DWLBC REPORT

Groundwater - surface water interactions on Kangaroo Island, Progress report 1: Rocky River shallow piezometer drilling program

2008/22

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Groundwater – surface water interactions on Kangaroo Island, Progress report 1: Rocky River shallow piezometer drilling program

Simone Stewart

Knowledge and Information Division
Department of Water, Land and Biodiversity Conservation

June 2008

Report DWLBC 2008/22

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Knowledge and Information Division
Department of Water, Land and Biodiversity Conservation
25 Grenfell Street, Adelaide
GPO Box 2834, Adelaide SA 5001
Telephone National (08) 8463 6946
International +61 8 8463 6946
Fax National (08) 8463 6999
International +61 8 8463 6999
Website www.dwlbc.sa.gov.au

ISBN 978-1-921528-13-2

Preferred way to cite this publication
Stewart S, 2008, *Groundwater – surface water interactions on Kangaroo Island, Progress report 1: Rocky River shallow piezometer drilling program,* DWLBC Report 2008/22, Department of Water, Land and Biodiversity Conservation, Government of South Australia

Download this document at: http://www.dwlbc.sa.gov.au/publications/reports/html

FOREWORD

South Australia's unique and precious natural resources are fundamental to the economic and social well being of the State. It is critical that these resources are managed in a sustainable manner to safeguard them both for current users and for future generations.

The Department of Water, Land and Biodiversity Conservation (DWLBC) strives to ensure that our natural resources are managed so that they are available for all users, including the environment.

In order for us to best manage these natural resources it is imperative that we have a sound knowledge of their condition and how they are likely to respond to management changes. DWLBC scientific and technical staff continue to improve this knowledge through undertaking investigations, technical reviews and resource modelling.

Rob Freeman
CHIEF EXECUTIVE
DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION

CONTENTS

FOREWORD i

SUMMARY 1

1. PROJECT OUTLINE 3

2. BACKGROUND 5

3. CATCHMENT CHARACTERISTICS 7

3.1 STUDY AREA 7
3.2 CLIMATE 7
3.3 GEOLOGY 7
3.4 HYDROLOGY 9
3.5 HYDROGEOLOGY 11

4. SITE SELECTION 13

4.1 EAST MELROSE TRACK 13
4.2 PLATYPUS POOLS 14
4.3 ROCKY RIVER BRIDGE 15

5. DRILLING 17

5.1 DRILLING 17
5.2 FIELD INVESTIGATIONS 18
5.3 WELL COMPLETION 18
5.4 GEOLOGY 21
5.4.1 Melrose site 21
5.4.2 Platypus site 21
5.4.3 Bridge site 22

6. SUMMARY AND FUTURE WORK 23

APPENDICES 25

A. ENVIRONMENTAL IMPACT ASSESSMENT 25
B. LITHOLOGICAL LOGS 27

UNITS OF MEASUREMENT 41

GLOSSARY 43

REFERENCES 45

LIST OF FIGURES

Figure 1. Map of Rocky River catchment displaying piezometer and weir locations 8
Figure 2. Rocky River monthly flow volumes as measured at the weir 9

Figure 3. Rainfall runoff correlation 10
Figure 4. Melrose site nested piezometer configuration 13
Figure 5. Platypus site nested piezometer configuration 14
Figure 6. Bridge site nested piezometer configuration 15

LIST OF TABLES

Table 1. Well construction details 19
Table A.1 Environmental Impact Assessment for all Rocky River sites 25
Table B.1 Lithological logs for all Rocky River wells 27

SUMMARY

The Kangaroo Island groundwater – surface water interaction study is a sub-project of the National Water Initiative (NWI) funded project: *Improve the knowledge of groundwater flow mechanisms in fractured rock aquifers in the Mount Lofty Ranges, Northern Adelaide Plains, and Kangaroo Island.*

The Kangaroo Island shallow piezometer drilling program is the first step in this project to improve the knowledge of groundwater flow mechanisms on Kangaroo Island. The pristine nature for the Rocky River Catchment in Flinders Chase National Park made it the ideal candidate for an investigative groundwater – surface water interaction study.

After site investigations and consideration of accessibility and piezometer transect orientation requirements, three points along the River were chosen: East Melrose Track, Platypus Pools, and Rocky River Bridge.

Piezometers were drilled along 150–200 m transects perpendicular to groundwater flow paths from the catchment boundary to stream discharge points. Each site contains a number of nested piezometers, installed at differing depths to monitor vertical changes in salinity and chemical parameters, and to observe any vertical flow systems. In addition, in-stream piezometers were installed at two of the three sites to monitor water level and chemistry variations directly under the riverbed of Rocky River. In total, 32 piezometers were drilled within the catchment.

All wells were completed with class 9 PVC casing of varying diameter, with a 0.5 mm aperture slotted casing across the production zone. Wells were gravel packed with 8 16 gravel to one metre above the production zone. The wells were then grouted to the surface with bentonite and either completed with a stainless steel standpipe with lockable cap, or a manhole cover. Wells were developed until the water ran clear with a minimum development time of 0.5 hours. Salinity samples and lithological samples were collected during drilling.

These piezometers will now be used for water level and salinity monitoring, and chemical analysis, to interpolate the groundwater flow directions within the catchment. This will aid in a further understanding of the mechanisms that govern groundwater flow and groundwater – surface water interactions under pristine catchment conditions. Information obtained from further studies at this site may be extrapolated over larger areas and used to improve decision making on the allocation of groundwater resources in fractured rock aquifers (FRAs) throughout the state.

1. PROJECT OUTLINE

The Kangaroo Island (KI) groundwater – surface water interaction study is a sub-project of the NWI funded project: *Improve the knowledge of groundwater flow mechanisms in fractured rock aquifers in the Mount Lofty Ranges, Northern Adelaide Plains and Kangaroo Island.*

The aim of this project is to improve decision making processes on the allocation of groundwater resources in FRAs by understanding the groundwater flow mechanisms occurring in these systems.

The Kangaroo Island shallow piezometer drilling program is the first step in an investigative project aimed to improve the knowledge of groundwater flow mechanisms on Kangaroo Island. The project has focussed on investigating groundwater – surface water interactions within a pristine catchment (Rocky River Catchment) in Flinders Chase National Park. Data collected has been used as baseline data to determine the extent of altered land use conditions on catchment scale processes, when compared with data obtained from cleared catchments.

2. BACKGROUND

During the period November 2004 to September 2005 the Department of Water, Land and Biodiversity Conservation (DWLBC), in conjunction with the Kangaroo Island Natural Resource Management (NRM) Board, undertook a groundwater–surface water interaction study (Shand et al 2006) focusing on four catchments on Kangaroo Island. The project, which covered a range of land use types and vegetation types, utilised the Cygnet River, Rocky River, Timber Creek and Willson River catchments.

The investigation was aimed to improve the knowledge of surface water and groundwater hydrochemistry on Kangaroo Island and therefore contribute to a better understanding of the mechanisms of catchment scale processes, in particular the linkages between surface water and groundwater.

An important outcome of the project was data showing the notable surface water salinity differences between the catchments. The influence that groundwater has on such salinity variances and also the influence it has on stream flow generation is poorly understood, as such, further work needed to be undertaken.

Analysis of the electrical conductivity (EC) for surface water within the catchments indicated that the Rocky River was very fresh (200–320 μS/cm) in comparison with the other catchments studied (ranges 1000–20000 μS/cm).

Of the four rivers studied, Rocky River was observed to be the only perennial river, which remained relatively fresh even during the peak of summer when the majority of rivers on KI are either dry or saline. It is thought that fresh groundwater may be contributing to stream flow generation to assist with flow during low runoff periods.

The Rocky River Catchment is the only catchment in South Australia that remains free from anthropogenic impacts, with the exception of minor access tracks and built assets. As such the Rocky River Catchment was chosen to undertake a catchment scale groundwater – surface water interaction study.

As there were currently no wells present within the Rocky River Catchment, the KI shallow piezometer drilling program was undertaken.

3. CATCHMENT CHARACTERISTICS

3.1 STUDY AREA

The Rocky River Catchment (RRC) is located within Flinders Chase National Park and Ravine Des Casoars Wilderness Protection Area. The catchment covers an area of ~216 km^2 and is bound by the Playford Highway to the north and by the West End Highway and Shackle Road on the east and west respectively. The main watercourse is ~40 km long and travels in a southwest direction across Scotch Thistle Flat and eventually discharges into the Southern Ocean at Maupertuis Bay (Fig. 1).

The RRC is one of very few catchments in South Australia which has not been imposed upon by land clearing practices, which thus makes it the ideal catchment within which to obtain base line water quality data (pre clearing) which can help to observe the superimposed effects of vegetation clearance in adjacent catchments.

3.2 CLIMATE

The RRC climate can be described as temperate with warm winters, cool summers and gentle sea breezes. The average summer temperature is 23°C and rarely increases beyond 35°C, whilst average winter temperatures rarely reach below 13°C.

Short-term rainfall data is available for the RRC from a rainfall gauging station located at the airstrip along Shackle Road. The average annual rainfall is 700 mm/y, based on 11 years of data. Rainfall is winter dominant with more than two thirds of the annual rainfall falling between the months of May and September.

3.3 GEOLOGY

Much of the central and southern parts of the RRC are underlain with the Kanmantoo Formation. The Kanmantoo Formation occurs as a medium to fine grained, grey feldspathic sandstone with thin biotite laminations (Shand et al 2006), which generally has a limited storativity and transmissivity. This is due to the tight and impermeable structure of the basement rocks, which contain few joints and fractures (Barnett and Dodds 2000).

In the northern part of the Catchment, deeply weathered basement material is the dominating geology, whilst in the south the Bridgewater Formation is present (Barnett and Dodds 2000). In contrast to the Kanmantoo Formation, the Bridgewater Formation is highly permeable and thus rainfall can infiltrate rapidly, as demonstrated by the lack of surface water drainage in areas underlain by the dunes. Where the dunes overlie impermeable basement rocks there is a potential for lateral groundwater flow due to the permeability variations in the two formations.

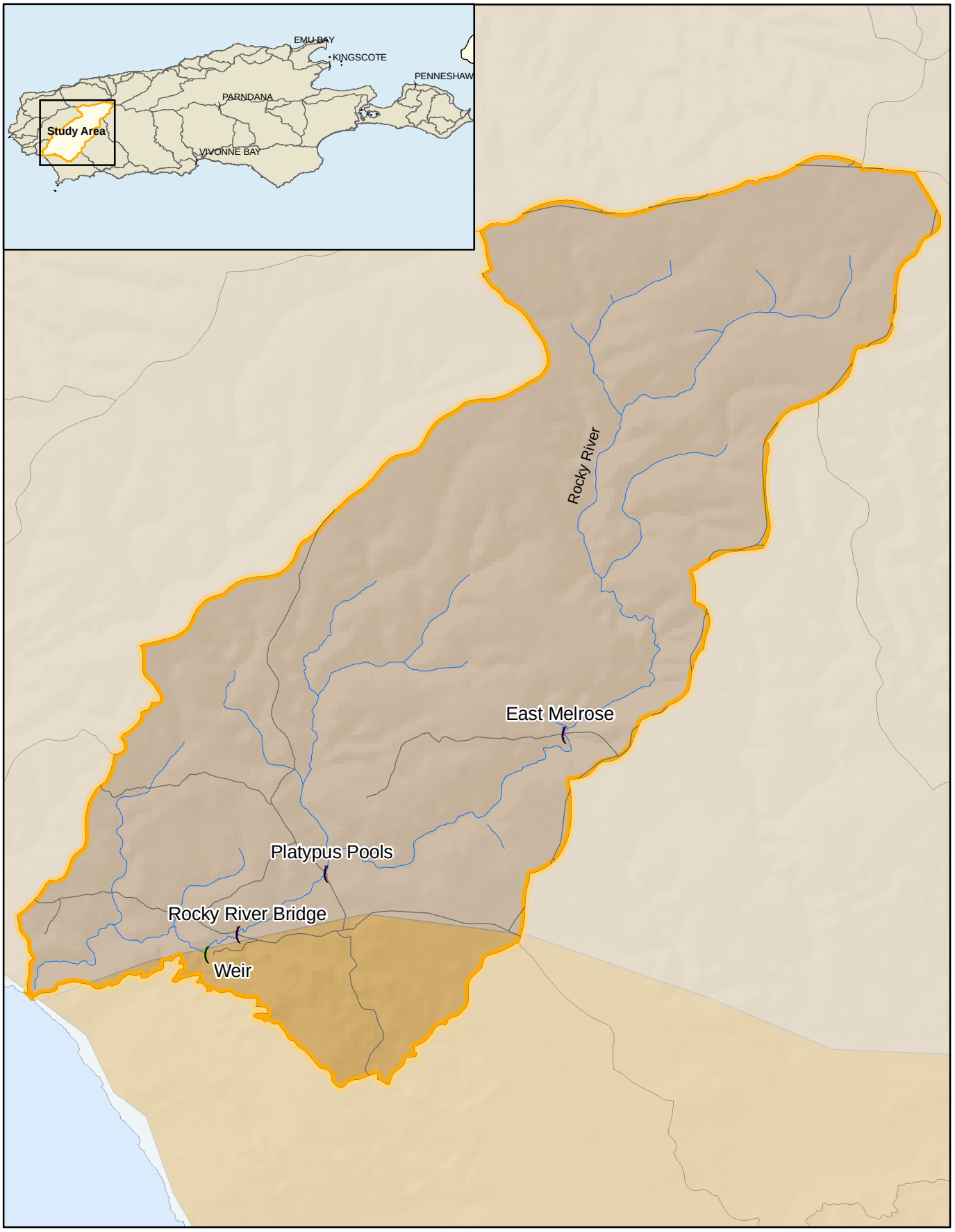

Figure 1. Map of Rocky River catchment displaying piezometer and weir locations

Piezometer Nests
Weir
Roads
Rocky River
Catchment Boundary
Kanmantoo Group
Bridgewater Formation

Produced By: Mt Lofty Ranges Team
Knowledge and Information Division
Department of Water, Land and Biodiversity Conservation
Projection: Transverse Mercator
Datum: Geocentric Datum of Australia 1994
Date: March 2008

0 1 2 3 4 5 km

Government of South Australia
Department of Water, Land and Biodiversity Conservation

M:\Projects_GW\NWI Fractured Rock\KIO\outputs\Rocky_River.mxd March 2008 S.Stewart

3.4 HYDROLOGY

The Rocky River represents a partly confined geomorphic river style. Consequently the River predominantly flows through defined riverbanks, and as such alluvial flood plains are not present within the Catchment. Unlike many rivers, the mouth of the Rocky River, which discharges into Maupertuis Bay at Snake Lagoon, does not represent an estuarine zone (Nilsen 2006).

Surface water flows in the River have been monitored since 1970 at a v-notch weir located in the southern portion of the Catchment off West Bay road (refer to Fig. 1).

The average annual flow of Rocky River over the past 36 years (1971–2006) has been 13.8 GL/y (13 808 000 m^3/y). Minimum flows have been as low as 1.6 GL/y (2006) whilst maximum flow has been as high as 44.7 GL/y (1992).

Flow in the Rocky River has become more seasonally dominant since 1998, constraining the majority of flow to the months of May–September with flow ceasing through December–February. Prior to this, the River would generally flow all year round with low flows in summer months and higher flows in winter months. There does not appear to be a significant increase in flow volumes as a direct response to rainfall (refer to Fig. 3).

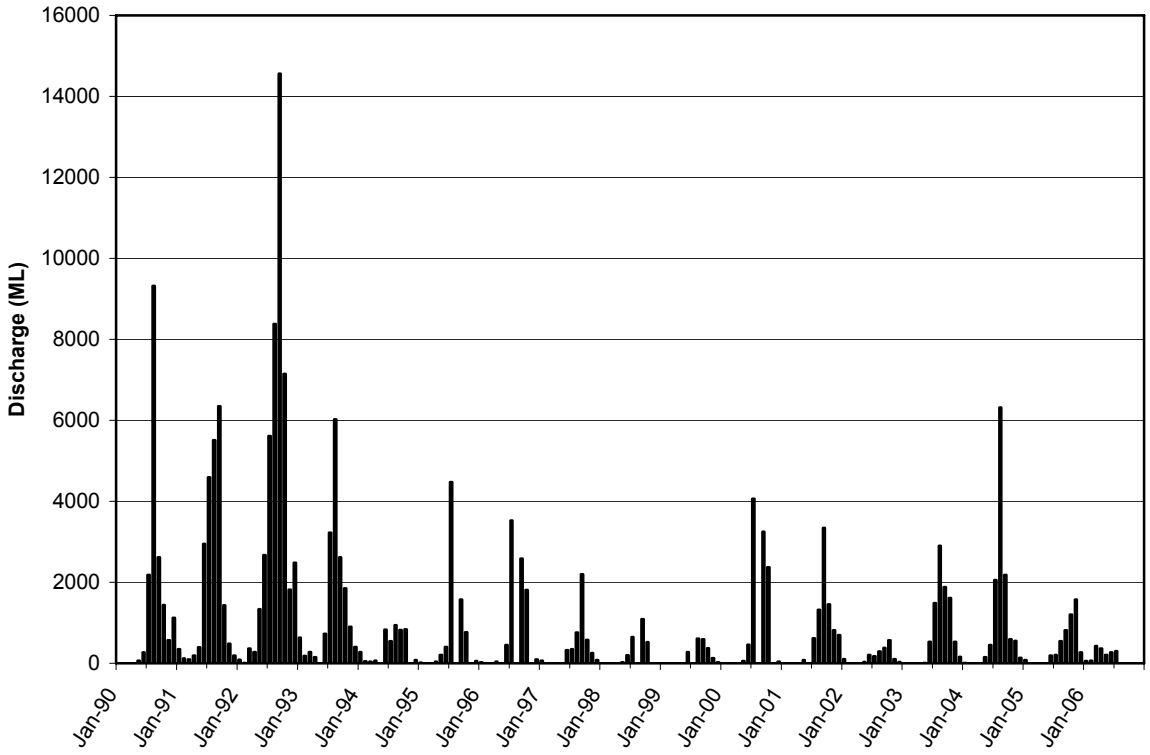

Figure 2. Rocky River monthly flow volumes as measured at the weir

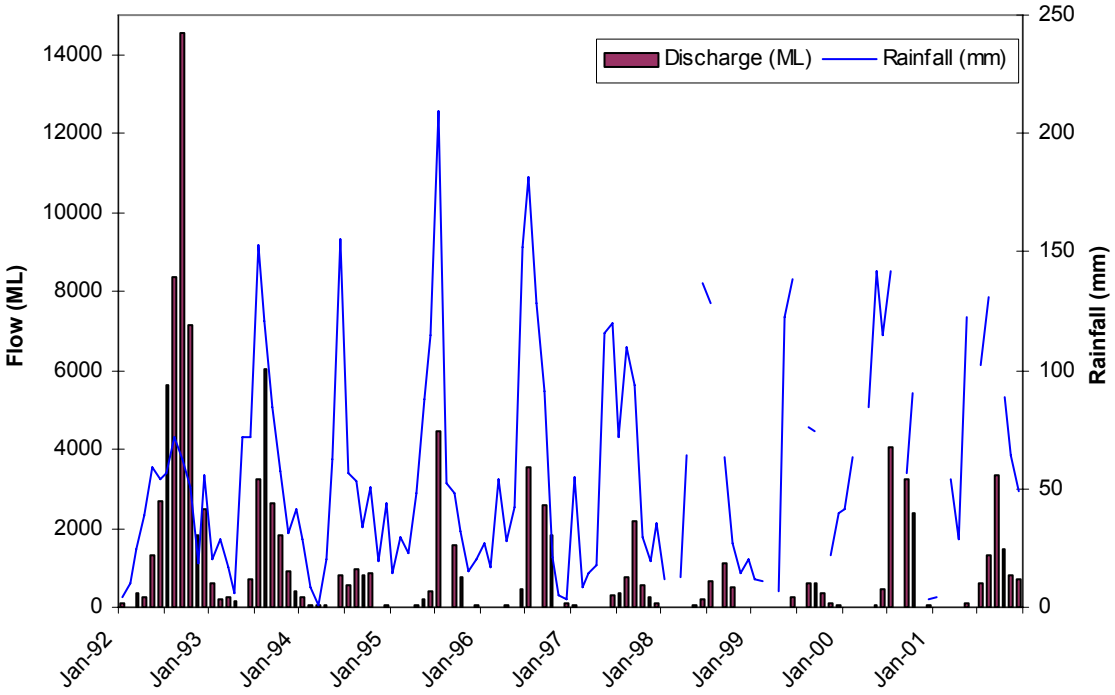

Figure 3. Rainfall runoff correlation

3.5 HYDROGEOLOGY

Due to the pristine nature of the RRC, potentiometric head elevations and groundwater flow directions in this area are unknown. It is assumed that the majority of groundwater flow is contained to FRAs, however there may be some superficial flow through thin sandy aquifers overlying the FRA.

Preliminary investigations by Shand et al (2006) of radon concentrations from the headwaters to the mouth of the river indicate that the Platypus Pools are a possible location of groundwater discharge into the surface water, due to the higher radon concentrations observed at these sample points. In addition, it can be assumed that the area between the East Melrose Track and the Platypus Pools represents a loosing reach, where the surface water is recharging the watertable, as observed by loss of flow between these two points. As such there must also be a groundwater discharge point located north of the East Melrose Track to sustain flow at this point, whilst the remainder of the River is stagnant or dry.

4. SITE SELECTION

Due to the pristine nature of the RRC, site selection was based primarily on access. It was determined that three separate drilling sites would be established within the Catchment at various points along the River. As the northern two thirds of the Catchment are inaccessible by road, all three sites were located within the southern third of the Catchment.

It was proposed that piezometers would be drilled along 150–200 m transects perpendicular to groundwater flow paths from the Catchment boundary to stream discharge points. Each site was to contain a number of nested piezometers, to be installed at differing depths to monitor vertical changes in salinity and chemical parameters, and to observe any vertical flow systems. In addition, in-stream piezometers were to be installed at two of the three sites to monitor water level and chemistry variations directly under the riverbed of Rocky River. Therefore, sites were chosen that were suitable for this orientation of piezometer transects. After consideration of accessibility and piezometer transect orientation requirements, three points along the river were chosen: East Melrose Track, Platypus Pools, and Rocky River Bridge (Fig. 1).

4.1 EAST MELROSE TRACK

The East Melrose Track (Melrose) site is the most northern site within the Rocky River Catchment. The piezometers are located along the east Melrose fire track. This site was chosen because it is the most northerly accessible site within the Catchment, located 17.5 km south of the headwaters.

Four nested piezometer sites were established at the Melrose site. One site consisting of four wells was located on the highlands (M1a, M1b, M1c, M1d); a second site on the eastern bank of the River consisting of two wells (M4a, M4b); a third site on the western bank of the River consisting of four wells (M3a, M3b, M3c, M3d); and a fourth site directly drilled into the River consisting of two wells (M2a, M2b). A total of 12 wells were drilled at the Melrose site.

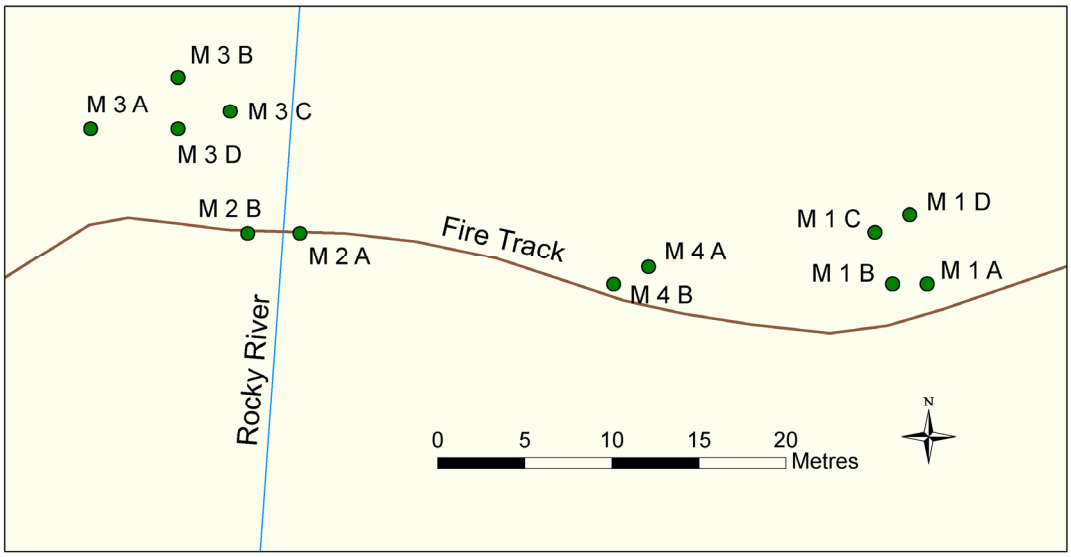

Figure 4. Melrose site nested piezometer configuration

4.2 PLATYPUS POOLS

The Platypus Pools (Platypus) site is located approximately 6.7 km downstream of the Melrose site and roughly 1.5 km from the Flinders Chase Visitors Centre. This site was chosen due to the possibility that it was a groundwater discharge area. This was assumed due to the presence of significant pools of water, which are present year–round, and due to the stronger radon concentrations found here by Shand et al (2006).

This piezometer nest transect is located along a fire track. Three nested piezometer sites were installed at the Platypus site, each consisting of four wells. One site was located directly adjacent the platypus pools (P3a, P3b, P3c, P3d); a second site located approximately 100 m south-east of the Rocky River (P2a, P2b, P2c, P2d); and the last site located approximately 150 m from site P2, also on the south-eastern side of the River, in the highlands (P1a, P1b, P1c, P1d). A total of 12 wells were drilled at the Platypus site.

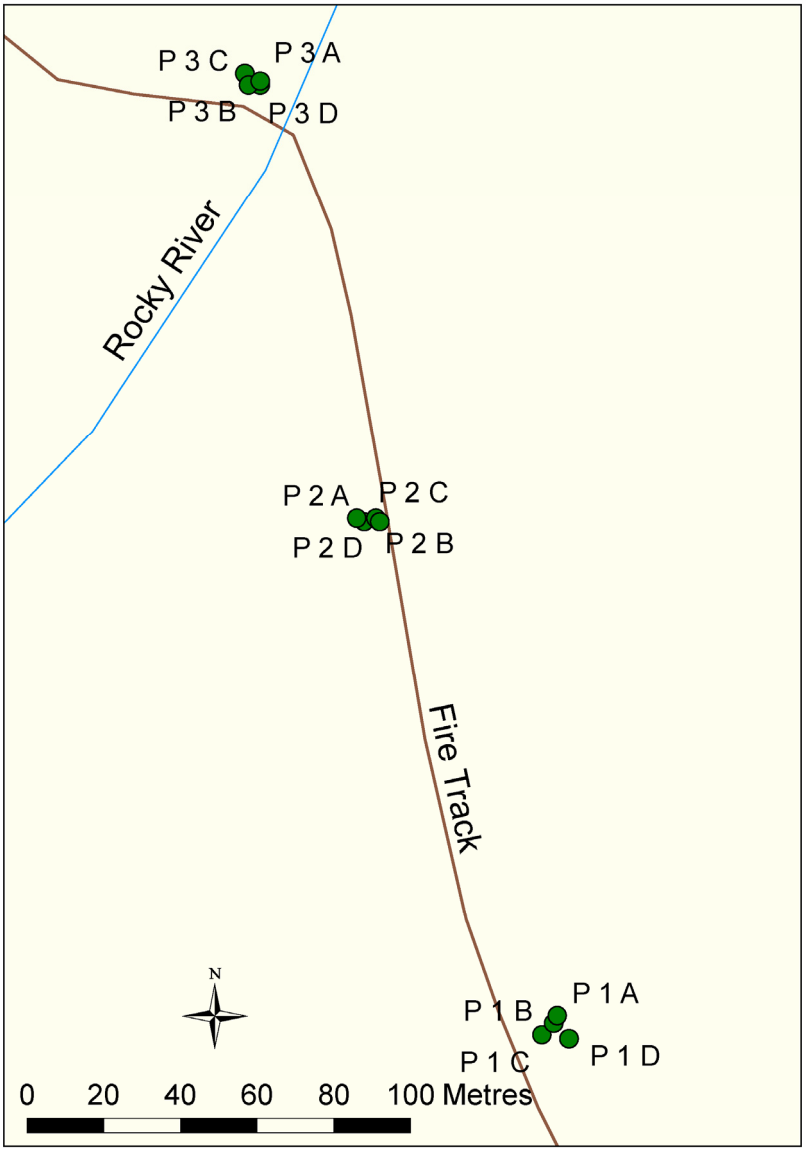

Figure 5. Platypus site nested piezometer configuration

4.3 ROCKY RIVER BRIDGE

The Rocky River Bridge (Bridge) site is located on the West Bay Road, and is the most southerly groundwater site within the Catchment. It is situated 7 km upstream of the River mouth. This site was chosen due to its accessibility.

Three nested piezometer sites were installed at the Bridge site. The first site is located on the eastern bank of the River, just off the road, consisting of two wells (B1a, B1b); the second site was located directly in-stream, consisting of two wells (B2a, B2b); and the third located on the western side of the River in the highlands, consisting of four wells (B3a, B3b, B3c, B3d). A total of eight wells were drilled at the Bridge site.

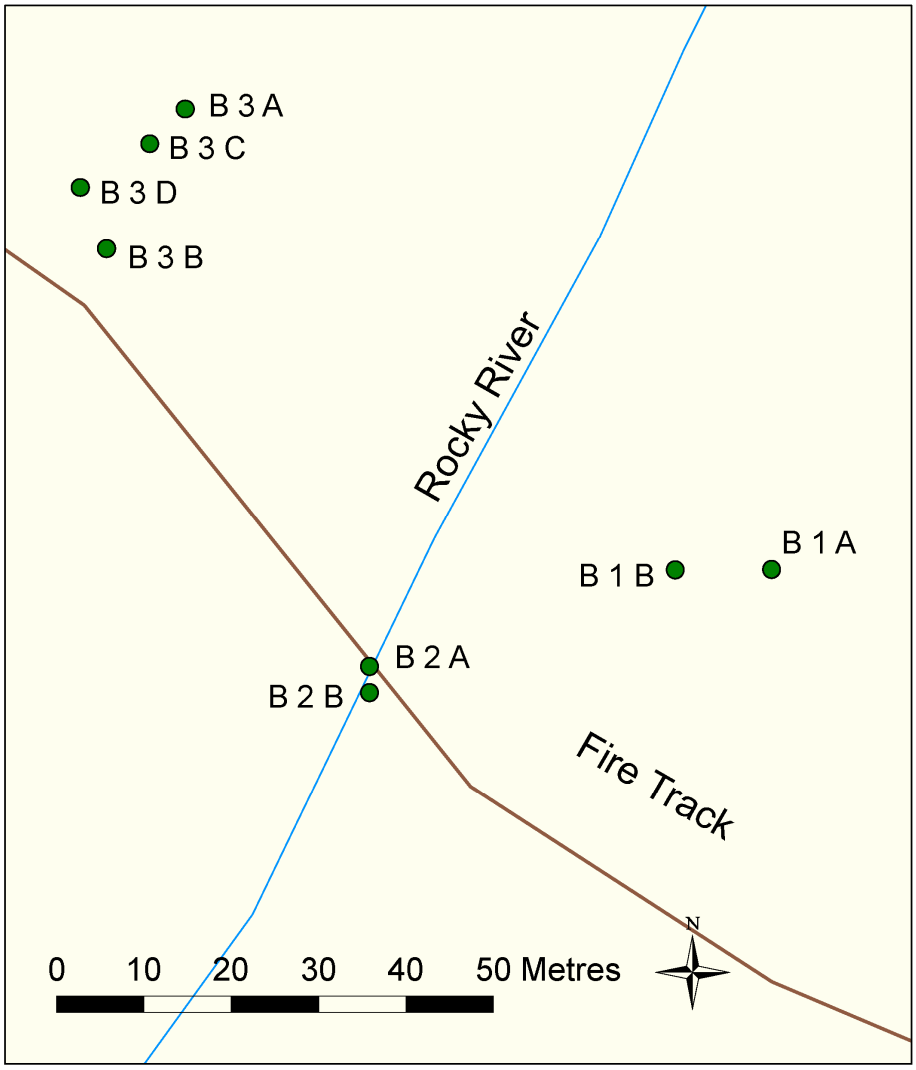

Figure 6. Bridge site nested piezometer configuration

5. DRILLING

5.1 DRILLING

DWLBC, The Department for Environment and Heritage (DEH) and Drilling Solutions SA undertook a site evaluation on 15 February 2007. During the site visit, an Environmental Impact Assessment (EIA) was undertaken, and as a result of the EIA a 'Measures to minimise impact brief' was signed by DWLBC, DEH and Drilling Solutions. The brief outlines measures to be undertaken at each site to minimise the impact on the environment by the drilling process (App. A). All sites were pegged at this stage and drilling was to commence in the following month.

Drilling Solutions SA undertook the drilling program during March and April 2007. An Investigator Mk5 Drill Rig was used to drill the majority of the piezometers while a Melvelle Porta – R16 Rig was used to drill two in-stream piezometers at the Bridge site.

Three drilling methods were used to complete the wells:

- Diamond core drilling (DIA)

  The deepest well at each site (M1d, P1d, B3b) was diamond core drilled to determine the types of geology likely to be encountered. The data acquired was used to determine the depths of the remaining piezometers at each site.

- Rotary air drilling (RTA)

  The remaining piezometers at the Melrose site and the deep well in nest 3 at the Bridge site (B3a) were rotary air drilled with the Investigator Mk5 Rig. This was possible because the FRA was located quite close to the surface.

  The two in-stream piezometers at the Bridge site (B2a, B2b) were rotary air drilled using the Melvelle Porta Rig. The rig had to be placed in the riverbed, which due to the dry winter of 2006, was waterless. The wells were to be drilled to a depth of four and eight meters, however due to the saturated sandy aquifer intercepted, circulation was continuously lost, and the wells collapsed. After many failed attempts to drill to the required depth the wells were completed at depths of 3.2 and 6.5 m, respectively.

- Hollow auger drilling (AUC)

  Due to the presence of a saturated sandy aquifer at the Bridge site, the remaining wells were hollow augered (B1a, B1b, B3c, B3d). This involved inserting the casing into the hollow centre tube whilst the drill pipe was still at depth, then the drill pipe was removed. This reduced the risk of well collapse. The remaining Platypus wells were drilled in the same manner, as there was a dense saturated clay aquitard present, which was causing well collapse.

5.2 FIELD INVESTIGATIONS

Prior to completion of the cored wells (M1d, P1d & B3b), geophysical logs, Electronmagnetic (EM) Flowmeter and Hydrolab surveys were undertaken. Hydrolab refers to a YSI® 600XL Series Sonde, which is used to measure variations in electrical conductivity (EC), pH and temperature with depth. DWLBC's Geophysical Technical Services Group completed down-hole geophysical surveys for the following parameters:

- Gamma Log – Measures natural presence of gamma rays; aids in defining lithology changes, bed boundaries and clay content
- Neutron Log – Measures the amount of hydrogen around the probe; can provide an indication of porosity and clay content (in combination with gamma log)
- Density (or gamma-gamma) Log – Gamma source and gamma receiver measures the electron density, which is a function of the bulk density of the formation
- Induction (medium and deep) Log – The induction tool uses electromagnetics to sense the conductivity (inverse of resistivity) of the adjacent formation; comparisons between deep and medium results can indicate porosity
- Point Resistance (PR) Log – Changes between a down-hole electrode and a reference surface electrode reflect changes in the formation resistivity; this can represent changes in porosity, water salinity, and fluid connectivity
- Calliper Log – Spring-loaded arms that press against the side of the hole and can indicate well and casing integrity; can be used to identify fractures in the lithology intercepted by the well.

In addition to the standard geophysical surveys, the EM Flowmeter was also used under ambient and pumped conditions to determine vertical flow within the wells at discrete intervals sealed by inflatable packers. An Acoustic Televiewer survey was also conducted to provide an orientated, visual indication of fracture distribution within each well.

5.3 WELL COMPLETION

All wells were completed with class 9 PVC casing of varying diameter, with a 0.5 mm aperture slotted casing across the production zone. A sump was not required, therefore the well base was a PVC end cap. All wells were gravel packed with 8 16 gravel to one meter above the production zone. The wells were then grouted to the surface with bentonite and either completed with a stainless steel standpipe with lockable cap, or a manhole cover. Wells were developed until the water ran clear with a minimum development time of 0.5 hours. Salinity samples were taken at this time and sent to the DWLBC for analysis.

Table 1. Well construction details

Site	Unit Number	Well Name	Easting	Northing	Drilling method	Ground Elevation (m AHD)	Well depth from surface (m)	TOC* above ground (m)	Screen interval from surface (m)	Gravel pack from surface (m)	Ave. EC (µS/cm)	Average RSWL (m AHD)
Melrose	6226–142	M1a	662018	6024914	RTA	91.66	6.52	0.52	3.52–6.52	3.02–6.52	15408	85.96
	6226–141	M1b	662018	6024916	RTA	91.65	10.54	0.43	7.54–10.54	6.74–10.54	7285	86.22
	6226–140	M1c	662017	6024917	RTA	91.64	30.11	0.39	27.11–30.11	25.61–30.11	5959	86.34
	6226–139	M1d	662018	6024919	DIA	91.58	14.39	0.47	11.39–14.39	10.89–14.39	4787	86.25
	6226–143	M2a	661984	6024916	RTA	86.79	6.25	0	4.25–6.25	3.45–6.25	855	86.02
	6226–144	M2b	661980	6024916	RTA	86.68	5	0	3–5	2–5	615	85.96
	6226–145	M3a	661971	6024923	RTA	87.94	14.44	0.49	11.44–14.44	10.94–14.44	4678	85.85
	6226–146	M3b	661972	6024922	RTA	87.66	10.15	0.44	7.15–10.15	6.55–10.15	4555	86.12
	6226–147	M3c	661973	6024922	RTA	87.50	6.29	0.4	3.29–6.29	2.59–6.29	4410	86.17
	6226–148	M3d	661974	6024921	RTA	87.46	3.38	0.49	1.38–3.38	0.88–3.38	5852	86.20
	6226–149	M4a	661998	6024916	RTA	88.55	3.79	0.61	1.79–3.79	1.29–3.79	1526	86.32
	6226–150	M4b	661997	6024916	RTA	88.33	3.36	0.54	1.36–3.36	0.86–3.36	1643	86.22
Platypus	6226–164	P1a	656297	6021350	AUC	57.89	8.55	0.65	6.05–8.55	5.55–8.55	6177	53.68
	6226–163	P1b	656295	6021349	AUC	57.83	15.2	0.71	12.2–15.2	11.2–15.2	13336	53.92
	6226–163	P1c	656293	6021347	AUC	57.86	28.5	0.66	25.5–28.5	24.5–28.5	13560	53.53
	6226–161	P1d	656298	6021347	DIA	57.88	45.73	0.57	42.73–45.73	41.73–45.73	8170	53.52
	6226–168	P2a	656247	6021479	AUC	56.37	3.01	0.59	1.01–3.01	0.81–3.01	15263	53.78
	6226–167	P2b	656246	6021481	AUC	56.36	5.28	0.64	2.28–5.28	1.78–5.28	5943	53.90
	6226–166	P2c	656247	6021482	AUC	56.34	9.11	0.65	6.11– 9.11	5.11–9.11	5309	53.92
	6226–165	P2d	656245	6021479	AUC	56.45	15.4	0.6	12.4–15.4	11.4–15.4	7463	54.24
	6226–173	P3a	656214	6021595	AUC	55.74	5.39	0.4	2.39–5.39	1.89–5.39	796	54.40
	6226–172	P3b	656214	6021597	AUC	55.70	8.22	0.57	5.22–8.22	5.22–8.22	986	54.40
	6226–171	P3c	656213	6021599	AUC	55.71	13.59	0.61	10.59–13.59	10.09–13.59	5615	54.39
	6226–170	P3d	656213	6021594	AUC	55.77	28.06	0.39	25.06–28.06	24.06–28.06	4838	53.89

Site	Unit Number	Well Name	Easting	Northing	Drilling method	Ground Elevation (m AHD)	Well depth from surface (m)	TOC* above ground (m)	Screen interval from surface (m)	Gravel pack from surface (m)	Ave. EC (µS/cm)	Average RSWL (m AHD)
Bridge	6226–159	B1a	654120	6020094	AUC	46.32	6.03	0.47	3.03–6.03	2.53–6.03	849	41.65
	6226–158	B1b	654120	6020093	AUC	46.34	9.43	0.57	6.43–9.43	6.03–9.43	DRY	DRY
	6226–156	B2a	654088	6020080	RTA	44.69	3.15	1.85	1.15–3.15	1.65–3.15	381	44.89
	6226–155	B2b	654089	6020079	RTA	44.68	6.85	1.85	4.85–6.85	None	593	DRY
	6226–152	B3a	654053	6020136	RTA	48.35	35	0	32–35	25–35	6281	37.66
	6226–151	B3b	654052	6020132	DIA	48.10	21.5	0	18.5–21.5	18–21.5	6486	37.36
	6226–153	B3c	654053	6020134	AUC	48.30	9.6	0	6.6–9.6	6.2–9.6	DRY	DRY
	6226–154	B3d	654051	6020134	AUC	48.28	6.4	0	3.4–6.4	3–6.4	DRY	DRY

* Top of standpipe

RTA – Rotary air drilling; DIA – Diamond core drilling; AUC – Hollow auger drilling

RSWL – Reduced standing water level

5.4 GEOLOGY

The geology throughout the Catchment is dominated by the Cambrian Kanmantoo Group metasediments, overlain by unconsolidated sands and clays. A detailed description of the geology encountered at each site is described below and lithological logs for each well can be found in Appendix B.

Samples were collected for each well at one-metre intervals, however additional samples were collected if lithological variations were encountered. All cuttings and core samples were submitted to the Department of Primary Industries and Resources SA (PIRSA) Core Library for storage.

5.4.1 MELROSE SITE

Geology at the Melrose site consists of a fine-grained, well sorted, moderate to well-cemented metasandstone of a minimum thickness of 27 m. Total thickness of this unit is unknown. Minor iron staining indicates weathering extends beyond 40 m depth. Minor chloritic alteration is also observable on some fracture sets.

Depth to basement varies with topography, and ranges from between zero metres in the riverbed to 12 m for the higher elevations at site M1.

Sediments overlying the basement are characterised by a relatively thin layer of sandy clay and clayey sand containing weathered sandstone fragments. Overlying sediments vary from sands, sandy clay to clayey sand with minor gravel lenses. Individual sediment types vary in thickness at each site.

5.4.2 PLATYPUS SITE

Geology at the Platypus site consists of a fine-grained, moderate to well sorted, subrounded, well-cemented, siliceous metasandstone with minor occurrences of biotite-quartz-schist interbeds. This unit has a minimum thickness of 25 m, however total thickness is unknown. The uppermost 5 m of this unit is highly weathered and friable. Iron staining indicates weathering extends beyond 53 m. Minor chloritic alteration can also be observed.

Topographic variations are minor at this site and depth to basement is approximately 25 m.

Unconsolidated sediments overlying this unit consist of interbedded clays, sands, sandy clays and clayey sands of varying thicknesses. At site P1 two significant clay layers were encountered between 11–13 m and 22–24.5 m. These layers consisted of a black, high density, high plasticity, clay with a high organic content. This clay was not observed at the other sites.

5.4.3 BRIDGE SITE

Geology at the Bridge site consists of interbedded metasandstones and schists of a minimum thickness of 25 m. Total thickness of this unit is unknown. The metasandstone is typically siliceous, fined-grained, well sorted with subrounded grains and moderately to wellcemented. The quartz-muscovite-schist is generally fine-grained and friable with minor biotite. Minor quartz veining occurs throughout the unit. Minor iron staining indicates weathering extends beyond 35 m depth.

Depth to basement across the site is approximately 11 m. Sediments overlying the basement consist of unconsolidated clayey sands and sandy clays with minor gravel lenses.

6. SUMMARY AND FUTURE WORK

In total, 32 piezometers were drilled within the RRC at the Melrose, Platypus and Bridge sites. Geology encountered during drilling consisted of a sandstone FRA overlain by sandy aquifers and clay aquitards.

All wells were successfully completed with class 9 PVC casing and a 0.5 mm aperture slotted casing across the production zone. They were gravel packed to one meter above the production zone and grouted to the surface with bentonite. Wells were then either completed with a stainless steel standpipe with lockable cap, or a manhole cover. Wells were developed until the water ran clear with a minimum development time of 0.5 hours. Salinity samples and lithological samples were collected during drilling.

Now established, these piezometers will be used to monitor water level (monthly) and salinity (quarterly). Groundwater and surface water sampling is likely to occur every three months, sampling for major cations and anions, trace elements, radon, strontium, stable isotopes, CFC's, carbon-14, and pH, EC, DO and temperature.

Data loggers that monitor salinity and water level will be installed in 12 of the piezometers and three stream loggers will be established, one at each site, and equipped with data loggers.

Soil chloride profiles will be collected throughout the Catchment, and there is a possibility that drive point piezometers will be installed in the upper reaches of the Catchment near the headwaters, to monitor shallow groundwater properties. Rainfall collectors are to be established at the Melrose site near the current pluviometer.

Surface water flow gauging will be carried out with each sampling round at five points along the Rocky River from Melrose to the River mouth. In addition to this, a 'run of river' north of the Melrose site to the headwaters, will sample surface water and any groundwater pools for various physical and chemical parameters.

Pump tests will be carried out on some of the piezometers to determine aquifer properties such as hydraulic conductivity, and there is a possibility that surface geophysical techniques will be used to determine the direction of anisotropy in the FRA.

Collation of all data acquired will result in a further understanding of the mechanisms that govern groundwater flow and groundwater – surface water interactions under pristine catchment conditions. This knowledge may then be used to improve decision-making on the allocation of groundwater resources in fractured rock aquifers through out the State.

APPENDICES

A. ENVIRONMENTAL IMPACT ASSESSMENT

Table A.1 Environmental Impact Assessment for all Rocky River sites

Site	Description	Measures to Minimise Impact
P1	Platypus water holes	Construct shallow sediment settling depression to capture sediment from the drilling process
		Utilise geofabric/shade cloth to establish secondary filter
		Allow excess water to follow path of existing wallaby track before flowing into native vegetation
		Collect any excess sediment captured in settling depression and dispose of at FCNP Dump (behind depot)
		Test groundwater during drilling process – if high PH, salinity etc, capture groundwater in storage tank and dispose of at FCNP Dump
		Ensure all associated vehicles are clean prior to entering Flinders Chase NP
		Use traffic cones and flagging tape to mark walking track to restrict public access
		Vehicles escorted by DEH staff to drilling site
P2	Platypus water holes	as per P1
P3	Platypus water holes	as per P1 +
		Some minor pruning of native vegetation at car park to allow vehicle access and reduce risk of overall damage to shrubs.
		Warning – Active beehive in tree hollow adjacent drill site
B1	Shackle Road – eastern side of bridge on southern bank	as per P1 +
		Use manhole covers to place access points flush with ground level
		Water and sediment flow from drilling rig diverted directly into storage tank for disposal at FCNP Dump
		Any sediment not captured in storage tank to be collected and disposed of at FCNP Dump
		Place geofabric ground sheet under storage tank
		Place geofabric under truck and plant to capture any fluid leaks
B2	Shackle Road – western side of bridge, in-stream, directly at the base of bridge foundations	as per P1 +
		Place drilling rig on concrete base of bridge
		Close Shackle Rd for period of time required to assemble drilling rig on bridge foundations
		Repair any damage to concrete foundations of bridge on completion of drilling
		Water and sediment flow from drilling rig diverted directly into storage tank for disposal at FCNP Dump
		Any sediment not captured in storage tank to be collected and disposed at FCNP Dump
		Place geofabric ground sheet under storage tank
		Place geofabric under truck and plant to capture any fluid leaks

B3	Shackle Road – eastern side of bridge on northern bank	as per P1 +
		Use manhole covers to place access points flush with ground level
		Use steel posts and flagging tape to cordon off area from Shackle Rd
M1	East Melrose Track – eastern side of crossing	as per P1 +
		Implement Phytophthora hygiene measures
M2	East Melrose Track – in-stream at crossing	as per P1 +
		Implement Phytophthora hygiene measures
		Manhole cover in middle of crossing flush with the top of existing concrete
		Repair any damage to concrete crossing on completion of drilling
		Water and sediment flow from drilling rig diverted directly into storage tank for disposal at FCNP Dump
		Any sediment not captured in storage tank to be collected and disposed of at FCNP Dump
		Place geofabric ground sheet under storage tank
		Place geofabric under truck and plant to capture any fluid leaks
M3	East Melrose Track – western side of crossing	as per P1 +
		Implement Phytophthora hygiene measures
		Water and sediment flow from drilling rig diverted directly into storage tank for disposal at FCNP Dump
		Any sediment not captured in storage tank to be collected and disposed of at FCNP Dump
		Place geofabric ground sheet under storage tank
		Place geofabric under truck and plant to capture any fluid leaks
	General	Information sheet at Rocky River Visitor Centre
		Inform visitors of the presence of the drilling rig and the noise associated with the operation of the rig
		Inform FOPs of the work being conducted
		Drillers to carry spill kits (fluid leaks)
		Drillers to carry fire extinguishers
		Repair any earthworks (e.g. sediment traps) on the completion of drilling at each site

FCNP – Flinders Chase National Park

FOP – Friends of Parks group

B. LITHOLOGICAL LOGS

Table B.1 Lithological logs for all Rocky River wells

Permit No	Map100	Seq No.	Depth From	Depth To	Major Lith	Minor Lith	Description
128312	6226	139	0	1	SAND		Sand. Yellow. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	139	1	2	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	139	2	3	SAND	CLYU	Clayey sand. Light brown. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	139	3	4.5	SAND	CLYU	Clayey sand. Orange. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	139	4.5	5	SAND	CLYU	Clayey sand. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	139	5	6	SAND	CLYU	Clayey sand. Orange. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	139	6	6.5	CLYU	SAND	Sandy clay. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Minor muscovites and opaques. Moderate plasticity. High sheen. Slightly sticky. Moderate density. Contains weathered sandstone fragments.
	6226	139	6.5	12	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques and muscovites. Slight iron staining on fracture faces. Some chloritic alteration on fracture faces.
	6226	139	12	13	SCHT		Weathered schist. Grey/black. Fine grained. Well sorted. Sub rounded. Fragments friable. Significant muscovite presence. Minor opaques.
	6226	139	13	19	SDST		Sandstone. Slightly weathered. Grey. Fine grained. Well sorted. Sub rounded. Fragments slightly friable. Minor opaques and muscovites.
	6226	139	19	21	SDST		Sandstone. Slightly weathered. Grey. Fine grained. Well sorted. Sub rounded. Fragments slightly friable. Minor opaques and muscovites. Slight chloritic alteration. Slight iron staining.
	6226	139	21	23	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments very friable. Minor opaques and muscovites. Iron staining on fracture faces. Chloritic alteration on fracture faces.
	6226	139	23	33	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. Iron staining and chloritic alteration on some fracture faces.

	6226	139	33	36	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
	6226	139	36	40	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. Iron staining on some fracture faces. EOH.
128305	6226	140	0	1	SAND		Sand. Orange. Fine grained. Moderately sorted. Sub rounded. Minor opaques and muscovites.
	6226	140	1	2	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor opaques.
	6226	140	2	4	SAND	CLYU	Clayey sand. Yellow/grey. Fine to very fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	140	4	5	SAND		Sand. Yellow. Fine to very fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	140	5	12	SAND	SDST	Sand with weathered sandstone. Orangey brown. Very fine to medium grained. Poorly sorted. Sub angular to sub rounded. Very minor opaques. Contains sandstone rock fragments.
	6226	140	12	24	SDST		Weathered sandstone. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites. Slight chloritic alteration.
	6226	140	24	27	SDST		Sandstone. Fine grained. Well sorted. Sub rounded. Slightly friable. Minor muscovites. Slight iron staining.
	6226	140	27	36	SDST		Weathered sandstone. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites.
	6226	140	36	40	SDST		Weathered sandstone. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques. EOH.
128304	6226	141	0	1	SAND		Sand. Yellow. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	141	1	2	SAND	CLYU	Clayey sand. Yellow. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	141	2	5	SAND	CLYU	Clayey sand. Orange. Fine grained. Well sorted. Sub rounded. Fragments friable. Opaques present.
	6226	141	5	10	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques. EOH.
128303	6226	142	0	4	SAND		Sand. Orange. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor muscovites.
	6226	142	4	6	SAND	GRVL	Gravely sand. Orange. Contains weathered sandstone and quartz fragments. Fine to medium grained. Poorly sorted. Sub angular to sub rounded. Minor muscovites. EOH.
128301	6226	143	0	2	XXXX		Concrete and ironstone boulders from bridge formation.
	6226	143	2	4	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovite.
	6226	143	4	5	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovite. Minor ironstone present.

	6226	143	5	7	SDST	GRVL	Sandstone/gravel. Grey. Fine to medium grained. Poorly sorted. Sub rounded. Ironstone fragments present. Quartz fragments present. EOH.
128302	6226	144	0	2	XXXX		Concrete and ironstone boulders from bridge formation.
	6226	144	2	4	SDST	GRVL	Weathered Sandstone/gravel. Grey. Fine to medium grained. Poorly sorted. Sub rounded. Ironstone fragments present. Quartz fragments present.
	6226	144	4	5	SAND	GRVL	Gravely sand. Grey. Contains quartz grains. Ironstone fragments. Organic matter. Poorly sorted. Sub angular to sub rounded. EOH.
128300	6226	145	0	1	SAND	CLYU	Clayey sand. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Minor muscovites.
	6226	145	1	2	SDST		Weathered sandstone. Grey. Fine to medium grained. Poorly sorted. Sub rounded. Fragments friable. Contains quartz grains.
	6226	145	2	4	XXXX		Core lost.
	6226	145	4	5	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments very friable.
	6226	145	5	6	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	145	6	12	SDST		Sandstone. Hard rock. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	145	12	13	SDST		Weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites. Significant opaques.
	6226	145	13	14	SDST		Sandstone. Hard rock. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. EOH.
128299	6226	146	0	1	SAND	CLYU	Clayey sand. Brown. Medium to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	146	1	2	SAND	SDST	Sand with weathered sandstone. Grey. Slight sulphuric smell. Fine to medium grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	146	2	3	SDST	GRVL	Sandstone gravel. Contains ironstone and quartz fragments. Large to fine grained. Poorly sorted. Sub angular to sub rounded. Organic matter. Strong sulphuric smell.
	6226	146	3	7	SDST		Sandstone. Hard rock. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites.
	6226	146	7	10	SDST		Sandstone. Hard rock. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. EOH.
128298	6226	147	0	1	SAND		Sand. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques and muscovites.
	6226	147	1	2	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.

	6226	147	2	3	SDST	GRVL	Weathered sandstone gravel. Contains ironstone and quartz fragments. Large to fine grained. Poorly sorted. Sub angular to sub rounded. Organic matter. Strong sulphuric smell. Minor muscovites and opaques.
	6226	147	3	4	SDST		Weathered sandstone contains quartz grains. Grey. Large to fine grained. Poorly sorted. Sub angular to sub rounded. Organic matter. Strong sulphuric smell. Minor muscovites and opaques.
	6226	147	4	6	SDST		Weathered sandstone contains quartz grains. Grey. Medium to fine grained. Poorly sorted. Sub angular to sub rounded. Organic matter. Strong sulphuric smell. Minor opaques. EOH.
128297	6226	148	0	1	SAND	CLYU	Clayey sand. Light brown. Fine grained. Well sorted. Sub rounded. Minor muscovites and opaques.
	6226	148	1	2	SAND	CLYU	Clayey sand. Brown. Fine grained. Well sorted. Sub rounded. Minor muscovites. Low plasticity.
	6226	148	2	3	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites and opaques. EOH.
128296	6226	149	0	1	SAND		Sand. Yellow. Fine grained. Well sorted. Sub rounded. Minor muscovites and opaques.
	6226	149	1	3	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Muscovites Present. Very minor opaques.
	6226	149	3	4	SAND	SDST	Brown sand containing weathered sandstone and schist. Fine to medium grained. Poorly sorted. Sub angular to sub rounded. Minor muscovites and opaques. Some chloritic alteration. EOH.
128295	6226	150	0	1	SAND		Sand. Yellow. Fine grained. Well sorted. Sub rounded. Minor muscovites and opaques.
	6226	150	1	2	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor muscovites.
	6226	150	2	3	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. EOH.
128311	6226	151	0	0.5	SOIL	SAND	Sandy topsoil. Light yellow. Fine grained. Moderately sorted. Sub rounded.
	6226	151	0.5	1.5	SAND	CLYU	Clayey sand. Orangey brown. Fine - very fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	151	1.5	2	CLYU	SAND	Sandy clay. Very dry. Brown. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques and muscovites.
	6226	151	2	2.5	CLYU	SAND	Sandy clay. Dry. Orangey brown. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites.
	6226	151	2.5	3	CLYU	SAND	Sandy clay. Grey. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites.
	6226	151	3	3.5	CLYU	SAND	Sandy clay. Orangey brown. Fine - very fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	151	3.5	4	CLYU	SAND	Sandy clay. Greyish orange. Fine - very fine grained. Moderately sorted. Sub rounded. Fragments friable.

						Minor opaques.
6226	151	4	4.5	SAND	CLYU	Clayey sand. Brown. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques and muscovites. Minor rock fragments present, weathered grey sandstone, rock fragments can be up to 2.5cm long.
6226	151	4.5	5.5	SAND	CLYU	Clayey sand. Brown. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques and muscovites. No rock fragments present.
6226	151	5.5	7.3	SAND	CLYU	Clayey sand. Dark grey. Very fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques. Muscovites present.
6226	151	7.3	8.6	SAND	CLYU	Clayey sand. Yellow. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
6226	151	8.6	8.7	SAND	CLYU	Clayey sand. Orangey brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
6226	151	8.7	10	XXXX	XXXX	Core lost
6226	151	10	12.4	SCHT		Highly weathered schist. Greyish brown. Very fine grained. Well sorted. Sub rounded. Fragments friable. Significant muscovites present.
6226	151	12.4	14	SCHT		Highly weathered schist. Brown. Fine grained. Well sorted. Sub rounded. Fragments friable. High muscovite content. Slight iron staining. Sample contained quartz vein from 12.4 to 12.8 m.
6226	151	14	19.3	SCHT		Schist. Brown. Fine grained. Well sorted. Sub rounded. Fragments friable. High muscovite and opaque content. Very slight iron staining.
6226	151	19.3	19.9	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites. Heavy iron staining.
6226	151	19.9	21.3	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor muscovites. Iron staining on fracture faces. Contains major quartz vein from 19.9 to 20.5 present in a mica cement. Sample also contains a minor quartz vein at 20.9m.
6226	151	21.3	22.8	SCHT		Schist. Brown. Fine grained. Well sorted. Sub rounded. Fragments friable. High muscovite and opaque content. Very slight iron staining.
6226	151	22.8	24.4	SCHT		Schist. Brown. Fine grained. Well sorted. Sub rounded. Fragments slightly friable. High muscovite and opaque content. Slight iron staining. Minor quartz vein at 23.6 m.
6226	151	24.4	28.5	SDST		Sandstone. Greyish yellow. Fine grained. Well sorted. Sub rounded. Fragments not friable. Minor muscovites and opaques. Slight iron staining. Minor quartz bands located at 25.8 m and 26.9 to 27.9 m.

	6226	151	28.5	29	SCHT		Schist. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques. High muscovite content. Slight iron staining.
	6226	151	29	30.6	SCHT		Schist. Grey. Fine grained. Well sorted. Sub rounded. Fragments slightly friable. Minor opaques. High muscovite content. Slight iron staining.
	6226	151	30.6	31.2	SCHT		Schist. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Minor opaques. High muscovite content. Slight iron staining.
	6226	151	31.2	32	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Slight iron staining.
	6226	151	32	35	SDST		Sandstone. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. Very thin quartz band (<0.5mm thick) surrounded in white siltstone with high muscovite content, slight mica texture 32 to 32.4 m. Slight mica content from 33.1 to 35 m. EOH.
128309	6226	152	0	1	SOIL	SAND	Sandy topsoil. Light brown. Fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	152	1	2	CLYU	SAND	Sandy clay. Orangey brown. Very fine - fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	152	2	3	CLYU	SAND	Sandy clay. Grey. Very fine - fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	152	3	5	SAND	CLYU	Clayey sand. Brownish grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Opaques present.
	6226	152	5	7	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Opaques and muscovites present.
	6226	152	7	9	SAND		Sand/gravel. Small quartz grains present. Medium - fine grained. Poorly sorted. Sub angular to sub rounded. Minor muscovites and opaques.
	6226	152	9	11	SAND		Sand. Light yellow/orange. Fine grained. Well sorted. Sub rounded. Minor opaques. Muscovites present.
	6226	152	11	16	SCHT		Very weathered schist. Brown. Fine grained. Well sorted. Sub rounded. Significant muscovite presence. Minor opaques.
	6226	152	16	17	SAND		Sand. Very high mica content >60%. Medium to fine grained. Poorly sorted. Angular to sub rounded. Significant muscovite presence. Contains some small quarts fragments.
	6226	152	17	18	SCHT		Highly weathered schist. Brown. Decreased mica content >30%. Medium to fine grained. Poorly sorted. Angular to sub rounded. Significant muscovite presence. Contains some small quarts fragments.
	6226	152	18	19	SAND		Sand. Very high mica content >60%. Medium to fine grained. Poorly sorted. Angular to sub rounded. Significant muscovite presence. Contains some small quarts fragments.

	6226	152	19	25	SCHT		Weathered schist. Brown. Fine grained. Well sorted. Sub rounded. Fragments friable. High muscovite content. Opaques present.
	6226	152	25	35	SCHT		Weathered schist. Brown. Very fine to fine grained. Well sorted. Sub rounded. Fragments friable. High muscovite content. Opaques present. EOH.
128293	6226	153	0	1	SAND	CLYU	Clayey sand. Brown. Fine to very fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	153	1	4	CLYU	SAND	Sandy clay. Grey. Fine to very fine grained. Moderately sorted. Sub rounded. Fragments friable. Very minor opaques.
	6226	153	4	5	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Very minor muscovites and opaques.
	6226	153	5	8	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	153	8	9	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques. Sample also contains significant quartz grains, can be up to 2.5 cm in length.
	6226	153	9	10	SAND		Sand. Yellow. Fine grained. Well sorted. Sub rounded. Minor opaques. EOH.
128292	6226	154	0	1	SAND		Sand. Yellow. Very fine to fine grained. Moderately sorted. Sub rounded.
	6226	154	1	3	CLYU	SAND	Sandy clay. Grey. Very fine to fine grained. Moderately sorted. Sub rounded.
	6226	154	3	4	SAND	CLYU	Clayey sand, small clay component. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	154	4	6	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. EOH.
128307	6226	155	0	1	CLYU	SAND	Slightly sandy clay. Minor muscovite. Slightly greasy feel. Soft. Sticky. Low plasticity. Damp.
	6226	155	1	3	SAND	SILT	Silty sand. Dark grey/brown. Fine grained. Poorly sorted. Sub angular to sub rounded. Minor opaques.
	6226	155	3	4	CLYU		Clay. Blue/grey. Moderate stiffness. Low plasticity. Moderate density. Sticky.
	6226	155	4	5	SILT		Silt with gravel layers. Dark grey. Gravel: poorly sorted. Sub angular to sub rounded. Up to 5mm. Low to moderate sphericity. Dominant quartz clear and milky. Organic material.
	6226	155	5	7	CLAY	SAND	Sandy clay with gravel layers. Poorly sorted. Clay: soft. Moderate plasticity. Moderate density. Gravel: quartz. Angular to sub angular. Moderate to low sphericity. Sand: fine to medium grained. Sub rounded. Minor opaques. Clear quartz.
	6226	155	7	8	SAND	CLYU	Clayey sand. Grey. Fine grained. Moderately to poorly sorted. Sub angular to sub rounded. Minor opaques. Moderate sphericity. EOH.

128306	6226	156	0	1	CLYU	SAND	Sandy clay. Dark brown/grey. Soft. Low plasticity. Pliable. Moderate to low density. Minor muscovites and organic matter.
	6226	156	1	3	SAND	SILT	Silty sand. Dark brown. Moderately to poorly sorted. Moderate sphericity. Sub angular to sub rounded. Minor organic matter. Minor opaques and muscovites.
	6226	156	3	4	SAND	CLYU	Clayey sand. Blue/grey. Moderately to poorly sorted. Sub angular to sub rounded. Moderate to low sphericity. Minor opaques mainly quartz sand, clear–milky. EOH.
128308a	6226	157	0	3	CLYU	SAND	Sandy clay. Light brown/yellow. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	157	3	4	SAND	CLYU	Clayey sand. Reddish brown. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	157	4	6	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	157	6	7	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites. Opaques present. Sample contains small quartz grains.
	6226	157	7	8	GRVL		Quartz gravel. Varying sizes <1 cm to 5 cm.
	6226	157	8	11	SAND		Sand. Greyish yellow. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor quartz grains present.
	6226	157	11	13	SAND		Sand. Grey. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques present. Sample contains significant quartz grains.
	6226	157	13	14	SAND		Sand. Grey. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques present. Sample contains organic matter.
	6226	157	14	15	SAND		Sand. Grey. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques present. Sample contains large quartz grains.
	6226	157	15	16	SAND	CLYU	Clayey sand low clay content. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. Large quartz grains present.
	6226	157	16	18	SAND	GRVL	Gravely sand. Brownish grey. Sand: Fine grained. Well sorted. Sub rounded. Gravel: Quartz of varying sizes, from <5mm to 2.5cm.
	6226	157	18	21	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor quartz grains. Organic matter present from 20–21 m.
	6226	157	21	31	SAND	CLUY	Clayey sand low clay content. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites. Small quartz grains present. EOH.

128308b	6226	158	0	1	XXXX		Hollow auguring so samples only every 2 m
	6226	158	1	1.5	CLYU	SAND	Sandy clay. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	158	2.5	3	SAND	CLYU	Clayey sand. Orangey red. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	158	4	4.5	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques. Sample contains quartz band with grains ranging up to 2 cm in length.
	6226	158	5.5	7.5	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Very minor opaques. Contains band of pure quartz sand from 7 to 7.5 m.
	6226	158	8.5	10	SAND	CLYU	Clayey sand. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Moderate plasticity. EOH.
128294	6226	159	0	2	SAND	CLYU	Clayey sand. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Very minor muscovites.
	6226	159	2	5	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	159	5	6	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. EOH.
128313	6226	161	0	1	SAND	CLYU	Clayey sand. Yellow/brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	161	1	2	CLYU	SAND	Sandy clay. Orange/red. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	161	2	3	CLYU	SAND	Sandy clay. Low sand content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	161	3	4.5	SAND	CLYU	Clayey sand. Low clay content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	161	4.5	5.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Low plasticity. Soapy feel.
	6226	161	5.5	6	SAND		Sand. Light grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	161	6	7	XXXX		Core lost.
	6226	161	7	7.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Moderate plasticity. Soapy feel.
	6226	161	7.5	8	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
	6226	161	8	11	XXXX		Core lost.
	6226	161	11	13	CLYU		Clay. Black. Dense. High plasticity. Slightly sticky. Minor muscovites.
	6226	161	13	13.5	SAND	CLYU	Clayey sand. Black. Significant organic matter smell. Fine grained. Well sorted. Sub rounded. Significant muscovite content.

	6226	161	13.5	14.5	XXXX		Core lost.
	6226	161	14.5	17	SAND	CLYU	Clayey sand. Dark grey. Fine grained. Well sorted. Sub rounded. Muscovites present.
	6226	161	17	22	XXXX		Core lost.
	6226	161	22	24.5	SAND	CLYU	Clayey sand. Black. Significant organic matter smell. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	161	24.5	25.5	CLYU		Clay. Black. High density. High plasticity. Sticky. Significant muscovite presence.
	6226	161	25.5	28	SAND	CLYU	Clayey sand. Black/grey. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	161	28	33	SDST		Highly weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Opaques present. Quartz band present at 32.3 m quartz fragments can be up to 2.5cm in length.
	6226	161	33	33.5	SCHT		Schist. Black. Fine grained. Well sorted. Sub rounded. Significant opaque and muscovite presence.
	6226	161	33.5	36.4	SDST		Sandstone. Hard rock. Fine grained. Well sorted. Sub rounded. High muscovite presence. Opaques present.
	6226	161	36.4	36.5	CLYU	SAND	Sandy clay. Black. High density. Moderate plasticity. High muscovite presence.
	6226	161	36.5	44	SDST		Sandstone. Hard rock. Fine grained. Well sorted. Sub rounded. High muscovite presence. Opaques present. Slight iron staining on fracture faces. Some chloritic alteration.
	6226	161	44	44.5	SCHT		Schist. Black/brown. Fine grained. Well sorted. Sub rounded. Significant opaque and muscovite presence.
	6226	161	44.5	48.5	SDST		Sandstone. Hard rock. Fine grained. Well sorted. Sub rounded. Slight iron staining on fracture faces. Some chloritic alteration.
	6226	161	48.5	53	SDST		Sandstone. Hard rock. Fine grained. Well sorted. Sub rounded. Slight iron/copper staining on fracture faces. Some chloritic alteration. High muscovite presence from 52.5 to 53 m. EOH.
128291	6226	162	0	1	SAND	CLYU	Clayey sand. Yellow/brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	162	1	2	CLYU	SAND	Sandy clay. Orange/red. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	162	2	3	CLYU	SAND	Sandy clay. Low sand content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	162	3	4.5	SAND	CLYU	Clayey sand. Low clay content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	162	4.5	5.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Low plasticity. Soapy feel.
	6226	162	5.5	6	SAND		Sand. Light grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	162	6	7	XXXX		Core lost.

	6226	162	7	7.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Moderate plasticity. Soapy feel.
	6226	162	7.5	8	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
	6226	162	8	11	XXXX		Core lost.
	6226	162	11	13	CLYU		Clay. Black. Dense. High plasticity. Slightly sticky. Minor muscovites.
	6226	162	13	13.5	SAND	CLYU	Clayey sand. Black. Significant organic matter smell. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	162	13.5	14.5	XXXX		Core lost.
	6226	162	14.5	17	SAND	CLYU	Clayey sand. Dark grey. Fine grained. Well sorted. Sub rounded. Muscovites present.
	6226	162	17	22	XXXX		Core lost.
	6226	162	22	24.5	SAND	CLYU	Clayey sand. Black. Significant organic matter smell. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	162	24.5	25.5	CLYU		Clay. Black. High density. High plasticity. Sticky. Significant muscovite presence.
	6226	162	25.5	28	SAND	CLYU	Clayey sand. Black/grey. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	162	28	28.5	SDST		Highly weathered sandstone. Grey. Fine grained. Well sorted. Sub rounded. Fragments friable. Opaques present. Quartz band present at 32.3 m quartz fragments can be up to 2.5 cm in length. EOH.
128290	6226	163	0	1	SAND	CLYU	Clayey sand. Yellow/brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	163	1	2	CLYU	SAND	Sandy clay. Orange/red. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	163	2	3	CLYU	SAND	Sandy clay. Low sand content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	163	3	4.5	SAND	CLYU	Clayey sand. Low clay content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	163	4.5	5.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Low plasticity. Soapy feel.
	6226	163	5.5	6	SAND		Sand. Light grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	163	6	7	XXXX		Core lost.
	6226	163	7	7.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Moderate plasticity. Soapy feel.
	6226	163	7.5	8	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
	6226	163	8	11	XXXX		Core lost.

	6226	163	11	13	CLYU		Clay. Black. Dense. High plasticity. Slightly sticky. Minor muscovites.
	6226	163	13	13.5	SAND	CLYU	Clayey sand. Black. Significant organic matter smell. Fine grained. Well sorted. Sub rounded. Significant muscovite content.
	6226	163	13.5	14.5	XXXX		Core lost.
	6226	163	14.5	15	SAND	CLYU	Clayey sand. Dark grey. Fine grained. Well sorted. Sub rounded. Muscovites present. EOH.
128289	6226	164	0	1	SAND	CLYU	Clayey sand. Yellow/brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	164	1	2	CLYU	SAND	Sandy clay. Orange/red. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	164	2	3	CLYU	SAND	Sandy clay. Low sand content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	164	3	4.5	SAND	CLYU	Clayey sand. Low clay content. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	164	4.5	5.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Low plasticity. Soapy feel.
	6226	164	5.5	6	SAND		Sand. Light grey. Fine grained. Well sorted. Sub rounded. Minor opaques.
	6226	164	6	7	XXXX		Core lost.
	6226	164	7	7.5	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Dry/hard. Dense. Moderate plasticity. Soapy feel.
	6226	164	7.5	8	SAND		Sand. Brown. Fine grained. Well sorted. Sub rounded. Minor opaques and muscovites.
	6226	164	8	9	XXXX		Core lost. EOH.
128288	6226	165	0	2	SAND	CLYU	Clayey sand. Light brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	165	2	7	CLYU	SAND	Sandy clay. Grey/orange. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. High plasticity. Sticky. Moderate density.
	6226	165	7	8	CLYU	SAND	Sandy clay. Grey/brown. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. Low plasticity. Sticky. Low density.
	6226	165	8	14.5	CLYU	SAND	Sandy clay. Grey/brown. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. Very low plasticity. Sticky. Low density.
	6226	165	14.5	15	SAND	CLYU	Clayey sand. Low clay content. Very fine to fine grained. Moderately sorted. Sub rounded. Significant muscovites. Opaques present. EOH.
128287	6226	166	0	2	SAND	CLYU	Clayey sand. Light brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable.

							Minor opaques.
	6226	166	2	7	CLYU	SAND	Sandy clay. Grey/orange. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. High plasticity. Sticky. Moderate density.
	6226	166	7	8	CLYU	SAND	Sandy clay. Grey/brown. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. Low plasticity. Sticky. Low density.
	6226	166	8	9	CLYU	SAND	Sandy clay. Grey/brown. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. Very low plasticity. Sticky. Low density. EOH.
128286	6226	167	0	2	SAND	CLYU	Clayey sand. Light brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	167	2	5	CLYU	SAND	Sandy clay. Grey/orange. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. High plasticity. Sticky. Moderate density. EOH.
129442	6226	168	0	2	SAND	CLYU	Clayey sand. Light brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques.
	6226	168	2	3	CLYU	SAND	Sandy clay. Grey/orange. Fine to medium grained. Moderately sorted. Sub rounded. Minor muscovites. High plasticity. Sticky. Moderate density. EOH.
128310a	6226	169	0	1	CLYU	SAND	Sandy clay. Brown. Very fine to fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques and muscovites.
	6226	169	1	2	SAND		Sand. Yellow. Very fine to fine grained. Moderately sorted. Sub rounded. Minor opaques.
	6226	169	2	6	SAND	CLYU	Clayey sand, small clay component. Grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor muscovites.
	6226	169	6	8	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites and opaques.
	6226	169	8	9	XXXX		Core lost.
	6226	169	9	15	GRVL	SAND	Sandy gravel. Grey. Fine grained. Well sorted. Sub rounded. Gravel: Quartz varying sizes. Angular to sub angular. EOH.
128310b	6226	170	0	1	SAND	CLYU	Clayey sand. Brown. Fine grained. Moderately sorted. Sub rounded. Fragments friable. Minor opaques and muscovites.
	6226	170	1	2	SAND		Sand. Brown/grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor muscovites.

	6226	170	2	5	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Very minor opaques.
	6226	170	5	11	CLYU	SAND	Sandy clay. Grey. Fine grained. Well sorted. Sub rounded. Sticky. Moderate plasticity. Low density.
	6226	170	11	12	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Muscovites present. Minor opaques.
	6226	170	12	19	XXXX		Core lost.
	6226	170	19	19.5	CLYU	SAND	Sandy clay. Black. Fine grained. Well sorted. Sub rounded. Muscovites present. Moderate plasticity. Moderately sticky.
	6226	170	19.5	27	XXXX		Core lost.
	6226	170	27	27.75	CLYU		Clay. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites. High plasticity. Sticky. Dense. EOH.
129441	6226	171	0	1	SAND	CLYU	Clayey sand. Brownish yellow. Medium to fine grained. Moderately sorted. Sub rounded. Opaques present.
	6226	171	1	2	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites.
	6226	171	2	5	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites. Wet.
	6226	171	5	15	XXXX		Core lost. EOH.
129440	6226	172	0	1	SAND	CLYU	Clayey sand. Brownish yellow. Medium to fine grained. Moderately sorted. Sub rounded. Opaques present.
	6226	172	1	2	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites.
	6226	172	2	6	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Minor muscovites. Wet.
	6226	172	6	7	SAND	CLYU	Clayey sand. Black. Fine grained. Well sorted. Sub rounded. Moderate plasticity.
	6226	172	7	9	XXXX		Core lost. EOH.
129439	6226	173	0	1	SAND	CLYU	Clayey sand. Brown. Fine grained. Moderately sorted. Sub rounded. Minor muscovites and opaques.
	6226	173	1	2	SAND		Sand. Light grey. Fine grained. Well sorted. Sub rounded. Minor opaques. Very minor muscovites.
	6226	173	2	4	SAND		Sand. Grey. Fine grained. Well sorted. Sub rounded. Very minor opaques.
	6226	173	4	5	SAND	CLYU	Clayey sand. Dark grey. Fine grained. Moderately sorted. Sub rounded. Minor muscovites and opaques. Sticky. Moderate plasticity. EOH.

EOH – End of Hole

UNITS OF MEASUREMENT

Units of measurement commonly used (SI and non-SI Australian legal)

Name of unit	Symbol	Definition in terms of other metric units	Quantity
day	d	24 h	time interval
gigalitre	GL	10^6 m^3	volume
gram	g	10^{-3} kg	mass
hectare	ha	10^4 m^2	area
hour	h	60 min	time interval
kilogram	kg	base unit	mass
kilolitre	kL	1 m^3	volume
kilometre	km	10^3 m	length
litre	L	10^{-3} m^3	volume
megalitre	ML	10^3 m^3	volume
metre	m	base unit	length
microgram	µg	10^{-6} g	mass
microlitre	µL	10^{-9} m^3	volume
milligram	mg	10^{-3} g	mass
millilitre	mL	10^{-6} m^3	volume
millimetre	mm	10^{-3} m	length
minute	min	60 s	time interval
second	s	base unit	time interval
tonne	t	1000 kg	mass
year	y	365 or 366 days	time interval

EC electrical conductivity (µS/cm)

pH acidity

GLOSSARY

Aquifer— An underground layer of rock or sediment which holds water and allows water to percolate through

Aquifer, confined — Aquifer in which the upper surface is impervious and the water is held at greater than atmospheric pressure. Water in a penetrating well will rise above the surface of the aquifer

Aquifer, unconfined— Aquifer in which the upper surface has free connection to the ground surface and the water surface is at atmospheric pressure

Baseflow— The water in a stream that results from groundwater discharge to the stream; this discharge often maintains flows during seasonal dry periods and has important ecological functions

Bore— *See well*

Catchment — A catchment is that area of land determined by topographic features within which rainfall will contribute to runoff at a particular point

DEH — Department for Environment and Heritage, Government of South Australia

DWLBC — Department of Water, Land and Biodiversity Conservation, Government of South Australia

EC— Abbreviation for electrical conductivity; 1 EC unit = 1 micro-Siemen per centimetre (µS/cm) measured at 25 degrees Celsius; commonly used to indicate the salinity of water

EIA — Environmental Impact Statement

Ephemeral streams/wetlands— Those streams or wetlands that usually contain water only on an occasional basis after rainfall events. Many arid zone streams and wetlands are ephemeral

Estuaries— Semi-enclosed waterbodies at the lower end of a freshwater stream that are subject to marine, freshwater and terrestrial influences and experience periodic fluctuations and gradients in salinity

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

Floodplain — Of a watercourse means: (a) the floodplain (if any) of the watercourse identified in a catchment water management plan or a local water management plan; adopted under Part 7 of the Water Resources Act 1997; or (b) where paragraph (a) does not apply — the floodplain (if any) of the watercourse identified in a development plan under the Development Act 1993, or (c) where neither paragraph (a) nor paragraph (b) applies — the land adjoining the watercourse that is periodically subject to flooding from the watercourse

FRA — Fractured Rock Aquifer

Gigalitre (GL)— One thousand million litres (1 000 000 000)

GIS (geographic information system) — Computer software allows for the linking of geographic data (for example land parcels) to textual data (soil type, land value, ownership); it allows for a range of features, from simple map production to complex data analysis

Groundwater— *See underground water*

Hydrogeology — The study of groundwater, which includes its occurrence, recharge and discharge processes and the properties of aquifers;*see hydrology*

Hydrology — The study of the characteristics, occurrence, movement and utilisation of water on and below the earth's surface and within its atmosphere; *See hydrogeology*

NWI — National Water Initiative

Permeability — A measure of the ease with which water flows through an aquifer or aquitard

PIRSA — Department of Primary Industries and Resources SA, Government of South Australia

Potentiometric head — The potentiometric head or surface is the level to which water rises in a well due to water pressure in the aquifer

Recharge area — The area of land from which water from the surface (rainfall, streamflow, irrigation, etc.) infiltrates into an aquifer;

RRC — Rocky River Catchment

Surface water — (a) water flowing over land (except in a watercourse), (i) after having fallen as rain or hail or having precipitated in any another manner, (ii) or after rising to the surface naturally from underground; (b) water of the kind referred to in paragraph (a) that has been collected in a dam or reservoir

Underground water (groundwater) — Water occurring naturally below ground level or water pumped, diverted or released into a well for storage underground

Waterbody — Waterbodies include watercourses, riparian zones, floodplains, wetlands, estuaries, lakes and groundwater aquifers

Watercourse — A river, creek or other natural watercourse (whether modified or not) and includes: a dam or reservoir that collects water flowing in a watercourse; and a lake through which water flows; and a channel (but not a channel declared by regulation to be excluded from the this definition) into which the water of a watercourse has been diverted; and part of a watercourse

Well — (a) an opening in the ground excavated for the purpose of obtaining access to underground water; (b) an opening in the ground excavated for some other purpose but that gives access to underground water; (c) a natural opening in the ground that gives access to underground water

REFERENCES

Barnett SR and Dodds AR, 2000, *Groundwater resources on Kangaroo Island*, PIRSA Report 2000/00015, client report for Primary Industries and Resources SA, Government of South Australia

Nilsen T, 2006, *Technical background to water management planning on Kangaroo Island, South Australia*, Report produced for the Kangaroo Island Natural Resources Management Board, South Australia

Shand P, James-Smith J, Love AJ, Nilsen T and Thomas D, 2006, *Hydrogeochemistry of surface waters and groundwaters, Kangaroo Island,* DWLBC Report 2007/18, Department of Water, Land and Biodiversity Conservation, Government of South Australia