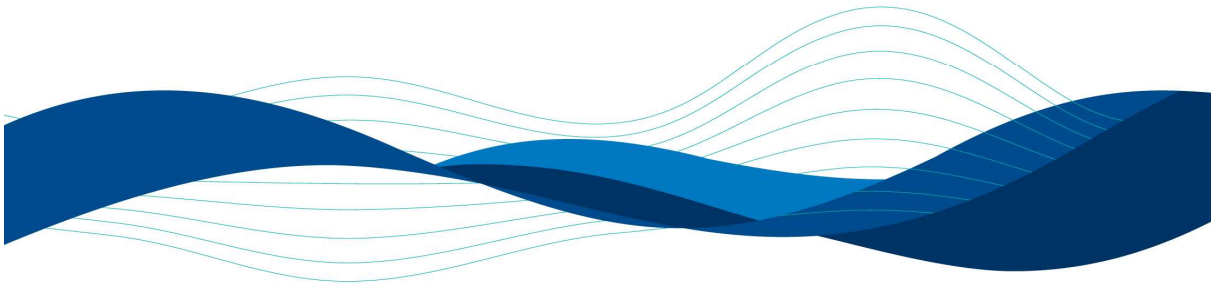
Southern Rural Water
Managing Water. Serving Communities.



Yangery Groundwater Management Plan Annual Report

2009-10

Introduction

This report summarises licence information, metered usage and monitoring data collected for the period between July 2009 and June 2010 in accordance with the recommendations given in the Yangery Groundwater Management Plan.

1. The Yangery Groundwater Management Plan

The groundwater located in the Yangery Water Supply Protection Area encompasses all aquifers to a depth of 100 meters below the natural surface (see map of page 4). These include aquifers associated with the Newer Volcanics, the Port Campbell Limestone, the Hanson Sand plains and costal dune and alluvial deposits. Groundwater within these aquifers is used for irrigation, dairy and stock and domestic purposes.

2. Southern Rural Water's duties under the Groundwater Management Plan

The Yangery Groundwater Management Plan identifies Southern Rural Water as the authority responsible for managing and administering the plan.

The plan requires SRW to:

- coordinate and cause to be carried out groundwater level monitoring and metering programs;
- administer groundwater licensing within the prescriptions of the plan;
- review and report annually to the Minister administering the Water Act 1989 on the implementation of the plan;
- review the plan and if, in its opinion, amendments are necessary or desirable, make recommendations to the Minister accordingly.

3. Allocations

The following table sets out the Permissible Consumptive Volume for the Yangery WSPA, and the total allocations for the period.

SRW and the Department of Sustainability and Environment recently completed a Dairy Wash Licensing Amnesty and are working through the applications received. This may result in future amendment of the PCV and associated licences, in accordance with government policy.

WSPA	PCV (ML)	Total No. Licences	Licensable (ML)	Domestic & Stock (ML)	Total (ML)
Yangery	14,103	162	14,100.7	3,338.9[1]	17,439.6

[1] *398.9ML of D&S attached to existing licences and 2,940ML (1,470 registered D&S bores at 2ML estimated use per bore) as at July 2009*

4. Metering

Of the 162 licences to take and use water from the Yangery WSPA, 154 are currently metered. Bores licensed for less than 10ML are not metered for compliance purposes. However, 20 meters are currently fitted to Dairy bores as part of a trial under the GMP.

Meters were read after the end of the irrigation season (between late May and early June) and the data stored in SRW's Water Management System. Metered use for the period was 4026.1ML*. This figure does not include all stock and domestic use or non-metered dairy use. It is estimated that total use could be approximately 6,966ML from registered bores (see footnote on previous page).

Review of the meter readings indicated that several groundwater users may have exceeded their licensed entitlement. At the time of writing, SRW was investigating these cases.

SRW is also engaged in a retrofitting program to conform with recent changes to the meter installation specifications. In Yangery, completion of this program is anticipated by the end of 2011.

* Water for Domestic & Stock use is extracted via metered bores in some cases.

5. Monitoring

There are 19 monitoring bores throughout the Yangery WSPA (see page 4). These bores are owned and managed by the Department of Sustainability & Environment and are used predominantly for monitoring static groundwater levels. Data collected from these bores are presented in appendix 1A and 1B.

Review of the groundwater level data indicates that:

- The groundwater elevations in bores 141300 and 141314 (PCL) dipped below sea level (0mAHD) in mid-2007. However, both bores have shown good recovery since then, especially during the winter months, and the water levels are currently 0.49m and 0.77m respectively; and
- The groundwater elevation in bore 141311 (PCL) was at its lowest on record in mid-2007 and has recovered by 1.4m since then; and

- The groundwater elevation in bore 141316 (PCL) has recovered to levels greater than 1mAHD, which has not been achieved since April 2006 and was at approximately 0.99mAHD at the time of writing; and
- The groundwater elevation in bore 141301 was close to sea level in December of 2006, and is currently 1.47mAHD.

Salinity has been measured at ten bores within the Yangery WSPA since 2001, with 16 of the 19 bores being monitored recently. The salinity monitoring results can be seen in Appendix 2.

Review of the salinity data indicates that:

- Bores 141300, 141301 and 141307 show the highest salinity across the monitored bores, of just over 3,000EC. Seawater has a salinity of around 62,000 EC. There is no evidence of rising salinity in any of the monitored bores.

Rainfall data from three weather stations in the area is presented in Appendix 3. Actual rainfall during the year was quite varied, with relatively high rainfall during several months between July 2009 and June 2010. All three weather stations recorded higher than usual rainfall for the reporting period. Port Fairy received >200mm above the long term median, (since records began in 1994).

6. Transfers of Water Entitlement

During the period between July 2009 and June 2010 a number of permanent and temporary transfers were approved within the Yangery WSPA.

There were two temporary (1 year) transfers approved with a combined volume of 25ML. Also, three permanent transfers occurred in this period, for a combined volume of 101ML

7. Plan Review

A review of the Groundwater Management Plan was completed in 2007. SRW did not propose to amend the Plan.

Review of additional data collected to date has not altered the findings of the review.

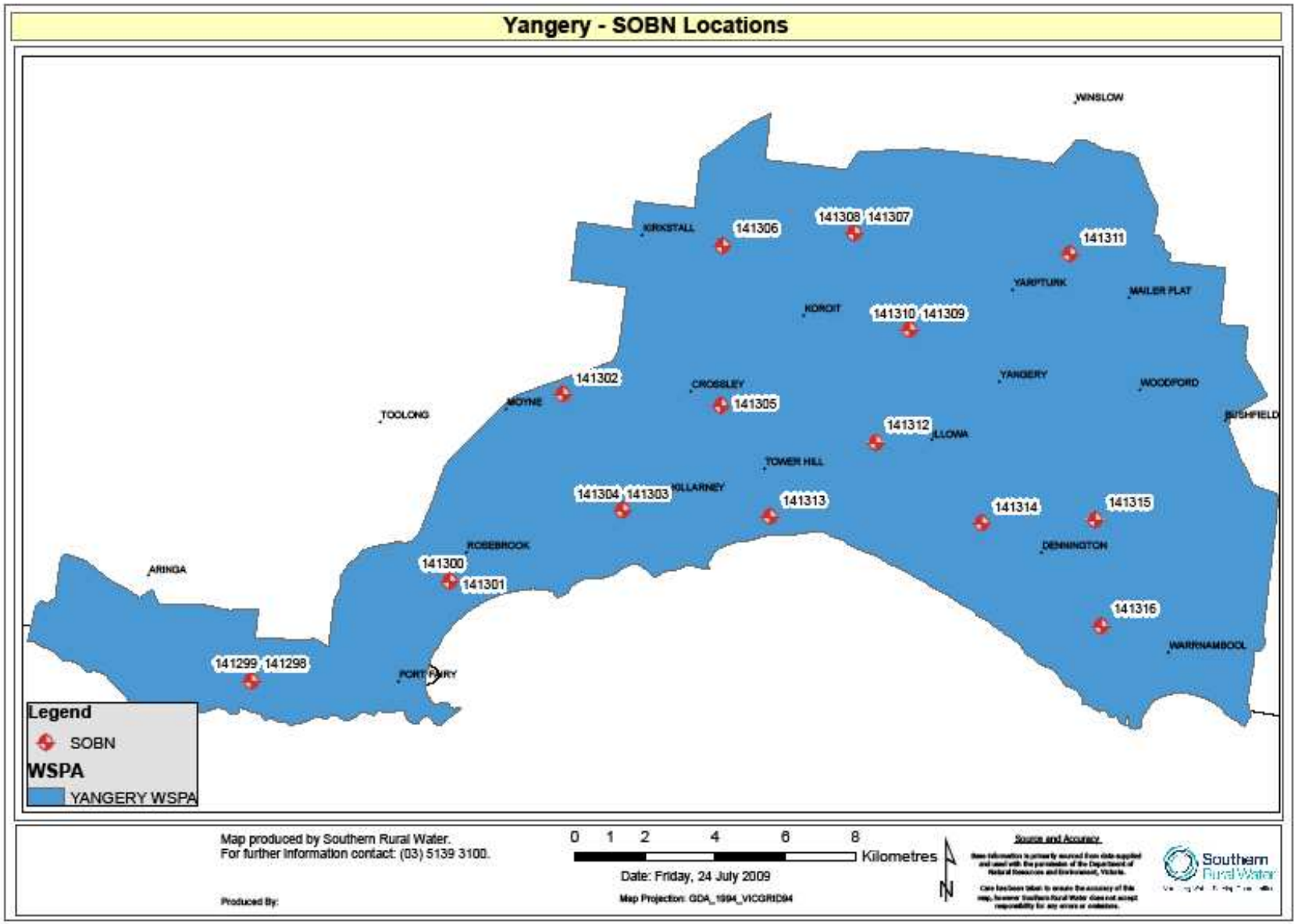


Figure 1: Yangery WSPA and Monitoring Locations

Appendix 1A. Monthly Monitoring Data (Groundwater Level)

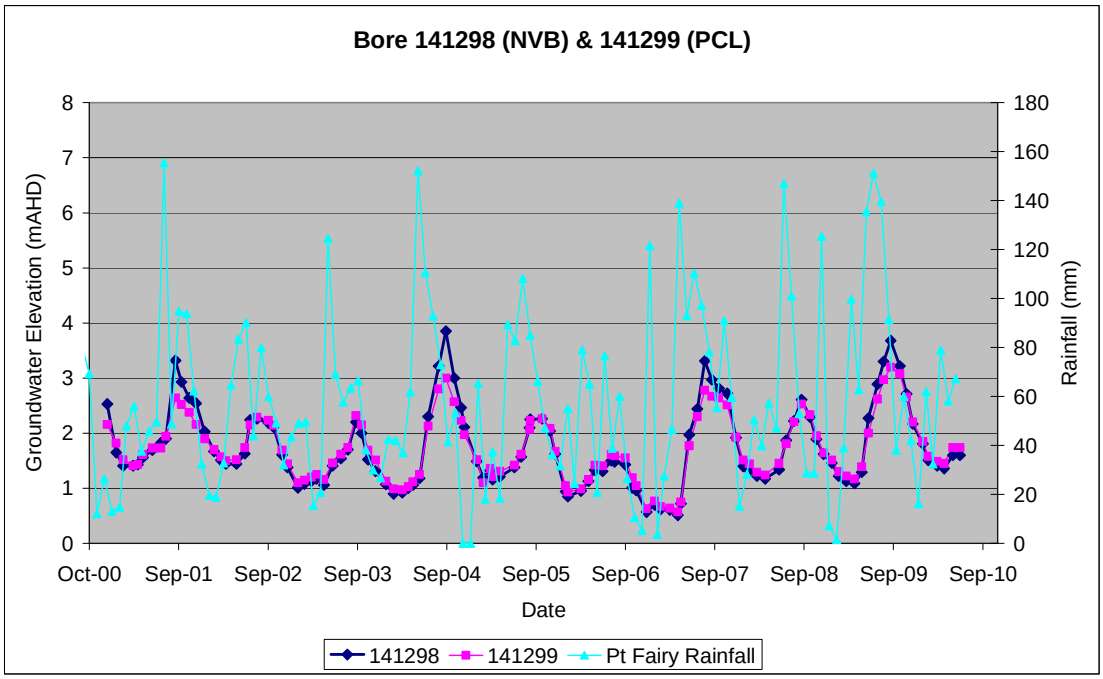
The tables below show the Reduced Water Level in metres AHD (relative to the Australian Height Datum or mean sea level) at each monitoring bore within the Yangery WSPA. This data was used to generate the hydrographs in Appendix 1B.

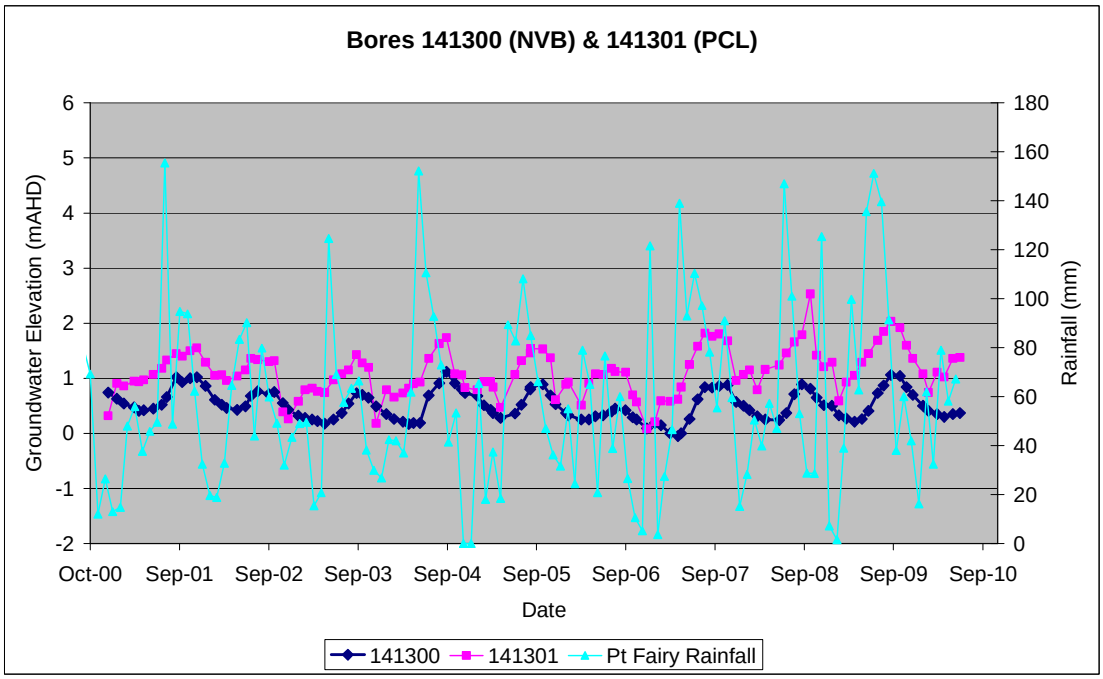
	141298	141299	141300	141301	141302	141303	141304	141305	141306
Jul-09	2.89	2.62	0.73	1.69	24.38	4.43	4.38	17.53	48.53
Aug-09	3.30	2.97	0.87	1.85	25.17	4.71	4.67	17.68	48.91
Sep-09	3.68	3.20	1.06	2.03	25.65	4.96	4.90	17.75	49.61
Oct-09	3.22	3.08	1.04	1.92	25.35	5.04	4.99	17.86	49.80
Nov-09	2.71	2.66	0.84	1.60	24.84	4.29	4.25	17.92	49.45
Dec-09	2.17	2.20	0.70	1.36	24.40	3.97	3.93	17.95	49.16
Jan-10	1.81	1.85	0.50	1.08	23.83	2.62	2.55	17.82	48.91
Feb-10	1.51	1.58	0.41	0.74	23.52	2.85	2.78	17.76	48.72
Mar-10	1.41	1.49	0.35	1.11	23.24	3.23	3.16	17.76	48.63
Apr-10	1.36	1.45	0.30	1.02	23.03	3.62	3.53	17.76	48.54
May-10	1.60	1.74	0.35	1.36	23.01	4.08	4.02	17.92	48.56
Jun-10	1.60	1.74	0.37	1.38	22.99	4.23	4.17	18.04	48.55
Jun-Jul	**-1.29**	**-0.88**	**-0.36**	**-0.31**	**-1.39**	**-0.20**	**-0.21**	**+0.51**	**+0.02**

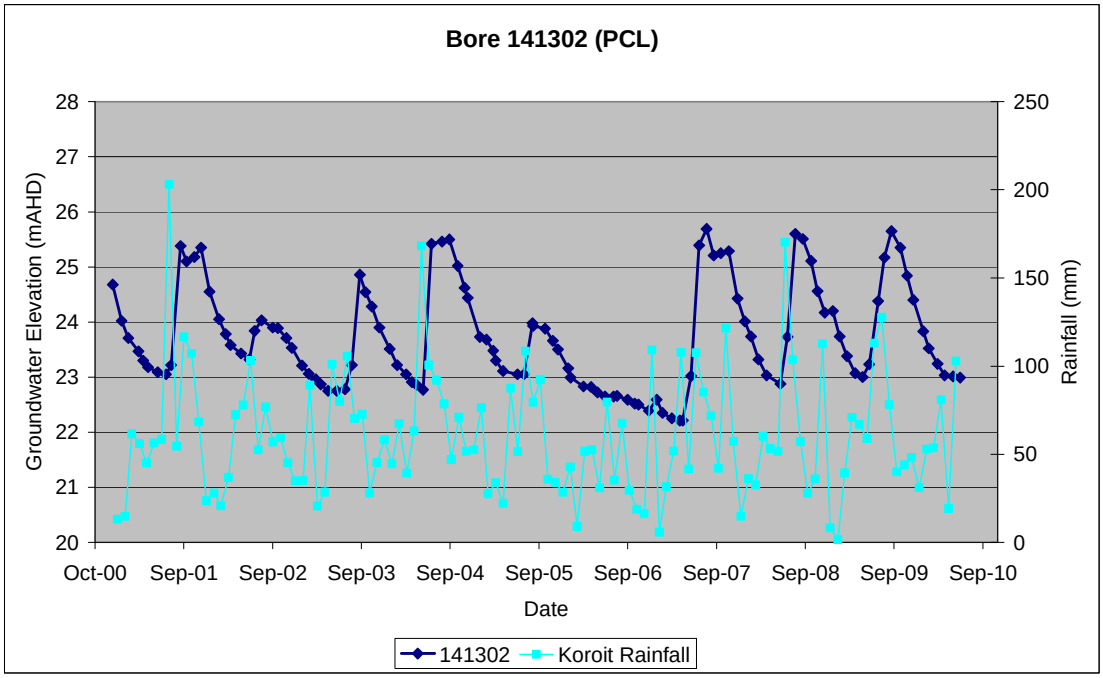
	141307	141308	141309	141310	141311	141312	141313	141314	141315	141316
Jul-09	73.07	73.07	49.82	49.10	53.66	7.73	2.45	0.95	6.12	0.92
Aug-09	73.29	73.30	50.37	49.36	53.83	7.79	2.60	1.14	6.12	0.96
Sep-09	73.75	73.77	50.30	49.43	53.99	7.75	2.79	1.36	6.14	1.02
Oct-09	74.23	74.26	50.65	49.72	54.40	7.76	2.66	1.52	6.16	1.11
Nov-09	74.10	74.11	50.44	49.38	54.52	7.78	2.63	1.31	6.18	1.09
Dec-09	74.08	74.06	50.34	49.35	54.69	7.80	2.52	0.97	6.20	1.03
Jan-10	73.20	73.19	50.03	48.91	54.57	7.77	2.31	0.53	6.17	0.95
Feb-10	73.59	73.63	49.45	48.43	54.45	7.78	2.23	0.42	6.18	0.92
Mar-10	73.62	73.62	49.44	48.46	54.44	7.81	2.21	0.45	6.21	0.88
Apr-10	73.58	73.58	49.43	48.95	54.44	7.76	2.13	0.52	6.20	0.86
May-10	73.66	73.66	49.97	49.39	54.54	7.84	2.27	0.53	6.24	0.96
Jun-10	73.68	73.68	50.27	49.71	54.62	7.92	2.35	1.01	6.28	1.04
Jun-Jul	**+0.61**	**+0.61**	**+0.45**	**+0.61**	**+0.96**	**+0.19**	**-0.10**	**+0.06**	**+0.16**	**+0.12**

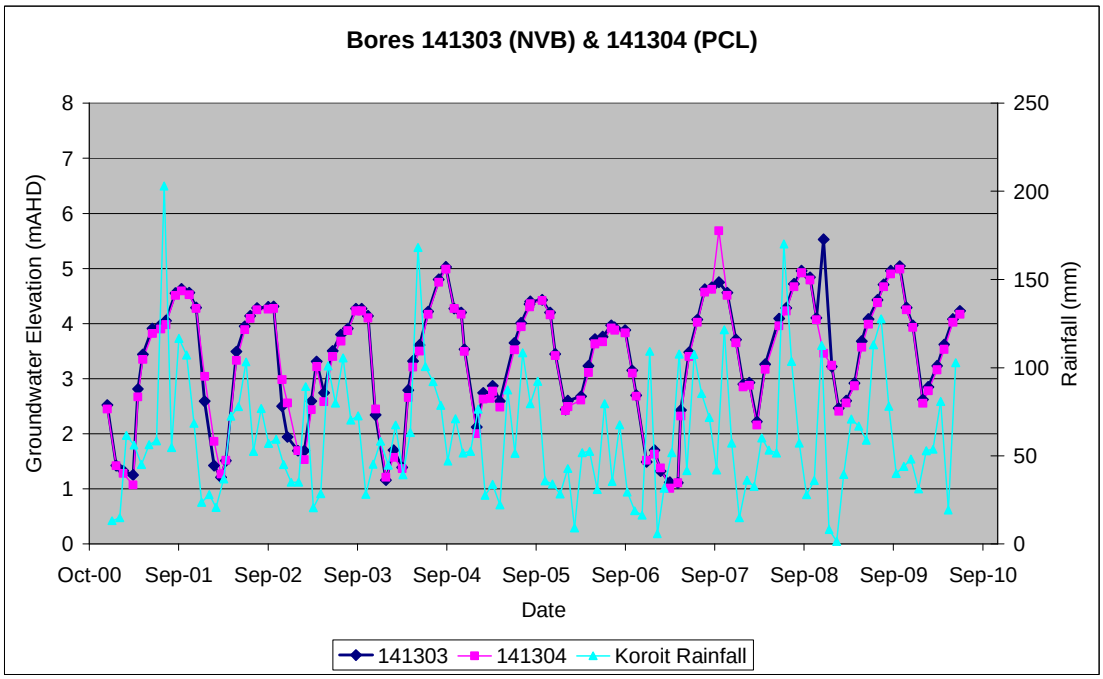
Appendix 1B. Hydrographs

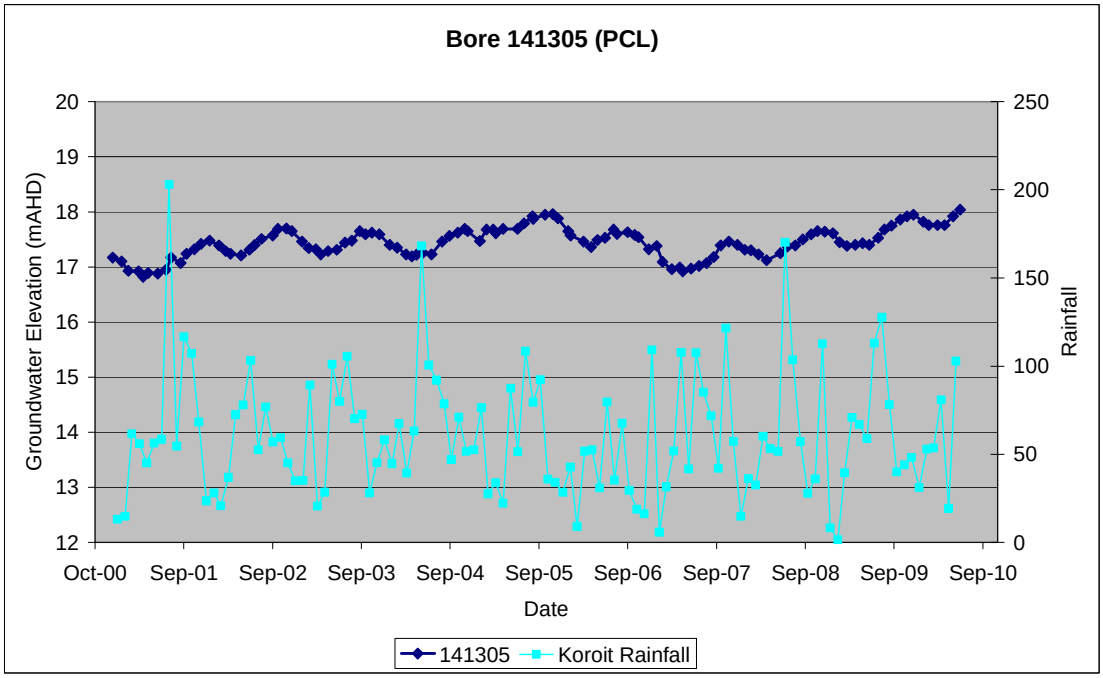
The following hydrographs show the trend in groundwater levels measured at monitoring bores throughout the Yangery Water Supply Protection Area. This is measured in metres above the Australian Height Datum (mAHD), or mean sea level. Basalt aquifer bores are labeled NVB and Port Campbell Limestone monitoring bores are labeled PCL.

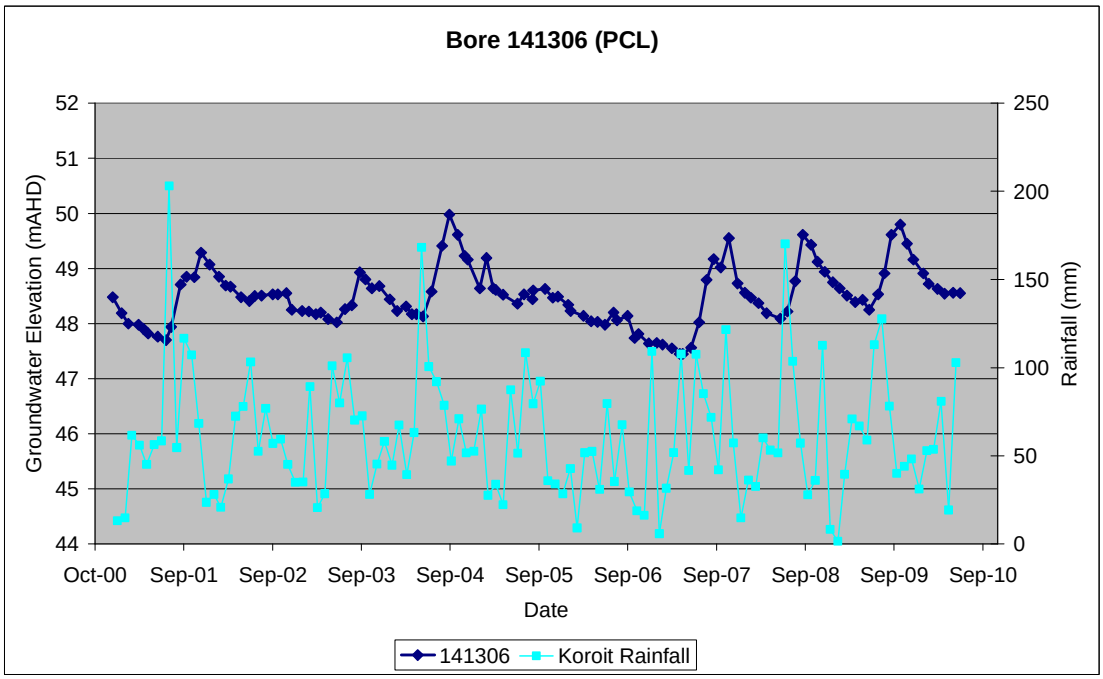


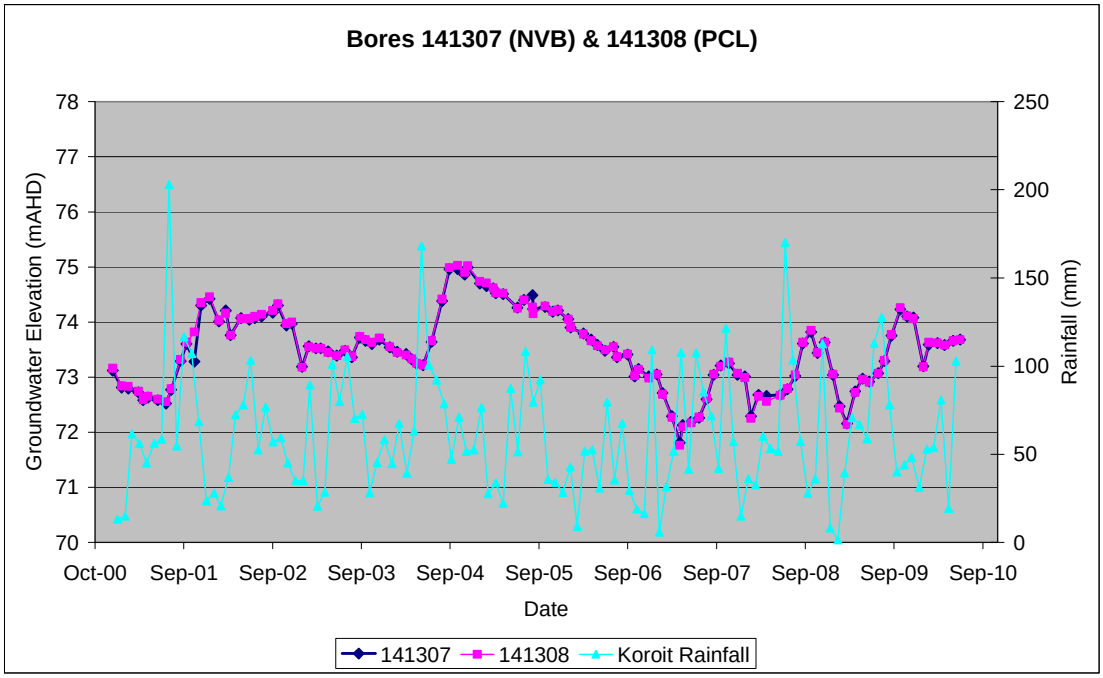


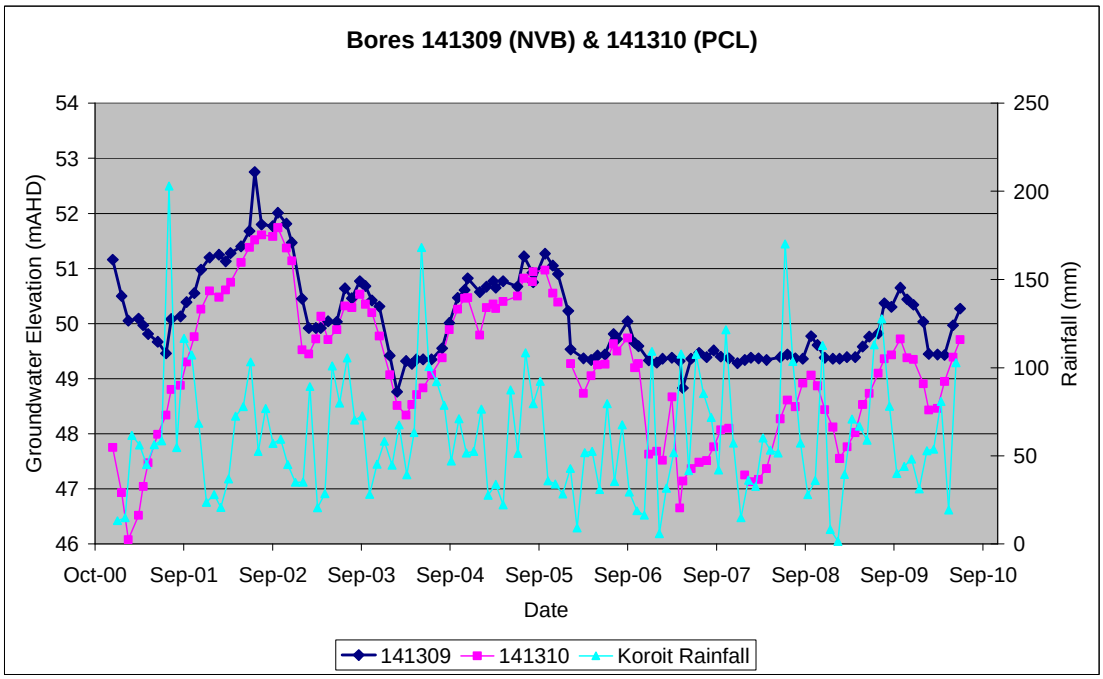

Bore 141302 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
28
27
26
25
24
23
22
21
20
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141302
Koroit Rainfall

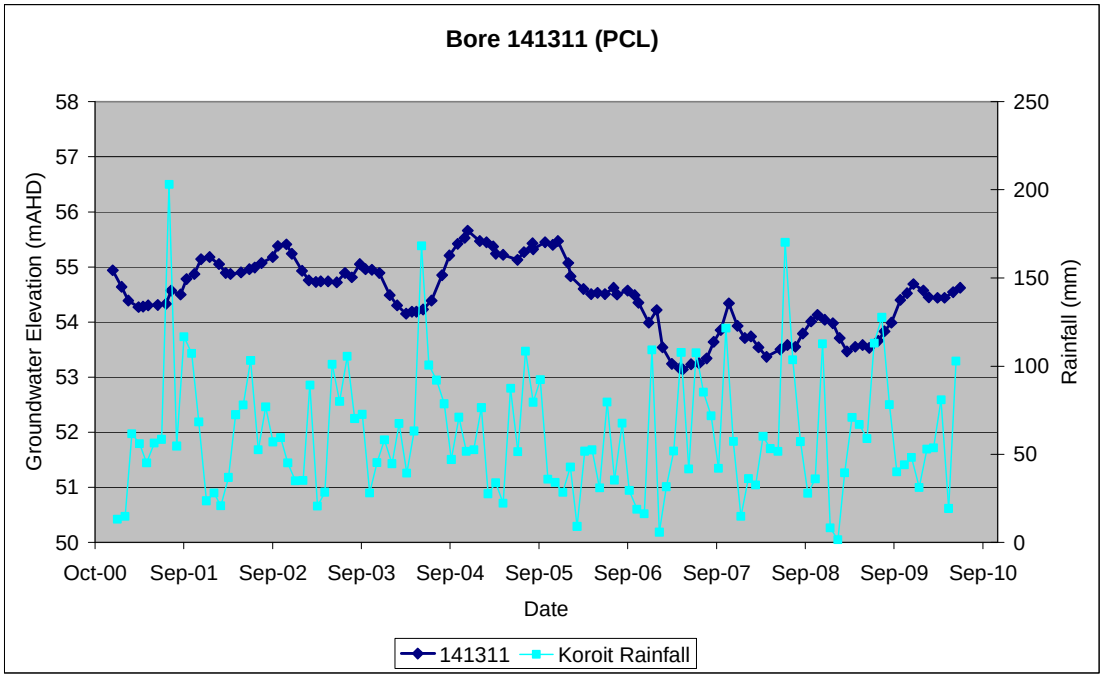

Bores 141303 (NVB) & 141304 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
8
7
6
5
4
3
2
1
0
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141303
141304
Koroit Rainfall

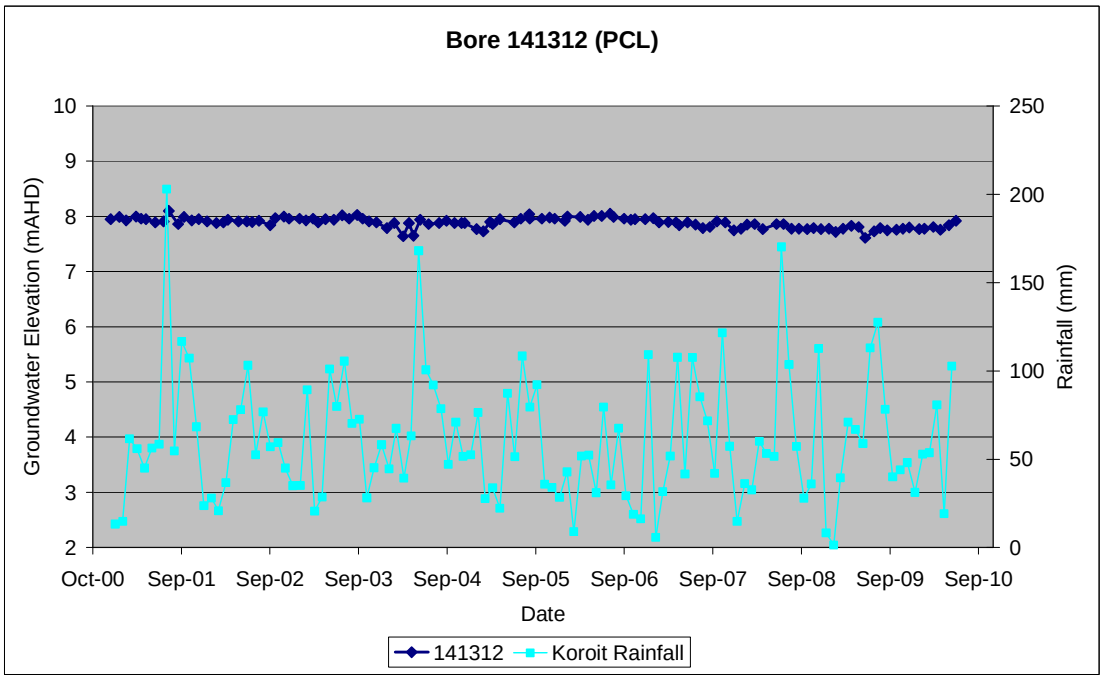

Bore 141305 (PCL)
Groundwater Elevation (mAHD)
Rainfall
20
19
18
17
16
15
14
13
12
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141305
Koroit Rainfall

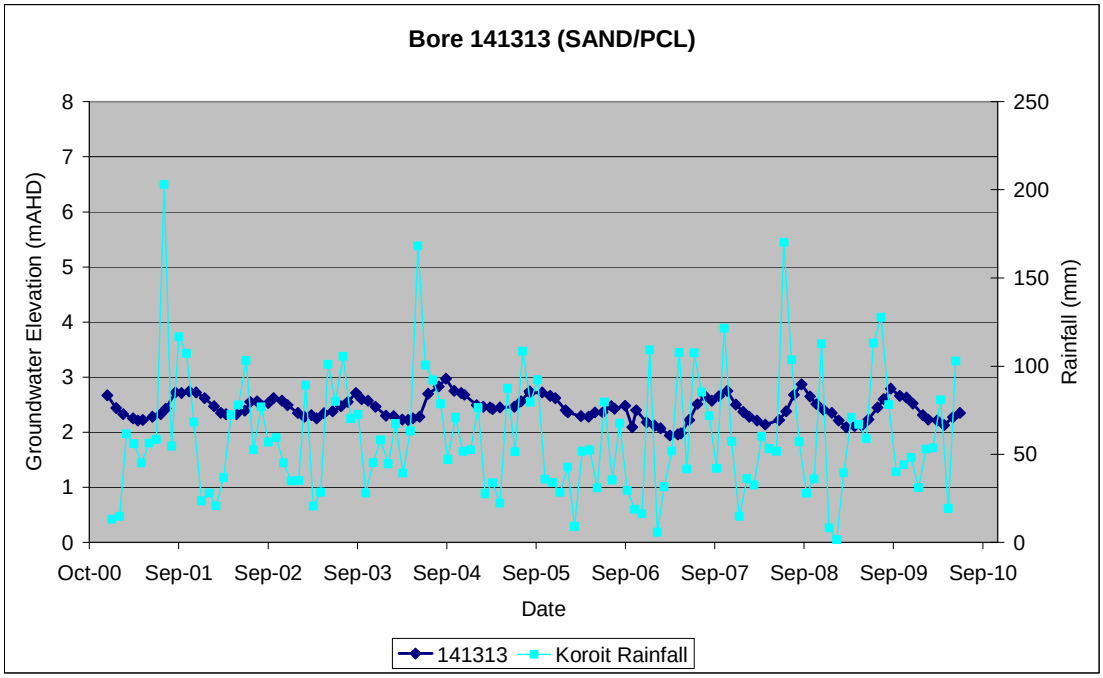

Bore 141306 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
52
51
50
49
48
47
46
45
44
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141306
Koroit Rainfall

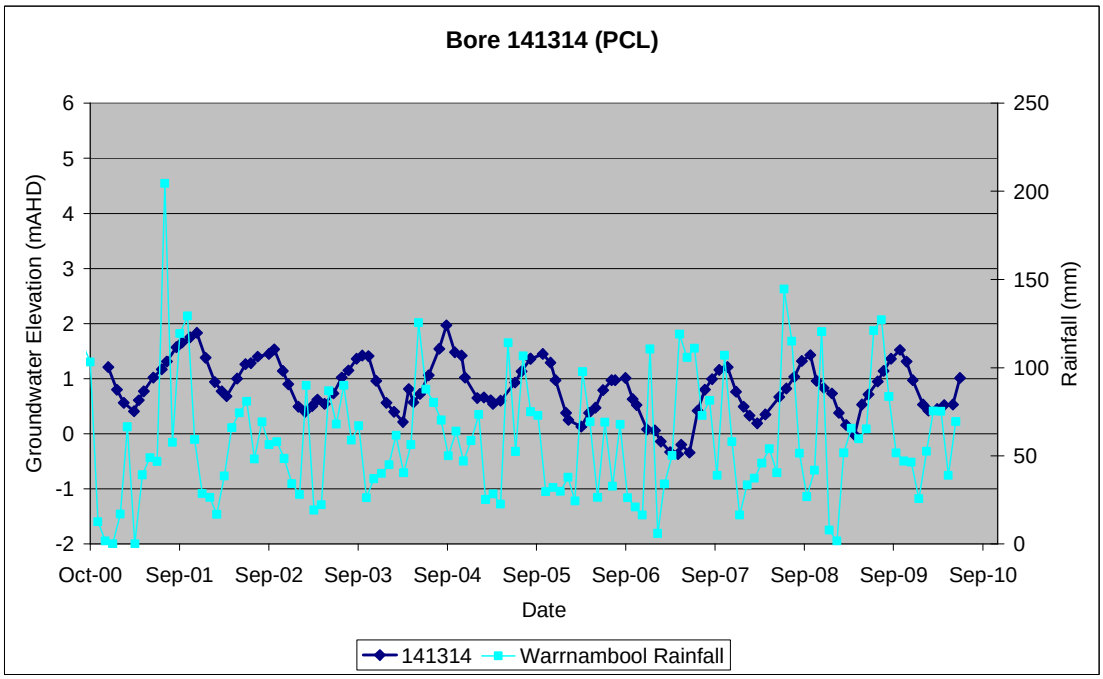

Bores 141307 (NVB) & 141308 (PCL)
Groundwater Elevation (mAHD)
78
77
76
75
74
73
72
71
70
Rainfall (mm)
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141307
141308
Koroit Rainfall

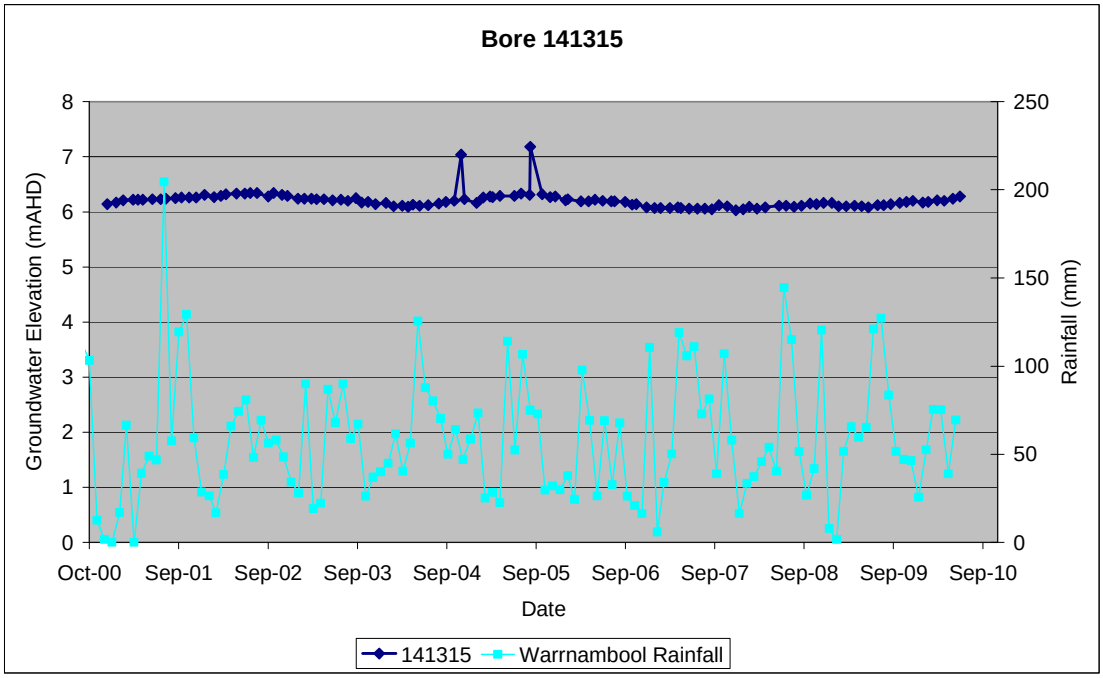

Bores 141309 (NVB) & 141310 (PCL)
Groundwater Elevation (mAHD)
54
53
52
51
50
49
48
47
46
Rainfall (mm)
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141309
141310
Koroit Rainfall

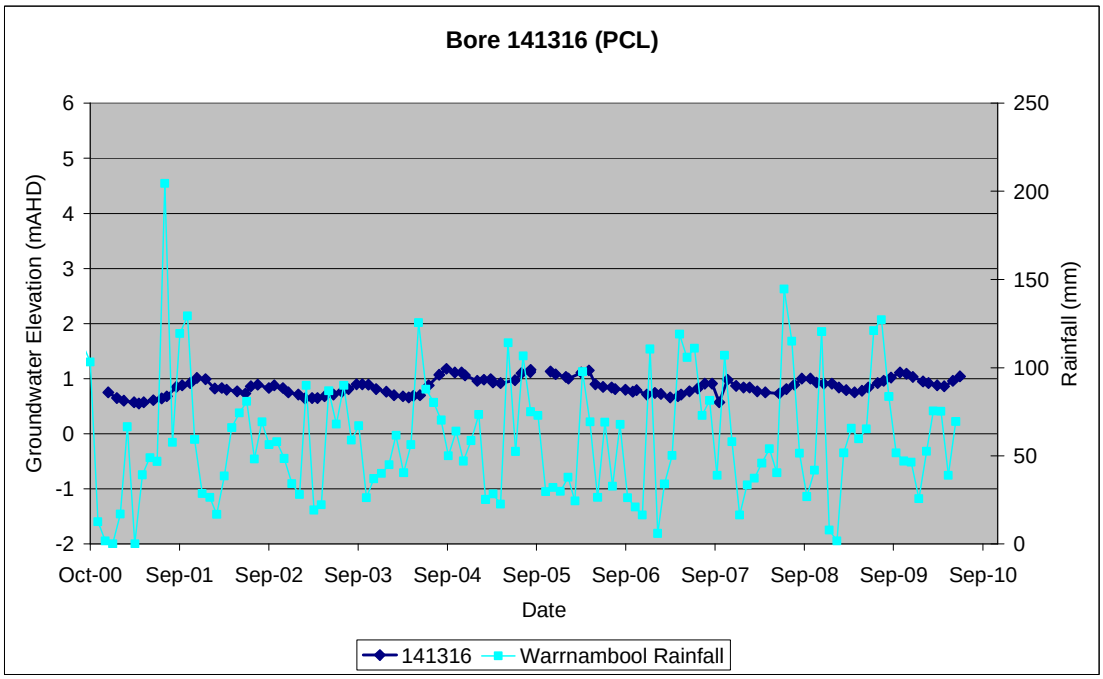

Bore 141311 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
58
57
56
55
54
53
52
51
50
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141311
Koroit Rainfall


Bore 141312 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
10
9
8
7
6
5
4
3
2
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141312
Koroit Rainfall


Bore 141313 (SAND/PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
8
7
6
5
4
3
2
1
0
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141313
Koroit Rainfall


Bore 141314 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
6
5
4
3
2
1
0
-1
-2
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141314
Warrnambool Rainfall


Bore 141315
Groundwater Elevation (mAHD)
Rainfall (mm)
8
7
6
5
4
3
2
1
0
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141315
Warrnambool Rainfall


Bore 141316 (PCL)
Groundwater Elevation (mAHD)
Rainfall (mm)
6
5
4
3
2
1
0
-1
-2
250
200
150
100
50
0
Oct-00
Sep-01
Sep-02
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Date
141316
Warrnambool Rainfall

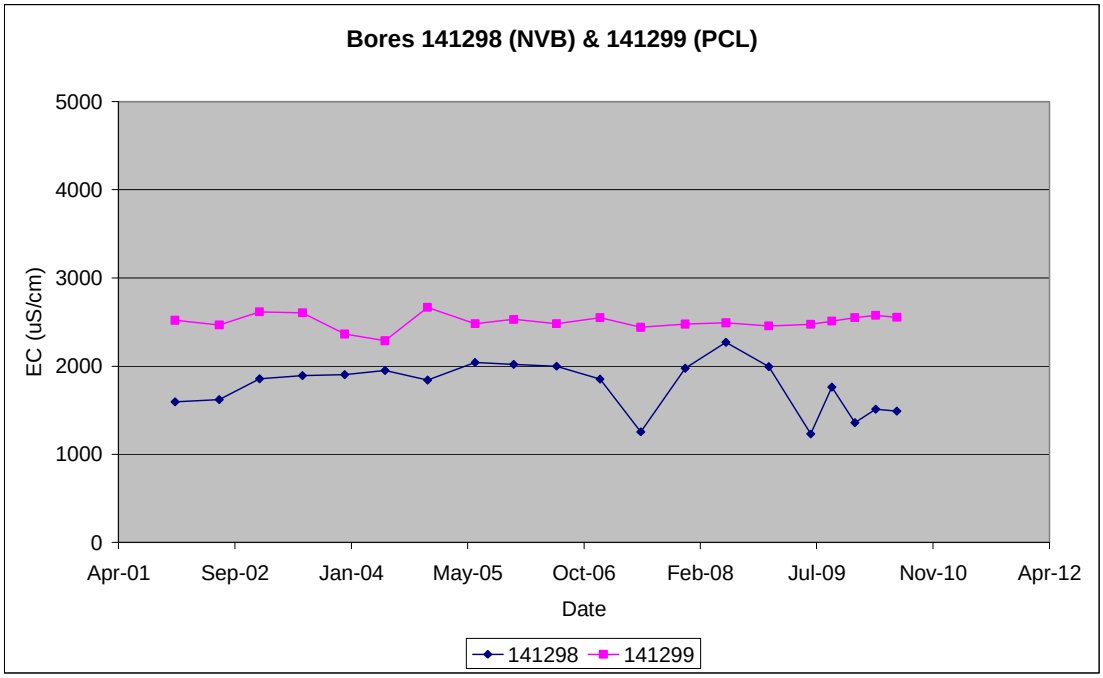
Appendix 2. Salinity Monitoring Data

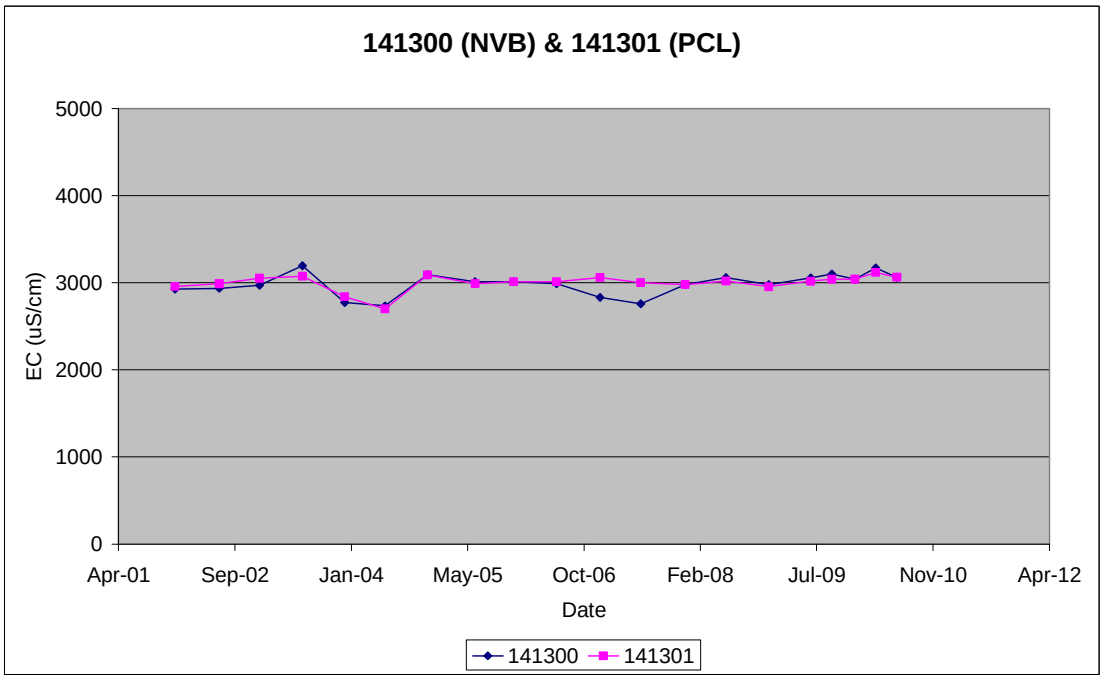
The following graph plots salinity trends observed from monitored bores between December 2001 and June 2010. Data is presented numerically below and graphically on the following pages. All results are temperature-adjusted Specific Electrical Conductivity, in units of microSiemens per centimeter, also known as EC units.

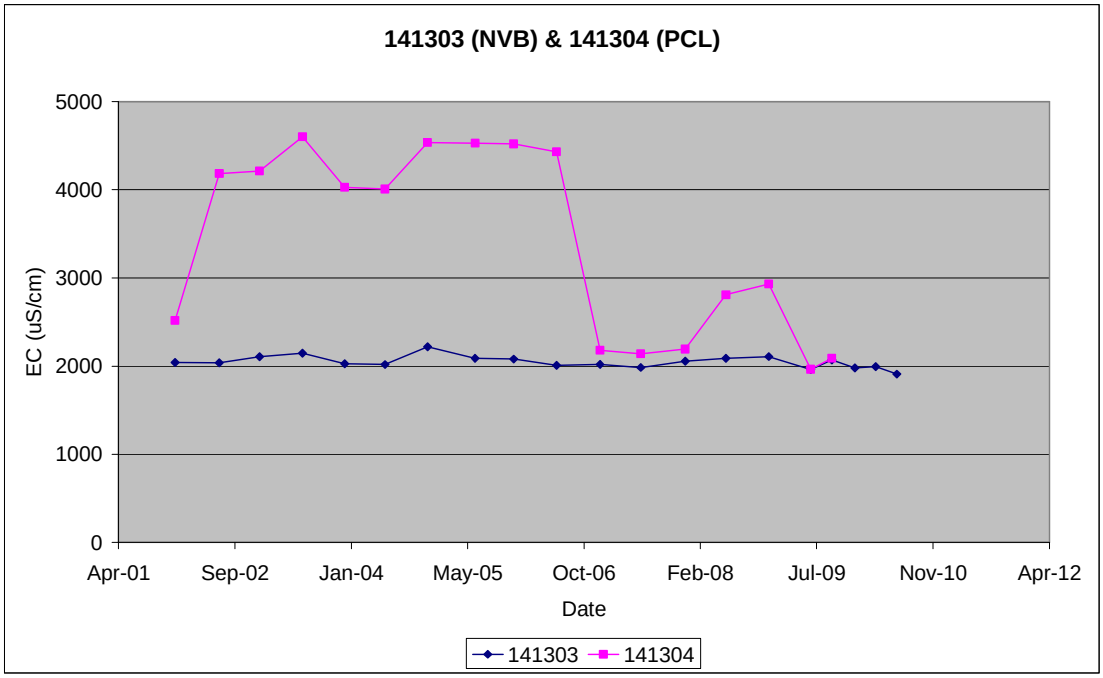
Bore	141298	141299	141300	141301	141302	141303	141304	141305	141306
Date									
Dec-01	1,594	2,520	2,928	2,957	-	2,041	2,517	-	2,419
Jun-02	1,620	2,466	2,935	2,987	-	2,039	4,185	-	2,390
Dec-02	1,858	2,616	2,970	3,050	-	2,106	4,212	-	2,398
Jun-03	1,892	2,603	3,197	3,074	-	2,146	4,604	-	2,448
Dec-03	1,904	2,364	2,772	2,838	-	2,025	4,030	-	2,194
Jun-04	1,950	2,287	2,735	2,698	-	2,017	4,008	-	2,202
Dec-04	1,840	2,668	3,093	3,087	-	2,219	4,537	-	2,496
Jun-05	2,040	2,480	3,010	2,990	-	2,090	4,530	-	2,350
Dec-05	2,020	2,530	3,010	3,010	-	2,080	4,520	-	2,370
Jun-06	2,000	2,480	2,990	3,010	-	2,010	4,430	-	2,120
Dec-06	1,853	2,550	2,830	3,060	-	2,020	2,180	-	2,370
Jun-07	1,255	2,440	2,760	3,000	-	1,985	2,140	-	2,280
Dec-07	1,975	2,476	2,980	2,980	-	2,056	2,193	-	2,306
Jun-08	2,270	2,490	3,060	3,020	2,170	2,090	2,810	1,319	2,350
Dec-08	1,995	2,456	2,978	2,954	1,286	2,108	2,931	1,312	2,320
Jun-09	1,229	2,474	3,057	3,018	2,014	1,961	1,965	1,246	2,207
Sep-09	1,760	2,510	3,100	3,040	-	2,070	2,090	-	-
Dec-09	1,357	2,550	3,040	3,040	-	1,980	*	1,375	2,330
Mar-10	1,512	2,576	3,171	3,119	2,108	1,996	*	1,369	2,428
Jun-10	1,490	2,555	3,063	3,062	1,999	1,908	*	1,308	2,156

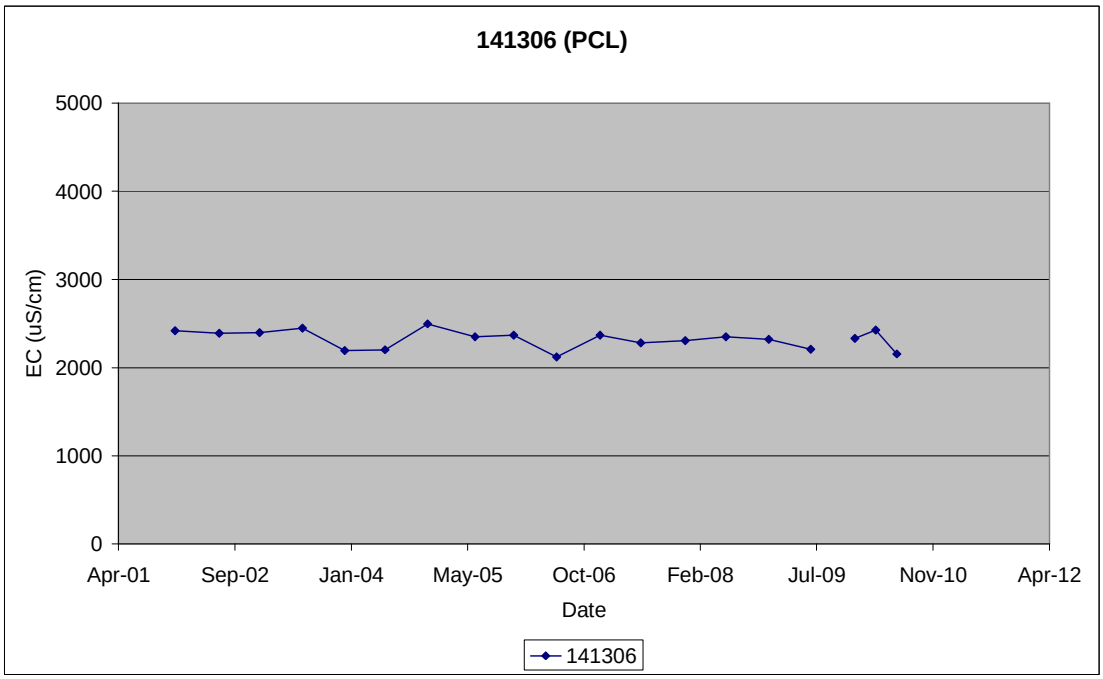
Bore	141307	141308	141309	141310	141311	141312	141313	141314	141315	141316
Date										
Dec-01	-	-	-	3,075	-	2,054	-	-	-	875
Jun-02	-	-	-	3,050	-	2,025	-	-	-	877
Dec-02	-	-	-	3,270	-	1,980	-	-	-	861
Jun-03	-	-	-	3,289	-	2,233	-	-	-	882
Dec-03	-	-	-	2,953	-	2,038	-	-	-	856
Jun-04	-	-	-	2,841	-	2,008	-	-	-	871
Dec-04	-	-	-	3,231	-	2,208	-	-	-	884
Jun-05	-	-	-	3,120	-	2,120	-	-	-	644
Dec-05	-	-	-	3,140	-	2,170	-	-	-	853
Jun-06	-	-	-	3,040	-	2,150	-	-	-	825
Dec-06	-	-	-	3,170	-	2,220	-	-	-	840
Jun-07	-	-	-	2,170	-	2,150	-	-	-	820
Dec-07	-	-	-	3,000	-	2,226	-	-	-	832
Jun-08	3,830	1,759	NS	976	3,070	2,310	2,300	1,527	2,950	814
Dec-08	3,698	1,796	NS	969	3,035	2,274	2,252	1,542	2,906	799
Jun-09	3,734	1,638	NS	878	3,043	1,884	2,080	1,406	2,887	724
Sep-09	-	-	NS	-	-	-	2,280	-	-	800
Dec-09	3,830	1,766	NS	963	2,980	2,280	*	1,525	3,000	820
Mar-10	3,911	1,782	NS	1,004	3,096	2,261	*	1,516	3,016	877
Jun-10	3,959	1,733	NS	947	2,696	2,070	*	1,441	2,880	762

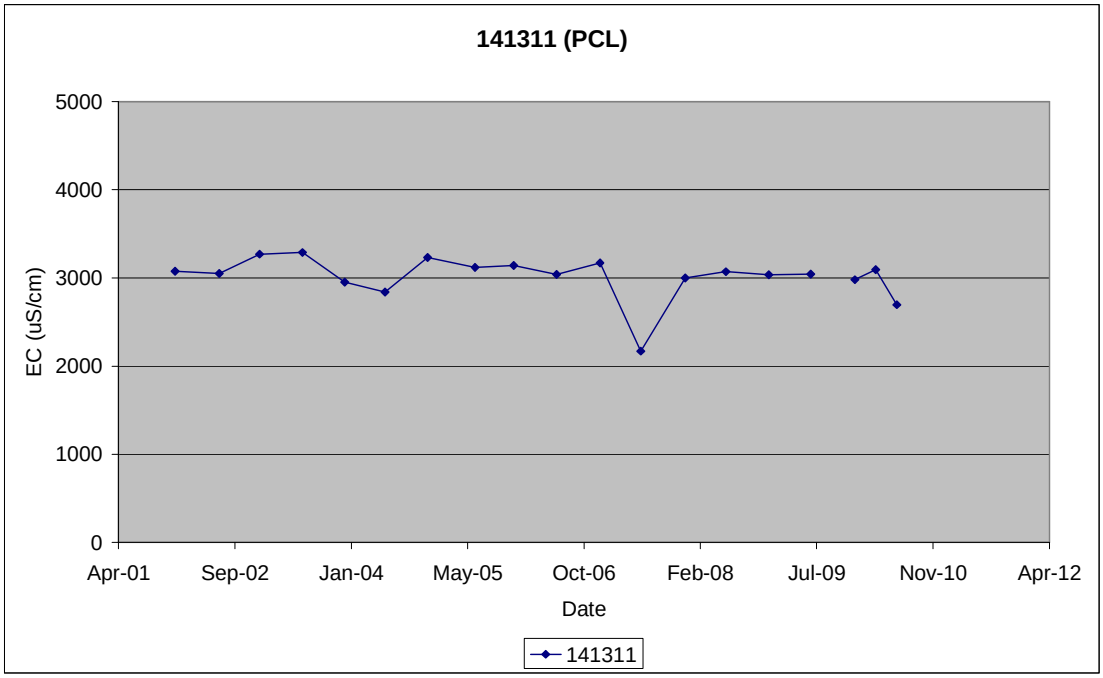
NOTE: NS = Not Sampled due to dry bore
- indicates no reading taken–salinity monitoring program has been expanded recently
** Bore removed from salinity sampling as unable to get a suitable water sample*

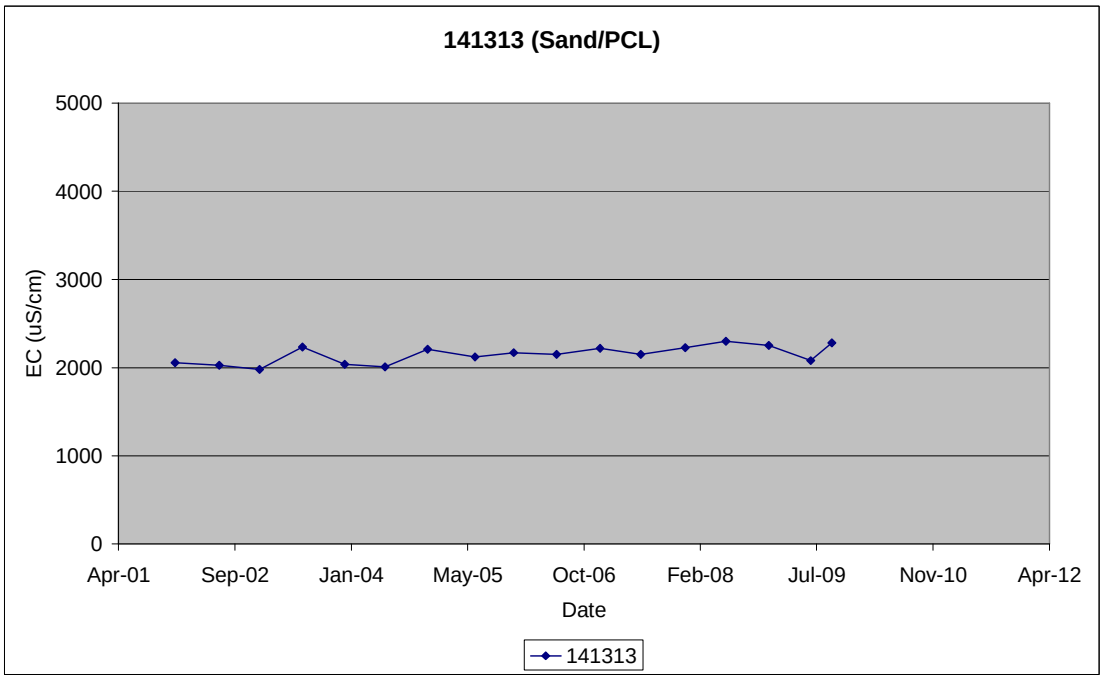

Bores 141298 (NVB) & 141299 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141298
141299

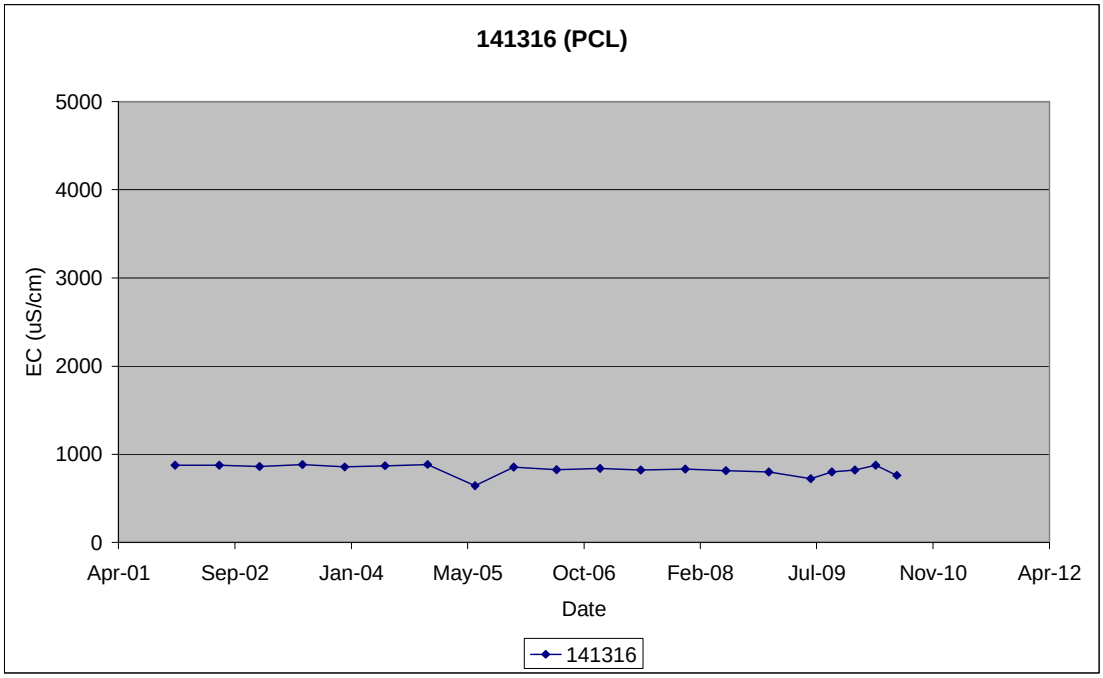

141300 (NVB) & 141301 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141300
141301


141303 (NVB) & 141304 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141303
141304


141306 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141306


141311 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141311


141313 (Sand/PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141313


141316 (PCL)
5000
4000
3000
2000
1000
0
EC (uS/cm)
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Date
141316

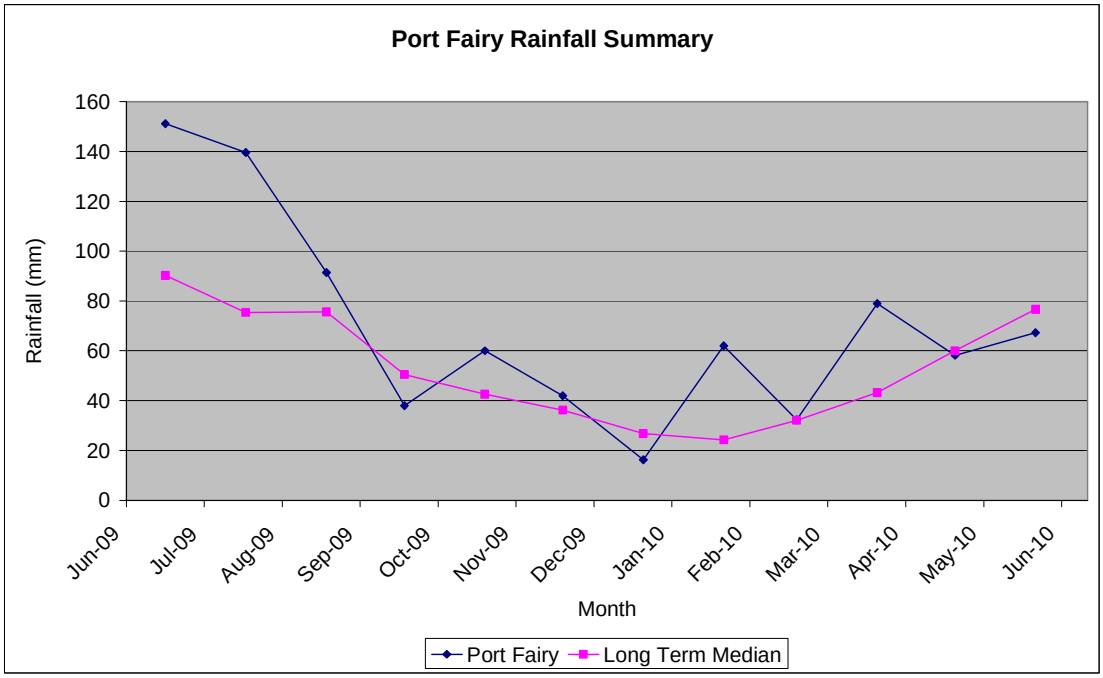
Appendix 3. Climate Data

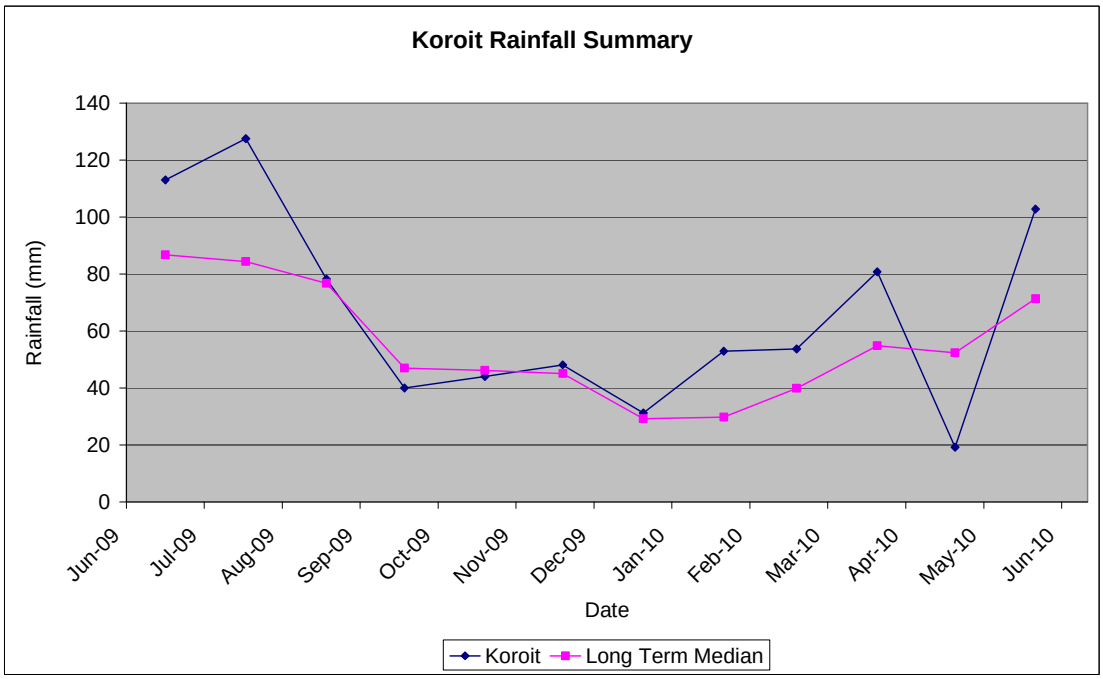
The following table displays actual rainfall data collected by the Bureau of Meteorology from the gauges at Port Fairy (90175), Koroit (90051) and Warrnambool Airport (90186).

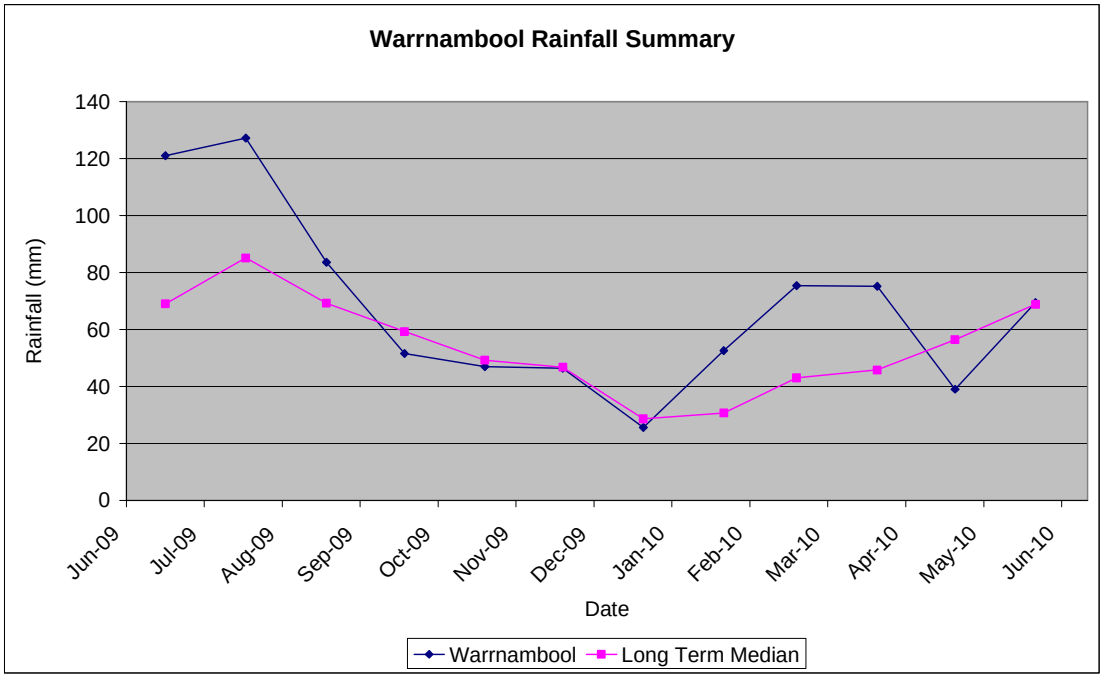
	Port Fairy		Koroit		Warrnambool	
Month	**Actual rainfall (mm)**	**Long-term median rainfall (mm)**	**Actual rainfall (mm)**	**Long-term median rainfall (mm)**	**Actual rainfall (mm)**	**Long-term median rainfall (mm)**
Jul-09	151.2	90.2	113	86.8	121	69
Aug-09	139.6	75.4	127.6	84.5	127.2	85.1
Sep-09	91.4	75.6	78.2	76.8	83.6	69.2
Oct-09	38	50.5	40	47	51.6	59.3
Nov-09	60	42.6	44	46.2	47	49.2
Dec-09	42	36.2	48.1	45.1	46.4	46.7
Jan-10	16.2	26.8	31.2	29.2	25.6	28.6
Feb-10	62	24.3	52.9	29.8	52.6	30.7
Mar-10	32.4	32.1	53.7	39.9	75.4	43
Apr-10	79	43.2	80.8	54.8	75.2	45.8
May-10	58.2	60	19.2	52.4	39	56.4
Jun-10	67.2	76.6	102.8	71.4	69.4	68.8
TOTAL	**837.2**	**633.5**	**791.5**	**663.8**	**814**	**651.8**

**The median is used as it reduces any skew caused by abnormally high or low rainfall events depicting a 'truer' representation.*

The long-term median rainfall was used as a comparative tool. For the period shown actual annual rainfall across the entire GMA was above the long-term annual median. The graphs clearly illustrate the actual rainfall for the report period compared to the long-term median. Actual rainfall was around the median for some of the year. However, there were several months throughout the year with higher rainfall, resulting in total annual rainfall exceeding the long-term median at all three weather stations during 09-10..


Port Fairy Rainfall Summary
Rainfall (mm)
160
140
120
100
80
60
40
20
0
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Month
Port Fairy
Long Term Median


Koroit Rainfall Summary
Rainfall (mm)
140
120
100
80
60
40
20
0
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Date
Koroit
Long Term Median


Warrnambool Rainfall Summary
Rainfall (mm)
140
120
100
80
60
40
20
0
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Date
Warrnambool
Long Term Median