The Department of
Water, Land and
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Conservation

McLaren Vale Prescribed Wells Area groundwater monitoring status report 2002

Report DWLBC 2002/06

Government
of South Australia

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Groundwater Assessment
Department of Water, Land and Biodiversity Conservation

August 2002

Report DWLBC 2002/06

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of South Australia

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Clarke, D.S., 2002. McLaren Vale Prescribed Wells Area groundwater monitoring status report 2002. *South Australia. Department of Water, Land and Biodiversity Conservation. Report,* DWLBC 2002/006.

Foreword

South Australia's natural resources are fundamental to the economic and social wellbeing of the state. One of the state's most precious natural resources, water is a basic requirement of all living organisms and is one of the essential elements ensuring biological diversity of life at all levels. In pristine or undeveloped situations, the condition of water resources reflects the equilibrium between rainfall, vegetation and other physical parameters. Development of these resources changes the natural balance and may cause degradation. If degradation is small, and the resource retains its utility, the community may assess these changes as being acceptable. However, significant stress will impact on the ability of a resource to continue to meet the needs of users and the environment. Understanding the cause and effect relationship between the various stresses imposed on the natural resources is paramount to developing effective management strategies. Reports of investigations into the availability and quality of water supplies throughout the state aim to build upon the existing knowledge base, enabling the community to make informed decisions concerning the future management of the natural resources, thus ensuring conservation of biological diversity.

Bryan Harris
Director, Resource Assessment Division
Department of Water, Land and Biodiversity Conservation

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INTRODUCTION

The Willunga observation well monitoring network provides critical water level and salinity information on the groundwater systems in the area. This information will lead to an understanding of the hydrodynamics of the system, highlight possible impacts and for the longer term, enable sustainable management of the resource within the McLaren Vale Prescribed Wells Area (PWA; Fig. 1).

The observation well network was established in the 1970s in response to a marked increase in the use of groundwater for irrigation purposes within the Willunga Basin and has been managed by the Groundwater Assessment Group within the Department of Water, Land and Biodiversity Conservation (DWLBC). The number of wells monitoring all aquifers on a monthly basis has increased to a total of 123 wells in the current network (2002).

The monitoring information is used in conjunction with the McLaren Vale PWA Water Allocation Plan (WAP; OCWMB, 2000), introduced in November 2000 to assess the:

- hydrogeological impacts of point of groundwater extraction changes
- water allocation transfer requests
- surface water injection requests for aquifer storage and recovery schemes, and
- potential impact on groundwater dependent ecosystems within the immediate area and also downgradient of a transfer.

The introduction of external water sources, such as mains water, reclaimed water for irrigation and the injection of reclaimed water for aquifer storage and recovery schemes may impact on the groundwater resources in the area. Consequently, the monitoring network should also serve to identify possible impacts on the hydrogeological environments from these types of activities.

The monitoring network is a primary resource management tool and endeavours to identify:

- regional water level changes
- regional changes in groundwater salinity
- sub-regions within an aquifer system that may become stressed as a result of concentrated pumping demand
- areas that may be at risk from salinisation.

This report provides a summary of the trends observed from the current monitoring data in relation to groundwater levels and groundwater quality in the McLaren Vale PWA for the period 1 July 1999 through 1 June 2002. The information presented in this report aims to be consistent with the WAP for the area such that the trends presented are over a water use year considered to be from 1 July through to 30 June. The McLaren Vale WAP also identifies a specific timeframe (three years) during which specified changes in groundwater levels (decline of an average rate of 1 m/y) or groundwater salinity (increase at an average rate of >100 mg/L/y) are considered unacceptable. These management rules are some of the criteria against which transfer of water allocations are assessed. Transfers will not be granted into those areas within the McLaren Vale PWA where changes in groundwater quality or level exceed the identified criteria. A number of the figures presented in this report identify changes in groundwater levels and salinity over the specified planning timeframe.

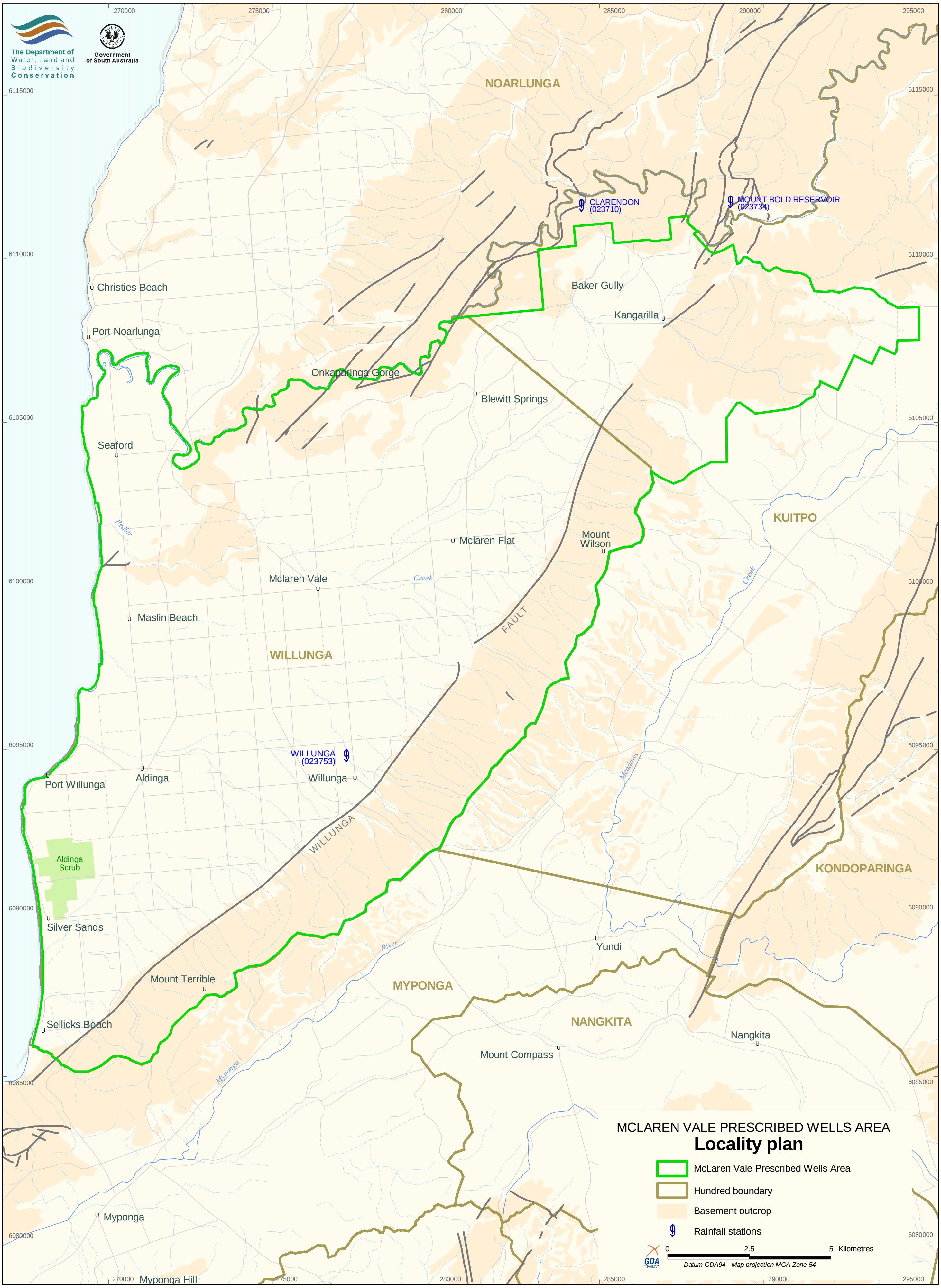

Figure 1

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SUMMARY OF AQUIFERS

The detailed geology and hydrogeology of the Willunga Basin have been outlined by Sereda and Martin (2001) and numerous Office of Minerals and Energy Resources reports (Table 1). In summary, the basin is a structurally controlled trough bounded in the south and east by the Willunga Fault and to the north by outcropping basement. The trough is formed by the southward tilt of a basement block below the Willunga Basin, with the upper edge of the block exposed at the Onkaparinga Gorge. The depth of the basin increases to ~250 m deep near the Willunga Fault.

Groundwater occurs in four major aquifers:

- Quaternary Aquifer
- Port Willunga Formation Aquifer
- Maslin Sands Aquifer
- Fractured Rock Aquifer.

Figure 2 illustrates a schematic cross-section detailing the extent of the aquifer systems throughout the Willunga Basin.

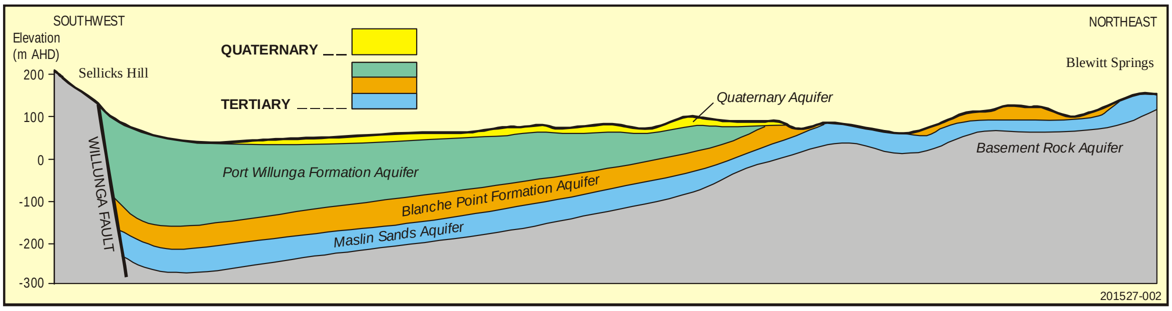

Figure 2 Schematic cross-section of the Willunga Basin

Quaternary Aquifer

The Quaternary Aquifer comprises watertable aquifers formed where sands and interbedded clays exist and a perched aquifer within the dune sand sediments in the Aldinga Scrub area. Recharge is predominantly derived from local rainfall and runoff provided by streams.

Table 1. Stratigraphy and hydrostratigraphy of the Willunga Embayment

		STRATIGRAPHY			HYDROSTRATIGRAPHY	
		Cooper, 1979	May, 1992	Fairburn, 1998	Bowering, 1979	Aldam, 1990a, b
Quaternary	Holocene	(Not included as part of the investigation)	–	Modern alluvium, Semaphore Sand Member and beach gravels.	Confining bed over much of the basin. Thin shallow sandy and gravel unconfined and semi-confined aquifers.	Aquifers, confining beds.
			Waldeila Formation; Ngankipari Sand	(Not mapped)		
				Ngankipari Sand		
	Pleistocene	(Not included as part of the investigation)	Christies Beach Formation; Ngankipari Sand	Christies Beach Formation		Aquifers, confining beds.
			(Not present in coastal section)	Kurrajong Formation		
			Taringa Formation	Ngaltinga Formation		
			Ngaltinga Formation: Snapper Point Sand Member			
			Ngaltinga Formation: Neva Clay Member	Pirramimma Sandstone		
			Robinson Point Formation	Ochre Cove Formation		
			(Mapped as Robinson Point Formation)	Seaford Formation		
			Burnham Limestone	Burnham Limestone		
Tertiary	Pliocene	(Not included as part of the investigation)	Hallett Cove Sandstone	Hallett Cove Sandstone	?	?
	Eocene to Oligocene	Port Willunga Formation: –; Ruwarung Member; Aldinga Member; Pirramimma Sand Member	–	Port Willunga Formation	Confined aquifer in southern half of basin. Unconfined elsewhere.	(Aquifer T1) Port Willunga Formation Aquifer including Pirramimma Sand, Aldinga and Ruwarung Members.
		Chinaman Gully Formation		Chinaman Gully Formation	Aquitard	Confining bed.
		Blanche Point Formation: Gull Rock Member		Undifferentiated (Blanche Point Formation and Tortachilla Limestone)	Confining bed over southern half of basin. Aquifer to aquitard elsewhere.	
		Tortachilla Limestone			Aquitard	
		Maslin sands: South Maslin Sand Member; North Maslin Sand Member		Maslin sands (Undifferentiated South Maslin Sand and North Maslin Sand)	Confined aquifer over most of basin. Unconfined in northern most part of basin.	(Aquifer T2) Maslin sands including South Maslin Sand and North Maslin Sand members.
Permian		Cape Jervis Formation	–	–	Varies from poor aquifer to aquitard.	?
Precambrian		Adelaide System	–	–	Almost entirely confined or semi-confined aquifer. Unconfined over a restricted area.	Basement aquifer, confining in places.

Port Willunga Formation Aquifer

The Port Willunga Formation Aquifer comprises sand and limestone and is generally high yielding. It is unconfined at the northern extent near McLaren Vale and McLaren Flat and confined by Quaternary sediments in the south and southwest regions. Recharge to this aquifer system principally occurs across the unconfined portion that is a narrow strip only some 2–3 km wide extending from the coast and slightly south of McLaren Vale township up to McLaren Flat (Martin, 1998). The aquifer sub-crops in the region to the northeast of McLaren Vale Flat.

The Port Willunga Formation overlays the confining bed consisting of the Chinaman Gully Formation Aquitard over the Blanche Point Formation and Tortachilla Limestone. The Blanche Point Formation comprises low permeability marine mudstone, limestone and chert. All formations are poor yielding but there are several observation wells penetrating these formations to monitor any changes. This information may assist in determining the movement of groundwater between aquifers and the effects of water extraction on the confining layer from the surrounding aquifers.

Maslin Sands Aquifer

The Maslin Sands Aquifer overlies the Fractured Rock Aquifer and comprises fine to coarse sands and clays. The aquifer is recharged in the northeast of the PWA in the vicinity of Baker Gully, Blewitt Springs and north of McLaren Flat where the aquifer outcrops.

South of Pedler Creek the aquifer is confined by the Blanche Point Formation Aquitard separating it from the Port Willunga Formation Aquifer.

Fractured Rock Aquifer

The Fractured Rock Aquifer outcrops east of the Willunga Fault and along the northern extent of the PWA along the Onkaparinga Gorge. Groundwater flows through fractures and fissures in the formation. The flow is variable and strongly influenced by the size, density and orientation of the fractures. This aquifer is recharged by rainfall in outcropping areas and the watertable is likely to reflect the surface topography.

CLIMATE

There is often a very strong relationship observed in shallow aquifer systems between changes in groundwater levels and rainfall, which occurs as a result of rapid recharge to these systems from rainfall. Where a strong relationship exists, changes in groundwater level can be quite easily matched against the rainfall event.

In many aquifer systems, because groundwater levels are recharge controlled, years of above average rainfall will result in rising groundwater levels, while years of below average rainfall will result in declining groundwater levels.

In deeper confined aquifer systems such as the Port Willunga Formation or Maslin Sands Aquifers, the majority of recharge typically occurs along the boundary margins. The observed response in these aquifers is a gradual rise in water levels which is a combination of aquifer recovery from summer pumping stresses and recharge.

Figure 3 shows the rainfall cumulative deviation from the monthly mean plotted against the monthly rainfall. The data, which ranges from 1960 to 2002, has been obtained from established meteorological stations closest to the potential recharge regions.

The rainfall gauging stations are managed by the Bureau of Meteorology and locations and station numbers are identified on Figure 1:

- Willunga — Station number 023753
- Clarendon Post Office — Station number 023710
- Mount Bold Reservoir — Station number 023734.

Figure 3 illustrates that Willunga and Clarendon experienced above average rainfall over the period 1968–75. Since then, rainfall has generally been below average as indicated by the declining trend in the cumulative deviation. Significant rainfall events occurred in 1986 and 1992. Since 1999, rainfall has been above average, more notably in the Clarendon region.

Mount Bold is located at higher ground elevation than the other two stations. Rainfall was below average over the period 1960–68, but has generally been above average since then. Noticeable rainfall events also occurred in 1986 and 1992 and rainfall has been above average since 1999.

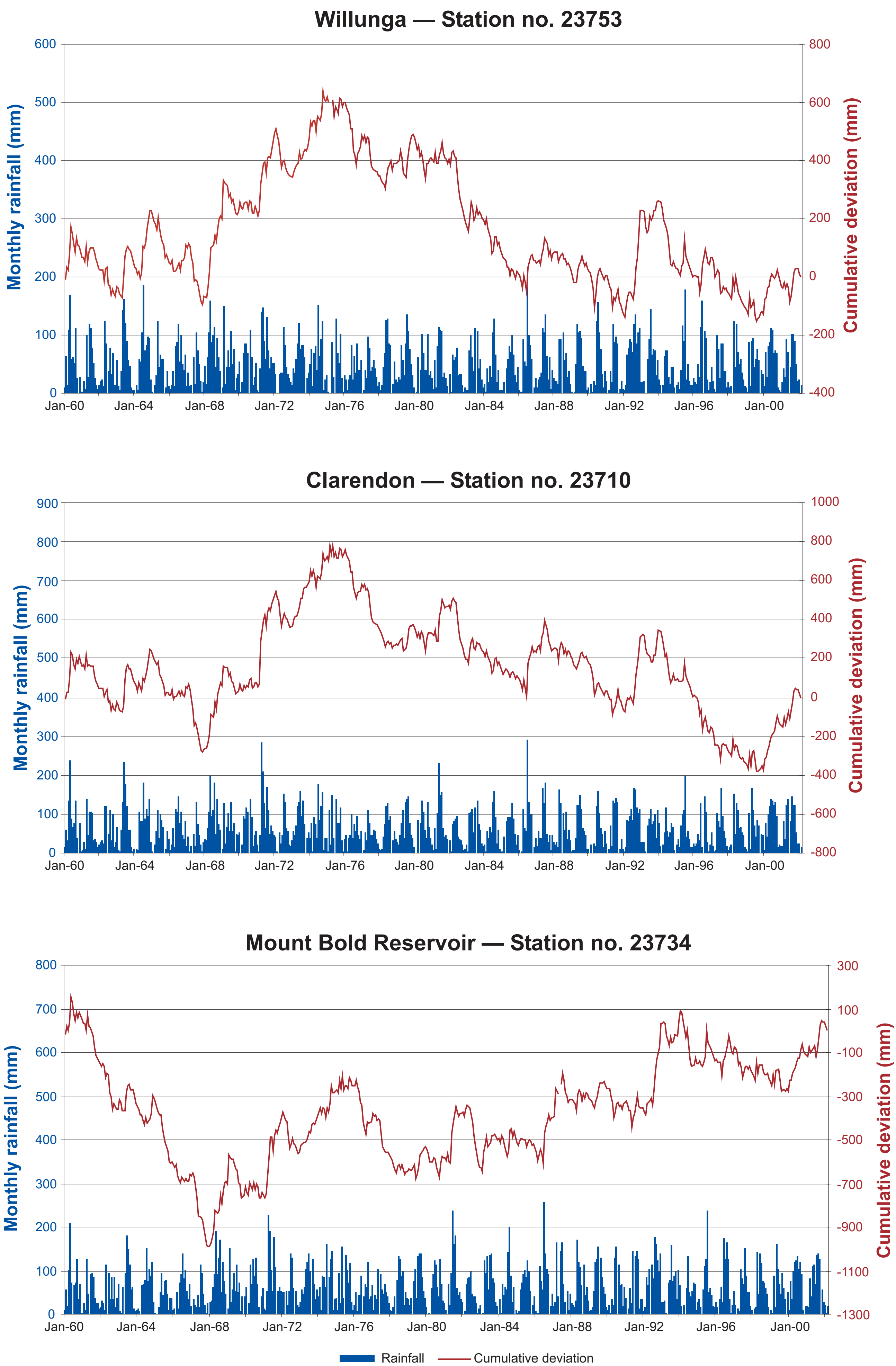

Figure 3 Monthly rainfall and cumulative deviation

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CURRENT OBSERVATION NETWORK

Groundwater trends throughout the PWA are currently monitored via private and government owned observation wells. Table 2 details the number of wells monitoring the different aquifers and aquitards.

Of these, 123 wells monitor the depth to water and salinity, 120 monitor depth to water levels (Fig. 4) and 49 monitor salinity (Fig. 5). Most of the observation bores monitor the aquifers, however, there are a small number of wells that monitor discrete aquifers within the regional confining beds.

Table 2. Current observation wells

Aquifer	**Aquitard**	**Water level** (m AHD)	**Salinity** (mg/L)
Quaternary	–	23	2
Port Willunga Formation	–	33	16
–	Chinaman Gully Formation	1	–
–	Chinaman Gully Formation and Blanche Point Formation	1	–
Blanche Point Formation	Blanche Point Formation	7	2
–	Tortachilla Limestone	1	–
Maslin Sands	–	30	20
Maslin Sands and Fractured Rock	–	4	1
Fractured Rock	–	20	8

During June 2002, 24 new observation wells were integrated into the network. Two sets of four nested piezometers with an associated single observation well (one situated next to Pedler Creek and the other on an upstream tributary), were incorporated into the network. The piezometers monitor the Quaternary and Port Willunga Formation Aquifers and the Chinaman Gully, Blanche Point Formation and Tortachilla Limestone Aquitards. The observation piezometers were established as part of the study conducted by Sereda and Martin (2002). Water level information acquired from these wells will provide valuable information about the recharge–discharge relationship between groundwater and streams.

Additionally, at the request of the Friends of Aldinga Scrub and in the interests of the OCWMB, 14 piezometers, that had been originally established by the Engineering and Water Supply Department in 1988 in the Aldinga Scrub, were surveyed and incorporated into the observation network. Six piezometers monitor the Port Willunga Formation Aquifer, while the remaining eight monitor the perched Quaternary Aquifer located in the dune sand (Semaphore Sand Member, Table 1). Water level information acquired from these piezometers will provide valuable understanding of the seasonal behaviour of the perched aquifer and the groundwater dependent ecosystems. A detailed description of the geology, history and piezometer surveying has been collated in a survey report (Clarke and Graham, 2002) which has been presented to the Friends of Aldinga Scrub and the OCWMB.

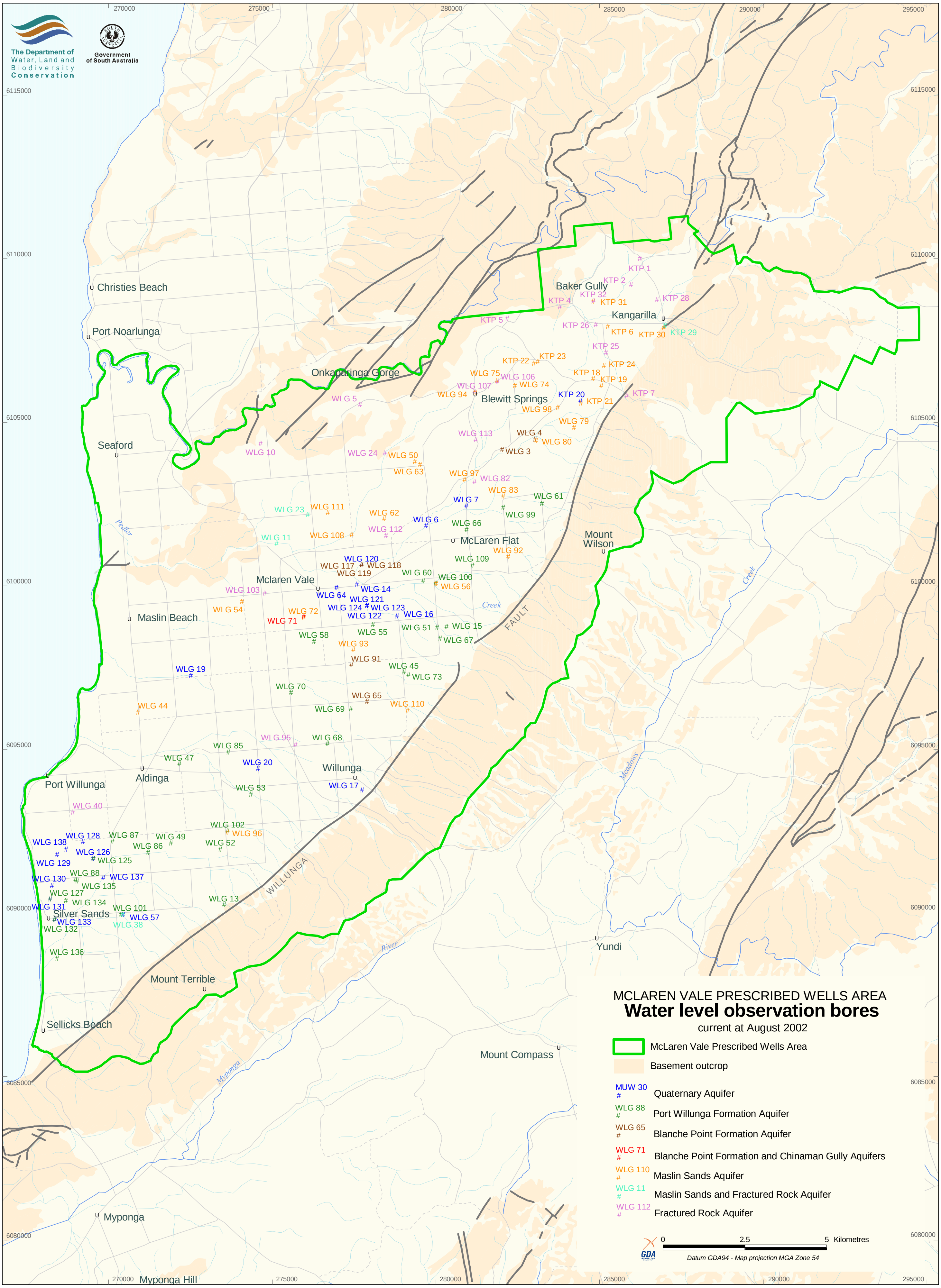

Figure 4

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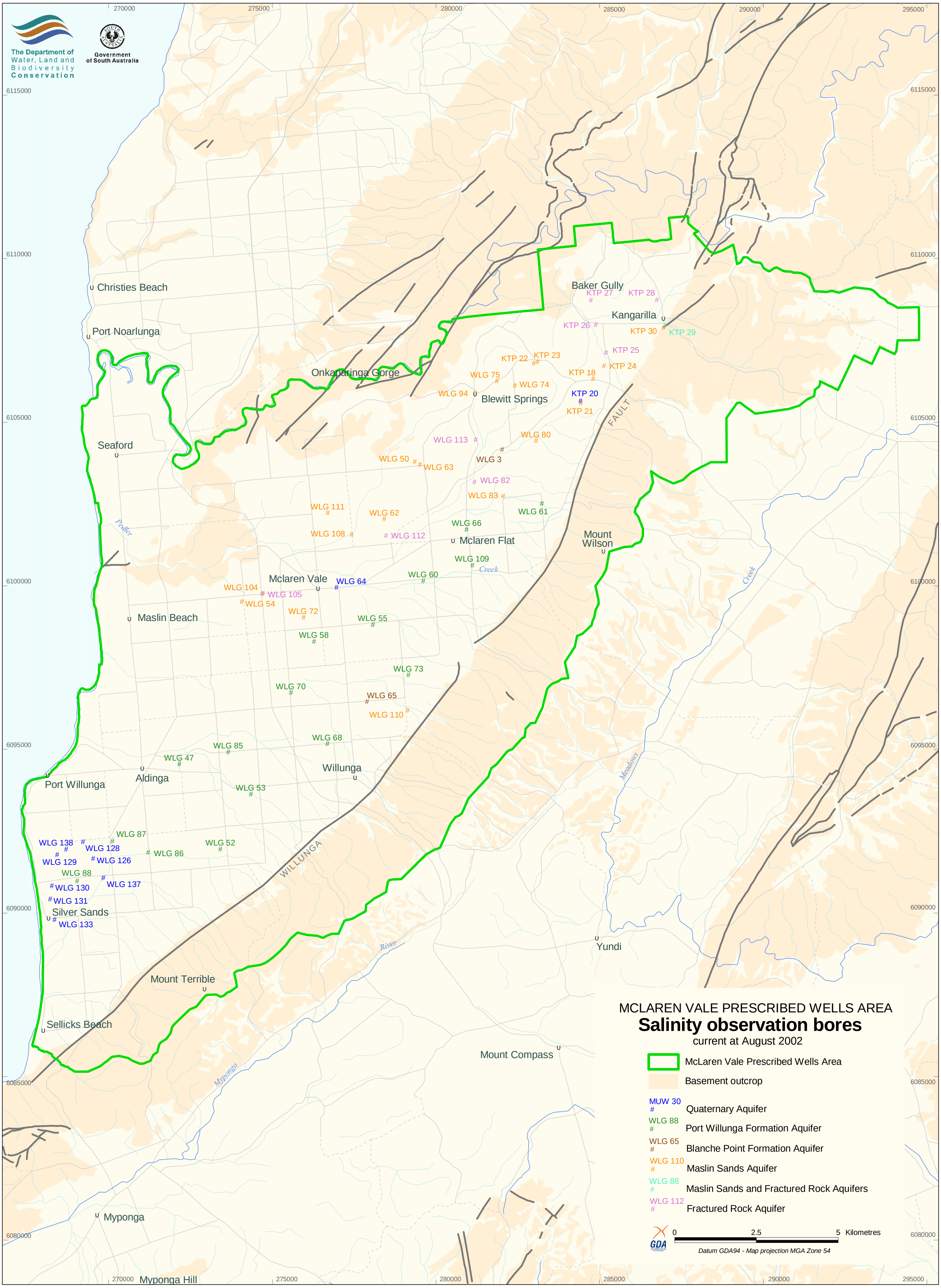

MCLAREN VALE PRESCRIBED WELLS AREA
Salinity observation bores
current at August 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
MUW 30 Quaternary Aquifer
WLG 88 Port Willunga Formation Aquifer
WLG 65 Blanche Point Formation Aquifer
WLG 110 Maslin Sands Aquifer
WLG 88 Maslin Sands and Fractured Rock Aquifers
WLG 112 Fractured Rock Aquifer
0 2.5 5 Kilometres
Datum GDA94 - Map projection MGA Zone 54
The Department of Water, Land and Biodiversity Conservation
Government of South Australia
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Seaford
Baker Gully
Kangarilla
Blewitt Springs
Mclaren Flat
Mclaren Vale
Mount Wilson
Maslin Beach
Willunga
Aldinga
Port Willunga
Silver Sands
Mount Terrible
Sellicks Beach
Yundi
Mount Compass
Myponga
Myponga Hill
WILLUNGA
FAULT

Figure 5

POTENTIOMETRIC SURFACE CONTOURS

Potentiometric contours determine the groundwater flow direction from recharge to discharge zones. Changes in flow direction caused by groundwater extraction may result in the development of a cone of depression in over-stressed parts of the aquifer.

Two sets of contours have been plotted on each of the maps (Figures 7–9) for the respective aquifer units. The November 2001 contours represent groundwater levels at peak recovery levels. The April 2002 contours represent the water levels at the end of the irrigation season. Changes or significant deflection in the position of these two sets of contours may indicate a redirection of groundwater flow towards areas that are becoming stressed due to a concentration in pumping demand.

Quaternary Aquifer

Historically, the Quaternary Aquifer has not been studied in detail and has only been monitored by a small number of observation wells. Consequently, it is not possible to construct reliable contours of the groundwater potentiometric surface for this aquifer system. With the introduction of the new Quaternary Aquifer observation wells, more information will be collected in time that will enable a more comprehensive representation of water levels.

Figure 6 identifies the changes in standing watertable from the recovery and irrigation season. The largest drawdowns are identified in WLG 6, 17 and 57 (6627-2374, 6627-1512 and 6527-1067, respectively) with drawdown values greater than 1 m. Both WLG 6 and 57 have been identified with a decreasing long-term water level trend possibly due to irrigation pressure.

Port Willunga Formation and Blanche Point Formation Aquifers

Groundwater typically flows from the northeast part of the basin towards the coast and the potentiometric surface contours typically align northwest–southeast across the basin.

A deflection observed in the 0, 5 and 10 m contour lines (Fig. 7) may suggest localised pumping stresses. A comparison with metered groundwater extraction in this area will need to be investigated in order to support this conclusion. Alternatively, the hydraulic properties of the aquifer may vary at this location and therefore the aquifer may not be able to deliver sufficient quantities of water to meet the localised pumping demand.

The deflection observed in the 45 m contours could also suggest that at this locality the aquifer is becoming stressed. Although it has been noted that the existing observation wells are completed in the lower part of the Port Willunga Formation Aquifer, which has slightly different hydraulic properties than the upper Port Willunga Formation Aquifer at this location. Further assessment and review of completion depths for both the irrigation wells and monitoring wells in this area is required.

Both the 70 and 80 m contours exhibit a deflection from the northwest–southeast trend, most likely as a result of the concentration in pumping demand in these areas.

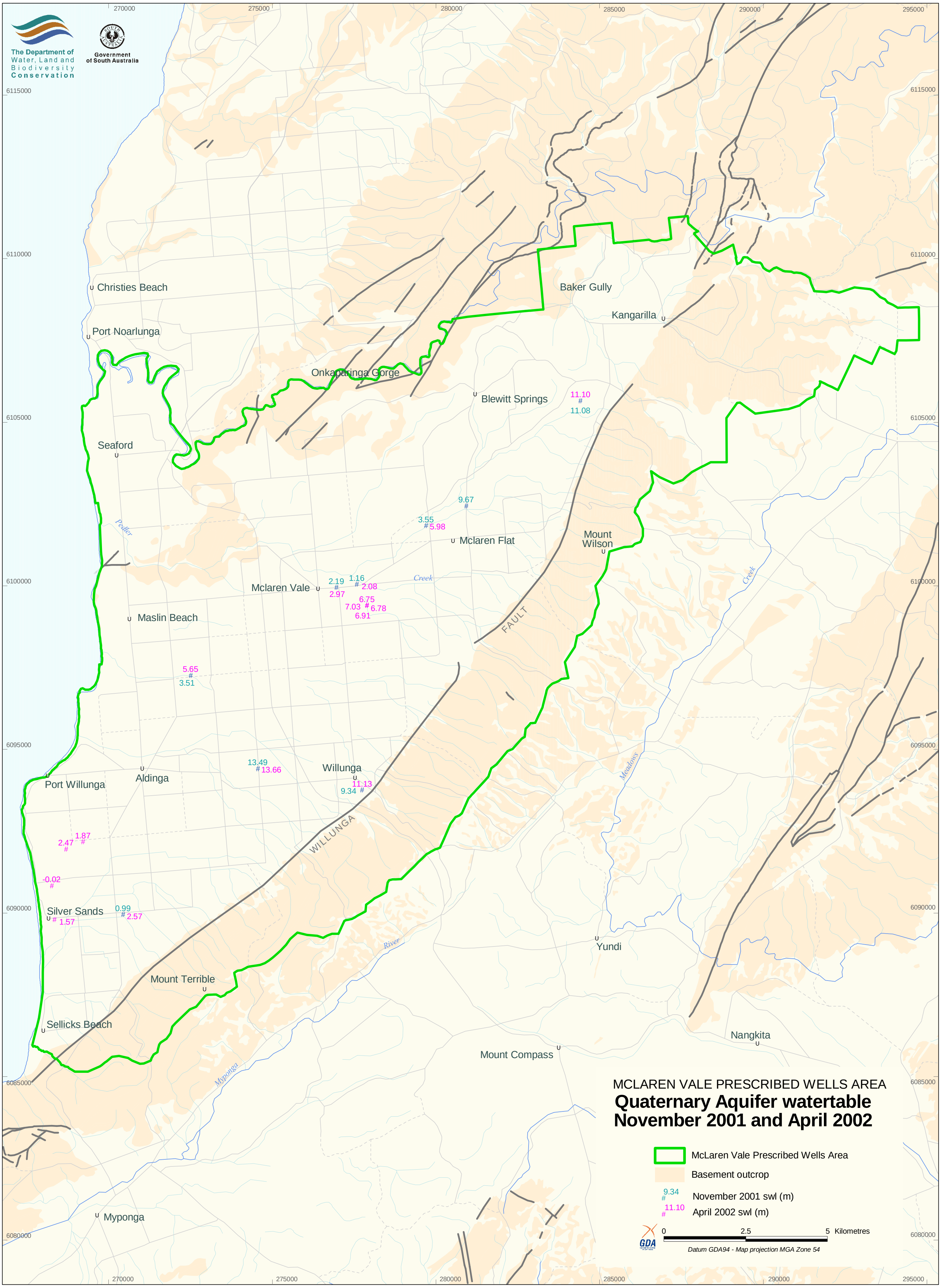

Figure 6

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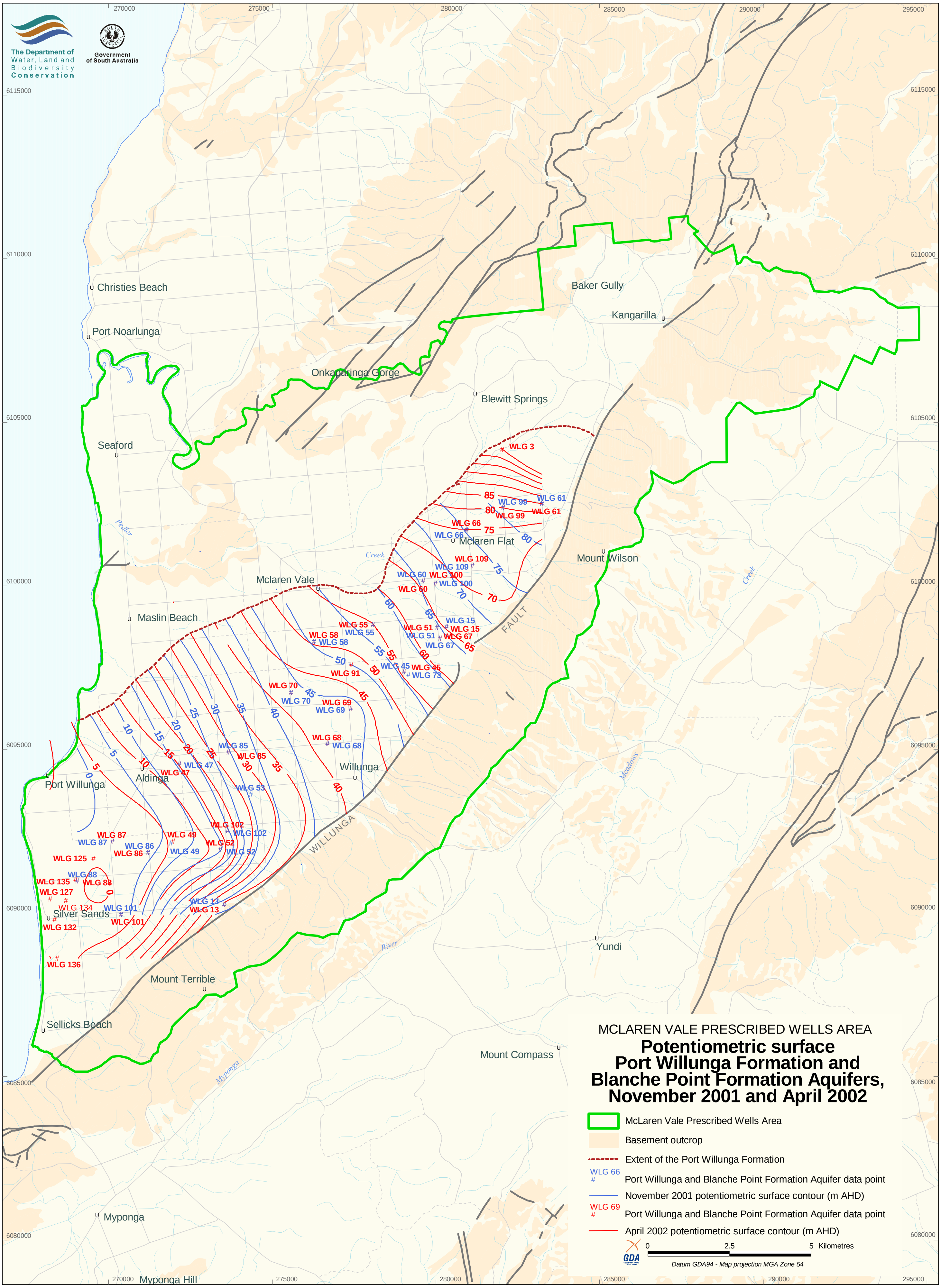

Figure 7

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Maslin Sands Aquifer

The potentiometric surface contours for the Maslin Sands Aquifer can be accepted as the best appropriate representation of groundwater levels as there are only a few observation wells in the central and southern section of the area to construct reliable contours.

The low transmissivity of the Maslin Sands Aquifer sediment (typically 35–50 m/d) results in considerable drawdowns in pumping wells during the main irrigation season. The derived contours of water levels (Fig. 8) show that the summer potentiometric surface is lower and receded to the northeast due to pumping, with some drawdown centres developing (particularly the 50 and 150–160 m contour intervals). However, in some cases the deflection in the watertable elevation may be due to variation in hydraulic properties of the discrete sub-aquifers within the Maslin sands unit and more detailed investigations are required to confirm this.

Fractured Rock Aquifer

The limited number of monitoring wells completed within the Fractured Rock Aquifer make it difficult to construct accurate contours of the potentiometric surface for this aquifer system. Therefore, the contours in Figure 9 should be regarded as the best approximation for the available data.

Significant seasonal variation, which is a result of pumping, can be observed between November 2001 and April 2002. In most cases, the low transmissivity of the fractured rocks leads to the development of considerable drawdowns in pumping wells.

Hydraulic properties of the Fractured Rock Aquifer are very complex and to achieve a better understanding of trends in groundwater, more observation wells are required, especially in areas that have a high density of irrigation wells. At least four new observation wells will be constructed during 2003, where irrigation demand is concentrated in the Fractured Rock Aquifer east of the Willunga Fault.

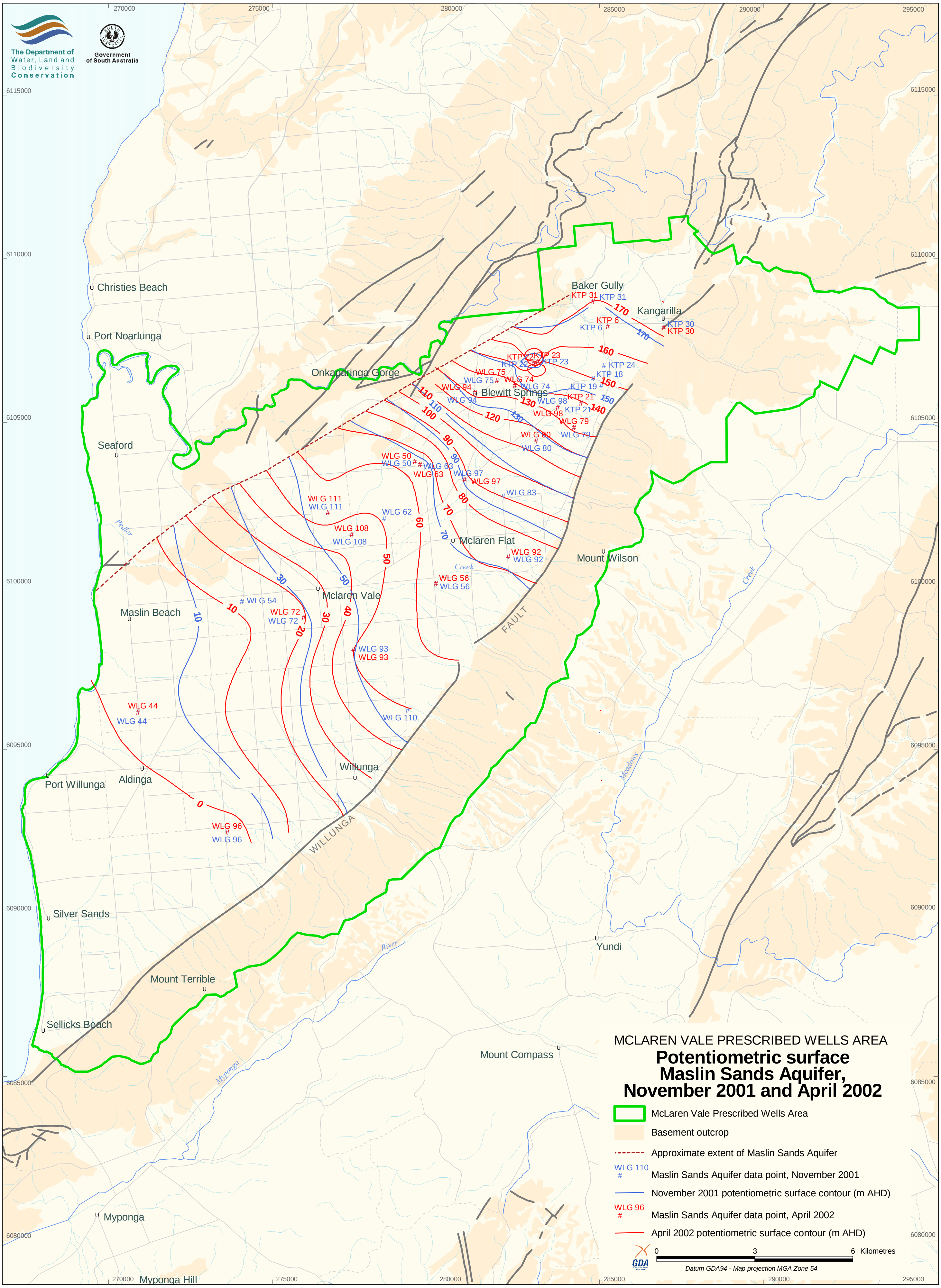

Figure 8

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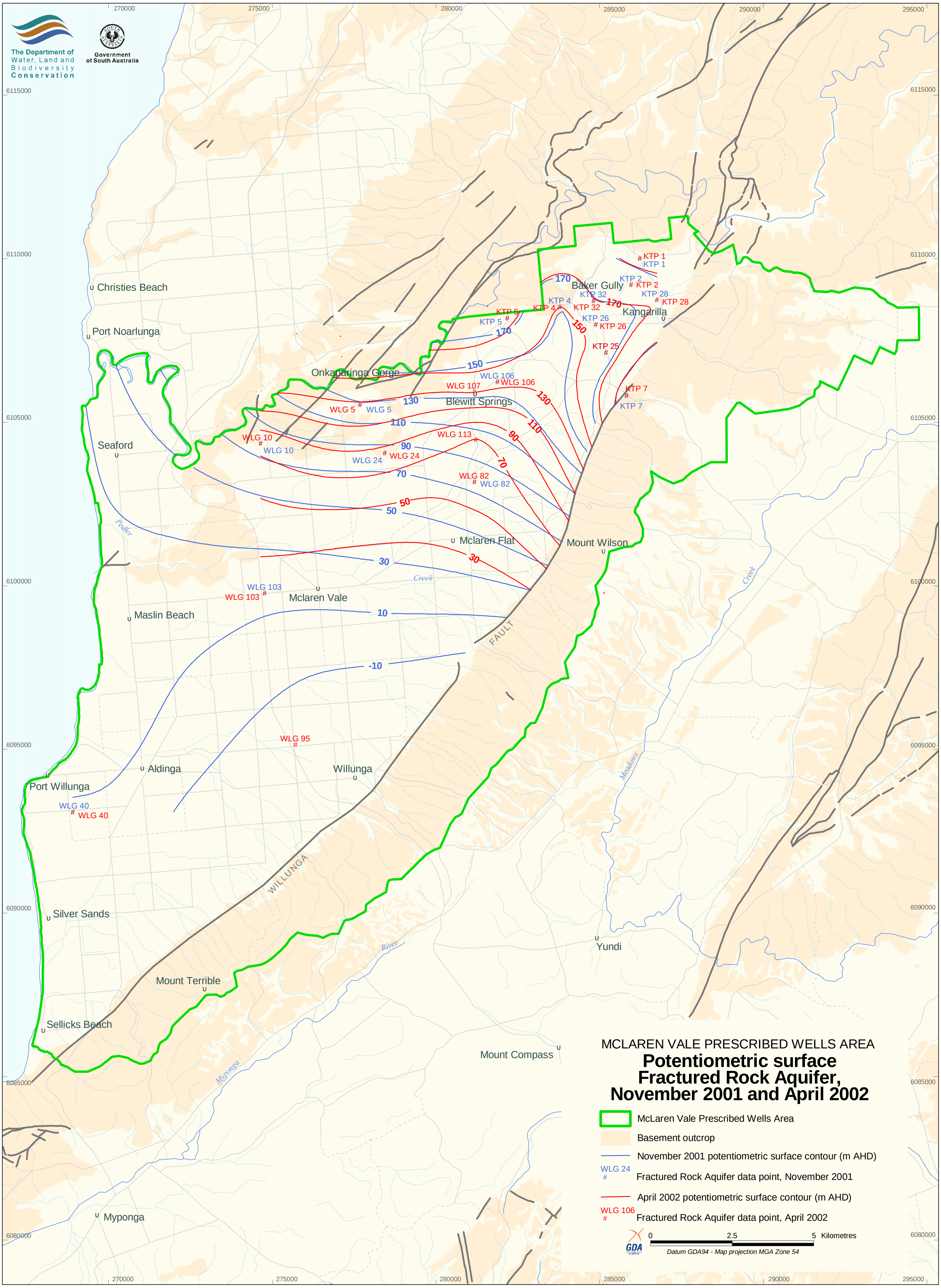
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MCLAREN VALE PRESCRIBED WELLS AREA
Potentiometric surface
Fractured Rock Aquifer,
November 2001 and April 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
November 2001 potentiometric surface contour (m AHD)
WLG 24
Fractured Rock Aquifer data point, November 2001
April 2002 potentiometric surface contour (m AHD)
WLG 106
Fractured Rock Aquifer data point, April 2002
0
2.5
5 Kilometres
GDA
Datum GDA94 - Map projection MGA Zone 54
Christies Beach
Port Noarlunga
Seaford
Maslin Beach
Port Willunga
Aldinga
Silver Sands
Mount Terrible
Sellicks Beach
Myponga
Mount Compass
Yundi
Willunga
Mclaren Vale
Mclaren Flat
Mount Wilson
Blewitt Springs
Onkaparinga Gorge
Baker Gully
Kangarilla
WILLUNGA
FAULT
Pedler
Creek
River
Meadows
Myponga
KTP 1
KTP 2
KTP 4
KTP 5
KTP 7
KTP 25
KTP 26
KTP 28
KTP 32
WLG 5
WLG 10
WLG 24
WLG 40
WLG 82
WLG 95
WLG 103
WLG 106
WLG 107
WLG 113
170
150
130
110
90
70
50
30
10
-10
270000
275000
280000
285000
290000
295000
6115000
6110000
6105000
6100000
6095000
6090000
6085000
6080000

Figure 9

WATER LEVEL TRENDS IN AQUIFERS

Both the three-year (1 June 1999 to 1 June 2002) and the five-year (31 December 1997 to 26 June 2002) water level trends have been analysed for each aquifer. The five-year period between 31 December 1997 and 26 June 2002 was reviewed because there has been a significant change in water use demand coupled with the expansion of irrigated horticulture throughout the region. Irrigation demand over the past five years has been more consistent with the estimated sustainable yield for the McLaren Vale PWA of 6000 ML per annum (OCWMB, 2000). The relatively mild summers and late spring rains over the past two irrigation seasons have also contributed to low irrigation demand.

Three-year water level trends

The three-year water level trends have been analysed to assess whether there are any 'stressed areas' as defined in the WAP (Section 6, Clause 4b; OCWMB, 2000). An area where water level has declined at a rate of at least 1 m over the previous three years is considered stressed.

QUATERNARY AQUIFER

Groundwater level declines are evident in four of the nine observation wells (Fig. 10) monitoring this aquifer system for the period 1 July 1999 through to 1 June 2002. The declines are relatively small, ranging between 0.05 and 0.60 m/y. When comparing the results with the 1995–99 groundwater level trends (Sereda and Martin, 2001) the water levels have risen in all cases, except WLG 6. The level of rise in groundwater has also been relatively minor (0.06–0.10 m/y) although one well (WLG 17) has experienced a rise of 0.45 m/y. The information reviewed from the current observation well network for the Quaternary Aquifer system indicates that there are no apparent areas of groundwater stress as defined by the McLaren Vale WAP.

Because there is little use of the Quaternary Aquifer system to meet irrigation demand, the existing observation network is probably sufficient to monitor the impacts to groundwater from this demand. However, if a primary aim of the monitoring network is to assist in assessing the needs of various groundwater dependent ecosystems throughout the McLaren Vale PWA, it is likely that some consideration may need to be given to the expansion of this network.

PORT WILLUNGA FORMATION AQUIFER

For the monitoring period 1 July 1999 through to 1 June 2002 there are two major areas where the aquifer is showing a decline in observed water levels. One region is located at the northern extent of the Port Willunga Formation Aquifer around McLaren Flat and the other region is around Aldinga (Fig. 11). In the McLaren Flat region declines are relatively minor ranging between 0.04 and 0.09 m/y. Two wells WLG 67 and 45 (6627-7792, 6627-2075) show a decline in water levels of 0.23 and 0.36 m/y respectively. This region also coincides with the deflection of the 45 m potentiometric surface contours (Fig. 7) further suggesting that pumping demand is high in this area of the Willunga Basin.

Declines in water levels around the Aldinga area are also minor, ranging from 0.01 to 0.13 m/y. Throughout the central portion of the basin and within the Port Willunga

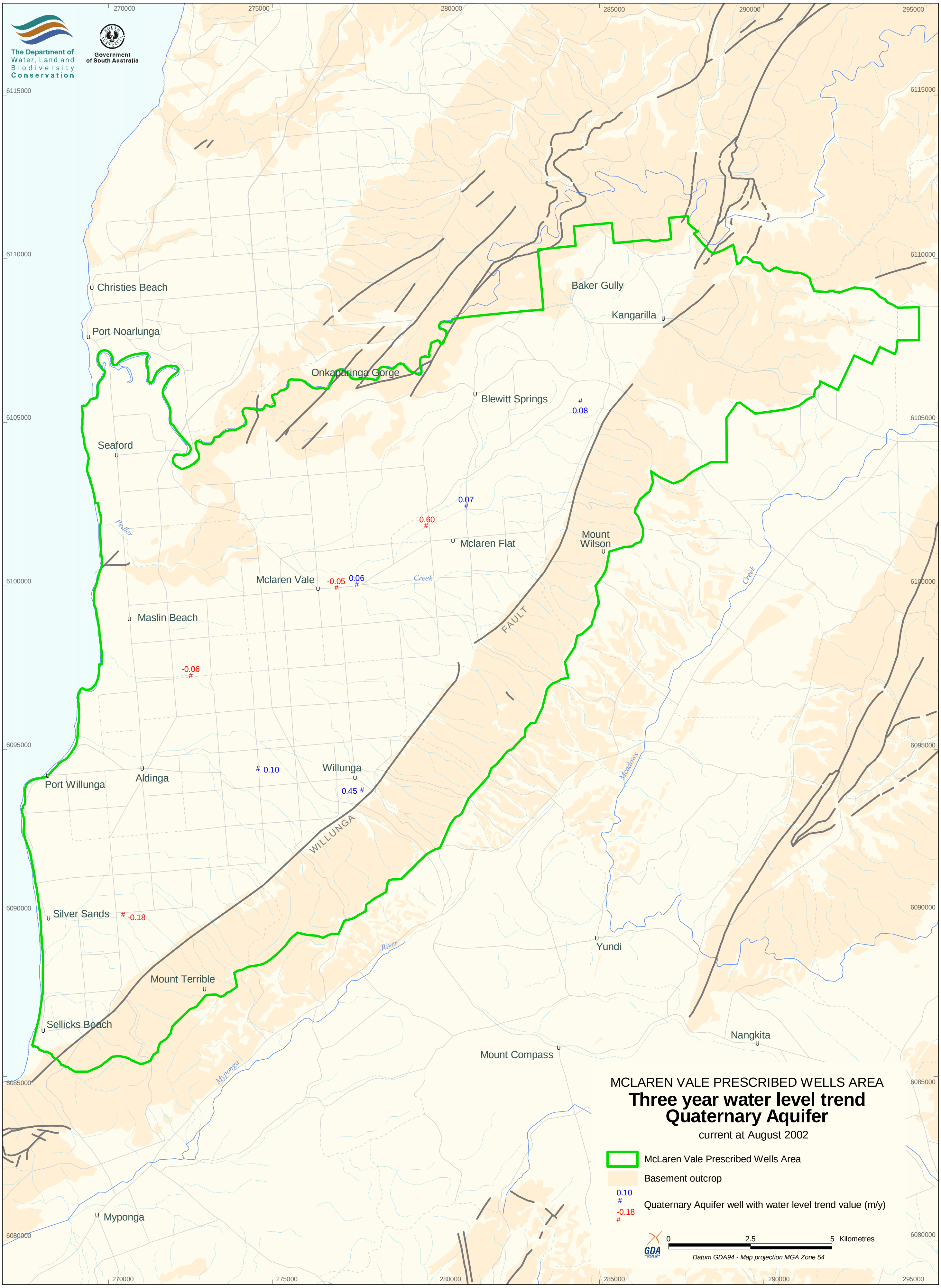

Figure 10

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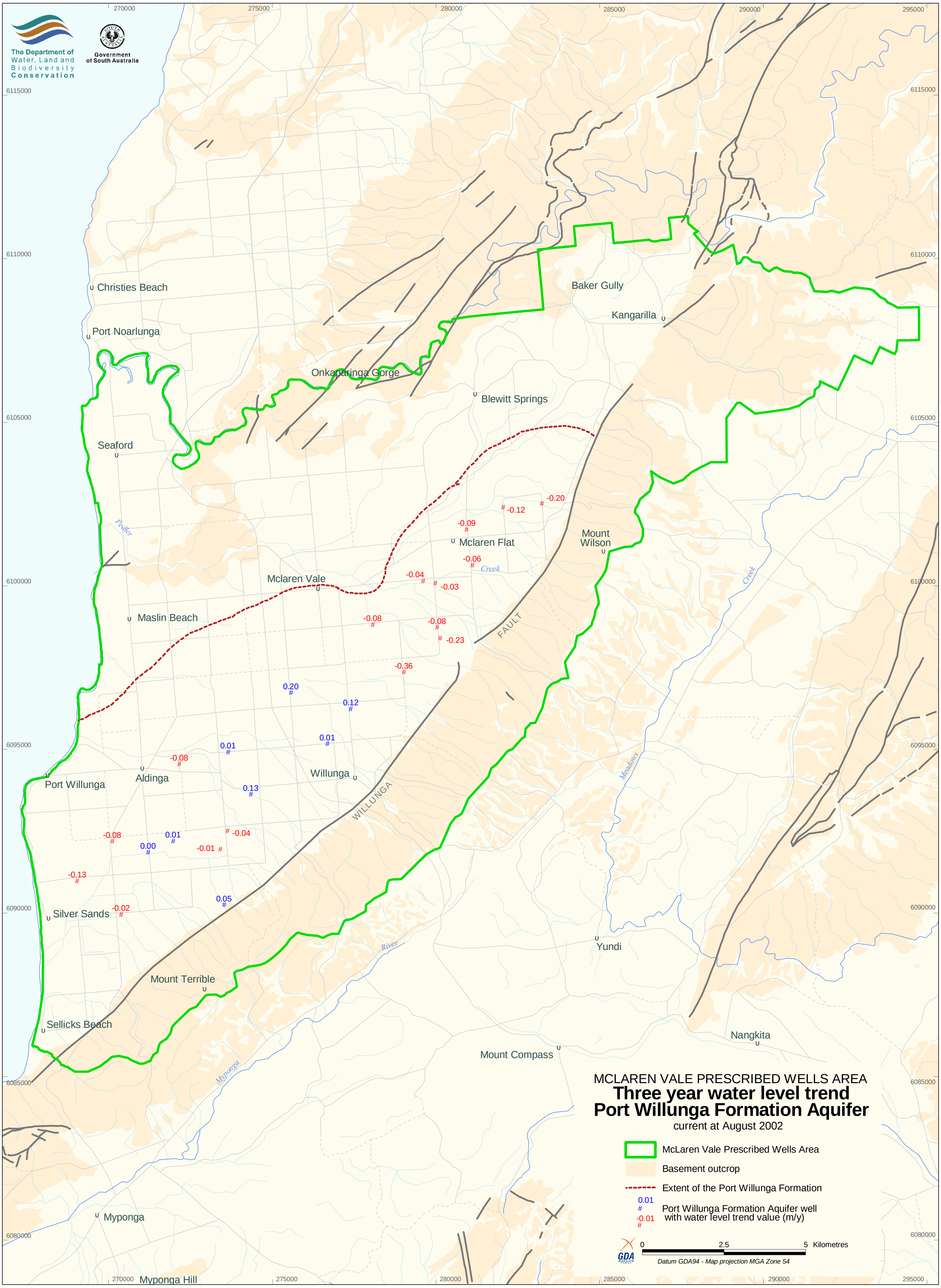
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Government of South Australia
MCLAREN VALE PRESCRIBED WELLS AREA
Three year water level trend
Port Willunga Formation Aquifer
current at August 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
Extent of the Port Willunga Formation
Port Willunga Formation Aquifer well with water level trend value (m/y)
0.01
-0.01
0
2.5
5 Kilometres
GDA
Datum GDA94 - Map projection MGA Zone 54
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Baker Gully
Kangarilla
Blewitt Springs
Seaford
Mclaren Flat
Mount Wilson
Mclaren Vale
Maslin Beach
Port Willunga
Aldinga
Willunga
WILLUNGA
FAULT
Silver Sands
Mount Terrible
Sellicks Beach
Yundi
Nangkita
Mount Compass
Myponga
Myponga Hill
-0.20
-0.12
-0.09
-0.06
-0.04
-0.03
-0.08
-0.08
-0.23
-0.36
0.20
0.12
0.01
0.01
-0.08
0.13
-0.08
0.01
0.00
-0.04
-0.01
-0.13
0.05
-0.02
270000
275000
280000
285000
290000
295000
6115000
6110000
6105000
6100000
6095000
6090000
6085000
6080000

Figure 11

Formation Aquifer groundwater levels have remained static or experienced very minor rises of less than 0.2 m/y for the period 1 July 1999 through to 1 June 2002. Therefore, the conclusion is that there are no regions within the Port Willunga Formation Aquifer currently experiencing any level of stress as defined by the McLaren Vale WAP (OCWMB, 2000) for the period assessed. Comparison of the results with the 1995–99 trends reported Sereda and Martin (2001), shows that the water levels have generally risen slightly, with the exception of WLG 67 and 45 in the northern section and WLG 87, 102, 88 and 101 (6527-1020, 6627-9337, 6527-1017 and 6527-1103, respectively) around Aldinga.

MASLIN SANDS AQUIFER

For the monitoring period 1 July 1999 through to 1 June 2002 the majority of the wells have shown a slight rise in groundwater levels (Fig. 12) of between 0.01 and 0.17 m/y. Six of the 23 observation wells are showing a rise in groundwater levels of greater than 0.3 m/y over the period. These wells are located throughout the Basin rather than being contained to a specific area. A review of the irrigation demand within the proximity of these wells may yield some indication of why water levels have risen by greater than 0.3 m/y. However, there are five observation wells located along the northern margin of the aquifer that are showing a decline of between 0.02 and 0.26 m/y. These wells are not concentrated in any specific location within the aquifer and a review of pumping demand over the past few years may yield some insight into the primary cause of the observed declines.

Again, over the period 1 July 1999 through to 1 June 2002 there are no regions within the Maslin Sands Aquifer currently experiencing any level of stress as defined by the McLaren Vale WAP. Comparison of the data presented by Sereda and Martin (2001) shows that over the period 1 July 1999 to 1 June 2002, observation wells in the Maslin Sands Aquifer have experienced a slight rise in groundwater levels.

This general rise in groundwater levels (albeit slight) observed in all aquifer systems is considered to be a result of the much lower levels of groundwater use over the past two years (~5700 ML in 2000–01 and 5200 ML during 2001–02 irrigation seasons) in comparison to previous irrigation years where use typically exceeded 6500 ML per irrigation year. The lower use is primarily a result of the relatively mild summer experienced during 2001–02 and also and wetter than normal spring months during the past two years. The summer of 2000-01 also experienced a period of greater than 14 consecutive days where temperatures exceeded 36°C, yet groundwater demand was approximately 5700 ML.

FRACTURED ROCK AQUIFER

The majority of the observation wells show a change in water level for the period 1 July 1999 through to 1 June 2002 from 0.16 m/y up to a maximum of 2.47 m/y (Fig. 13). The variability in water level recovery within the Fractured Rock Aquifer is typical as these same systems also experience the greatest drawdowns (sometimes in excess of 20 m) under pumping stress. Two wells show declines in groundwater levels for the same period: KTP 28 (6627-7618) near Kangarilla, where the decline is 0.22 m/y; and WLG 113 (6627-3852) near Blewitt Springs, where the decline in groundwater levels over the period 1 July 1999 through 1 June 2002 of 1.04 m/y exceeds the intended definition of a stressed area as defined in the McLaren Vale PWA WAP (OCWMB, 2000).

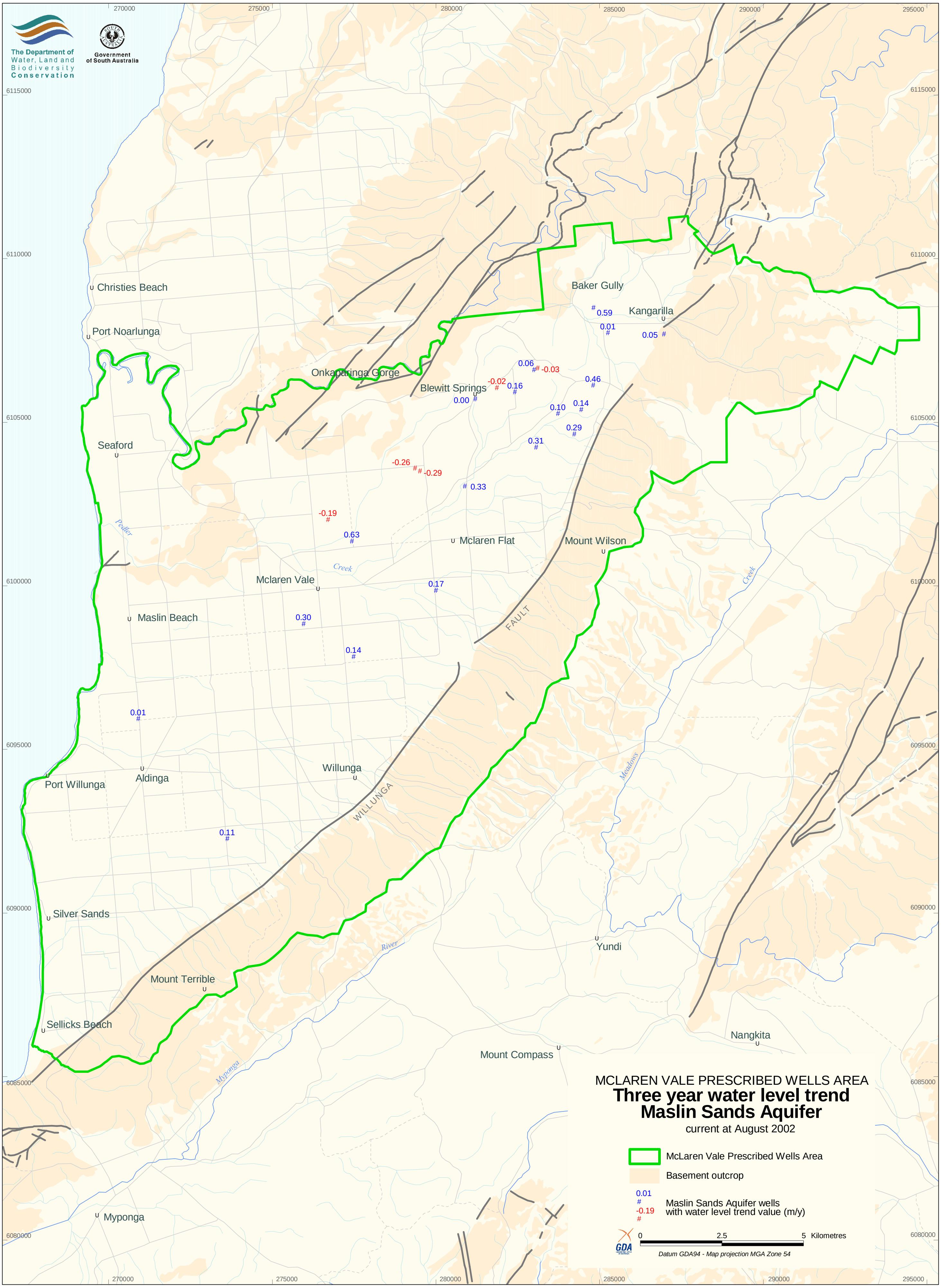


Figure 12

PIRSA Publishing Services AV:201527_012

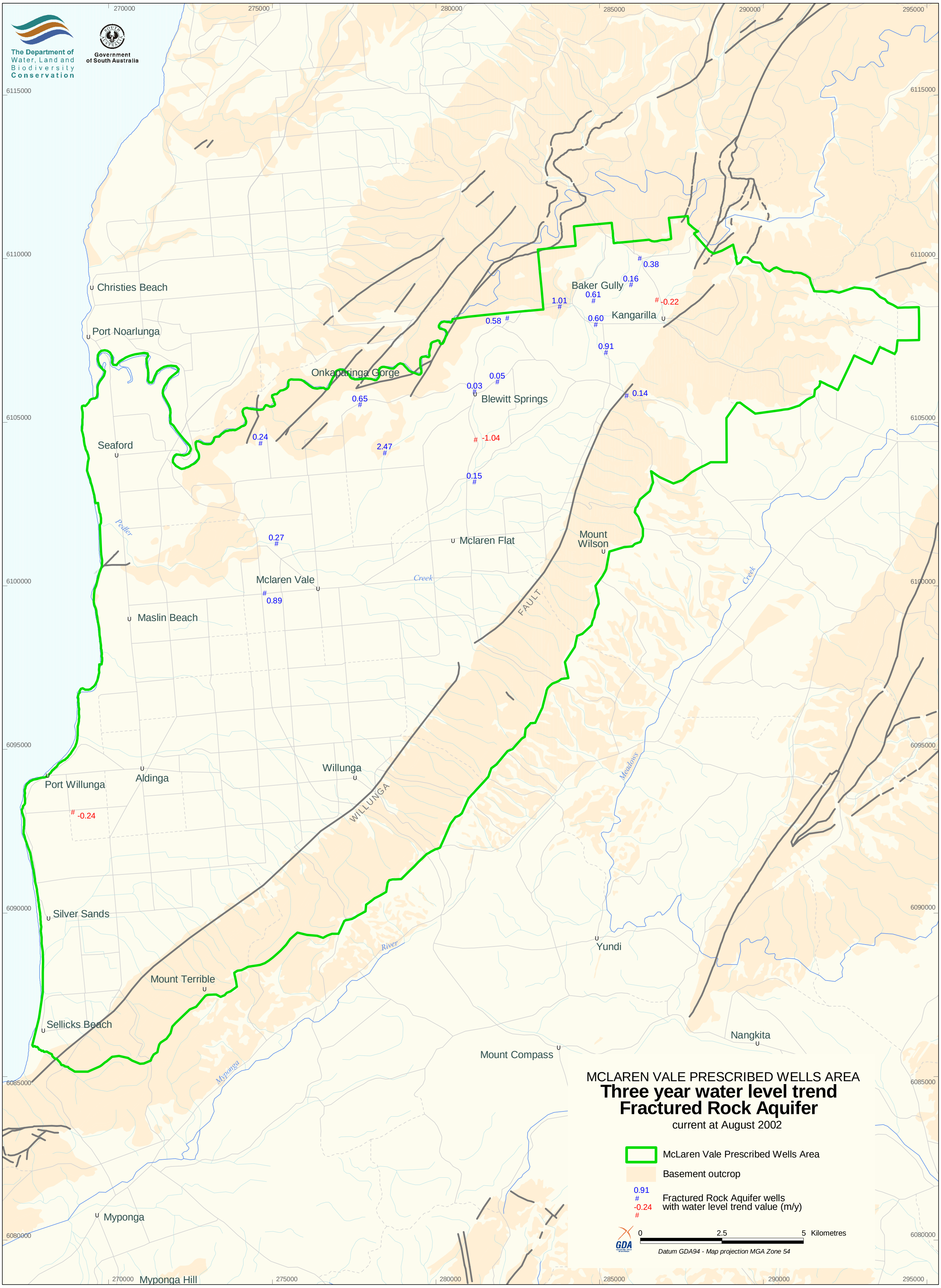


Figure 13

PIRSA Publishing Services AV:201527_013

There is evidence that the Fractured Rock Aquifer on the eastern side of the fault north of Willunga is stressed. This is an area of intense groundwater extraction for irrigation. The decline became evident due to sudden a decrease in water supply to a nearby spring fed dam over the last four years. A report of a site visit and investigation has been documented (DWR, 2001). It is difficult to make any further assessment in this area, as there are no observation wells and therefore no groundwater level information. A drilling program has been established to install four wells during 2003 in areas where licensed wells are concentrated east of the Willunga Fault.

Long-term water level trends

Water level trends have also been assessed over the period 31 December 1997 through to 26 June 2002 in an effort to provide a longer term assessment of water level changes outside the period identified in the McLaren Vale WAP. This period also represents an interval where groundwater demand has approximated the estimated sustainable yield for the groundwater system of 6000 ML per annum (OCWMB, 2000).

QUATERNARY AQUIFER

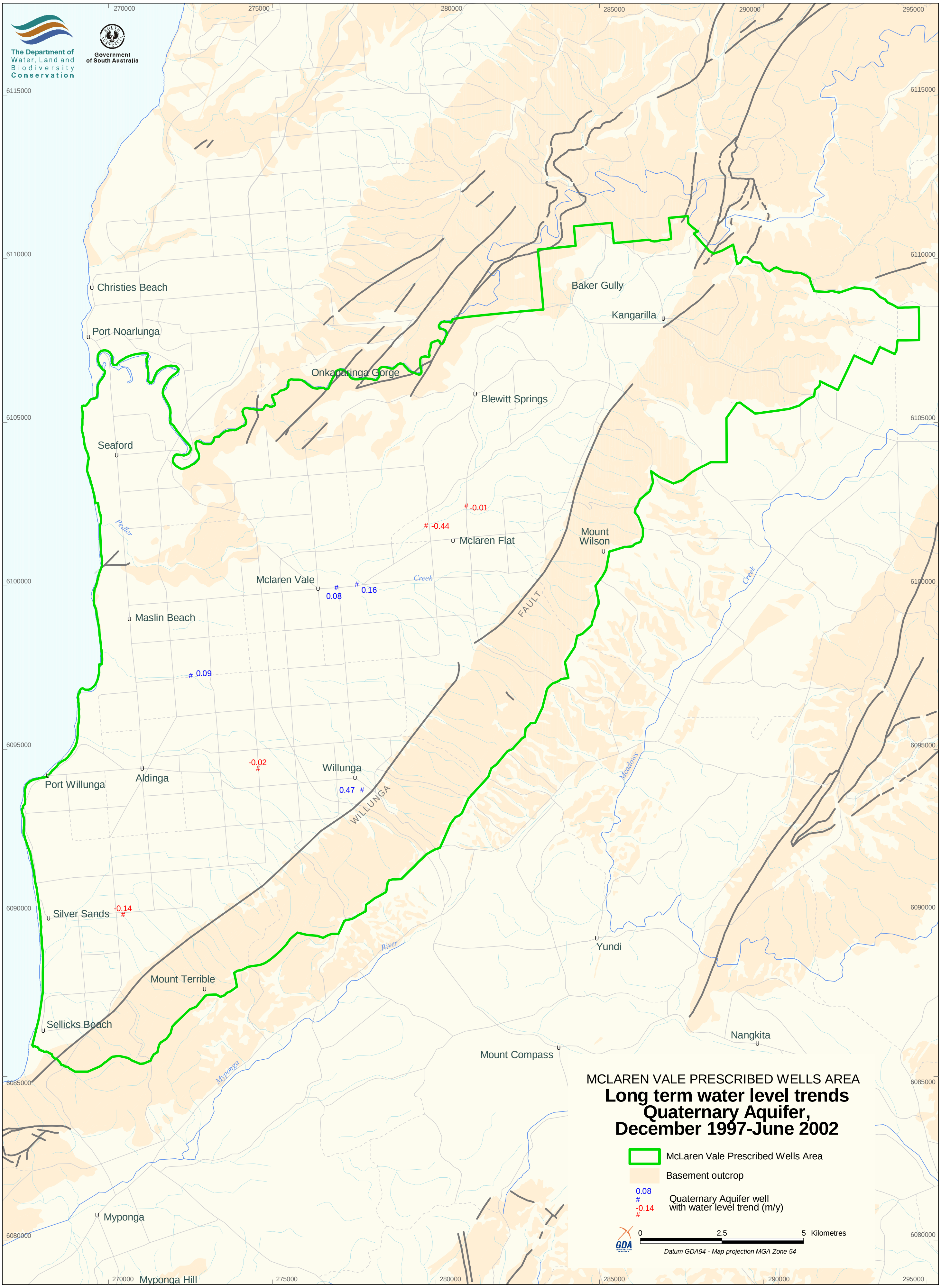
Changes in observed water levels over the period 31 December 1997 through to 26 June 2002 are generally consistent with the changes reported on for the past three years (Fig. 14). The magnitude of groundwater rise is consistent (between 0.08 and 0.16 m/y), while observation wells WLG 6 in McLaren Flat and WLG 57 in the southeastern section of the PWA continue to show declines in groundwater levels of 0.44 and 0.14 m/y respectively. Further investigation as to why these wells continue to show declining groundwater levels against the general background of rising groundwater levels may be warranted.

PORT WILLUNGA FORMATION AQUIFER

Within the Port Willunga Formation Aquifer system, changes in water levels are also consistent when compared over the period 31 December 1997 through to 26 June 2002 and 1 July 1999 through to 1 June 2002. Water level trends have generally increased across the aquifer (Fig. 15). When compared to the 1991–99 annual trend presented by Sereda and Martin (2001) the rate of decline in water levels has generally slowed and also in some cases the observation wells now show a slight rise in groundwater levels. A decrease in recorded groundwater levels still occurs throughout the most northern extent of the Port Willunga Aquifer and around Aldinga.

MASLIN SANDS AQUIFER

Over the period 31 December 1997 to 26 June 2002 (Fig. 16) changes in observed groundwater levels are consistent with those changes over the period 1 July 1999 through 1 June 2002. The majority of wells continue to show slight rises in groundwater levels. Observation wells WLG 50 and 86 both continue to show declines in observed groundwater levels. Pumping demand adjacent to these two observation wells is thought to be the major cause for the observed declines.



The Department of Water, Land and Biodiversity Conservation
Government of South Australia
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Baker Gully
Kangarilla
Blewitt Springs
Seaford
-0.01
-0.44
Mclaren Flat
Mount Wilson
Mclaren Vale
0.08
0.16
Maslin Beach
FAULT
0.09
-0.02
Willunga
0.47
WILLUNGA
Port Willunga
Aldinga
Silver Sands
-0.14
Yundi
Mount Terrible
Sellicks Beach
Nangkita
Mount Compass
Myponga
Myponga Hill
MCLAREN VALE PRESCRIBED WELLS AREA
Long term water level trends
Quaternary Aquifer,
December 1997-June 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
Quaternary Aquifer well with water level trend (m/y)
0 2.5 5 Kilometres
Datum GDA94 - Map projection MGA Zone 54
PIRSA Publishing Services AV:201527_014

Figure 14

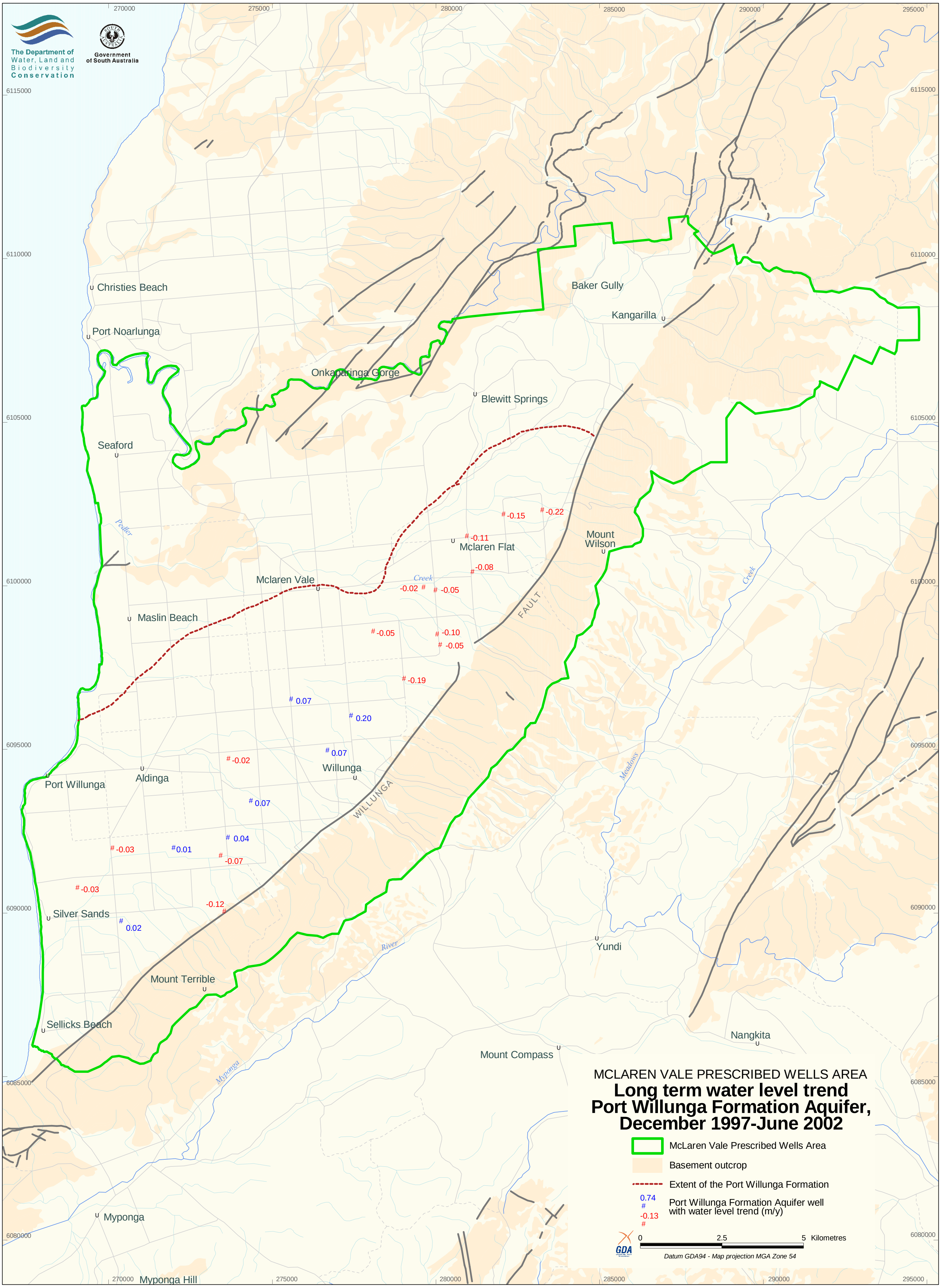


Figure 15

PIRSA Publishing Services AV:201527_015

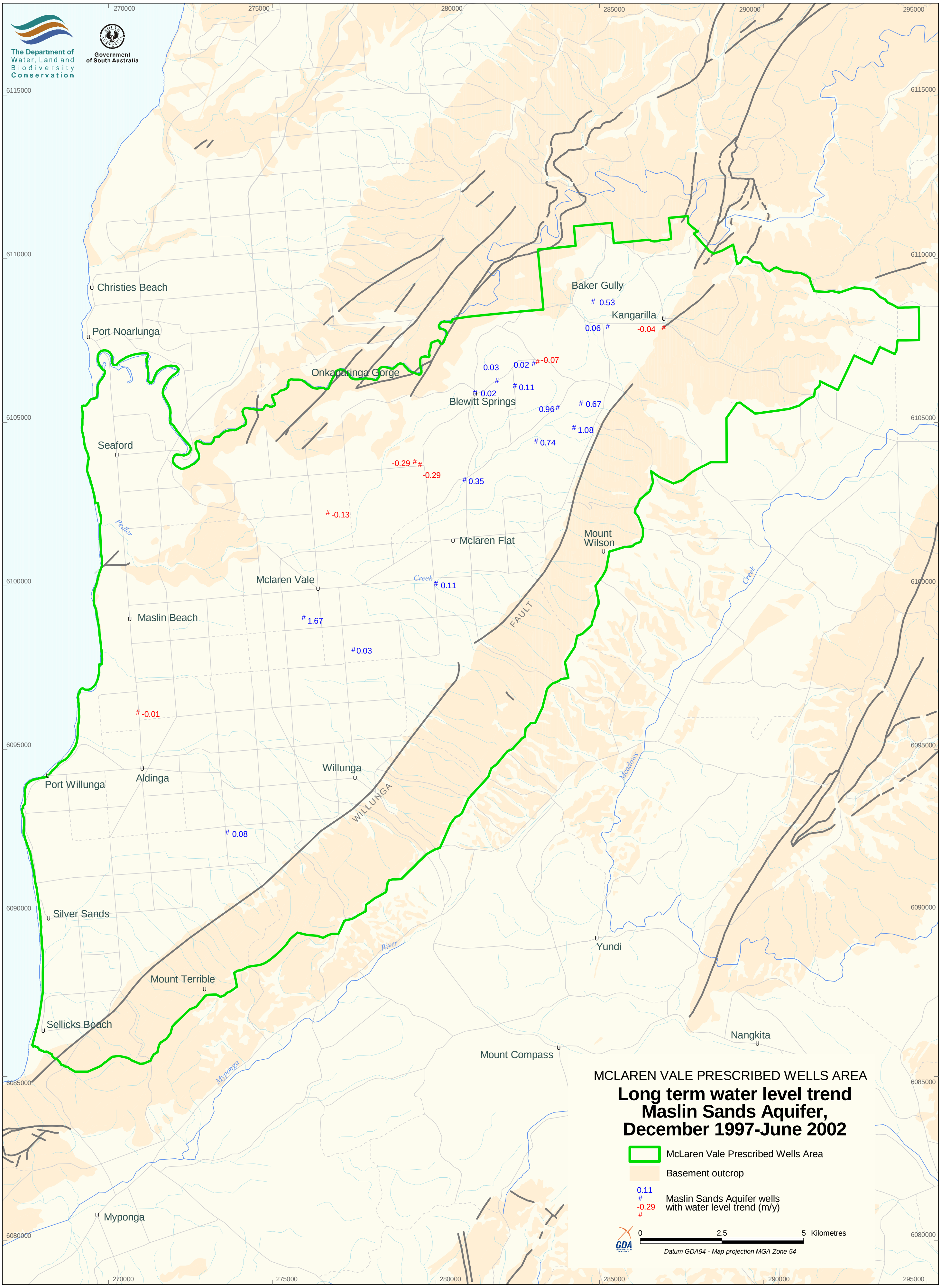


Figure 16

PIRSA Publishing Services AV:201527_016

FRACTURED ROCK AQUIFER

Changes in groundwater levels over the period 31 December 1997 through 26 June 2002 (Fig. 17) are also consistent with those changes observed over the past three years. Observation wells KTP 25 (6627-3691) and WLG 10 (6627-3770) both continue to show long-term declines in observed groundwater levels. Pumping demand adjacent to these observation wells is again considered to be the primary cause of the observed decline in groundwater levels.

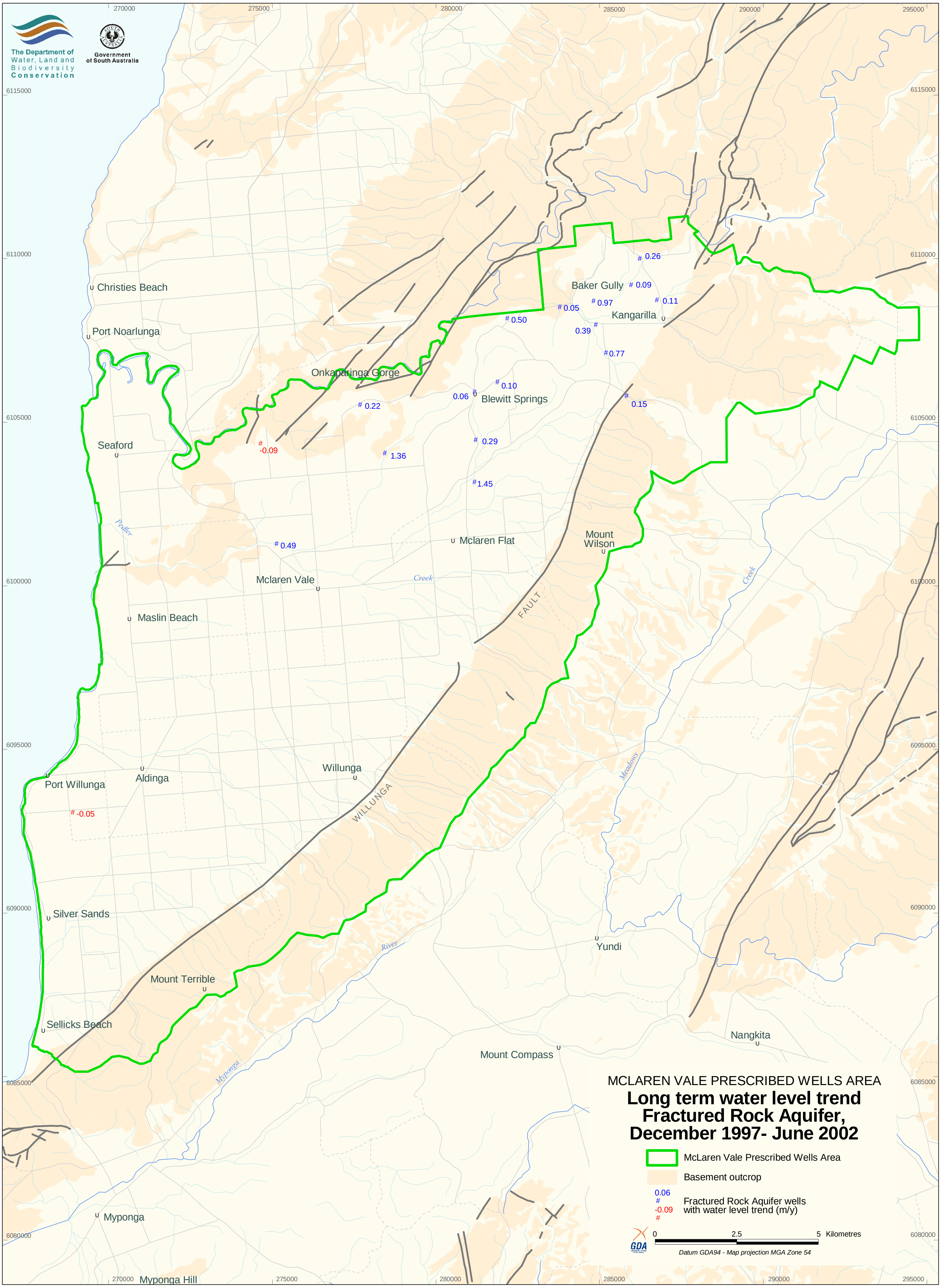


Figure 17

PIRSA Publishing Services AV:201527_017

LATEST SALINITY

Figures 18–21 show the latest salinity levels in Quaternary, Port Willunga Formation, Maslin Sand and Fractured Rock Aquifers respectively.

The salinity of the Quaternary Aquifer is very high in the Aldinga Scrub area where the aquifer is perched. This may be due to concentration of salts in the profile from evaporation.

The salinity increases towards the coast in the Port Willunga Formation Aquifer. This increase of salinity down the potentiometric surface is typical as salinity increases with distance from the recharge zone as water moves through the aquifer. A high local salinity value has been recorded at WLG 66 (6627-7709). The high value may be caused through increased local pumping pressure in the area.

The salinity of the Maslin Sands Aquifer is generally higher than that of the Port Willunga Formation Aquifer, while the salinity in the Fractured Rock Aquifer is variable.

Salinity trends in aquifers

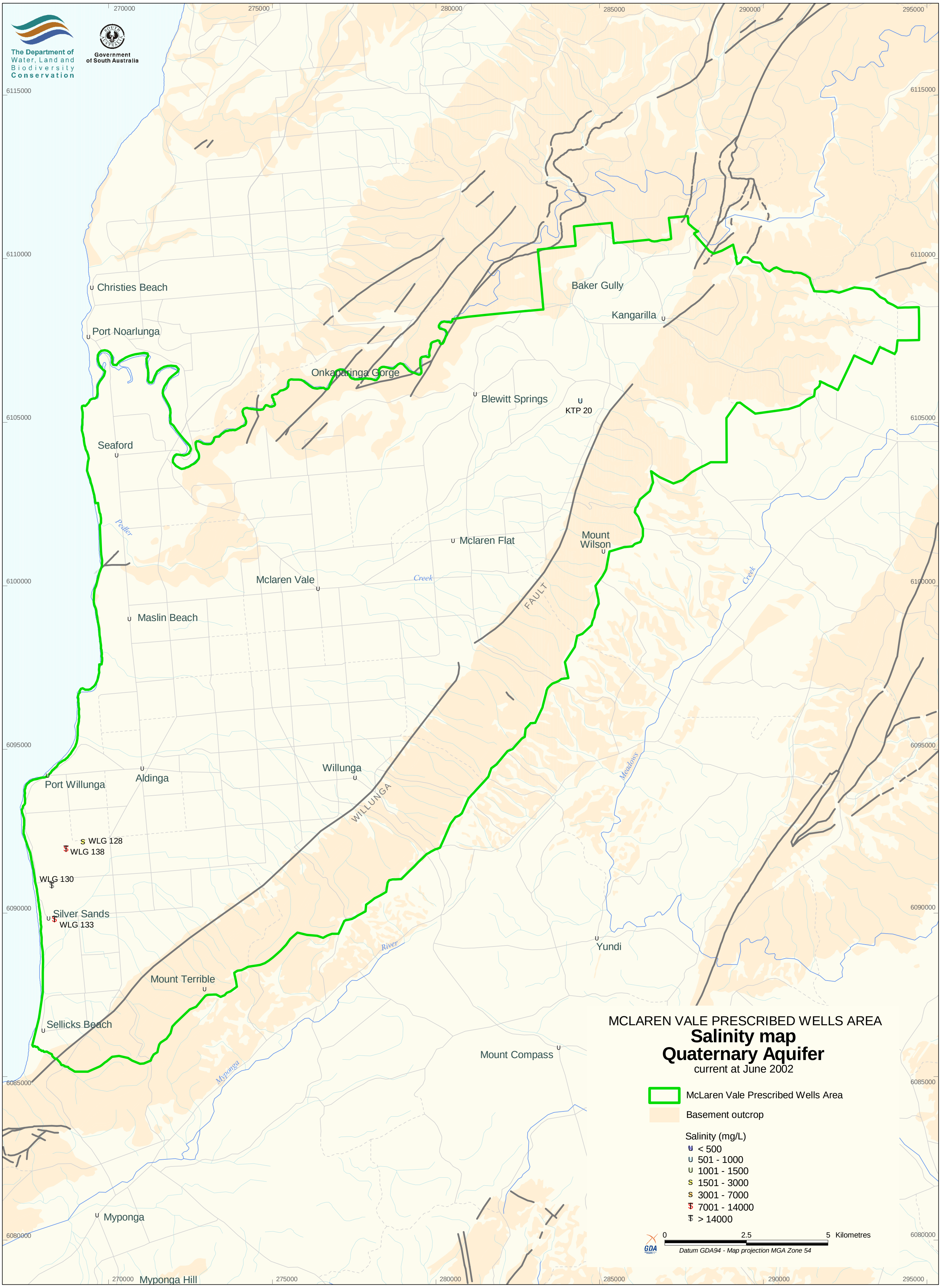
The three-year salinity trends (between 1 June 1999 and 1 June 2002) have been analysed for the Port Willunga Formation, Maslin Sands and Fractured Rock Aquifers. There is not enough water quality information to comment on changes in the Quaternary Aquifer.

There is some discontinuity in the salinity data due to problems obtaining water samples from some of the private irrigation wells. Water samples should be taken after pumping for at least three well volumes. The issue of the field officer starting pumps of private wells (with the potential for damage) is addressed by leaving sample bottles for the owners to fill. Unfortunately monthly samples are often not collected using this system.

The three-year salinity trends have been analysed to identify any stressed areas as defined in the WAP (Section 6 Clause 4b, OCWMB, 2000). An area where groundwater salinity has increased at an average rate of 100 mg/L (total dissolved solids, TDS) over the previous three years is considered a ‘stressed area’.

PORT WILLUNGA FORMATION AQUIFER

The majority of the wells are displaying a negative trend (Fig. 22) showing that the salinity value is decreasing. There are slight increase values in WLG 87, 73 and 14 (6527-1020, 6627-7096 and 6627-2201) but they are not considered stressed areas. However WLG 86 (6527-1052) situated in the Aldinga area has a positive trend of 12 mg/L/y over three years and is therefore considered a stressed area. Licences wishing to transfer water allocations into this area to draw from the Port Willunga Formation Aquifer will be restricted.



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Government of South Australia
MCLAREN VALE PRESCRIBED WELLS AREA
Salinity map
Quaternary Aquifer
current at June 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
Salinity (mg/L)
< 500
501 - 1000
1001 - 1500
1501 - 3000
3001 - 7000
7001 - 14000
> 14000
0
2.5
5 Kilometres
Datum GDA94 - Map projection MGA Zone 54
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Baker Gully
Kangarilla
Blewitt Springs
KTP 20
Seaford
Mclaren Flat
Mount Wilson
Mclaren Vale
Maslin Beach
FAULT
WILLUNGA
Port Willunga
Aldinga
Willunga
WLG 128
WLG 138
WLG 130
Silver Sands
WLG 133
Yundi
Mount Terrible
Sellicks Beach
Mount Compass
Myponga
Myponga Hill
Creek
River
270000
275000
280000
285000
290000
295000
6115000
6110000
6105000
6100000
6095000
6090000
6085000
6080000

Figure 18

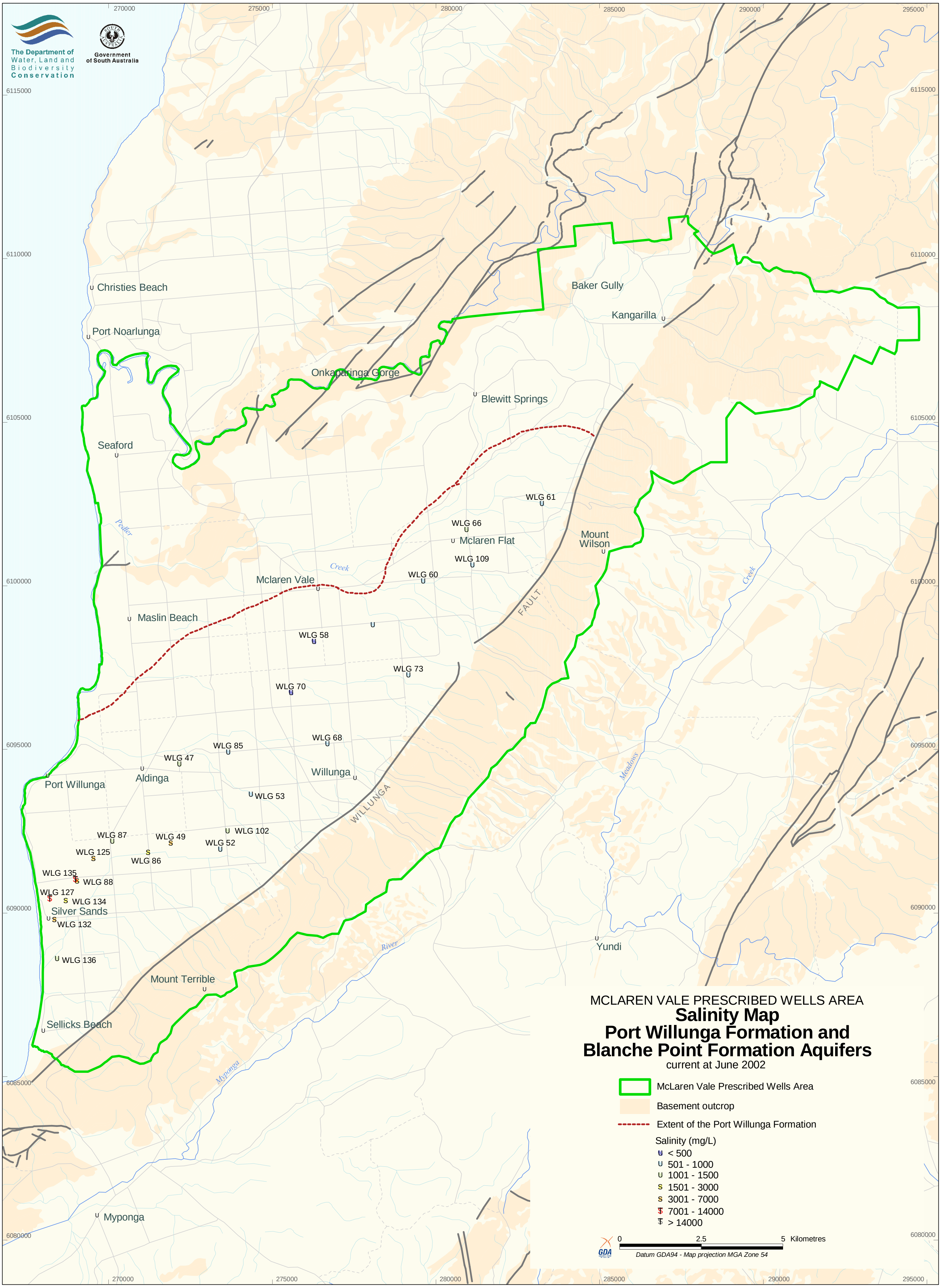
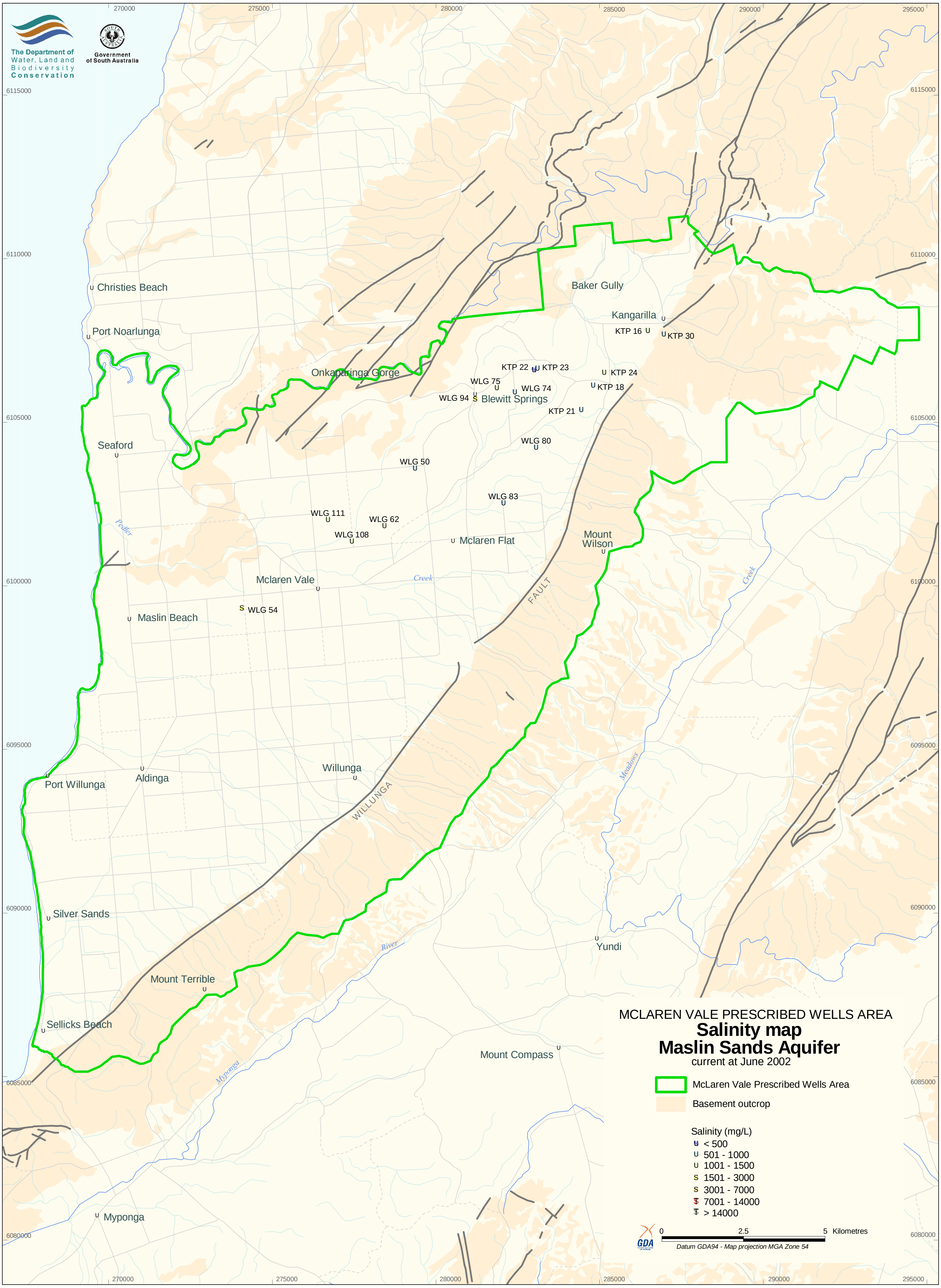


Figure 19

PIRSA Publishing Services AV:201527_019



The Department of Water, Land and Biodiversity Conservation
Government of South Australia
MCLAREN VALE PRESCRIBED WELLS AREA
Salinity map
Maslin Sands Aquifer
current at June 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
Salinity (mg/L)
< 500
501 - 1000
1001 - 1500
1501 - 3000
3001 - 7000
7001 - 14000
> 14000
0
2.5
5 Kilometres
GDA
Datum GDA94 - Map projection MGA Zone 54
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Seaford
Baker Gully
Kangarilla
KTP 16
KTP 30
KTP 22
KTP 23
KTP 24
KTP 18
KTP 21
WLG 75
WLG 74
WLG 94
Blewitt Springs
WLG 80
WLG 50
WLG 83
WLG 111
WLG 62
WLG 108
Mclaren Flat
Mount Wilson
Mclaren Vale
WLG 54
Maslin Beach
FAULT
WILLUNGA
Willunga
Aldinga
Port Willunga
Silver Sands
Yundi
Mount Terrible
Sellicks Beach
Mount Compass
Myponga
Pedler
Creek
River
Meadows
Myponga
270000
275000
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285000
290000
295000
6115000
6110000
6105000
6100000
6095000
6090000
6085000
6080000

Figure 20

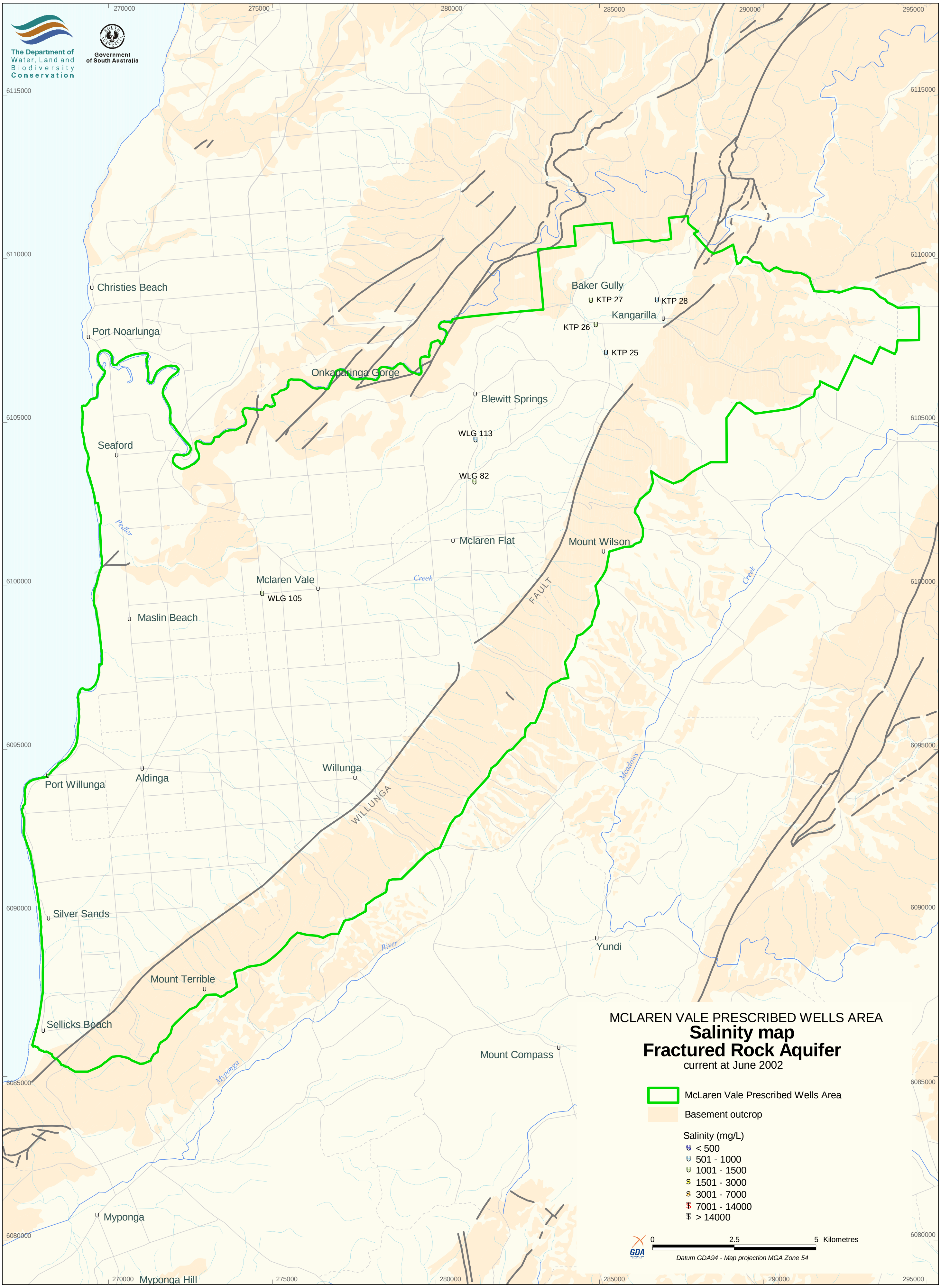


Figure 21

PIRSA Publishing Services AV:201527_021

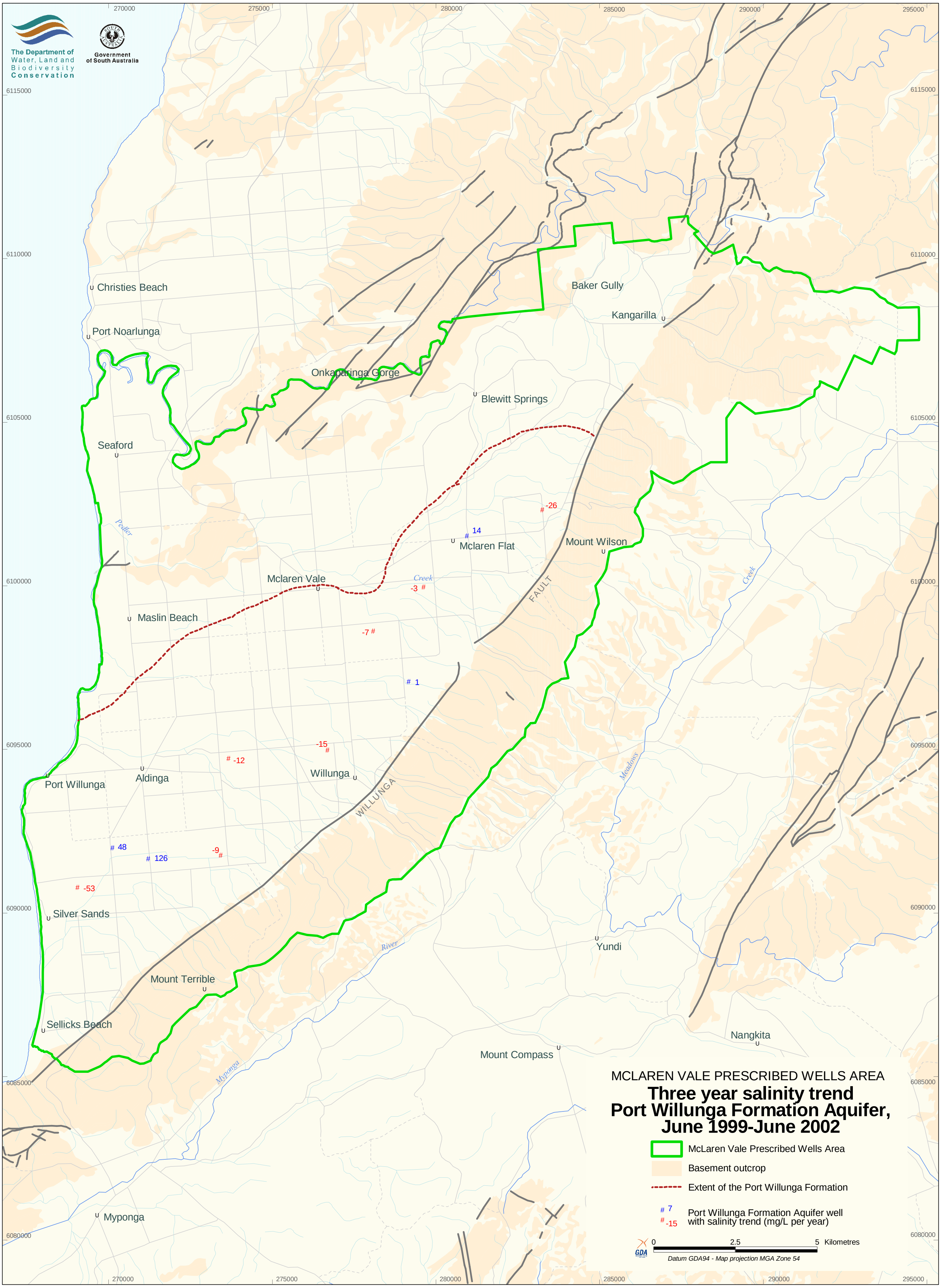
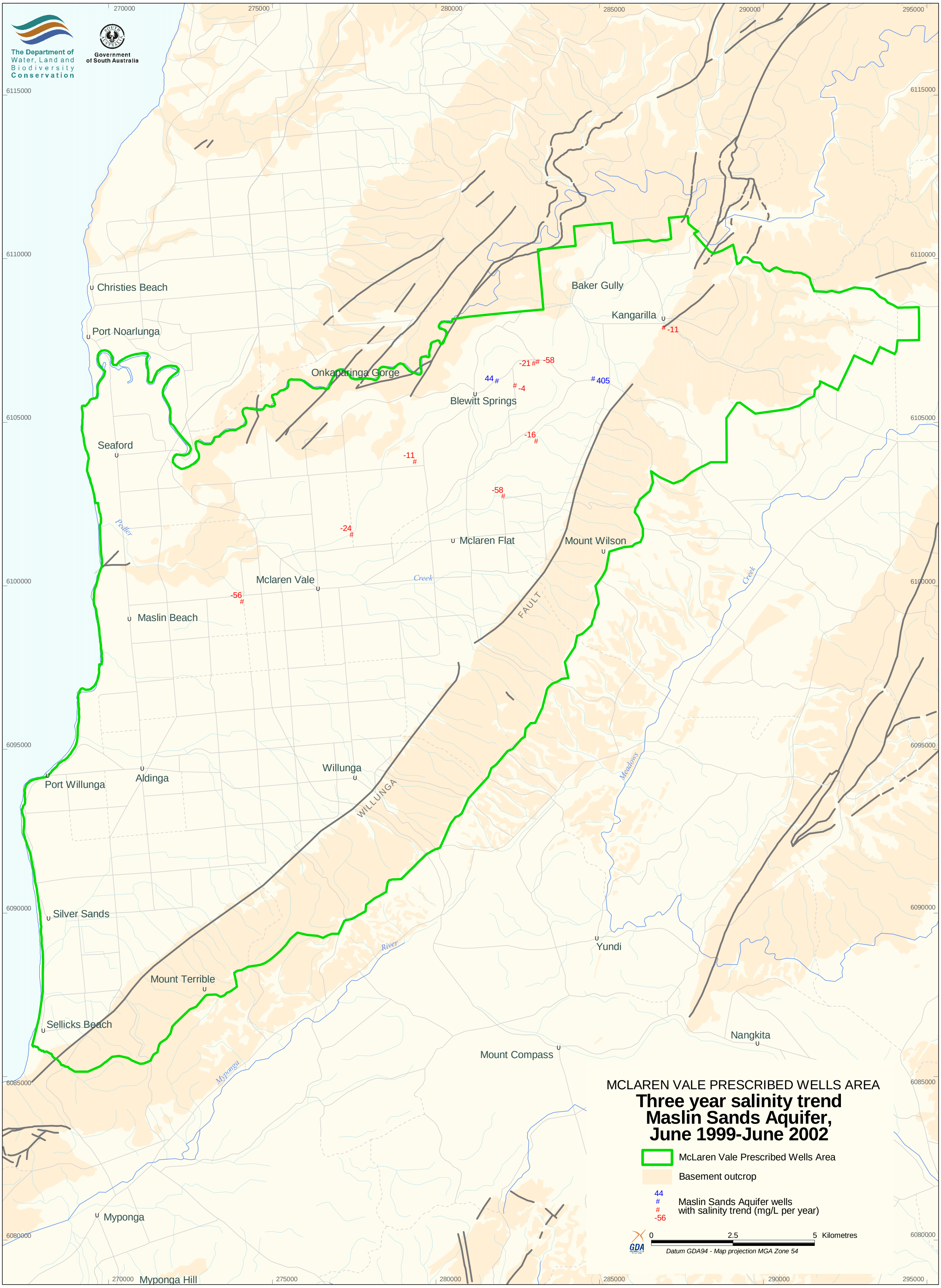


Figure 22

PIRSA Publishing Services AV:201527_022



The Department of Water, Land and Biodiversity Conservation
Government of South Australia
MCLAREN VALE PRESCRIBED WELLS AREA
Three year salinity trend Maslin Sands Aquifer, June 1999-June 2002
McLaren Vale Prescribed Wells Area
Basement outcrop
Maslin Sands Aquifer wells with salinity trend (mg/L per year)
0
2.5
5 Kilometres
Datum GDA94 - Map projection MGA Zone 54
Christies Beach
Port Noarlunga
Onkaparinga Gorge
Seaford
Baker Gully
Kangarilla
Blewitt Springs
Mclaren Flat
Mount Wilson
Mclaren Vale
Maslin Beach
Port Willunga
Aldinga
Willunga
Silver Sands
Mount Terrible
Sellicks Beach
Yundi
Nangkita
Mount Compass
Myponga
Myponga Hill
FAULT
WILLUNGA
-11
-21
-58
44
-4
405
-16
-58
-24
-56

Figure 23

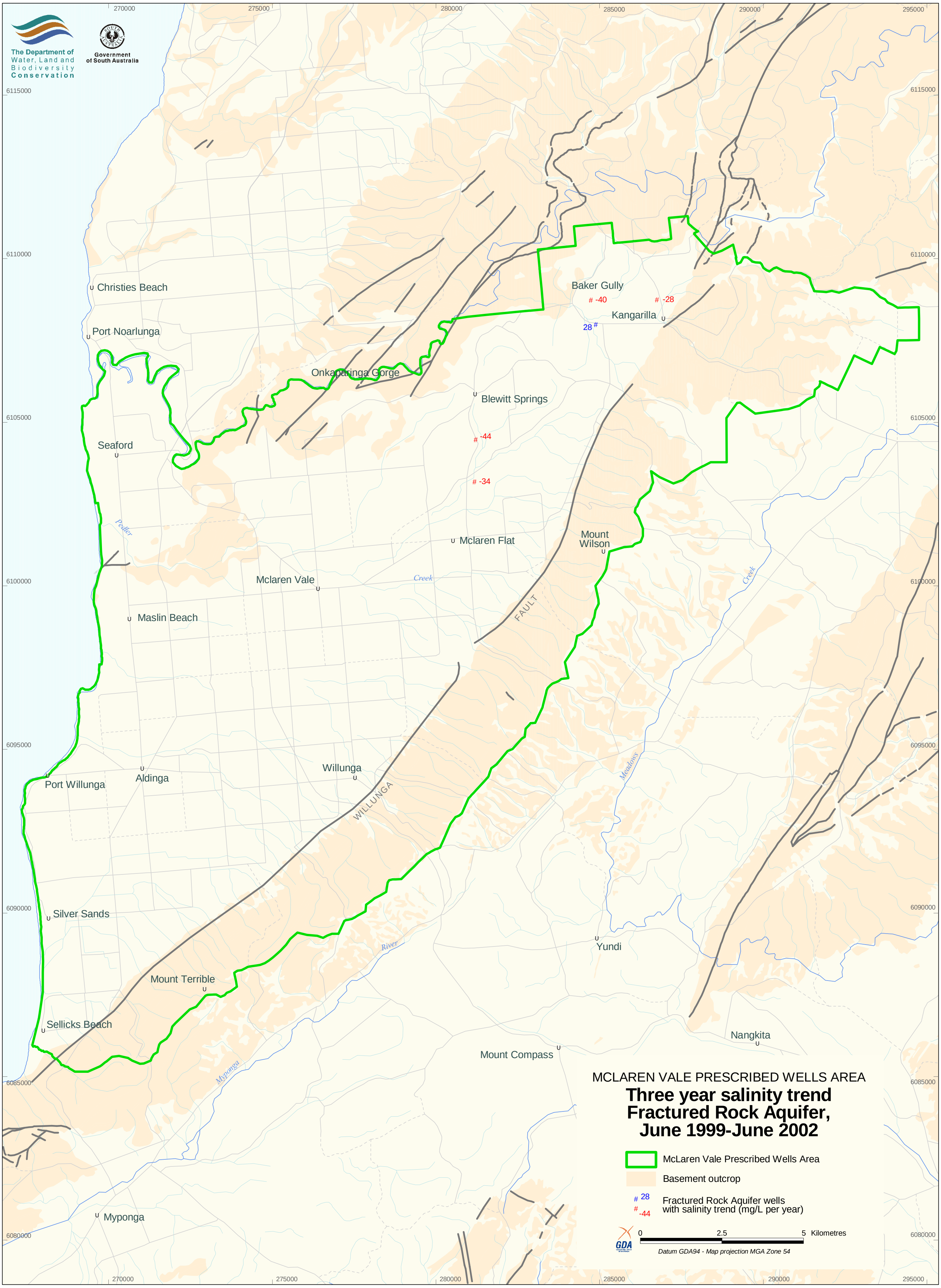


Figure 24

PIRSA Publishing Services AV:201527_024

MASLIN SANDS AQUIFER

All wells except KTP 18 (6627-7395) and WLG 75 (6627-7631) are displaying a negative trend (Fig. 23), showing that the salinity values have decreased. WLG 75 has an increasing trend but is not considered to be stressed. However, KTP 18 is displaying a trend of 405 mg/L/y over the last three years and is therefore considered a stressed area. Licences wishing to transfer water allocations into this area to draw from the Maslin Sands Aquifer will be restricted.

FRACTURED ROCK AQUIFER

All wells are displaying a stable to a decreasing salinity trend (Fig. 24). KTP 26 is displaying a positive trend but is not considered to be stressed.

CONCLUSIONS

Generally, the water level trends in the McLaren Vale PWA have been relatively stable over the last three years. Comparisons made with the 1995–99 water level trends documented by Sereda and Martin (2001) show that there has been a slight increase in groundwater levels in all aquifers, especially in the Port Willunga Formation and the Maslin Sands Aquifers. Since 1999, the cumulative deviation from the mean monthly rainfall has shown an increasing trend indicating above average rainfall. The observed increase in groundwater levels in the confined aquifer systems are more likely due to a decrease in extraction rather than recharge. There are four primary reasons why groundwater extraction has decreased in the past two years:

- decrease in licensed groundwater volumes as a result of water allocation changes implemented with the introduction of the WAP (OCWMB, 2000)
- mild summer (2001–02)
- late irrigation season (2000–02)
- changes in crop type from almonds (which require more intensive irrigation) to viticulture.

Two stressed areas have been identified in the Fractured Rock Aquifer, around Blewitt Springs and East of the Willunga Fault. Requests to transfer water allocations into these areas will be restricted.

If a primary aim of the monitoring network of the Quaternary Aquifer system is to assist in assessing the needs of various groundwater dependent ecosystems within the McLaren Vale PWA, it is likely that some consideration may need to be given to the expansion of this network to meet this objective.

Generally, the Port Willunga Formation, Maslin Sands and Fractured Rock Aquifers are stable or displaying negative salinity trends over the last three years. However, requests to transfer water allocation will be restricted in two areas, WLG 86 in the Port Willunga Formation Aquifer and KTP 18 in the Maslin Sands Aquifer because they are identified as stressed areas.

SHORTENED FORMS

Measurement

Name of unit	Symbol	Definition in terms of other metric units	
Day	d		time interval
Gram	g		Mass
Kilolitre	kL	10^3 m^3	Volume
Kilometre	km	10^3 m	Length
Litre	L	10^{-3} m^3	Volume
Megalitre	ML	10^6 m^3	Volume
Metre	m		Length
Metres per day	m/d		
Metres per year	m/y		
Milligram	mg	10^{-3} g	Mass
Milligrams per litre	mg/L		
Milligrams per litre per year	mg/L/y		
Millimetre	mm	10^{-3} m	Length

General

Shortened form	Description
AHD	Australian height datum
DWLBC	Department of Water, Land and Biodiversity Conservation (formerly DWR)
DWR	Department for Water Resources (now DWLBC)
OCWMB	Onkaparinga Catchment Water Management Board
PWA	prescribed wells area
SWL	standing water level
TDS	total dissolved solids
WAP	water allocation plan

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