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Water Availability in the Murray

Why has this report been produced?

The CSIRO Murray-Darling Basin Sustainable Yields Project resulted from the Summit on the Southern Murray-Darling Basin (MDB) convened by the then Prime Minister on 7 November 2006. The project is providing governments with a robust, basin-wide estimate of water availability on an individual catchment and aquifer basis, taking into account climate change and other risks. The report for the Murray is now complete and it complements existing reports for the 17 upstream regions. A report for the entire MDB will be released shortly. Information on how these results may be used in the development of a new sustainable diversion limit for the MDB can be found at www.environment.gov.au/water/mdb/yields.html.

The Murray region

The Murray region straddles southern New South Wales, northern Victoria and south-eastern South Australia and represents 19.5 percent of the total area of the MDB. The region is based around the Murray River and lower Darling River below Menindee and extends the full length of the Murray River to the Southern Ocean. It receives inflows from the Barwon-Darling, Murrumbidgee, Ovens, Goulburn-Broken, Campaspe and Loddon-Avoca regions. The population is 309,000 or 16 percent of the MDB total, concentrated in the centres of Albury-Wodonga, Echuca, Swan Hill, Mildura, Renmark, Murray Bridge and Goolwa. While the results below are primarily for the Murray region as defined above, because this region is strongly affected by inflows from upstream regions (including the Barwon-Darling and its tributaries, the Murrumbidgee and several Victorian regions), in places findings relate to hydrologic assessments aggregated through the entire connected river system of the Murray-Darling Basin.

The dominant land use in the Murray region is dryland pasture for livestock grazing. Dryland cropping is also a major enterprise. Around 22 percent of the region is native vegetation. In 2000, there were 539,900 ha of irrigated cropping in the region including rice in southern New South Wales; pastures, hay production and horticulture in northern Victoria; and horticulture in the Sunraysia and Riverland regions of the lower Murray. There are around 53,000 ha of commercial forestry plantations in the upper Murray. The region uses over 36 percent of the surface water diverted for irrigation and urban use in the MDB and around 14 percent of groundwater used in the MDB.

The region includes some large and important wetlands along the Murray River, the lower Darling River, the Great Darling Anabranch and the Edward Wakool system. A number of the wetlands are listed as sites of international importance under the Ramsar Convention including: Barmah Forest; Gunbower Forest; Hattah-Kulkyne Lakes; the Riverland wetland complex; and the Coorong, and Lakes Alexandrina and Albert. Several sites are 'Icon Sites' under the Murray-Darling Basin Commission's Living Murray Initiative. The environmental assessments provided below relate to the Icon Sites and to the Lower Darling River and associated anabranch lakes; the latter are collectively listed as a wetland of national importance.

Key findings

- Average surface water availability for the MDB aggregated to Wentworth under the **historical climate** is 14,493 GL/year. For the Murray region, average surface water availability is 11,162 GL/year. Under **current development**, surface water use across the MDB aggregated to Wentworth (including downstream use) is extremely high with 56 percent of the average available water used. Average surface water use within the Murray region aggregated to Wentworth is 4045 GL/year or a high 36 percent of the average surface water available in the region. Current groundwater use within the region is about 233 GL/year or 5 percent of total water use in the region.
- If the **recent (1997 to 2006) climate** were to persist, average surface water availability for the Murray region would fall by 30 percent, average diversions in the Murray region would fall by 13 percent and end-of-system flows would fall by 50 percent. The relative level of surface water use across the MDB would be 66 percent.
- The best estimate (median) of **climate change by 2030** is less severe than the recent past. Under this climate, average surface water availability for the Murray region would fall by 14 percent, average diversions in the Murray region would fall by 4 percent and end-of-system flows would fall by 24 percent.
- **Future development** of farm dams by 2030 is expected to reduce total runoff across the region by less than 1 percent. Although likely commercial plantation forestry expansion by 2030 would have significant local effects on runoff, the impact on average annual runoff for the entire Murray region would be negligible. Groundwater use in the region is expected to treble by 2030 to be 701 GL/year or 15 percent of total average water use.

For historical climate and current development (baseline for subsequent comparisons)

The average annual rainfall and modelled runoff for the Murray region are 340 mm and 24 mm respectively. The region generates 16.5 percent of total MDB runoff. Current average surface water availability for the MDB aggregated to Wentworth on the Murray River is 14,493 GL/year. For the Murray region, current average surface water availability is 11,162 GL/year as availability is reduced by water use in upstream regions. Of this, the Murray region contributes 5211 GL/year (or 47 percent) on average, with the remainder of the water being contributed by upstream regions. About one-tenth of the Murray region contribution is an inter-basin transfer from the Snowy Mountains Hydro-electric Scheme into the upper Murray. Current average surface water use across the MDB reduces streamflow at Wentworth by 7422 GL/year. On average, an additional 673 GL/year is diverted downstream of Wentworth. Combined, these give a total 'effective use' across the MDB of 8095 GL/year which is an extremely high 56 percent of the average available MDB water. Average surface water use within the Murray region is 4045 GL/yr or half of the total 'effective use' for the MDB. The relative level of surface water use for the Murray region is therefore a high 36 percent.

The end-of-system flow of the Murray River has been significantly reduced by water resource development. The average annual end-of-system flow under without-development conditions (but including Snowy Mountains Hydro-electric Scheme contributions) is 12,233 GL/year and this has been reduced by 61 percent to 4733 GL/year on average as a result of water resource development. The higher relative level of use (compared to the 56 percent level of use quoted above) is a result of lower water availability at the Murray mouth due to evaporative losses from the lower river and the Lower Lakes. Cease-to-flow conditions occur at the Murray River mouth 1 percent of the time under without-development conditions; under current development conditions flow ceases 40 percent of the time. In spite of these changes in end-of-system flow conditions, the average (and minimum) areal extent of the Lower Lakes has increased 6 percent due to construction of the barrages across the river mouth. Under the 1895 to 2006 climate and current development, levels in the Lower Lakes never fall below mean sea level.

Total groundwater extraction in the Murray region for 2004/05 is estimated at 233 GL and represents 13.5 percent of groundwater use in the MDB. This extraction volume represents 5 percent of total water use within the region and around 8 percent of total water use in years of lowest surface water diversion. The majority (83 percent) was from the Katunga Water Supply Protection Area (WSPA), Lower and Upper Murray Alluvium and South Australia–Victoria Border Zone groundwater management units (GMUs). The eventual total net streamflow loss to groundwater as a result of the current level of groundwater extraction is estimated to be 101 GL/year. This is comprised of 73 GL/year of streamflow loss from both rivers and drains across the modelled Southern Riverine Plains area (from upstream of Yarrawonga to downstream of Swan Hill) and 28 GL/year of streamflow loss across non-modelled GMUs.

Groundwater modelling indicates that current groundwater extraction across the Southern Riverine Plain modelled area within the Murray region is 166 GL/year and represents 84 percent of total diffuse recharge or 45 percent of combined diffuse and river recharge. About one-quarter of the extraction in the modelled area within the region is outside the Lower Murray Alluvium and Katunga WSPA GMUs. For the Lower Murray Alluvium GMU (parts of which lie outside the Murray region), modelling indicates that current extraction – which is essentially equivalent to the long-term average extraction limit – represents 29 percent of total groundwater recharge. This is a low level of development which can be supported by the existing distribution of bores. Total recharge exceeds extraction in all years. Leakage from the more saline Shepparton Formation to deeper aquifers is 109 GL/year and is a large component of the water balance. This leakage thus represents a salinisation risk for the deeper aquifers which are the primary aquifers for irrigation supply. For the Katunga WSPA GMU which is entirely within the Murray region, modelling indicates that current extraction represents 42 percent of total groundwater recharge. This is a moderate level of development which can be supported by the existing distribution of bores. Total recharge exceeds extraction for 100 percent of the time. Under a long-term continuation of the recent climate there would be no change in recharge and under the best estimate 2030 climate the water balance would essentially remain unchanged. The modelling indicates that although current extraction is less than half the long-term average extraction limit, this level of extraction represents the maximum yield of the GMU under current extraction rules.

Simple water balance analyses for the 20 lower priority GMUs indicate that total current extraction outside of the modelled Southern Riverine Plains area is 67 GL/year. For the eight lower priority GMUs where rainfall recharge is significant, current extraction is less than one-fifth of recharge, except for the Upper Murray Alluvium GMU where extraction is nearly eight times the rainfall recharge.

For the major wetlands and floodplain forests along the Murray River, water resource development in the Murray region and in the upstream contributing regions has approximately doubled the average period between significant inundation events (to at least three and a half years). Flood volumes have also been greatly reduced such that the average annual flood volume is now less than a quarter, and in some cases only a fifth, of the volume under without-development conditions. For the Lower Lakes, Coorong and Murray Mouth, water resource development has