

## **Supplementary Material**

### **Snowy River environmental flows post-2002: lessons to be learnt**

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**Table S1. Scientific indicators used in Snowy Water Inquiry to assess river condition (Young *et al.* 2004)**

|  | Quantity sub-indices   | Quality sub-indices   | Reference conditions  | Data source for assessment of indices now   |
|--|--|---|---|---|
| <b>Biotic conditions</b>               |  |   |   |   |
| Instream vegetation communities        | Vegetation abundance   | Percentage indigenous cover   | Pre-European settlement (field reports and photos)                          | Qualitative assessment based on aerial and site photo   |
| Aquatic macro-invertebrate communities | Slow and fast water abundance                                      | Slow and fast water richness  | Abundance: qualitative assessment on sight                                  | Richness: sampling and impacted/non-impacted sites, regression models with hydrological variables |
| Fish communities                       | Total fish abundance and native species abundance                  | Native species richness<br>Community naturalness  | Abundance: qualitative assessment on site                                   | Richness: qualitative assessment informed by previous data for impacted and non-impacted sites    |
| <b>Habitat condition</b>               |  |   |   |   |
| Hydraulic habitat                      | Slow and fast water extent   | Slow and fast water condition<br>Hydraulic temporal patterns<br>Lateral connectivity<br>Bed disturbance | Pre-Scheme inferred from analysis of hydrologic change at 22 gauge stations | Qualitative assessments based on field inspections  |
| Physical habitat                       | Channel size<br>Bed forms  | Morphological diversity<br>Substrate conditions<br>Woody debris   | Qualitative assessment based on pre-scheme photos                           | Qualitative assessment based on field inspections and onsite/aerial photos                        |
| Water quality                          | Total phosphorus<br>Water temperature                              | Turbidity   | Past data   | TP and TB monthly data over 26 years and qualitative assessment                                   |
| Barriers to fish passage               |  | Upstream barriers<br>Downstream barriers  | Pre-scheme condition  | Qualitative assessment on aerial photos and inspections of barriers (man and natural)             |
| Riparian vegetation                    | Riparian width<br>Longitudinal continuity<br>Structural intactness | Indigenous regeneration<br>Billabong vegetation   | Pre-European settlement based on unimpacted sites and journals              | Assessment using geo-referenced aerial photos along transects                                     |

**Table S2. Semi-structured interview questions**

| Broad   | Specific   | Open-ended   |
|---|--|--|
| Who are you?  | Do you think that environmental measures could have been improved in the SWIOID?                           | Is there any important topic that we haven't discussed that you think I should know about? |
| What was your position at the time of the 2002 SWIOID?  | Do you think the socio-economic outcomes could have been improved in the SWIOID and/or its implementation? |  |
| What is your role in relation to the Snowy Hydro Scheme now (if anything)?  | Do you think the implementation of the river flows have honoured the intent of the SWIOID?                 |  |
| At the time the SWIOUD was made, from your point of view, were the measures within the SWIOID a satisfactory outcome? | If you were making a river restoration agreement again, what would you do differently?                     |  |

**Summary of implementation of target volumes for the Snowy River**

The Water Savings Summary table was used as a primary source for volume available in environmental entitlements and the Snowy River Annual Allocation. To clarify interpretation of this data source: as an example, the information was presented under ‘2007/08 account for release in 2008/09.’ This was interpreted as the availability of water from the entitlements for release in the next Water Year, rather than the total volume of entitlements.

**Table S3. Comparison of volumes released for Snowy River environmental flows with targets stipulated in the Snowy Water Inquiry Outcomes Implementation Deed (GL year<sup>-A</sup>; summarised in Table S4–S7)**

| Water year | Actual release for Snowy River e-flows | Target release SWI/OID |
|------------|--|------------------------|
| 2002–03    | 10.7                                   | 38                     |
| 2003–04    | 29.7                                   | 38                     |
| 2004–05    | 23.5                                   | 38                     |
| 2005–06    | 41.7                                   | 142                    |
| 2006–07    | 36                                     | 142                    |
| 2007–08    | 32.1                                   | 142                    |
| 2008–09    | 38.7                                   | 142                    |
| 2009–10    | 38.7                                   | 212                    |
| 2010–11    | 62.3                                   | 212                    |
| 2011–12    | 149.5                                  | 212                    |
| 2012–13    | 155.2                                  | 212                    |
| 2013–14    | 182.1                                  | 212                    |
| 2014–15    | 148.6                                  | 212                    |
| 2015–16    | 139.4                                  | 212                    |
| 2016–17    | 122.2                                  | 212                    |
| 2017–18    | 207.5                                  | 212                    |
| 2018–19    | 129.4                                  | 212                    |

**Table S4. Summary of implementation for Stage 1 target volumes in the Snowy Water Inquiry Outcomes Implementation Deed**

| Water Year | Volume available in Environment Entitlements<br>(GL) | Volume in Snowy River Apportioned Entitlement<br>(GL) | Snowy River Annual Allocation<br>(GL) | Snowy River Annual Allocation Apportioned to Mowamba Borrowings Account<br>(GL) | Final Volume for Snowy River Increased Flows<br>(GL)         | Target Releases for Snowy River Increased Flows<br>(GL)      | Delivered Releases for Snowy River Increased flows (in addition to Base Passing Flows)<br>(GL) | Target releases according to the SWIOID |
|------------|--|---|---------------------------------------|---|--|--|--|---|
| 2002-2003  | No entitlement <sup>A</sup>                          | No entitlement <sup>A</sup>                           | No entitlement <sup>A</sup>           | Flows debited to Account <sup>B</sup>   | Unregulated flows from Mowamba and Cobbon Creek <sup>B</sup> | Unregulated flows from Mowamba and Cobbon Creek <sup>B</sup> | 10.7 GL <sup>A</sup>   | Up to 38 GL                             |

<sup>A</sup>New South Wales Department of Water and Energy (2007).

<sup>B</sup>Commonwealth of Australia *et al.* (2002), Pt. 2 s.19 ss.6(2).

**Table S5. Summary of implementation for Stage Two target volumes in the Snowy Water Inquiry Outcomes Implementation Deed**

| Water Year | Volume available in Environment Entitlements<br>(GL) | Volume in Snowy River Apportioned Entitlement<br>(GL) | Snowy River Annual Allocation<br>(GL) | Snowy River Annual Allocation Apportioned to Mowamba Borrowings Account<br>(GL) | Final Volume for Snowy River Increased Flows<br>(GL) | Target Releases for Snowy River Increased Flows<br>(GL)      | Delivered Releases for Snowy River Increased flows (in addition to Base Passing Flows)<br>(GL) | Target releases according to the SWIOD |
|------------|--|---|---------------------------------------|---|--|--|--|--|
| 2003–04    | No entitlements                                      | No entitlements                                       | No entitlements                       | Flows debited to Account <sup>A</sup>   | Unregulated flows from Mowamba and Cobbon Creek      | Unregulated flows from Mowamba and Cobbon Creek              | 29.7 GL <sup>B</sup>   | Up to 38 GL                            |
| 2004–05    | No entitlements                                      | No entitlements                                       | No entitlements                       | Flows debited to Account <sup>A</sup>   | Unregulated flows from Mowamba and Cobbon Creek      | Unregulated flows from Mowamba and Cobbon Creek              | 23.5 GL <sup>B</sup>   | Up to 38 GL                            |
| 2005–06    | 57 GL <sup>B,E</sup>                                 | 38 GL <sup>B</sup>                                    | 38 GL <sup>B</sup>                    | 0 GL <sup>B</sup>   | 38GL <sup>B</sup>                                    | 38 GL with continuation of flows from Mowamba <sup>B,F</sup> | 40 GL in addition to 1.7 GL <sup>B,G</sup>   | Target annual average flow 142 GL      |
| 2006–07    | 63 GL <sup>B,E</sup>                                 | 42GL <sup>B</sup>                                     | 42 GL <sup>B</sup>                    | 4 GL <sup>B</sup>   | 38 GL <sup>B</sup>                                   | 36 GL <sup>B</sup>   | (Over)<br>36 GL <sup>B</sup>   | Target annual average flow 142 GL      |
| 2007–08    | 49.5 GL <sup>B,H</sup>                               | 44.7GL <sup>B</sup>                                   | 33 GL <sup>B</sup>                    | 0 GL <sup>B,I</sup>   | 33 GL <sup>B</sup>                                   | 32.1 GL <sup>B</sup>   | 32.2 GL <sup>C</sup> (Over)  | Target annual average flow 142 GL      |
| 2008–09    | 57.9 GL <sup>D</sup>                                 | -   | 38 GL <sup>D</sup>                    | 585 ML <sup>D</sup>   | 38 GL <sup>A</sup>                                   | 38.3 GL <sup>C</sup>   | 38.7 GL <sup>C</sup> (Over)  | Target annual average flow 142 GL      |

<sup>A</sup>Commonwealth of Australia *et al.* (2002), Pt. 2 s.19 ss.6(2).

<sup>B</sup>New South Wales Department of Water and Energy (2007).

<sup>C</sup>Snowy Hydro Limited (2017a).

<sup>D</sup>New South Wales Department of Planning, Industry and Environment (2020).

<sup>E</sup>This is 100% allocation.

<sup>F</sup>Start of Water Year 2005 until January 2006.

<sup>G</sup>Mowamba Flow.

<sup>H</sup>Allocation from total 67 GL.

<sup>I</sup>Allocation to Snowy River <38 GL.

**Table S6. Summary of implementation for Stage Three target volumes in the Snowy Water Inquiry Outcomes Implementation Deed**

| Water Year | Volume available in Environment Entitlements<br>(GL) | Volume in Snowy River Apportioned Entitlement<br>(GL) | Snowy River Annual Allocation<br>(GL) | Snowy River Annual Allocation Apportioned to Mowamba Borrowings Account<br>(GL) | Final Volume for Snowy River Increased Flows<br>(GL) | Target Releases for Snowy River Increased Flows<br>(GL) | Delivered Releases for Snowy River Increased flows (in addition to Base Passing Flows)<br>(GL) | Target releases according to the SWIOID |
|------------|--|---|---------------------------------------|---|--|---|--|---|
| 2009–10    | 63.4 <sup>A,I</sup>                                  | 145 <sup>B</sup>                                      | 42.2 <sup>C</sup>                     | 4.2 <sup>C</sup>  | 38 <sup>D</sup>                                      | 37.7 <sup>C</sup>                                       | 38.7 <sup>E</sup> (Over)   | Target annual average flow 212 GL       |
| 2010–11    | 93.3 <sup>B,J</sup>                                  | -   | 62 <sup>A</sup>                       | 24.2 <sup>A</sup>   | 38 <sup>F</sup>                                      | 37 <sup>E</sup>   | 62.3 <sup>E,K</sup>  | Target annual average flow 212 GL       |
| 2011–12    | 221.9 <sup>A</sup>                                   | -   | 151.9 <sup>A</sup>                    | Not applicable  | Not applicable                                       | 149.5 <sup>H</sup>                                      | 149.9 <sup>H</sup> (over)  | Target annual average flow 212 GL       |

<sup>A</sup>New South Wales Department of Planning, Industry and Environment (2020).

<sup>B</sup>New South Wales Office of Water (2010).

<sup>C</sup>Snowy Scientific Committee (2009).

<sup>D</sup>Snowy Scientific Committee (2009); Commonwealth of Australia *et al.* (2002), Pt. 2 s.19 ss.6(3).

<sup>E</sup>Snowy Hydro Limited (2017a).

<sup>F</sup>Commonwealth of Australia *et al.* (2002), Pt. 2 s.19 ss.6(3); Snowy Hydro Limited (2017a).

<sup>G</sup>New South Wales Department of Industry (2018).

<sup>H</sup>Snowy Hydro Limited (2013).

<sup>I</sup>Allocation from total out 216.780 GL (New South Wales Office of Water 2010).

<sup>J</sup>Allocation from total 217 GL.

<sup>K</sup>Mowamba Debt paid off (New South Wales Department of Industry 2018).

**Table S7. Summary of implementation for Stage Four target volumes in the Snowy Water Inquiry Outcomes Implementation Deed**

| Water Year | Volume available in Environment Entitlements (GL) | Volume in Snowy River Apportioned Entitlement (GL) | Snowy River Annual Allocation (GL) | Snowy River Annual Allocation Apportioned to Mowamba Borrowings Account (GL) | Final Volume for Snowy River Increased Flows (GL) | Target Releases for Snowy River Increased Flows (GL) | Delivered Releases for Snowy River Increased Flows (in addition to Base Passing Flows) (GL) | Target releases according to the SWIOD |
|------------|---|--|------------------------------------|--|---|--|---|--|
| 2012–13    | 224.2 <sup>A</sup>                                | -  | 154.2 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 155.2 <sup>B</sup>                                   | 154.7 <sup>B</sup><br>(Under)   | Target annual average flow 212–294 GL  |
| 2013–14    | 251.6 <sup>A</sup>                                | -  | 181.6 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 182.1 <sup>C</sup>                                   | 183.5 <sup>C</sup><br>(Over)  | Target annual average flow 212–294 GL  |
| 2014–15    | 218.2 <sup>A</sup>                                | -  | 148.2 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 146.8 <sup>D</sup>                                   | 147.6 <sup>D</sup><br>(Over)  | Target annual average flow 212–294 GL  |
| 2015–16    | 212.1 <sup>A</sup>                                | 212 <sup>E</sup>                                   | 142.1 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 139.4 <sup>F</sup>                                   | 139.8 <sup>F</sup><br>(Over)  | Target annual average flow 212–294 GL  |
| 2016–17    | 186.9 <sup>A</sup>                                | 238.2 <sup>A</sup>                                 | 124.6 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 122.2 <sup>G</sup>                                   | 124.7 <sup>G</sup><br>(Over)  | Target annual average flow 212–294 GL  |
| 2017–18    | 284.3 <sup>A</sup>                                | -  | 214.3 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 207.5 <sup>H,L</sup>                                 | 207.1 <sup>H</sup><br>(Under)   | Target annual average flow 212–294 GL  |
| 2018–19    | 195.3 <sup>A</sup>                                | -  | 130.2 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 128.6 <sup>I</sup>                                   | 129.4 <sup>I</sup><br>(Over)  | Target annual average flow 212–294 GL  |
| 2019–20    | 165.3 <sup>A</sup>                                | -  | 110.2 <sup>A</sup>                 | Not applicable   | Not applicable                                    | 110.2 <sup>J</sup>                                   | 82.97   | Target annual average flow 212–294 GL  |
| 2020–21    | 124.5 <sup>A</sup>                                | -  | 83 <sup>A</sup>                    | Not applicable   | Not applicable                                    | 83 <sup>K</sup>                                      | -   | Target annual average flow 212–294 GL  |

<sup>A</sup>New South Wales Department of Planning, Industry and Environment (2020).

<sup>B</sup>Snowy Hydro Limited (2013).

<sup>C</sup>Snowy Hydro Limited (2014).

<sup>D</sup>Snowy Hydro Limited (2015).

<sup>E</sup>Williams (2016).

<sup>F</sup>Snowy Hydro Limited (2016).

<sup>G</sup>Snowy Hydro Limited (2017*b*).

<sup>H</sup>Snowy Hydro Limited (2018).

<sup>I</sup>Snowy Hydro Limited (2019).

<sup>J</sup>New South Wales Department of Planning, Industry and Environment (2019).

<sup>K</sup>New South Wales Department of Planning, Industry and Environment (2020).

<sup>L</sup>2.334 GL remains undelivered (New South Wales Department of Planning, Industry and Environment 2020).



**Table S8. Percentage yield from Murray and Murrumbidgee entitlements in the New South Wales and Victorian systems (Ruralco Water Brokers, see ‘Trading Zone Information’ at <https://www.ruralcowater.com.au/>).**

|         | NSW Murrumbidgee zone 13 |                  | NSW Murray above choke zone 10 |                  | NSW Murray below choke zone 11 |                  | VIC Murray above choke zone 6 |                 | VIC Murray below choke zone 7 |                 | Average high security or reliability | Average general security or low reliability |
|---------|--------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|-------------------------------|-----------------|-------------------------------|-----------------|--------------------------------------|---|
|         | High security            | General security | High security                  | General security | High security                  | General security | High reliability              | Low reliability | High reliability              | Low reliability |                                      |   |
| 2020–21 | 100                      | 100              | 97                             | 50               | 97                             | 50               | 100                           | 0               | 100                           | 0               | 99                                   | 40  |
| 2019–20 | 95                       | 11               | 97                             | 3                | 97                             | 3                | 66                            | 0               | 66                            | 0               | 84                                   | 3   |
| 2018–19 | 95                       | 7                | 97                             | 0                | 97                             | 0                | 100                           | 0               | 100                           | 0               | 98                                   | 1   |
| 2017–18 | 95                       | 45               | 97                             | 51               | 97                             | 51               | 100                           | 0               | 100                           | 0               | 98                                   | 29  |
| 2016–17 | 100                      | 100              | 100                            | 100              | 100                            | 100              | 100                           | 5               | 100                           | 5               | 100                                  | 62  |
| 2015–16 | 95                       | 37               | 97                             | 23               | 97                             | 23               | 100                           | 0               | 100                           | 0               | 98                                   | 17  |
| 2014–15 | 95                       | 53               | 97                             | 61               | 97                             | 61               | 100                           | 0               | 100                           | 0               | 98                                   | 35  |
| 2013–14 | 95                       | 63               | 100                            | 100              | 100                            | 100              | 100                           | 0               | 100                           | 0               | 99                                   | 53  |
| 2012–13 | 100                      | 100              | 100                            | 100              | 100                            | 100              | 100                           | 0               | 100                           | 0               | 100                                  | 60  |
| 2011–12 | 100                      | 100              | 100                            | 100              | 100                            | 100              | 100                           | 0               | 100                           | 0               | 100                                  | 60  |
| 2010–11 | 100                      | 100              | 100                            | 100              | 100                            | 100              | 100                           | 0               | 100                           | 0               | 100                                  | 60  |
| 2009–10 | 95                       | 27               | 97                             | 27               | 97                             | 27               | 100                           | 0               | 100                           | 0               | 98                                   | 16  |
| 2008–09 | 95                       | 21               | 95                             | 9                | 95                             | 9                | 33                            | 0               | 33                            | 0               | 70                                   | 8   |
| 2007–08 | 95                       | 13               | 25                             | 0                | 25                             | 0                | 43                            | 0               | 43                            | 0               | 46                                   | 3   |
| 2006–07 | 95                       | 10               | 97                             | 0                | 97                             | 0                | 95                            | 0               | 95                            | 0               | 96                                   | 2   |
| 2005–06 | 95                       | 54               | 97                             | 63               | 97                             | 63               | 100                           | 0               | 100                           | 0               | 98                                   | 36  |
| 2004–05 | 95                       | 40               | 97                             | 49               | 97                             | 49               | 100                           | 0               | 100                           | 0               | 98                                   | 28  |

**Table S9. Expected proportion of Snowy Water Inquiry Outcomes Implementation Deed (SWIOID) targets to be delivered, calculated from the average yield of Murray and Murrumbidgee entitlements, compared to the environmental flow volume released to the Snowy River and the SWIOID target.**

|         | Average high security<br>or reliability | Average general<br>or low security | Indicative minimum<br>environmental flow volume that<br>should have been released for<br>Snowy River<br>(offset by 1 year) | Environmental flow volume<br>actually released for Snowy River<br>(offset by 1 year) | Target release<br>SWIOID |
|---------|---|------------------------------------|--|--|--------------------------|
|         | (GL)                                    | (GL)                               |  |  |                          |
| 2004–05 | 37                                      | n/a                                | n/a  | 42   | 38                       |
| 2005–06 | 37                                      | n/a                                | n/a  | 36   | 38                       |
| 2006–07 | 136                                     | n/a                                | n/a  | 32   | 142                      |
| 2007–08 | 66                                      | n/a                                | n/a  | 39   | 142                      |
| 2008–09 | 100                                     | n/a                                | n/a  | 39   | 142                      |
| 2009–10 | 139                                     | n/a                                | n/a  | 37   | 142                      |
| 2010–11 | 142                                     | 42                                 | 184  | 150  | 212                      |
| 2011–12 | 142                                     | 42                                 | 184  | 155  | 212                      |
| 2012–13 | 142                                     | 42                                 | 184  | 182  | 212                      |
| 2013–14 | 141                                     | 37                                 | 177  | 149  | 212                      |
| 2014–15 | 139                                     | 25                                 | 163  | 139  | 212                      |
| 2015–16 | 139                                     | 12                                 | 151  | 122  | 212                      |
| 2016–17 | 142                                     | 43                                 | 185  | 208  | 212                      |
| 2017–18 | 139                                     | 42                                 | 181  | 129  | 212                      |
| 2018–19 | 139                                     | 1                                  | 140  | 83   | 212                      |
| 2019–20 | 120                                     | 2                                  | 122  | n/a  | 212                      |
| 2020–21 | 140                                     | 28                                 | 168  | n/a  | 212                      |

**Table S10. Revised environmental objectives of the Snowy Flow Response Monitoring and Modelling program (Williams 2016)**

|              |  |
|--------------|--|
| Objective 1  | Over-arching long term river rehabilitation in the Snowy River   |
| Objective 2  | Morphological change in the Snowy River channel                  |
| Objective 3  | River-bed maintenance and available nutrient translocation sites |
| Objective 4  | Basal resources and primary productivity                         |
| Objective 5  | Riverine and aquatic vegetation                                  |
| Objective 6  | Thermal regime in the Snowy River                                |
| Objective 7  | Benthic aquatic macro-invertebrate communities                   |
| Objective 8a | Fish assemblages- upper Snowy River                              |
| Objective 8b | Fish assemblages- lower river                                    |
| Objective 9  | Dispersal of native fish via local and large-scale dispersal     |
| Objective 10 | Platypus abundance and distribution                              |
| Objective 11 | Estuary health- salinity dynamics and entrance condition.        |
| Objective 12 | Aesthetics   |
| Objective 13 | Cultural recognition   |

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**Table S11. Summary of responses to Question 1: were the measures satisfactory?**

| Question 1  | Alliance   | Scientists  | Government  |
|---|--|---|---|
| At the time the SWIOID was made, from your point of view, were the measures for the Snowy River a satisfactory outcome? | <p>—Mixed opinion of whether satisfactory</p> <p>—21% flow is not a high enough volume to restore health of the Snowy River, in comparison to 28% flow<sup>A</sup></p> <p>—Flow volumes agreed to are good considering the difficulties in their negotiation<sup>B</sup></p> <p>—Mowamba Weir was expected to be, and should have been, permanently decommissioned<sup>C</sup></p> | <p>—Both did not directly comment on if a satisfactory outcome</p> <p>—SWIOID did not clearly articulate what they wanted for the Snowy River<sup>A</sup></p> <p>—Measures could be better; more water always better and environmental objectives too broad<sup>B</sup></p> <p>—Flow volumes were a political and social figure<sup>C</sup></p> | <p>—Overall, a satisfactory outcome</p> <p>—Returning environmental flows were unprecedented at the time<sup>A</sup></p> <p>—Flow volume figures and overall agreement represented a good compromise made through political negotiation<sup>B</sup></p> |
| Interviewee   | <sup>A</sup> ALL1, ALL2; <sup>B</sup> ALL3; <sup>C</sup> ALL2, ALL3  | <sup>A</sup> SCI1, SCI2; <sup>B</sup> SCI2; <sup>C</sup> SCI1   | <sup>A</sup> GOV2, GOV3; <sup>B</sup> GOV1, GOV3  |

**Table S12. Summary of responses to Question 2: could measures for e-flows for the Snowy River be improved?**

| Question 2   | Alliance  | Scientists   | Government  |
|--|---|--|---|
| Do you think that measures for e-flows for the Snowy River could have been improved in the SWIOID? | <ul style="list-style-type: none"> <li>—More can be achieved with 28%, considered minimum flow required for the Snowy River<sup>A</sup></li> <li>—21% was too much of a compromise and not scientifically valid<sup>B</sup></li> <li>—Flow targets were not made mandatory so cannot be enforced<sup>C</sup></li> <li>—Decommissioning Mowamba Weir to help achieve environmental objective 3 (river connectivity)<sup>D</sup></li> </ul> | <ul style="list-style-type: none"> <li>—Flow volumes oversimplified in debate, so needed more scientific input in implementation<sup>A</sup></li> <li>—Environmental objectives too broad, making it hard to monitor and implement<sup>B</sup></li> <li>—had to prioritise which environmental objective to deliver<sup>B</sup></li> <li>—Gap between scientific environmental outcome and what is considered an environmental outcome socially<sup>C</sup></li> <li>—No clear articulation of what was wanted to be achieved with increased flows (river restoration or partial recovery?)<sup>C</sup></li> <li>—Low allocation of entitlements and Mowamba Borrowing Debt made it hard to deliver environmental flows<sup>B</sup></li> </ul> | <ul style="list-style-type: none"> <li>—Overall environmental objective became river recovery rather than river rehabilitation<sup>A</sup></li> <li>—Complexity in trade-offs and compromises meant environmental measures could be better<sup>B</sup></li> <li>—Environmental objectives too broad</li> <li>—Decommissioning Mowamba not in line with environmental objective to restore connectivity<sup>C</sup></li> <li>—Limited consideration of drought impacting allocations<sup>D</sup></li> <li>—No improvements needed<sup>E</sup></li> </ul> |
| Interviewee  | <sup>A</sup> ALL1, ALL3; <sup>B</sup> ALL1; <sup>C</sup> ALL2; <sup>D</sup> ALL2, ALL3  | <sup>A</sup> SCI1 Note: not involved in process after 2002; <sup>B</sup> SCI2; <sup>C</sup> SCI1, SCI2   | <sup>A</sup> GOV1, GOV2, GOV3; <sup>B</sup> GOV1, GOV2; <sup>C</sup> GOV3; <sup>D</sup> GOV1; <sup>E</sup> GOV2   |

**Table S13. Summary of Questions 3: could socio-economic outcomes be improved?**

| Question 3   | Alliance  | Scientists  | Government   |
|--|---|---|--|
| Do you think the socio-economic outcomes could have been improved in the SWIOID and/or its implementation? | <ul style="list-style-type: none"> <li>—Negotiations perceived to have been dominated by irrigation and hydroelectricity considerations<sup>A</sup></li> <li>—Lack of mandatory targets challenges equality of trade-offs in implementation<sup>B</sup></li> <li>—Snowy Scientific Committee advice was not properly considered<sup>B</sup></li> <li>—Delay in establishing Snowy Scientific Committee meant little transfer of information<sup>B</sup></li> <li>—Snowy Hydro Limited had too much influence in re-commissioning of Mowamba Weir<sup>C</sup></li> </ul> | <ul style="list-style-type: none"> <li>—Negotiations were based on conflict that polarised people, and little done for conflict resolution<sup>A</sup></li> <li>—Little communication from science with community to establish expectations of what will happen<sup>B</sup></li> <li>—Clear separation of science and overall decision-making in Snowy Water Inquiry<sup>B</sup></li> <li>o Advantage: demonstrates no bias of science towards the environment</li> <li>—Disadvantage: unable to see which factors were key considerations in the final decision</li> <li>—Intent of deed to be equitable between irrigator and environment allocations, but opinion it falls short of this<sup>C</sup></li> <li>—Snowy Scientific Committee had little weight behind their advice</li> </ul> | <ul style="list-style-type: none"> <li>—People will be disappointed with outcomes as ideas behind agreement contested<sup>A</sup></li> <li>—21% as far as the government would compromise in context of competing demands<sup>B</sup></li> <li>—Disappointment in outcomes can be attributed to lack of understanding on allocations of entitlements<sup>C</sup></li> <li>—Flow figures were a political determination, informed by science, good outcome<sup>C</sup></li> <li>—Delay and discontinuing Snowy Scientific Committee led to lack of confidence in implementation<sup>B</sup></li> <li>—Snowy Advisory Committee to incorporate broader representation<sup>E</sup></li> <li>—Equality across all entitlement holders<sup>D</sup></li> </ul> |
| Interviewee  | <sup>A</sup> ALL1, ALL2, ALL3; <sup>B</sup> ALL2; <sup>C</sup> ALL3   | <sup>A</sup> SC11, SC12; <sup>B</sup> SC11; <sup>C</sup> SC12   | <sup>A</sup> GOV1, GOV3; <sup>B</sup> GOV3; <sup>C</sup> GOV1, GOV2; <sup>D</sup> GOV2; <sup>E</sup> GOV1  |

**Table S14. Summary of Question 4: has implementation of measures honoured the Snowy Water Inquiry Outcomes Implementation Deed?**

| Question 4  | Alliance  | Scientists  | Government   |
|---|---|---|--|
| Do you think the implementation of measures for the Snowy River have honoured the intent of the SWIOID? | <p>—21% flows were never delivered<sup>A</sup></p> <p>—The intent of the SWIOID and what was written did not match, influencing the implementation<sup>B</sup></p> <p>—Expectation that 28% flows would be delivered, not up to 28%<sup>C</sup></p> <p>—Majority of environmental objectives not achieved<sup>D</sup></p> <p>—Thought Mowamba weir would be permanently decommissioned.<sup>D</sup></p> | <p>—Issues with implementation comes from differing expectation between the political decision, those implementing and electorate expectation<sup>A</sup></p> <p>—Millennium Drought impacted allocation and proper flows only delivered when drought broke<sup>B</sup></p> <p>—Opinion that 21% flows would never be delivered as Water for Rivers obtained entitlements with expectation only for Snowy River e-flows.<sup>B</sup></p> <p>—The multi-level offtake built did not match expectation.<sup>B</sup></p> | <p>—21% flows were delivered<sup>A</sup></p> <p>—Millennium Drought impacted availability of entitlements, and allocation of water for the Snowy River</p> <p>—why 21% flow not always delivered<sup>A</sup></p> <p>—Environmental objectives achieved<sup>B</sup></p> <p>—Fish ladder could not be achieved because of Jindabyne dam, so built a mini-hydro power station<sup>C</sup></p> <p>—Clearly articulated in SWIOID that Mowamba would be recommissioned<sup>D</sup></p> <p>—Flow releases now made to mimic natural flow regime of unregulated Thredbo River<sup>C</sup></p> |
| Interviewee   | <sup>A</sup> ALL1, ALL2, ALL3; <sup>B</sup> ALL1, ALL3; <sup>C</sup> ALL2; <sup>D</sup> ALL3  | <sup>A</sup> SCI1; <sup>B</sup> SCI2  | <sup>A</sup> GOV1, GOV2, GOV3; <sup>B</sup> GOV2; <sup>C</sup> GOV1; <sup>D</sup> GOV3   |

**Table S15. Summary of Question 5: what would you do differently?**

| Question 5   | Alliance  | Scientists  | Government   |
|--|---|---|--|
| If you were making a river restoration agreement again, what would you do differently? | <ul style="list-style-type: none"> <li>—Would ensure they had a lawyer on their side in negotiations<sup>A</sup></li> <li>—Make flow targets mandatory<sup>B</sup></li> <li>—More aware the procuring obligations relies on interpretation<sup>C</sup></li> <li>—Ensure more negotiation power or leverage<sup>C</sup></li> </ul> | <ul style="list-style-type: none"> <li>—Need to spend more time defining what does restoring the health of the river mean to ensure more specific environmental objectives<sup>A</sup></li> <li>—Need conflict resolution<sup>B</sup></li> <li>—Better communication from policy makers about trade-offs being made for transparency<sup>C</sup></li> <li>—Better communication between science and community to establish what is to be expected for accountability of those implementing<sup>C</sup></li> </ul> | <ul style="list-style-type: none"> <li>—Important to have adaptive mechanisms – in reference to: <ul style="list-style-type: none"> <li>—Changing climate<sup>A</sup></li> <li>—River restoration a hypothesis<sup>B</sup></li> </ul> </li> <li>—Need review of agreement in context of climate change<sup>A</sup></li> <li>—Need a provision to have continual scientific input and monitoring to ensure proper implementation<sup>B</sup></li> </ul> |
| Interviewee  | <sup>A</sup> ALL1; <sup>B</sup> ALL2; <sup>C</sup> ALL3   | <sup>A</sup> SCII, SCI2; <sup>B</sup> SCI2; <sup>C</sup> SCII   | <sup>A</sup> GOV1; <sup>B</sup> GOV2   |



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