3 GROUNDWATER USE IN THE MURRAY-DARLING BASIN

3.1 Introduction

This section contains a summary of the available data on historic use, current use and future use reported at a basin, jurisdiction and GMU scale (Sections 3.3 to 3.5) and a discussion of the data (Section 3.6).

The primary data source for this section was the data provided by each of the jurisdictions in response to the request from MDBC and MDBMC to report on groundwater issues (the data tables submitted are provided in Appendix A). The jurisdiction’s responses were supported with additional information from reports summarised in Section 2.

3.2 Groundwater resources of the Murray-Darling Basin

Groundwater is used extensively throughout the basin and contributes around 10 to 15% of the basin water resource. Around 65% of groundwater is used for irrigation (Figure 3.1), which is taken from an area covering less than 20% of the basin (SKM, 2003).

There are three aquifer types within the basin – basinal sediments of the Murray Geological Basin and associated deposits in the Darling River Drainage Basin; porous sandstones within the Great Artesian Basin; and aquifers within the fractured rocks of the highlands (Lachlan Fold Belt, New England Block, and Mt Lofty Ranges, Evans et al., 2004).

The basinal aquifers are regional in extent and granular in nature, whereas individual fractured rock aquifers are much smaller and more localised (although in total, fractured rock aquifers cover a larger area). Basinal aquifers provide most of the basin’s groundwater resources. The GAB sandstones are extensive but occur at depth and generally have no influence on stream flow in the basin and hence are disregarded in this report.

There is a detailed description of the basin’s groundwater systems in the Groundwater Status Report (GSR, refer Section 2), including analysis of trends in groundwater levels and salinity, and a description of inter-aquifer connections. This information can be used to support the analysis of stream-aquifer interaction.

Groundwater flow systems (GFS) have also been defined throughout the basin as an aide to the management of dryland salinity (refer to Section 2).

The National Land and Water Resource Audit (NLWRA, 2000) defined a Groundwater Management Unit (GMU) as a “hydraulically connected groundwater system that is defined and recognised by Territory and State agencies”. Unincorporated areas (UA) are the parts of groundwater provinces...
that are not designated as GMUs. There is limited potential for use to increase in UAs.

New GMUs are being proclaimed in NSW as pressure on the use of existing water resources increases and the potential for adverse impacts on streamflow and quality.

A breakdown of the number of GMUs and UAs in each jurisdiction is provided in Table 3.1.

**Table 3.1 Summary of number of groundwater management units and unincorporated areas by jurisdiction.**

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Number of GMUs (excluding GAB)</th>
<th>Number of GMUs in the GAB</th>
<th>Number of unincorporated areas (UA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>26(^2)</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>New South Wales</td>
<td>26(^1)</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Victoria</td>
<td>22(^3)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>South Australia</td>
<td>12(^3)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

\(^1\) Includes a GMU for the Border Rivers alluvium.

\(^2\) Includes Toowoomba North Basalt, Toowoomba South Basalt, Warwick Area Basalt, Emu Creek alluvium GMUs.

\(^3\) Includes GMUs outside the Murray drainage basin but within the Murray geological basin.

This report focuses on the GMUs and excludes GAB GMUs and UAs on the basis of the likely impact of groundwater pumping on streamflow.

The operation of salt interception schemes (SIS) provide a benefit to river water quality by intercepting salt within the aquifer before it discharges to the river. Data for salt interception schemes is also provided in the report.

### 3.3 Groundwater management and sustainable yield

All basin jurisdictions are committed to managing groundwater resources according to a sustainable yield approach. The National definition of sustainable yield is:

*Sustainable groundwater yield is defined as the groundwater extraction regime, measured over a specified timeframe that allows acceptable levels of stress and protects dependent economic, social and environmental values.*
This definition is normally accompanied by explanatory notes for extraction regime, acceptable levels of stress, storage depletion and protecting dependent economic, social and environmental values which are provided in Section 8.

A key component of the definition of sustainable yield is the trade-offs that can occur between various users, usually between consumptive and environmental users on the basis that a balance is needed to maintain the social and economic development that has occurred with the use of groundwater. In this sense the value of sustainable yield can change over time as social values change so that GMUs that are currently over-used with respect to sustainable yield could be seen as being sustainable at some point in the future.

There are variations between jurisdictions in the approach to definition of sustainable yield and there are also variations in approaches to how sustainable yield is used in the context of water sharing and water allocation plans.

3.4 Historical use in the Murray-Darling Basin

Historical groundwater use data are summarized in Section 3.4.1 and data qualifications are described in Section 3.4.2.

3.4.1 Data

A compilation of historical use data is provided in Table 3.2. The data is based on information from the sources identified in this report (Section 2) with the exception of sources listed in the footnotes to Table 3.2.

In general, the history of use at the GMU scale falls into two broad categories - one where the use has continued to increase, but with possible minor fluctuations around the trend line (e.g. Lower Murrumbidgee, Figure 3.2); and another where use was relatively constant (usually capped) but again with fluctuations (sometimes the fluctuations are large, e.g. Condamine).

There is additional groundwater use, sustainable yield and allocation data from the MDBC Water Audit Monitoring reports which are summarised in Appendix B.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>*1623</td>
<td>*92</td>
<td>*129</td>
<td></td>
</tr>
<tr>
<td>New South Wales</td>
<td>*1009</td>
<td>*742</td>
<td>667</td>
<td></td>
</tr>
<tr>
<td>Victoria</td>
<td>*622</td>
<td>*217</td>
<td>*212</td>
<td></td>
</tr>
<tr>
<td>South Australia</td>
<td>*430</td>
<td>23</td>
<td>*213</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>894</td>
<td>3684</td>
<td>1074</td>
<td>1033</td>
</tr>
</tbody>
</table>

Compilation of historical groundwater use data.

1 Data provided by MDBC. The authors have not reviewed the report and it is not known whether the value includes all GMUs.
Trends in groundwater use in the Lower Murrumbidgee and Condamine GMUs

Figure 3.2
Values include GAB aquifers and unincorporated areas. The NLWRA website was experiencing difficulties and access to GMU-scale information was not possible.

Data not available for Toowoomba North Basalt, Toowoomba South Basalt, Warwick Area Basalt, Emu Creek alluvium GMUs. Data excludes GAB GMUs.

Data includes Toowoomba North Basalt, Toowoomba South Basalt, Warwick Area Basalt, Emu Creek alluvium GMUs. Data excludes GAB GMUs.

Data includes Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone, Molong limestone and excludes Border Rivers alluvium and GAB GMUs.

Data excludes Telopea Downs, Lilimur, Neuarpur, Boikerbert, Moolort, Bungaree, Glengower, Bullarook and Tourello GMUs.

Data includes values for Angas Bremer and Mallee GMUs.

This value is larger than the SKM and Watermark values because it includes values for the GMUs that are within the Murray geological basin, but outside the Murray drainage basin. This value also includes unincorporated areas.

Includes unincorporated areas.

3.4.2 Data qualification

Compilation of historical groundwater use data for trend analysis is made difficult because of differences in the GMUs reported between data sources and the incomplete datasets (e.g. missing years).

There is no information readily available that describes the reliability of the Water Review 1985 and NWLRA (2000) datasets. A comparison of the different datasets raises some issues such as the 400 GL difference between the NLWRA and later datasets which appears to be assigned to unincorporated areas in Victoria and South Australia.

There are reliable historical datasets available for some GMUs with records that go back 20 to 30 years. However there are other data sets where use has not been metered but instead estimated. These historical datasets are currently being collated as part of the Watermark project (Stage 2).

3.5 Current (2002/03) groundwater use in the Murray-Darling Basin

The available groundwater use data for 2002/03 has been compiled and summarised in Section 3.5.1 and data qualifications are described in Section 3.5.2.
3.5.1 Data

A compilation of current use data for each jurisdiction is provided in Table 3.3. A composite set of values of groundwater use for 2002/03 has been constructed and presented in Table 3.3 (last column) based on the range of available data.

A compilation of current volumes of groundwater extracted from salt interception schemes is provided in Table 3.4.

The volume of groundwater use in each GMU (excluding GAB aquifers) in 2002/03 is mapped in Figures 3.3 and 3.4. The extent of GMUs has to be presented using two maps because of some GMUs overlap each other in the vertical profile. The first map (Figure 3.3) shows the extent of those GMUs that are not overlain by other GMUs and the second map (Figure 3.4) shows the extent of those GMUs that are partly or wholly overlain by other GMUs.

The extent of the GMUs in Figures 3.3 and 3.4 is based on the information available in October 2004, however, it is recognised that new GMU boundaries are being identified in NSW as part of the macro water sharing planning process.

The GMUs with largest volumes of groundwater use in 2002/03 (greater than 50 GL) are:

- Lower Murrumbidgee (381 GL);
- Lower Murray (134 GL);
- Upper Namoi (132 GL);
- Lower Lachlan (123 GL);
- Shepparton (120 GL);
- Lower Namoi (119 GL); and
- Lower Macquarie (54 GL).
GMU key and name
N09, Lower Namoi Alluvium
N10, Lower Murrumbidgee Alluvium
N11, Lower Gwydir Alluvium
N12, Upper Namoi Alluvium
N13, Paris River Alluvium
N14, Macs Creek Alluvium
N15, Misceaneous Tributaries of the Namoi River (Alluvium)
N16, Lower Macquarie Alluvium
N17, Upper Macquarie Alluvium
N18, Gulgong Valley Alluvium
N19, Upper Lachlan Alluvium
N20, Lower Lachlan Alluvium
N21, Mid Murrumbidgee Alluvium
N22, Billabong Creek Alluvium
N23, Upper Murray Alluvium
N24, Lower Murray Alluvium
N27, Coolaburragundy - Talbragar Valley Alluvium
N28, Bell Valley Alluvium
N29, Balgalie River Alluvium
N42, Orange Basalt
N43, Young Granite
N44, Inverell Basalt
N59, Lower Namoi Alluvium
G01, Condamine - Condamine Groundwater Management Area Sub-Area 5
G02, Condamine River (Down-river of Condamine Groundwater Management Area)
G03, Condamine River Alluvium (Killarney to Murrays Bridge)
G04, Condamine River Alluvium (Murrays Bridge to Cunningham)
G05, Condamine River Alluvium (Cunningham to Ellangowan)
G06, Grampians Creek
G07, Dalyellup Creek Alluvium
G08, Kings Creek Alluvium
G09, Swan Creek Alluvium
G70, Notby Basalts
G71, St. George Alluvium
G72, Border River
G999, Emu Creek Alluvium
S16, Angas Bremer
S20, Malke - 1
S23, Merre
V11, Alexandra
V12, King Lake
V35, Mulitlingong
V36, Barnwartha
V37, Murrumgee
V38, Goomerbah
V43, Shepparton Groundwater Supply Protection Area
V44, Ellemere
V45, Mid Lockton
V49, Murrywee Groundwater Supply Protection Area
V55, Upper Lockton
V56, Spring Hill Groundwater Supply Protection Area

Groundwater Use (GL)

NOTE:
For display purposes this map shows Groundwater Management Units (GMU) that are not overlain by any other GMUs.
Groundwater Use (GL)

- less than 50
- 50 - 100
- 100 - 200
- 200 - 400
- No Data

NOTE:
For display purposes this map shows Groundwater Management Units (GMU) that underly GMUs in Figure 3.3

GMU key and name

- V40, Kilaa
- N45, Mudgee Limestone
- N49, Molong Limestone
- Q51, Upper Hodgson Creek
- Q52, Toowoomba City Basalt
- Q52a, Toowoomba North Basalts
- Q52b, Toowoomba South Basalts
- Q52c, Warrick Area Basalts
- V39, Katunga Groundwater Supply Protection Area
- V41, Mild Goulburn
- V42, Campaspe Groundwater Supply Protection Area

GROUNDWATER USE
IN 2002 / 2003
WITHIN UNDERLYING GMUs

Figure 3.4
Table 3.3 Compilation and summary of the data available describing current (2002/03) groundwater use.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Number of GMUs with current use data provided in the jurisdiction’s responses</th>
<th>Current use (GL, provided in the jurisdiction’s responses)</th>
<th>Current use (GL, from adjusted jurisdiction’s responses)</th>
<th>Current use (GL, taken from the Water Audit Monitoring Report 2002-03)</th>
<th>Current use (GL, used in the Watermark project)</th>
<th>Current use data (GL, based on an evaluation by the authors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>26</td>
<td>151</td>
<td>151</td>
<td>Not available at the GMU scale</td>
<td>154</td>
<td>151</td>
</tr>
<tr>
<td>New South Wales</td>
<td>25</td>
<td>1008</td>
<td>1855</td>
<td>1290</td>
<td>1120</td>
<td>1126</td>
</tr>
<tr>
<td>Victoria</td>
<td>15</td>
<td>310</td>
<td>234</td>
<td>Only available for metered GMUs</td>
<td>Only available for metered GMUs</td>
<td>239</td>
</tr>
<tr>
<td>South Australia</td>
<td>3</td>
<td>44</td>
<td>1234</td>
<td>Not provided</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>1513</td>
<td>1274</td>
<td></td>
<td>1550</td>
<td></td>
</tr>
</tbody>
</table>

1 Use data for NSW was provided to REM by MDBDC taken from the Water Auditing Monitoring Report for 2002/03.
2 Queensland and SA data provided to REM for the Watermark project.
3 Data from Watermark was added for the Toowoomba North Basalt, Toowoomba South Basalt, Warwick Area Basalt, Emu Creek alluvium GMUs, but excludes the six GAB GMUs (pers. comm. David Free, NRM). The difference between the 154 GL (Watermark) and 151 GL (jurisdiction’s response) values occurs because of round-off.
4 NSW data for current use not necessarily for 2002/03 and in some GMUs the data is based on information used in model calibration runs. Data excludes Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone, Molong limestone and Border Rivers alluvium GMUs, and includes four GAB GMUs.
5 NSW data provided to REM for the Watermark project excludes GAB aquifers and the Border Rivers alluvium, but includes estimates for Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone and Molong limestone GMUs.
6 Victorian data does not include GMUs located in western Victoria (Balrootan, Murrayville, Telopea Downs, Lillimur, Neuarpur, Boikerbert). Excludes SIS.
7 Victorian data does not include GMUs located in western Victoria (Telopea Downs, Lillimur, Neuarpur, Boikerbert). Excludes groundwater use in UAs and SIS.
8 Use value based on volume pumped from the Waikerie, Woolpunda and Qualco-Sunlands salt interception schemes and Angas Bremer, Marne and Mallee GMUs. The SA contact suggested not including SA GMUs that lie outside the drainage basin (pers. comm. Steve Barnett, DWLBC).
9 SA values for Angas Bremer, Marne and Mallee GMUs.
10 Includes a 5.5 GL (rounded up to 6 GL) volume for the NSW part of the Border Rivers (pers. comm. David Free) added to the 1120 GL from Watermark.
11 Excludes values for GAB, use in UAs and SIS.
12 Excludes SIS and use in UAs.
Table 3.4 Compilation and summary of the data available describing current (2002/03) groundwater extraction from salt interception schemes.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Current volume of groundwater extracted (GL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>0</td>
</tr>
<tr>
<td>New South Wales</td>
<td>7.7&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Victoria</td>
<td>7.3&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>South Australia</td>
<td>9.8&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total</td>
<td>24.8</td>
</tr>
</tbody>
</table>

<sup>1</sup> Data provided by DIPNR

<sup>2</sup> Data provided by River Murray Water and does not include value for SIS at Pyramid Creek.

<sup>3</sup> Data provided in SA jurisdiction’s response
3.5.2 Data qualifications

Queensland

The jurisdiction’s response (Appendix A) contains data for 26 GMUs. The response did not include the GAB aquifers in their response because the GAB aquifers are not connected to surface water systems (pers. comm. David Free, NRM).

Eight of the 26 GMUs for which data was supplied have metered data, which is supplemented with estimates for stock and domestic use. Use values for the remaining 18 GMUs are estimates only. There is no information presented which allows an assessment of the accuracy of the estimated use values.

Data from the Water Audit Monitoring Reporting process was not included because the data provided was based on Cap catchments rather the GMUs.

New South Wales

The jurisdiction’s response (Appendix A) contains use data for 25 metered GMUs. Data for the Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone and Molong limestone GMUs was not provided because use in these GMUs is small (pers. comm. George Gates, DIPNR). The NSW response does not contain data for the NSW part of the Border Rivers alluvium, although data provided by Queensland indicates NSW metered use to be around 5.5 GL/yr (pers. comm. David Free, NRM).

NSW provided estimates of current use that didn’t necessarily correspond with the 2002/03-year and were derived from datasets used in groundwater flow model calibration. In some cases the volume of current use provided by NSW related to a year other than 2002/03. This was done because the estimates of impact on streamflow (refer Section 4) are taken from model output (in 10 GMUs) and the presentation of model input data in the jurisdiction’s response therefore made the response internally consistent (pers. comm. Mike Williams, DIPNR).

The reason for differences in current use values in non-modelled GMUs is not known.

NSW advised that groundwater use data from the Water Audit Monitoring process could be used to report use in 2002/03. There is a difference of 265 GL between the use values provided in the adjusted NSW jurisdiction’s response and the use values in the Water Audit Monitoring Report (2002/03) datasets.

Victoria

The jurisdiction’s response (Appendix A) contains data for 15 GMUs. There are six GMUs (of the 15 GMUs in the response) with metered data only and the remaining nine GMUs have estimated use values or a combination of metered and estimated values.

Groundwater use in most unmetered GMUs is relatively small and these unmetered GMUs are therefore less important when discussing basin-scale
impacts. The Shepparton GMU is the exception with an estimated 2002/03 use of around 120 GL, which is a large part of the total volume reported in the jurisdiction’s response (310 GL).

South Australia

The data on 2002/03 use in the jurisdiction’s response was for the three GMUs within the Murray-Darling drainage basin (Angas Bremer, Marne and Mallee GMUs). Data for salt interception schemes along the River Murray was also included.

3.6 Future use

A compilation of the future use data for each jurisdiction is provided in Table 3.5. A composite set of values of groundwater use for 2002/03 is also presented in Table 3.5 (last column).

The volume of groundwater estimated to be used in each GMU (excluding GAB aquifers) in 2052/53 is mapped in Figures 3.5 and 3.6.

The rate of growth varies between GMUs and between jurisdictions with use in NSW expected to plateau at sustainable yield within 10 years. Growth in Queensland is limited by a groundwater cap that is in place for most GMUs. The rate of rise in use is not expected to be large because use in many of the GMUs is capped.

Future growth in Victoria is expected to increase significantly. Use in South Australia is not expected to increase significantly because of limits to the availability of low salinity water in the Mallee GMU.

The largest projected increases in groundwater use over the 50-year period are in the Upper Lachlan (161 GL) and Mid Murrumbidgee (53 GL) GMUs. For the Upper Lachlan and Mid Murrumbidgee, the sustainable yield estimates are preliminary and may be revised downwards over the next 10 years prior to these projected increases actually occurring. In other GMUs such as the Lower Murrumbidgee and Upper Namoi, use is expected to fall back to the sustainable yield over the next 50-years as regulatory controls take effect.
Figure 3.5

PROJECTED GROUNDWATER USE IN 2052/2053 WITHIN EACH GMU

Groundwater Use (GL)

- Less than 50
- 50 - 100
- 100 - 200
- 200 - 400
- No Data

NOTE: For display purposes this map shows Groundwater Management Units (GMU) that are not overlain by any other GMUs

GMU key and name

- N09, Lower Namoi Alluvium
- N10, Lower Murrumbidgee Alluvium
- N11, Lower Gwydir Alluvium
- N12, Upper Namoi Alluvium
- N13, Peel River Alluvium
- N14, Muscles Creek Alluvium
- N15, Miscellaneous Tributaries of the Namoi River (Alluvium)
- N16, Lower Macquarie Alluvium
- N17, Upper Macquarie Alluvium
- N18, Cudgegong Valley Alluvium
- N19, Upper Lachlan Alluvium
- N20, Lower Lachlan Alluvium
- N21, Mid Murrumbidgee Alluvium
- N22, Billabong Creek Alluvium
- N23, Upper Murray Alluvium
- N24, Lower Murray Alluvium
- N27, Coolaburraquandy - Tallagarro Valley Alluvium
- N28, Bell Valley Alluvium
- N29, Belubula River Alluvium
- N40, Orange Basalt
- N43, Young Granite
- N44, Inverell Basalt
- N999, Border River
- Q999, Border River
- N53, Myll / Motta Creek North
- Q53, Myll Creek
- Q54, Lower Oakey Creek Alluvium
- Q56, Oakey Creek Management Area
- Q57, Condamine - Condamine Groundwater Management Area Sub-Area 1
- Q58, Condamine - Condamine Groundwater Management Area Sub-Area 2
- Q59, Condamine - Condamine Groundwater Management Area Sub-Area 3
- Q60, Condamine - Condamine Groundwater Management Area Sub-Area 4
- Q61, Condamine - Condamine Groundwater Management Area Sub-Area 5
- Q62, Condamine River (Down-river of Condamine Groundwater Management Area)
- Q63, Condamine River Alluvium (Kilarney to Murrays Bridge)
- Q64, Condamine River Alluvium (Murrays Bridge to Cunningham)
- Q65, Condamine River Alluvium (Cunningham to Ellengowan)
- Q66, Glengallan Creek
- Q67, Dalrymple Creek Alluvium
- Q68, Kings Creek Alluvium
- Q69, Swan Creek Alluvium
- Q70, Nothy Basalt
- Q71, St. George Alluvium
- Q73, Border River
- Q999, Ems Creek Alluvium
- S18, Angas Bremer
- S20, Melies - 1
- S23, Marne
- V11, Alexandra
- V12, King Lake
- V35, Mulikilginginy
- V37, Barwarratha
- V39, Numpringa
- V38, Goomerbal
- V43, Shipparton Groundwater Supply Protection Area
- V44, Ellekerree
- V45, Mid Loddon
- V47, Balrootan (Nhill)
- V49, Murrayville Groundwater Supply Protection Area
- V55, Upper Loddon
- V56, Spring Hill Groundwater Supply Protection Area

Note: For display purposes this map shows Groundwater Management Units (GMU) that are not overlain by any other GMUs.
PROJECTED GROUNDWATER USE IN 2052/2053 WITHIN UNDERLYING GMUs

NOTE:
For display purposes this map shows Groundwater Management Units (GMU) that underly GMUs in Figure 3.5

GMU key and name
N48, Mudgee Limestone
N49, Murring Limestone
Q51, Upper Hodgson Creek
Q52, Toowoomba City Basalt
Q52a, Toowoomba North Basalts
Q52b, Toowoomba South Basalts
Q52c, Warrick Area Basalts
V39, Katunga Groundwater Supply Protection Area
V40, Kialla
V41, Mid Goulburn
V42, Campaspe Groundwater Supply Protection Area
Table 3.5 Compilation and summary of the data available describing projected groundwater use.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Number of GMUs with future use data in the jurisdiction’s responses</th>
<th>Estimated future use (GL, from the jurisdiction’s response)</th>
<th>Estimated future use (GL, from adjusted jurisdiction’s responses)</th>
<th>Estimated future use (GL, based on an evaluation by the authors)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012/13</td>
<td>2052/53</td>
<td>2012/13</td>
<td>2052/53</td>
</tr>
<tr>
<td>Queensland</td>
<td>26</td>
<td>181</td>
<td>215</td>
<td>181</td>
</tr>
<tr>
<td>New South Wales</td>
<td>25</td>
<td>1312</td>
<td>1312</td>
<td>1203</td>
</tr>
<tr>
<td>Victoria</td>
<td>15</td>
<td>378</td>
<td>445</td>
<td>263</td>
</tr>
<tr>
<td>South Australia</td>
<td>3</td>
<td>77</td>
<td>95</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>1948</td>
<td>2067</td>
<td>1689</td>
</tr>
</tbody>
</table>

1 Data from Watermark was added for the Toowoomba North Basalt, Toowoomba South Basalt, Warwick Area Basalt, Emu Creek alluvium GMUs, but excludes the six GAB GMUs and use in UAs (pers. comm. David Free). It was assumed the upper limit was the estimated sustainable yield. It was assumed that 50% of the available increase would occur in the first 10 years and the remaining 50% of the available increase would occur in the remaining 40 years.

2 Data excludes Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone, Molong limestone and Border Rivers alluvium GMUs, and includes four GAB GMUs.

3 Victorian data does not include GMUs located in western Victoria (Balrootan, Murrayville, Telopea Downs, Lillimur, Neuarpur, Boikerbert). Excludes SIS.

4 Victorian data does not include GMUs located in western Victoria (Telopea Downs, Lillimur, Neuarpur, Boikerbert). Excludes groundwater use in UAs and SIS.

5 Use value based on volume pumped from the Waikerie, Woolpunda, Qualco-Sunlands, Pike River, Murtho, Loxton, Bookpurnong and Chowilla salt interception schemes and values for Angas Bremer, Marne and Mallee GMUs. Excludes groundwater use in UAs.

6 Data from Watermark added for Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone, Molong limestone and Border Rivers alluvium GMUs, and excludes four GAB GMUs, SIS and UAs. The upper limit to use for the additional GMUs is the estimate of sustainable yield provided for the Watermark project.

7 Excludes values for UAs and SIS.

8 Data excludes Mid and Upper Murrumbidgee fractured rock, the Mudgee limestone, Molong limestone and Border Rivers alluvium GMUs. Excludes GAB GMUs, UAs and SIS.
Table 3.6. Compilation and summary of the data available describing projected groundwater extraction from salt interception schemes.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Volume of groundwater extracted (GL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012/13</td>
</tr>
<tr>
<td>Queensland</td>
<td>0</td>
</tr>
<tr>
<td>New South Wales</td>
<td>8.2(^1)</td>
</tr>
<tr>
<td>Victoria</td>
<td>7.3(^2)</td>
</tr>
<tr>
<td>South Australia</td>
<td>34.6(^3)</td>
</tr>
<tr>
<td>Total</td>
<td>50.1</td>
</tr>
</tbody>
</table>

\(^1\) Data provided by DIPNR
\(^2\) Data provided by River Murray Water and does not include value for SIS at Pyramid Creek.
\(^3\) Data provided in SA jurisdiction’s response
3.6.1 Data qualification

Queensland

The addition of the data for the GMUs not originally included in the jurisdiction’s response (refer to footnote 1 to Table 3.5) is not expected to change the overall outcome from the analysis because these GMUs are relatively small (total of 39 GL allocated).

New South Wales

The addition of data for those small GMUs not included in the response increase the estimate of future use by around 48 GL/yr.

Victoria

The estimates of future use provided within the jurisdiction’s response are based on the assumption that use will reach the upper limit (permissible annual volume) in 50-years, with half the increase occurring in the next 10-years and the remaining increase in the following 40-years.

Future use in metered GMUs are described in the response as having a “medium confidence” and future use in unmetered GMUs are described as having a “low confidence”.

South Australia

Data was provided for relevant GMUs and for salt interception schemes

3.7 Key findings and discussion

The collation of jurisdiction and basin scale datasets confirms that groundwater use has increased significantly within the basin over the last 20-years. The Water Review (1985) report estimated groundwater use to be 894 GL in 1983/84. Groundwater use increased gradually to 1033 GL in 2000/01, and then increased more rapidly to 1550 GL in 2002/03. There was an additional 24.8 GL extracted by salt interception schemes in 2002/03.

There is no basin-scale dataset that describes use in 1993/94, although it has been estimated that total groundwater use rose by 310 GL/yr between 1993/94 and 1999/00 (SKM, 2003). It is not clear from the SKM report whether the 310 GL applies to all groundwater resources in the basin or just GMUs.

Groundwater use has increased in nearly all GMUs in the basin since 2000/01 and the only GMUs where use has been stable are those where use is at or above the sustainable yield. The largest increase in use between 2000/01 and 2002/03 occurred in the alluvial plain GMUs mostly in southern New South Wales (450 GL).

The rapid rise is considered to be due mainly to new development of irrigated areas, the implementation of the Cap on surface water diversions which is limited to 1993/94 development levels, and the continuing dry climatic conditions.
There are very few GMUs that have shown a falling trend, even where use exceeds sustainable yield. Capital investment in infrastructure for the use of groundwater is likely to mean that groundwater use will not decline significantly.

Figure 3.7 provides a summary of (approximated) basin scale historical trends in groundwater use. The groundwater use trend line shown in the figure is stylised based on only a few pieces of data. Figure 3.7 also provides a trend line that represents the growth in the diversion of surface water.

The rapid increase in groundwater use since 2000/01 indicates that the sustainable yield of the basin’s groundwater resources will be reached within the next 5 to 10 years. Use in 2002/03 was 1550 GL which is around 80% of the sustainable yield for the basin. This contrasts with the situation in 2000/01 when use was 58% of the sustainable yield.

The ratio of use in 2002/03 to estimated sustainable yield in each GMU is mapped in Figure 3.8 and 3.9. The estimates of sustainable yield are taken from datasets provided to REM for the Watermark project. There are 18 GMUs within the basin where current use is greater than the estimated sustainable yield. There are three large GMUs; the Lower Lachlan, Lower Murrumbidgee, Lower Murray where use in 2002/03 exceeded the sustainable yield. Water sharing plans are being introduced across NSW to keep average groundwater use (over a 10-year period) at a level at, or below, sustainable yield. Over used GMUs exist in Queensland (Condamine Sub area 3).

Groundwater use is estimated to increase by 17% (to 1822 GL/yr) over the 50-year timeframe. The volume of groundwater extracted by salt interception schemes is estimated to increase by nearly 140% (to around 59 GL/yr) over the 50-year timeframe. Most of this increase is estimated to occur when new salt interception schemes are commissioned along the South Australian reach of the River Murray.

With respect to future groundwater use, most of the increase in groundwater use can be expected in the 10-year rather 50-year timeframe recognising the rapid growth seen since 2000/01. This conclusion is in stark contrast to previous studies that have suggested a gentler rise over the next 50 years or so (SKM, 2003). It is expected that reduced allocations and the introduction of trading of groundwater licences in NSW GMUs will further accelerate groundwater use.

The largest growth is anticipated to occur (on a volumetric basis) in the Upper Lachlan and Mid-Murrumbidgee GMUs (based on current sustainable yield estimates). However other factors such as market forces and climate change will also be important. The overriding factor is likely to be revised management plans at the GMU scale.

There is limited scope for further development of groundwater resources in South Australia and Queensland.

The level of confidence in the current groundwater use data varies between GMUs. There is no readily available data to determine the accuracy of estimated or metered use values, but some semi-quantitative observations can be made.
Trends in surface water and groundwater use for the basin

Figure 3.7

Additional volume of groundwater pumped since 1993/94

Projected groundwater use

Additional volume of groundwater pumped since 2002/03

Annual surface water diversions (GL/year)

Year

1920 1940 1960 1980 2000 2020 2040 2060

894 GL

1550 GL

1744 GL

1822 GL

SURFACE WATER DIVERSIONS

14 000

12 000

10 000

8 000

6 000

4 000

2 000
Figure 3.9
RATIO OF GROUNDWATER USE IN 2002/2003 TO SUSTAINABLE YIELD WITHIN UNDERLYING GMUs

Use / Sustainable Yield (%)

- Less than 50
- 50 - 75
- 75 - 100
- 100
- Greater than 100
- No data

NOTE: For display purposes this map shows Groundwater Management Units (GMU) that underly GMUs in Figure 3.8

GMU key and name
- N49, Mudgee Limestone
- N49, Molong Limestone
- Q51, Upper Hodgson Creek
- Q52, Toowoomba City Basalt
- Q52a, Toowoomba North Basalts
- Q52b, Toowoomba South Basalts
- Q52c, Warrick Area Basalts
- V39, Katunga Groundwater Supply Protection Area
- V40, Kilteel
- V41, Mid Goulburn
- V42, Campeape Groundwater Supply Protection Area
In some jurisdictions there are a high number GMUs where use is estimated rather than metered. For example in Victoria only six of the 15 GMUs reported in the jurisdiction response have been metered. GMU scale analysis of use is hampered by the lack of metered groundwater use data. Similar issues occur in Queensland.

Most jurisdiction’s responses did not include a small number of GMUs. In some cases (e.g. in Victoria) this is because a number of smaller GMUs have been consolidated to form larger GMUs.

The use data for 2002/03 (the benchmark year agreed by GTRG) in the NSW jurisdiction’s response did not match data provided by NSW to the Water Audit Monitoring report process. The difference in 10 of the NSW GMUs were because the use numbers in the jurisdiction’s response was taken from groundwater model calibration runs, which didn’t necessarily include 2002/03.

The usage data from NSW prepared for groundwater flow modelling requires verification of the metered pumping information lodged for the full period of record. The data is examined on a bore by bore basis for consistency and filed checked with groundwater users and compliance officers. It is considered highly reliable.

The difference between the two NSW use values was around 20% (265 GL) of the adjusted jurisdiction’s response, which is significant. The differences at the GMU scale were more significant, for some GMUs such as Upper Lachlan where the NSW jurisdiction’s response had a current use value of 12.5 GL and the data from the Water Audit Monitoring Report shows a value of 44.1 GL for 2002/03. A difference of this significance needs to be resolved.

It will be difficult to develop and implement management arrangements where accurate groundwater use data is of low reliability. There is a need to comprehensively meter the use of groundwater to implement a monitoring and evaluation strategy as part of a continued assessment of sustainable yield issues. However, there is also a need to establish clear objectives for the design of a metering program so that data is collected at the appropriate time and spatial scales.

The uncertainty in future use values is recognized by the Victorian response which includes either a “low confidence” (for unmetered GMUs) or “medium confidence” (for metered GMUs) tag against each GMU. There is no indication of the accuracy of these estimates in other jurisdiction’s responses, although the NSW response indicates a tag of “regional best guess” for 14 GMUs.

Equally uncertain is the time it will take to reach the higher level of usage. Jurisdictions have assumed that the rate of increase in use will be greatest in the next 10 years. This is considered a reasonable assumption given the rapid growth in use seen over the last 2 to 3 years.

It is clear from historical trends in groundwater use that the simple linear average rate of rise model of projected groundwater use (SKM, 2003) does not hold and that large upward steps in groundwater use can occur over short periods. A more comprehensive assessment of the factors that can affect future use in high
priority GMUs would provide a higher level of certainty of estimated future use. The factors involved are likely to include physical, policy and regulatory settings, and market and social factors that drive patterns in use. Failure to adequately understand these drivers could result in actual use increasing more rapidly than anticipated before appropriate management arrangements have been implemented.