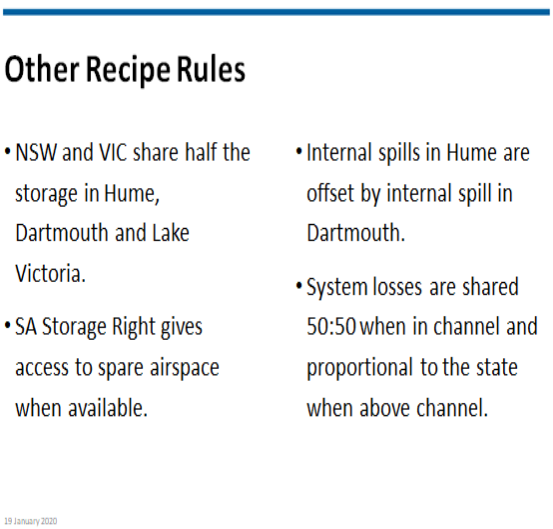


Image: MDBA

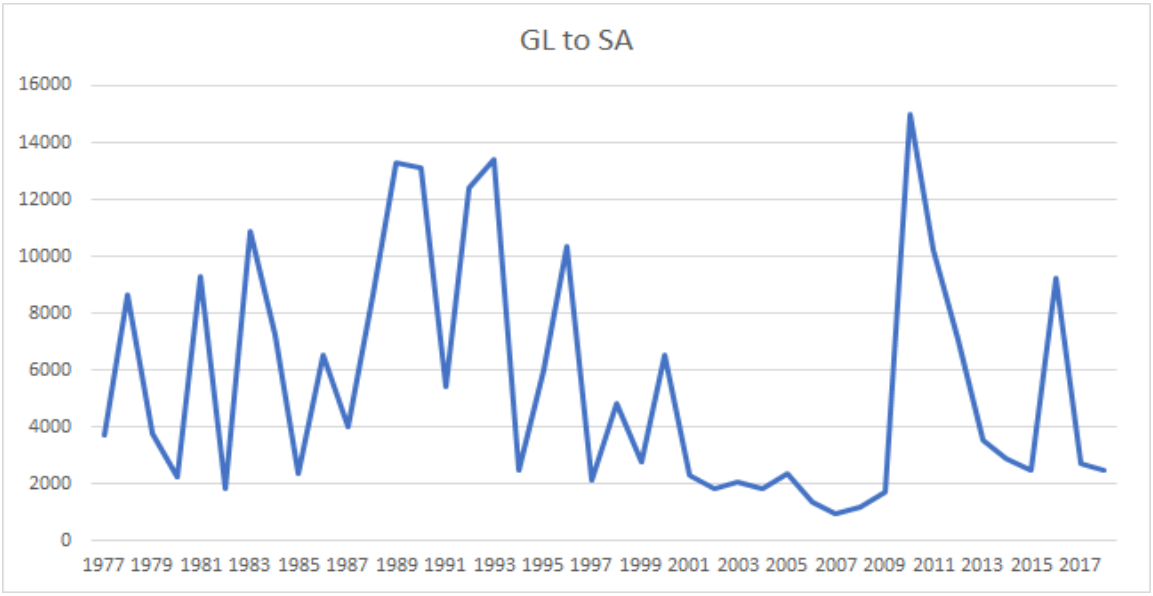
River Murray Agreement has a Tiered system:

- Tier 1; Tier 2; Tier 3, reflect inflow conditions and decisions for water management
- If the Northern Basin is not contributing inflows to Menindee, the extent of impact on NSW Murray GS allocation may depend on timing of decisions to move between Tiers (periods of special accounting)





Images: MDBA



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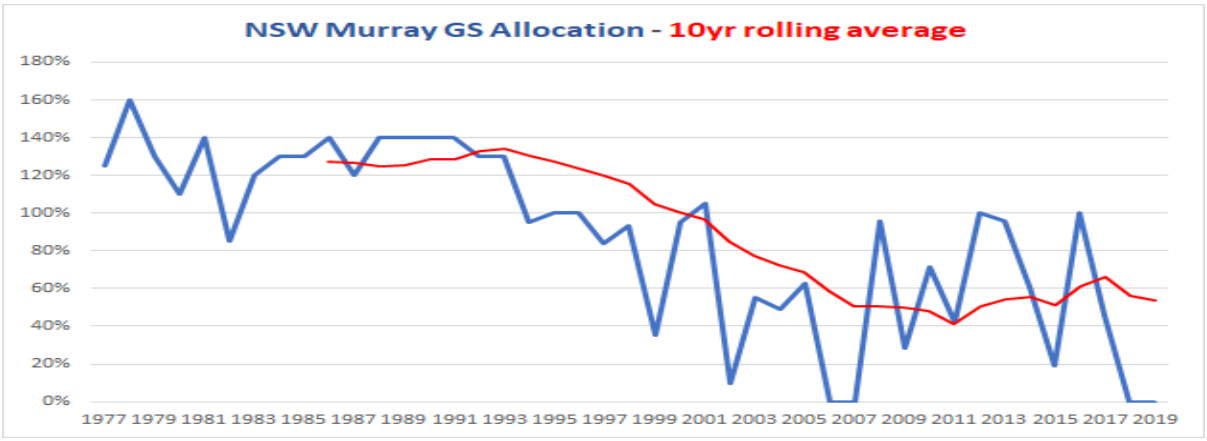
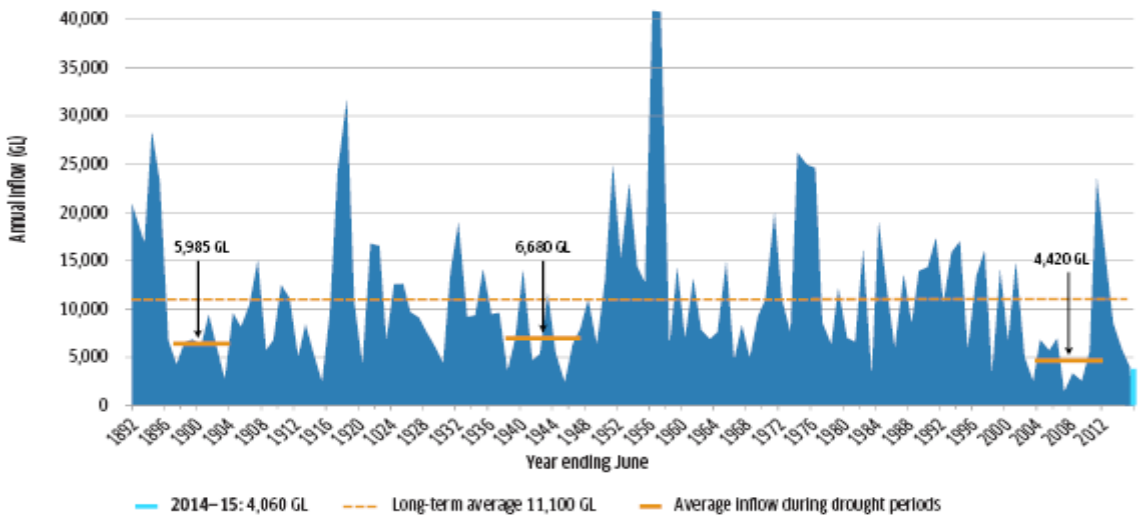
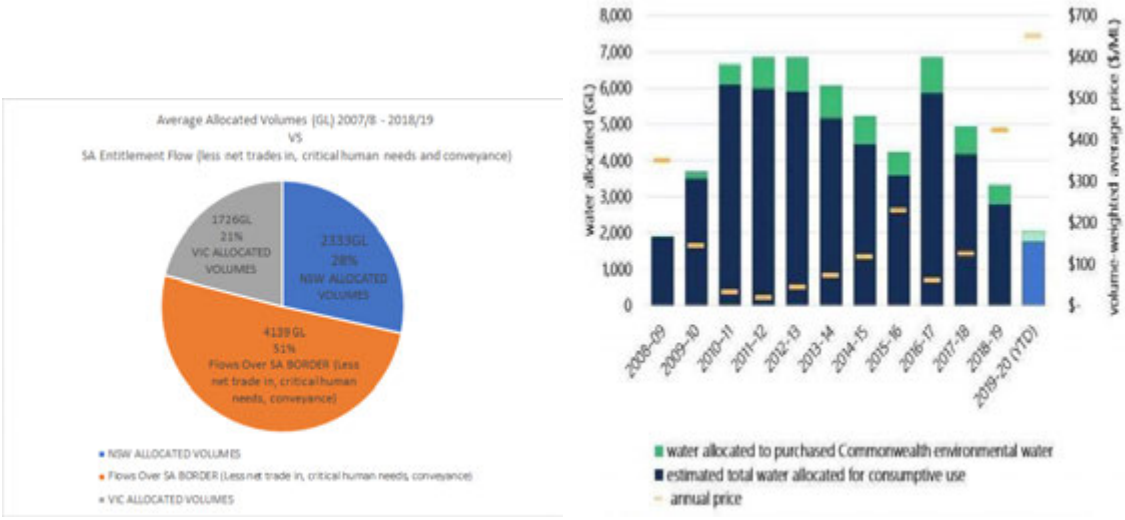


(DPIE 2020)





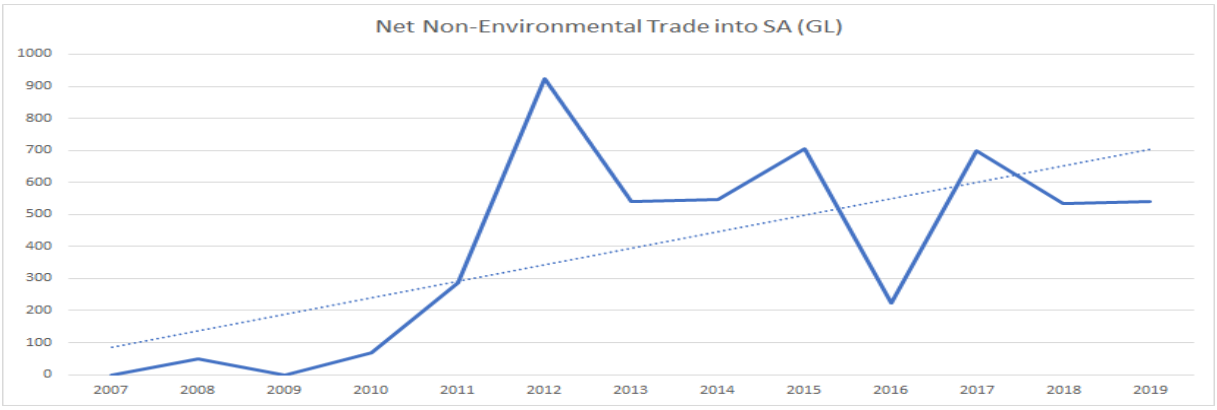


Image: SRI (Using raw data from: DPIE, CEWH, MDBA, Dept Environment and Energy, Vic Water Register, Water Connect SA 2020)

Principal issues affecting the reliability of NSW Murray GS entitlements are (but not limited to:

South Australia's entitlement flow of 1850GL has moved to:

- **Reduced reliance on Northern Basin inflows to Menindee**
- **Increased reliance on NSW Southern storages**

Murray Darling Basin Plan:

- **Sets new flow shares for SA (environmental flows) - NSW Murray and Northern Victoria**
- **Basin Plan changes delivered in Murray Darling Basin Agreement & River Operational Plans**

MURRAY DARLING BASIN AUTHORITY (MDBA)

- Murray Darling Basin Authority's failure to incorporate the principles of adaptive management and new information into the Basin Plan
- MDBA's statements regarding Basin Plan concerns (S&E) in the Southern Basin = 'no change'

- Lack of adaptive management; scientific validity of Basin Plan water recovery targets /Basin Plan; inflexibility to have alternative solutions

RIVER MURRAY AGREEMENT: Cumulative rule changes:

- Have limited effects on High Security entitlements
- Maximise impacts to General Security entitlements

SOCIAL AND ECONOMIC IMPACTS

- MDBA's Regulatory Impacts Statement (2012) described social and economic impacts as **'modest'** as a result of:
    - Government options to purchase water for the environment (e.g. Buyback, Efficiency Programs, on farm or Irrigation Infrastructure Operators)
    - Sustainable Diversion Adjustment Mechanism Projects
- Basin Plan targets 2289GL of the 2750GL Basin Plan water recovery target to be sourced from Southern Basin
    - 83% of physical water recovery for the environment has occurred in the Southern Basin primarily in NSW Murray /Northern Victoria and Lower Darling
- MDBA's conversion yield formula increases risks to NSW Murray Valley/Northern Victoria by
    - Total volumes to be recovered for the environment (incomplete, refer formula)
    - Loss of irrigation water available in the trade market
- Impacts are not confined to irrigators
    - Constraints Management Strategy
    - Regional business and communities
- Additional irrigation entitlements are still to be purchased to meet 'gap' prior to achieving SDL offset Projects scores (650GL currently scored at 605GL)

- Balance of additional water recovery to reach 2750GL will be through Government purchases and up to 650GL of SDL/CMS projects – (projects risks e.g. Menindee Lakes/Yanco/CMS) – impacts on Murray GS yield and reliability, flooding risks, 'easements to flood
    - High risks for budgetary failures with SDL projects – increased water pricing to irrigators (NSW IPART determinations)
- Potential for additional water recovery of 450GL (Basin Plan)
- MDBA statement at Joint Stakeholders meeting Deniliquin (2018)
    - new/or updated information on Social and Economic impacts arising from the Basin Plan will NOT result in amended Basin Plan decisions

RIVER MURRAY AGEEMENT: MINCO/BOC

Levels of experience in River Management at Ministerial Council (MINCO) and Basin Official Committee (BOC)

- Stakeholder concerns about levels of experience in Murray River operations
- Stakeholder concerns about interpretations /amendments associated with River Murray Agreement and Objective and Outcomes Procedure Manuals

- Relevant levels of Political /bureaucratic experience to assess impacts of on property rights of water/and broader impacts
- Decisions compromising the reliability of NSW Murray General Security entitlements.
- Decisions are made without consultation with NSW Murray stakeholders
- Consultation can be targeted at metropolitan based irrigation or farmer groups such as NSW Irrigators Council (NSWIC), National Irrigators Council (NIC) or National Farmers Federation (NFF).
    - NSW Murray Valley issues not understood or;
    - Decisions made on the basis of State/regional or broader political benefits

NORTHERN BASIN

Reduction of inflows to the Murray River from the Northern Basin to Menindee Lakes:

- Loss of inflows from Northern Basin (extraction rules changes and/or drought)
- Places higher demands on limitations of Murray River/Goulburn River to meet SA Minimum Entitlement Flows (1154GL) plus loss and dilution (696GL)
- increases reliance on Southern Basin storages for irrigation entitlements orders Murray/Lower Darling irrigators (below Weir 32)

SOUTH AUSTRALIA

Coorong, Murray Mouth (CLLMM)

- MDBA's catchment inflow maps exclude historic flow contributions from South East of South Australia's catchment to the Coorong, Murray Mouth (Basin Plan) but Basin Plan attempts to geographically replaces with additional flows - Murray River
- South East of South Australia Drainage Scheme, and Upper South East of South Australia Drainage & Flood Mitigation Scheme divert flows away from the Coorong/Murray Mouth– to Southern Ocean
- Diverted flows to Southern Ocean (volumes not transparent) note: in 2000 (450GL) diverted to Southern Ocean[xl]

Salinity Management Requirements impacting resource availability (NSW Murray)

- Outdated Salinity Risks Models – but dilution rules (x 2) still being applied
- South Australia's Additional Dilution Flow rule is linked storage volumes not official salinity levels measured at Morgan (SA). Salinity points well within /below 800EC
- South Australian Salinity Dilution/Loss rule (696GL) – applied consistently;
    - **i.** even if SA receives above its minimum entitlement flow of 1154GL
    - **ii.** flood events
- MDBA rule for SA is applied to meet baseline river health/salinity management flows, however approximately 300 GL evaporates in lower lakes
- Basin Plan: incorporates South Australia's 2 million tonnes salt export figure (Murray Mouth) flow targets despite no scientific evidence
- Basin Plan new salinity target for Lake Alexandrina:
    - 1000 EC 95% of years;
    - 1500 EC 100% of years
    - Flow targets are mandated in Basin Plan under 'limits of change'

Lower Lakes/Murray Mouth:

- Basin Plan sets additional flow volumes for CLLMM to;
    - Cover evaporative losses Lower Lakes (730 GL – 1000 GL)
    - Replace pre (1939) tidal prism /estuarine influences on the Mouth (16GL twice daily) with freshwater flows from Murray River
- 'End of system' flows over barrages to clear Murray Mouth are not metered (estimates only)
- Environmental flows will have high commercial benefits, including additional maintenance of Lake Alexandrina at 0.75AHD (above sea level); enable additional or maintenance of Hindmarsh Island canal systems, increase surety of irrigation supplies/delivery

Flow Transparency:

- Incomplete application of Nationally Agreed Meter Standards (levels of self-reporting)
- Lack of transparency of Murray River flows to South Australian (SA retains control over SA border)
    - Reporting transparency concerns, Basin Plan extra SA 2000 GL (Basin Plan flow target)
    - Above average entitlement flows (4000 – 5500GL)
- How will MDBA/SA report on full transparency on entitlement flows, environmental flows, tracking usage and how losses will/are to be accounted for

River Murray Agreement amendment enabling SA to defer its minimum monthly entitlement flows:

- Benefit to SA: above average entitlement flows or environmental flows, deliver components of 1850GL entitlement flow
    - covers SA evaporative losses Lower Lakes accounted for in 1154GL (SA entitlement)
    - provides flow requirements Murray Mouth avoids Lake Alexandrina lake level fluctuations
- Flow benefits not deducted from SA deferred entitlement flows/resource volumes

Murray River Capacity/system demands

- **Increased system demands** for SA, Environmental flows, new horticulture demands downstream of the Barmah Choke are increasing pressure for bank full or above riverbank capacity transfers of operational water
- Losses calculation are debited to total resource pool, with corresponding reduction in water availability to NSW Murray General Security Entitlements
- Above bank capacity transfers of operational water to orders downstream of the Barmah choke
- New irrigation developments downstream of the Barmah choke – add to operational losses and pressure on river capacities

Murray Darling Basin Plan flow target to South Australia border of 80 GL (80,000 ML)

- MDBA documents state 70GL (77,000 ML/d) is to be delivered from the Murray River
- To be achieved by Constraints Management Strategy
    - Flow Targets described as for meeting environmental flows

    - Documents relating to PPM rule; SDL/CMS Business cases refer to proposed higher flows as Murray River as operational changes
- The Constraints Management Strategy under current proposals will deliver 'above bank' Murray River operational rules, delivers commercial flow benefit new irrigation demands downstream of Barmah Choke
- Basin Plan therefore has/will deliver capacity to bypass existing River Murray Agreement Barmah Choke and trade zone rules

MURRUMBIDGEE VALLEY

Murrumbidgee River has 'end of valley' flow requirements, substantially less than Murray River to meet SA Minimum entitlement flow and new Basin Plan flow targets

- Large- scale new irrigation demands may place increased pressures that further limit 'end of valley' flow contributions to the Murray
- Murrumbidgee submitted Yanco SDL project reduces inflows to the Murray River and retain higher flows in the Murrumbidgee River below Gogeldrie Weir – (reduction in tributary inflows to Murray impacting on supply)

SNOWY HYDRO LICENSE: Amendments (June 2011)

New Reserve Volume has been determined by MDBA modelling and is set out in the new Schedule H to the Murray-Darling Basin Agreement.

- Murray Valley: new 225 GL conveyance reserve to ensure that critical human water needs can be met through a repeat of a drought of similar magnitude to the recent one.
    - Murrumbidgee Valley: MDBA states impact of the recent drought (Millennium) was less severe, and 150 GL to be set aside is required to support town water supply, important regional industries, and 50% of high security entitlements.

SOUTHERN CATCHMENT INFLOW MODELS

Resource calculation: ***Dry Sequence inflow model***

- Post Millennium Drought, application of precautionary principle where inflow models over 114 years are based on worst case inflow scenario for each year over the 114 years

ENVIRONMENTAL ENTITLEMENTS/WATER CHARACTERISTICS

Water Entitlements purchased by the Commonwealth were to retain same property rights (characteristics) as the original irrigation water entitlement (as at the time of purchase):

MDBA Yield Conversion Factor:

1. MDBA created a formula to calculate average yield values of water purchases across different jurisdictions in the Basin
2. The application of the yield formula by the MDBA means that CEWH entitlements have changed characteristics and have a different yield value than an irrigation entitlement
3. Yield Conversion Formula and its effects on Basin Plan water recovery targets (environment) will have higher proportional impacts to the NSW Murray Valley due to higher recovery targets
    - In 2019, CEWH water entitlements purchased/acquired = 2,830GL/entitlements

- MDBA Conversion formula still means additional water must be purchased to reach the target before the SDL Adjustment Mechanism 'allowed'
    - SDL Adjustment value (650GL, current score at 605GL)

4. MDBA Yield Conversion Factor for the additional targeted water recovery, will increase supply/demand effects on the water market and river operational issues/losses (delivered as bank full /or overbank flows)
5. Yield Conversion Formula also equals higher physical demands on Murray River system, as environmental flows schedules are to be concentrated in Spring

CEWH entitlements – other changes to characteristics?

- Concerns for how Commonwealth Environmental Water Holder (CEWH) uses its entitlements Zone 10 (above choke) and Zone 11 (below choke) and whether this breaching trade /zone restrictions
- Environmental transfers increasing pressure on system operations
- Lack of transparency/accuracy in environmental loss calculations, additional losses being borne in overall resource assessments (negatively impact yield/allocations to Murray Valley GS entitlements)
- MDBA merger of environmental entitlements (CEWH/NSW/Vic/Planned) and subsequent calculations for use/losses/return flows

Pre-Requisite Policy Measures (PPMs) MDBA mandatory condition to States

- Piggybacking of environmental flows
    - Environment flow Re-use provision
    - Minimal environmental sites have return flows (x2), formula is applied to multiple sites – Hume Dam to Murray Mouth

Environmental Flow calculations

- MDBA/CEWH Environmental models calculate losses of 20% (assumed 80% return flows).
    - There is no transparent or consultative process to verify the accuracy of this calculation
- MDBA confirm that actual return flows also are limited to two sites Barmah Millewa and Perricoota Koondrook
    - but MDBA/CEWH are using same calculations for all environmental water Hume Dam to Murray Mouth
- Barmah Millewa Forest entitlement rule is separate parcel of water described in NSW Murray Valley Water Sharing Plans, forest return flows are resumed in consumptive resource assessments
    - Indications that MDBA intends to merge (BM) entitlements delivery with other environmental water orders
    - High risks of miscalculation or no calculation of Barmah Millewa return flows to consumptive pool (affecting NSW Murray GS)
- Risk of conveyance and overbank losses – release of environmental water using Pre-Requisite Policy Measure rule (PPM) – reducing consumptive pool (affecting NSW Murray GS)

    - High levels of carryover (irrigation or CEWH) can have negative affect on resource calculations (Murray GS)
- CEWH Plans for concentration of Spring water entitlement deliveries:
    - Increase risks of water quality decline (algal blooms) and salinity spikes outside Spring
    - Increases risks to other irrigators, there will be **insufficient baseline flows** to supply irrigation orders (for smaller systems off main Murray or Edward River riverbeds)

WATER ACT 2007 TRADE REQUIREMENTS: Removing impediments to trade of water

- The National Water initiative (NWI) (2004) established property rights for water, rights recognised in State Water Sharing plans (WSP)
- The Water Act (2007) requires the removal of impediments to trade
    - ACCC Inquiry (current) – assessing barriers to trade
- Planned environmental water are rules within WSPs to protect the environment (not tradeable)
- Current Zone Trading zones recognise that the movement of water in the Southern Basin is limited by system capacity issues and are consistent with the historical design by Governments of regulation of the supply of water, e.g. construction of Southern basin storage dams; development of original Government irrigation schemes (e.g. Goulburn Valley, Murray Valley, Murrumbidgee Irrigation Schemes)
- Trade zone conditions may also be applied within private irrigation systems to recognise the physical constraints of delivering water from A to B and related sharing arrangements within a system

4. DELIVERABILITY

The Murray River is approximately 2500 km from its headwaters in the Upper Murray to its outlet in the Southern Ocean[xli]

- At Albury the stream gradient of the Murray is 125mm/1km(5inches/km) down to Wentworth, which is a mere 33 metres above sea level.
- The Murray at the confluence with the Goulburn is still 1992 kms from the Murray Mouth and a mere 124.9 metres above sea level.
- Natural physical constraints and geography mean river systems have exceptionally low amounts of fall along their courses.
- The Murray, Edward/Wakool system and Murrumbidgee Rivers have significant bends and water travel time is accentuated because of significant natural river bends in the rivers
- Mildura is still 878 kms from the Murray Mouth but only 34.5 metres above sea level.
- The last 100km to the Murray Mouth in SA falls at 12mm/km (half an inch/km).
- Transfers of water to South Australia incur major transmission/conveyance losses [xlii]

Flows to South Australia from the Murray River are affected by natural river system capacities and constraints. This includes sizes of natural riverbanks, natural restrictions (e.g. chokes), inflows from Northern Basin, inflows from Victorian and NSW tributaries. MDBA define system constraints as structural constraints; physical barriers either natural or built; or non-structural

constraints: operational rules either chosen by operators or formalised by agreements or legislation

Exceeding system constraints is recognised as increasing regional flooding risks, causing adverse environmental impacts such as bank slumping, creating agricultural pollution runoff from flooding, hypoxic blackwater events in warmer seasonal conditions.

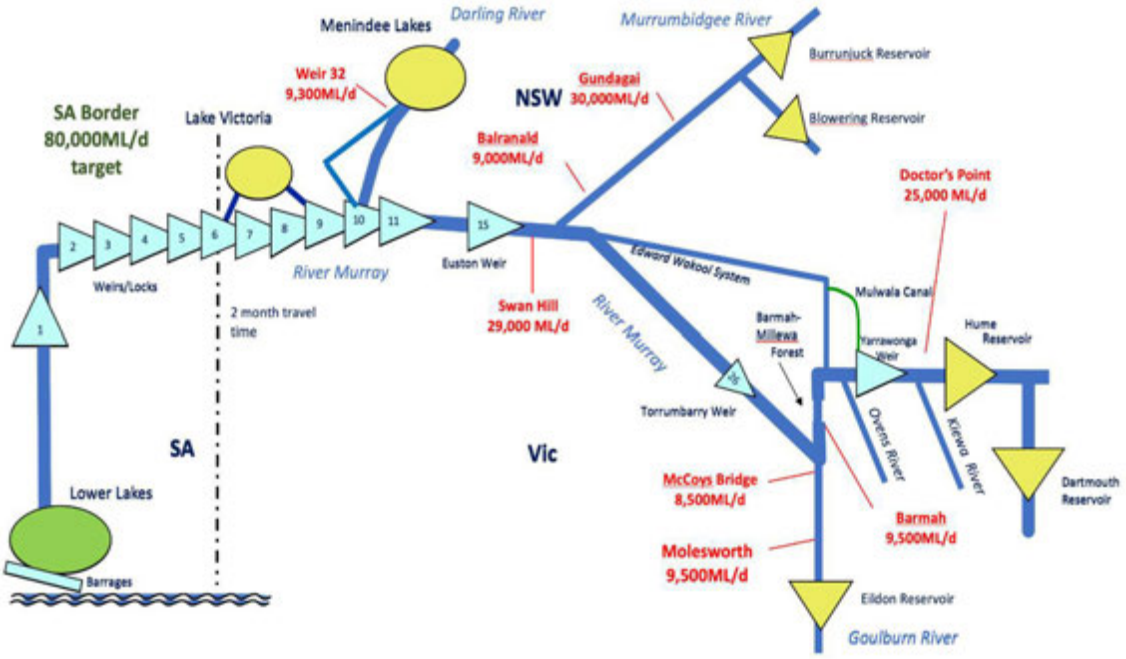


Image: Murray Darling Constraints Modelling Report: 16.12.19

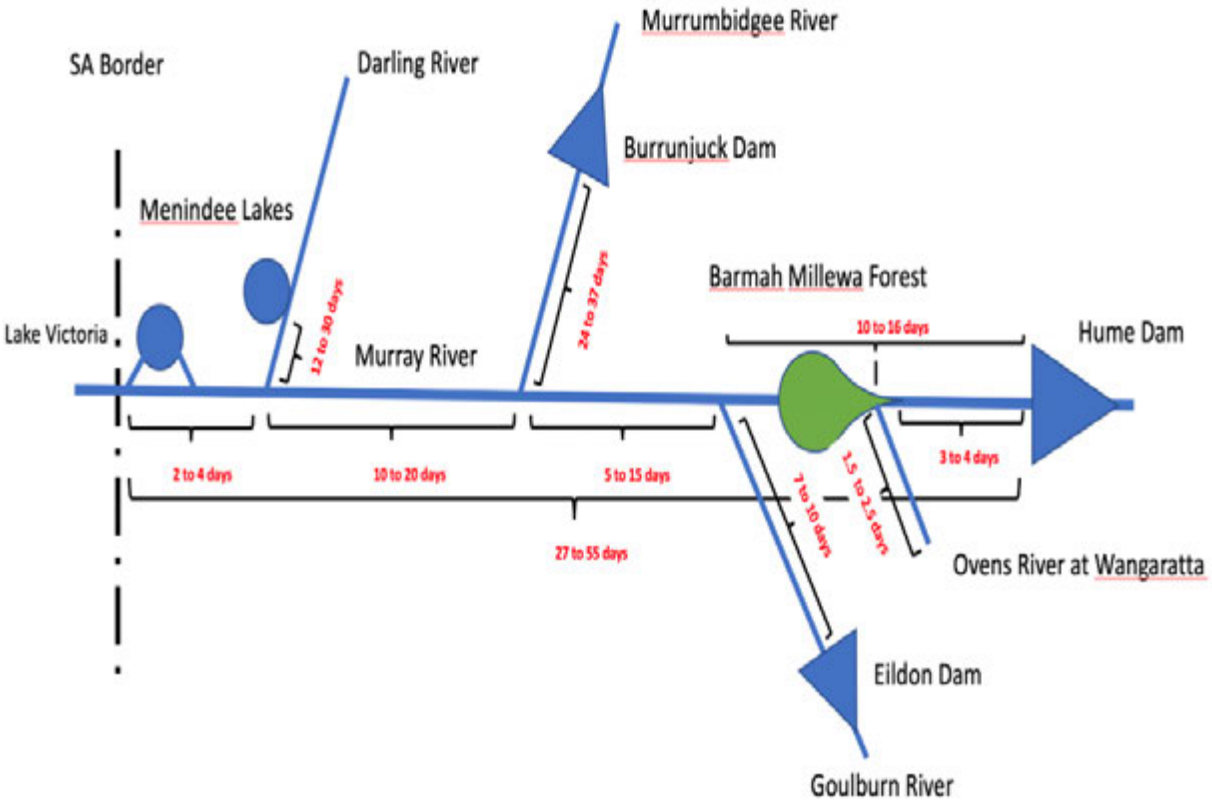


Image: Murray Darling Constraints Modelling Report: 16.12.19

MDBA - delivery risk mitigation measures;

- Bulk transfers below choke; Lake Victoria
- Intervalley Trade options
- Transfer of additional water around Barmah Choke (Edward Wakool system & Murray Irrigation Limited infrastructure)
- Sustained releases from Hume to through summer
- Surcharging weir pool in the mid Murray below Choke (e.g. Euston Weir)
- Other sources e.g. Lake Boga

MDBA - risk factors for delivery shortfalls[xliii]

- timing decisions to bulk water transfers to Lake Victoria
- increased demands downstream Barmah Choke include new and future demands from increased horticulture plantations
- Limited storage capacity in Lake Victoria to supplement flows from upstream storages
- Climatic demands (e.g. heat waves)
- Trade related demand changes (e.g. from Goulburn River to SW of Victoria/SA)

What are delivery shortfall options/risk factors for General Security (GS) entitlements?

- MDBA/Basin Governments – apply temporary water restrictions inequitably (e.g. NSW General Security)
- Location of GS entitlements will determine scale of risk (timing of restrictions and capacity to make up delays more likely to impact delivery in smaller systems)
- Constraints Management Strategy enables commercial irrigation delivery downstream Barmah and Edward Wakool system natural chokes
- Operational losses from 'above bank capacity' deliveries are accounted for in total water resources, impacting GS entitlements
- Delivery of operational water and environmental water 'above capacity' reduces loss accountability

River Murray Agreement (historically)

- Relied on combined system inflows
- Storage volumes + inflows from Murray, Goulburn, Murrumbidgee + Darling River Systems

What are chokes?[xliv]

- There are multiple system chokes on the Goulburn, Murray and Edward/Wakool river systems
- Millewa Choke (Murray) capacity was 10,600 now < 9,500 ML/d
- Barmah Choke (Murray) capacity was 8,500 now < 7,000 ML/d
- *The Barmah Choke contributes to a number of operational and policy challenges in the River Murray system, including:*
  1) Delivery of sufficient water to the lower Murray to meet peak irrigation demands;
  2) Delivery of sufficient water to Lake Victoria to supply South Australia;
  3) Management of rain rejection1
  4) Delivery of future environmental flows; and events that can lead to undesirable flooding of the Barmah- Millewa Forest;
  5) Constraints on the trade of water.

- Barham choke (Murray) capacity in flood events is 36,000 – 37,000 ML/d
- Edward River offtake capacity is 1600ML/d with multiple chokes downstream in Edward/Wakool system
- Goulburn River choke (Molesworth) is 9,500 ML/d;

Murray River flow demands:

- Murray River operations (existing)
- Includes: River Murray Agreement SA minimum entitlement flows (1154GL + 696GL dilution/loss)
- Additional: Basin Plan target 2000GL (3 yr. rolling average; 650GL delivered annually)
- Additional: Basin Plan flow target of 80GL, primarily relying on increased flows down the NSW Murray and Goulburn River systems.
    - The proposal to deliver 60 – 80GL to SA Border) would typically mean a peak flow of 160,000 ML/d from at least 3 of the 4 major river systems. This is due to significant flow attenuation and the natural misalignment of contributory peak flows from the four regions." (HMROCSCS-Hydrological Modelling of Relaxation of Operational Constraints in the Southern Connected System 2012)
    - MDBA documentation/modelling states 77GL of the 80GL was to flow through the Mid Murray (below Yarrawonga Weir)

Modelling river hydrology for operational purposes [xlv]

- River operators forecast future:
    - inflows from tributaries downstream of storages
    - demand from water users (i.e. what is needed to be supplied)
    - conveyance losses (i.e. leakage, seepage and evaporation losses that occur while the water is in transit and storage) travel times (i.e. the time it takes for the water to arrive at where it is to be used, a factor that is dependent on flow magnitude and antecedent conditions).

System Losses: Current

- Storage loss = 150GL
- Conveyance Reserves = 225GL
- Critical Human needs = 342GL (61GL NSW, 77GL Vic;204GL SA)
- Conveyance to SA Border = 750GL
- SA loss and dilution – 696GL
- Unaccounted flows: MDBA data state average flows to SA border 4000 GL, long term average 5100GL (MDBA Live River data long term avg is 5549GL)
- (2009) The Guide to the Basin Plan Technical background stated "13.8% of the consumptive pool is accounted for by transmission losses."

System Losses: New/emerging Risks:

1. Increased development downstream of Barmah Choke (pressure on Murray /Edward Wakool/system losses)
2. Breach of trading zones and lack of transparency on losses
3. Lack of transparency with environmental water orders (losses calculations)
4. System losses occur (or increase) in any bypassing the Barmah Choke option

Victorian Government: Fact Sheet Water supply and Demand; *An assessment of water availability and horticulture water demand in the southern Murray-Darling Basin (2019*)- Report summary:

- Horticultural demand is concentrated in the Lower Murray Region and physical system constraints can limit the availability of water that can be traded or delivered to the region
- Estimates for current horticultural water demand (i.e. from tree plantings like grapes, fruit and nuts including almonds) is 1,230 GL per year and will grow to 1,400 GL once all current plantings reach full maturity. (55% higher than recent estimates by the Australian Bureau of Statistics):
- <u>If horticulture manages to meet this demand by purchasing water on the market, there would be little water left to supply other irrigated industries (Figure 2), and there could be increased water market prices.</u>
    - During periods of extreme dry water availability (like a repeat of the worst year of the Millennium drought), horticultural water demand will be similar to all surface water that may be allocated for productive use in that year.
    - Not all of the water available in the southern Murray-Darling Basin will be available to supply horticulture, decisions of entitlement holders in other industries and the constraints on trade from system connectivity, physical constraints and trade limits.

Murray Darling Basin Plan (2012) 2750GL

- MDBA acknowledged Hume Dam to Yarrawonga Weir Legal constraints when setting Basin Plan flow targets to SA border
- MDBA advised Federal and State Governments that 'system constraints' would not impede new Basin Plan flow targets to SA border.
- Despite Stakeholder documented advice since 2010, MDBA continued to report '**<u>no</u>** system constraints issues' within 2750GL Basin

Murray Darling Basin Plan (2012) 450GL 'up-water': (2750GL + 450Gl = 3200GL)

- MDBA advised Federal and State Governments that system constraints <u>only applied t</u>o the additional 450GL
- South Australian Premier Weatherill threatened the Federal Government with a High Court challenge in 2012, if the amount of water recovered was not increased from 2750GL to 3,200GL.
- Federal Labor Government negotiated an additional political deal.
    - An extra 450GL and a further $1.775 billion was added to the Basin Plan
    - Funding announcement included a 'relaxed constraints' strategy and mitigation costs of $200 million in order to deliver the 450GL prior to any actual assessment of scale or cost benefit analysis
    - The Water Amendment (Water for the Environment Special Account) Bill 2012, included the legislative proviso that the $1.775 billion fund set aside may only be used for "water to be recovered and constraints to be removed without negatively impacting on the wellbeing of communities in the Basin**.**
    - Subsequent flow modelling in the 'Hydrologic Modelling of the Relaxation of Operational Constraints in the Southern Connected System' stated that 17 out of

the 18 chosen environmental icon sites could be watered with the addition of the 450GL. However, the modelling assumed that river operating, and physical constraints were relaxed or removed.
    - No evidence has been provided on the importance of these sites, what additional specific flow requirements are needed for each site and how many of these 17 out of 18 sites relate to actual Murray River flows (i.e. location in the basin)
- In December 2019, Murray Darling Basin Ministerial Council (MINCO) agreed to revise the social and economic impact risks with the 450GL 'up-water'

MDBA Pre – Requisite Policy Measure rule (mandatory)[xlvi]

- PPMs are made effective through inclusion in relevant river operations instruments, including the Murray-Darling Basin Agreement and the Objectives and Outcomes for River Operations in the River Murray System
- PPMs will manage and account for the release and use of held environmental water
    - To account for and protect 'return flows' of water for the environment which can be used for environmental purposes downstream (environmental flow reuse).
    - To provide for piggybacking. Water for the environment can be released on top of unregulated flows. Environmental water holders will be able to order water from storage during regulated or unregulated flow events
- Prerequisite policy measures are legislative and operational rule changes that improve the use, management and accounting of water for the environment in the southern-connected Murray– Darling Basin
- These measures are made by states through: • state legislative changes • amendments to local water sharing plans • changes to regulations and operational manuals • the new water resource plans.
- NSW will apply conservative estimates of environmental water use where there is uncertainty or a lack of information
- Implementation of these policy measures must ensure that reliability of other water entitlements are not adversely affected.
- The MDBA is responsible for coordinating the implementation of PPMs for the shared resources of the River Murray, on behalf of New South Wales, Victoria and South Australia.
- Whenever an environmental watering event relies upon an action that requires the use of an assumed use method, an Assumed Use Statement shall be prepared that sets out the calculation of the volumes of water debited from Water Access Licence accounts, and (where relevant) the volume of water accounted as environmental water that is passed into the downstream system. NSW Department of Industry | INT19/30886 | 6

Issues:

- Accuracy of 'assumed' environmental water use and return flows
- PPM rule notes reference in future to 'other' orders (non-environmental)
- PPM linked to Constraints Management Strategy, enabling future commercial benefit from taxpayer funded processes
- PPM re-use requirements (MDBA calculations) assume all environmental sites have return flows (Hume Dam to Murray Mouth) lack of evidence/transparency)

- Piggybacking and losses arising 'overbank flows'
- Elevated flooding risks (Murray; Edward Wakool; Goulburn)

Basin Plan: Constraints Management Strategy (CMS)

2012: Parliament of Australia: Senate Standing Committee on Rural and Regional Affairs and Transport Hansard – Management of the Murray Darling Basin Inquiry:

Ms Jody Swirepik, Executive Director, Environmental Management, Murray-Darling Basin Authority (Hansard November 2012)

> *"As Dr Dickson said, there are environmental outcomes we were trying to achieve and desirable flow regimes that we thought were linked to achieving those outcomes. We have made an assessment across the whole of the basin with that in mind. We set the environmental outcomes and desirable flow regimes from a purely environmental point of view—what we would like to actually achieve. We knew right at the very beginning that some of the flow regimes we were identifying, which we know are good for the environment, are actually quite large floods.*

Constraints Management Strategy (CMS):

- Initially described to public as necessary for delivery of environmental flows (Basin Plan)
- MDBA advised CMS issues not relevant in 2750GL Basin Plan target (only relevant to additional 450GL)
- Links to Pre-Requisite Policy Measure rule change
- Lack of clarity why 'overbank' flows required (Basin Plan) but not under Living Murray /Infrastructure Investments (>$500 mill)

Basin Plan objective: Hume Dam to Yarrawonga Weir

Current Legal conditions (25,000 ML/day); Basin Plan objective: (40,000 ML/day)

- Legal easements on private land to limit flows to 25,000 ML/d took 12 years to negotiate/implement to aid irrigation flows downstream
- Exceedance causes flooding on private land
- Other system constraints, smaller rivers/creeks

Murray River: Yarrawonga to Wakool Junction

Flow objectives to exceed natural riverbanks: Basin Plan objective: 77,000 ML/d

- Tocumwal to Barmah Choke
  - Millewa Choke capacity < 10,600 ML/d (sedimentation now reduced to <9500)
  - Barmah Choke capacity < 8,500 ML/d (sedimentation now reduced to 7,500)
- Relevant flood factors:
  1. Murray flows upstream of Barmah Choke force floodwaters North to Edward Wakool system)
  2. Murray flows downstream of Barmah Choke force floodwater North (Edward Wakool)
  3. Murray River choke at Barham – Peak Flood Chokes 32,000 - 36,000 ML/d

4. **Combined Murray and Goulburn floods mean up to 80% Murray Flood water** leaves Murray River upstream of Goulburn River confluence (further elevates flood risks in Edward Wakool

- At the University of Melbourne Water Security Series October 2019 Joe Davis, Senior Director of Operations Improvement at the MDBA stated that the Barmah Choke river channel capacity was currently at 9,500ML/day and they were undertaking modelling to investigate how delivery risks are changing and key factors driving that risk. (Melbourne University, 2019)
- The result of this management is that the natural constraints of the system are reducing as indicated by analysis in 2008 citing it at 8500ML/day (MDBC 2008) vs analysis in 2019 to 7000ML/day (MDBA 2019) or a drop of 21.4% or 1500ML/day. Development approved by local and state governments has been on the rise and therefore demand has soared, unabated. It must be clarified by the MDBA what actual figure for the choke channel capacity they are using in their investigations and modelling.

Edward River (NSW) Offtake

- Maximum capacity 1600 ML/d;Multiple chokes Edward Wakool system
- Edward River (Picnic Point Mathoura) is an anabranch of the Murray with return flows to the Murray at downstream Kyalite
- Gulpa Creek capacity is 350ML/d
- Stevens Weir section of the Edwards River capacity is 2700 ML/d
- Other system constraints, smaller rivers/creeks

Murray Irrigation Limited (NSW): Irrigation canal/channel system offtake

- Mulwala Canal at Yarrawonga is 10,000 ML/d
- Irrigation Canal system reduces to reflect telescopic system design
- Irrigation Schemes has a number of 'escapes' to Murray or Edward River
- Escapes flows are limited in design to reflect capacities of Edward/Wakool River system

Yarrawonga Weir (Vic) offtake

- Canal capacity is approx. 3,100 ML/d discharge capacity to Victorian irrigation system
- System has limited return flows directly to the Murray River

Murrumbidgee River

Basin Plan objective: 40,000 ML/d

- Murrumbidgee River has capacity limits, including but not limited to Tumut; Wagga
- Hay to Balranald, channel capacity diminishes to 7000 ML/d at Balranald
- Note: unclear what % of MDBA proposed 40,000 ML/d flow target would transfer to actual increases in end of valley flows)

Goulburn River - Eildon Weir to Murray River

Basin Plan objective: 40,000 ML/d

- Upper Goulburn receives variable and high-speed tributary inflows - (catchment rain)
- Upper Goulburn River limits (Molesworth Choke) = capacity limits 9,500ML/d
- McCoys Bridge =8500ML/day
- Goulburn River Flood Levee Bank capacity at Shepparton

Regional Flooding Risks occur or factors increase:

- Murray River floods can occur from Hume Dam
- Murray River floods from Ovens (Vic) tributary inflows
- Murray River floods occur if merging of Murray + Ovens Rivers high flow events
- Murray, Edwards/Wakool system floods increase if Goulburn River is in flood.
- When the Murray and Goulburn are both in major flood, up to 80% of Murray River flood flows are forced North into the Edward Wakool System (Goulburn floods back up Murray Floods near Barmah Lakes)
- If the Campaspe River (Vic) merges with the Murray at Echuca
- If Murrumbidgee/Yanco/Billabong floods merge with Murray /Edward Wakool floods
- If the Barmah Millewa Forest has been pre wet, regional flooding risks increase
- Goulburn, Campaspe, Murray are in flood (upstream Perricoota Koondrook, Torrumbarry) ,increased regional flooding risks Edward Wakool system
- In major floods, Barham maximum bank capacity is 35,000 ML/d. Flows exceeding this are pushed northwards into Edward Wakool system
- Basin Plan and environmental water management and flow targets will increase the risks, timing, frequency and duration of regional flooding

Murray Darling Basin Authority has received documentary evidence on flow target risks from October 2010:

- Information has not altered MDBA Basin Plan flow targets or water recovery decisions
- MDBA did/has not amended advice to Federal /State Governments that 'capacity' constraints would limit the deliverability of MDBA proposed Basin Plan flow targets to SA
- MDBA has not enabled or sought an adaptive approach, new information, or alternative strategies in regard to flow targets they had set (in line with SA) for the Murray River and CLLMM
- MDBA has been very explicit, during stakeholder Meeting (Deniliquin) MDBA advised 'there will be no changes to the basin plan based on new reports on social and economic impacts. This is contrary to the Basin Plan, Australian Government, Water Act 2007 (2019), section 21; General Basis for which Basin Plan is developed: (4) (b*); act on the basis available scientific knowledge and socio- economic analysis*. This section in the Water Act (2007) suggest:
    - Basin Plan is open to adaptive management and incorporation new information
    - MDBA appear in direct contravention

October 2010:

- **MDBA managed the release of environmental flows from Hume Dam and artificially retained Murray River flows at up to 20,000 ML/d**
    - Property access Mid Murray was negatively impacted
    - Harvest delays due to roads, low level creek crossing under water caused major localised crop losses (delayed harvest/rain event)

September 2016

- Mid Murray experienced natural flood (flow rates approximately 77GL -approx. 86GL (77,000 ML/day to 86,000 ML/d)
- This natural flood mirrored MDBA Basin Plan flow targets for the Murray River
- Flood waters extended over rural roads up to ¾ hour away from the Murray River
- Some level of private property impacts

- BOM reports period as one of the 'wettest years on record'
- BOM forecast 100 ML/rain
- MDBA reduced releases/outflows from Hume Dam to regulated summer levels

October 2016

- September flood conditions still prevailed in the Mid Murray (system exceeding capacity)
- BOM forecast rain event occurred
- A Catastrophic flood event resulted in the mid Murray causing failure of the Central Murray Floodplain Plan and associated flood levee system
- Flows under Tocumwal bridge recorded at 204,000 ML/d
- Flows of 60,000ML/day over the South Australian border commenced on 11th November 2016, peaked at 94,246ML/day on 30th November and were then in excess of 65,000ML/day reaching approximately 74,000 ML/d day over the barrages until 18th December 2016.
- Flows reached SA border in December recorded 95,000 ML/d on 30.11.2016
- Flows reached SA Barrages in late December recorded at approx. 74,000 ML/d (estimates only as not measured)
- 3 weeks after Murray flood reached SA Murray Mouth, dredging of the Mouth was resumed reaffirming historical records that show increased flows down the Murray are not a solution for sedimentation risk in the Murray Mouth
    - Dredging operations at the Murray Mouth commenced on 9th Jan 2015
    - At 29th Dec 2019, a total of approximately 5, 183, 071 cubic metres of sand had been removed by dredging operations." (River Murray Flow Report 3rd Jan 2020- Dept for Env. and Water, SA Govt.) 2 dredges have operated most of the time since 2015.
- Murrumbidgee, Murray and Mid Goulburn, flows to South Australia were of the volume, or in excess of the volume, being proposed by the MDBA under the Constraints Management Strategy, that is in excess of 60,000ML/day for over 5 weeks at the border.

MDBA: Response to constraints/flooding risks (Upper Mid Murray) (pre 2016)

- Request by landholders for improved response to future flooding risks and amendments to Basin Plan.

MDBA Minutes (Dec 2016) response

"landholders were irresponsible with their infrastructure"

- No changes to Murray Darling Basin Plan or flow targets to SA
- David Dreverman, (MDBA Executive Director River Management), conceded in the Senate Estimates Hearing February 28th 2017, that the flood flows over the SA border of in excess of 60,000ML/day for 5 weeks from 11th November to 18th December and peaking at 95,000ML/day during the 2016 floods were not sufficient to scour the Murray Mouth of sand. Mr Dreverman stated he was surprised as they were expecting a "little bit more scouring." Dredging at the mouth recommenced 3 weeks later on 9th January 2017, despite the fact that flows "hit 75,00ML/day over the Murray Mouth barrages"

MINCO/BOC/MDBA – Post 2016 October Flood

- 'Lessons Learnt document (December 2016) found no MDBA management issues
- Post 2016 Flood: MDBA not amended Basin Plan targets, or provided a public flood risk analysis of its Basin Plan flow targets for the Murray, Edward Wakool system, Murrumbidgee or Goulburn Rivers
- 2016 Catastrophic flood confirmed that Basin Plan flow targets of (65-77GL) will elevate major regional flooding risks (A September 2016 flood mimicked Basin Plan flow targets)
- MDBA classify minor flood levels below Yarrawonga – Tocumwal as 77 GL)
    - Review needed to understand significance of term 'minor flood'
    - 77GL ensures flood waters across private land up to ¾ hour from Murray River

Political Responses to Constraints Management Strategy:

- Assistant Federal Water Minister Ann Ruston stated at a Senate Inquiry into the Basin Plan and Constraints February 2017 -*"The Federal Government will not be funding any of the activities of the State Government in this space if the conditions for landowners are such that they do not wish us to proceed with it. That safety mechanism goes without saying no matter how far down the track we go in trying to achieve outcomes*."
- The Victorian Government recognises that "*any relaxation of constraints will pose third party flooding related risks which can impact public and private land, infrastructure, stock and people*." The Victorian Water Minister, Lisa Neville has stated, "*Victoria will not flood private property without consent, or undertake compulsory acquisition of land or easements," and these measures must be agreed to by landowners*
- Retired Commonwealth Environmental Water Holder, David Papps at a Deniliquin meeting with Stakeholders, acknowledged that timing would need to be' perfect' and it would be very difficult to achieve this proposed target.
- The Federal Government also wrote in a letter to landowners, "*environmental watering that would flood private land will not be undertaken by the Commonwealth Environmental Water Holder without the consent of the landholder."*
- Victorian Water Minister, Lisa Neville, has directed the Goulburn Constraints Management Project (option for 17,000ML/day) and will not allow overbank flooding of private property. The initial proposed flood flows proposed by the MDBA were 40,000ML/day at McCoy's Bridge. (note: current capacity constraint 8,500 ML/d)
- Landowners in the Upper Goulburn Catchment in Sept 2015 signed a statement refusing to negotiate easements or allow man-made flooding of their private property.
- The MDB Constraints Modelling Review Report by NSW and Vic. Minister's Independent Expert Panel- Dec 2019 Page 4 stated that the Panel considered there was insufficient information in a wide range of aspects of the constraints project. As such the panel has been advised that given these uncertainties, "river operators will not be creating 'managed' 80,000ML/day flows at the SA border."
- MDBA Annual Report 2018-2019 P33) state: SDL projects cannot be expected to deliver 605GL, as "of the notified SDLAM projects, the constraints measures contribute to approximately one third of the total supply adjustments and are co-dependent.
- The Independent Expert Panel review of the MDB Constraints Modelling said it *"considers that continuing with the existing approach given the current community*

concerns whilst maintaining the June 2024 deadline for completion, has a high chance of failure."

Stakeholder Responses Constraints Management Strategy: (Upper Goulburn River)[xlvii]

- MDBA target for running the Goulburn at or near the top of bank flows, combined with the proposal to " piggy-back" releases from Eildon Weir on top of high tributary flows (now known as Hydro Cues), is of great concern to floodplain landowners who from experience know the unpredictability of fast flowing floods in the Upper Goulburn Catchment and fear that they will severely impacted
    - The Victorian State Water Minister, Lisa Neville has previously publicly stated:
    - All Goulburn flows will now be in-channel to top of bank
    - No flooding of private property
    - In relation to the 450GL up water, NO further recovery of water due to severe social and economic impacts that have already occurred and would occur.
- Page xiii Hydrologic Modelling of Relaxation of Operational Constraints in the Southern Connected System states:
    - "Undertaking detailed assessments and analysis to identify whether any of the constraints tested in this study could actually be relaxed was not within the scope of this report."
    - In other words, the decision to proceed with a Constraint Management Strategy in order to deliver greater volumes of environmental water downstream was based on no evidence whatsoever that the channel restrictions in the 4 major river systems or the multitude of other constraints throughout the basin could, in actual fact, be 'relaxed' and the proposed flows actually delivered.

The Constraints Management Strategies are simply not feasible nor are they technically achievable and the proponents are now discovering the insurmountable problems of attempting to 'relax' constraints. Some of these myriad constraints are:

- The natural physical landscape and topography and river channel capacity which can never be mitigated or overcome.
- The steep mountain and hill country particularly in the Upper Goulburn Catchment where unpredictable, flash flows occur
- **T**he natural river channel capacity in the major river systems of less than 9,5000ML/day above which flooding starts -Molesworth Choke in the Goulburn,
- River travel time lag -6 days from Eildon Weir to McCoys Bridge in the Lower Goulburn Floodplain:
    - Lake Eildon to Trawool – one to two days.
    - Trawool to Seymour – zero to one day.
    - Seymour to Shepparton – one to two days.
    - Shepparton to Loch Garry – one day.

    - Loch Garry to McCoys Bridge – one day
- Run of river losses- not accounted for in business case strategies. Changes in loss behaviour for events which move from in-channel to overbank have not been considered.
- MDBA Proposed flow targets will increase flooding risks on the Goulburn

Stakeholder Responses Constraints Management Strategy (Murray/Edward Wakool River system)

- Post 2016 flood, Stakeholders reaffirmed in documentation/meetings to MDBA, State/Federal Governments the need for changes to Basin Plan targets, not feasible as proposed, do not have community /stakeholder support
- Events confirmed the MDBA Basin Plan flow targets for Central Murray will elevate regional flooding risks
- NSW Government decision to proceed with SDL/CMS projects as State Significant Development (increased opportunity to fast track decisions/reduce objections)
- NSW Government's Water Act Amendment Bill (2018); to remove the NSW State Government from liability from the release of environmental water at the same time enforcing flow regimes known to elevate flooding risks through SDL projects/CMS Projects
- Murray Valley stakeholders continue to request MDBA/MINCO/BOC to work constructively/ collaboratively with affected stakeholders on alternative solutions. Options have significant cost savings to taxpayers, but are not progressed. This may be linked to MDBA public statements 'there will be no changes'
- There are multiple chokes on the Murray and Edward Wakool system (contrary to political perceptions). Public /political perceptions confined to Barmah Choke
- Stakeholder Advisory Committee: Yarrawonga to Wakool Junction
    - experienced significant consultation failures with the MDBA
    - Experienced significant consultation failures with NSW processes
    - Do not support NSW modified flow targets lodged with MDBA 30.6.17
- Hume to Yarrawonga Landholders have not been consulted prior to NSW lodging business case and do not support SDL Business Case (40,000 ML/d flow target)
- MDBA /NSW are still not able to identify costs 'on easements to flood' private property or tourism impacts

Sustainable Diversion Adjustment Mechanism Projects (Southern Basin)

- Includes provisions for SDL projects to offset water recovery
- Includes provisions for CMS Projects to offset water recovery by enabling higher Murray flows
- Menindee Lakes SDL project -removes the need to establish/ensure baseline flows from Northern Basin reach Menindee Lakes but transfers problems to NSW Murray

- Water NSW/MDBA have identified that Menindee Lakes (106GL) the evaporative savings entitlement created, can be sourced from the Murray system for water orders/deliveries
- Majority of NSW SDL/CMS Projects are required to be achieved in the Murray Valley (MDBA downstream target 971GL). Murray Valley is incurring 'lions share' of the NSW state share of 971GL eg 458GL, to be delivered largely through the Menindee Lakes Project and operation changes to the Murray River
- Basin Plan SDL /CMS flow targets increase losses in the Murray system
- Yanco Creek SDL - reduced tributary inflows to the Murray
- NSW Government has designated CMS/SDL projects as State Significant Developments

Murray-Darling Basin Constraints Modelling

Report prepared for the Victorian and New South Wales Governments NSW and Victorian Ministers' Independent Expert Panel; (16 December 2019) identified the following:

- **80GL SA Border**:
    - Highest risk relates to CMS proposal to provide flows of up to 80,000 ML per day at the SA border
    - Requires releases from storages in the upper catchments of the Murrumbidgee, Goulburn, and Murray rivers to be coordinated with releases from the lower Darling River
    - Travel times far exceed the ability to accurately forecast rainfall events that could increase unregulated flows in the many tributary streams that contribute to inundation events
    - River operators will not be creating 'managed' 80,000 ML/d flows at the South Australian border

- **Rainfall Risks:**
    - River operators have identified that investment in additional rainfall and stream gauging is required at various locations to enable better informed decisions about regulating overbank flows.
    - Irrespective of improvements in real time river operation models, they will still require weather forecasts as an input, the accuracy of which falls away beyond several days.
    - Panel advised -high levels of uncertainty associated with rainfall and runoff forecasts, particularly in high runoff areas of the upper-catchment. This means that there is a significant risk of getting it wrong and the forecasts:
    - The risks of releasing environmental water to produce environmental flows are substantially higher because the river operator will be asked to increase releases to produce an overbank flow when rainfall occurs

- Environmental releases are targeted to occur in spring when the risks of flood inducing rainfall is high – not low
- Panel found modelling information about changes in flood risks has not been presented at a scale need to build confidence of landholders
- It takes one to two months for water to flow through the length of the Murray system, a degree of uncertainty and residual risk will remain
- The Panel has heard that while some causes of uncertainty are likely to be reduced over time, significant uncertainties will persist

Models:

- Negotiation of easements and the design of mitigation works cannot rely on models
- Constraints Management Strategy (SDL) Business cases did not do property scale investments of risks
- Current modelling is not suitable for assessing and communicating the 3rd party risks.
- Modelling has been undertaken at an aggregate scale for planning purposes.
- Panel has found that "the extent to which the use of the environmental portfolio (of water allocations) relies on implementation of constraints measures" has been partially assessed
- Panel found modelling information about changes in flooding risk have not been presented at a scale needed to build the confidence of landholders.
- Legal liability associated with increased flooding arising from decisions to store rather than release environmental allocations were not resolved.
- Different software platforms are used to model the three river systems. This has meant that it is necessary to run the Murrumbidgee and Goulburn models to provide flow inputs to the Murray model.
- Panel notes that CSIRO (CSIRO, 2014) described ecological elements method used in SDL Adjustment as a highly simplified hydro-ecological model that does not try to predict a score that relates to actual ecosystem health, it is an ecological scoring model that uses simple hydrological metrics in a marginal change scenario

Legal Risks:

- Legal liabilities of increasing flood flows by holding environmental allocations in storages has not been examined, it is likely that there would be a strong adverse community reaction regardless of the legal position.
- MDBA is accountable for any compensation arising from the management and operation of the Murray. Victoria, New South Wales and South Australia must meet in equal compensation7 shares the cost of any compensation
- River operators have expressed concern to the Panel about residual risks of unintentionally exceeding the agreed notified flow rate.
- Panel found with the exception of environmental flows to Barmah-Millewa Forest, there is little operational experience of releasing environmental water allocations to piggy-back or extend overbank flows.
- Panel found it may take 10 to 20 years or more to implement and it is not possible to prescribe the final outcome
- Legal issues that may arise if flooding risks were intentionally increased by purchasing extra water and holding it in storage has not been investigated by the Panel
- Flows in the Goulburn River and other Victorian tributaries of the Murray River downstream of Doctors Point are regulated by GMW in accordance with the Victorian *Water Act 1989*. GMW is liable for damage to property caused by intentionally regulating

flows to flood land9. This means GMW must enter into agreements with landholders or purchase easements to intentionally inundation land in Victoria to avoid legal liability and compensation payments.

Issue: Additional Legal liability (Murray Valley Stakeholders)

- increased operational losses, low level inundation or elevated regional flood not defined
- NSW Water Act Amendment Bill (2018) – NSW Government ensures it is not liable for release of environmental flows

Image: SRI

Photos: L Burge, Millewa Choke

Photo: Burge 2016 Murray Flood (Barmah/Millewa region)

Murray River capacity 10,600 down to 9,500ML/d)

Photo: Burge 2016 Murray Flood (Barmah/Millewa region)

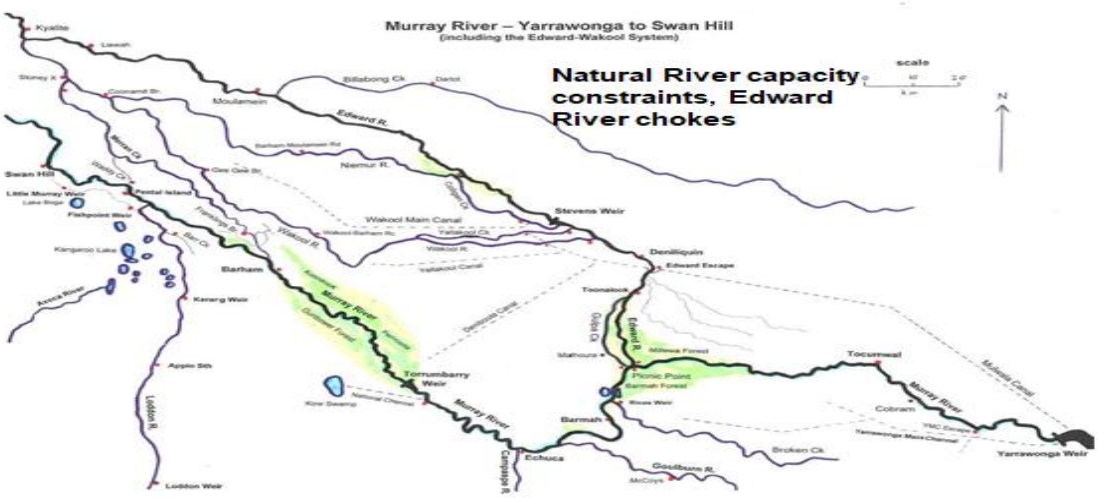
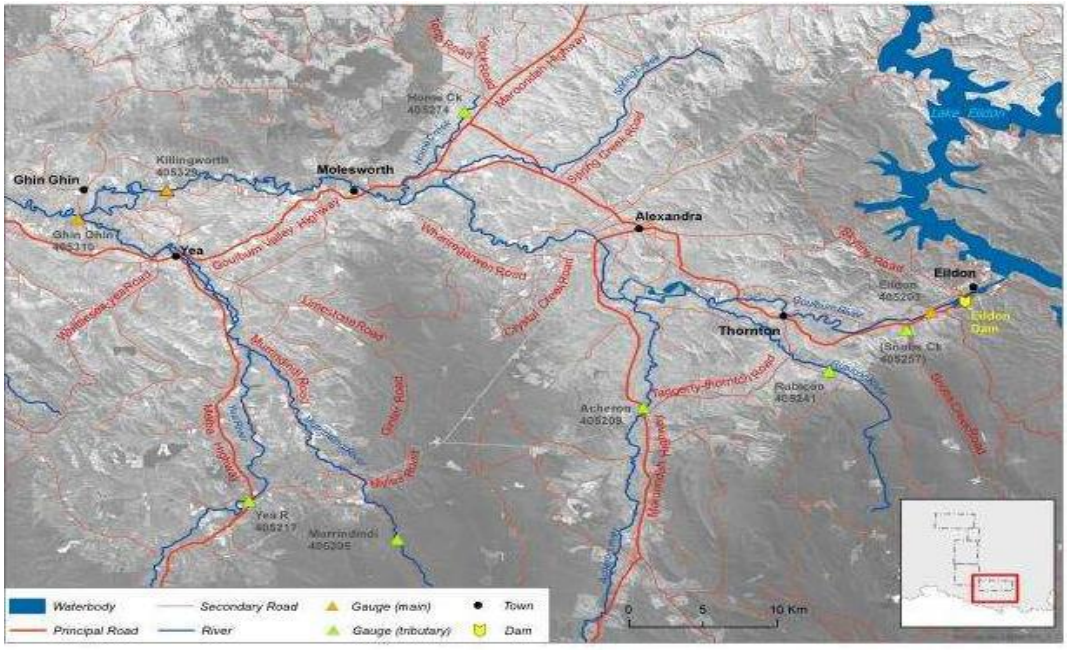


Image: Water NSW/MDBA



MDBA: Basin Plan proposed Goulburn River flows @ 40,000ML/d

Goulburn River floods(vic.) elevate major floods downstream on the Murray and Edwards/Wakool Rivers (NSW).

Photo with silage: Goulburn River Flats (Vic)-channel capacity at Molesworth Choke 9,500ML/d

Flooding risks within Molesworth choke region

5. FUTURE MANAGEMENT AND OPPORTUNITIES

REVIEW WATER ACT 2007

- Amend Water Act 2007 to enable the adoption of new information
- Amend Murray Darling Basin Plan

Review of Murray Darling Basin Authority (MDBA)

- Restructure the MDBA and introduce a culture of 'adaptive management approach' to decisions
- Develop collaborative model similar to former Murray Darling Basin Commission with relevant experts at Board level
- Revise Basin Plan flow targets to South Australia and enable the inclusion of localise solutions in the Basin Plan to offset flow requirements from NSW Murray Valley and Northern Victoria
- Investigate why the MDBA will not permit changes to the Basin Plan when evidence to do so is compelling

- Revise MDBA's Regulatory Impact Statement (2012) as a basis for allowing the introduction of new information and amending decisions

Review of Basin Plan Science

- Sustainable Rivers Audit
- CSIRO Sustainable Yield Report
- Environmental Inundation models
- Living Murray Infrastructure Program (benefits)
    - Living Murray Scientific Reference Panel 1500 GL with > $500 million investment in Wetland and operational infrastructure delivered 'healthy working Murray River'
- Include South East of South Australia catchment inflows in models
- Review science relating to Coorong, Lower Lakes and Murray Mouth (CLLMM)
- Amend Basin Plan 80GL flow target to South Australia

Review/Amend Murray Darling Basin Agreement:

- to account for improved knowledge of Northern Basin inflow/extraction rates
- reduced reliability for General Security water entitlements

Review Basin Inflow/Outflow Models:

- Northern Basin inflows to Murray River (SA) **(17%)**
- Watercourse diversions (**10,940GL/year)**
- Review accuracy of 'take'; **MDBA allowance: 20% plus or minus**
- Farm Dams and Planation Forestry (**2740GL/y)**
- Murray Mouth long-term average flows **(5,500GL/y)**
- Murray Mouth long - term average **(12,500GL/y**

- Full implementation of NWI Nationally agreed metering principles and standards for irrigation extractions across the Murray Darling Basin
- Increase capacity for instream data collection (Northern & Southern basin)
- **Identify options in Northern Basin to re-establish baseline flows to Menindee Lakes**
- Public and transparent metering for South Australia Drainage Scheme discharge figures to the Southern Ocean
- Fully meters 'end of system' flows at the barrages
- Increase capacity for flow data Upper Goulburn River Catchment has currently only 47% of its catchment gauged:
    - Yea River, the second largest tributary to Goulburn in the Upper Catchment, has only 50% of its catchment gauged, yet these tributaries provide 50% of the Goulburn flows.
- Dry Sequence Inflow Modelling

Environmental requirements & inundation models

- Amend classifications benefits for the environment ensure all flows are recognised as benefiting the environment (not just held CEWH entitlements)
    - Operational and irrigation flows[xlviii]
- Amend CEWH water releases requirements to enable South Australia's flows in excess of entitlements flows (>in excess of 1154GL +696GL) e.g. average flows of 4000GL and long-term average 5100GL; to be recognise in environmental benefits and % of flows are recalculated to consumptive pool
- Ensure full scientific transparency on Living Murray Scientific Reference Panel findings, Living Murray Infrastructure investments and evaluate flow target requirements/differences set by the Basin Plan
- Review modelled frequency of Murray River redgum forests and floodplains
    - Basin Plan states inundation required 19.5 out of every 20 years
    - Empirical evidence from multiple peer reviewed reports shows that the frequency of flooding that is needed to maintain river redgums is 1 in every 7 years (CSIRO, 2018) whilst also capturing that anything above 5 in 10 years these ecosystems begin to shut down with reducing evapotranspiration rates and a decreasing active sapwood area (Doody et al, 2015).
    - Wetlands requiring 3-7 dry years out of 10, so that no net sediment accumulated (Gell et al, 2018) not 19.5/20

Review and Revise SDL/CMS Projects:

- Review existing projects that are high risk or do not have stakeholder /community support
- Enable amendments to existing capacity for new projects to be included
- Amend timelines to achieve above outcomes
- Amend flow targets in SDL/CMS to avoid environmental bank slumping in Goulburn, Murray and Edward Wakool system and exceedance of system capacities
- Amend flow targets in line with new infrastructure options CLLMM to offset flow demands from NSW/Vic Murray Valley

- A report by an Independent Expert Advisory Panel (Peter Davies et al), The MDB Plan Limits of Change Review, September 2017, states that the base flow metric (developed by Alluvium in 2010) was used in the Environmentally Sustainable Level of Take (ESLT) and Sustainable Diversion Limit (SDL) process. It has also been used in the Sustainable Diversion Level Adjustment Mechanism (SDLAM).
- However, the Alluvium 2010 report clearly stated: "The proposed metrics and targets were not developed for system optimisation, nor have they been developed for the purpose of developing more detailed catchment scale water planning.
    - System optimisation and more detailed catchment water planning should be the subject of more detailed reach by reach and system by system environmental flow investigations."

Metering and monitoring:

- Application of Nationally Agreed Metering standards in Northern and Southern Basin and determination of volumes of 'take' prior to further decision on water recovery and/or decisions on SDL/CMS projects in the Southern Basin
- Amend Basin Plan targets and timelines until inflows and irrigation levels of 'take' can be accurately measured to Nationally agreed standards (AS4747)
- Introduce Teledyne or other similar system to measure in-river flows and private storages (Northern/Southern Basin). Ensure a system of measurement:
    - Enables accurate cross section data collection with telemetry feedback to Government water managers
    - enable accurate data of release over the barrages
    - Resolve current plus or minus 20% accuracy figures in Murray River management
    - Enables higher levels of accuracy for data collection for use of environmental entitlements and return flow calculations
    - Enables 20% loss factor for environmental flows to have the same level of metering requirements as Southern Basin irrigators (95% accuracy / + or - 5% accuracy)
- Introduce Lidar cameras that can take highly accurate evidence for 'off river' structures in the Northern Basin
    - For example: Teledyne Optech Titan lidar camera can produce accuracy to 2cm from 1000 metres in an airplane travelling at 140kph, measuring a seamless width of 750 metres, on the ground.
    - Technology also measures shallow water depth, accurately, for water volumes in dams, including by aircraft borne systems (TeledyneISCO, 2020)

Moratorium on Developments:

- Moratorium on (large scale) new irrigation development to asset system capacities and delivery losses
- Enable risks identified to be incorporated in Water Act 2007 requirements to remove barriers to trade

Coorong, Lower Lakes, Murray Mouth (CLLMM)

Focus investments on Coorong, Lower Lakes Murray Mouth to achieve sustainable solutions that reduce flow requirements from the Murray River

- Develop infrastructure options Coorong, Lower Lakes, Murray Mouth (CLLMM)

    1. **Refer: Attachment A**
    2. **Refer: Attachment B; Ken Jury - A Better Way for the Murray Darling Basin. 2016**.

- Develop Lock Zero in SA and develop infrastructure options for managing Coorong, Lower Lakes and Murray Mouth (CLLMM) to enable adaptive management of the Lower Lakes during periods of drought and/or low inflows, and preparation against climate change
    1. to provide alternate management options for the Lower Lakes to reduce demand on upstream states (Adaptive Management option for drought)

OPPORTUNITIES FOR INTERIM INCREASES TO WATER AVAILABILITY:

Short term:

- **Ensure River Murray** operations do no exceed channel capacity that lead to operational losses being borne by the consumptive pool (General Security)
- **Increased conveyance and transmission losses (**outside previous history of use, or net trade conditions), on the Murray be attributed to relevant entities:
    1. CEWH environmental entitlements
    2. Commercial trades of temporary or permanent entitlements
    3. Net trade changes to South Australia that result in increased delivery losses

- **Recalculate annual environmental benefits** from 'above average flows or flood flows' (annual environmental benefits from water naturally delivered above capacity, currently not recognised)
    1. Attribute to environmental held entitlements (usage) for that period
    2. Options to return % of CEWH water to consumptive pool (General Security)

- **Review Dry Sequence Inflow Modelling**

- **Salinity targets**
    1. Evaluate options to return Dilution flow rule of 696GL to consumptive pool
    2. Investigate actual flow to SA (e.g. from 1968 flow rates 2.99-time minimum entitlement flows)
    3. Remove SA Additional Dilution Flow Rule – River Murray Agreement

- **Moratorium on any new irrigation developments** downstream of the Barmah Choke for:
    1. New approvals
    2. Expansion of existing

- **Public disclosure of all WAL Numbers** being transferred into different zones including
    1. CEWH
    2. Commercial users

- **Operate Adelaide de- salinisation plant** (as per Federal Funding conditions) to offset Adelaide's water demands on the Murray (100GL saving)

- **Moratorium on Federal Funding** of the Basin Plan until a full review of the Basin Plan
    1. Science
    2. Modelling
    3. Inflow calculations
    4. Assessment of CLLMM and new infrastructure options
        - 2000 GL flow requirement Basin Plan, 650GL annually

- **Federal freeze on;**
    1. the 450GL (up water)

- **Full review of 605GL SDL projects** until a full review of all projects /Basin Plan flow targets, assessment of risks; and assessment of operational losses on the Murray System (NSW/Vic)
    1. Allowance of Complementary measures are included
    2. **Reject investment** in SA proposed 'Coorong Connector'. This SA project aims to create a channel link between Lake Albert and the Coorong with increased flows from the Murray River benefitting local irrigators (note: currently Lake Albert is a terminal brackish lake with no natural connection to the Coorong).

- **Amend Murray River Agreement** to account for reduction in inflows from the Darling
    1. To account for drought conditions more effectively and to stop cross subsidisation of inflow losses on NSW Murray
    2. Amend SA 1850GL agreement to account for changes in Northern Basin
    3. Investigate historical Valley flow contributions to SA entitlement flows annually from each valley and identify variances and/ changes

- **Fully implement National Water Initiative and National Agreed Standards for Monitoring and Compliance**

- **Full implementation of the National Water Initiative: National Framework For Non-Urban Water Metering**
    1. paragraphs 87 and 88 of the Agreement specify requirements for national metering standards and a nationally consistent framework for water metering and measurement:
    2. 87. The Parties agree that generally metering should be undertaken on a consistent basis in the following circumstances:
        - i. for categories of entitlements identified in a water planning process as requiring metering
        - ii. where water access entitlements are traded
        - iii. in an area where there are disputes over the sharing of available water
        - iv. where new entitlements are issued; or v. where there is a community demand.
        - 88. Recognising that information available from metering needs to be practical, credible and reliable,
    3. the Parties agree to develop by 2006 and apply by 2007: i. a national meter specification;
        - ii. national meter standards specifying the installation of meters in conjunction with the meter specification
        - and iii. national standards for ancillary data collection systems associated with meters.

- **Independent review of water modelling requirements for Murray River ecosystem** health and levels of inundation

    1. Enable full transparent review of Basin Plan18 indicator sites water needs on the Murray System
    2. Review Living Murray Initiative infrastructure works

-

- **Develop rules and monitoring system to transparently account for flows passing over South Australian border**
    1. Including full telemetry metering of extractions
    2. Fully automate the South Australian barrages and incorporate world class options for adaptive management (marine/fresh) (K Jury, 2016)

- **Moratorium on Murray Darling Basin Plan flow targets to the Coorong, Lower Lakes, Murray Mouth (CLLMM) until a full review: (ATTACHMENT A)**
    1. Identifies alternate or additional infrastructure options to achieve sustainable outcomes for the CLLMM
    2. **I**dentify diversions volumes from South East of South Australia's Drainage Scheme and South Australia's Upper South East Drainage & Flood Mitigation Scheme to the Southern Ocean and assess potential water savings
    3. Remove Federal Government Funding rule impediment that limits flows to Southern Lagoon of the Coorong from the Upper SE of SA Drainage & Flood Mitigation Scheme (in excess of proposed SDL 26GL)
    4. Review alternative options to scour Murray Mouth
    5. Assess volumetric savings and return to NSW Murray Valley consumptive pool

Attachment A:

SOUTH AUSTRALIA INVESTMENT OPTIONS

ADAPTING TO CLIMATE CHANGE – COORONG, LOWER LAKES AND MURRAY MOUTH (CLLMM)

The Coorong:

1. **Ocean Connection**: Pipe (+valve) Infrastructure through Coorong Sand dunes to allow marine waters into Southern Lagoon:
    a. Ocean water replaces the loss of freshwater flows from SE of SA, currently diverted by drainage schemes away from the Coorong out to the Southern Ocean
    b. Enables reduction in hyper salinity of Southern Lagoon
    c. Delivers ecological health and native fish benefits
    d. Potential to revive the Mulloway industry (refer: SA SARDI Aquatic Sciences paper no.22
    e. Creates continuous flow connection using ocean waters, ocean → southern Lagoon → to Northern Lagoon →exiting in Murray Mouth
    f. Restores flow volumes to Murray Mouth, reduction in dredging/+ reliance on additional Murray River flows
    g. International recognition for RAMSAR significance is maintain through amendments to ecological character descriptions

2. **South East of SA Drainage Scheme** (Main)
    a. Restore percentage of South East of South Australia main drainage Scheme to the Southern Lagoon (flows currently diverted to Southern Ocean)

3. **South East of SA Upper South East & Flood Mitigation Scheme**
    a. Increase volumetric return rate for SA SDL Project: from 26 GL (avg)
    b. Investigate restoration of flows to the Coorong, Murray Mouth; **> 100 - 500 GL**

Lock Zero:

1. Enables an adaptive management approach and risk management strategy to address climate change risks and prolonged drought
2. Infrastructure investment to protect/upgrade Adelaide's offtake water supply system
3. Eliminates risks of acid sulphate soil exposure in Lower Lakes (temporary restoration of estuary/use of marine inflows)
4. Creates evaporative savings measures bringing benefits to Southern Basin

Murray Mouth:

- Full Telemetry metering on Barrages
    - Improved flow data to allow risk management strategies to be researched and utilised
    - Achieves reliable flow data to maximise research into management of the Murray Mouth

- **Full automation of Barrages inclusive of two-way flow technology**
    - Enables adaptive management of Lake Alexandrina to address climate risks or prolonged drought (partial or temporary restoration of estuarine conditions)
    - Eliminates risks of acid sulphate soil exposure if flow volumes to South Australia are insufficient to maintain Lower Lake volumes
    - Allows additional options to enable periodic/short term restoration of natural tidal prism to clear Murray Mouth
    - Prevents sea water intrusions during Southerly Swells and maximises opportunities to reduce salinity levels in Lake Alexandrina
    - Combination of infrastructure/technology investment, ocean inflow to Southern lagoon, partial or periodic restoration of tidal prism, helps reduce risks of dislocation of acid sulphate soil occurring from reliance on dredging operations
    - Enables options to expel European Carp from Lake Alexandrina
    - Helps local communities manage and prepare for sea level rise (refer SA Government: (barrages overtopped by 2100 *Securing the Future 2010*)

- **Review Mundoo and Ewe Island Barrages.**
    - Refer: Murray Darling Basin Commission*: River Murray Barrages, Environmental Flows 'An evaluation of environmental flow needs in the Lower Lakes and Coorong'* – a report for the Murray Darling Basin Commission – June 2000

SUMMARY OF BENEFITS: CLLMM Infrastructure Investments

- Options to achieve physical water savings
    - Adaptive Management for the Lower Lakes (Climate Change/Drought)
    - Lower Lakes evaporative savings
    - Reduction in high Murray flow system losses that are incurred due to the reliance on Murray Water (fresh water) to scour out the Murray Mouth
    - Via restoring flows to the Southern Lagoon using ocean water/part fresh (SE of SA)
    - Adverse impacts individual Lower Lakes—subsidies for piped supplies (e.g. Murray Water)
    - Water Savings potential 500**GL– 1000GL annually**
- Increase return of South East of SA Drainage Scheme and Upper SE of SA Drainage and Flood Mitigation Scheme to the Coorong (above current proposed return of 26GL)
    - Water Savings potential **> 500GL annually**
- Water savings benefits shared proportionally between SA, Vic and NSW Murray to sustain irrigation regions
- Reduces emerging water risks demands on below Barmah choke horticulture plantations
- Allows permanent infrastructure in CLLMM region to manage climate change /drought, increased flexibility and options in Southern Basin, maintain viability of irrigation regions
- Permanent solution to hyper salinity and ecological risks in the Coorong
- Cost effective and ecologically sustainable option for managing sedimentation risks, in the Murray Mouth
- Resolves system constraints Mid Murray and Edward Wakool, including losses when Menindee cannot contribute to Murray flows
- Avoids taxpayers/or irrigation funding on action to bypass Barmah and overcome other river chokes (Edward Wakool)
- Addresses system capacities limits in the Murray River and Goulburn River (NSW/Vic).
- Enables more strategically focussed progression for environmental watering of wetlands within known Murray River system capacities. Maximises community collaboration within a revised Constraints Management Strategy.
- Substantial short, medium to longer term employment opportunities in South Australia (automation of barrages, Lock Zero, Ocean inflow system to Southern Lagoon)
- Securing water from the Murray assists South Australia in reducing price rise risks for Adelaide's drinking water
- Broadscale benefits to water availability and reduced risks irrigation regions from impacts of the Basin Plan on Water Markets
- Resolves operational system capacity risks/losses and avoids bank erosion issues in the mid Murray region (e.g. Barmah Millewa) and other central Murray forests issues
- Reduces upstream flooding risk from Basin Plan including the target of 80GL at SA Border
- Note: the combined impact of the October 2016 catastrophic flood in the Murray River, high flows in Murrumbidgee (med flood) and Menindee achieved approximately 94GL only (limited days). Within 3 weeks of combined floods reaching barrages, dredging of the Murray Mouth had to be resumed
- Delivers increased flexibility and a reduction in system loss issues for management of Commonwealth Environmental Water Holder (CEWH)

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