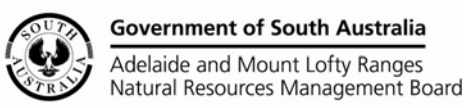
Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

MONITORING, EVALUATION AND REPORTING FRAMEWORK

Regional Groundwater Monitoring Program

May 2009



Regional Groundwater Monitoring Program

- Final Report
- May 2009

Sinclair Knight Merz
ABN 37 001 024 095
Level 5, 33 King William Street
Adelaide SA 5000 Australia
Tel: +61 8 8424 3800
Fax: +61 8 8424 3810
Web: www.skmconsulting.com

Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
V1	23 March 2009	A Pannell	R Martin	24 March 2009	Technical and quality review
Final	5 May, 2009	A Pannell	R Martin	5 May 2009	Final review

Distribution of copies

Revision	Copy no	Quantity	Issued to
V1	1	1 - electronic	K Smith (AMLRNRMB)
Final	1	1 - electronic	K Smith (AMLRNRMB)

Printed:	5 May 2009
Last saved:	5 May 2009 02:42 PM
File name:	I:\VESA\Projects\VE23159\Deliverables\VE23159 GW Monitoring Program v2.docx
Author:	R Martin, A Pannell, C McCallum
Project manager:	A Pannell
Name of organisation:	AMLRNRMB
Name of project:	Regional Groundwater Monitoring Program
Name of document:	Regional Groundwater Monitoring Program
Document version:	Final
Project number:	VE23159

1 Introduction

The Adelaide and Mount Lofty Ranges (AMLR) Natural Resources Management Board ('the Board') has developed a Natural Resources Management (NRM) Plan for the region. The Plan will guide investment in actions to improve the condition of the region's natural resources (soil, water, geological features, landscapes, native flora and fauna and ecosystem) for current and future generations.

The Board is also responsible for monitoring, evaluating and reporting on progress in implementing parts of the Plan associated with its investment plan, the achievement towards stated targets and the condition of the region's natural resources.

The Board's Monitoring Evaluation and Reporting Framework (MERF) identifies two 20 year regional targets relating to the quality and sustainable use of groundwater (Table 1). The MERF identifies environmental indicators related to these regional targets to monitor and evaluate the Board's performance towards achieving the regional natural resource management vision and goals.

Table 1. Regional Targets and Indicators (Groundwater)

Regional Target	Target	Information requirement	Environmental Indicator(s)
T2	**Surface and groundwater quality** All water resources meet water quality guidelines to protect defined environmental values	Groundwater quality	Groundwater salinity
T3	**Water resources managed within sustainable limits** All water resources used within sustainable limits (allowing for variability)	Groundwater use	Groundwater levels Groundwater used for agriculture / irrigation Groundwater used by industry Groundwater used for urban/domestic Volume of groundwater allocated and used compared to sustainable yield

This report provides a recommended regional groundwater monitoring program for the Adelaide and Mount Lofty Ranges region. The program has been designed to allow the Board to meet its reporting requirements. The monitoring program proposed includes existing groundwater monitoring carried out by the key stakeholder, Department of Water, Land & Biodiversity Conservation (DWLBC), and identifies additional sites where long term monitoring at key sites is required to assess management issues that may arise due to changing land uses and increased demand.

Monitoring of the groundwater resource is of particular interest to DWLBC, who are responsible for reporting the state and condition of the groundwater resource across the state. The Board is

responsible for the management of the groundwater resource and therefore requires information to determine if management actions are achieving the desired outcomes.

Other stakeholders to be consulted on the proposed groundwater monitoring network include:

- EPA;
- SA Water and,
- PIRSA.

Monitoring also plays a key role in community consultation, in particular when formulating management policy around the sustainable use of the resource. By providing real-time access to the data it is envisaged that the community will gain a much greater understanding of the how the resource responds to various stresses facilitating a shared approach to adapting management actions.

2 Groundwater Monitoring

2.1 Background

Over allocation, decreased recharge and rising salinity threaten the long-term security of the groundwater resources of the Adelaide Plains and Mount Lofty Ranges region. These threats, if not effectively managed, affect the capacity of the resource to meet consumptive demands and protect environmental values.

The objective of this report is to identify a regional groundwater monitoring program that allows for a consistent approach to the monitoring, evaluation and reporting of groundwater resource condition across the Board's region.

There are currently five groundwater management areas within the Board region prescribed under Section 76 of the *Natural Resources Management Act* 2004;

1. Northern Adelaide Plains Prescribed Wells Area;
2. Central Adelaide Prescribed Wells Area;
3. Barossa Prescribed Water Resources Area;
4. McLaren Vale Prescribed Wells Area (which will form part of the Western Mount Lofty Ranges Prescribed Water Resource Area); and,
5. Western Mount Lofty Ranges Prescribed Water Resource Area.

The boundaries of some of the regions have been arbitrarily defined (e.g. the Northern Adelaide Plains), and may in future change or be incorporated into management areas based on aquifer type and extent, surface water catchment areas and hydrological setting.

Water Allocation Plans (WAPs) are required to be prepared by the Board for each prescribed area, and must provide for sustainable allocations to meet environmental, social and economic needs. The Board needs to undertake regular monitoring of the capacity of the groundwater resource in each area to meet the demands for that water.

In the main heavily exploited aquifers, comprehensive monitoring networks comprising of both private and state owned wells have been established and are presently managed by DWLBC. In some localities there are time series records spanning over five decades. Over the years, the monitoring networks have been rationalised and with no 'new' investment in monitoring infrastructure over the past decade by the state, 'hot spot' areas have developed in response to changed land use practises. As there is no monitoring in these areas the actual resource condition cannot be assessed and management actions are difficult to implement as there is no 'history' on which to base management actions.

The issues associated with current monitoring practices include inconsistent timing and frequency of readings across the region, security of future access to wells (non-government owned wells) and more recently the influence of new users on the groundwater systems such as Managed Aquifer Recharge (MAR) schemes.

Groundwater level and salinity monitoring is currently carried out by a number of groups including:

- The Department of Water, Land and Biodiversity Conservation (DWLBC);
- The Adelaide and Mount Lofty Ranges NRM Board (AMLR-NRMB);
- The South Australian Environment Protection Authority (SA EPA);
- Private industries and landholders; and
- Land care groups.

Data from the DWLBC monitoring program is stored on the Obswell database on the DWLBC website and is available to a wide range of users. It is uncertain how much of the other monitoring information is captured.

2.2 Data Loggers and Telemetry

It is essential to have a standardised monitoring program across the region. This will allow for comparisons to be made regarding the state of the resource. The use of data loggers at key sites (some of which should be telemetered) will enable sampling at a greater accuracy and frequency, and guide the timing of seasonal monitoring to ensure irrigation drawdown is more accurately reported. It is envisaged that through the use of data loggers, cost savings will be achieved over time through more efficient timing and frequency of data collection across the broader networks.

2.3 Monitoring Objectives

The objective of the groundwater monitoring program is to provide timely and accurate data that will enable the Board to:

- Monitor the efficiency of water allocation plan implementation;
- Minimise the impact of land use and land and water management on long-term groundwater quality and quantity;
- Provide long-term access to good quality groundwater for irrigators, stock and domestic uses and the environment; and,
- Provide the community with key reference sites around which management decisions will be made.

2.4 Monitoring Frequency

The use of data loggers and telemetry will allow for continuous water level monitoring at selected sites. It will improve the reliability of data and guide the collection of field data from the wider network. This will enable sampling to be undertaken at appropriate times to show impacts on the

groundwater system during the irrigation season. It may also allow the frequency of monitoring across the region to be decreased over time as data collection is targeted to identify seasonal (extraction) fluctuations.

For the wider monitoring network, water level and salinity data should be collected as a minimum twice yearly, at the end of the summer irrigation period and again following the winter recovery/recharge period. The timing of this monitoring may vary from year to year as irrigation seasons adjust to variations in seasonal rainfall.

Current monitoring frequencies should be continued once the telemetric and data logger monitoring stations are installed. A review of data from these stations should then be carried out to determine where adjustments can be made to the current monitoring frequency.

2.5 Monitoring Site Selection

DWLBC have indicated that they will continue to monitor existing sites including private bores. DWLBC have also recently been successful in obtaining funding for the installation of 13 stand alone water level monitoring systems (data logger) and 8 telemetered water level monitoring stations.

The monitoring sites recommended in this report have considered the long term data requirements of the AMLRNRMB. The future of data from the private bores cannot be secured as properties may change hands and access may become restricted. Consequently, a monitoring program has been recommended that does not rely on private bores and complements the DWLBC level of instrumented sites. A number of new monitoring locations have been roughly identified. The exact location of the monitoring bores will require more detailed on-ground and land tenure investigation to ensure the site is appropriate.

Recommended monitoring sites have been selected throughout the Adelaide Mount Lofty Ranges using the following criteria:

- Aquifer being monitored;
- State owned monitoring wells;
- Locations of existing stresses on the groundwater resources, e.g. cones of depression;
- Bore currency;
- Use of data – WAP reporting, State of Region reporting, other (EPA licence condition); and,
- Quality of information on well construction and lithological logs.

It is recommended that both water level and salinity be monitored from the same set of key reference monitoring bores as suggested in Section 3 of this report.

3 Monitoring Locations

Data from the proposed monitoring sites will provide information on aquifer condition and be used for reporting to the community. The monitoring sites have been grouped into monitoring areas, based on the groundwater management (prescription) areas. For several areas, some of the proposed new monitoring sites are outside the historical prescribed wells areas, however they have been included in order to provide a more robust spatial network. These new sites are located in regions where new demands have emerged over the past decade as a result of land use change.

The McLaren Vale Prescribed Wells Area may eventually be amalgamated into the broader Western Mount Lofty Ranges Water Resources Area.

The sites listed as DWLBC data logger / telemetric sites are those for which funding has been obtained in 2009. DWLBC has indicated that funding will be sought for additional sites in future years.

3.1 Barossa Prescribed Water Resources Area

REGION: BAROSSA					
Aquifer	**Current monitoring sites**	**DWLBC sites**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites ***	**New sites recommended**
Quaternary	24	21	-	MOR273, BRS022	5 Barossa Upper Aquifer[1]
Rowland Flat (Barossa lower)	24	23	12	BLV002	
Fractured Rock	42	22	-	BLV004, MOR058	7 Eden Valley FR 5 Gawler FR[2] 4 Roseworthy FR[3]
Other	51	14	-	-	

* - DWLBC have proposed to install a comprehensive network of Telemtered sites within the Barossa PWRA therefore no new sites are required at this time.

[1] – 1 of the Barossa Upper Aquifer monitoring sites fall outside the Barossa WRA

[2] - 4 of the proposed Gawler Fractured Rock monitoring sites fall outside the Barossa WRA

[3] - 2 of the proposed Roseworthy Fractured Rock monitoring sites fall outside the Barossa WRA

Figure 1 shows the sites of the regional monitoring program in the Barossa area.

BLV 9
BLV 4
BLV 2
BLV 3
BLV 10
BLV 5
BLV 8
MOR 100
MOR 211
MOR 212
MOR 208
MOR 209
MOR 273
MOR 200
MOR 256
NURIOOTPA
MOR 135
MOR 199
MOR 207
MOR 83
MOR 84
MOR 205
MOR 102
MOR 103
MOR 206
MOR 94
MOR 282
NTP 8
NTP 10
MOR 80
MOR 81
MOR 77
MOR 74
MOR 92
MOR 93
MOR 68
MOR 69
MOR 70
MOR 95
MOR 96
MOR 97
MOR 98
NTP 9
NTP 11
MOR 275
MOR 71
MOR 72
MOR 263
MOR 274
MOR 66
MOR 62
MOR 213
MOR 136
MOR 276
MOR 277
MOR 272
MOR 257
MOR 65
MOR 266
MOR 267
MOR 64
MOR 268
MOR 269
MOR 270
MOR 271
MOR 259
MOR 260
MOR 261
MOR 262
MOR 265
MOR 202
MOR 203
MOR 204
MOR 58
NTP 7
MOR 107
LYNDOCH
MOR 201
BRS 25
BRS 22
BRS 24
BRS 23

Legend

- Recommended Telemetry Sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer

DWLBC Sites Only (labelled)

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga

Same colour triangle (unlabelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks
- Locality
- Main Highway
- AMLR Watercourses
- Water Body
- Prescribed Area Boundary
- AMLRNRMB Boundary

Data Sources: DWLBC

0 5
A3 1:130,000 Kilometres

ADELAIDE

SINCLAIR KNIGHT MERZ SKM

Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 1 - Barossa Prescribed Water Resources Area v1

Friday, March 13, 2009 2:36:52 PM
I:\VESA\Projects\VE23159\Technical\GIS\Template\Groundwater Network_Barossa.mxd

Water level monitoring should continue to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Within the Barossa region, three telemetered sites in the sedimentary aquifer and two in the fractured rock are required to adequately monitor the resource. These sites complement the sites identified by DWLBC.

Well BRS022 (located south of the sedimentary rock aquifer region) was chosen to monitor the amount of through-flow occurring through the system. Although this site has not been in operation very long, the location will provide useful data regarding groundwater movement and potential flow into the creeks to assist in assessing baseflow.

Significant expansion of irrigated horticulture into the Eden Valley has occurred over the past decade and it is recommended that a new well be constructed and Telemetry infrastructure installed as a priority.

3.2 Northern Adelaide Plains Prescribed Wells Area

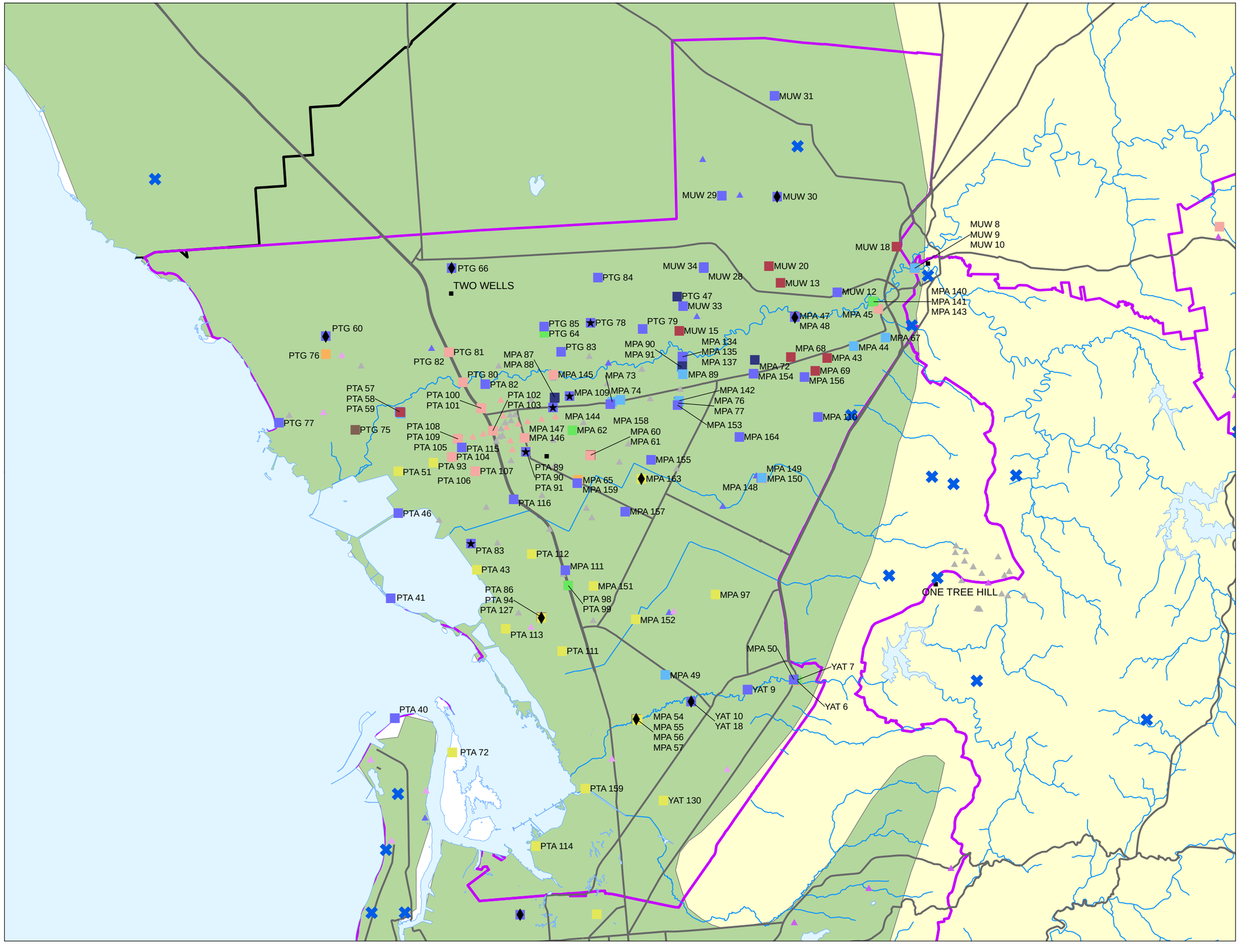
REGION: NAP					
Aquifer	**Current monitoring sites**	**DWLBC sites**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
T1	34	25	-	PTA127 (T) MPA163 (DL) MPA056 (DL)	4 eastern NAP PWA[1]
T2	54	45	5	PTG060 (DL) PTG066 (T) MPA048 (T) MUW030 (T) YAT010 (DL)	7 north of NAP PWA[2]
Quaternary	81	64	-		
Other	51	-	-		

[1] - 3 of the proposed T1 eastern proposed monitoring sites fall outside the NAP PWA

[2] - 6 of the proposed T2 north proposed monitoring sites fall outside the NAP PWA

Water level monitoring should continue to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 2 shows the sites of the regional monitoring program in the Northern Adelaide area.



Legend

- Recommended Telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer

DWLBC Sites Only (labelled)

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga

Same colour triangle (not labelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks
- Locality
- Main Highway
- AMLR Watercourses
- Water Body
- Prescribed Area Boundary
- Adelaide & Mt Lofty Ranges

Data Sources: DWLBC

0 5

A3 1:150,000 Kilometres

SKM

Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 2 - Northern Adelaide Plains Prescribed Wells Area v1

Friday, March 13, 2009 2:56:31 PM
I:\VESA\Projects\VE23159\Technical\GIS\Template\Groundwater Network_Northern Adelaide Plains.mxd

Five wells within the NAP have already been identified for telemetry as presented in Figure 3.2. Other DWLBC assets have been selected in the Tertiary aquifers throughout the Northern Adelaide Plains. The wells selected in the T2 aquifer are distributed around the existing cone of depression. These are to provide insight into the seasonal fluctuations and amount of drawdown.

MUW030 is situated at Kangaroo Flat. Kangaroo Flat is an area where changing land use over the past decade has resulted in significant pressures on the resource. MUW030 is only a relatively new well, but it is essential that monitoring is carried out in this region to provide relevant information.

At the southern end extent of the NAP PWA three wells have been identified as key reference sites. Extraction in this area is predominantly from the T1 aquifer.

A new monitoring bore with data logger should be installed north of the NAP area as a priority to assess new demand in this area.

3.3 Central Adelaide Prescribed Wells Area

REGION: CENTRAL ADELAIDE					
Aquifer	**Current monitoring sites**	**DWLBC assets**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
T1	56	33		YAT031 (T) ADE034 (DL) NOA043 (DL)	
T2	16	10		PTA067 (T)	10 along Hills Face
Quaternary	42	18	-	ADE191 (DL)	4 LeFevre Peninsular
Fractured Rock	35	10	-		

Water level monitoring should continue to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 3 shows the sites of the regional monitoring program in the Central Adelaide area.

PTA 40
PTA 72
PTA 65
PTA 66
PTA 67
PTA 128
YAT 115
YAT 112
YAT 109
YAT 91
ADE 169
ADE 170
YAT 106
ADE 166
YAT 113
YAT 111
YAT 105
ADE 167
ADE 168
YAT 124
YAT 31
YAT 92
YAT 123
YAT 37
YAT 66
YAT 93
YAT 110
ADE 126
ADE 34
ADE 190
ADE 191
ADE 185
ADE 171
YAT 131
YAT 118
ADE 2
ADE 158
ADELAIDE
ADE 131
ADE 175
ADE 5
ADE 7
ADE 198
ADE 146
ADE 59
ADE 10
ADE 90
ADE 12
ADE 36
ADE 14
ADE 15
ADE 152
ADE 176
ADE 177
ADE 17
ADE 180
ADE 193
ADE 78
ADE 139
ADE 140
ADE 184
NOA 2
NOA 43
NOA 26
NOA 27
NOA 25
ADE 181
ADE 182
ADE 173

Legend

- Recommended telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer (DWLBC Sites)

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga
- Locality
- Main Highway
- AMLR Watercourses
- Water Body
- Prescribed Area Boundary
- AMLRNRMB Boundary

Same colour triangle (not labelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks

Data Sources: DWLBC

0 5
A3 1:130,000 Kilometres

ADELAIDE

SINCLAIR KNIGHT MERZ SKM

Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 3 - Central Adelaide Prescribed Wells Area v1

Friday, March 13, 2009 2:38:28 PM
I:\VES\Projects\VE23159\Technical\GIS\Template\Groundwater Network_Adelaide Plains.mxd

Five key reference sites have been identified to be equipped with telemetry for the Adelaide metropolitan area. PTA067 (T2) is located near the boundary between the Adelaide metropolitan region and Northern Adelaide Plains region. YAT031 (T1) has been recommended as it is within close proximity to large industrial extractions where a permanent cone of depression has developed.

ADE190 (Q5) is the only government owned monitoring asset located near the site of large industrial extraction northwest of the CDB and has a long-standing monitoring record. Whilst most of the extraction is from the T1 aquifer directly underlying the Q5 equipping this well with telemetry will enable an assessment to be made concerning the connectivity between the aquifers and the propensity for pumping induced downward leakage. This site will be crucial in evaluating the potential effects of increasing salinisation of the pumped (T1) aquifer that may result from induced downward leakage from the more saline overlying aquifer.

NOA043 is a recent monitoring well however has been selected as a key reference site to provide information on water level changes in the area where significant irrigation of open space is occurring.

3.4 McLaren Vale Prescribed Wells Area

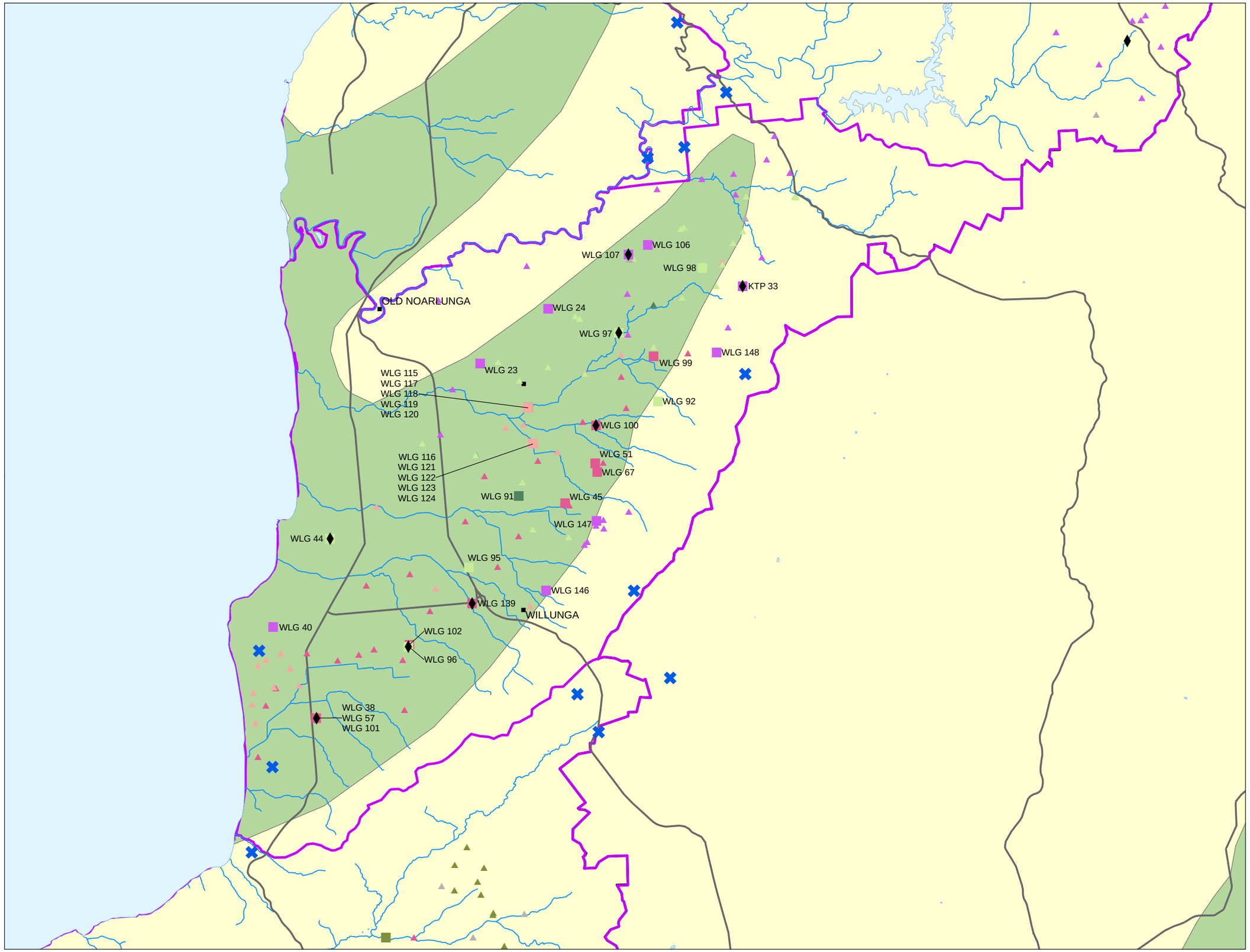
REGION: MCLAREN VALE					
Aquifer	**Current monitoring sites**	**DWLBC assets**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
Maslin Sands	38	10	-	WLG096 (T) WLG097 (T) WLG044 (DL)	
Port Willunga	31	9	-	WLG057 (DL) WLG100 (T) WLG139 (T)	
Fractured Rock	32	10	-	WLG107 (DL) KTP033 (DL)	5 Fractured Rock[1]
Quaternary	30	8	-		3 Coastal sites
Unknown	3		-		

[1] – 3 of the proposed new Fractured Rock monitoring sites are outside the McLaren Vale PWA.

Water level monitoring should continue to be monitored monthly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 4 shows the sites of the regional monitoring program in the McLaren Vale area.

Within the McLaren Vale/Willunga PWA, key reference sites are identified in the Maslin Sands, Port Willunga and Fractured Rock aquifers. These sites present a good spatial distribution throughout the Maslin Sands and Port Willunga Formation aquifers. KTP033 will serve as a reference site for the Kangarilla area.



Legend

- Recommended Telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer (DWLBC Sites)

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga

Same colour triangle (labelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks
- Locality
- Main Highway
- AMLR Watercourses
- Water Body
- Prescribed Area Boundary
- AMLRNRNB Boundary

Data Sources: DWLBC

0 5
A1 1:125,000 Kilometres

SINCLAIR KNIGHT MERZ SKM

Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 4 - McLaren Vale Prescribed Wells Area v1

Friday, March 13, 2009 2:43:57 PM
I:\VESA\Projects\VE23159\Technical\GIS\Template\Groundwater Network_McLaren Vale.mxd

3.5 Western Mount Lofty Ranges Water Resource Area

The Western Mount Lofty Ranges Water Resource Area extends from north of One Tree Hill to the Fleurieu Peninsular. One Tree Hill has been included in this area although several of the monitoring sites are located in the Central Adelaide area.

3.5.1 One Tree Hill

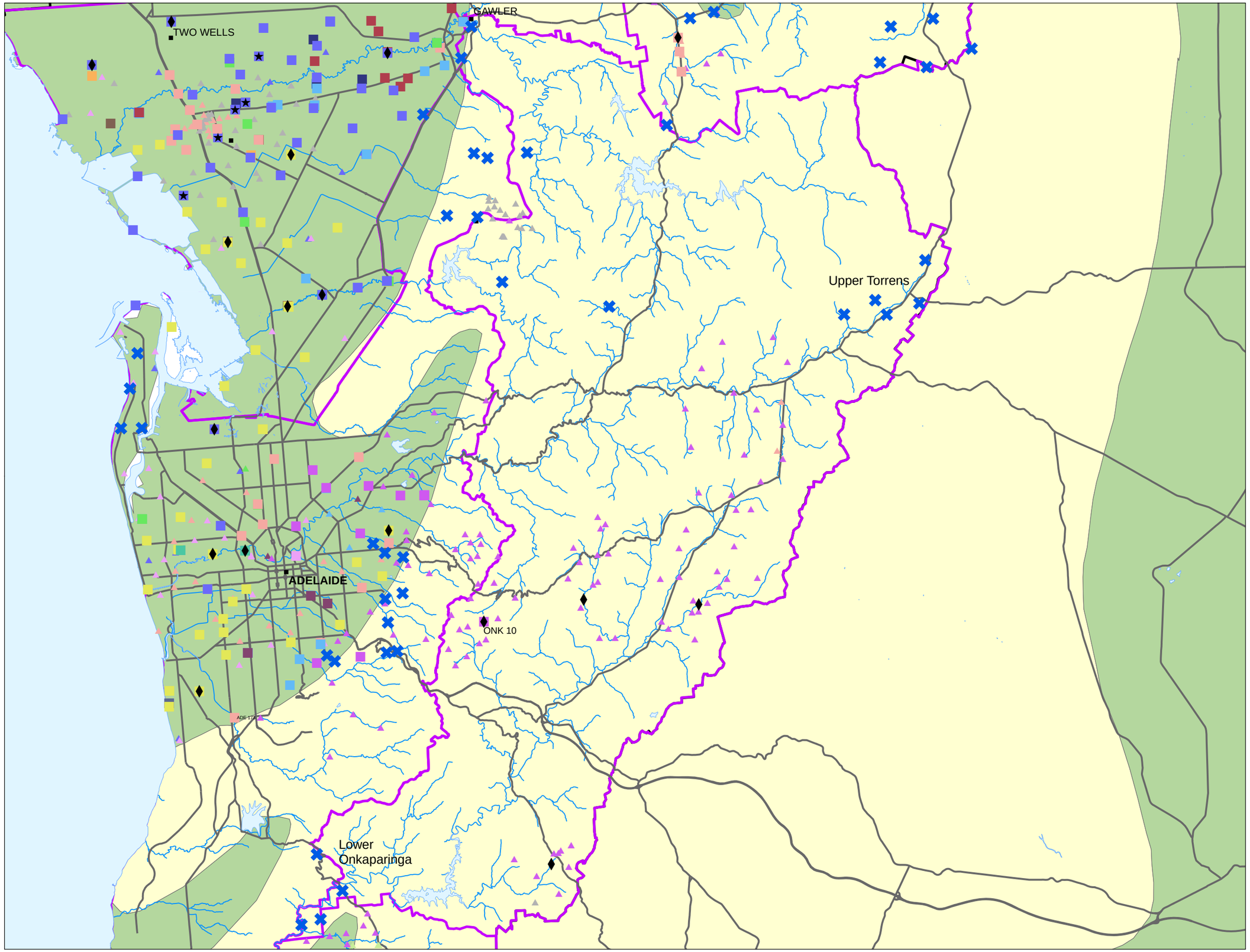
REGION: One Tree Hill					
Aquifer	**Current monitoring sites**	**DWLBC assets**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
Unknown	18	-		6628-21990 (DL) **or** 6628-13653 (DL)	-

Water level monitoring should continue to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 5 shows the sites of the regional monitoring program in the Western Mount Lofty Ranges including One Tree Hill.

No DWLBC assets exist within the One Tree Hill region so either private wells must be considered for telemetry or construction of new monitoring wells should be undertaken.

One of the two telemetry sites were suggested for the One Tree Hill region should be selected for data logger installation. There are no DWLBC assets here. Two private wells (6628-21990 and 6628-13653) have been chosen as possible sites as these have long term monitoring data. The current state of each of these wells is not known. As stated previously, any use of such wells for long term monitoring will require consent from the land owner and a formal agreement must be obtained or new bores will need to be installed.



Legend

- Recommended Telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer

DWLBC Sites Only (labelled)

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga

Same colour triangle (labelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks
- Locality
- Main Highway
- Drainage
- AMLR Watercourses
- Prescribed Area Boundary
- AMLRNRMB Boundary

Data Sources: DWLBC

0 10

A1 1:240,000 Kilometres

SINCLAIR KNIGHT MERZ SKM

Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 5 - Western Mount Lofty Prescribed Water Resources Area v1

Friday, March 13, 2009 3:02:46 PM
I:\VESA\Projects\VE23159\Technical\GIS\Template\Groundwater Network_Western Mount Lofty.mxd

3.5.2 Upper Torrens Onkaparinga

REGION: UPPER TORRENS ONKAPARINGA					
Aquifer	**Current monitoring sites**	**DWLBC assets**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
Quaternary	3	-	-		
Fracture Rock	76	1	-	4 – require new bores not on private land, approximate location only	5 Upper Torrens 4 Lower Onkaparinga

Water level monitoring should be continued to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 5 shows the sites of the regional monitoring program in the Western Mount Lofty Ranges including the Torrens and Onkaparinga sites.

In the Western Mount Lofty Ranges, including the upper Onkaparinga and upper Torrens, land use change has resulted in increased demand for groundwater resources. Currently there are no Government assets in these locations and new secure sites will need to be established. The use of telemetry in this region should also be considered, either through the use of private wells or via the construction of new monitoring wells.

A new monitoring bore equipped with a data logger should be installed in the Upper Torrens area as a priority to allow assessments to be made concerning the impacts of demands on groundwater in this area. A site along Melrose St south-west of Mount Pleasant is recommended.

3.5.3 Southern Fleurieu

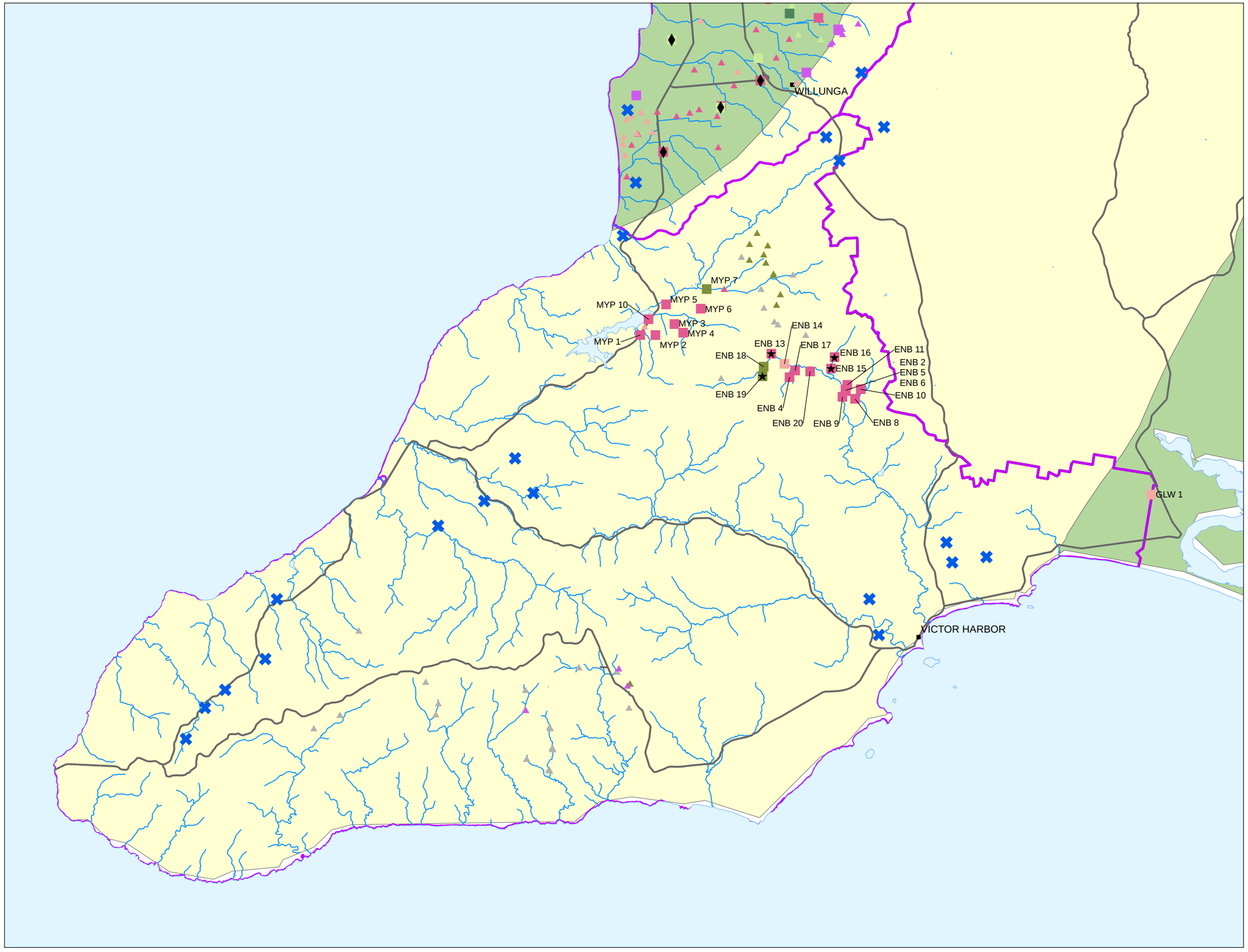
REGION: Southern Fleurieu					
Aquifer	**Current monitoring sites**	**DWLBC assets**	**DWLBC approved data logger / telemetric sites**	**Proposed telemetry (T) / data logger (DL) sites**	**New sites recommended**
Cape Jervis Formation	14	3	1	-	-
Quaternary	2	1	-	-	-
Tertiary	21	20	2	-	-
Fractured Rock	3		1	1 (DL) at priority site	14
Unknown	33	-	-	-	-

Water level monitoring should be continued to be monitored quarterly until a review of data-logger and telemetered data is undertaken. Salinity monitoring should be undertaken twice per year.

Figure 6 shows the sites of the regional monitoring program in the Southern Fleurieu area.

Within the Southern Fleurieu, DWLBC has assets located in the Hindmarsh Inman subregion (including Myponga and Hindmarsh Tiers). Four groundwater sites have already been identified for long-term monitoring by DWLBC in this region, so it is considered that this provides sufficient coverage in this area. The western and southern areas of Southern Fleurieu are not well monitored and recent changes in land use resulting in greater groundwater demand are emerging. Establishment of a monitoring bore equipped with a data logger near Main South Road south of Delamere should be undertaken as a priority. In the future, additional monitoring bores may be established at the additional locations identified in Figure 7. The information gained from instrumentation of the above sites will help to inform future investment in the expansion of the existing monitoring network.

The monitoring bores used for the DWLBC investigation of groundwater impacts from forestry around Deep Creek are on private land. This project is examining the impacts of forestry on groundwater discharge and surface water flows. Once the project is completed, the outcomes should be reviewed and a decision made concerning the need to maintain long-term monitoring in this location.



Legend

- Recommended Telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Data Logger/Telemetric monitoring

Groundwater Monitoring by Aquifer

- Cape Jervis Formation
- Fractured Rock
- Q(Q2)
- Q(Q3)
- Q(Q3)+Q(Q4)
- Q(Q4)
- Q(Q5)
- Quaternary
- T(T1)+Q(Q1)
- T(T1),Tow(T1)
- T(T2),Tow(T2)
- T(T3)
- T(T4)
- T(TC1)
- T(TC1)+Teoc(C-F)
- Maslin Sands
- Blanche Point
- Chinaman Gully
- Rowland Flat (Barossa lower)
- Port Willunga

Same colour triangle (not labelled) indicates private monitoring well

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks
- Locality
- Main Highway
- Water Body
- AMLR Watercourses
- Prescribed Area Boundary
- AMLRNRMB Boundary

Data Sources: DWLBC

0 7

A1 1:200,000 Kilometres

SINCLAIR KNIGHT MERZ SKM

Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board

AMLR Groundwater Monitoring Network

Figure 6 - Fleurieu Peninsular (Mount Lofty Ranges Water Resource Area) v1

GDA 1994 MGA Zone 54

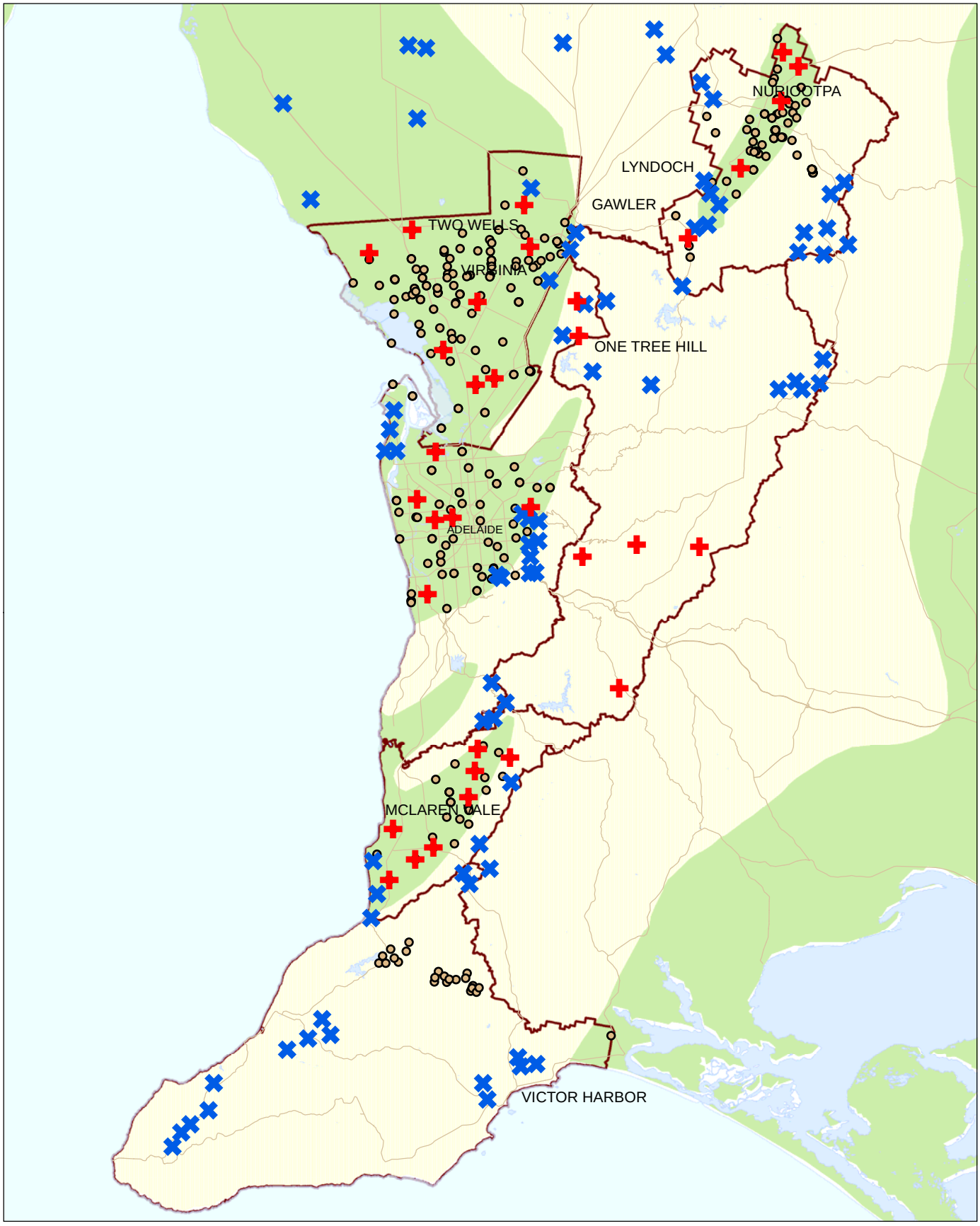
Friday, March 13, 2009 2:39:59 PM
I:\VESA\Projects\VE23159\Technical\GIS\Template\Groundwater Network_Fleurieu.mxd

4 Proposed Monitoring Network

Figure 7 shows the regional groundwater monitoring network, with the number of sites in each area summarised in the table below. Prioritisation of these sites has been undertaken in the following section.

Table 4-1 Proposed Monitoring Network by Management Area

	New Monitoring Bores	New Telemetery / Data Logger Sites	Ongoing Monitoring Sites
Barossa	21	5	80
Northern Adelaide Plains	11	8	134
Central Adelaide	14	5	71
McLaren Vale	8	8	37
Torrens Onkaparinga	13	4	1
Fleurieu	14	0	24
One Tree Hill	0	2	0
TOTAL	**80**	**32**	**347**



Legend

- Recommended Telemetry sites
- Recommended Monitoring Location (New)
- DWLBC Monitoring Sites (Gov owned)
- Prescribed Area Boundary

Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks

Data Source: DWLBC

0 20

A4 1:650,000 Kilometres

Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board

SKM

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 7 - Monitoring Site Locations v1

Tuesday May 5, 2009
I:\VESA\Projects\VE23159\Technical\GIS\Template\Regional Network.mxd

5 Priority Monitoring Works

A prioritised program of monitoring works including installation of new bores, telemetry and data loggers has been developed to form the AMLRNRMB's application for funding under the Australian Government Modernisation and Extension of Hydrologic Monitoring Systems Program administered by the Bureau of Meteorology.

The table below summarises the priority works and cost estimates.

Table 5-1 Summary of Priority Monitoring Infrastructure

	New Monitoring Bores	Cost Estimate	New Telemeted Site	Cost Estimate	New Data Loggers	Cost Estimate
Barossa	1 (Eden Valley area)	$50,000	-		1	$3,500
Northern Adelaide Plains	1 (north of NAP area)	$70,000	4	$40,000	5	$17,500
Central Adelaide	-		2	$20,000	3	$10,500
McLaren Vale	-		4	$40,000	4	$14,000
Torrens Onkaparinga	1 (upper Torrens)	$60,000	-		1	$3,500
Fleurieu	1 (southern Fleurieu)	$50,000	-		1	$3,500
One Tree Hill	-		-		1	$3,500
TOTAL	**4**	**$230,000**	**10**	**$100,000**	**16**	**$56,000**
TOTAL COST	**$386,000**					

A breakdown by individual sites is included in Table 5-2.

The distribution of these sites is shown in Figure 8.

Table 5-2 Individual Site Requirements for Groundwater Monitoring Infrastructure, May 2009

Groundwater Management Area	Location	Type	E	N	Aquifer Monitored	Cost Estimate
Barossa	Eden Valley area	New monitoring bore and data logger	323642	6169179	FR	$53,500
Northern Adelaide Plains	North of WAP area	New monitoring bore and data logger	273826	6182517	T2	$73,500
Northern Adelaide Plains	PTA127	Telemetry	276984	6154390	T1	$10,000
Northern Adelaide Plains	PTG066	Telemetry	273235	6168967	T2	$10,000
Northern Adelaide Plains	MPA048	Telemetry	287547	6166911	T2	$10,000
Northern Adelaide Plains	MUW030	Telemetry	286809	6171947	T2	$10,000
Northern Adelaide Plains	MPA163	Data logger	281148	6160183	T1	$3,500
Northern Adelaide Plains	MPA056	Data logger	280936	6150155	T1	$3,500
Northern Adelaide Plains	PTG060	Data logger	267989	6166116	T2	$3,500
Northern Adelaide Plains	YAT010	Data logger	283224	6150899	T2	$3,500
Central Adelaide	YAT031	Telemetry	273828	6136200	T1	$10,000
Central Adelaide	PTA067	Telemetry	276092	6142002	T2	$10,000
Central Adelaide	ADE034	Data logger	287622	6135304	T1	$3,500
Central Adelaide	NOA043	Data logger	275091	6124681	T1	$3,500
Central Adelaide	ADE191	Data logger	278127	6133988	Q	$3,500
McLaren Vale	WLG096	Telemetry	273605	6092416	Maslin Sands	$10,000
McLaren Vale	WLG097	Telemetry	280857	6103227	Maslin Sands	$10,000
McLaren Vale	WLG100	Telemetry	280074	6100036	Port Willunga	$10,000
McLaren Vale	WLG139	Telemetry	275801	6093894	Port Willunga	$10,000
McLaren Vale	WLG044	Data logger	270906	6096136	Maslin Sands	$3,500
McLaren Vale	WLG057	Data logger	270438	6089953	Port Willunga	$3,500
McLaren Vale	WLG107	Data logger	281189	6105910	FR	$3,500
McLaren Vale	KTP033	Data logger	285126	6104831	FR	$3,500
Torrens Onkaparinga	Upper Torrens	New monitoring bore and data logger	320571	6149598	FR	$63,500
Fleurieu	Southern Fleurieu	New monitoring bore and data logger	245121	6059268	FR	$53,500
One Tree Hill	6628-21990 **or** 6628-13653 (DL)	Data logger	293491	6156062	unknown	$3,500
					TOTAL	**$386,000.00**

Legend

- New Monitoring Bore with Data Logger
- Data Logger Installation
- Telemetry Installation
- Prescribed Area Boundary

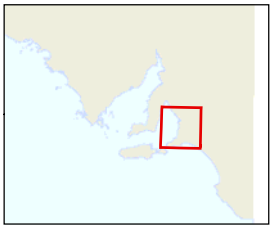
Groundwater Aquifers

- Fractured Rocks
- Sedimentary Rocks

Data Source: DWLBC

0 20

A4 1:656,227 Kilometres



Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board

SKM

AMLR Groundwater Monitoring Network

GDA 1994 MGA Zone 54

Figure 8 - Priority Monitoring Works Locations v1

Tuesday, May 5, 2009
I:\VESA\Projects\VE23159\Technical\GIS\Template\Figure 8 BoM Sites.mxd