TECHNICAL NOTE 2012/05

Department for Environment, Water and Natural Resources

SOUTH EAST TOWN WATER SUPPLY – MOUNT BURR TWS 5 AND TWS 6 – MOUNT BURR, SOUTH AUSTRALIA

Jeff Lawson, Stephen Howles and Adrian Costar

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Department of Environment, Water and Natural Resources

Science, Monitoring and Information Division

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.waterforgood.sa.gov.au	

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INTRODUCTION

In early 2011 the former Department for Water (DFW)), now the Department for Environment, Water and Natural Resources (DEWNR), was contracted by the South Australian Water Corporation (SA Water) to drill and construct two production wells for the township of Mount Burr in the South East region of South Australia, a region also known as the Limestone Coast. These wells were part of a program of work undertaken during the first half of 2012 which also included the drilling and construction of production wells at Millicent, Naracoorte, Lucindale, and Kalangadoo. This report discusses the drilling and construction of production wells Mount Burr TWS 5 and TWS 6. The new wells were replacement wells for the existing production wells Mount Burr TWS 3 and TWS 1 respectively.

The original wells were drilled by the Department for Mines in the 1960's and used steel casing to support the unconsolidated volcanic sediments. Casing integrity checks indicated corrosion of the steel casing which was considered a risk to the long-term viability of the wells.

Diverse Resources Group Pty Ltd was contracted to drill and construct the new wells. Drilling commenced on 19 April 2012 and was completed approximately 3 weeks later.

DFW Groundwater Technical Services conducted pumping tests in May 2012.

MOUNT BURR TOWN WATER SUPPLY

Mount Burr is located approximately 40 kilometres north west of Mt Gambier and is reliant on groundwater from the Gambier Limestone unconfined aquifer for its town water supply. Prior to commencement of this project two production wells were in use: TWS 1 and TWS 3.

The groundwater salinity in the vicinity of Mount Burr TWS 1 and 3 in the Gambier Limestone is approximately 450 mg/L.

The pumping rate from Mount Burr TWS 1 was approximately 12.7 L/s while Mount Burr TWS 3 was approximately 10 L/s.

Details of the Mount Burr production wells (historic and current) are given in Table 1. The location of the new and pre-existing wells is given in Fig. 1.

Table 1. Mount Burr production well details (Gambier Limestone)

Well name	Unit number	Drill date	Depth (m)	Obs date	DTW (m)	Obs date	TDS (mg/L)	Obs date	Yield (L/s)
Mount Burr TWS 1	6922-1164	14 Nov 1962 (1945)	124.97 (129.54)	14 Nov 1962	28.04	29 Mar 2011	483	N/A	10.1
Mount Burr TWS 2	6922-4098	26 Jun 1953	96.01	26 Jun 1953	21.95	29 Mar 2011	410	26 Jun 1953	12.6
Mount Burr TWS 3	6922-1167	5 Feb 1965	161.54	5 Feb 1965	50.29	27 Feb 1991	430	5 Feb 1965	2.5
Mount Burr TWS 5	6922-4726	27 Apr 2012	165.0	27 Apr 2012	52.70	27 Apr 2011	401	27 Apr 2012	8.3
Mount Burr TWS 6	6922-4725	8 May 2012	132.0	8 May 2012	34.80	8 May 2012	468	8 May 2012	6.0

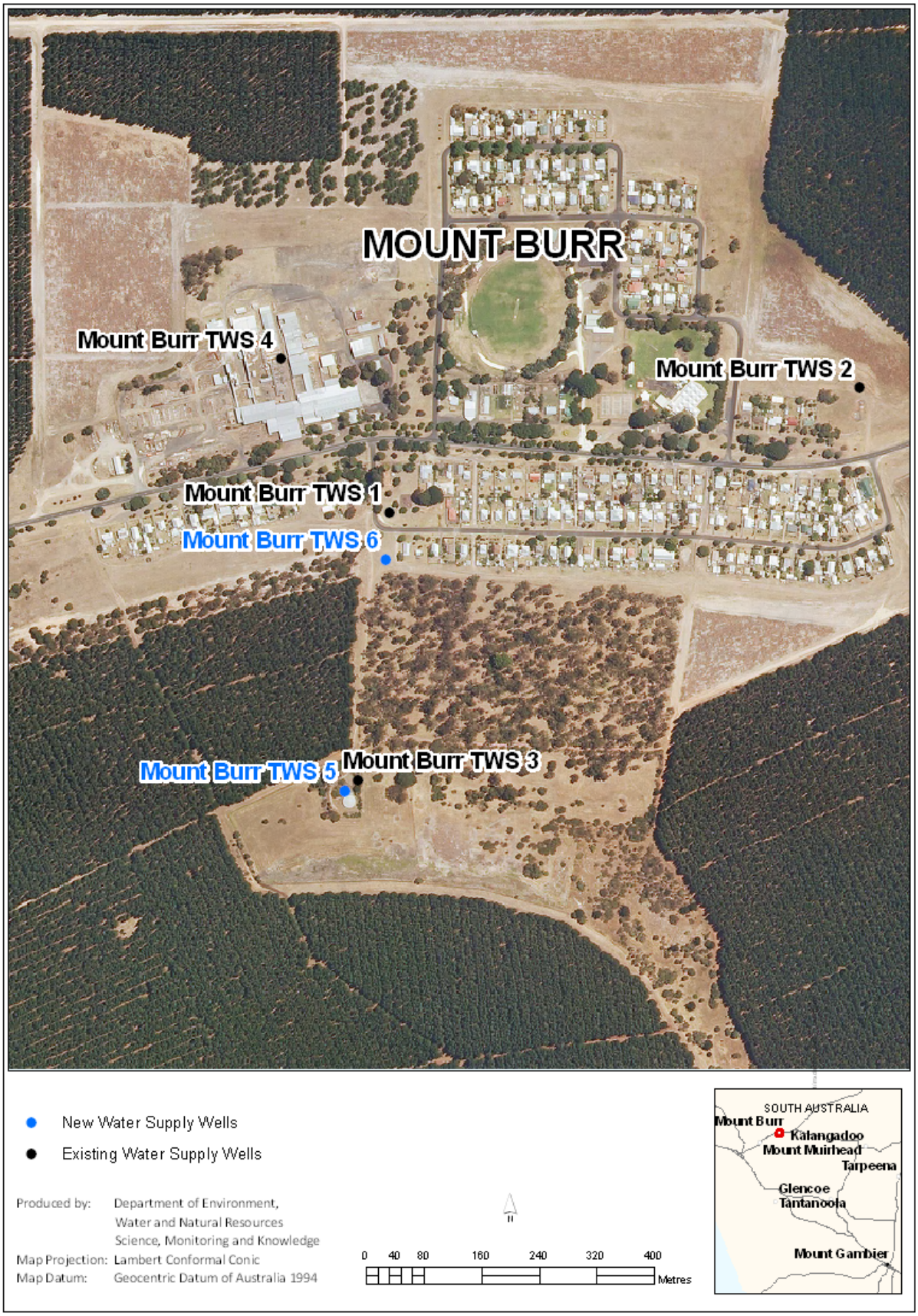


Figure 1. Location of Mount Burr production wells

WELL DESIGN AND CONSTRUCTION

MOUNT BURR TWS 5

Diverse Resources Group Pty Ltd was engaged by DFW to drill and construct the production wells. The drilling rig employed for the drilling operations was an Atlas Copco T3W. This rig is capable of rotary air rotary mud drilling methods.

The site of Mount Burr TWS 5 (Fig. 1) was chosen by SA Water Hydrogeologists to target the unconfined Gambier Limestone aquifer system.

Mount Burr TWS 5 was drilled as a production well under permit number 208588 (well unit number 6922-4726) and was completed on 27 April 2012.

The final design of Mount Burr TWS 5 was based on information gathered during drilling. Strata samples were collected every two metres. The well construction diagram (Fig. 2) shows the lithology encountered during drilling.

The well was drilled and constructed according to the following steps:

- The pilot drillhole was mud drilled to the casing point at 122 m using a 203 mm (8 inch) blade bit
- Severe lost-circulation problems occurred during the drilling of this well due to the karstic nature of the limestone
- The pilot drillhole was reamed to 17 m using a 450 mm (17.7 inch) blade bit
- Steel surface control casing 355 mm (14 inch) ID was run into the drillhole to a depth of 17 m
- The pilot drillhole was reamed to 122 m using a 350 mm (13.8 inch) blade bit
- A Class 12 PVC 253 mm (10 inch) ID casing string was run into the drillhole to a depth of 114 m
- The casing was pressure displacement cemented to surface
- Once the grout had set, the pilot drillhole was mud drilled to total depth at 165 m using a 245 mm (9.6 inch) blade bit
- The well was completed with an open hole production zone 114–165 m
- Development of the well was undertaken by airlifting from a depth of 112 m (2 m above the open hole section) until the groundwater produced from the well was clear and free of suspended solids. Airlifting was controlled and full development was achieved after 120 min. The well was airlifted to a maximum yield of 8 L/s.

Sterilisation of the well was achieved by adding chlorine to the drilling fluid and maintaining this throughout the drilling process.

A final depth to water of 52.7 m (note depth to water was actually 72 m the anomaly being due to the well not having recovered from development) and a yield of 8.3 L/s were recorded at the conclusion of drilling.

Groundwater salinity was 480 mg/L (871 uScm) based on the result of laboratory water chemisty analysis.

The Drillers Well Construction Report (Schedule 8) is given in Appendix A and a water well log (including lithological / stratigraphic description) is given in Appendix B.

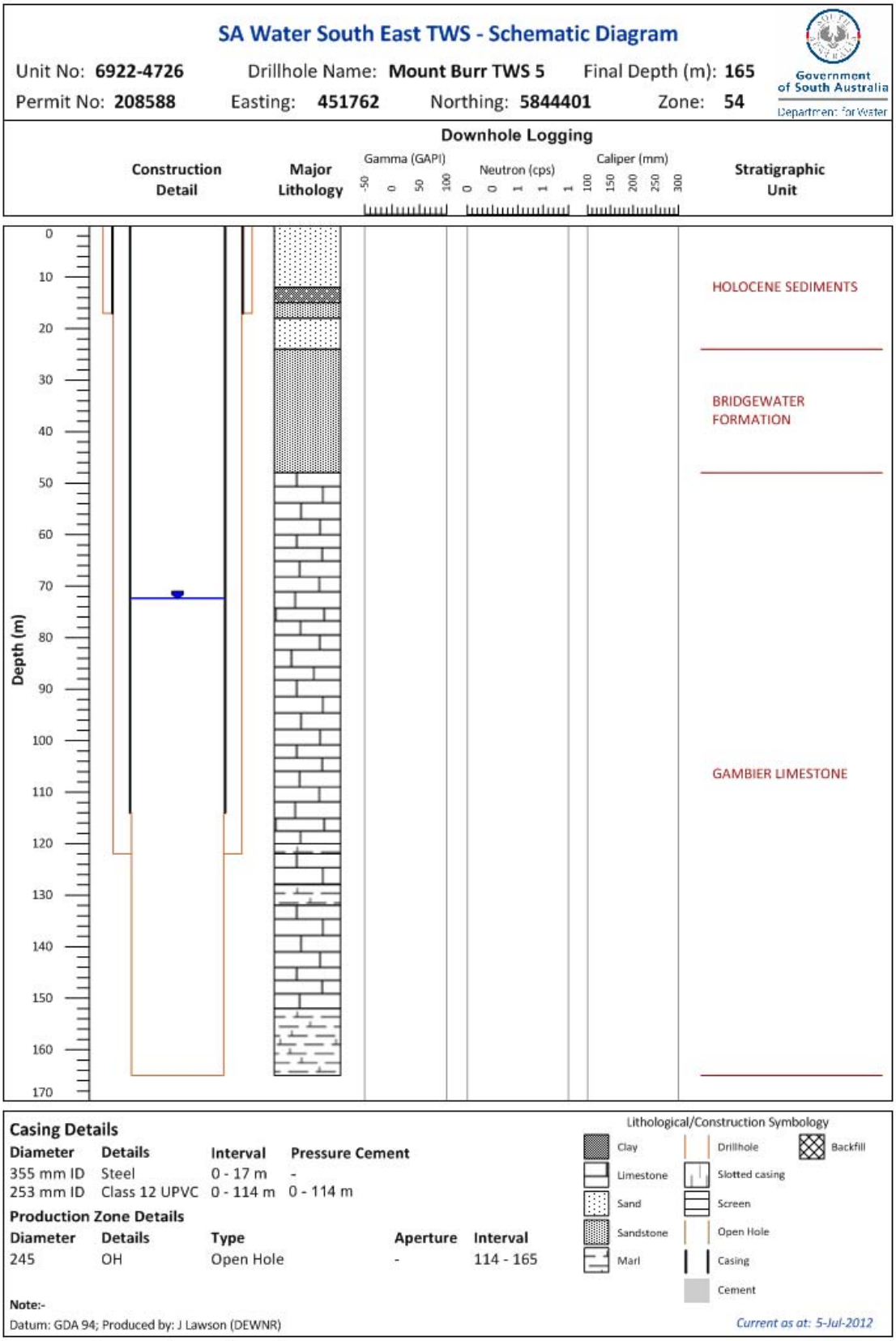


Figure 2. Well construction diagram and lithological sequence Mount Burr TWS 5

MOUNT BURR TWS 6

The site of Mount Burr TWS 6 (Fig. 1) was chosen by SA Water Hydrogeologists to target the unconfined Gambier Limestone aquifer system.

Mount Burr TWS 6 was drilled as a production well under permit number 208590 (well unit number 6922-4725) and was completed on 8 May 2012.

The final design of Mount Burr TWS 6 was based on information gathered during drilling. Strata samples were collected every two metres. The well construction diagram (Fig. 3) gives the lithology encountered during drilling.

The well was drilled and constructed according to the following steps:

- The pilot drillhole was mud drilled to the casing point at 70 m using a 203 mm (8 inch) blade bit
- The pilot drillhole was reamed to 17 m using a 450 mm (17.7 inch) blade bit
- Steel surface control casing 355 mm (14 inch) ID was run into the drillhole to a depth of 17 m
- The pilot drillhole was reamed to 70 m using a 345 mm (13.6 inch) blade bit
- A Class 12 PVC 253 mm (10 inch) ID casing string was run into the drillhole to a depth of 68 m
- The casing was pressure displacement cemented to surface
- Once the grout had set, the pilot drillhole was air drilled to total depth at 132 m using a 245 mm (9.6 inch) blade bit
- The well was completed with an open hole production zone 68–132 m
- Development of the well was undertaken by airlifting from a depth of 56 m (2 m above the open hole section) until the groundwater produced from the well was clear and free of suspended solids. Airlifting was controlled and full development was achieved after 120 min. The well was airlifted to a maximum yield of 10 L/s.

Sterilisation of the well was achieved by adding chlorine to the drilling fluid and maintaining this throughout the drilling process.

A final depth to water of 34.8 m (note depth to water is actually 41 m, the anomaly being due to the well not having recovered from development) and a yield of 6 L/s were recorded at the conclusion of drilling.

No groundwater salinity data was available.

The Drillers Well Construction Report (Schedule 8) is given in Appendix A and a water well log (including lithological description) is given in Appendix B.

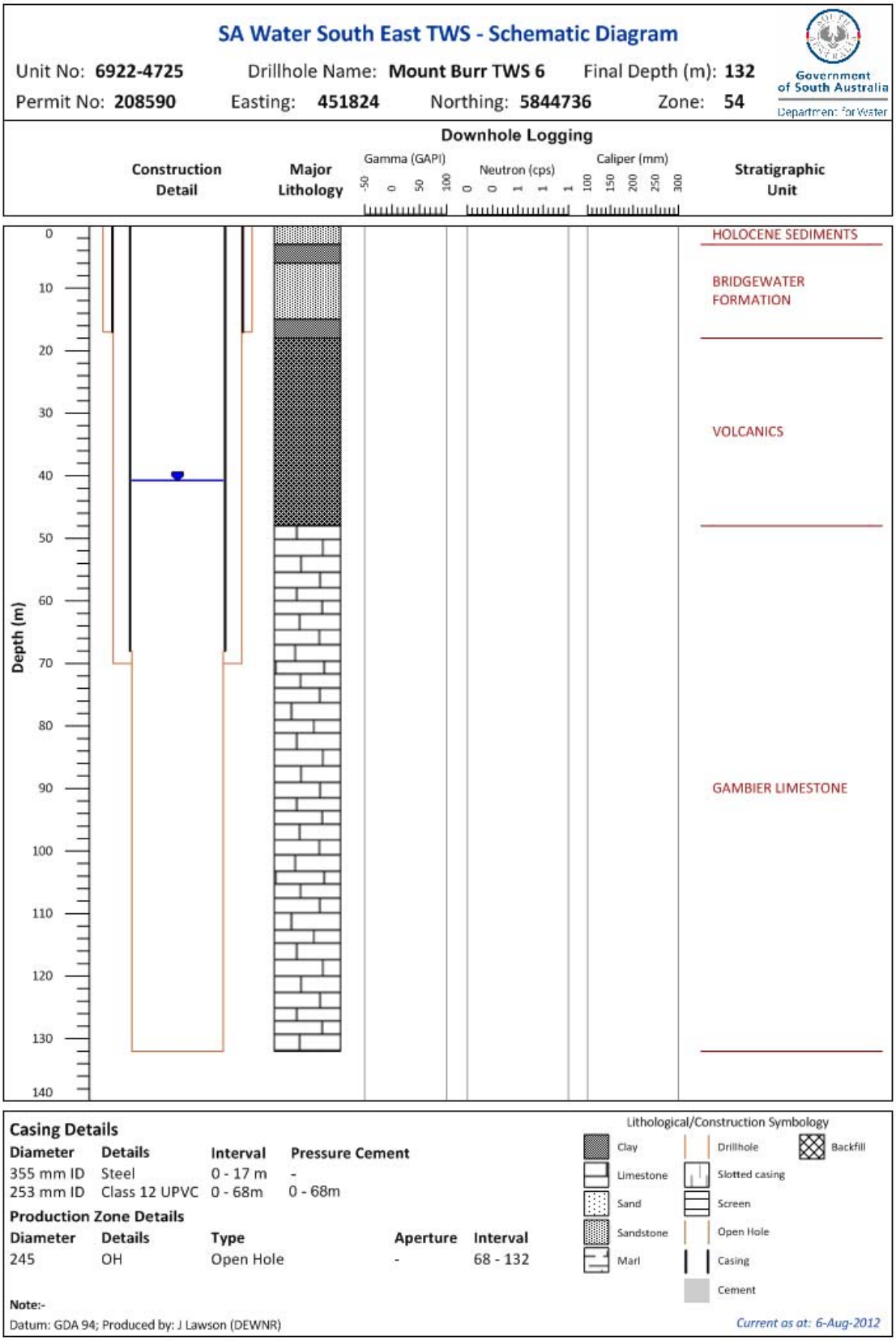


Figure 3. Well construction diagram and lithological sequence Mount Burr TWS 6

PUMPING TESTS

PUMPING TEST DESIGN

A pumping test (aquifer test) is conducted by pumping a well and observing the aquifer 'response' or drawdown in the well and / or neighbouring observation wells. Pumping tests are carried out on wells to determine one or more of the following:

- The aquifer and aquitard hydraulic parameters used to determine the ability of the aquifer to store and transmit water and which can be used in analytical and numerical groundwater modelling
- The existence and potentially location of sub-surface hydraulic boundaries which may affect, beneficially or adversely, the long-term hydraulic behaviour and pumping performance of the well
- The long-term pumping rate of the well
- The design efficiency of the well
- The performance of the groundwater basin.

In this case, pumping tests were required to determine:

- The maximum sustainable pumping rate for a range of pumping times
- The pump setting
- Whether dewatering of the aquifer was occurring.

The pumping tests that were conducted consisted of a step drawdown test and a constant rate discharge test.

STEP DRAWDOWN TEST

The step drawdown test allows determination of the hydraulic behaviour of the well under pumping stress. The step drawdown test usually consists of three or more steps at increasing pumping rates, but with the rate ramaining constant throughout each step.

The objective of step drawdown testing is to determine the well equation (Equation 1) which reflects the efficiency of the well design and relates drawdown, puming rate and time. This equation (ideally) allows prediction of the hydraulic performance of production wells for a design pumping rate and generation of yield drawdown curves for any given time.

The well equation allows determination of the maximum sustainable pumping rate of the well and consequently the selection of a suitable pumping rate for the constant rate discharge test.

$$s(t) = (a\,Q + c\,Q^2) + b\log(t)\,Q \qquad \textbf{Equation (1)}$$

Where:

s(t)	=	drawdown (m)
Q	=	pumping rate (m^3/min)
t	=	time (min)
a	=	constant related to well loss for laminar flow
c	=	constant related to well loss for turbulent flow
b	=	constant related to aquifer loss for laminar flow

and,

Well loss (m)	=	$a Q + c Q^2$
Aquifer loss (m)	=	b log(t) Q
Well efficiency	=	(aquifer loss as a percentage of S(t)

The specific capacity is defined as:

SC = Q/S	=	(L/s)/m of drawdown)

CONSTANT RATE DISCHARGE TEST

The constant rate discharge test allows determination of the hydraulic behaviour of the aquifer system under pumping stress. The constant rate discharge test is conducted at a constant pumping rate for a duration commensurate with the intended use of the well, however this is often compromised by the cost of running long-term tests.

The water level data collected from the constant rate discharge test allows determination of:

- Aquifer and aquitard hydraulic parameters
- Presence of hydraulic boundaries which may have an effect on pumping sustainability under long-term operational pumping
- Dewatering of the aquifer system, which may have an effect on pumping sustainability under long-term operational pumping
- Interference of neighbouring production wells.

The constant rate discharge test should ideally be followed by a period of groundwater level monitoring during the recovery of he well, although this is frequently not undertaken to reduce cost. Recovery is ideally monitored until 95% of the drawdown has been recovered. The residual drawdown data can be used to determine whether interference effects are present from either recharge boundaries, or conversely from impermeable boundaries or dewatering of the aquifer:

- If no interference is present, the extrapolated residual drawdown should intersect the zero residual drawdown line at $t/t_1 = 1$
- If a recharge boundary has been encountered, the line will intersect the zero residual drawdown line at a value of $t/t_1 > 1$
- If dewatering has occurred or an impermeable boundary has been encountered, the line will intersect the zero residual drawdown line at a value of $t/t_1 < 1$.

Observations from monitoring during pumping provide important data for gaining a better understanding of the broader aquifer system. Data are more reliable than those measured in the production well where turbulence may exist due to the pump. The data indicate the extent of the hydraulic influence of the production well and allow accurate determination of aquifer and aquitard hydraulic parameters.

GROUNDWATER QUALITY TEST

Preliminary groundwater sampling for a town water supply production well with domestic application should be tested for the following suite of chemical parameters (G Dworak and J West (SA Water) 2011, pers. comm., 5 May):

- basic chemistry: TDS, Na, Ca, Mg, K, CO3, HCO3, Cl, F, SO4, hardness and alkalinity1
- pH, colour and turbidity
- nutrients: NH3, NO3, NO2, soluble P and DOC
- metals (total and soluble): Al, Cd, Sb, Ni, Cu, Zn, Pb, Cr, Mn, Fe, As, Ba, Mo, Se, Hg, B, Ag, Be, I, CN, Sn, Zn, Br and U
- radioactivity.

PUMPING TEST RESULTS MOUNT BURR TWS 5

CONDUCT OF TEST

The pumping tests conducted on Mount Burr TWS 5 consisted of a step drawdown test and a constant rate discharge test and recovery test over the period 21–23 May 2012. Test details are given in Table 2 the results are given in Appendix C.

DFW Groundwater Technical Services conducted the testing. Further development of the well was initially carried out during which pumping rates and groundwater levels were monitored. From this preliminary data, rates were selected for the step drawdown test.

Groundwater samples were collected for full analysis at the Australian Water Quality Centre (AWQC) (Appendix D). Samples from one of the production wells were lost. The results reported for Mount Burr TWS 6 have a date of collection from the period of the Mount Burr TWS 5 pumping test and are most likely to be from this well.

Table 2. Pumping test details Mount Burr TWS 5

Test type	Test date	Step	Duration (min)	Pumping Rate (L/s)
Step drawdown	21 May 2012	1	100	5
		2	100	7
		3	100	10
Constant rate discharge	22–23 May 2012	1	720	10
Recovery	23 May 2012	–	200	0

STEP DRAWDOWN TEST

Analysis of the step drawdown results for Mount Burrr TWS 5 (Fig. 4) leads to the following well equation:

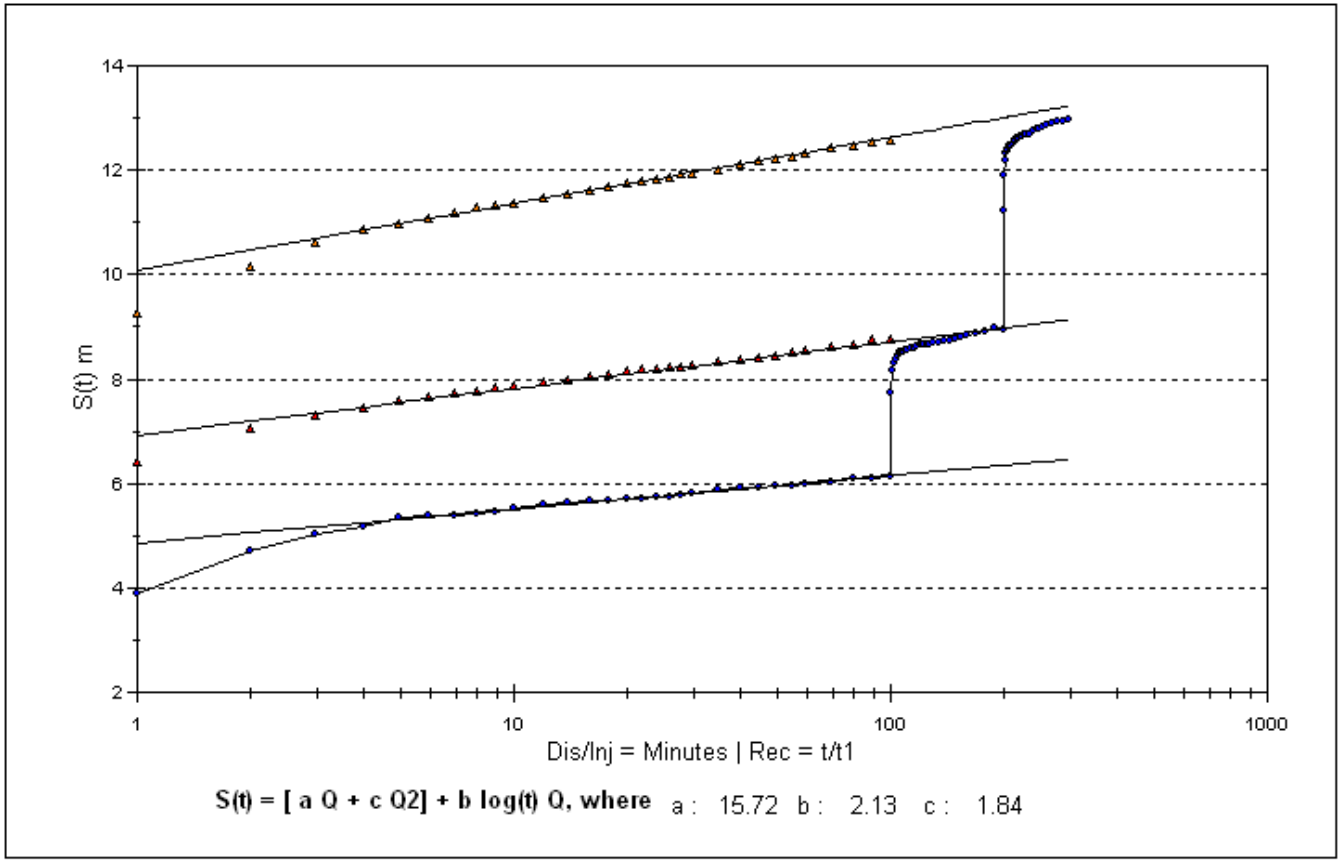
$$s(t) = 15.72\,Q + 1.84\,Q^2 + 2.13 \log (t)\,Q \qquad \text{Equation (2)}$$

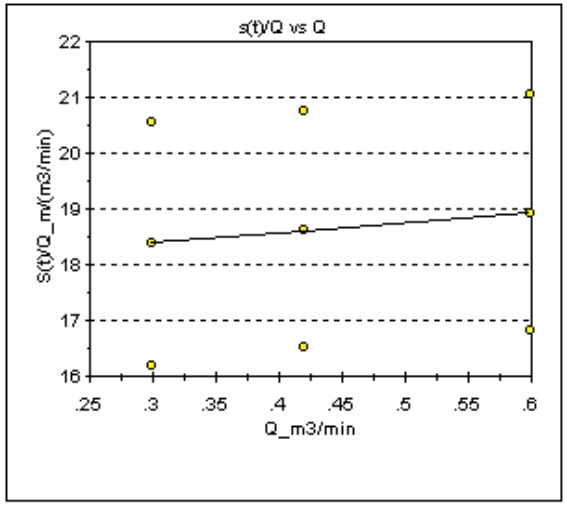
The well equation can be used as a predictive tool. Table 3 gives predicted drawdown after 1 000 000 minutes (approximately 2 years) of continuous pumping at a range of pumping rates.

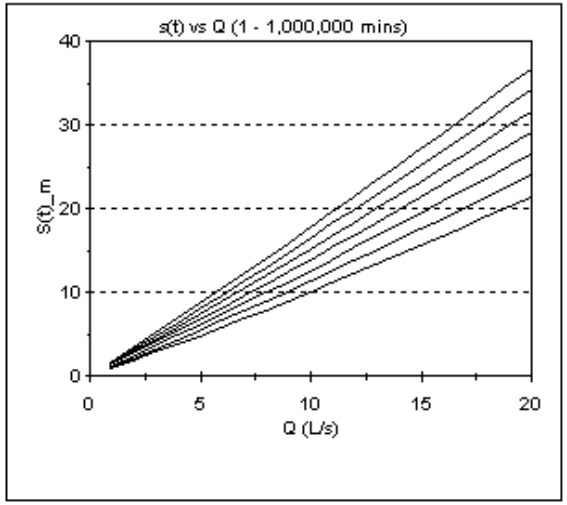
Table 3. Predicted drawdown Mount Burr TWS 5

Pumping rate (L/s)	DTW (m)*	Casing length (m)	Theoretical Available DD (m)	Duration (min)	Predicted DD (m)
5	72	114	42	1 000 000	8.72
10	72	114	42	1 000 000	17.78
15	72	114	42	1 000 000	27.17
20	72	114	42	1 000 000	36.89

* Measurement taken at start of step drawdown test and rounded to a whole number







TheStep	Q_L/s	Q_m3/min	Duration_min	St1	St1/Q	St10	St10/Q	St100	St100/Q	dS	dS/Q	T_m2/day
1	5.00	0.30	100	4.87	16.23	5.52	18.40	6.17	20.57	0.65	2.17	122
2	7.00	0.42	100	6.95	16.54	7.84	18.66	8.73	20.78	0.89	2.12	124
3	10.00	0.60	100	10.10	16.84	11.37	18.95	12.64	21.07	1.27	2.12	124
maintest	10.00	0.60	720									

Figure 4. Step drawdown test analysis of drawdown using Hazel method Mount Burr TWS 5

CONSTANT RATE DISCHARGE TEST

Production Well

Drawdown (residual drawdown) were recorded during the constant rate discharge test and recovery (Fig. 5).

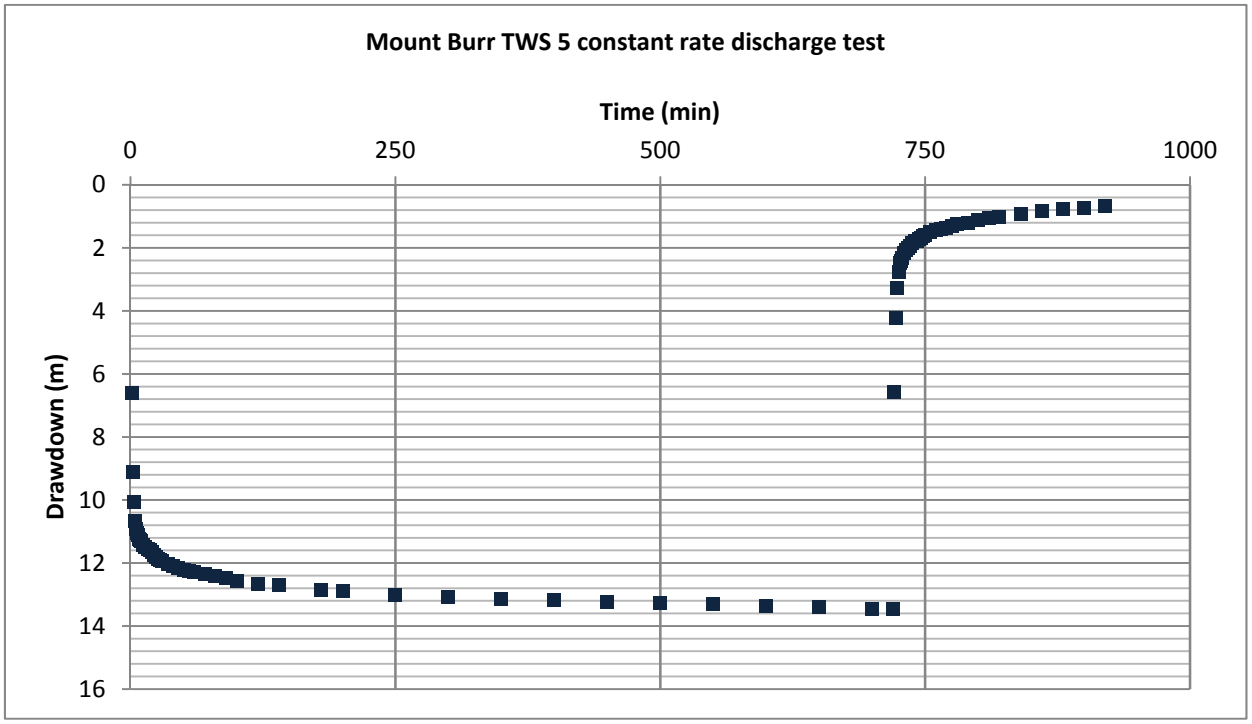


Figure 5. Linear-linear plot of drawdown Mount Burr TWS 5 constant rate discharge test

Drawdown versus time and residual drawdown versus t/t_1 (where t is the time since pumping began and t_1 is the time since pumping stopped) are given in Fig. 6.

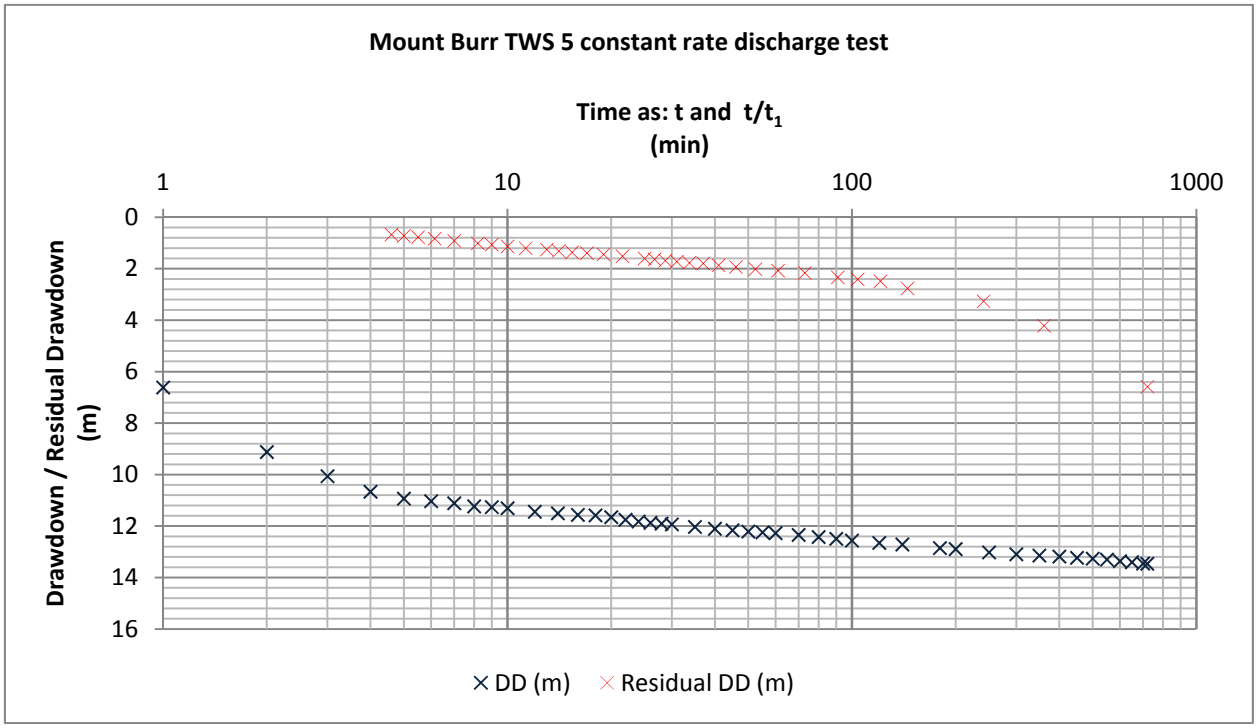


Figure 6. Log-linear plot of drawdown / residual drawdown Mount Burr TWS 5 constant rate discharge test

The following general comments can be made:

- A drawdown of 13.46 m developed during the test
- The well equation slightly over-predicts the observed drawdown at the end of the constant rate discharge test by +2.4% (Fig. 7)
- The specific capacity at 100 minutes was 0.8 L/s per metre of drawdown
- Well loss was approximately 73% of drawdown at the end of the test
- Recovery was monitored until residual drawdown was within 5% of the total drawdown developed. Monitioring of recovery was terminated after 200 minutes and the data are insufficient to make any conclusive comments in relation to the aquifer. It should be noted that that Gambier Limestone is a thick regional unconfined aquifer and its capacity to meet demand does not present a problem.

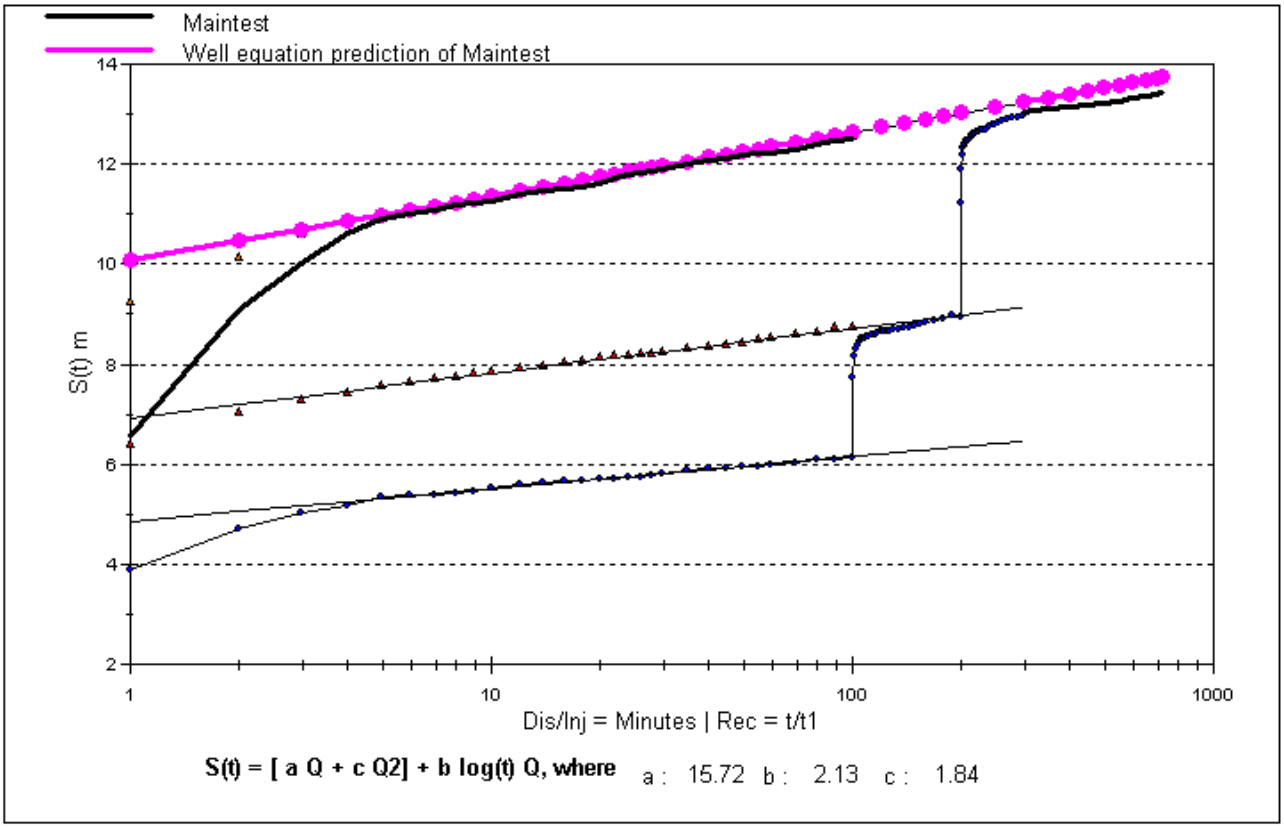


Figure 7. Well equation prediction of constant rate discharge test Mount Burr TWS 5

Observation Wells

Drawdown was observed at Mount Burr TWS 3 and and Mount Burr TWS 6 at radial distances of 26.5 m and 328 m respectively from the production (Fig. 8). The logger data from Mount Burr TWS 6 has not been included in Appendix C.

The data from the Mount Burr TWS 3 were analysed using the Cooper Jacob method (Fig.9). The following general comments can be made:

- A drawdown of 4.1 m developed during the test
- The Gambier Limestone exhibited a drawdown signature at the observation well consistent with an unconfined aquifer

- The hydraulic parameters of Gambier Limestone are given Table 4. The storage coefficient is inconsistent with an unconfined aquifer. This anomaly may be due to the short duration of the test
- During the period of the test no hydraulic boundaries were intersected.

Table 4. Analysis results observation well Mount Burr TWS 3

Obs. Well	Radial distance (m)	Transmissivity (m^2/day)	Storage coefficient	Hydraulic resistance (day)	Method
Mount Burr TWS 3	26.8	130	6.70 x 10-5	N / A	Cooper Jacob

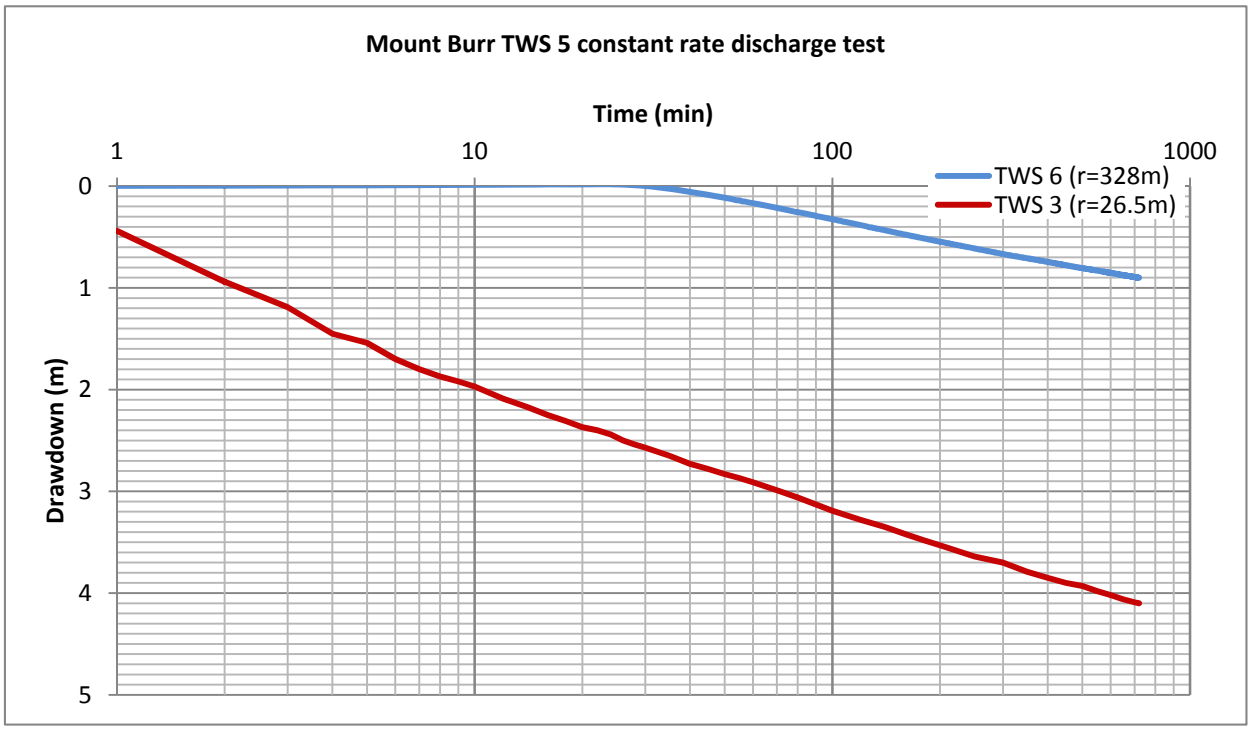
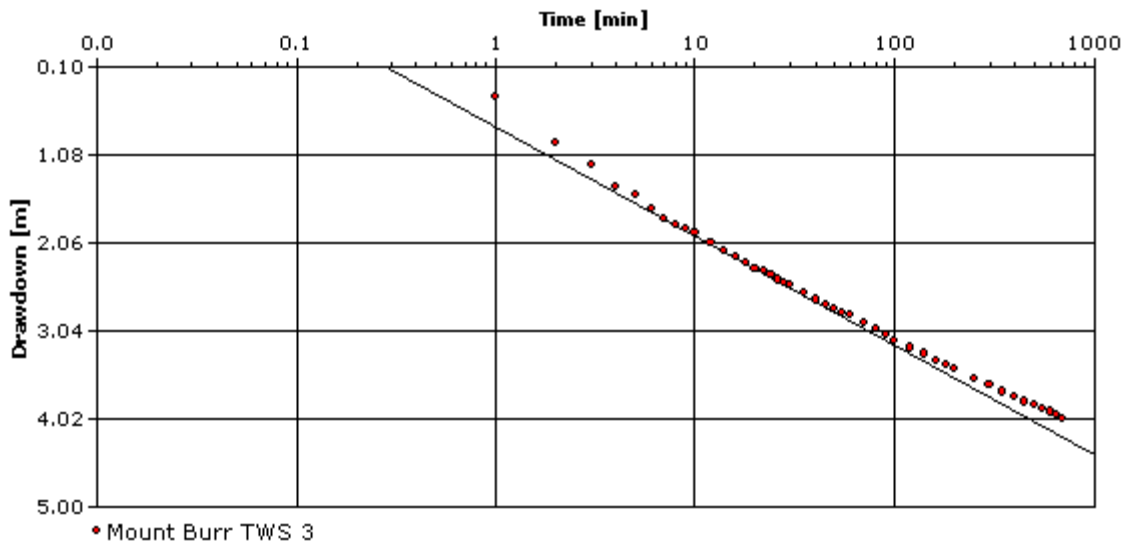


Figure 8. Log-linear plot of drawdown observation wells Mount Burr TWS 3 and TWS 6

Location: Mount Burr, South Australia	Pumping Test: Mount Burr TWS 5	Pumping Well: Mount Burr TWS 5
Test Conducted by:		Test Date: 22/05/2012
Analysis Performed by: G Howles	Cooper Jacob	Analysis Date: 23/08/2012
Aquifer Thickness: 105.00 m	Discharge Rate: 10 [l/s]	



Calculation after Cooper & Jacob

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
Mount Burr TWS 3	1.30×10^{-2}	1.23×10^{-4}	6.70×10^{-5}	26.5	

Figure 9. Cooper Jacob analysis of drawdown observation well Mount Burr TWS 3

GROUNDWATER SALINITY

Groundwater salinity (Fig. 10) was continuously recorded in the field during the constant rate discharge test. Groundwater salinity increased slightly (<10 mg/L) during the test ending at around 415 mg/L. Groundwater salinity was 480 mg/L (871 uScm) based on the result of laboratory water chemisty analysis.

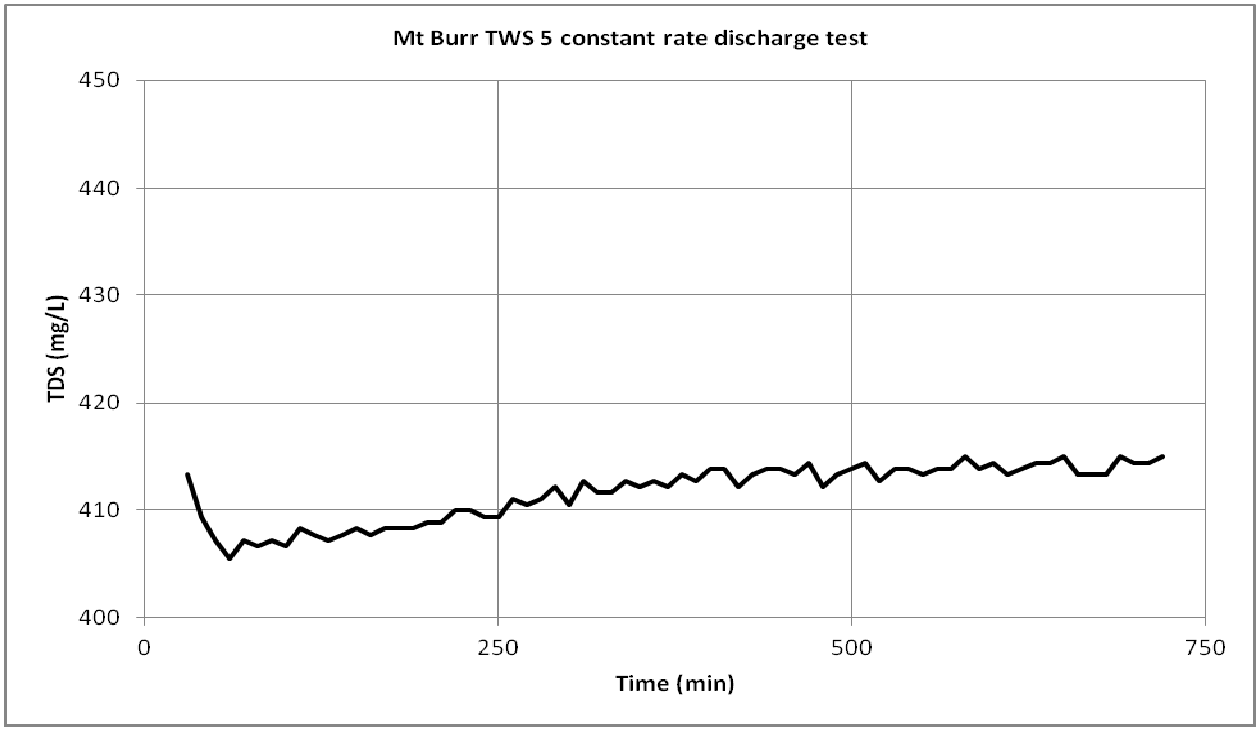


Figure 10. Groundwater salinity Mount Burr TWS 5 constant rate discharge test

PUMPING TEST RESULTS MOUNT BURR TWS 6

CONDUCT OF TEST

The pumping tests conducted on Mount Burr TWS 6 consisted of a step drawdown test and a constant rate discharge test and recovery test over the period 18–20 May 2011. Test details are given in Table 5 and the results are given in Appendix C.

DFW Groundwater Technical Services conducted the testing. Further development of the well was initially carried out during which pumping rates and groundwater levels were monitored. From this preliminary data, rates were selected for the step drawdown test.

Groundwater samples were collected for full analysis at the Australian Water Quality Centre (AWQC) (Appendix D). Samples from one of the production wells were lost. The results reported for Mount Burr TWS 6 have a date of collection from the period of the Mount Burr TWS 5 pumping test and are most likely to be from that well.

Table 5. Pumping test details Mount Burr TWS 6

Test type	Test date	Step	Duration (min)	Pumping Rate (L/s)
Step drawdown	18 May 2012	1	60	5
		2	60	10
		3	60	15
Constant rate discharge	19–20 May 2012	1	720	15
Recovery	20 May 2012	–	360	0

STEP DRAWDOWN TEST

Analysis of the step drawdown results for Mount Burr TWS 6 (Fig. 11) leads to the following well equation:

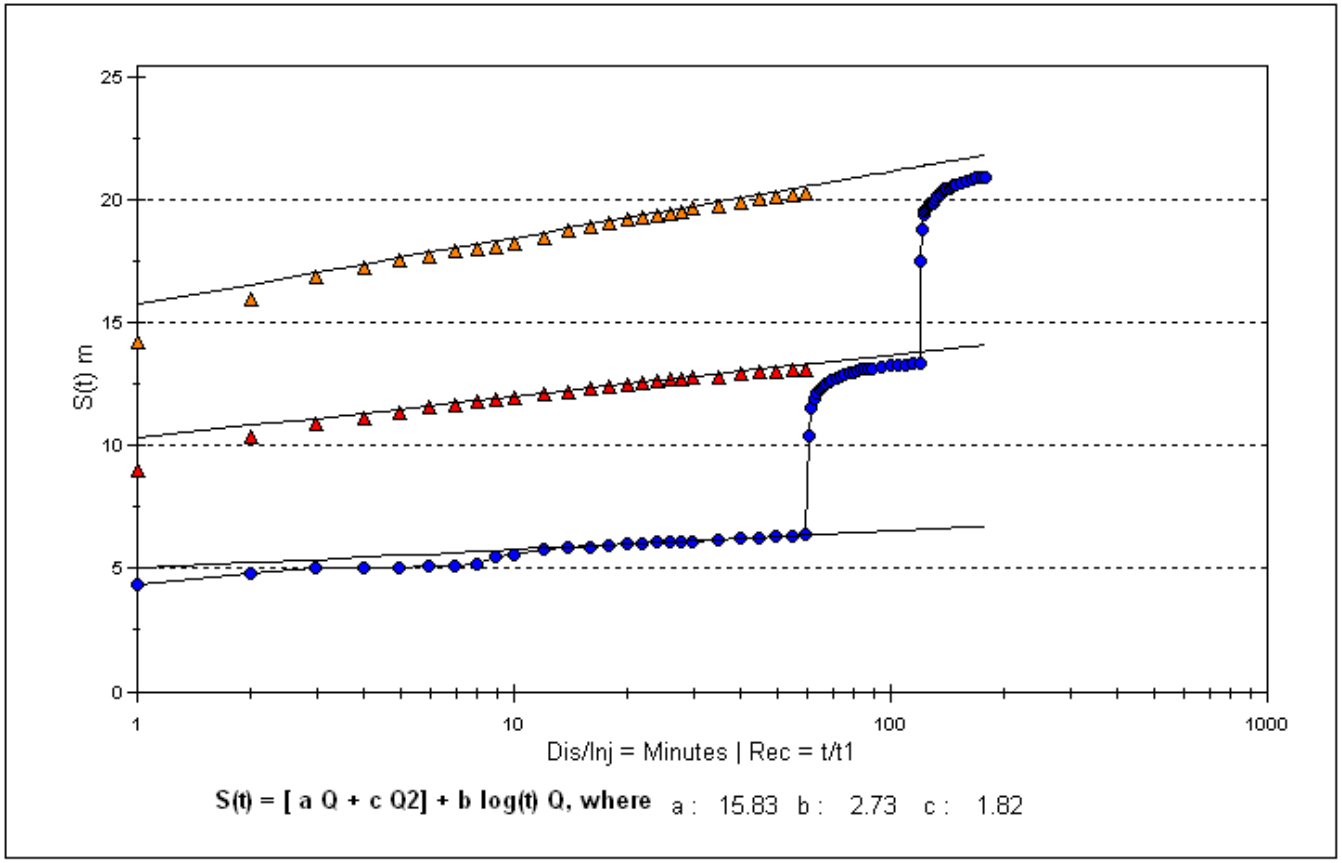
$$s(t) = 15.83\,Q + 1.82\,Q^2 + 2.73 \log (t)\,Q \qquad \text{Equation (3)}$$

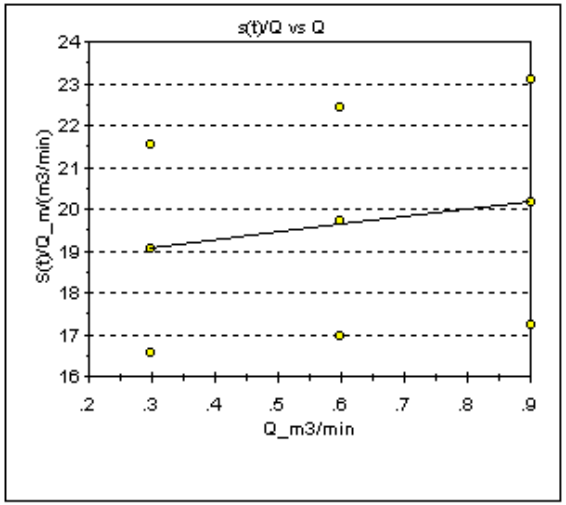
The well equation can be used as a predictive tool. Table 6 gives predicted drawdown after 1 000 000 minutes (approximately 2 years) of continuous pumping at a range of pumping rates.

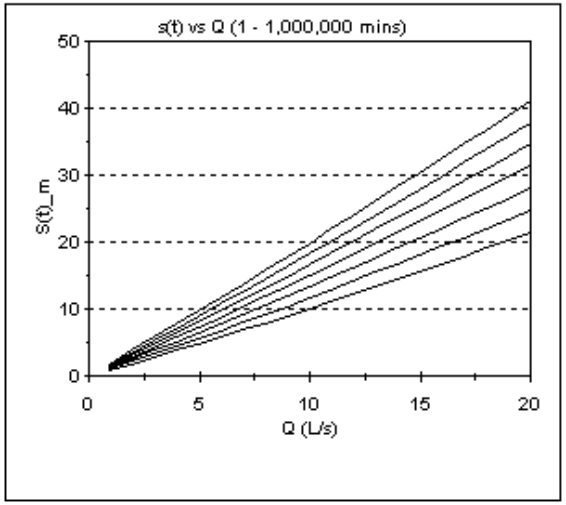
Table 6. Predicted drawdown Mount Burr TWS 6

Pumping rate (L/s)	DTW (m)*	Casing length (m)	Available DD (m)	Duration (min)	Predicted DD (m)
5	41	68	27	1 000 000	9.83
10	41	68	27	1 000 000	19.99
15	41	68	27	1 000 000	30.47
20	41	68	27	1 000 000	41.28

* Measurement taken at start of step drawdown test and rounded to a whole number







TheStep	Q_L/s	Q_m3/min	Duration_min	St1	St1/Q	St10	St10/Q	St100	St100/Q	dS	dS/Q	T_m2/day
1	5.00	0.30	60	4.98	16.60	5.73	19.10	6.48	21.60	0.75	2.50	105
2	10.00	0.60	60	10.19	16.99	11.84	19.74	13.49	22.49	1.65	2.75	96
3	15.00	0.90	60	15.52	17.25	18.17	20.19	20.82	23.13	2.65	2.94	89
maintest	15.00	0.90	720									

Figure 11. Step drawdown test analysis of drawdown using Hazel method Mount Burr TWS 6

CONSTANT RATE DISCHARGE TEST

Production Well

Drawdown (residual drawdown) were recorded during the constant rate discharge test and recovery (Fig. 12).

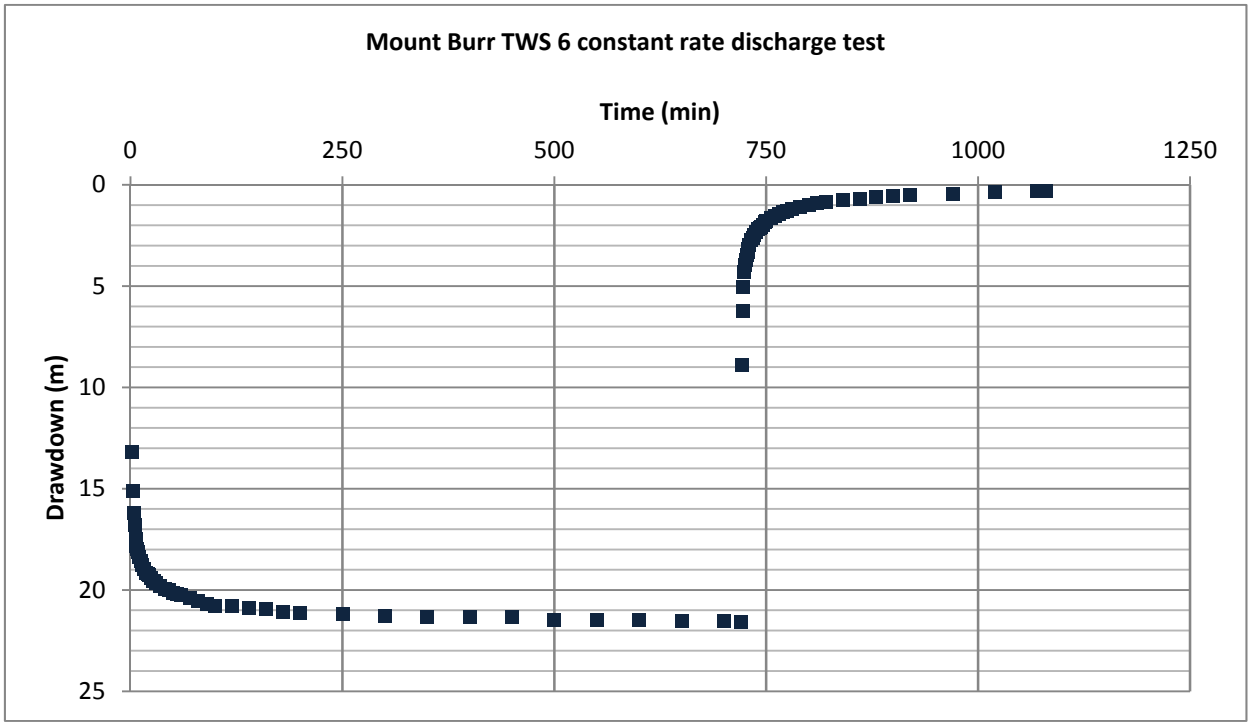


Figure 12. Linear-linear plot of drawdown Mount Burr TWS 6 constant rate discharge test

Drawdown versus time and residual drawdown versus t/t_1 (where t is the time since pumping began and t_1 is the time since pumping stopped) are given in Fig. 13.

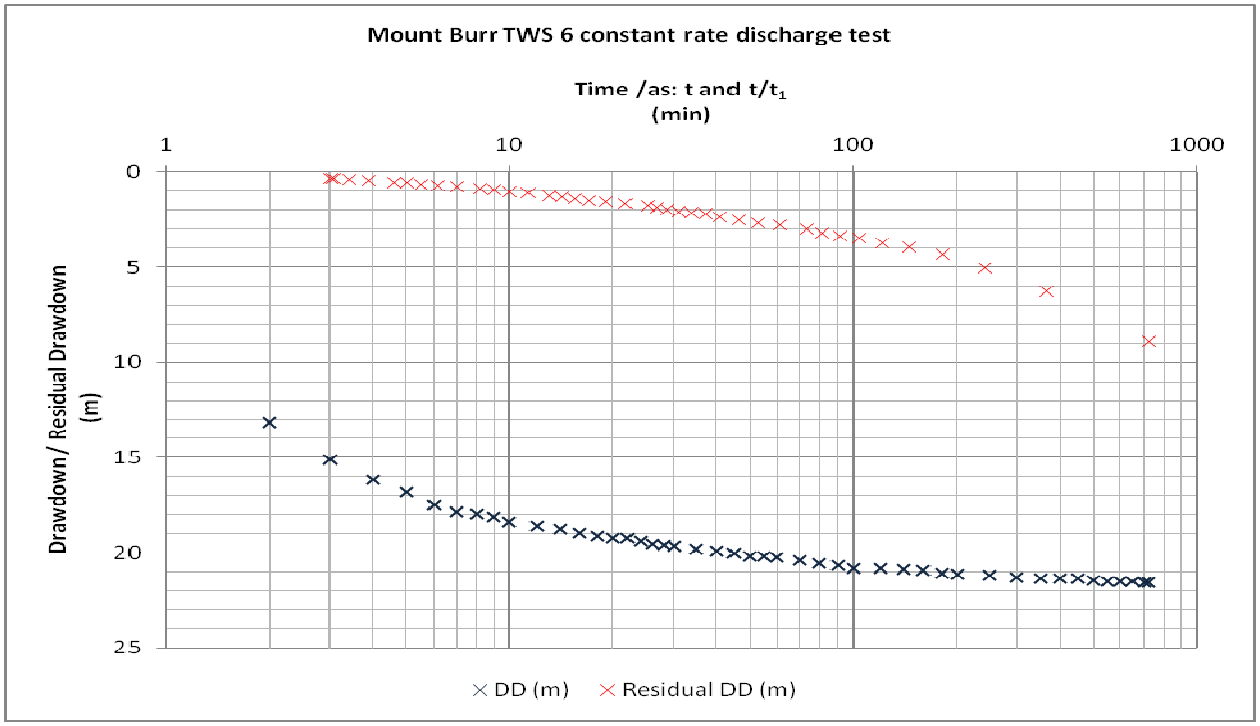


Figure 13. Log-linear plot of drawdown / residual drawdown Mount Burr TWS 6 constant rate discharge test

The following general comments can be made:

- A drawdown of 21.57 m developed during the test
- The well equation slightly under-predicts the observed drawdown at the end of the constant rate discharge test by +5.45% (Fig. 47)
- The specific capacity at 100 minutes was 0.72 L/s/m of drawdown
- Well loss was approximately 69% of drawdown at the end of the test
- Recovery was monitored until residual drawdown was within 2% of the total drawdown developed. The extrapolation of the residual drawdown data may indicate intersection with zero residual drawdown at t = 1 indicating that there is no interference or hydraulic boundaries.

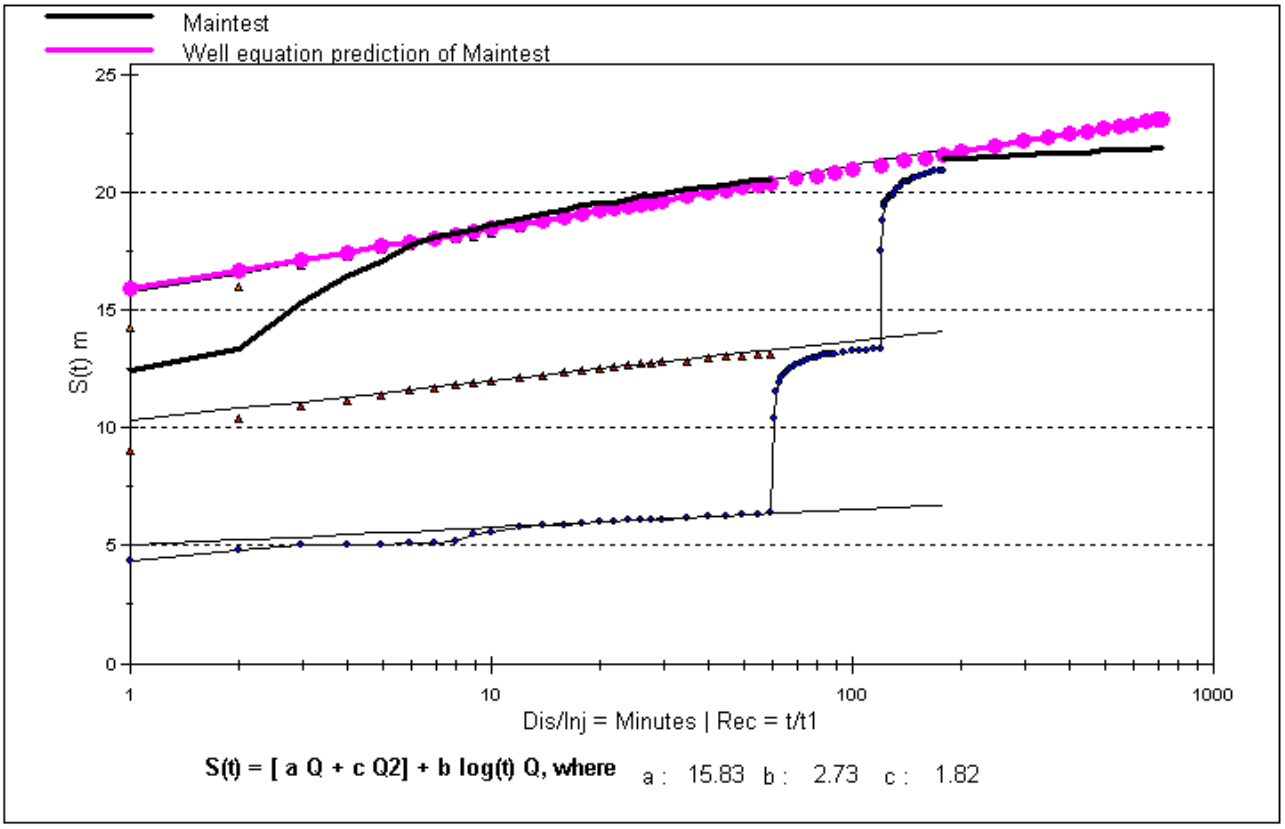


Figure 14. Well equation prediction of constant rate discharge test Mount Burr TWS 6

Observation Wells

Drawdown was observed at Mount Burr TWS 1 and and Mount Burr TWS 5 at radial distances of 67 m and 328 m respectively from the production (Fig. 15). The logger data from Mount Burr TWS 5 has not been included in Appendix C.

The data from the Mount Burr 1 were analysed using the Cooper Jacob method (Fig.16) and the Neuman method (Fig. 17). The following general comments can be made:

- A drawdown of 1.75 m developed during the test
- The Gambier Limestone exhibited a drawdown signature at the observation well consistent with an unconfined aquifer
- The hydraulic parameters of Gambier Limestone are given Table 7. The storage coefficient is inconsistent with an unconfined aquifer. This anomaly may be due to the short duration of the test
- During the period of the test no hydraulic boundaries were intersected.

Table 7. Analysis results observation well Mount Burr TWS 1

Obs. Well	Radial distance (m)	Transmissivity (m^2/day)	Storage coefficient	Hydraulic resistance (day)	Method
Mount Burr TWS 1	67.0	325	2.50 x 10-4	N / A	Cooper Jacob
			Specific Yield		
Mount Burr TWS 1	67.0	179	3.61 x 10-3	N / A	Neuman

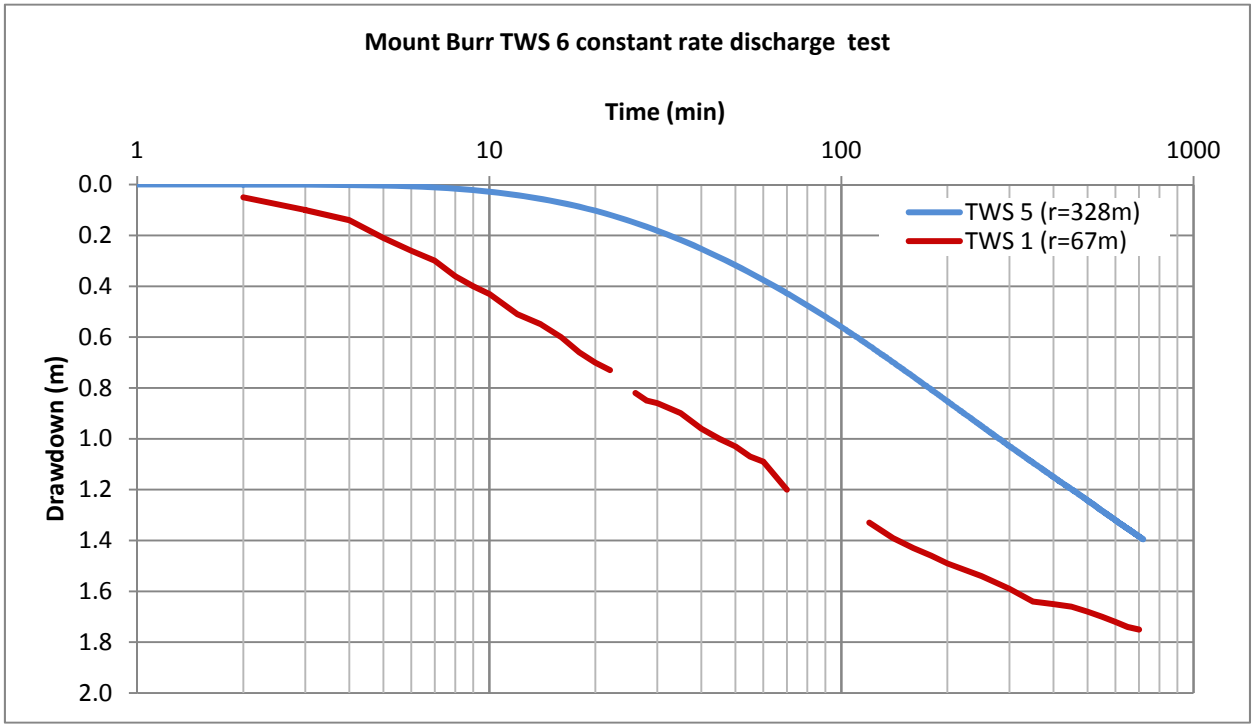
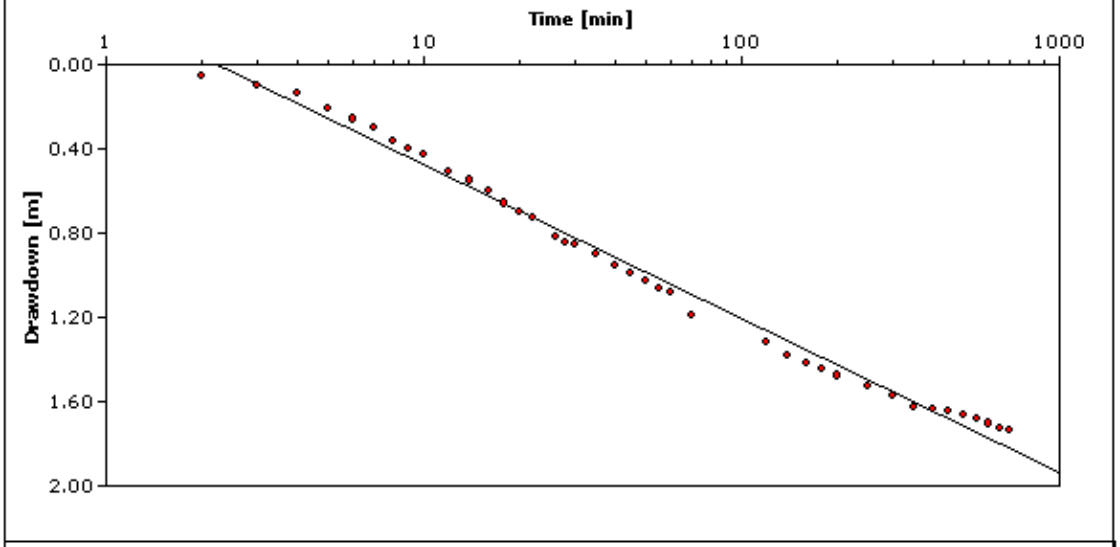


Figure 15. Log-linear plot of drawdown observation wells Mount Burr TWS 1 and TWS 5

Location: Mount Burr, South Australia	Pumping Test: Mount Burr TWS 6	Pumping Well: Mount Burr TWS 6
Test Conducted by:		Test Date: 24/08/2012
Analysis Performed by:	Cooper Jacob	Analysis Date: 24/08/2012
Aquifer Thickness: 97.00 m	Discharge Rate: 15 [l/s]	

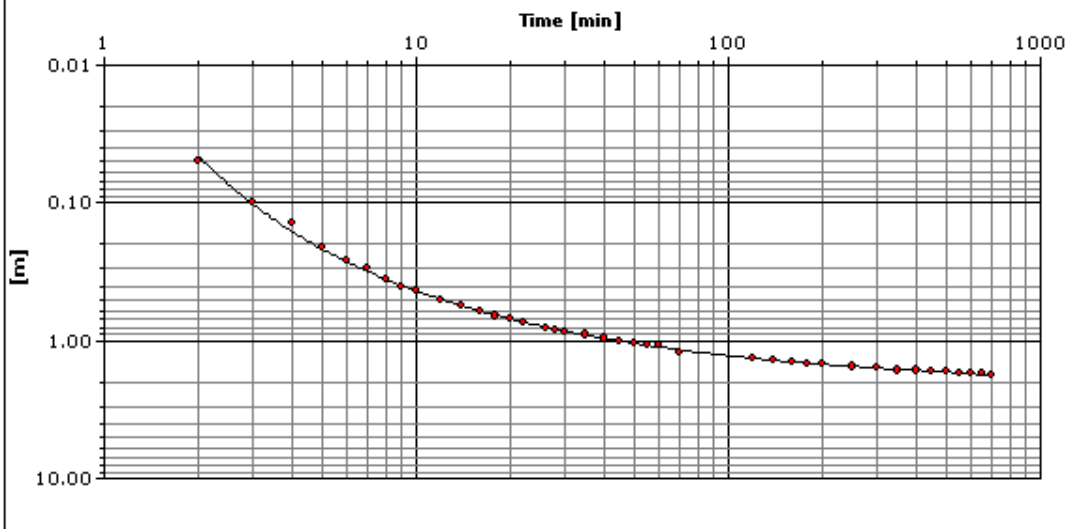


Calculation after Cooper & Jacob

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
Mount Burr TWS 1	3.25×10^{-2}	3.35×10^{-3}	2.50×10^{-3}	67.0	

Figure 16. Cooper Jacob analysis of drawdown observation well Mount Burr TWS 1

Location: Mount Burr, South Australia	Pumping Test: Mount Burr TWS 6	Pumping Well: Mount Burr TWS 6
Test Conducted by:		Test Date: 24/08/2012
Analysis Performed by: G Howles	Neuman	Analysis Date: 13/09/2012
Aquifer Thickness: 97.00 m	Discharge Rate: 15 [l/s]	



Calculation after Neuman

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Specific Yield	Ratio Kz/Kh	Ratio Sy/S	Radial Distance to PW [m]
Mount Burr TWS 1	1.79×10^{-2}	1.85×10^{-3}	3.61×10^{-1}	4.95×10^{-2}	1.00×10^{-1}	67.0

Figure 17. Neuman analysis of drawdown observation well Mount Burr TWS 1

GROUNDWATER SALINITY

Groundwater salinity was not recorded in the field during the constant rate discharge test due to logger failure.

RECOMMENDATIONS

It is recommended that Mount Burr TWS 5 and TWS 6 be pumped operationally and monitored for a full 12 months to confirm the long-term hydraulic behaviour of the well. The recommended pumping rate and pump depth are given in Table 8.

The current program of work included the design, implementation and testing of the production wells. The report includes a brief analysis and interpretation of the constant rate discharge tests. This analysis and interpretation can be futher explored in a future program of work dealing with regional aquifer and aquitard assesment.

Table 8. Well completion details and pumping test summary Mt Burr TWS 5 and Mt Burr TWS 6

	Parameter Description	Mount Burr TWS 5	Mount Burr TWS 6
Well Design	Target aquifer	Gambier Limestone	Gambier Limestone
	Assumed depth to water (m)	72 [1]	41 [1]
	Casing inner diameter (mm) nominal	250	250
	Casing length (m)	114	68
	Available drawdown (m)	42	27
SA Water Specification	Required pumping rate (L/s)	10	10
	Required pumping duration	1 h twice per day	1 h twice per day
	Modelled pumping rate (L/s)	10	10
	Modelled pumping duration	2 h (120 min)	2 h (120 min)
	Predicted drawdown (m)	12.8	13.6
DFW Recommendation	Pumping rate (L/s)	10	10
	Pumping duration	3 h (180 min)	3 h (180 min)
	Predicted drawdown (m)	13.0	13.9
	Pump intake depth (m)	93 [3]	63 [3]
	Resultant available drawdown safety factor (m)	8.0	8.1

Note:

[1] Measurement taken at start of constant rate discharge test and rounded to a whole number

[2] Parameter arbitrary as not set by SA Water

[3] Pump intake depth based on 3 metre pump column

APPENDIXES

A. WELL CONSTRUCTION REPORT

GOVERNMENT OF SOUTH AUSTRALIA
DRILLERS WELL CONSTRUCTION REPORT
Natural Resource Management Act 2004
DETAILS OF ALL WORK UNDERTAKEN MUST BE REFLECTED IN THIS REPORT

1. PERMIT NO: 20858 Site 05

NAME OF DRILLER Paul Juhtt Licence No: 3-123
Contact Phone/Mobile No.: 0429 900761
Name of plant operator if under supervision: Darren Nash

PERMIT HOLDER or land occupier: Dept for Water
Postal Address: PO Box 1246
Mount Gambier Post Code 5290

2. LOCATION OF WELL
Date of Survey ..... Surveyed by ..... Method .....
GPS COORDINATES AND DATUM USED: 451768 / 5844399
☐ GDA 94/WGS84 ☐ AGD 66/84 ☐ ZONE 52 ☐ ZONE 53 ☐ ZONE 54

3. WELL NAME: MT Burr 5#
4. LAND IDENTIFICATION
Pastoral Lease or Hundred: Reedy
Title or Plan and Parcel: CR 6008/270
Name of Property: SA Water

5. SUMMARY (Please tick appropriate boxes and complete all relevant details)
Date work Commenced: 19/4/12 Date work Completed: 27/4/12
Work carried out: New Well ☑ Deepen ☐ Enlarge ☐ Rehabilitate ☐ Backfill ☐
Is this a Replacement well? YES/NO if yes please quote replaced well number.....
Is this an Existing well? YES/NO if yes please quote well number or GPS coordinates.....
Was well Abandoned? YES/NO if so please state reason and method of backfill .....
Maximum Depth Drilled: 165 (m) Final Depth: 165 (m) Final Standing Water Level: 52.7 (m) Final Yield: 8.3 (L/sec)

6. DRILLING DETAILS If not a drilled well, please complete Sections: 6.2, 9, 10, 11, 12 and 13 as necessary

6.1 Construction Details

From (m)	To (m)	Diam (mm)	Drilling Method Cable Tool, Rotary Auger, Down Hole Hammer, etc.	Fluid Used (Air, Water, Mud Type)
0	17	450	Blade	Mud
17	122	350	Blade	Mud
122	165	247	Blade	Mud

6.2 Water Cut Details (measurements from natural surface to nearest 0.1 m)

Date	Water Cut From (m)	Water Cut To (m)	Standing Water Level (m)	Estimated Yield (L/sec)	Hole Depth at Test (m)	Casing at Test (m)	Test Method	Salinity (mg/L) or Taste
27/4	114	157	52.7	8.3	165	114	Air	Good

7. CASING LEFT IN WELL

7.1 Dimensions From (m)	To (m)	Internal Diam. (mm)	7.2 Type Swell Joint, Welded Collar, Steel, FRP, PVC, etc.	7.3 Casing Cemented Yes	No	From (m)	To (m)	Cement (bags)	Water (litres)	Other Additives	Cementing Method Used	Comments
0	17	350	Steel	☑	☐	0	17	800kg	5kL	-	Pumped	
0	114	250	PVC	☑	☐	0	114	2100	+5kL	Bent.	Pumped	

7.4 COLLAR CASING (must be cemented to surface) ☐ ☐

8. CONSTRUCTION AT PRODUCTION LEVEL
8.1 Method
☑ Open Hole
☐ Slotted Casing
☐ Screen(s)
☐ Other, give details:

8.2 Screen or Casing (*If variable aperture screen used give limits)

Type	From (m)	To (m)	Aperture* (mm)	Inner Diam (mm)	Outer Diam (mm)	Material	Trade Name	Completion of Base

8.3 Liner/Seal (Packer)

Material	Depth (m)	Internal Diam (mm)

8.4 Gravel Packing

Method of Placement	Gravel Passing Mesh Size	From (m)	To (m)

9. IF NOT A DRILLED WELL

Method	Depth (m)	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

10. DEVELOPMENT (State methods and time taken)

Method	Hours	Minutes
Air - Bubbler	40	

11. PUMPING TEST (measurements from natural surface to nearest 0.1m)

Interval Tested From (m)	To (m)	Water Level (m)	Test Method	Pump Depth (m)	Discharge Rate (L/sec)	Method of Measuring Discharge	Hours Pumped	Draw Down (m)

12. SAMPLES
The Natural Resource Management Act 2004 and Regulations require that strata and water samples must be obtained. If any samples have not been obtained state reasons:
NO STRATA REQ
As the person responsible I advise that the work has been completed as described above.
Signature of Licensed Driller ..... Date 29/4/12

Driller to deliver this copy together with water samples collected and well location map within 14 days of completion to any of the locations below:
Department of Water Land and Biodiversity Conservation
Science Monitoring & Information, GPO Box 2834 Adelaide SA 5001 (reports only)
Water Laboratory and Geophysical Services, 23 Conyngham Street GLENSIDE SA 5065 or
Mount Gambier Regional Office, 11 Helen Street MOUNT GAMBIER SA 5290 or
Naracoorte Regional Office, 101 Cedar Avenue, NARACOORTE SA 5271

13. FORMATION LOG

From (m)	To (m)	Description of Material
0	1	Topsoil
1	52	Sandstone
52	157	Limestone
157	165	Clayey/marl.

UNIT NUMBER

GOVERNMENT OF SOUTH AUSTRALIA

DRILLERS WELL CONSTRUCTION REPORT

Natural Resource Management Act 2004

DETAILS OF ALL WORK UNDERTAKEN MUST BE REFLECTED IN THIS REPORT

1. PERMIT NO: 20859 0 Site

NAME OF DRILLER PAUL JUETT Licence No 3.123

Contact Phone/Mobile No.: 0427 900 761

Name of plant operator if under supervision CHARLES JUETT

PERMIT HOLDER or land occupier DEPT FOR WATER

Postal Address PO BOX 1246

MT GAMBIER Post Code 5290

2. LOCATION OF WELL

Date of Survey 7/5/12 Surveyed by PJ Method GPS

GPS COORDINATES AND DATUM USED

S 37° 32' 590"

E 140° 22' 278"

☐ GDA 94/WGS84 ☐ AGD 66/84 ☐ ZONE 52 ☐ ZONE 53 ☐ ZONE 54

3. WELL NAME MT BURR 67

4. LAND IDENTIFICATION

Pastoral Lease or Hundred: REDDOCH

Title or Plan and Parcel: SAS 270 CR 6008/230

Name of Property

5. SUMMARY *(Please tick appropriate boxes and complete all relevant details)*

Date work Commenced 2/5/12 Date work Completed 8/5/12

Work carried out: New Well ☑ Deepen ☐ Enlarge ☐ Rehabilitate ☐ Backfill ☐

Is this a Replacement well? YES/NO if yes please quote replaced well number

Is this an Existing well? YES/NO **if yes please quote well number or GPS coordinates**

Was well Abandoned? YES/NO if so please state reason and method of backfill

Maximum Depth Drilled 132 (m) Final Depth 132 (m) Final Standing Water Level 34.8 (m) Final Yield 6 (L/sec)

6. DRILLING DETAILS If not a drilled well, please complete Sections: 6.2, 9, 10, 11, 12 and 13 as necessary

6.1 Construction Details

From (m)	To (m)	Diam (mm)	Drilling Method Cable Tool, Rotary Auger, Down Hole Hammer, etc.	Fluid Used (Air, Water, Mud Type)
0	17	450	BLADE	MUD
17	70	345	BLADE	MUD
70	132	245	BLADE	AIR

6.2 Water Cut Details (measurements from natural surface to nearest 0.1 m)

Date	Water Cut From (m)	Water Cut To (m)	Standing Water Level (m)	Estimated Yield (L/sec)	Hole Depth at Test (m)	Casing at Test (m)	Test Method	Salinity (mg/L) or Taste
7/5	70	132	34.8	6	132	68	AIR	60:1

7. CASING LEFT IN WELL

7.1 Dimensions / 7.2 Type / 7.3 Casing Cemented

From (m)	To (m)	Internal Diam. (mm)	Swell Joint, Welded Collar, Steel, FRP, PVC, etc.	Yes	No	From (m)	To (m)	Cement (bags)	Water (litres)	Other Additives	Cementing Method Used	Comments
0	17	350	STEEL	☑	☐	0	17	20	540	BENTO	POURED	
0	68	255	AC	☑	☐	0	68	44	1190	5% BENT	PUMPED	TOP UP 5m

7.4 COLLAR CASING (must be cemented to surface)

				☐	☐						

8. CONSTRUCTION AT PRODUCTION LEVEL

8.1 Method

☑ Open Hole

☐ Slotted Casing

☐ Screen(s)

☐ Other, give details:

8.2 Screen or Casing (*If variable aperture screen used give limits)

Type	From (m)	To (m)	Aperture* (mm)	Inner Diam (mm)	Outer Diam (mm)	Material	Trade Name	Completion of Base

8.3 Liner Seal (Packer)

Material	Depth (m)	Internal Diam (mm)

8.4 Gravel Packing

Method of Placement	Gravel Passing Mesh Size	From (m)	To (m)

9. IF NOT A DRILLED WELL

Method	Depth (m)	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

10. DEVELOPMENT (State methods and time taken)

Method	Hours	Minutes
AIR	4	

11. PUMPING TEST (measurements from natural surface to nearest 0.1m)

Interval Tested From (m)	Interval Tested To (m)	Water Level (m)	Test Method	Pump Depth (m)	Discharge Rate (L/sec)	Method of Measuring Discharge	Hours Pumped	Draw Down (m)

12. SAMPLES

The Natural Resource Management Act 2004 and Regulations require that strata and water samples must be obtained. If any samples have not been obtained state reasons:

NO SAMPLES REQ

As the person responsible I advise that the work has been completed as described above.

Signature of Licensed Driller PJ Date 8/5/12

Driller to deliver this copy together with water samples collected and well location map within 14 days of completion to any of the locations below:
Department of Water Land and Biodiversity Conservation
Science Monitoring & Information, GPO Box 2834 Adelaide SA 5001 (reports only)
Water Laboratory and Geophysical Services, 23 Conyngham Street GLENSIDE SA 5065 or
Mount Gambier Regional Office, 11 Helen Street MOUNT GAMBIER SA 5290 or
Naracoorte Regional Office, 101 Cedar Avenue, NARACOORTE SA 5271

13. FORMATION LOG

From (m)	To (m)	Description of Material
0	1	TOPSOIL
1	40	SAND
40	155	JOHNSTONE - YELLOW
155	54	DARK VOLCANICS
54	132	LIMESTONE

UNIT NUMBER

B. WATER WELL LOG

Project**: MOUNT BURR TWS 5**

Permit Number: **208588**
Date Completed: **27 April 2012**
Unit No: **692204726**
Drillhole Name: **Mount Burr TWS 5**
Logged By: **Jeff Lawson**

Backfilled (Y/N): **N**
Total Depth (m): **165**
Drill Method: **Rotary water/ mud**
Drilling Company: **Diverse Resources Group**
Driller: **Paul Juett**

Coordinates
Easting: **451768**
Northing: **5844399**
Zone: **54**
Datum: **GDA94**

Ground Elevation (mAHD): **117.4m (DEM)**
Reference Elevation (mAHD): **TBD**
Reference Point Type: **TOC**

General Comments:

Lithological Description

Depth (m)		Major Lith Unit(s)	Lithology	Formation
From	To			
0	6	SAND	Brown, unconsolidated. Some strongly cemented medium grained fragments, high sand composition. Colour indicates high iron content – occasionally almost red ochre.	HOLOCENE
6	9		Light brown, unconsolidated. Fine grained.	
9	12		Brown and essentially as above but with the inclusion of strongly cemented, fine grained fragments.	
12	15	SANDY CLAY	Brown sand but in a matrix with loosely bound clay. Easily broken down in water.	
15	18	SANDSTONE	Brown, equal split between strongly cemented fragments and unconsolidated sand. Some poor quality fossils now present.	
18	21	SAND	Brown, unconsolidated. 20% of the sample strongly cemented fragments.	
21	24		Essentially as above. Some calcareous strongly cemented fine grained chips and rounded basalt pieces.	
24	27	SANDSTONE	Very pale brown to white. Strongly cemented fine to medium grained fragments. Poor quality fossil definition. 10% Basalt	BRIDGEWATER FORMATION
27	33		Minor basalt	
33	39		High percentage of unconsolidated material. No basalt.	
39	45		Essentially unconsolidated. Mix of sand and fine fossil	

Depth (m)		Major Lith Unit(s)	Lithology	Formation
From	To			
			content. 20% strongly cemented chips.	
45	48		Strongly cemented portion dominant.	
48	120		Lost circulation.	
120	122	FLINT	Varies from black to brown, angular to sub angular flint. Almost 50% limestone – strongly cemented, fine grained, varies from white to orange.	GAMBIER LIMESTONE
122	124	LIMESTONE	Strongly cemented, fine grained, and varies from white to orange. 30% Flint.	
124	126	LIMESTONE	A 50:50 split between limestone and flint.	
126	128	LIMESTONE	White, generally strongly cemented. Some good quality fossil remnants. Medium to fine grained. Some orange limestone fragments probable uphole contamination. 25% Flint – grey, angular.	
128	132	FLINT	High percentage of grey partially silicified fragments. Also black and brown flint chips. 30% fine grained limestone.	
132	134	LIMESTONE	White, weakly cemented to uncemented. Fine bryozoa. Minor calcite rhombs. 40% flint – black, grey, brown.	
134	136	LIMESTONE	Flint percentage decreasing to about 2%. Probable start of the production zone.	
136	140	LIMESTONE	Fine to medium grained. Shell fragments to 1cm. 10% flint.	
140	142	LIMESTONE	Flint slightly stronger at about 20%	
142	144	LIMESTONE	Some glauconite staining in the limestone. Flint decreasing to about 10%.	
144	150	LIMESTONE	Much stronger glauconitic staining. Overall the limestone is fine grained. Calcite rhombs. 10% flint.	
150	152	LIMESTONE	Flint content increasing slightly. Probable base of the production zone.	
152	154	MARLY LIMESTONE	Weakly bound marl. Limestone content similar to above. 5 to 10% flint.	
154	156	MARL	Off white, strongly bound marl. Approximately only 20% limestone. Trace of flint.	
156	158	MARL	Pale grey, soft, strongly bound. Limestone percentage only small.	
158	162	MARL	Grey, weakly to moderately bounded marl. About 25% flint – grey to dark grey. Limestone about 10 to 15%	
162	164	MARL	Off white. As above.	
164	165	MARL	Grey moderately bound marl. Minor flint and limestone.	

Water Cut Information

Depth (m)		Depth to Water (m)	Supply			Water Analysis		
From	To		Yield (L/s)	Test Length (min)	Method	Sample No.	Salinity	Salinity Unit (mg/L / EC)
114	165	72	10	720	Pump	N/A	N/A	401

Casing and Production Zone Information

Case or Production Zone	Depth (m)		Inner Diam (mm)	Material	Aperture (mm)	Cementing		
	From	To				Y/N	From (m)	To (m)
Surface control casing	0	17	355	Schedule 20 steel		y	0	17
Well Casing	0	114	253	Class 12 PVC		Y	0	114
Prod zone	114	165	245	Open hole				

Project**: MOUNT BURR TWS 6**

Permit Number: **208590**
Date Completed: **8/5/2012**
Unit No: **6922-4725**
Drillhole Name: **Mount Burr TWS 6**
Logged By: **Jeff Lawson**

Backfilled (Y/N): **N**
Total Depth (m): **132**
Drill Method: **Rotary Mud and Air**
Drilling Company: **Diverse Resources Group**
Driller: **Paul Juett**

Coordinates
Easting: **451824**
Northing: **5844736**
Zone: **54**
Datum: **GDA94**

Ground Elevation (mAHD): **87 (DEM)**
Reference Elevation (mAHD): **TBD**
Reference Point Type: **TOC**

General Comments: from 108 metres the well was drilled using air circulation. Sample quality still very high.

Lithological Description

Depth (m)		Major Lith Unit(s)	Lithology	Formation
From	To			
0	3	SANDSTONE	Pale orange, weakly cemented to uncemented. Hint of fossil content. Suspected high iron content in the profile.	HOLOCENE
3	6	CLAY	Orange to pale red. Soft, pliable clay. Higher sand content in the clay.	
6	9	SANDSTONE	Brown to pale red. Obvious high iron in the zone. Piece of fine grained red flint.	BRIDGEWATER FORMATION
9	15		With minor brown clay	
15	18	CLAY	Brown moderately bounded. Strongly cemented fine grained, iron stained fragments. Minor sand.	
18	21	BASALT	Black fine grained fragments. Approximately 35% sandstone, weakly to strongly cemented, iron stained.	VOLCANICS
21	36		Black to grey, strong basalt layer. Some uphole contamination.	
36	48		Black, brown, grey. Strongly cemented fine grained fragments. 5 to 10 % limestone appearing in the sample.	
48	57		Off white, unconsolidated well preserved fossil content (bryozoa and fractured shell). Medium to coarse grained. 20% Flint – brown, angular fragments. Minor partially silicified grey limestone.	GAMBIER LIMESTONE
57	60		As above. 5-10% light brown, angular flint.	
60	64		Limestone has a finer element. Strongly cemented fine grained fragments but overall still medium to coarse grained. Minor flint.	
64	66		White, weakly cemented to uncemented. Fine to	

Depth (m)		Major Lith Unit(s)	Lithology	Formation
From	To			
			medium grained limestone. Minor flint.	GAMBIER LIMESTONE
66	68		Medium grained limestone. 10 – 15% brown to grey flint.	
68	70	LIMESTONE	Cream, essentially coarse unconsolidated fossil content. (bryozoal). 10 – 15% flint – light grey.	
70	72		Coarse grained limestone. 5 – 10% flint but additionally with a 10% grey, partially silicified flint content.	
72	74		Coarse grained limestone. 30 – 40% Flint – grey and some partially silicified fragments. Sample suffering from uphole contamination.	
74	78		As above. Minor uphole contamination.	
78	80	LIMESTONE/ FLINT	Approximate 50:50 split of limestone and flint.	
80	82		White, unconsolidated. Medium to coarse fossil content. Coral fragments to 5mm. 30% grey flint.	
82	86		Becoming a little finer.	
86	90		White varies from fine to coarse. Average medium grained. 5- 10% flint.	
90	92		White varies from weakly cemented to uncemented. Medium grained limestone, extremely bryozoal. 5% flint, black to brown.	
92	92		Coarse grained fragments to 5 mm.	
94	96		Unusual colour change to a very pale brown. Essentially uncemented – very bryozoal. Medium to coarse grained.	
96	98		Very pale brown, coarse grained limestone. Flint progression to 30 to 40% of sample – varies from brown fragments, some with limestone coating to grey partially silicified fragments.	
98	102	LIMESTONE	White, weakly cemented to uncemented. Overall fine grained limestone, some medium grained fossils. 20% flint – brown angular chips.	
102	104		White, weakly to medium cementation. Minor loose fossils. Fine grained limestone. 10 -15% flint- grey.	
104	106		Some medium grained limestone, overall fine grained. 10 – 15% flint.	
106	108		Some coral fragments. Medium to fine grained limestone. Minor flint.	
108	110		White, strongly cemented fine grained limestone. Minor unconsolidated fraction. 40% Flint – dark to light grey. Minor partially silicified flint.	
110	112		Bright white. Strongly cemented to uncemented. Unconsolidated component has coarse bryozoa. Overall fine grained but with a medium component.	

Depth (m)		Major Lith Unit(s)	Lithology	Formation
From	To			
			No flint.	
112	114	LIMESTONE	Bright white. Changing slightly to a medium grained limestone. Some glauconite staining. No flint.	GAMBIER LIMESTONE
114	116		Sample has a green tinge – glauconite staining. In close up, still pale green weakly cemented fine grained samples. 5 - 10% brown flint.	
116	118		Off white. Weakly cemented to uncemented. Medium to coarse grained bryozoa. Overall medium grained. Minor flint.	
118	122		Medium to coarse grained limestone. Minor glauconite staining.	
122	126		Echinoid spine fragment to over 1cm.	
126	128		White, coarse grained essentially uncemented. Occasional fine grained, strongly cemented fragments. 5% grey flint.	
128	130		Medium to coarse grained. No flint.	
130	132		Overall medium grained limestone. Minor flint.	

Water Cut Information

Depth (m)		Depth to Water (m)	Supply			Water Analysis		
From	To		L/sec	Test Length	Method	Sample No	Salinity	Salinity Unit (mg/L/EC)
68	132	40.57	15	720 min	Pump			

Casing and Production Zone Information

Case or Production Zone	Depth (m)		Inner Diam (mm)	Material	Aperture (mm)	Cementing		
	From	To				Y/N	From (m)	To (m)
Surface control casing	0	17	355	Schedule 20 steel		y	0	17
Well Casing	0	68	253	Class 12 PVC		Y	0	68
Prod zone	68	132	245	Open hole				

C. PUMPING TEST DATA

C.1 MOUNT BURR TWS 5 STEP DRAWDOWN TEST

MOUNT BURR TWS 5

Start date	Start time	Step	Duration (min)	Q (L/s)	Well Name	Well Type	r (m)	Aquifer	Ref Elev. (m AHD)
21/05/2012	08:30	1	100	5	Mount Burr TWS 5	Production	0	Gambier Limestone	Not surveyed
"		2	100	7	"	"	"	"	"
"		3	100	10	"	"	"	"	"

MOUNT BURR TWS 5 MANUAL DATA

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
1	5	0	72.01	0.00
1	5	1	75.90	3.89
1	5	2	76.72	4.71
1	5	3	77.07	5.06
1	5	4	77.20	5.19
1	5	5	77.36	5.35
1	5	6	77.40	5.39
1	5	7	77.42	5.41
1	5	8	77.46	5.45
1	5	9	77.48	5.47
1	5	10	77.56	5.55
1	5	12	77.61	5.60
1	5	14	77.65	5.64
1	5	16	77.69	5.68
1	5	18	77.70	5.69
1	5	20	77.73	5.72
1	5	22	77.73	5.72
1	5	24	77.75	5.74
1	5	26	77.77	5.76
1	5	28	77.79	5.78
1	5	30	77.83	5.82
1	5	35	77.90	5.89
1	5	40	77.94	5.93
1	5	45	77.95	5.94
1	5	50	77.98	5.97
1	5	55	77.98	5.97
1	5	60	78.00	5.99
1	5	70	78.06	6.05
1	5	80	78.12	6.11
1	5	90	78.14	6.13
1	5	100	78.17	6.16

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
2	7	101	79.76	7.75
2	7	102	80.18	8.17
2	7	103	80.34	8.33
2	7	104	80.41	8.40
2	7	105	80.48	8.47
2	7	106	80.50	8.49
2	7	107	80.53	8.52
2	7	108	80.53	8.52
2	7	109	80.56	8.55
2	7	110	80.58	8.57
2	7	112	80.59	8.58
2	7	114	80.61	8.60
2	7	116	80.63	8.62
2	7	118	80.66	8.65
2	7	120	80.68	8.67
2	7	122	80.69	8.68
2	7	124	80.69	8.68
2	7	126	80.70	8.69
2	7	128	80.70	8.69
2	7	130	80.71	8.70
2	7	135	80.73	8.72
2	7	140	80.74	8.73
2	7	145	80.76	8.75
2	7	150	80.79	8.78
2	7	155	80.82	8.81
2	7	160	80.85	8.84
2	7	170	80.90	8.89
2	7	180	80.93	8.92
2	7	190	80.99	8.98
2	7	200	80.98	8.97
3	10	201	83.26	11.25
3	10	202	83.91	11.90
3	10	203	84.20	12.19
3	10	204	84.35	12.34
3	10	205	84.38	12.37
3	10	206	84.42	12.41
3	10	207	84.46	12.45
3	10	208	84.50	12.49
3	10	209	84.51	12.50
3	10	210	84.51	12.50
3	10	212	84.55	12.54
3	10	214	84.57	12.56

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
3	10	216	84.60	12.59
3	10	218	84.63	12.62
3	10	220	84.65	12.64
3	10	222	84.66	12.65
3	10	224	84.66	12.65
3	10	226	84.68	12.67
3	10	228	84.70	12.69
3	10	230	84.70	12.69
3	10	235	84.71	12.70
3	10	240	84.77	12.76
3	10	245	84.81	12.80
3	10	250	84.81	12.80
3	10	255	84.84	12.83
3	10	260	84.88	12.87
3	10	270	84.93	12.92
3	10	280	84.95	12.94
3	10	290	84.97	12.96
10	10	300	85.00	12.99

C.2 MOUNT BURR TWS 5 CONSTANT RATE DISCHARGE TEST

MOUNT BURR TWS 5

Start date	Start time	Step	Duration (min)	Q (L/s)	Well Name	Well Type	r (m)	Aquifer	Ref Elev. (m AHD)
22/05/2012	08:30	1	Pumping 720 Recovery 200	10	Mount Burr TWS 5	Production	0	Gambier Limestone	Not surveyed
					Mount Burr TWS 3	Observation	26.5	Gambier Limestone	Not surveyed
					Mount Burr TWS 6	Observation	328	Gambier Limestone	Not surveyed

MOUNT BURR TWS 5 MANUAL DATA

Q (L/s)	Time (min)	DTW (m)	DD (m)
10	0	71.99	0.00
10	1	78.60	6.61
10	2	81.11	9.12
10	3	82.05	10.06
10	4	82.65	10.66
10	5	82.92	10.93
10	6	83.02	11.03
10	7	83.10	11.11
10	8	83.22	11.23
10	9	83.25	11.26
10	10	83.29	11.30
10	12	83.43	11.44
10	14	83.49	11.50
10	16	83.55	11.56
10	18	83.57	11.58
10	20	83.64	11.65
10	22	83.74	11.75
10	24	83.81	11.82
10	26	83.86	11.87
10	28	83.89	11.90
10	30	83.92	11.93
10	35	84.02	12.03
10	40	84.09	12.10
10	45	84.15	12.16
10	50	84.20	12.21
10	55	84.23	12.24
10	60	84.26	12.27
10	70	84.33	12.34
10	80	84.41	12.42

Q (L/s)	Time (min)	DTW (m)	DD (m)
10	90	84.48	12.49
10	100	84.55	12.56
10	120	84.64	12.65
10	140	84.70	12.71
10	160	85.77	13.78
10	180	84.84	12.85
10	200	84.88	12.89
10	250	85.01	13.02
10	300	85.08	13.09
10	350	85.13	13.14
10	400	85.17	13.18
10	450	85.22	13.23
10	500	85.25	13.26
10	550	85.29	13.30
10	600	85.35	13.36
10	650	85.39	13.40
10	700	85.44	13.45
10	720	85.45	13.46
0	721	78.57	6.58
0	722	76.20	4.21
0	723	75.25	3.26
0	724	-	-
0	725	74.75	2.76
0	726	74.47	2.48
0	727	74.40	2.41
0	728	74.32	2.33
0	729	-	
0	730	74.15	2.16
0	732	74.06	2.07
0	734	74.00	2.01
0	736	73.92	1.93
0	738	73.85	1.86
0	740	73.78	1.79
0	742	73.76	1.77
0	744	73.71	1.72
0	746	73.67	1.68
0	748	73.62	1.63
0	750	73.59	1.60
0	755	73.50	1.51
0	760	73.43	1.44
0	765	73.38	1.39
0	770	73.35	1.36

Q (L/s)	Time (min)	DTW (m)	DD (m)
0	775	73.30	1.31
0	780	73.24	1.25
0	790	73.19	1.20
0	800	73.12	1.13
0	810	73.05	1.06
0	820	73.00	1.01
0	840	72.90	0.91
0	860	72.82	0.83
0	880	72.76	0.77
0	900	72.71	0.72
0	920	72.66	0.67

MOUNT BURR TWS 3 MANUAL DATA

Q (L/s)	Time (min)	DTW (m)	DD (m)
	0	71.71	0.00
	1	72.15	0.44
	2	72.65	0.94
	3	72.90	1.19
	4	73.16	1.45
	5	73.25	1.54
	6	73.41	1.70
	7	73.51	1.80
	8	73.58	1.87
	9	73.63	1.92
	10	73.68	1.97
	12	73.80	2.09
	14	73.88	2.17
	16	73.96	2.25
	18	74.02	2.31
	20	74.08	2.37
	22	74.11	2.40
	24	74.15	2.44
	26	74.21	2.50
	28	74.25	2.54
	30	74.28	2.57
	35	74.36	2.65
	40	74.44	2.73
	45	74.49	2.78
	50	74.54	2.83
	55	74.58	2.87
	60	74.62	2.91

Q (L/s)	Time (min)	DTW (m)	DD (m)
	70	74.70	2.99
	80	74.77	3.06
	90	74.84	3.13
	100	74.90	3.19
	120	74.99	3.28
	140	75.06	3.35
	160	75.13	3.42
	180	75.19	3.48
	200	75.24	3.53
	250	75.35	3.64
	300	75.41	3.70
	350	75.50	3.79
	400	75.56	3.85
	450	75.61	3.90
	500	75.64	3.93
	550	75.69	3.98
	600	75.73	4.02
	650	75.77	4.06
	700	75.80	4.09
	720	75.81	4.10
	721	-	-
	722	-	-
	723	74.65	2.94
	724	-	-
	725	74.16	2.45
	726	74.06	2.35
	727	74.01	2.30
	728	-	-
	729	-	-
	730	73.82	2.11
	732	73.69	1.98
	734	73.61	1.90
	736	73.52	1.81
	738	73.47	1.76
	740	73.42	1.71
	742	73.37	1.66
	744	73.33	1.62
	746	73.30	1.59
	748	73.26	1.55
	750	73.23	1.52
	755	73.15	1.44
	760	73.08	1.37

Q (L/s)	Time (min)	DTW (m)	DD (m)
	765	73.02	1.31
	770	72.99	1.28
	775	72.93	1.22
	780	-	-
	790	72.82	1.11
	800	72.78	1.07
	810	72.70	0.99
	820	72.66	0.95
	840	72.58	0.87
	860	72.49	0.78
	880	72.43	0.72
	900	72.39	0.68
	920	72.33	0.62

C.3 MOUNT BURR TWS 6 STEP DRAWDOWN TEST

MOUNT BURR TWS 6

Start date	Start time	Step	Duration (min)	Q (L/s)	Well Name	Well Type	r (m)	Aquifer	Ref Elev. (m AHD)
18/05/2012	08:30	1	60	5	Mount Burr TWS 6	Production	0	Gambier Limestone	Not surveyed
"		2	60	10	"	"	"	"	"
"		3	60	15	"	"	"	"	"

MOUNT BURR TWS 6 MANUAL DATA

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
1	5	0	40.57	0.00
1	5	1	44.90	4.33
1	5	2	45.35	4.78
1	5	3	45.61	5.04
1	5	4	45.58	5.01
1	5	5	45.58	5.01
1	5	6	45.66	5.09
1	5	7	45.68	5.11
1	5	8	45.72	5.15
1	5	9	45.99	5.42
1	5	10	46.12	5.55
1	5	12	46.30	5.73
1	5	14	46.38	5.81
1	5	16	46.42	5.85
1	5	18	46.49	5.92
1	5	20	46.52	5.95
1	5	22	46.55	5.98
1	5	24	46.58	6.01
1	5	26	46.60	6.03
1	5	28	46.62	6.05
1	5	30	46.62	6.05
1	5	35	46.72	6.15
1	5	40	46.76	6.19
1	5	45	46.79	6.22
1	5	50	46.82	6.25
1	5	55	46.84	6.27
1	5	60	46.88	6.31
2	10	61	50.85	10.28
2	10	62	51.93	11.36
2	10	63	52.34	11.77
2	10	64	52.52	11.95
2	10	65	52.68	12.11

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
2	10	66	52.80	12.23
2	10	67	52.87	12.30
2	10	68	52.93	12.36
2	10	69	53.00	12.43
2	10	70	53.06	12.49
2	10	72	53.13	12.56
2	10	74	53.20	12.63
2	10	76	53.30	12.73
2	10	78	53.35	12.78
2	10	80	53.40	12.83
2	10	82	53.44	12.87
2	10	84	53.48	12.91
2	10	86	53.50	12.93
2	10	88	53.54	12.97
2	10	90	53.55	12.98
2	10	95	53.58	13.01
2	10	100	53.66	13.09
2	10	105	53.69	13.12
2	10	110	53.70	13.13
2	10	115	53.75	13.18
2	10	120	53.77	13.20
3	15	121	57.82	17.25
3	15	122	59.05	18.48
3	15	123	59.65	19.08
3	15	124	59.81	19.24
3	15	125	59.92	19.35
3	15	126	60.00	19.43
3	15	127	60.07	19.50
3	15	128	60.10	19.53
3	15	129	60.11	19.54
3	15	130	60.14	19.57
3	15	132	60.30	19.73
3	15	134	60.45	19.88
3	15	136	60.50	19.93
3	15	138	60.60	20.03
3	15	140	60.68	20.11
3	15	142	60.72	20.15
3	15	144	60.74	20.17
3	15	146	60.78	20.21
3	15	148	60.84	20.27
3	15	150	60.89	20.32
3	15	155	60.91	20.34

Step No.	Q (L/s)	Time (min)	DTW (m)	DD (m)
3	15	160	61.03	20.46
3	15	165	61.09	20.52
3	15	170	61.12	20.55
3	15	175	61.17	20.60
3	15	180	61.18	20.61

C.4 MOUNT BURR TWS 6 CONSTANT RATE DISCHARGE TEST

MOUNT BURR TWS 6

Start date	Start time	Step	Duration (min)	Q (L/s)	Well Name	Well Type	r (m)	Aquifer	Ref Elev. (m AHD)
19/05/2012	08:30	1	Pumping 720 Recovery 360	15	Mount Burr TWS 6	Production	0	Gambier Limestone	Not surveyed
					Mount Burr TWS 1	Observation	67	Gambier Limestone	Not surveyed
					Mount Burr TWS 5	Observation	328	Gambier Limestone	Not surveyed

MOUNT BURR TWS 6 MANUAL DATA

Q (L/s)	Time (min)	DTW (m)	DD (m)
15	0	40.57	0.00
15	1	52.85	12.28
15	2	53.75	13.18
15	3	55.70	15.13
15	4	56.76	16.19
15	5	57.37	16.80
15	6	58.07	17.50
15	7	58.42	17.85
15	8	58.55	17.98
15	9	58.70	18.13
15	10	58.95	18.38
15	12	59.16	18.59
15	14	59.35	18.78
15	16	59.55	18.98
15	18	59.71	19.14
15	20	59.80	19.23
15	22	59.82	19.25
15	24	59.98	19.41
15	26	60.11	19.54
15	28	60.15	19.58
15	30	60.20	19.63
15	35	60.38	19.81
15	40	60.50	19.93
15	45	60.57	20.00
15	50	60.73	20.16
15	55	60.77	20.20
15	60	60.81	20.24
15	70	60.97	20.40
15	80	61.12	20.55

Q (L/s)	Time (min)	DTW (m)	DD (m)
15	90	61.24	20.67
15	100	61.37	20.80
15	120	61.38	20.81
15	140	61.46	20.89
15	160	61.50	20.93
15	180	61.64	21.07
15	200	61.68	21.11
15	250	61.75	21.18
15	300	61.84	21.27
15	350	61.90	21.33
15	400	61.90	21.33
15	450	61.91	21.34
15	500	62.03	21.46
15	550	62.05	21.48
15	600	62.05	21.48
15	650	62.08	21.51
15	700	62.11	21.54
15	720	62.14	21.57
0	721	49.44	8.87
0	722	46.81	6.24
0	723	45.59	5.02
0	724	44.87	4.30
0	725	44.50	3.93
0	726	44.28	3.71
0	727	44.03	3.46
0	728	43.90	3.33
0	729	43.73	3.16
0	730	43.55	2.98
0	732	43.30	2.73
0	734	43.20	2.63
0	736	43.05	2.48
0	738	42.89	2.32
0	740	42.76	2.19
0	742	42.71	2.14
0	744	42.64	2.07
0	746	42.53	1.96
0	748	42.41	1.84
0	750	42.34	1.77
0	755	42.19	1.62
0	760	42.12	1.55
0	765	42.03	1.46
0	770	41.93	1.36

Q (L/s)	Time (min)	DTW (m)	DD (m)
0	775	41.86	1.29
0	780	41.77	1.20
0	790	41.65	1.08
0	800	41.58	1.01
0	810	41.48	0.91
0	820	41.40	0.83
0	840	41.31	0.74
0	860	41.26	0.69
0	880	41.19	0.62
0	900	41.12	0.55
0	920	41.08	0.51
0	970	41.00	0.43
0	1020	40.94	0.37
0	1070	40.89	0.32
0	1080	40.87	0.30

MOUNT BURR TWS 1 MANUAL DATA

Q (L/s)	Time (min)	DTW (m)	DD (m)
	0	33.22	0.00
	1	-	-
	2	33.27	0.05
	3	33.32	0.10
	4	33.36	0.14
	5	33.43	0.21
	6	33.48	0.26
	7	33.52	0.30
	8	33.58	0.36
	9	33.62	0.40
	10	33.65	0.43
	12	33.73	0.51
	14	33.77	0.55
	16	33.82	0.60
	18	33.88	0.66
	20	33.92	0.70
	22	33.95	0.73
	24	-	-
	26	34.04	0.82
	28	34.07	0.85
	30	34.08	0.86
	35	34.12	0.90
	40	34.18	0.96

Q (L/s)	Time (min)	DTW (m)	DD (m)
	45	34.22	1.00
	50	34.25	1.03
	55	34.29	1.07
	60	34.31	1.09
	70	34.42	1.20
	80	-	-
	90	-	-
	100	-	-
	120	34.55	1.33
	140	34.61	1.39
	160	34.65	1.43
	180	34.68	1.46
	200	34.71	1.49
	250	34.76	1.54
	300	34.81	1.59
	350	34.86	1.64
	400	34.87	1.65
	450	34.88	1.66
	500	34.90	1.68
	550	34.92	1.70
	600	34.94	1.72
	650	34.96	1.74
	700	34.97	1.75
	720	-	-
	721	-	-
	722	-	-
	723	-	-
	724	-	-
	725	-	-
	726	-	-
	727	-	-
	728	-	-
	729	-	-
	730	-	-
	732	-	-
	734	34.42	1.20
	736	-	-
	738	-	-
	740	-	-
	742	-	-
	744	-	-
	746	34.23	1.01

Q (L/s)	Time (min)	DTW (m)	DD (m)
	748	-	-
	750	-	-
	755	34.09	0.87
	760	-	-
	765	-	-
	770	33.96	0.74
	775	-	-
	780	-	-
	790	33.83	0.61
	800	-	-
	810	33.71	0.49
	820	-	-
	840	33.61	0.39
	860	33.61	0.39
	880	33.57	0.35
	900	33.54	0.32
	920	33.47	0.25
	970	33.46	0.24
	1020	33.42	0.20
	1070	33.38	0.16
	1080	33.37	0.15

D. WATER CHEMISTRY

As noted above these results are most likely to be from Mt Burr TWS 5.

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Australian Water Quality Centre

SAW Infrastructure
ATTN: Zoe Sands
250 Victoria Square
Adelaide
SA 5001 AUSTRALIA

08/06/2012

Dear Zoe

Please find attached the Final Analytical Report for

Customer Service Request: 105296-2012-CSR-12
Account: 105296
Project: AWQC-59879 SAW Infrastructure - Mt Burr Bore 6 Commissioning 11/12

This report has also been sent to: Maree Shephard

Please note AWQC Sample Receipt hours are Monday to Friday 8.30am - 4.30pm.

Yours sincerely,

Pat Poldervaart
Account Manager
Pat.Poldervaart@sawater.com.au
+61 8 7424 2095

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Australian Water Quality Centre

FINAL REPORT: 104196

Report Information

Project Name	AWQC-59879
Customer	SAW Infrastructure
CSR_ID	105296-2012-CSR-12

Analytical Results

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Sampling Point	46406-Mt Burr Bore No 6
Sampled Date	21/05/2012 12:00:00AM
Sample Received Date	21/05/2012 8:11:35PM
Sample ID	*2012-002-3469
Status	Endorsed
Collection Type	Customer Collected

Bacteriology	LOR	Result
Coliforms T0080-07 WMZ-500		
Coliforms		1 /100mL
Coliforms - Presumptive		1 /100mL
E.coli T0081-07 WMZ-500		
E.coli		0 /100mL
E.coli - Presumptive		0 /100mL

Inorganic Chemistry - Metals	LOR	Result
Aluminium - Acid Soluble TIC-003 W09-023		
Aluminium - Acid Soluble	0.001	<0.001 mg/L
Aluminium - Soluble TIC-003 W09-023		
Aluminium - Soluble	0.001	<0.001 mg/L
Aluminium - Total TIC-003 W09-023		
Aluminium - Total	0.001	<0.001 mg/L
Antimony - Soluble TIC-003 W09-023		
Antimony - Soluble	0.0005	<0.0005 mg/L
Antimony - Total TIC-003 W09-023		
Antimony - Total	0.0005	<0.0005 mg/L
Arsenic - Soluble TIC-003 W09-023		
Arsenic - Soluble	0.0003	<0.0003 mg/L
Arsenic - Total TIC-003 W09-023		
Arsenic - Total	0.0003	<0.0003 mg/L
Barium - Soluble TIC-003 W09-023		
Barium - Soluble	0.0005	0.0173 mg/L
Barium - Total TIC-003 W09-023		
Barium - Total	0.0005	0.0175 mg/L
Beryllium - Soluble TIC-003 W09-023		
Beryllium - Soluble	0.0003	<0.0003 mg/L
Beryllium - Total TIC-003 W09-023		
Beryllium - Total	0.0003	<0.0003 mg/L
Boron - Soluble TIC-003 W09-023		

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Boron - Soluble TIC-003 W09-023		
Boron - Soluble	0.020	<0.020 mg/L
Cadmium - Soluble TIC-003 W09-023		
Cadmium - Soluble	0.0001	<0.0001 mg/L
Cadmium - Total TIC-003 W09-023		
Cadmium - Total	0.0001	<0.0001 mg/L
Calcium Hardness as CaCO3 W09-023		
Calcium Hardness as CaCO3	2.0	297 mg/L
Calcium TIC-004 W09-023		
Calcium	0.1	119 mg/L
Carbonate Hardness as CaCO3 T0203-01 W09-023		
Carbonate hardness as CaCO3	2	292 mg/L
Chlorides - Total as NaCl W09-023		
Chlorides - Total as NaCl	7	163 mg/L
Chromium - Soluble TIC-003 W09-023		
Chromium - Soluble	0.0001	0.0011 mg/L
Chromium - Total TIC-003 W09-023		
Chromium - Total	0.0001	0.0012 mg/L
Copper - Soluble TIC-003 W09-023		
Copper - Soluble	0.0001	0.0009 mg/L
Copper - Total TIC-003 W09-023		
Copper - Total	0.0001	0.0009 mg/L
Dissolved Solids by Calculation W09-023		
Dissolved solids by calculation	0	465 mg/L
Ion Balance W09-023		
Ion balance		1.34 %
Iron - Soluble TIC-003 W09-023		
Iron - Soluble	0.0005	0.0005 mg/L
Iron - Total TIC-003 W09-023		
Iron - Total	0.0005	0.0020 mg/L
Langelier Index W09-023		
Langelier Index		0.29
Lead - Soluble TIC-003 W09-023		
Lead - Soluble	0.0001	<0.0001 mg/L
Lead - Total TIC-003 W09-023		
Lead - Total	0.0001	<0.0001 mg/L
Magnesium Hardness as CaCO3 W09-023		
Magnesium Hardness as CaCO3	2	49 mg/L

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Magnesium TIC-003 W09-023		
Magnesium	0.04	11.9 mg/L
Manganese - Soluble TIC-003 W09-023		
Manganese - Soluble	0.0001	<0.0001 mg/L
Manganese - Total TIC-003 W09-023		
Manganese - Total	0.0001	<0.0001 mg/L
Mercury - Soluble TIC-003 W09-023		
Mercury - Soluble	0.00003	<0.00003 mg/L
Mercury - Total TIC-003 W09-023		
Mercury - Total	0.00003	<0.00003 mg/L
Molybdenum - Soluble TIC-003 W09-023		
Molybdenum - Soluble	0.0001	<0.0001 mg/L
Molybdenum - Total TIC-003 W09-023		
Molybdenum - Total	0.0001	<0.0001 mg/L
Nickel - Soluble TIC-003 W09-023		
Nickel - Soluble	0.0001	0.0008 mg/L
Nickel - Total TIC-003 W09-023		
Nickel - Total	0.0001	0.0008 mg/L
Noncarbonate Hardness as CaCO3 T0204-01 W09-023		
Noncarbonate hardness as CaCO3	2	54 mg/L
Potassium TIC-003 W09-023		
Potassium	0.040	1.58 mg/L
Selenium - Soluble TIC-003 W09-023		
Selenium - Soluble	0.0001	0.0003 mg/L
Selenium - Total TIC-003 W09-023		
Selenium - Total	0.0001	0.0003 mg/L
Silver - Soluble TIC-003 W09-023		
Silver - Soluble	0.00003	<0.00003 mg/L
Silver - Total TIC-003 W09-023		
Silver - Total	0.00003	<0.00003 mg/L
Sodium Adsorption Ratio W09-023		
Sodium Adsorption Ratio - Calculation		1.18
Sodium TIC-004 W09-023		
Sodium	0.1	50.4 mg/L
Sodium/Total Cations Ratio W09-023		
Sodium/Total cations ratio	1	24.0 %
Sulphur TIC-004 W09-023		
Sulphate	1.5	8.7 mg/L

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Tin - Soluble TIC-003 W09-023		
Tin - Soluble	0.0005	<0.0005 mg/L
Tin - Total TIC-003 W09-023		
Tin - Total	0.0005	<0.0005 mg/L
Total Hardness as CaCO3 W09-023		
Total Hardness as CaCO3	2.0	346 mg/L
Uranium - Soluble TIC-003 W09-023		
Uranium - Soluble	0.0001	0.0002 mg/L
Uranium - Total TIC-003 W09-023		
Uranium - Total	0.0001	0.0002 mg/L
Zinc - soluble TIC-003 W09-023		
Zinc - Soluble	0.0003	0.0046 mg/L
Zinc - Total TIC-003 W09-023		
Zinc - Total	0.0003	0.0052 mg/L

Inorganic Chemistry - Nutrients	**LOR**	**Result**
Ammonia as N T0100-01 W09-023		
Ammonia as N	0.005	<0.005 mg/L
Bromide T0114-01 W09-023		
Bromide	0.025	0.32 mg/L
Chloride T0104-02 W09-023		
Chloride	4.0	99 mg/L
Fluoride W09-023		
Fluoride	0.10	<0.10 mg/L
Iodide T0117-01 W09-023		
Iodide	0.01	<0.01 mg/L
Nitrate + Nitrite as N T0161-01 W09-023		
Nitrate + Nitrite as N	0.003	1.32 mg/L
Nitrate + Nitrite as NO3 T0161-01 W09-023		
Nitrate + Nitrite as NO3	0.02	5.85 mg/L
Nitrate as N W09-023		
Nitrate as Nitrogen	0.005	1.32 mg/L
Nitrite as N T0107-01 W09-023		
Nitrite as Nitrogen	0.003	<0.003 mg/L
Phosphorus - Filterable Reactive as P T0108-01 W09-023		
Phosphorus - Filterable Reactive as P	0.003	0.051 mg/L
Phosphorus - Total T0109-01 W09-023		

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Phosphorus - Total T0109-01 W09-023		
Phosphorus - Total	0.005	0.039 mg/L
Silica - Reactive T0111-01 W09-023		
Silica - Reactive	1	22 mg/L
TKN as N T0112-01 W09-023		
TKN as Nitrogen	0.05	<0.05 mg/L

Organic Chemistry	**LOR**	**Result**
Dissolved Organic Carbon W09-023		
Dissolved Organic Carbon	0.3	0.7 mg/L
GCMS Scan - Dichloromethane T1072-01 W09-023		
# GCMS Scan		No semi-volatile organic compounds were detected. Some compounds may not have even been extracted using dichloromethane and/or detected by GC/MS.
OrganoChlorine Pesticides T0700-01 W09-023		
Aldrin	0.01	<0.01 µg/L
Chlordane-a	0.01	<0.01 µg/L
Chlordane-g	0.01	<0.01 µg/L
Chlorothalonil	0.05	<0.05 µg/L
Chlorpyrifos	0.05	<0.05 µg/L
Chlorthal-Dimethyl	0.05	<0.05 µg/L
DDD	0.05	<0.05 µg/L
DDE	0.05	<0.05 µg/L
DDT	0.05	<0.05 µg/L
Dieldrin	0.01	<0.01 µg/L
Endosulfan 1	0.05	<0.05 µg/L
Endosulfan 2	0.05	<0.05 µg/L
Endosulfan Sulphate	0.05	<0.05 µg/L
Endrin	0.05	<0.05 µg/L
Heptachlor	0.05	<0.05 µg/L
Heptachlor Epoxide	0.05	<0.05 µg/L
Hexachlorobenzene	0.05	<0.05 µg/L
Lindane	0.05	<0.05 µg/L
Methoxychlor	0.05	<0.05 µg/L
Total Aldrin and Dieldrin	0.02	<0.02 µg/L
Trifluralin	0.05	<0.05 µg/L
Vinclozolin	0.05	<0.05 µg/L

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Organophosphorous and Triazine Pesticides T0800-01 W09-023

Atrazine	0.5	<0.5 µg/L
Azinphos-methyl	0.5	<0.5 µg/L
Diazinon	0.5	<0.5 µg/L
Fenitrothion	0.5	<0.5 µg/L
Hexazinone	0.5	<0.5 µg/L
Malathion	0.5	<0.5 µg/L
Parathion	0.5	<0.5 µg/L
Parathion methyl	0.3	<0.3 µg/L
Prometryne	0.5	<0.5 µg/L
Simazine	0.5	<0.5 µg/L

Inorganic Chemistry - Physical	LOR	Result

Alkalinity Carbonate Bicarbonate and Hydroxide T0101-01 W09-023

Alkalinity as Calcium Carbonate		292 mg/L
Bicarbonate		356 mg/L
Carbonate		0 mg/L
Hydroxide		0 mg/L

Carbon Dioxide - Free W09-023

Carbon Dioxide - Free	0	28 mg/L

Conductivity & Total Dissolved Solids T0016-01 W09-023

Conductivity	1	871 µScm
Total Dissolved Solids (by EC)	1.0	480 mg/L

pH T0010-01 W09-023

pH		7.3 pH units

Inorganic Chemistry - Waste Water	LOR	Result

Chlorine Demand - 24 hrs T0136-03 W09-023

Chlorine Demand 24hrs		1.033 mg/L

Chlorine Demand - 30 mins T0136-03 W09-023

Chlorine Demand 30 mins		0.6867 mg/L

Chlorine Demand - 8 hrs T0136-03 W09-023

Chlorine Demand 8 hrs		0.83 mg/L

Cyanide - Total T0167-03 W09-023

Cyanide as CN - Total	0.05	<0.05 mg/L

Western Radiation Services	LOR	Result

Gross Alpha Activity W09-023

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Gross Alpha Activity W09-023

!External Lab Report No.		WRS-J6908
Gross Alpha Activity	0.005	0.012 Bq/L

Gross Beta Activity (K-40 corrected) W09-023

!External Lab Report No.		WRS-J6908
Gross Beta Activity (K-40 corrected)	0.010	<0.010 Bq/L

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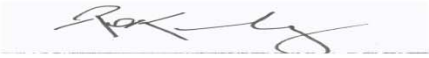
NATA Signatories

Vickie Dalgleish - Microbiology Senior Technical Officer



Roger Kennedy - Inorganic Chemistry Process Coordinator

Stephanie Semczuk - Inorganic Chemistry Team Leader

Kamilla Springer - Organic Chemistry Technical Officer

Boutsaba Vorakoumane - Organic Chemistry Scientific Officer

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Incidents

Sample ID	S.Point	Description	Sampled Date	Analysis (where Applicable)	Incident Description
2012-002-3469	46406	Mt Burr Bore 6	21/05/2012	Phosphorus - Total	Dependent results are within acceptable analytical uncertainty

Analytical Method

Analytical Method Code	Description	Reference Method
T0010-01	Determination of pH	
T0016-01	Determination of Conductivity	
T0080-07	Coliforms - MPN Defined Substrate Technique	AS 4276.21-2005
T0081-07	E Coli - MPN Define Substrate Technique Refer T0080-07	AS 4276.21-2005
T0100-01	Ammonia/Ammonium - Automated Flow Colorimetry	APHA 4500-NH3 G
T0101-01	Alkalinity - Automated Acidimetric Titration	
T0104-02	Chloride - Automated Flow Colorimetry	APHA 4500-Cl- E
T0107-01	Nitrite - Automated Flow Colorimetry	APHA 4500-NO3-I
T0108-01	Filterable Reactive Phosphorus - Automated Flow Colorimetry	APHA 4500-P G
T0109-01	Total Phosphorus - Automated Flow Colorimetry	APHA 4500-P F
T0111-01	Reactive Silica - Automated Flow Coloimetry	APHA 4500-Si02 F
T0112-01	TKN - Automated Flow Colorimetry	APHA-N org A
T0114-01	Bromide	USEPA Method 300.0 (1993).
T0117-01	Iodide	USEPA Method 300.0 (1993).
T0136-03	Chlorine Demand	Cowell method
T0136-03	Chlorine Demand	Futurefarms CSBP Ltd
T0161-01	Nitrate + Nitrate (NOx) - Automated Flow Colorimetry	APHA 4500-NO3-I
T0167-03	Cyanide - Total	Futurefarms CSBP Ltd
T0203-01	Carbonate Hardness as CaCo3	
T0204-01	Noncarbonate Hardness as CaCo3	
T0700-01	Chlorinated Pesticides	USEPA Method 508
T0800-01	Nitrogen and Phosphorous Containing Pesticides	USEPA Method 507
T1072-01	Fullscan by GCMS	In House
TIC-003	Elemental Analysis - ICP Mass Spectrometry	EPA method 200.8
TIC-004	Determination of Metals - ICP Spectrometry by ICP2	APHA 3120
W-052	Preparation of Samples for Metal Analysis	APHA 3030A to 3030D

Sampling Method

Sampling Method Code	Description
W09-023	Sampling Method for Chemical Analyses
WMZ-500	Sampling Method for Microbiological Analyses

NATA WORLD RECOGNISED ACCREDITATION

Corporate Accreditation No.1115
Chemical and Biological Testing
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Notes
1. **The last figure of the result value is a significant figure.**
2. **Samples are analysed as received.**
3. **# determination of the component is not covered by NATA Accreditation.**
4. **^ indicates result is out of specification according to the reference Guideline. Refer to Report footer.**
5. *** indicates incident have been recorded against the sample. Refer to Report footer.**
6. **& Indicates the results have changed since the last issued report.**
7. **The Limit of Reporting (LOR) is the lowest concentration of analyte which is reported at the AWQC and is based on the LOQ rounded up to a more readily used value. The Limit of Quantitation (LOQ) is the lowest concentration of analyte for which quantitative results may be obtained within a specified degree of confidence.**

ABN 69336525019 A business unit of the South Australian Water Corporation

PO Box 1751
Adelaide SA 5001

250 Victoria Square
Adelaide SA 5000

Tel: 1300 653 366
Fax: 1300 883 171

Internet: www.awqc.com.au
Email: awqc@sawater.com.au

Australian Water Quality Centre

FINAL REPORT: 104196

Laboratory Information

Laboratory	NATA accreditation ID
Bacteriology	1115
Inorganic Chemistry - Metals	1115
Inorganic Chemistry - Nutrients	1115
Organic Chemistry	1115
Inorganic Chemistry - Physical	1115
Inorganic Chemistry - Waste Water	1115
Western Radiation Services	14174

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