Alinytjara Wiluṟara Demand and Supply Statement
2013
Foreword

I am pleased to present the Alinytjara Wiluŋara Demand and Supply Statement, a key commitment in Water for Good – the State Government’s plan to ensure our water future to 2050.

The Alinytjara Wiluŋara Demand and Supply Statement is the third of eight regional demand and supply statements. These statements are high level strategic documents that project the available water supply and demands for a region and any possible future demand-supply imbalance. The projections in these statements will then be used to guide the timing and nature of future demand management or supply augmentation options, when needed.

At this stage it has not been possible to prepare demand-supply projections for the Alinytjara Wiluŋara region as there has not been sufficient data available. However, there is work underway to increase our knowledge of the water resources in the Alinytjara Wiluŋara region, including the Finding Long-term Outback Water Solutions initiative. Any new data from this or other projects in the region will be incorporated into the Statement during the annual review, and demand-supply projections will be developed if possible.

The future use of water use across the Alinytjara Wiluŋara region needs to be considered delicately. Aboriginal communities have a complex relationship with water that goes beyond simply using it for consumptive purposes. Aboriginal people of the Alinytjara Wiluŋara region have strong cultural associations with regional water resources and it is important that this relationship is acknowledged.

The Alinytjara Wiluŋara region also has the potential for growth in the mining and petroleum sectors, one of the State Government’s strategic priorities, which could increase demand on the region’s water resources.

The balance between water users and ongoing water security remains a challenge for South Australia but I am confident that the Alinytjara Wiluŋara Demand and Supply Statement provides critical information to help us ensure the Alinytjara Wiluŋara Region’s water supply continues to support its culture, economy, lifestyle and environment.

The Hon Ian Hunter MLC

Minister for Water and the River Murray
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1 Alinytjara Wiluŋara Demand and Supply Statement in Summary

This section of the Alinytjara Wiluŋara Demand and Supply Statement (DSS) introduces the context and scope of regional demand and supply statements and summarises the key findings of the Alinytjara Wiluŋara DSS.

The key findings, which are discussed in more detail at the end of this section, relate to:

- The limited level of current knowledge regarding the capacity and quality of the region’s water resources; and
- The potential for a large increase in water demand from the mining, petroleum and gas industries into the future.

South Australia has a vast land area with diverse landscapes and climatic conditions that influence the quantity and source of available water. Beyond the city of Adelaide, the population is scattered widely, with some regional centres, towns and communities without a local and reliable natural water source. In order to determine the best ways to secure the State’s water resources, it is important to first take stock of the resources available, the current and projected future demands on them, and the likely timing of any potential demand-supply imbalance.

It is also important to recognise that the water industry in South Australia is changing. To achieve a more dynamic water sector, the State Government has enacted the Water Industry Act 2012 that will better reflect the changing environment. The purpose of the Water Industry Act 2012 is to provide a framework to support a contemporary and developing water industry by:

- Providing for an integrated approach to water demand and supply planning; and
- Providing for the regulation of the water industry.

A changing climate, drought, economic development initiatives and expected population growth have driven this change in what has typically been a relatively stable service sector. South Australia is also a signatory to the National Water Initiative (NWI), Australia’s blueprint for water reform.

The NWI promotes a more cohesive national approach to the way Australia manages, measures, plans for, prices and trades water. It also acknowledges the complex relationship that Aboriginal communities have with water and stipulates that State water plans will account for indigenous access to water resources for social, spiritual and cultural purposes (NWI 2004). The First Peoples’ Water Engagement Council (FPWEC) (2012), with representatives from Aboriginal communities across Australia, including George Cooley from South Australia, was established to provide advice to the National Water Commission in relation to implementation of the NWI. The FPWEC have provided definitions to the National Water Commission of Aboriginal water needs.

Within this context, as stated in Water for Good, the State Government is developing regional demand and supply statements for all eight Natural Resources Management (NRM) regions throughout the State. The Alinytjara Wiluŋara DSS aims to provide a long-term (40 years) overview of water supply and demand in the Alinytjara Wiluŋara NRM region of South Australia. It applies an adaptive management process, outlining the state of all water resources in
the region for drinking and non-drinking water, listing the major demands on these water resources, and identifying the likely timeframes for any possible future demand-supply imbalance.

The statements provide a desktop assessment based on the best available information, there is no new science or research undertaken to prepare them. The statements do not intend to make recommendations and outline actions to address any current or future demand-supply imbalance.

Water for Good states that the Minister for Water and the River Murray will establish an Independent Planning Process if demand-supply projections indicate a gap is likely to exist in the foreseeable future. It is through an Independent Planning Process that such recommendations and actions would be considered. Therefore, this Statement will be used to guide planning for the timing and nature of future demand management or supply options, ensuring that long-term solutions are based on a thorough understanding of the state of local resources, the demand for them and likely future pressures, including the impacts of climate change.

Although identifying solutions to address augmentation or policy issues is not within scope of the Alintjara Wiluŋara DSS, the State Government will need to consider how best to address them.

The Alintjara Wiluŋara DSS will be reviewed annually. The Statement will also be comprehensively reviewed and updated every five years, unless such a review is triggered earlier based on the findings of the annual review process.

The Alintjara Wiluŋara DSS builds on, and does not duplicate, other water planning processes. Other key plans that link to the Alintjara Wiluŋara DSS include:

- South Australia’s Strategic Plan
- Water for Good
- Infrastructure and Land Use Draft Plan for Regional and Remote Aboriginal Communities
- State Natural Resources Management Plan
- Alintjara Wiluŋara Natural Resources Management Plan
- Climate Change Adaptation Framework for South Australia

In addition, the Alintjara Wiluŋara NRM Board introduced amendments to the AW NRM Plan to improve management of water resources in the region. Effective from 1 July 2013, the amendments aim to regulate water affecting activities to protect the water resources and related natural assets (AW NRM Board 2013). It is important to note that the Alintjara Wiluŋara DSS has a different purpose than processes used to manage water resources such as regulation of water affecting activities and water allocation plans. A regional demand and supply statement aims to provide a long-term (40 years) overview of water supply and demand, whereas a water allocation plan is a statutory document detailing the rules for the allocation, use and transfer of water from prescribed water resources, as well as the water affecting activities that require permits. For further information about the differences between the regional demand and supply statements and water allocation plans go to www.environment.sa.gov.au/managing-natural-resources/water-use/water-planning. The Alintjara Wiluŋara DSS is based on the Alintjara Wiluŋara NRM region boundary, as shown in Figure 1.
Figure 1: Alinytjara Wilurara Natural Resources Management Region
The Alinytjara Wiluŋara NRM region incorporates three main Aboriginal Lands: Anangu Pitjantjatjara Yankunytjatjara (APY) Lands, Maralinga Tjarutja (MT) Lands and Yalata. There is no formal water distribution network throughout the whole of the Alinytjara Wiluŋara region, rather there are supplies to individual townships. Water infrastructure and assets are owned by the Aboriginal land owners. SA Water manages the infrastructure and assets on behalf of some of the Aboriginal land owners in the Alinytjara Wiluŋara region and is responsible for water supply infrastructure planning, construction, operations and maintenance in these instances.

Water for the environment is essential for ecosystem and waterway health, and ultimately the resources’ productivity. The environmental water provisions of the Alinytjara Wiluŋara region are set out in the Alinytjara Wiluŋara Natural Resources Management (NRM) Plan. As such they are not explicitly included in this Statement. The Alinytjara Wiluŋara NRM Plan contains a long-term outcome for healthier water-dependent ecosystems – all water dependent ecosystems have improved ecological and cultural health.

There are currently no prescribed water resources in the Alinytjara Wiluŋara region. However if there were in the future, then one of the issues considered when preparing the associated water allocation plan is the quantity and quality of water needed for dependent ecosystems, and the time periods during which those ecosystems need water. The appropriate proportions are then set aside to meet these demands and the remaining proportion is available for allocation. The Alinytjara Wiluŋara DSS would only include supply from the prescribed wells areas available for allocation, meaning the remainder would be available to the environment.

1.1 Key Findings

Groundwater resources are the key water source in the Alinytjara Wiluŋara region, for community use as well as for other purposes such as current and potential mining use and pastoral use. The current level of knowledge regarding the capacity and quality of these resources is limited and has restricted the ability to prepare demand-supply projections for this Statement as has been possible in other regions such as Eyre Peninsula and Northern and Yorke.

The Department of Environment, Water and Natural Resources (DEWNR) initiative, “Finding Long-term Outback Water Solutions” (FLOWS) aims to increase this knowledge base. It is intended that this Statement will be updated as new information becomes available from the FLOWS initiative and other research in the region.

There is only a small demand on water from the mining sector in the Alinytjara Wiluŋara region at this stage, however, the coverage of mineral, petroleum and gas exploration licences and applications across the Alinytjara Wiluŋara region (see figures 4, 5 and 6) highlights the potential growth in demand for water resources from this sector.

Realising the benefits of the mining boom is a key priority for the State Government and, in order to achieve this in a sustainable manner, further research into the volumes of water available for use is required. The DEWNR FLOWS initiative will contribute towards increasing our understanding of the capacity of the water resources in the Alinytjara Wiluŋara region to ensure the most appropriate management decisions can be made.

The Australian Groundwater Technologies (AGT) (2008) report indicates that the approximate well life of some of the wells in the communities of Amata, Pukatja (Emabella) and Yunyarinyi (Kenmore Park) is between one and ten years and the sustainable use of the wells is short to medium term. A current assessment of the well life and sustainability of each of the Aboriginal communities’ wells throughout the Alinytjara Wiluŋara region is underway, which will be beneficial to inform future planning decisions.
A recent scientific report by Alcoe et al (2012) has identified that the water resources of the Yunyarinyi (Kenmore Park), Pukatja and Kaltjiti (Fregon) Aboriginal communities are at very high risk from the impacts of climate change by 2050. In the long term, this could result in reduced recharge to the groundwater resources that supply these communities and therefore less water available for use.
2 Current Resources

This section of the Alinytjara Wiluara DSS provides an overview of the region, including the area covered, population, the major lands and land uses. It also provides an outline of the region’s climatic characteristics and uses the best available information to describe the region’s water resources, what the water resources are and their quantity and quality if known.

2.1 Regional Overview

The region encompassed by the Alinytjara Wiluara Natural Resources Management Board (AW NRM Board) covers more than 250,000 km² (including marine areas), which is 28% of the State, supporting 2841 people (2011 Census). The region contains the following lands and waters:

- Anangu Pitjantjatjara Yankunytjatjara (APY) Lands (vested in the Anangu Pitjantjatjara under the Anangu Pitjantjatjara Yankunytjatjara Lands Right Act 1981)
- Maralinga Tjarutja (MT) Lands (vested in the Maralinga Tjarutja under the Maralinga Tjarutja Land Rights Act 1984)
- Yalata (vested in the Aboriginal Lands Trust under the Aboriginal Lands Trust Act 1966)
- Areas dedicated under the South Australian National Parks and Wildlife Act 1972 and Wilderness Protection Act 1992, adjoining the Yalata and Maralinga Tjarutja Lands, including:
  - Mamungari Conservation Park
  - Tallaringa Conservation Park
  - Yumbara Conservation Park
  - Yellabinna Regional Reserve and Yellabinna Wilderness Protection Area
  - Pureba Conservation Park
  - Nullarbor Regional Reserve and Nullarbor National Park

The vast majority of the Alinytjara Wiluara region’s population (approximately 2500 people) live throughout the APY Lands. The Yalata community comprises about 160 people and the population of the MT Lands consists of about 100 people. Oak Valley is the population centre of the MT Lands and the number of people in the community rises significantly during cultural activities and during the winter months (AW NRM Board 2011).

There is no privately owned land within the AW NRM region, with the primary land tenure being formally recognised Aboriginal Lands, National Parks, Wildlife Reserves and Wilderness Areas (AW NRM Board 2011). There are also five Indigenous Protected Areas (IPA) either in operation or in planning in the APY Lands and one IPA at Yalata (AW NRM Board 2011). The Mamungari Conservation Park was returned to Maralinga Tjarutja in 2004 as the first co-managed park in South Australia (MCP Board of Management 2011).

As the result of the resolution of native title in South Australia a number of Indigenous Land Use Agreements have been or are about to be entered into by the State in the AW NRM Region. The agreements relate to national and conservation parks, wilderness protection areas and Crown lands. In May 2011, Antakirinja Matu-Yankunytjatjara Native Title was recognised for Tallaringa Conservation Park (AW NRM Board 2011).
Other land uses include areas administered by the Department of Defence, including the Maralinga Restricted Area, which remains part of the Woomera Prohibited Area, mineral exploration licenses and pastoral land (GHD 2009).

Oak Valley has guided tours, a visitor centre and visitor accommodation. The Head of Bight is also a popular tourism stopover during winter months to see the southern right whale, particularly the calving, from a viewing centre owned and operated by the community.

The Iluka Jacinth-Ambrosia zircon mineral sand mine is located within the Yellabinya Regional Reserve.

The climatic characteristics of the region are that it is semi-arid to arid with a hot, dry desert climate, short cool to cold winters and low, unreliable rainfall.

The mean maximum temperature during summer (December to February) ranges from 32°C to 36°C in the central desert plains and northern ranges to 24°C to 28°C in the southern coastal regions. The mean summer minimum temperature ranges from around 20°C in the northern ranges to around 15°C in the central desert plains and southern coastal regions. Mean maximum temperatures during the winter months (June to August) are similar across the region, generally ranging from 18°C in the south to around 21°C in the north. Mean winter minimum temperatures are also similar across the region ranging from 4°C in the north to nearly 8°C in the south (Watt and Berens 2011).

Rainfall patterns are spatially variable with the areas along the coast experiencing wet winters, while the summer months are the wettest for the north and central areas (Table 2). Average annual rainfall ranges from around 150-225 mm throughout the interior to around 220-280 mm in the north and 220-360 mm near the coast (Table 2), however rainfall in the arid areas of the State is highly variable, unpredictable and consequently, averages can be misleading. Rainfall occurrence and intensity is episodic, sometimes without significant rainfall for years, or alternatively intense rainfall can deliver annual rainfalls in a single event. Average annual evaporation exceeds 3500 mm, resulting in the rapid evaporation of any surface water runoff (Watt & Berens 2011).

Table 1: Temperature statistics for the Alinytjara Wilurara NRM region (BoM 2012)

<table>
<thead>
<tr>
<th>Locality</th>
<th>Mean annual maximum temp (°C)</th>
<th>Mean annual minimum temp (°C)</th>
<th>Mean summer maximum temp (°C)</th>
<th>Mean summer minimum temp (°C)</th>
<th>Mean winter maximum temp (°C)</th>
<th>Mean winter minimum temp (°C)</th>
<th>Period of record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pukatja</td>
<td>27.3</td>
<td>13.1</td>
<td>34.2</td>
<td>20.1</td>
<td>19.0</td>
<td>5.0</td>
<td>1997-2012</td>
</tr>
<tr>
<td>Marla</td>
<td>28.6</td>
<td>13.6</td>
<td>36.0</td>
<td>21.1</td>
<td>20.6</td>
<td>5.6</td>
<td>1985-2012</td>
</tr>
<tr>
<td>Maralinga</td>
<td>25.2</td>
<td>11.7</td>
<td>31.8</td>
<td>15.7</td>
<td>18.0</td>
<td>7.2</td>
<td>1955-1967</td>
</tr>
<tr>
<td>Nullarbor</td>
<td>23.6</td>
<td>10.7</td>
<td>27.4</td>
<td>15.3</td>
<td>18.9</td>
<td>5.8</td>
<td>1986-2012</td>
</tr>
</tbody>
</table>
Table 2: Rainfall statistics for the Alinytjara Wilurara NRM region (BoM 2012)

<table>
<thead>
<tr>
<th>Locality</th>
<th>Mean annual rainfall (mm)</th>
<th>Mean summer rainfall (mm/month)</th>
<th>Highest summer rainfall (mm/month)</th>
<th>Lowest summer rainfall (mm/month)</th>
<th>Mean winter rainfall (mm/month)</th>
<th>Highest winter rainfall (mm/month)</th>
<th>Lowest winter rainfall (mm/month)</th>
<th>Period of record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amata</td>
<td>290.8</td>
<td>36.5</td>
<td>254.4</td>
<td>0</td>
<td>13.3</td>
<td>68.7</td>
<td>0</td>
<td>1962-2012</td>
</tr>
<tr>
<td>Marla</td>
<td>247.7</td>
<td>29.2</td>
<td>186.8</td>
<td>0</td>
<td>12.2</td>
<td>88.4</td>
<td>0</td>
<td>1985-2012</td>
</tr>
<tr>
<td>Maralinga</td>
<td>224.4</td>
<td>19.9</td>
<td>142.1</td>
<td>0</td>
<td>17.8</td>
<td>95.0</td>
<td>0</td>
<td>1955-2011</td>
</tr>
<tr>
<td>Nullarbor</td>
<td>250.4</td>
<td>13.2</td>
<td>121.8</td>
<td>0</td>
<td>27.4</td>
<td>105.7</td>
<td>0</td>
<td>1888-2012</td>
</tr>
</tbody>
</table>

2.2 Water Resources

Aboriginal people of the Alinytjara Wilurara region have strong cultural associations with regional water resources (AW NRM Board 2011). Although there is no detailed information regarding what these associations from a water demand and supply perspective are and with what specific resources, it is important that this relationship is acknowledged.

There is no regional reticulated water system across the Alinytjara Wilurara region and, due to the low and unpredictable rainfall, coupled with high evaporation rates, there are no permanent surface water resources. As such, local groundwater resources are the key source of water upon which the region currently relies (Watt and Berens 2011).

Groundwater Resources

There is limited understanding of the groundwater resources in the Alinytjara Wilurara region. However Watt and Berens (2011) have undertaken to improve this understanding and have reported on the existing data and knowledge about the groundwater resources in the region.

Across South Australia, few assessments have addressed regional groundwater storages (Watt and Berens 2011). The Spencer Region Strategic Water Management Study (Martin et al 1998) provided first-order assessments of groundwater storage for a number of geological and groundwater provinces, including the Eucla Basin, Officer Basin and Palaeovalleys in the Alinytjara Wilurara region (see table 3). Available knowledge and shallow groundwater salinity was also considered to group groundwater storages by salinity class. Martin et al (1998) stress the importance of recognising that their estimates are only first-order approximations and that more detailed and targeted assessments will be required to refine the estimates of the total resource.

Watt and Berens (2011) agree that caution should be used when considering the findings of Martin et al (1998), suggesting that the preliminary estimates of total groundwater storages within each province could potentially be an over-estimate and it is likely that they are based on data that lacks a high degree of validation. Furthermore, Watt and Berens (2011) state that estimates from any source should be treated with caution until a more detailed and reliable assessment of groundwater resources can be addressed in any subsequent investigations.
Table 3: Summary of total groundwater resources and estimated use (Watt and Berens 2011)

<table>
<thead>
<tr>
<th>Groundwater province</th>
<th>Total GW resource* (ML)</th>
<th>Estimated GW use (ML/y)</th>
<th>Comments &amp; additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucla Basin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh (0–1500 mg/L)</td>
<td>155 000</td>
<td>15 000</td>
<td>This summary considers a historical Eucla Basin extent which does not include Tertiary sediments that extend throughout much of the Eyre Peninsula. Thick Tertiary successions are the marine limestones of the Eucla Group and the terrigenous sediments of the Immama Group. Major units include the Pidinga Formation, Hampton Sandstone and Wilson Bluff Limestone.</td>
</tr>
<tr>
<td>Brackish (1500–7000 mg/L)</td>
<td>360 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saline (&gt;7000 mg/L)</td>
<td>2 730 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officer Basin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh (0–1500 mg/L)</td>
<td>60 000</td>
<td>2</td>
<td>It is unclear if these resource estimates include the full extent of the Officer Basin or only resources contained within GAB and palaeovalley sediments that overlap the basin. Very little is confidently known about groundwater resources of the Officer Basin, which is generally considered an area of insufficient data; investigations have been limited to Aboriginal community water supplies. Limited potable groundwater has been encountered and is regarded as fossil water. Known aquifers include Neoproterozoic to Cambrian units of the Mumaroo Sandstone and Trainor Hill Sandstone.</td>
</tr>
<tr>
<td>Brackish (1500–7000 mg/L)</td>
<td>120 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saline (&gt;7000 mg/L)</td>
<td>4 000 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Artesian Basin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh (0–1500 mg/L)</td>
<td>4350 x 10^6</td>
<td>155 000</td>
<td>The total resource of the GAB is extremely large and estimates vary depending on the number of basins and sub-basins included. The FNPWA WAP estimate of 64.9 x 10^6 GL is believed to include aquifers from the Arckaringa, Eromanga and Lake Eyre Basins. The South Australian GAB region (comprising entirely Eromanga Basin sediments) is largely within the FNPWA. The limited occurrence within the non-prescribed areas of the AW and SAAL NRM regions are at the basin margins where thinner non-artesian aquifers occur; the most significant aquifer is the Algebuckina Sandstone and Cadna-owie Formation, where water quality is generally good.</td>
</tr>
<tr>
<td>Brackish (1500–7000 mg/L)</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saline (&gt;7000 mg/L)</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palaeovalleys</td>
<td></td>
<td></td>
<td>An extensive region of palaeodrainage that drained the Musgrave Block and Stuart and Gawler Ranges exist across the State, with a large network covering the AWNRM Region. They have the potential to contain large quantities of water (albeit of high salinity) and can be of vital importance to the mining industry. Estimates presented in this table are for the whole State.</td>
</tr>
<tr>
<td>Fresh (0–1500 mg/L)</td>
<td>unknown</td>
<td>unknown</td>
<td></td>
</tr>
<tr>
<td>Brackish (1500–7000 mg/L)</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saline (&gt;7000 mg/L)</td>
<td>6 x 10^6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Watt and Berens (2011) have compiled groundwater information about the following major hydrogeological units in the Alinytjara Wiluŋara Region (see figures 2 and 3):

- Gawler Craton;
- Musgrave Block;
- Officer Basin;
- Arckaringa Basin;
- Eromanga Basin;
- Eucla Basin;
- Palaeovalleys; and
- Quaternary Sands.
Figure 2: Geological provinces in the Alinytjara Wilurara region
Figure 3: Palaeovalley sediments in the Aliynjara Wilurara region
Gawler Craton

Groundwater of the Gawler Craton occurs within fractured rock and weathered Precambrian basement rocks. These groundwater resources are not largely utilised and not well understood. Throughout the region, exposure of the Gawler Craton at ground surface level is limited to the south east (see figure 2) and the aquifers of the overlying provinces are typically the preferred target for groundwater (Watt and Berens 2011).

Incised palaeovalley sediments are likely to hold significant volumes of groundwater, although limited information is available (Watt and Berens 2011).

Musgrave Block

The Musgrave Block contains a regional fractured rock aquifer with groundwater flow occurring along fractures and faults and within the weathered zone, which is generally 60-100 m below the surface (GHD 2009). The weathered and fractured rock basement aquifers are utilised primarily in regions of outcropping and shallow basement, and due to the relatively higher rainfall in the Musgrave area, these aquifers are recharged more often and can typically host low salinity groundwater (<1000 mg/L) (Watt and Berens 2011). In some areas of the APY Lands these aquifers are heavily relied on by local communities (Rowe et al 2007). In deeper fractured rock, groundwater is often highly saline (Rowe et al 2007).

Knowledge of the Palaeovalleys in the Musgrave Block indicates their potential to contain significant volumes of water; although the groundwater is generally considered to be highly saline (Lewis et al 2010).

Wells drilled into the shallower Quaternary alluvium, sand or calcrete deposits return low yields but can be suitable for stock watering requirements (Rowe et al 2007).

Watt and Berens (2011) conclude that little is known regarding the potential for groundwater supplies in the Musgrave Block, outlining that groundwater investigations to date have focussed on providing high quality, low yielding supplies for a small number of Aboriginal communities.

Officer Basin

Little is known of groundwater in the Officer Basin as the area is generally data poor (Watt and Berens 2011). Small occurrences of relatively low salinity groundwater are regarded as fossil water, derived from recharge along the southern margin of the Musgrave Block (Martin et al 1998).

Occurring widely throughout the north-east of the basin (see figure 2), the Trainor Hill Sandstone aquifer is recognised as one of the main aquifers in the Officer Basin, with groundwater typically presenting as saline with low yields (Martin et al 1998).

In the Maralinga area (see figure 2), the Marinoan Murnaroo Sandstone aquifer is thought to be a noteworthy groundwater resource, occurring at depths of less than 20 m. In the same area, the Tanana Formation aquifer has been confirmed as an aquifer with limited yield. Both aquifers are considered to be of moderate salinity (Dodds 1997).

The Punkerri Sandstone aquifer in the western portion of the Officer Basin (see figure 2) may be an aquifer of potential significance, although very little is known about its extent and groundwater properties (Martin et al 1998).

Palaeovalley sediments, primarily in the Pidinga Formation, are likely to provide groundwater that is highly saline and acidic with high levels of iron and radioactive elements (Buxton 2005).
The Ooldea and Barton Ranges, together with the underlying Hampton Sandstone aquifer, could potentially be a source of additional groundwater as the palaeovalleys draining from the Musgrave Block and Officer Basin appear to terminate along this margin (Martin et al 1998).

**Arckaringa Basin**

The Permian sediments infilling the Arckaringa Basin comprise two main aquifer systems (GHD 2009). The upper portion of the Mount Toondina Formation is known to comprise some sandy units and may act as a permeable aquifer. The Boorthanna Formation forms an aquifer in several zones separated by significant layers of low permeability sediments, especially in the eastern parts of the AW NRM region where thicker and deeper Boorthanna Formation intersections occur. The Stuart Range Formation, where it occurs, forms an effective aquitard between the two aquifers (Watt and Berens 2011).

**Eromanga Basin**

Information about the non-artesian aquifers of the Great Artesian Basin (GAB) is not well documented and is generally limited to specific mining projects (Watt and Berens 2011). Temite Resources’ Caim Hill Project has recently indentified a 0.5 ML/d supply of brackish groundwater from the Eromanga Basin (Temite Resources 2009, cited in AGT 2010b). Feasibility studies into mining of the Wintinna and Weedina Permian coal deposits identified significant GAB aquifers overlying the deeper coal seams, which represent a significant available groundwater resource (Meekatharra Mineral 1984; Getty Australian Coal Company 1985, cited in AGT 2010b).

In the south-west of the basin, groundwater is too saline for stock, although fresher water can occur after recharge from rainfall as the system becomes generally semi-confined to unconfined in this area (SAAL NRMB 2009). However, the saturated thickness of the Algebuckina Sandstone is typically less than ten metres and evapotranspiration can occur from shallow watertables resulting in salinity increases in poorly flushed sections of the aquifer (SAAL NRMB 2009).

**Eucla Basin**

The total resource of the Eucla Basin appears large, with isolated pockets of good quality groundwater scattered throughout where recharge potential is highest (Martin et al 1998).

The Pidinga Formation contains minor confined sand aquifers and the Hampton Sandstone comprises an unconfined aquifer that occurs extensively around the inner Eucla Basin margins to depths up to 25 m (PB 2008a). The Wilson Bluff Limestone has been identified as a likely source of large volumes of highly saline groundwater due to its highly porous nature (Watt and Berens 2011). The Ooldea Sand of the Ooldea and Barton Ranges, together with the underlying Hampton Sandstone, could potentially provide additional groundwater supplies as the palaeovalleys draining from the Musgrave Block and Officer Basin appear to terminate along this margin (Martin et al 1998). At the coastal margins of the Eucla Basin the Wilson Bluff Formation features karst developments containing saline groundwater (Webb et al. 2011) from 120m to 90m. Further inland, the shallower Abrakumie and Nullarbor Limestone Formations also can reveal karst features with saline groundwater from 30m.

**Palaeovalleys**

Palaeovalley sediments that are incised into basement material of the Musgrave Block, Officer Basin and Gawler Craton have the potential to contain significant volumes of groundwater, however this water is likely to be highly saline and acidic with high levels of iron and radioactive elements (Watt and Berens 2011). The Iluka Jacinth-Ambrosia Mineral Sands Mining Project sources groundwater from a Tertiary palaeovalley draining the Gawler
Craton at the eastern margin of the Eucla Basin (Watt and Berens 2011). The bore field is expected to yield up to 300 L/s, with approximately 9500 ML/a of highly saline groundwater (30 000-70 000 mg/L) extracted (PB 2008b). Watt and Berens (2011) suggest the potential for other palaeovalleys in the area to supply large volumes of groundwater is untested, but the considerable volume sourced by Iluka Resources may be indicative of other similar groundwater resources.

**Quaternary Sands**

While Quaternary sands are extensive across the AW NRM region in the form of the Great Victoria Desert, sequences are typically thin and unsaturated. Alluvial/fluvial deposits are common adjacent to outcropping basement along ephemeral drainage lines. Localised direct recharge from rainfall to these sediments can result in discrete occurrences of freshwater; however, these are unlikely to provide reliable or sustainable supplies of good quality water due to the highly variable nature of recharge in the area. Additionally, high rates of evapotranspiration can lead to the depletion and salinisation of these resources (Watt and Berens 2011).

**Surface Water**

The climatic characteristics of the Alinytjara Wilurara region, in conjunction with the topography, support only semi-permanent surface water resources. As such, there is no reliable supply from surface water. However, there are some geological formations where surface water is stored for a significant period. GHD (2009) list the presence of the following surface water features throughout the Alinytjara Wilurara Region:

- Rivers and creeks
- Springs
- Waterholes
- Playa Salt Lakes
- Wetlands
- Soaks
- Rockholes
- Claypans
- Dew

Rainfall across the region, while generally low, is also variable in scale and frequency. Moderate rainfall events, with a total of 15-20 mm, can cause a flow in minor streams that last for an hour or two. Such a flow may occur as often as five times a year. However around twice this amount is needed before major streams will begin to flow, and such falls can be expected less frequently than once a year (Rowe et al 2007).

A consequence of the irregular rainfall is the ephemeral and episodic nature of watercourses within the region. These watercourses are also limited in their distribution with the majority draining through the vast Western Plateau Drainage Division (NW&WA 2000, cited in Rowe et al 2007). This includes portions of the Mackay, Finke River, Warburton, Nullarbor and Gairdner Basins. These vast drainage lines are susceptible to the region’s high rates of evaporation losses (Rowe et al 2007).
Despite the susceptibility of watercourses to high transmission losses, semi-permanent and temporary waterholes are typical within the region’s river systems. There are a large number of waterholes that are deepened and widened reaches of the channel, which hold water from a few months to up to a few years (Rowe et al 2007).

The location of claypans, rockholes and soaks dictated traditional Aboriginal travel routes (Giles 1975, cited in Rowe et al 2007). Throughout the MT Lands, smaller lakes and claypans may hold drinkable water for short periods of time after rain. It is thought that some claypans may have been dammed by the Maralinga Tjarutja people to increase their yield (Rowe et al 2007).

Rockholes are found throughout the Alinytjara Wilurara region and were traditionally relied upon as one of the main sources of water for Aboriginal people as they provide fresh surface water for short periods after rain. Along the Nullarbor Plain, some rockholes have been artificially enlarged to hold a greater volume or provided with a lid (Wheeler 1974; Davis and Kirke 1991; McKenzie and Robinson 1987; DEHAA 1999, cited in Rowe et al 2007). There are a few hundred rockholes within the Nullarbor as a whole, holding from a few cubic centimetres of water to a few litres (Wheeler 1974, cited in Rowe et al 2007). These were formerly an ephemeral but highly valuable water source for Aboriginal people crossing the Nullarbor Plain after rain (Wheeler 1974; Davis and Kirke 1991; Davey et al 1992, cited in Rowe et al 2007).

One recorded rockhole within the Unnamed Conservation Park (Pat’s Auld Vat) has a capacity of 22kL (Davis and Kirke 1991, cited in Rowe et al 2007). Examples of other rockholes in the Yellabinna and Yumba regions of Yalata include Pidinga Rockhole, Dinah Rock Waters and the spectacular Narla Rocks North and Narla Rocks South (WAC 2004, cited in Rowe et al 2007).

In the MT Lands freshwater can also be found in a few soaks, which are surface expressions of groundwater (INRMG 2003, cited Rowe et al 2007).

Other surface water features include springs, playa salt lakes and dew. Over the entire APY Lands there are only a handful of semi-permanent springs and playa salt lakes are very limited (Rowe et al 2007). In the MT Lands, the Serpentine Lakes are playa salt lakes that are aligned north-south and extend for approximately one hundred kilometres (WAC 1996, cited in Rowe et al 2007).

Another traditional source of surface water in the Alinytjara Wilurara region is heavy dew. Dew of up to 0.2-0.4 mm is possible overnight, which would be gathered using grass sponges (Davis and Kirke 1991, cited in Rowe et al 2007).

In recent times, shed tanks and rainwater tanks have been built along the Eyre Highway to collect water. As neither dams nor storages may be reliable, water is often imported from outside the Nullarbor to provide for the needs of population centres along the Eyre Highway and Trans-Australian Railway (Wheeler 1974, cited in Rowe et al 2007).

Rainwater is used as an important drinking water source in all communities and although there is limited information regarding the volumes of water used, anecdotal evidence suggests that many houses have rainwater tanks that are a source of drinking water.
3 Community Water Supply

This section of the Alinytjara Wilurara DSS provides a summary of the water used by Aboriginal communities in the Alinytjara Wilurara region for those communities where data is available. It also provides an assessment of the approximate well life for each production well of the Aboriginal communities and their sustainability rating.

Groundwater is supplied to 11 communities across the Alinytjara Wilurara region (see table 4). The water infrastructure and assets are owned by the Aboriginal land owners, however SA Water is responsible for water supply infrastructure planning, construction, operations (including monitoring of water quality) and maintenance. SA Water also manages common effluent disposal schemes where they exist and the Department for Communities and Social Inclusion maintains household septic tanks.

**Table 4: Aboriginal communities with water infrastructure managed by SA Water**

<table>
<thead>
<tr>
<th>Aboriginal Land Owners</th>
<th>Aboriginal Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anangu Pitjantjatjara Yankunytjara Lands</td>
<td>Amata, Pukatja (Emabella), Kaltjiti (Fregon), Iwantja (Indulkana), Kalka, Yunyarinyi (Kenmore Park), Mimili, Pipalyatjara and Umuwa</td>
</tr>
<tr>
<td>Maralinga Tjarutja Lands</td>
<td>Oak Valley</td>
</tr>
<tr>
<td>Aboriginal Lands Trust Land</td>
<td>Yalata</td>
</tr>
</tbody>
</table>

The combined total annual average volume of water pumped for the 11 main community water supplies managed by SA Water in the Alinytjara Wilurara region is approximately 490 ML/a (see table 5).

**Table 5: Total annual average volume of water supplied to each of the 11 Aboriginal communities in the Alinytjara Wilurara region managed by SA Water (source: DEWNR)**

<table>
<thead>
<tr>
<th>Aboriginal Community</th>
<th>Total Annual Average Volume (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amata</td>
<td>51</td>
</tr>
<tr>
<td>Pukatja (Emabella)</td>
<td>110</td>
</tr>
<tr>
<td>Kaltjiti (Fregon)</td>
<td>65</td>
</tr>
<tr>
<td>Iwantja (Indulkana)</td>
<td>35</td>
</tr>
<tr>
<td>Kalka</td>
<td>12</td>
</tr>
<tr>
<td>Yunyarinya (Kenmore Park)</td>
<td>18</td>
</tr>
<tr>
<td>Mimili</td>
<td>40</td>
</tr>
<tr>
<td>Pipalyatjara</td>
<td>31</td>
</tr>
<tr>
<td>Umuwa</td>
<td>30</td>
</tr>
<tr>
<td>Oak Valley</td>
<td>42</td>
</tr>
<tr>
<td>Yalata</td>
<td>56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>490</strong></td>
</tr>
</tbody>
</table>

The table below (table 6) outlines the approximate well life for each production well of the Aboriginal communities managed by SA Water and their sustainability rating.
Table 6: Approximate well life and sustainability for each of the Aboriginal communities in the Alinytjara Wilurara region managed by SA Water (AGT 2008)

<table>
<thead>
<tr>
<th>Community/Well No.</th>
<th>Community/Well No.</th>
<th>Approximate Well Life</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A15</td>
<td></td>
<td></td>
<td>Well decommissioned</td>
</tr>
<tr>
<td>A17</td>
<td></td>
<td>5-10 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>A26</td>
<td></td>
<td>13 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>A109</td>
<td></td>
<td>6 years</td>
<td>Short Term</td>
</tr>
<tr>
<td>Pukatja (Emabella)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E12</td>
<td></td>
<td>&gt;15 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>E42</td>
<td></td>
<td>9-12 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>E44</td>
<td></td>
<td>1-5 years</td>
<td>Short Term</td>
</tr>
<tr>
<td>E45</td>
<td></td>
<td>5-10 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>E97B</td>
<td></td>
<td>8-10 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>E97G</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>E97K</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>E97L</td>
<td></td>
<td>5-10 years</td>
<td>Observation Well</td>
</tr>
<tr>
<td>E97M</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>Kaltjiti (Fregon)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td></td>
<td></td>
<td>Well abandoned</td>
</tr>
<tr>
<td>F7</td>
<td></td>
<td>&gt;15 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>F14</td>
<td></td>
<td>&gt;15 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>FE4</td>
<td></td>
<td></td>
<td>No longer in use</td>
</tr>
<tr>
<td>F64</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>Iwantja (Indulkana)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I19</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>I19A</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>I25</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>I26</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>I27</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>IR1</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>IR2</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>IR3</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>Kalka</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KA1</td>
<td></td>
<td></td>
<td>Observation Well</td>
</tr>
<tr>
<td>KA2</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>KA3</td>
<td></td>
<td>&gt;10 years</td>
<td>Medium Term (needs more assessment)</td>
</tr>
<tr>
<td>KA137</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>Yunyarinyi (Kenmore Park)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KP6</td>
<td></td>
<td>5-10 years</td>
<td>Short to Medium Term</td>
</tr>
<tr>
<td>KP7</td>
<td></td>
<td>&gt;10 years</td>
<td>Long Term</td>
</tr>
<tr>
<td>KP98</td>
<td></td>
<td>5-7 years</td>
<td>Short Term</td>
</tr>
<tr>
<td>Community/Well No.</td>
<td>Approximate Well Life</td>
<td>Sustainability</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td><strong>Mimili</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>M4</td>
<td></td>
<td>Observation Well</td>
<td></td>
</tr>
<tr>
<td>M59</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>M61</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td><strong>Pipalyatjara</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIP95</td>
<td>&gt;22 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>PIP96</td>
<td>Not currently under stress but likely &gt;20 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td><strong>Umuwa</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U149</td>
<td>20 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td><strong>Oak Valley</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OV7</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>OV8</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>OV9</td>
<td>&gt;10 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td><strong>Yalata</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YT2</td>
<td>&gt;45 years</td>
<td>Long Term</td>
<td></td>
</tr>
<tr>
<td>YT3</td>
<td>&gt;50 years</td>
<td>Long Term</td>
<td></td>
</tr>
</tbody>
</table>
4 Future Demand and Supply

This section of the Alintjara Wilurara DSS describes the key issues that are, or have the potential to, influence current and future demand for water resources in the Alintjara Wilurara region or the supply of water to the region.

4.1 Demands

Current and future demand for water resources in the Alintjara Wilurara region is, or has the potential to be, influenced by the following key issues:

- Cultural water demand
- Population growth
- Mining demand and expansion
- Pastoral demand
- Road building and maintenance demand

Cultural Water Demand

Aboriginal people of the Alintjara Wilurara region have strong cultural associations with regional water resources (AW NRM Board 2011). Although there is no detailed information regarding what these associations from a water demand and supply perspective are and with what specific resources, it is important that this relationship is acknowledged.

The complex relationship Aboriginal communities have with water goes beyond simply using it for consumptive purposes. The Intergovernmental Agreement on a National Water Initiative acknowledges this relationship by stipulating in sections 52-54 that State water plans will account for indigenous access to water resources for social, spiritual, and cultural purposes (NWI 2004).

The First Peoples' Water Engagement Council (2012) has provided advice to the National Water Commission in relation to the implementation of sections 52-54 of the NWI. This advice defines Aboriginal water needs into two categories:

- Aboriginal Water; and
- Aboriginal Economic Water.

Aboriginal Water is an all-encompassing concept describing the water requirements for the enhancement and protection of Aboriginal peoples' physical, spiritual, cultural, and social well-being (FPWEC 2012). This covers the amount, location, quality, flow rate, temperature, flow frequency and timing, and decision-making structures necessary to sustain country and culture (FPWEC 2012).

Aboriginal Economic Water refers to an allocation of water from the consumptive pool that is made available to Aboriginal people who wish to engage in commercial enterprises that require the consumption or diversion of water resources (FPWEC 2012).

In South Australia the mechanism to enable the provision of water to meet Aboriginal needs is through the development of a Water Allocation Plan for a prescribed water resource. At present there are no prescribed water
resources in the Alinytjara Wilurara region and therefore no formal allowance of water to meet Aboriginal water requirements.

As recognised by the FPWEC (2012), there is an overwhelming need for more research to identify and quantify the cultural, social, spiritual, and economic water needs of Australia’s Aboriginal peoples. Such research will assist in ensuring the South Australian Government can achieve the objectives set out in the NWI and the recommendations of the FPWEC at such a time as a Water Allocation Plan is developed in the Alinytjara Wilurara region.

**Population Growth**

The population in the Alinytjara Wilurara region in 2011 was 2841 people (Australian Bureau of Statistics (ABS) 2012a). A population as small as this is very difficult to project into the future, compounded by the fact that it is overwhelmingly comprised of Aboriginal communities whose numbers are liable to fluctuate dramatically within the year and from one year to the next, due to the mobile and fluctuating nature of these communities.

However, based on the best available information to date, the Department of Planning, Transport and Infrastructure advise that the median series population projection (that is the most likely scenario) out to 2036 is for a population of 3181 people in the Alinytjara Wilurara region. The high series population projection out to 2036 is for a population of 3435 people.

**Mining Demand and Expansion**

The Government has established its “Seven Strategic Priorities” to focus the State’s efforts and drive the work of government. One of these priorities is to realise the benefits of the mining boom for all, with the vision that South Australia has a thriving resources industry and is a key mining services hub for Australia and the region.

South Australia’s Strategic Plan further supports this priority, containing targets for exploration, production and processing in the mining sector that will drive significant growth into the future.

The 2011 Resources and Energy Sector Infrastructure Council (RESIC) Infrastructure Demand Study shows that demand for water from the mining sector in the Upper North region in the years 2011-2013 is expected to be approximately 7.1 GL, increasing to 12.6 GL from 2021. However, the RESIC Study notes that none of this demand on water resources is expected to come from mines in the Alinytjara Wilurara region.

There is demand for water from the Iluka Jacinth-Ambrosia mine. Water for processing operations is sourced from a hyper saline palaeochannel and borefield located 34 kilometres from the process plant. The palaeochannel is remote from the Nullarbor cave system. The amount of water drawn from the palaeochannel is approximately 7 GL/a and is expected to consume in the order of 6 per cent of the entire palaeochannel volume over the life of the mine. A reverse osmosis plant on site supplies drinking quality water and water for the on-site fire protection system (Iluka Resources Limited 2012).

The AW NRM Board (2011) considers that mining and mineral exploration may be a threat to the region’s groundwater resources. Figures 4, 5 and 6 show how the majority of the AW NRM Region is covered by either mining, petroleum or gas exploration licences or exploration licence applications. There are currently 101 mineral exploration licences and 140 mineral exploration licence applications, eight petroleum exploration licences and 18 petroleum exploration licence applications held within the Alinytjara Wilurara Region (Watt and Berens 2011).
Figure 4: Mineral Exploration Permits and Applications in the Alinytjara Wilurara region
Figure 5: Petroleum Exploration Permits and Applications in the Alinytjara Wilurara region
Figure 6: Gas storage exploration permits and applications in the Alinytjara Wilurara region
The Challenger Gold Mine, while located outside the AW NRM region boundary, sources 580 ML of groundwater from palaeovalley and weathered and fractured rock aquifers in the Gawler Craton (Watt and Berens 2011). As groundwater within the palaeovalleys of the Gawler Craton is known to drain westwards into the Eucla Basin, the mine could have some impact on groundwater resources within the region (Watt and Berens 2011).

Dewatering of mines and supply well-fields can cause the development of considerable cones of depression within the targeted aquifer (AGT 2010a). This has the potential to affect the water supply for communities in close proximity to the mine if they are accessing water from the same aquifer (Watt and Berens 2011). Guidelines from the Mining Act 1971 outlines that the Department for Manufacturing, Innovation, Trade, Resources and Energy must require any new mining project to assess the risks to the environment and stakeholders (Watt and Berens 2011).

In addition, in 2012 South Australia signed the National Partnership Agreement (NPA) on Coal Seam Gas and Large Coal Mining Developments which puts in place more rigorous and transparent assessment requirements for such resource projects with regard to water impacts. Under the NPA, participating States are required to ensure that coal seam gas and large scale coal projects are referred to an Independent Expert Scientific Committee established under the Environment Protection and Biodiversity Conservation Act for independent advice on water related impacts and that the recommendations of the Committee are considered as part of required legislative approvals.

Another influence on the Alinytjara Wiluṟara region is that there is potential for mines in Western Australia to draw water from aquifers that underlie both States or from aquifers that are interconnected with aquifers in South Australia.

**Pastoral Demand**

There is no reliable data about water use associated with livestock in the Alinytjara Wiluṟara region although broader grazing pressures exist in the region from camels and horses. There is also increasing interest within Yalata area for growing the cattle industry.

**Road Building and Maintenance Demand**

The Department of Planning, Transport and Infrastructure (DPTI) advised that it manages around 6,000 km of sealed and unsealed roads in the Alinytjara Wiluṟara NRM Region. DPTI estimate that the annual water usage for road building and maintenance activities in this area is approximately 20 ML.

The Department of Planning, Transport and Infrastructure has concerns about the impact of the mining expansion in the region and the potential requirement for additional road maintenance activities and water resources.

**4.2 Supplies**

There have been few assessments of the Alinytjara Wiluṟara regions groundwater resources and any estimates should be treated with caution until a more detailed and reliable assessment of groundwater resources can be addressed in subsequent investigations (Watt and Berens 2011).

DEWNR, in partnership with the Goyder Institute for Water Research, is currently undertaking the FLOWS initiative. This initiative aims to increase the knowledge base and options for long-term water solutions for the outback to support mining, energy and industry development and community water supplies. It is intended that this Statement will be updated as new information becomes available from the FLOWS initiative and other research projects.
Climate Change

The Department of Environment and Natural Resources (DENR 2010) have indicated greater warming in the Alinytjara Wiluara region into the future as a result of climate change compared to other regions of the State, given that the region is primarily located inland. DENR (2010) also suggest that rainfall will decrease into the future due to climate change, with strong decreases expected in summer, winter and spring compared to anticipated decreases in autumn (see table 7). The projected temperature and rainfall changes for the Alinytjara Wiluara region have been reported as ranges, which are indicative of the degree of uncertainty in the projections (see table 7). In a 2030 climate, the ranges in projected changes are due mainly to uncertainty in how sensitive the climate is to the atmospheric concentration of greenhouse gases. In a 2070 climate, the ranges in projected changes are greater because there is uncertainty in both different emission pathways and climate sensitivity.

Table 7: Projected average range of temperature and rainfall change in the Alinytjara Wiluara region for 2030 and 2070 (Suppiah et al. 2006; CSIRO & BoM 2007)

<table>
<thead>
<tr>
<th>Climatic characteristic</th>
<th>2030</th>
<th>2070</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual</td>
<td>Summer</td>
</tr>
<tr>
<td>Temp (°C)</td>
<td>0.6 – 1.3</td>
<td>0.6 – 1.4</td>
</tr>
</tbody>
</table>

Many arid-zone groundwater systems host groundwater that is very old and may have been recharged under a different climate to today’s (Clarke et al 1987). These systems may contain ‘fossil’ water and some may not receive recharge from present-day rainfall. Consequently, impacts on the capacity of these ‘fossil’ groundwater resources resulting from climate change are very unlikely at the decadal time scale.

Some groundwater systems in arid regions show changes to the aquifers water level in response to local rainfall events. These events are likely to result in groundwater recharge only if the rainfall is of sufficient intensity and duration to percolate down to the water table through very thick unsaturated soil profiles in environments that exhibit very high rates of evaporation.

In arid areas, rainfall in excess of around 150–200 mm in any given month is required to generate groundwater recharge (Harrington et al 2002). For this reason, projections of changes in average annual rainfall in arid areas are likely to be an unreliable indicator of the likely changes to the capacity of groundwater resources. Alcoe et al (2012) have included changes in average annual rainfall in their study for consistency with previous Impacts of Climate Change on Water Resources studies in other regions of the State, and because changes in average annual rainfall will also have implications for groundwater resources that respond to contemporary rainfall in semi-arid areas of the Alinytjara Wiluara region.

Climate change modelling results reported by Alcoe et al (2012) suggest that under a high-emissions scenario and using the ‘Most-Likely’ case global circulation model (GCM), average annual rainfall is projected to reduce by 10% at the 2050 time horizon, relative to the 1990 baseline case (Table 8). Under the same scenario, GCM and time horizon, the number of months with greater than 100 mm rainfall reduces by 39% compared to the 1990 baseline case.
Table 8: Change in rainfall metrics—expressed as a percentage compared to the 1990 historic baseline case—averaged across the AW NRM Region

<table>
<thead>
<tr>
<th>Case</th>
<th>Emissions</th>
<th>Change in Annual Average Rainfall (%)</th>
<th>Change in 1st Percentile Daily Rainfall (%)</th>
<th>Change in Number of Months &gt; 100mm Rainfall (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2030</td>
<td>2050</td>
<td>2070</td>
</tr>
<tr>
<td>Best</td>
<td>Low</td>
<td>-4</td>
<td>-7</td>
<td>-9</td>
</tr>
<tr>
<td>Best</td>
<td>High</td>
<td>-5</td>
<td>-8</td>
<td>-12</td>
</tr>
<tr>
<td>Most Likely</td>
<td>Low</td>
<td>-5</td>
<td>-8</td>
<td>-10</td>
</tr>
<tr>
<td>Most Likely</td>
<td>High</td>
<td>-5</td>
<td>-10</td>
<td>-14</td>
</tr>
<tr>
<td>Worst</td>
<td>Low</td>
<td>-13</td>
<td>-19</td>
<td>-24</td>
</tr>
<tr>
<td>Worst</td>
<td>High</td>
<td>-14</td>
<td>-24</td>
<td>-33</td>
</tr>
</tbody>
</table>

‘Best’ case = BCCR GCM; ‘most-likely’ case = NCAR CCSM3 GCM; ‘worst’ case = CSIRO Mark 3.5 GCM; low-emissions scenario = SRES B1; high-emissions scenario = SRES A2

The study, undertaken by Alcoe et al (2012), of the impacts of climate change on the water resources in the Alinytjara Wiluŋara region shows the projected risk to the capacity of the water resources that supply the local Aboriginal communities (see table 9). This risk assessment is based on whether the groundwater resources are responsive to contemporary, extreme rainfall events and the projected change in the frequency of extreme rainfall events that lead to recharge.

The capacity of groundwater resources around the communities of Yunyarinyi, Pukatja and Kaltijiti have been identified as being at the greatest risk from impacts due to climate change.

Yalata was not included in the risk analysis because recharge in the semi-arid climate sub-zone is not likely to be governed by extreme, summer-dominant rainfall events. Furthermore, the data suggests that there is only a weak relationship between rainfall and water level and consequently, it is possible that the aquifer upon which the residents of Yalata rely for potable supply is recharged as far away as the Ooldea Ranges or the Nullarbor Plain (i.e. tens or hundreds of kilometres away). As a result, it is very unlikely that climate change will have any short to medium-term impact on water levels and as such, the resource has been assigned to the low-risk category of impacts from climate change.
<table>
<thead>
<tr>
<th>Area/well</th>
<th>Years between recharge events (1990 historical)</th>
<th>Change in frequency of recharge events (%)</th>
<th>Groundwater response to contemporary rainfall (from Table 5)</th>
<th>Projected risk to capacity of water resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amata</td>
<td>2</td>
<td>-26</td>
<td>-32</td>
<td>-38</td>
</tr>
<tr>
<td>Iwantja</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>IMB-19</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>IMB-19A</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>IMB-25</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>IMB-27</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>IR-1&amp;IR-2</td>
<td>3</td>
<td>-7</td>
<td>-10</td>
<td>-23</td>
</tr>
<tr>
<td>Kalka</td>
<td>3</td>
<td>-12</td>
<td>-21</td>
<td>-25</td>
</tr>
<tr>
<td>Kaltjiti</td>
<td>3</td>
<td>-30</td>
<td>-45</td>
<td>-50</td>
</tr>
<tr>
<td>Mimili</td>
<td>4</td>
<td>-11</td>
<td>-36</td>
<td>-45</td>
</tr>
<tr>
<td>Oak Valley</td>
<td>10</td>
<td>-20</td>
<td>-50</td>
<td>-20</td>
</tr>
<tr>
<td>Pipalyatjara</td>
<td>3</td>
<td>-20</td>
<td>-36</td>
<td>-35</td>
</tr>
<tr>
<td>Pukatja</td>
<td>1</td>
<td>-28</td>
<td>-43</td>
<td>-49</td>
</tr>
<tr>
<td>Yunyarinyi</td>
<td>2</td>
<td>-30</td>
<td>-42</td>
<td>-50</td>
</tr>
</tbody>
</table>
5 Findings

This section of the Alinytjara Wiluara DSS outlines the key findings. Some of the findings identified in this Statement warrant further discussion, which may lead to specific recommendations. It is not within the scope of this Statement to provide recommendations. However, if deemed necessary, the South Australian Minister for Water and the River Murray will determine how to address the findings of the Statement by establishing an independent planning process to consider and recommend options.

The key findings identified in this Statement relate to:

- Community water supplies;
- Data availability; and
- Mining demand and expansion.

### 5.1 Community Water Supplies

The AGT (2008) report indicates that the approximate well life of some of the wells in Amata, Pukaţja (Emabella) and Yunyarinyi (Kenmore Park) is between one and ten years and the sustainable use of the wells is short to medium term. An updated assessment of the well life and sustainability of each of the Aboriginal communities’ wells throughout the Alinytjara Wiluara region is underway, which will be beneficial to inform future planning decisions.

It will be important to improve our understanding of the capacity of each of the communities’ supplies and enhance our monitoring capabilities considering the State Government’s commitments under the National Partnership Agreement on Remote Indigenous Housing.

Furthermore, the water resources of the Yunyarinyi (Kenmore Park), Pukaţja (Emabella) and Kaltjiti (Fregon) Aboriginal communities have been identified as being at very high risk from the impacts of climate change by 2050.

### 5.2 Data Availability

One of the key aims of regional demand and supply statements is to prepare demand-supply projections, identifying when demand is expected to exceed supply, out to 2050. It has not been possible to prepare such projections for the Alinytjara Wiluara region due to the lack of data available and the scientific advice that any estimated data should be treated with caution until a more detailed and reliable assessment of water resources can be addressed in subsequent investigations.

It is anticipated that the outcomes of the FLOWS initiative will increase our knowledge about the capacity of groundwater resources in the Alinytjara Wiluara region. When available, any new information will be used to update this Statement and contribute towards the preparation of demand-supply projections.

The sustainable management of the water resources in the Alinytjara Wiluara region is dependent on this new information. Without an understanding of the capacity of the region’s water resources, how the water resources interact, and how they recharge, there is an ongoing risk of inappropriate management.
5.3 Mining Demand and Expansion

The coverage of mineral exploration licences and applications, and petroleum exploration licences and applications across the Alinytjara Wilurara region highlights the potential growth in demand for water resources from this sector.

Realising the benefits of the mining boom is a key strategy for the State Government and, in order to achieve this in a sustainable manner, further research into the volumes of water available for use is required. The DEWNR and Goyder Institute for Water Research FLOWS initiative will contribute towards increasing our understanding of the capacity of the water resources in the Alinytjara Wilurara region to ensure the most appropriate management decisions can be made.

Additionally, consideration should be given to the implications and management of interstate water use from interconnected groundwater aquifers.

6 Staying on Track – Annual Review

This section of the Alinytjara Wilurara DSS discusses the Adaptive Management Framework within which the regional demand and supply statements operate. It outlines the requirements for the statements to be annually reviewed as well as comprehensively reviewed every five years.

Water for Good outlines that the statements will be annually reviewed as an integral part of an Adaptive Management Framework, shown in Figure 7. This commitment is further enhanced through the Water Industry Act 2012, which states that the Minister for Water and the River Murray will produce an annual report providing information about the demand and supply status of the various regions of the State.

Figure 7: Adaptive Management Framework
6.1 Demand and Supply Statement Projections

No demand-supply projections have been included in this Statement due to the limited data available about water sources and demands in the Alinytjara Wilurara region. It is intended that this Statement will be updated based on new information about the capacity of groundwater resources in the Alinytjara Wilurara region obtained following the completion of the FLOWS initiative. At this time, the availability of sufficient data to prepare demand-supply projections will be reconsidered.

6.2 Review of Regional Demand and Supply Statements

The annual review of this Statement will differ to the standard annual review process given that no demand-supply projections have been produced to date.

Traditionally the review process would assess the demand and supply assumptions underlying the demand-supply projections, based on the most recent data provided by State agencies. Nevertheless, in the absence of demand-supply projections, this Statement will still be reviewed in the sense that any new data will be sought and if sufficient data of an acceptable quality is available, demand-supply projections will be prepared. A qualitative assessment of the region’s demand-supply status will be prepared if no new data is available.

When triggers are reached decisions must be made on whether or not to take corrective action. Trigger points help to ensure that decisions are cost-effective and timely. In particular they:

- Reduce risk and identify opportunities;
- Encourage a large range of innovative solutions;
- Reduce the risk of making high-cost investments that prove to be redundant, or are delivered earlier than needed; and
- Ensure demand and supply is continually monitored.

Once projections have been developed, it is intended that DEWNR would recommend that the Minister for Water initiate an Independent Planning Process should demand be expected to exceed supply within the five year trigger point. Should the Minister decide corrective action is needed, an Independent Planning Process will be established to review options and recommend a solution. It should not be assumed that all identified demand and supply gaps will necessarily be filled by the Government.

Details of the annual review of the Alinytjara Wilurara DSS will appear in the Minister’s Annual Review, which, as outlined in the Water Industry Act 2012, is expected to be tabled in Parliament by 31 March each year.

Water for Good also proposes a more thorough review of the regional demand and supply statements is conducted every five years, which may involve field visits, stakeholder consultation and investigative studies.
7 Glossary

Alluvial — Composed of or pertaining to alluvium, or deposited by running water.

Alluvium — General term for detrital deposits made by rivers or streams or found on alluvial fans, floodplains, etc. Alluvium consists of gravel, sand, silt and clay and often contains organic matter. It does not include the subaqueous sediments of lakes and seas.

Aquifer — Underground sediments or fractured rock that hold water and allow water to flow through them. Aquifers include confined, unconfined and artesian types.

Arid — A climate with summer dominant rainfall that tends to be very episodic in nature.

Artesian — An aquifer in which the water surface is bounded by an impervious rock formation; the water surface is at greater than atmospheric pressure and hence rises in any well which penetrates the overlying confining aquifer.

Catchment — An area of land that collects rainfall and contributes to surface water (streams, rivers, wetlands) or to groundwater.

Climate change — Variations in historic weather patterns due to increases in the Earth’s average temperature resulting from increased greenhouse gases in the atmosphere.

Demand management — An approach that is used to intentionally reduce the consumption of water through specific initiatives, normally either to conserve supplies or defer augmentations.

Desalination — The process of removing dissolved salts from seawater (or brackish water) so that it becomes suitable for drinking or other productive uses.

Drinking quality water — Water that is fit for human consumption.

Dry Sheep Equivalent — Dry Sheep Equivalent (DSE) is a standard unit frequently used to compare the feed requirements of different classes of stock or to assess the carrying capacity and potential productivity of a given farm or area of grazing land.

Ephemeral — Usually containing water only on an occasional basis after rainfall events. Many arid zone streams and wetlands are ephemeral.

Evapotranspiration — The total loss of water as a result of transpiration from plants and evaporation from land and surface water bodies.

Fluvial — Of or pertaining to rivers; produced by the action of a river or stream.

Fossil water — Groundwater that has remained sealed in an aquifer for a long period of time.

Groundwater — Sub-surface water, particularly that which is held in aquifers.

Palaeochannel — ancient buried river channel formed by palaeorivers in arid areas of the State.
**Palaeoriver** — Refers to an ancient fluvial system responsible for a particular feature.

**Palaeovalley** — Refers to the valley incised by the palaeoriver.

**Permian** — The period at the end of the Palaeozoic Era, from 299-251 Ma and is subdivided into the Cisuralian, Guadalupian and Lopingian epochs from oldest to youngest.

**Playa** — A flat, dry barren plain at the bottom of a desert basin, underlain by silt, clay and evaporates; it is often the bed of an ephemeral lake and may be covered with white salts.

**Prescribed Water Resource** — A prescribed water resource may be surface water, groundwater, watercourse water, or a combination of these.

**Prescription** — Prescription establishes a framework for the sustainable management of water resources, provides more secure access to water for all water users, establishes a potentially tradable statutory water right, and recognises the environment as a legitimate user of water.

**Quaternary** — The most recent period of geological time, a division of the Cainozoic.

**Recharge** — The infiltration of water into an aquifer from the surface (rainfall, stream flow, irrigation etc.).

**Resource capacity** — The total volume of water available for supply from a water resource.

**Run-off** — Precipitation that flows from a catchment area into rivers, lakes, watercourses, reservoirs or dams.

**Security of supply** — Reliability or surety of meeting water supply demand. Storages provide the capability to ensure a certain level of supply is available despite seasonal variations in stream flow.

**Sediment** — Solid material, organic or inorganic in origin, that has settled out from a state of suspension in a fluid and has been transported and deposited by wind, water or ice; loose sediment such as sand and mud may become consolidated and/or cemented to form coherent sedimentary rock.

**Semi-arid** — A climate where rainfall is winter dominant.

**Surface water** — water flowing over land or collected in a dam or reservoir.

**Wastewater** — Contaminated water before it undergoes any form of treatment. The water may be contaminated with solids, chemicals, or changes in temperature.

**Water allocation plan** — A legal document detailing the rules for the allocation, use and transfer of water from prescribed water resources, as well as the water-affecting activities that require permits.

**Watercourse water** — water which is contained or flows, whether permanently or from time to time, in a river, creek or other natural watercourse (whether modified or not).
8 Abbreviations

GL — gigalitre (1 GL = 1 000 000 000 L)

GL/a — gigalitres per annum

kL — kilolitre (1 kL = 1 000 L)

kL/a — kilolitres per annum

kL/day — kilolitres per day

L — Litre

ML — megalitre (1 ML = 1 000 000 L)

ML/a — megalitres per annum

ML/d — megalitres per day
9 Bibliography


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