Southern Rural Water
Managing Water. Serving Communities.

Koo Wee Rup WSPA Groundwater Management Plan

Annual Report
2017-18

Foreword

This report is submitted to the Minister for Water, Port Phillip & Westernport Catchment Management Authority and Melbourne Water in accordance with s32C *Water Act 1989*. A copy of this report is available for inspection at the offices of the Authority, and notice of report availability will be published as required by s32D of the *Water Act 1989*.

The purpose of this report is to detail Authority activities administering and enforcing the management plan and provide information that is required to be reported under the Plan.

Area Summary

Area	Koo Wee Rup Water Supply Protection Area
Segment	Groundwater
Area Declared	January 2002
Plan Approved	4 August 2010
Allocation Limit (Permissible Annual Volume)	12,915 ML
Scheduled Plan Review	A review commenced in 2017 and remains underway
Implementation Authority	Southern Rural Water
Relevant CMA	Port Phillip & Westernport Catchment Management Authority
Report Period	1 July 2017 – 30 June 2018

1 Executive Summary

The Koo Wee Rup Groundwater Management Plan (GMP) was prepared under Division 3 Part 3 of the *Water Act 1989* for the Koo Wee Rup Water Supply Protection Area (WSPA) and relates to the groundwater resources of the protection area. The Koo Wee Rup GMP was approved by the Minister for Water in August 2010.

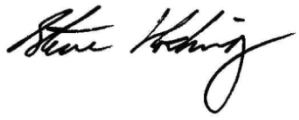
The objective of the management plan is to make sure that the water resources of the area are managed in an equitable manner and to ensure the long-term sustainability of those resources.

Southern Rural Water (SRW) is the authority responsible for managing and administering the plan, which includes the preparation of an annual report to demonstrate compliance. The annual report summarises licence information, metered usage and monitoring data collected for the reporting period in accordance with the recommendations given in the Koo Wee Rup GMP.

The Koo Wee Rup GMP Annual Report for 2017-18 demonstrates that SRW has complied with the requirements of the plan.

Monitoring and metering indicate no significant changes in the condition of the resource or water usage patterns; therefore it is considered that the groundwater resources of the Koo Wee Rup WSPA are being managed sustainably. No changes are proposed for the monitoring strategy in 2017-18.

The GMP requires that a review is undertaken of the plan after 5 years. SRW is currently reviewing the Koo Wee Rup Groundwater Management Plan which began in 2017. Some preliminary findings indicate that groundwater trading rules are too restrictive and that a greater amount of flexibility in trade rules will benefit current and new enterprises. SRW is currently exploring different options to enable more flexibility in the trading rules, in a sustainable manner. Existing and potential licence holders will be consulted during 2018 on the current groundwater management arrangements.



STEVE HOSKING
Manager Groundwater & Rivers

2 Introduction

This report summarises licence information, metered usage and monitoring data collected for the period between 1 July 2017 and 30 June 2018 in accordance with the recommendations given in the Koo Wee Rup GMP.

The Koo Wee Rup WSPA is separated into 8 zones and comprises the groundwater resource, mainly in the Westernport sequence (Baxter, Sherwood and Yallock formations). The Westernport sequence is generally considered a single aquifer system, as there is a hydraulic connection between each individual formation. Taking this into account, there has been no vertical limits placed on the depth of the Koo Wee Rup WSPA. However basaltic clay of the Older Volcanics is considered to form a semi-confining layer between the Westernport sequence and the underlying Older Volcanics/Childers formations.

Groundwater within the Koo Wee Rup WSPA is used for irrigation, dairy, industrial and stock and domestic purposes.

The Koo Wee Rup GMP identifies SRW as the authority responsible for managing and administering the plan.

The objective of the management plan, as set out in the *Water Act 1989*, is to make sure that the water resources of the area are managed in an equitable manner and to ensure the long-term sustainability of those resources.

The plan requires SRW to:

- Coordinate groundwater level monitoring and metering programs;
- Review monitoring and metering data;
- 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;
- Seek review of the plan and if, in its opinion, amendments are necessary or desirable, make recommendations to the Minister accordingly.

The success of the Koo Wee Rup GMP is measured through a number of licensing, metering and monitoring objectives. These include:

- All consumptive use to be metered and recorded in line with both State Government and Corporation metering policies;
- Groundwater usage is to be maintained within licence volumes;
- Water levels and water quality (salinity) is to be monitored to maintain acceptable levels and to ensure the long term sustainable use of the aquifer(s);
- Trading of existing consumptive use allocations occurs in accordance with all relevant provisions of the *Water Act 1989* and/or any supplementary rules adopted for the Koo Wee Rup WSPA;
- No new groundwater licences will be issued if the total of all groundwater licence entitlements equals or exceeds the PCV declared for the Koo Wee Rup WSPA, unless allowed for by prescriptions 7 & 8.

Further information can be obtained from the Koo Wee Rup WSPA Groundwater Management Plan. A copy can be found on Southern Rural Water's website: www.srw.com.au.

3 Key Observations

3.1 Rainfall

Rainfall during the reporting period was 844.8mm (measured at Lang Lang). Lang Lang has an average rainfall of 860mm per year.

3.2 Water Levels

Groundwater levels are actively measured in twenty eight (28) bores, monitoring the Quaternary Sands, Westernport Group, Older Volcanics and Childers aquifers. Monitoring frequency was reduced from monthly to quarterly in 2011 due to rising groundwater levels, which reduced the risk of saline intrusion.

In July 2016, DELWP reduced the number of active observation bores in KWR from 43 to 28. This reduction was part of a project to "Improving management of Victoria's groundwater resources". This project reduced the number of active observation bores across all of Victoria.

The location of observation bores in the area are shown below in Figure 1. Hydrograph for bore 71187 is included for example in Figure 2. All hydrographs are presented in appendix 2.

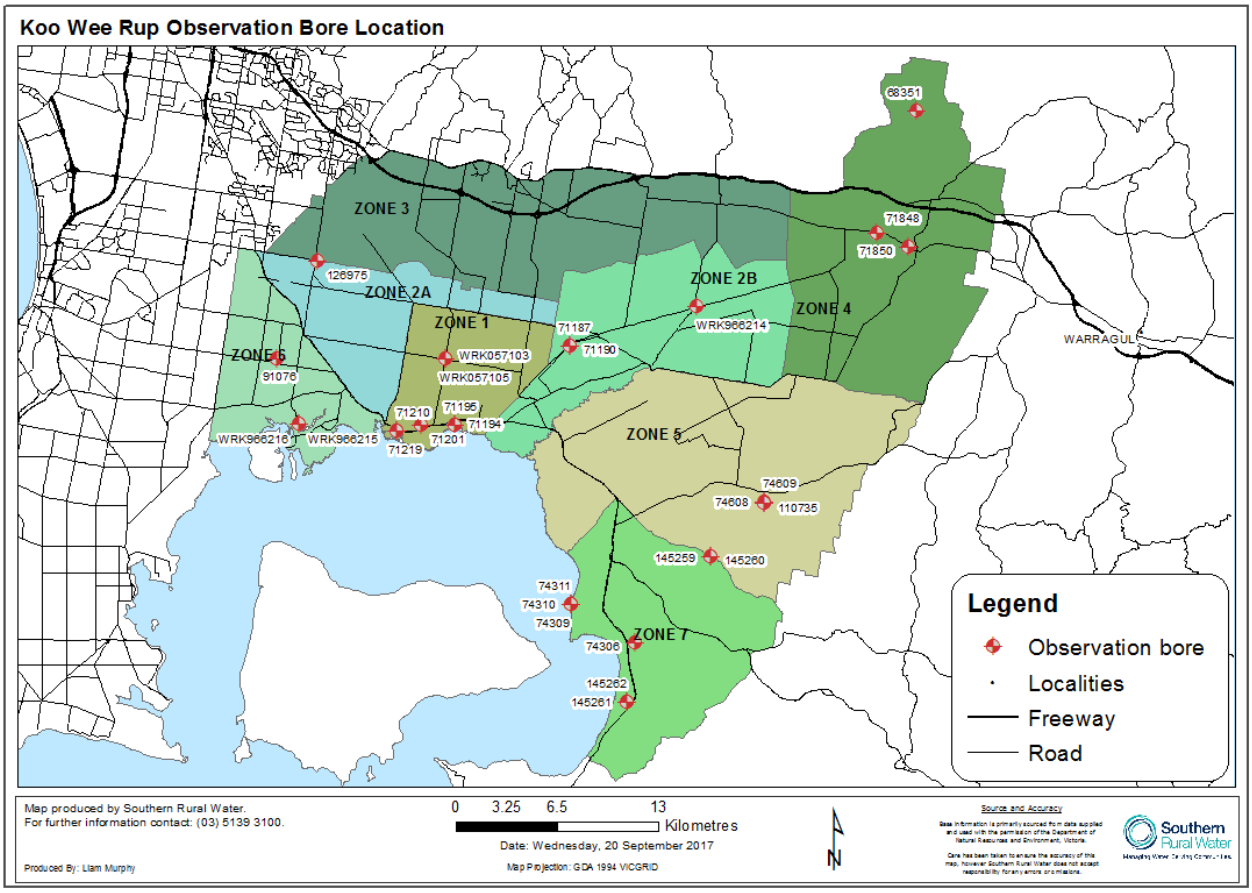


Figure 1: SOBN locations in Koo Wee Rup WSPA.

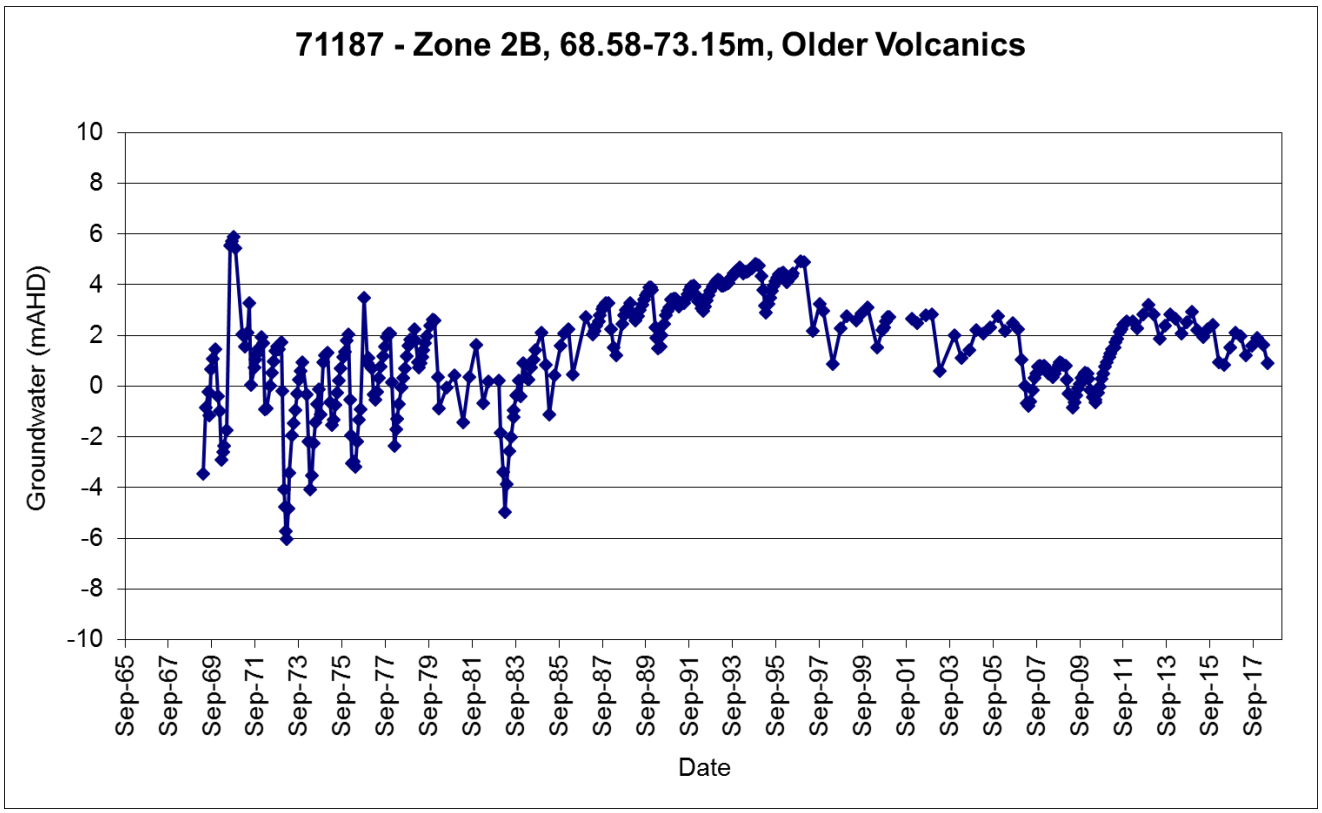


Figure 2: Example hydrograph from Zone 2B.

The groundwater elevation data indicates:

- Long term declining water levels across the WSPA, with most bores falling by up to 4m or less over forty years.
- Current water levels in many bores are similar to levels seen in the 1990's.
- In the last 12 months levels have been at a similar level seen in July 2017, which reflects the recorded use of groundwater and the near average rainfall.
- As of May 2018, a total of seven bores had groundwater levels below sea level. Water levels in many of these bores hover around 0mAHD and typically rise above this level over the winter.

3.3 Salinity

Salinity has been relatively stable over the past 9 years. Readings over the past 12 months have risen in some bores and fallen in others, so there is no clear trend, but most bores remain within historic ranges. Refer figure 3 for summary results.

Bores to make note of:

- Bore 71194, which is on the coast in zone 1 is showing a declining trend over the past two years. Salinity in this bore has varied considerably over the past several years, which correlates to when rainfall is high and usage is low and vice versa.
- Bore 74311, which is on the coast in zone 7 has decreased since monitoring began in 2008.

Salinity will continue to be monitored and reviewed on an annual basis. Salinity monitoring was reduced from quarterly to annually in 2011 due to rising groundwater levels, which reduced the risk of saline intrusion.

All salinity graphs are presented in appendix 3.

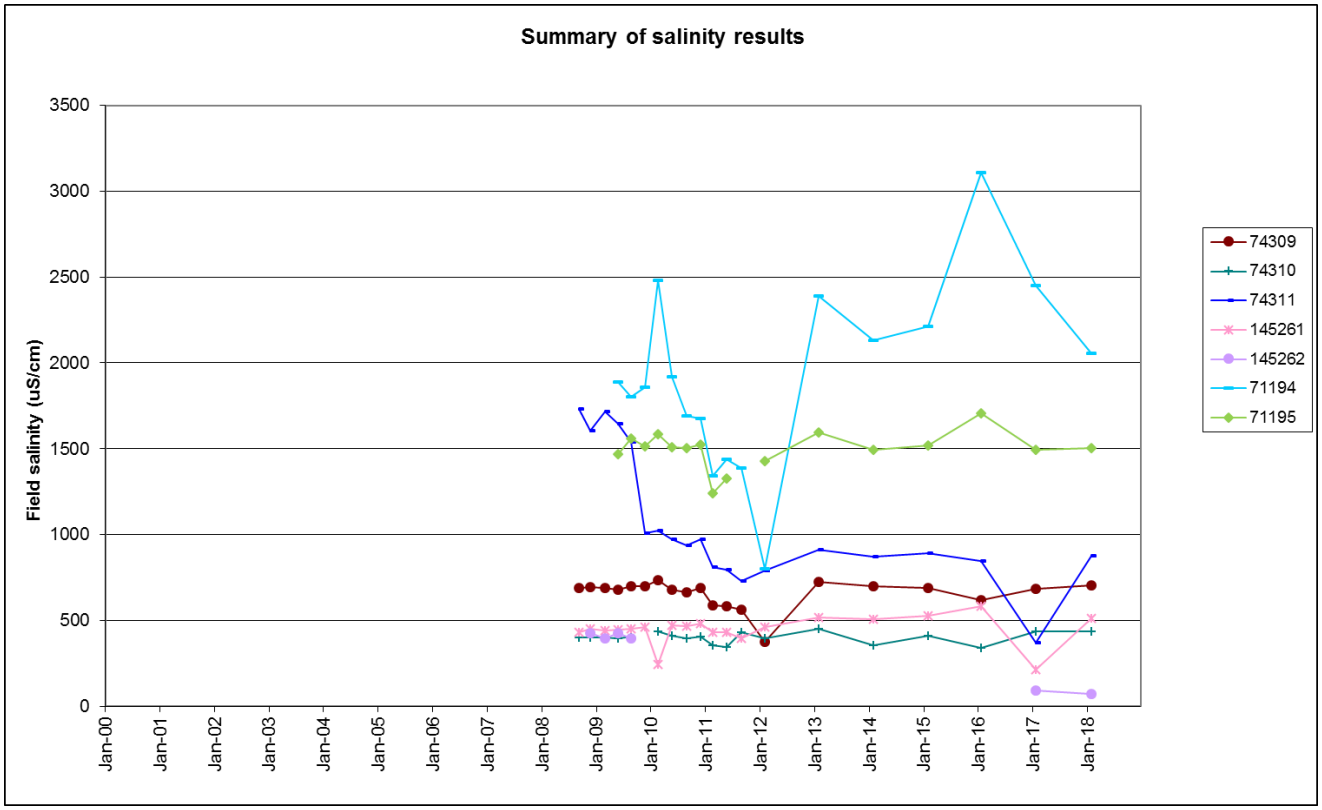


Figure 3: Graph showing salinity in KWR.

EC (electrical conductivity) units are microSiemens per centimeter (uS/cm)

3.4 Water Use

The following table provides detail on water use in the 2017-18 year as compared to four previous years.
The total number of licences has decreased over the 5 years predominantly due to customers amalgamating multiple licences held into one licence and also due to surrendering of licences.
The total number of metered licences has also decreased due to changes in licence use from irrigation back to stock and domestic use only or licences becoming inactive.

At 30 June	**2014**	**2015**	**2016**	**2017**	**2018**
No. of licences	370	364	352	344	346
Total entitlement volume (ML)	12,611.8	12,597.5	12,579.6	12,577.2	12,575.0
No. of metered licences	204	197	193	173	162
Total entitlement volume metered (ML)	10,208.8	10,076.2	10,314.3	9,561.1	9,412.7
Metered volume used (ML)	3,277.2	3,698.8	4,347.8	3,503.3	3,451.1
Use % of allocation	26%	29%	35%	28%	28%
No. of licences with use greater than entitlement	3	6	2	1	2
Permissible Consumptive Volume (PCV)	12,915	12,915	12,915	12,915	12,915
Use as a % of PCV	25%	29%	34%	27%	27%
No. of D&S bores[1]	1,164	1,126	1,125	1,061	996
D & S bores estimated use[1]	1,746	1,689	1,688	2,402	1,494
Estimated D & S use from licensed bores[2]	555	534	528	516	519

[1]Taken from the Victorian State Water Accounts

[2]Estimated 1.5ML per licence 2013 onwards

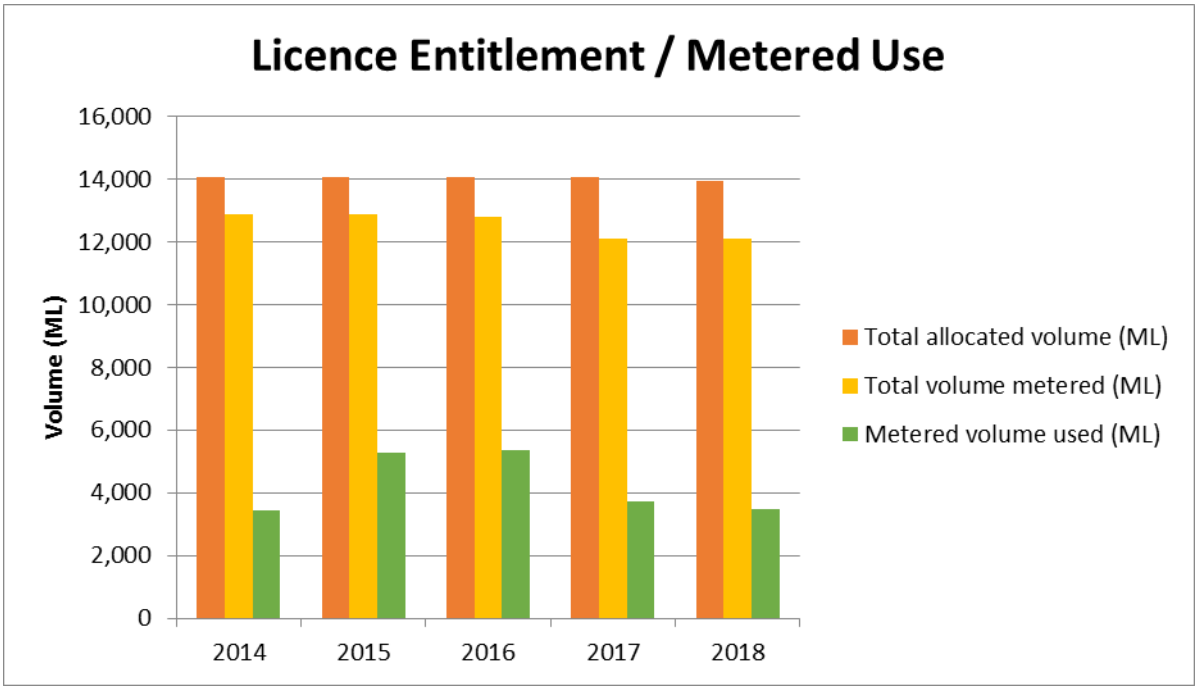


Figure 4: Licence entitlement compared to metered volume and usage.

3.5 Non compliance

The following table lists the licences where water was taken in excess of licensed entitlement.

Licence No	Licence Volume	Amount taken	Amount overused	Comment
BEE021716	10	11.5	1.5	Warning letter issued to customer, no further action in this instance
BEE024786	23	23.3	0.3	Overuse is within 5% tolerance, no further action is required

SRW investigates all compliance issues and considers several factors such as the seriousness of the breach and impact on the resource and other users, prior to deciding on the most appropriate action. The action taken by SRW can include the use of direction notices, warning letters and prosecution.

4 Plan Implementation

4.1 Monitoring

4.1.1 Prescriptions

The following table details the requirements of the management plan in relation to monitoring.

Plan Requirement:	**Activity / Reference**	**Complies**
13. The Department must ensure that monitoring bores are properly maintained and replaced if necessary; and 14. The Department and the Corporation must ensure that data collected from monitoring bores are entered into the State's groundwater management system (or equivalent), within 30 days of them being received.	The monitoring bores are owned and managed by the Department of Environment, Land, Water and Planning (DELWP). All bores have minor maintenance carried out annually which includes site clearance, rust removal, painting, and ensuring the bore is secure and safe. The DELWP carries out additional maintenance on bores that have been identified as requiring attention under the annual program	Yes Yes
15. The Department and the Corporation must ensure that water level monitoring and investigations are carried out at appropriate locations throughout the Protection Area to: i. assess annual and long term impact on water levels from groundwater pumping; ii. monitor regional and local seasonal drawdown; iii. examine interaction between groundwater and surface water; iv. provide information for future resource assessments; and v. monitor the impacts of groundwater pumping generally across the Protection Area and in areas of high intensity groundwater pumping.	SRW works closely with the DELWP to ensure that the monitoring program meets the requirements of the Plan. If SRW identifies bores of greater interest, monitoring may be undertaken in addition to the DELWP's monitoring program. SRW regularly reviews the groundwater level monitoring program and data.	Yes
16. The Corporation shall review the groundwater level monitoring program as the established trigger level is approached (the trigger level at the time of writing is specified in Schedule 1 but may be reviewed and amended by the Corporation, as necessary).	SRW regularly reviews the groundwater level monitoring program. Monitoring program is presented in the Appendices.	Yes
17. The Corporation must ensure that water quality monitoring is carried out at appropriate locations throughout the Protection Area to provide information that allows assessment of changes in the groundwater salinity.	SRW regularly reviews the salinity monitoring program and data. Salinity monitoring program is presented in the Appendices.	Yes
18. The Corporation shall review the groundwater quality monitoring program as the established trigger level is approached (the trigger level at the time of writing is specified in Schedule 1	SRW regularly reviews the salinity monitoring program.	Yes

of the Plan).		

4.2 Metering

4.2.1 Prescriptions

The following table details the requirements of the management plan in relation to metering.

Prescription	Activity	Complies
10. All meters will comply with State metering policy and the Corporation's metering policy	SRW has completed a Metering Action Plan that outlines how our metering fleet will comply with the required metering standards. Meters comply with the current requirements.	Yes
11. The Corporation must: i. ensure all meters within the Protection Area are read twice per year – in or around January and June; ii. determine the volume of water extracted from the bore since the flow meter was last read; and iii. within 30 days after a meter is read, record the amount of water used on a database.	All meters were manually read twice however a project was commenced installing Automated Meter Reading (AMR) technology on all metered bores. This will provide access to daily meter readings. Meter readings and usage data were recorded and stored in SRW's metering system. Usage is also recorded in the State Water Register.	Yes
12. The Corporation may request the Licensee to read a meter and to provide the Corporation with the meter reading: i. the Licensee must comply with the request; and ii. for the purposes of this clause, the Corporation must provide a phone number, email address, pre-paid mail or similar method for the licensee to lodge the meter read.	SRW did not request any licensees to read their meter and provide the meter reading.	Yes

4.2.2 Metering activities

Meters are installed on active licences greater than 10ML. Some licences may require multiple meters to properly account for water usage
As highlighted in section 3.4 the total number of metered licences has decreased in the area due to changes in licence use from irrigation back to stock and domestic use only or licences becoming inactive.

	Year to 30 June 2018	Total for WSPA at 30 June 2018
Number of licences issued (see section 4.4 for details)	0	346
Number of meters installed	2	197
Meters requiring maintenance	40	
Meters replaced	23 removed 13 replaced	

Meters read (1 – date)	Jan/Feb 2018	
Meters read (2 – date)	Jun 2018	
Number of estimated readings	0	

4.3 Restrictions on Licensing and Licence Transfers

4.3.1 Prescriptions

The following table details the requirements of the management plan in relation to licensing

Plan Requirement:	**Activity/Reference**	**Complies**
1. Temporary trade of water entitlement is allowed within a zone or coastal sub-zone and from one zone to another zone provided that: (i) Where usage has exceeded 80% of allocation over the previous 2 years, water levels have recovered appropriately*; (ii) Transfer does not occur into coastal sub-zones**; (iii) Transfer does not occur into zones 1, 2B, 4 and 5; and (iv) A temporary trade shall expire no later than 30th June in the financial year in which it is approved (ie 1 July to 30 June). (v) At the request of both trading parties, the temporary transfer may commence on 1 July if it is approved prior to 30 June (ie transfer entitlements can start in the new irrigation season rather than having to commence in the middle of an irrigation season).	23 temporary transfers were processed during the reporting period in accordance with this prescription.	Yes
2. Permanent trade of Water Entitlement shall be allowed within zones and from one zone to another zone provided that: (i) Where usage has exceeded 80% of allocation over the previous 2 years, water levels have recovered appropriately*; (ii) Review of groundwater monitoring data indicates that the transfer is unlikely to have significant adverse impacts and seasonal water level recovery in the target zone is acceptable. (iii) Transfer does not occur into zones 1, 2B, 4 & 5; and (iv) Transfer does not occur into coastal sub-zones.	9 permanent transfer was processed during the reporting period.	Yes
3. All groundwater licenses in the WSPA will be migrated to the State Water Register within six months of Ministerial approval of this Management Plan.	All licences are located in the Water Register.	Yes
4. No new groundwater licenses shall be issued, except as described in Prescriptions 7 and 8.	2 new licence was issued to enable temporary trade to be processed	Yes
5. The total licence entitlement/allocation shall not exceed 12,915 ML (PCV Gazette G28 11 July 2011), or any volume adjusted in accordance with Prescriptions 6 to 8.	Total entitlement volume is less than PCV.	Yes
6. If a groundwater licence is surrendered, revoked or not renewed the total entitlement in Prescription 5 will be reduced by that licence volume.	2 licenses totalling 2.4 ML were surrendered at the request of the licence holder. As per prescription 5 the total licence volume is 12,575ML	Yes

7. The Corporation may issue a licence which may lead to the total groundwater licence entitlement in Prescription 5 being exceeded to overcome an administrative oversight or other anomaly, provided it does not exceed the PCV (12,915ML at time of writing).	The two new licences issued did not increase the overall total entitlement volume for the GMU	Yes
8. The Corporation may issue or amend a groundwater licence in accordance with any State-wide policy. The volume in Prescription 5 and the PCV (by application to the Minister) will be adjusted.	Nothing to report	Yes
9. The Corporation must report the details of any licence referred to in Prescriptions 6 to 8 in the annual report.	Refer to appendices for details	Yes

4.4 Licensing Activities

The following table provides details of licensing activities. As highlighted in section 3.4 there has been a reduction in the number of licences over the past 5 years predominantly due to customers amalgamating multiple licences held into one licence

Year to 30 June 2017	**No.**	**Volume ML**
New licences issued*	0	0
New licences issued#	2	0
Additional volumes on existing licences	0	0
Licences revoked	0	0
Permanent transfers	9	345.1
Temporary transfers	23	687
D&S Bores notifying use	0	0

*Issued as a result of a split licence
Issued with zero entitlement to enable trade to occur

4.4.1 Compliance and Exceptions

Activities undertaken during the reporting period comply with the requirements of the Plan.

4.4.2 Issues Affecting Implementation

Nil

5 Conclusions

The objective of the management plan, as set out in the *Water Act 1989*, is *to make sure that the water resources of the area are managed in an equitable manner and to ensure the long-term sustainability of those resources.*

The evidence provided demonstrates that the groundwater resources of the Koo Wee Rup WSPA are being managed sustainably.

The GMP requires that a review is undertaken of the plan after 5 years. SRW is currently reviewing the Koo Wee Rup Groundwater Management Plan. Some preliminary findings indicate that groundwater trading rules are too restrictive and that a greater amount of flexibility in trade rules will benefit current and new enterprises. SRW is currently exploring different options to enable more flexibility in the trading rules, in a sustainable manner. Existing and potential licence holders will be consulted during 2018 on the current groundwater management arrangements.

Appendices

5.1.1 Licence Details

Entitlement Number	Application Type	Purpose	Previous Volume	Approved Volume
BEE027554	Surrender	Dairy	1.3	0
BEE023847	Surrender	Dairy	1.1	0

Water Trade details for the 2017-18 season can be found at:

http://waterregister.vic.gov.au/water-trading/take-and-use-licence-trading

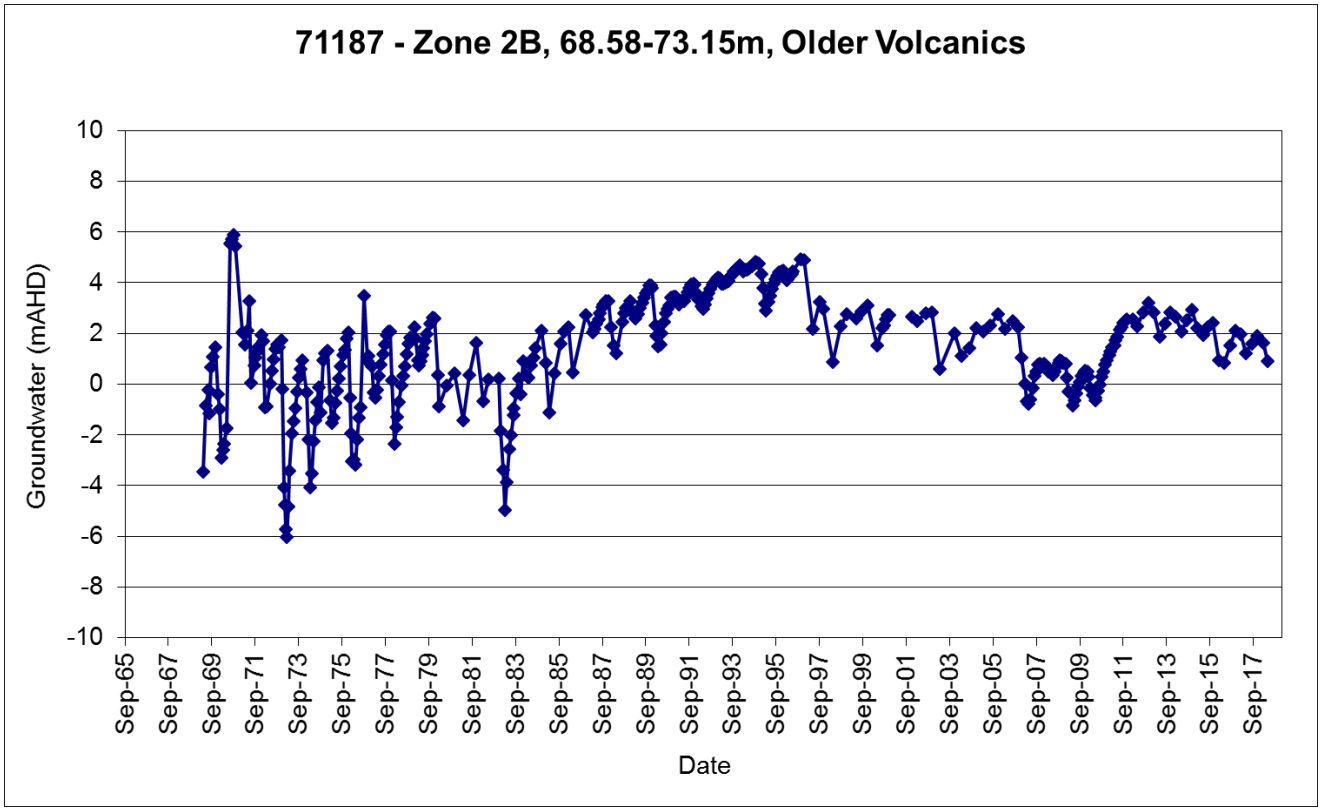
5.1.2 Monitoring program details

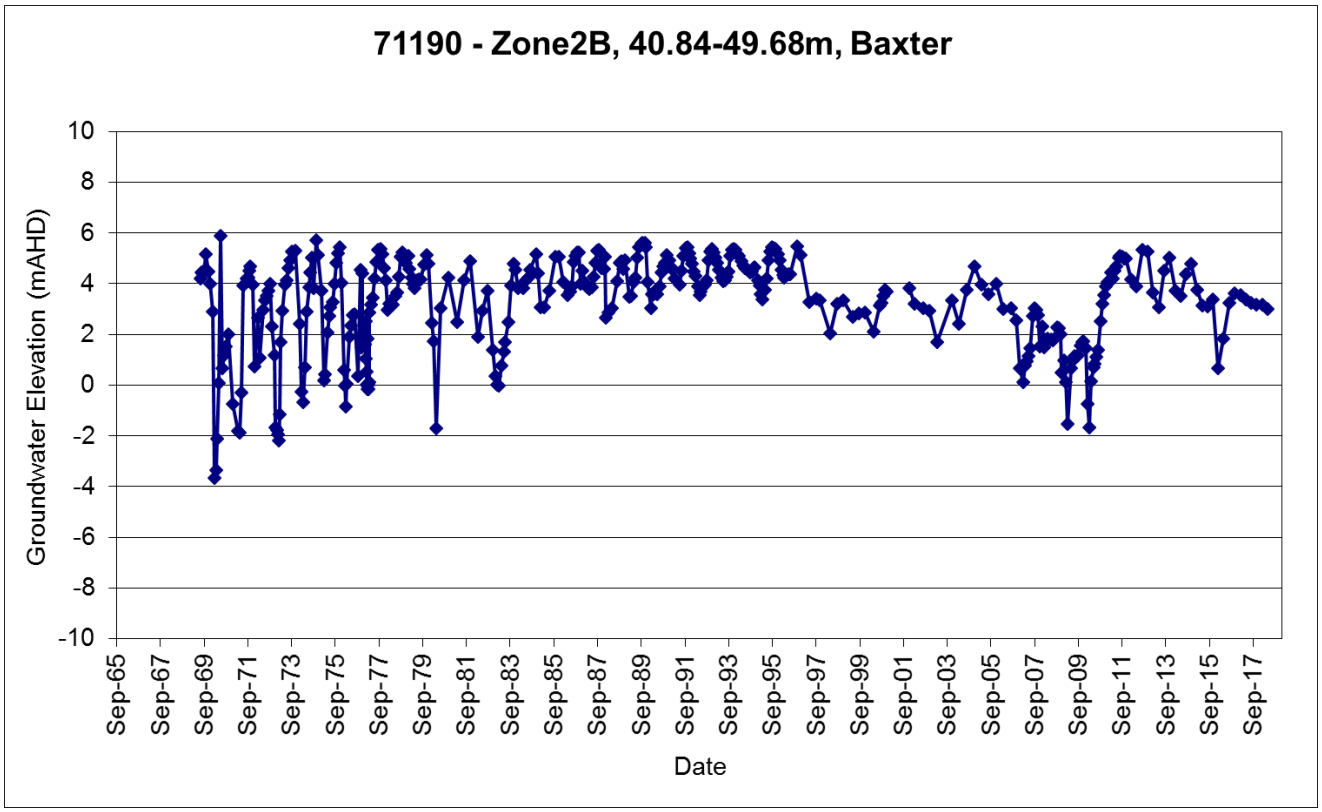
Groundwater monitoring program summary

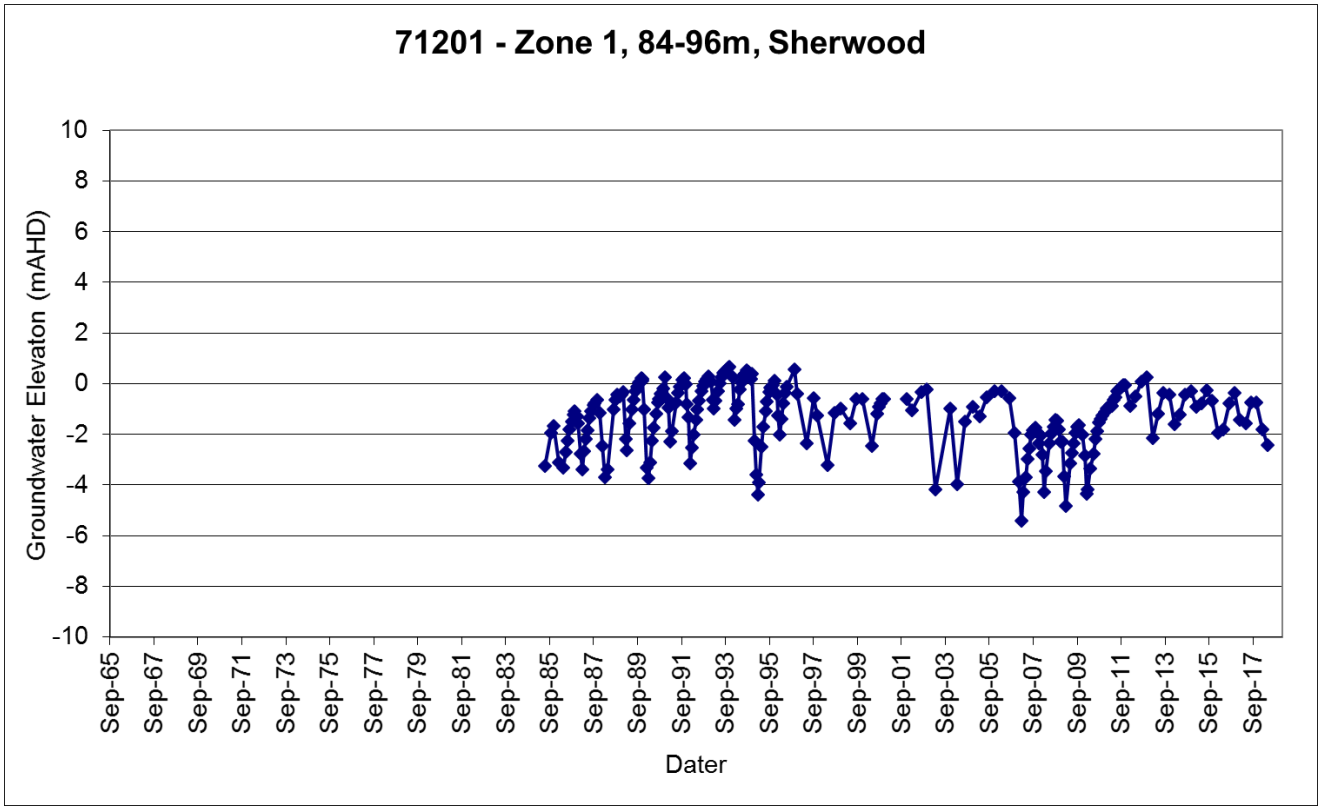
BHID	Zone	Formation	GW Level	Salinity
71194	1	Baxter, Sherwood	Quarterly	Annual
71195	1	Sherwood	Quarterly	Annual
71201	1	Sherwood	Quarterly	
71210	1	Sherwood	Quarterly	
71219	1	Baxter	Quarterly	Annual
WRK057103	1	Older Volcanics	Quarterly	
WRK057105	1	Sherwood	Quarterly	
68351	4	Quaternary Sands	Quarterly	
71848	4	Yallock	Quarterly	
71850	4	Yallock	Quarterly	
74608	5	Older Volcanics	Quarterly	
74609	5	Yallock	Quarterly	
110735	5	Quaternary Sands	Quarterly	
91076	6	Silurian Bedrock	Quarterly	
74306	7	Childers	Quarterly	
74309	7	Older Volcanics	Quarterly	Annual

74310	7	Sherwood	Quarterly	Annual
74311	7	Baxter	Quarterly	Annual
145259	7	Westernport	Quarterly	
145260	7	Childers	Quarterly	
145261	7	Westernport	Quarterly	Annual
145262	7	Childers	Quarterly	Annual
126975	2A	Older Volcanics	Quarterly	
71187	2B	Older Volcanics	Quarterly	
71190	2B	Baxter	Quarterly	
WRK966214	2B	Yallock	Quarterly	
WRK966215	6	Sherwood	Quarterly	
WRK966216	6	Older Volcanics	Quarterly	

5.1.3 Hydrographs






71201 - Zone 1, 84-96m, Sherwood
Groundwater Elevaton (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
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Sep-81
Sep-83
Sep-85
Sep-87
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Sep-93
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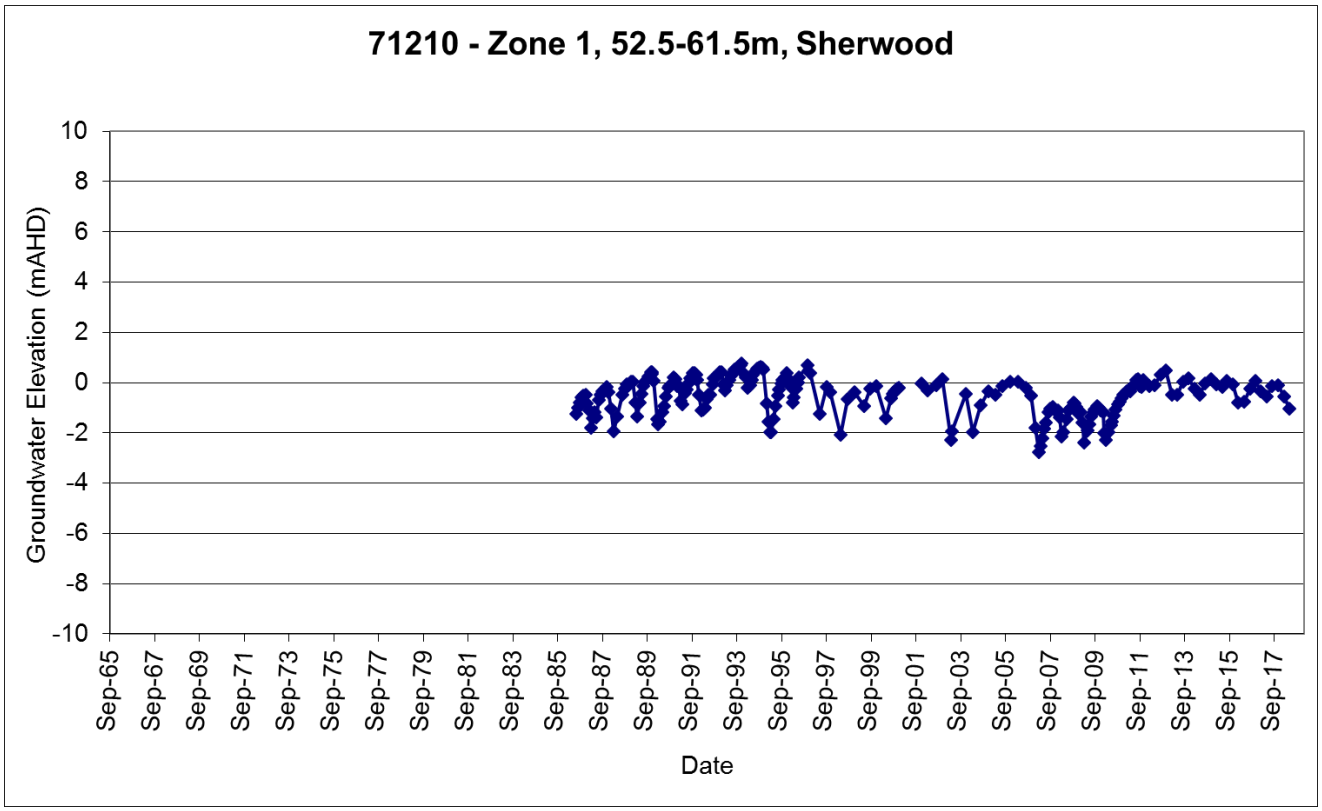
71210 - Zone 1, 52.5-61.5m, Sherwood
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
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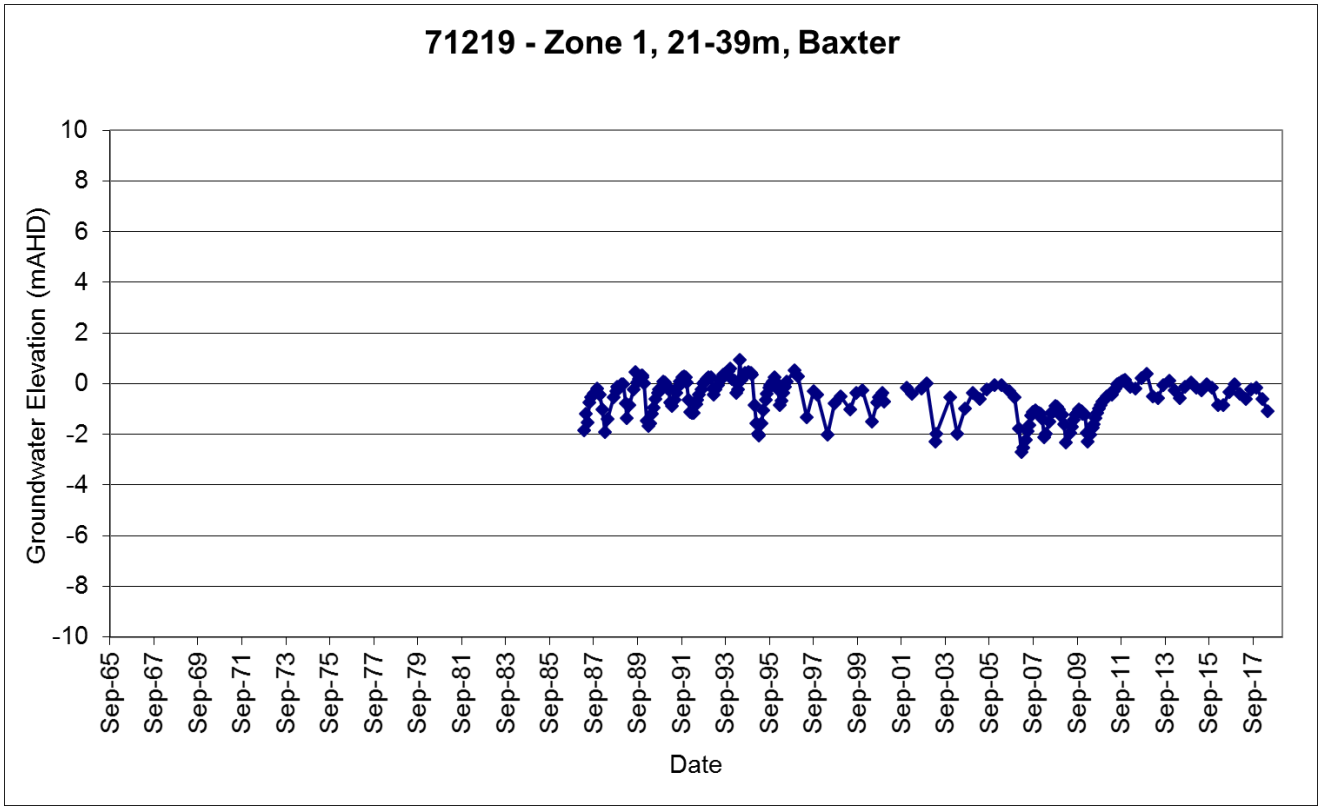
71219 - Zone 1, 21-39m, Baxter
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
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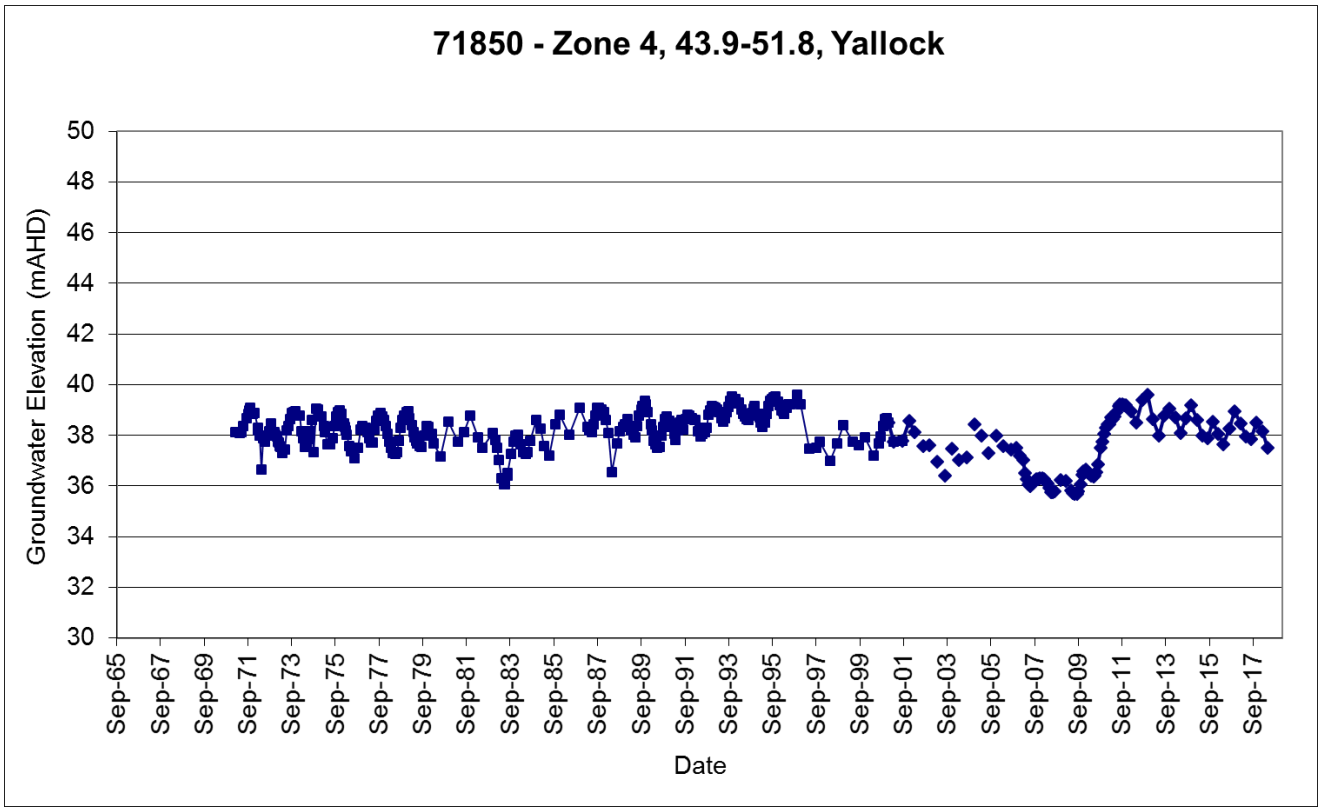
71850 - Zone 4, 43.9-51.8, Yallock
Groundwater Elevation (mAHD)
50
48
46
44
42
40
38
36
34
32
30
Sep-65
Sep-67
Sep-69
Sep-71
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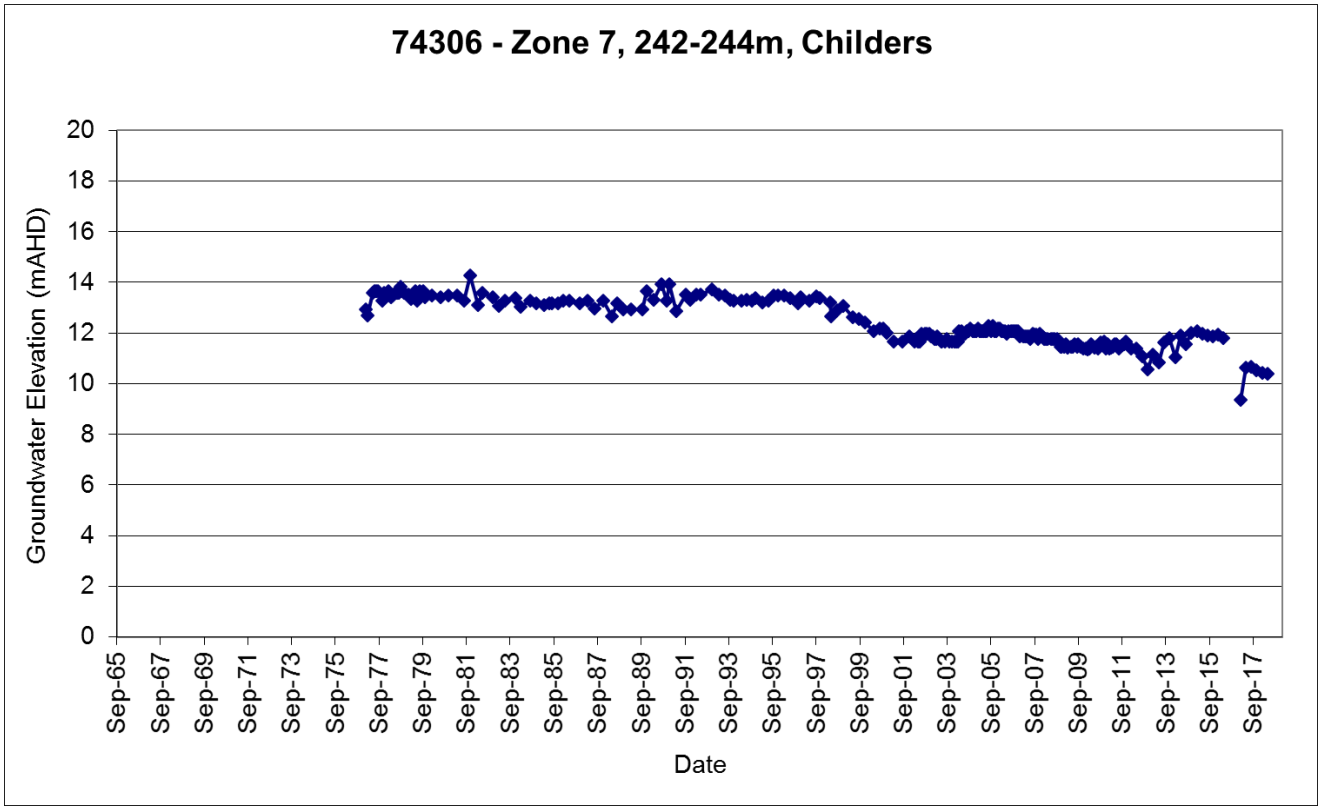
74306 - Zone 7, 242-244m, Childers
Groundwater Elevation (mAHD)
20
18
16
14
12
10
8
6
4
2
0
Sep-65
Sep-67
Sep-69
Sep-71
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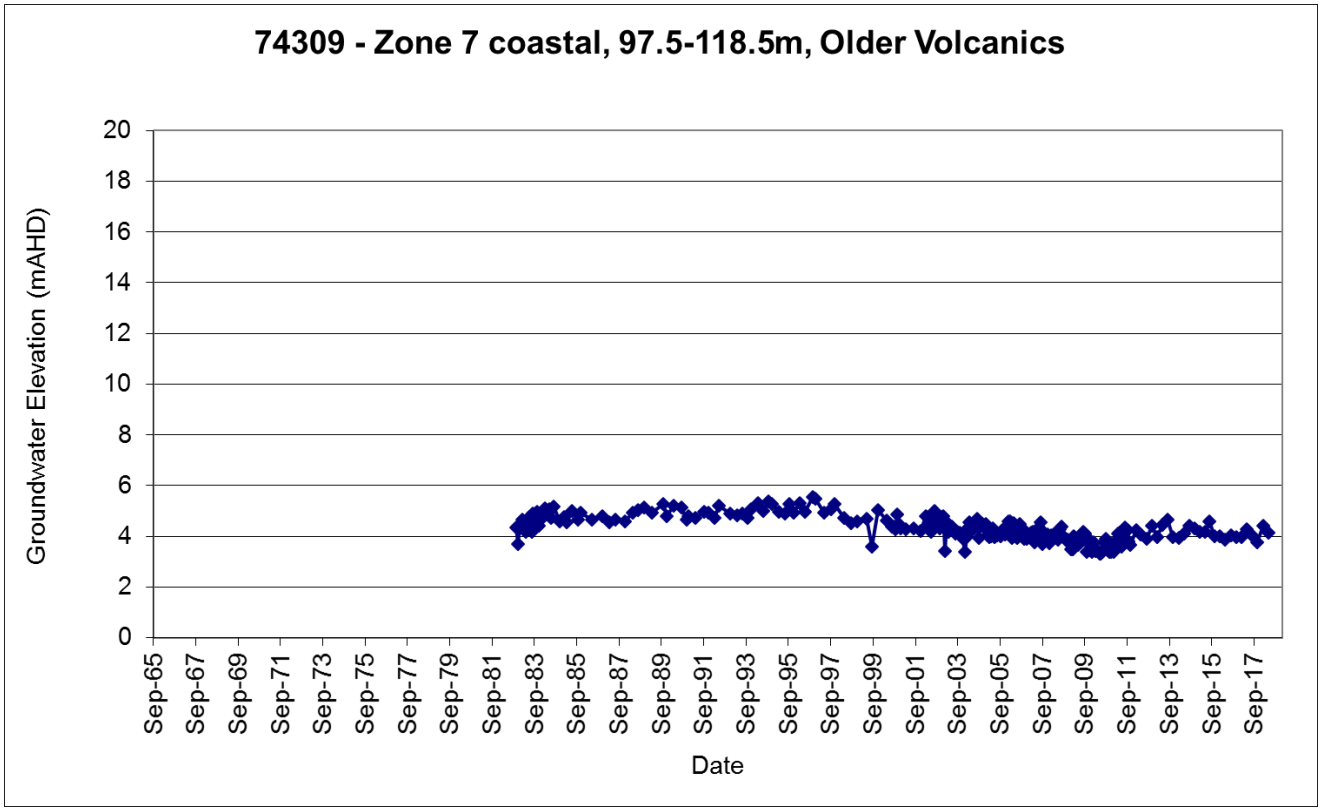
74309 - Zone 7 coastal, 97.5-118.5m, Older Volcanics
Groundwater Elevation (mAHD)
20
18
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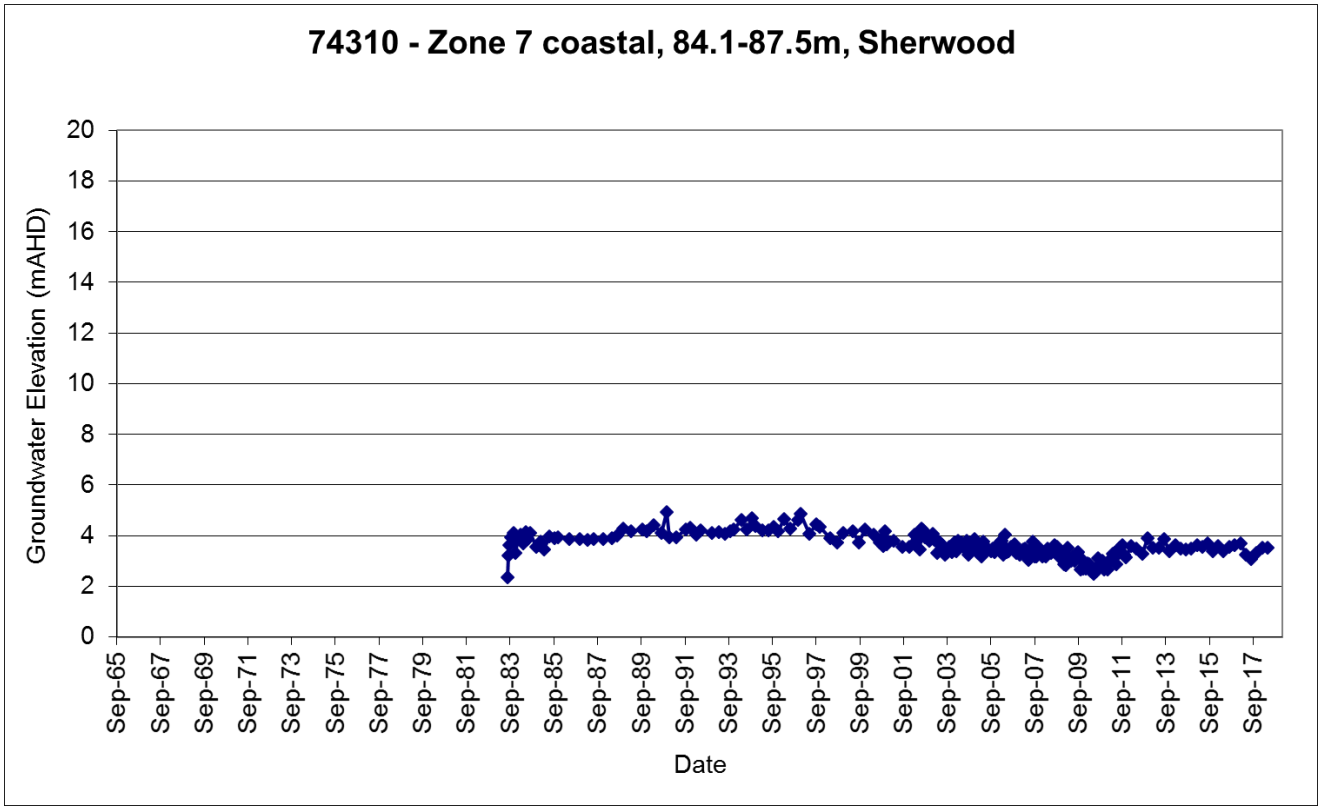
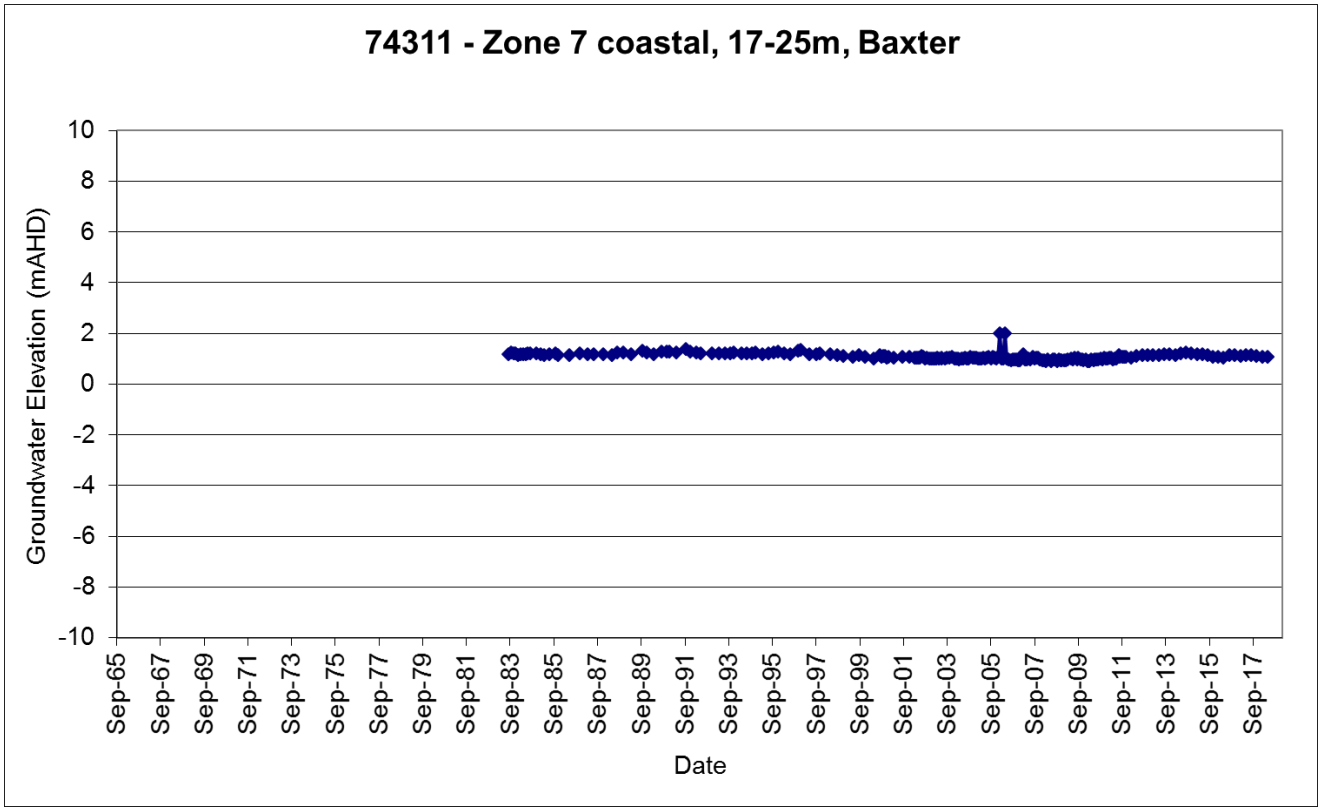
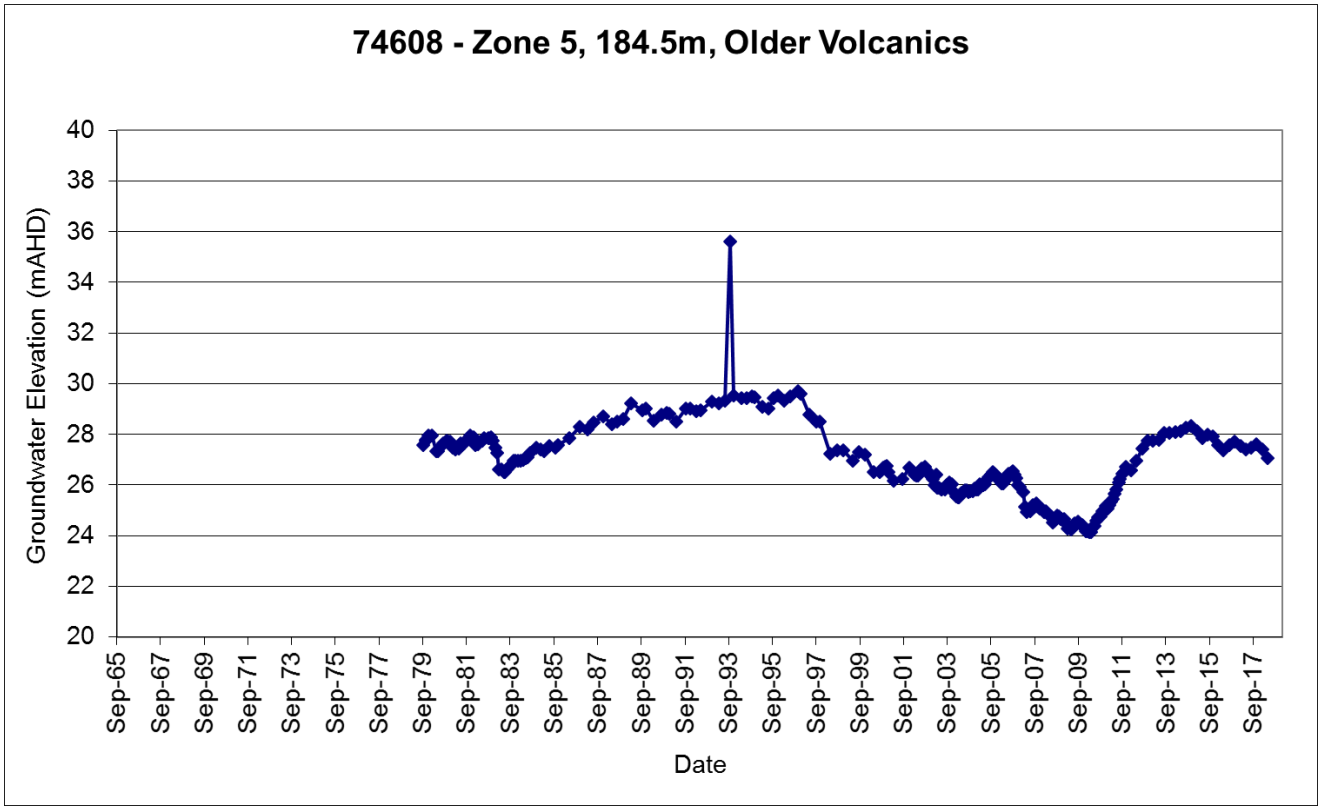
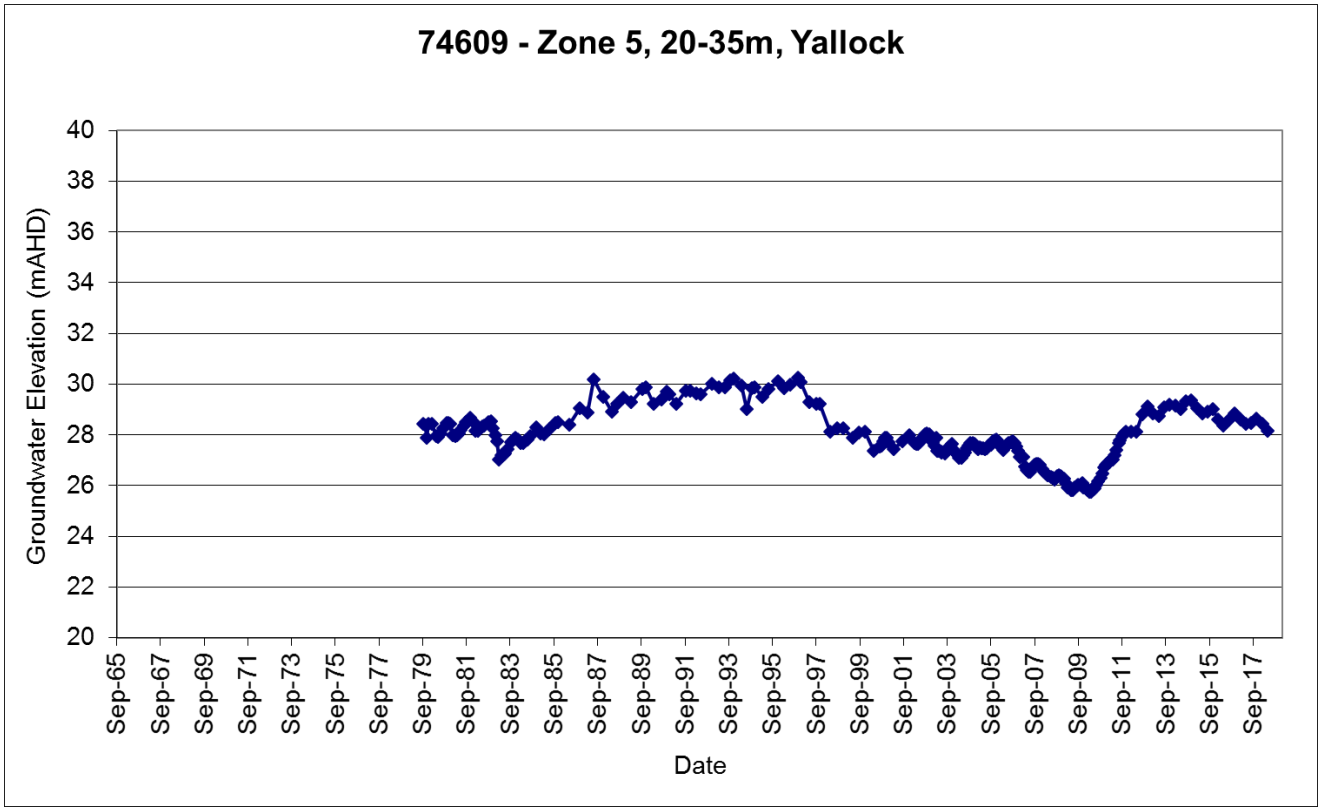
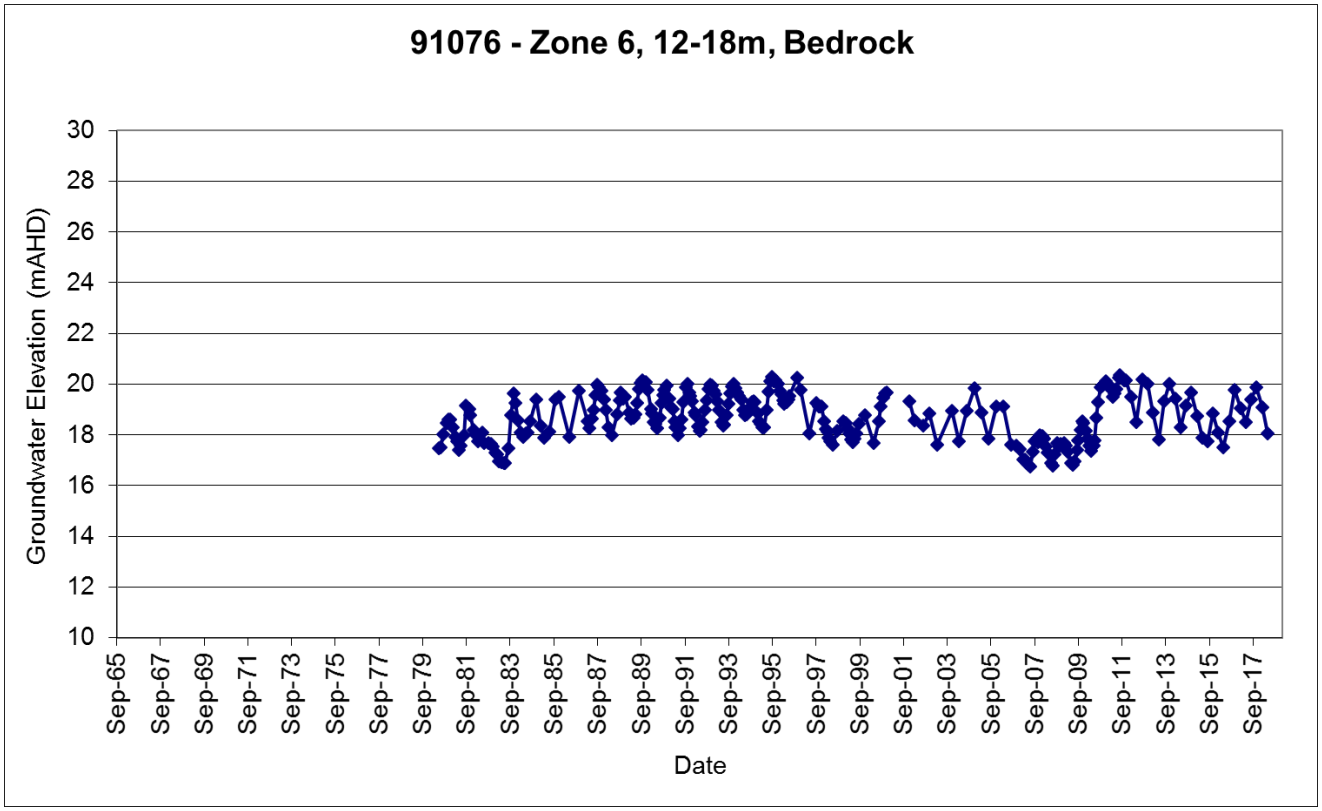
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

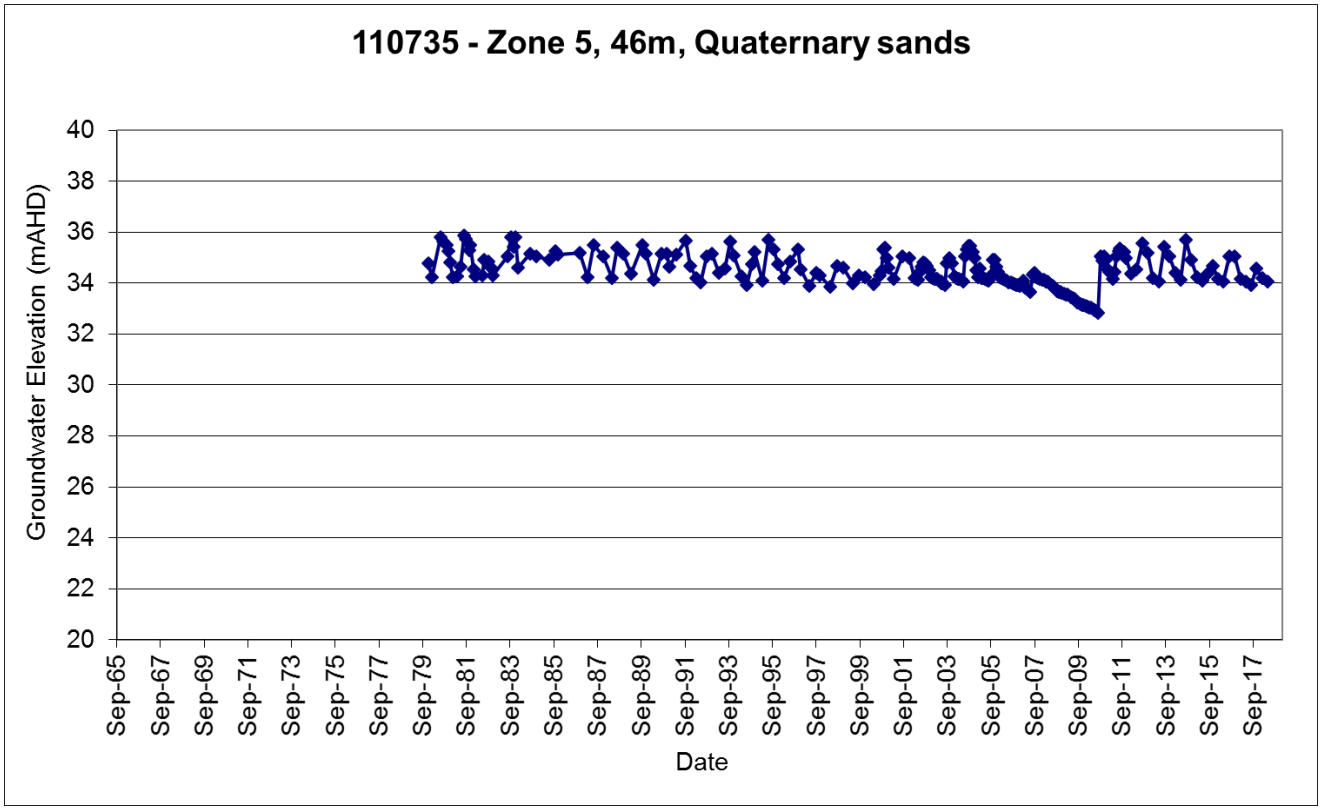

74310 - Zone 7 coastal, 84.1-87.5m, Sherwood
Groundwater Elevation (mAHD)
20
18
16
14
12
10
8
6
4
2
0
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

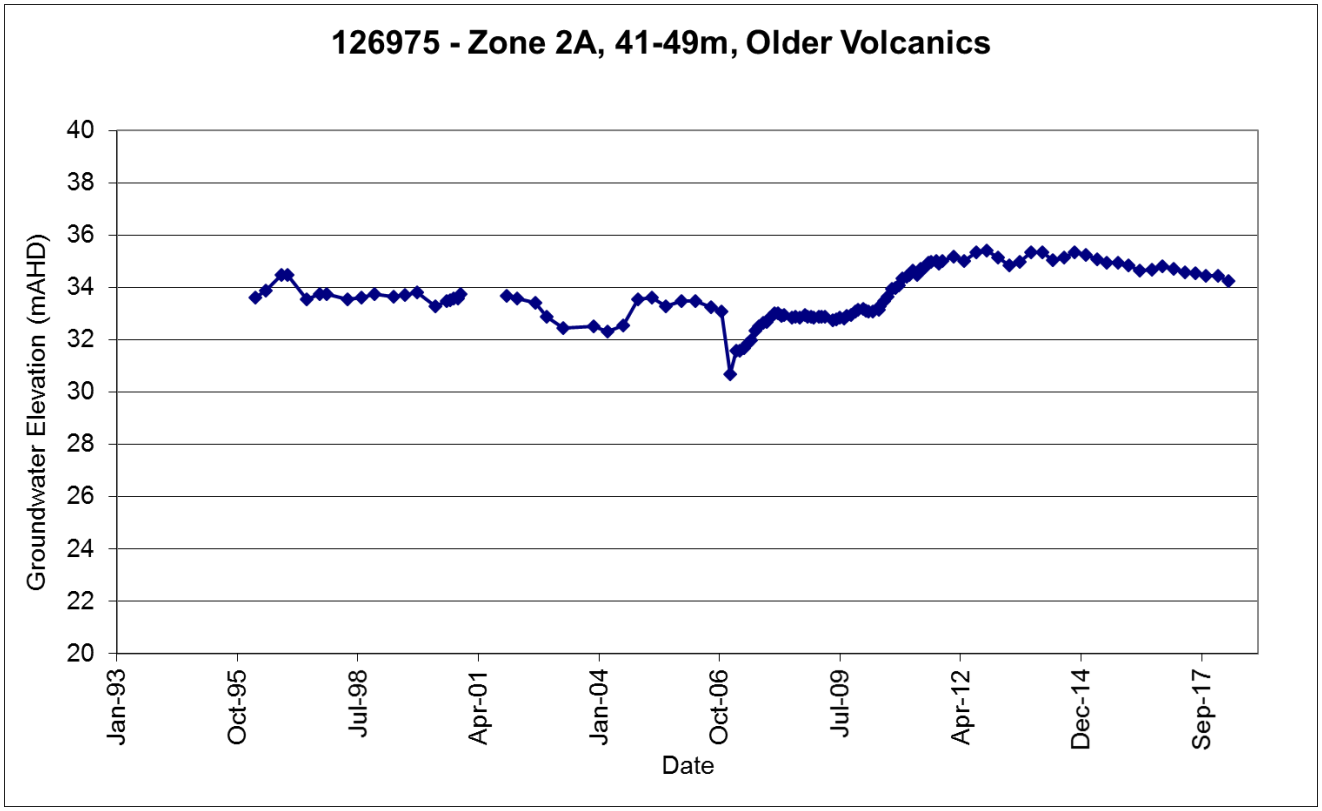

74311 - Zone 7 coastal, 17-25m, Baxter
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

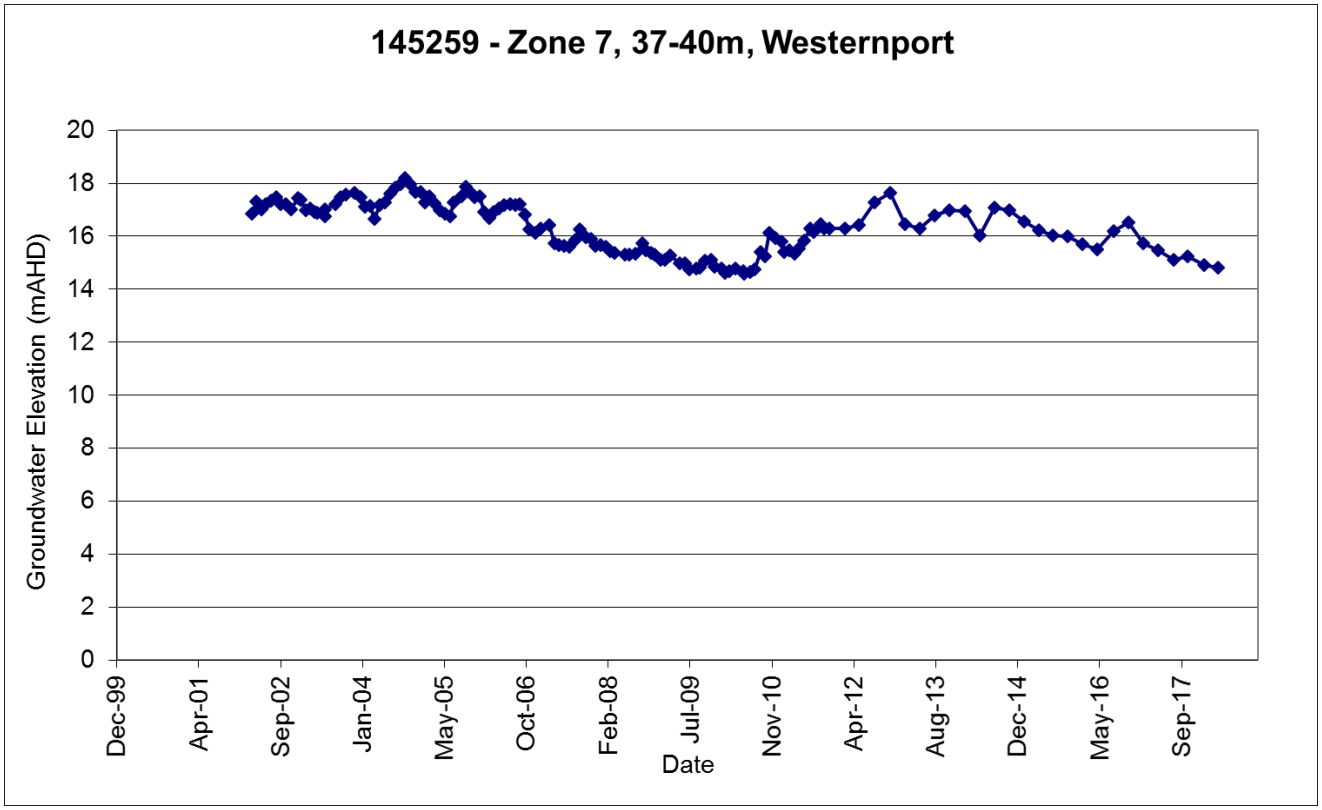

74608 - Zone 5, 184.5m, Older Volcanics
Groundwater Elevation (mAHD)
40
38
36
34
32
30
28
26
24
22
20
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

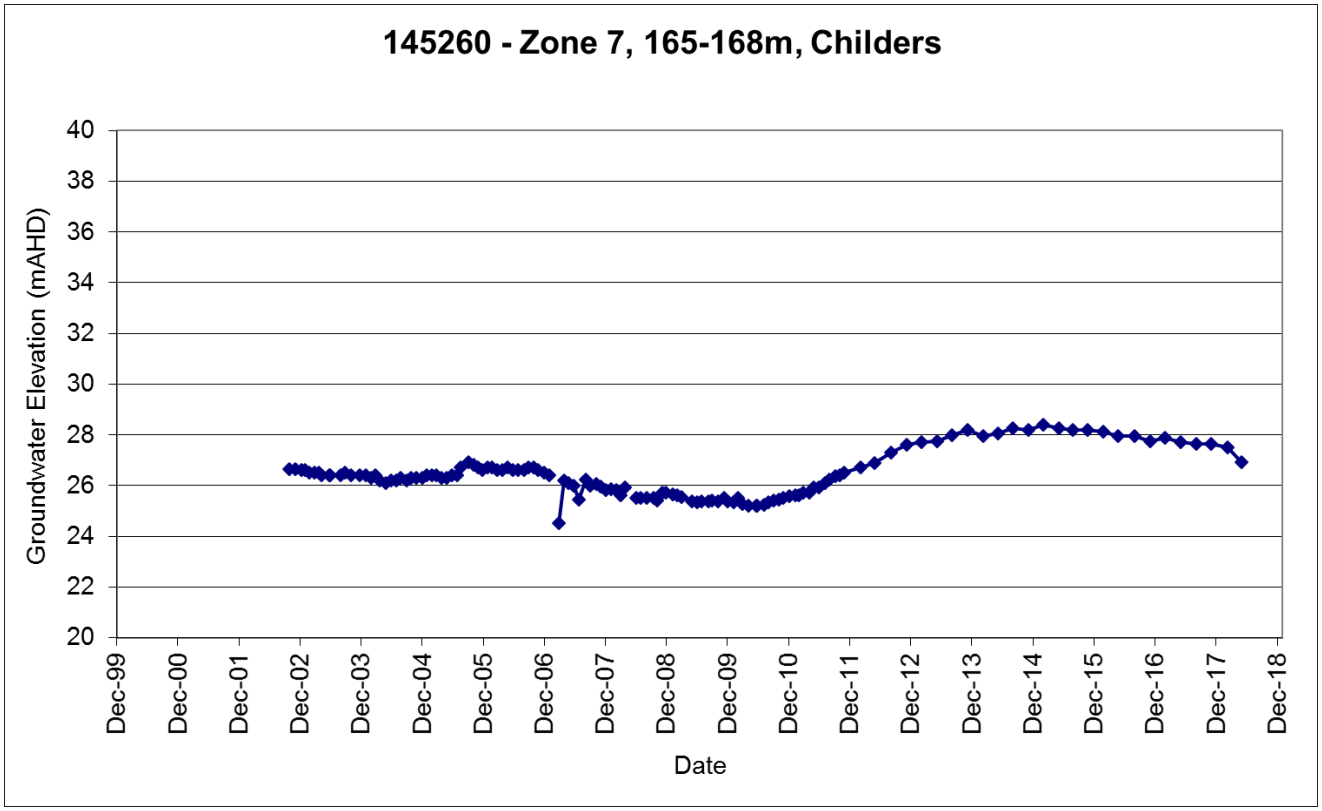

74609 - Zone 5, 20-35m, Yallock
Groundwater Elevation (mAHD)
40
38
36
34
32
30
28
26
24
22
20
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

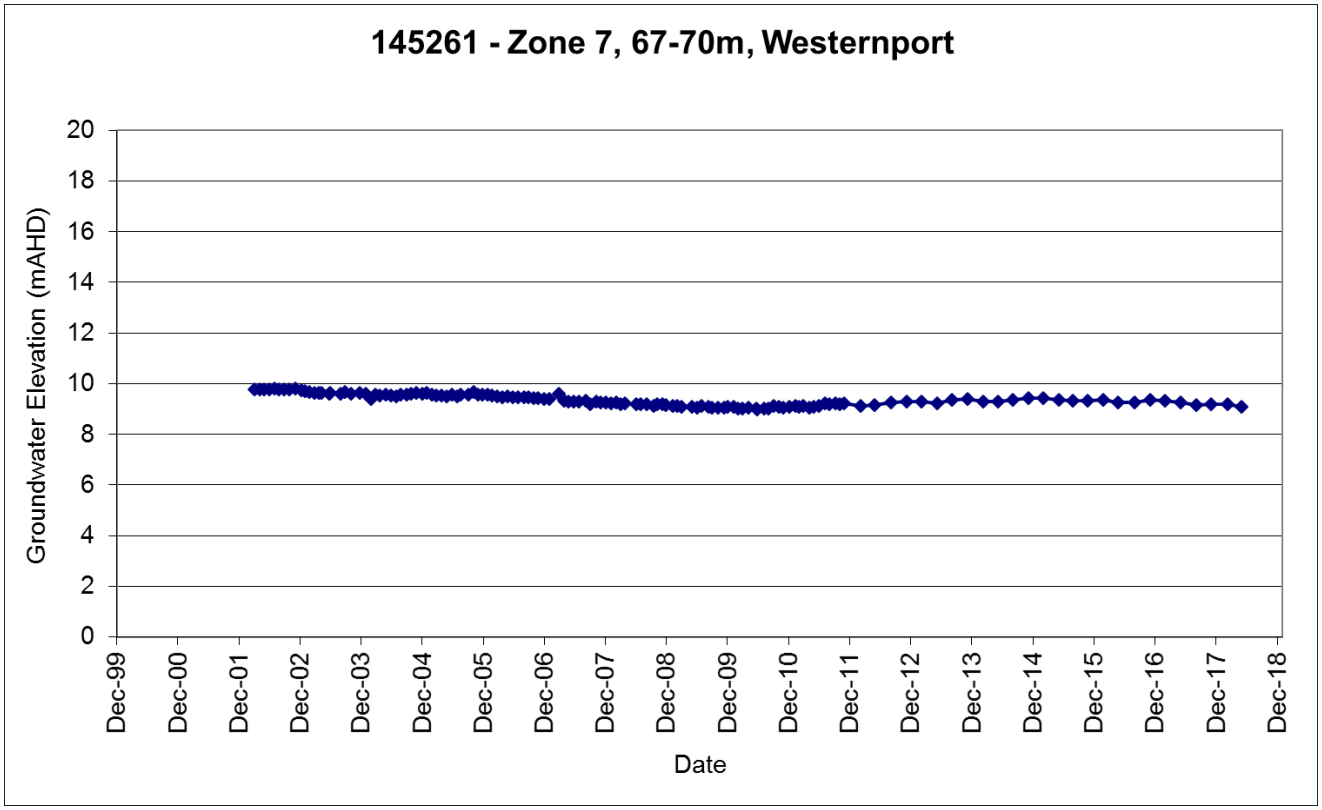

91076 - Zone 6, 12-18m, Bedrock
Groundwater Elevation (mAHD)
30
28
26
24
22
20
18
16
14
12
10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

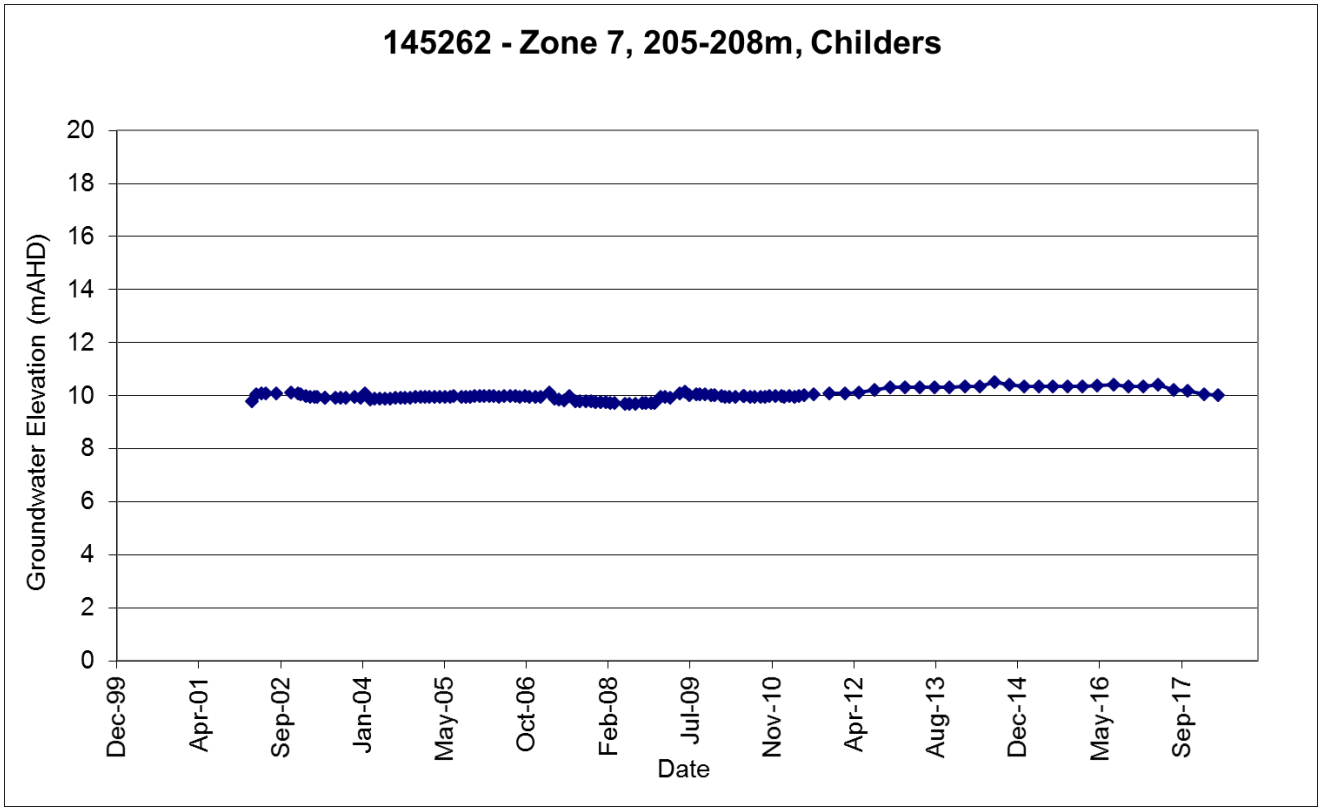

110735 - Zone 5, 46m, Quaternary sands
Groundwater Elevation (mAHD)
40
38
36
34
32
30
28
26
24
22
20
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

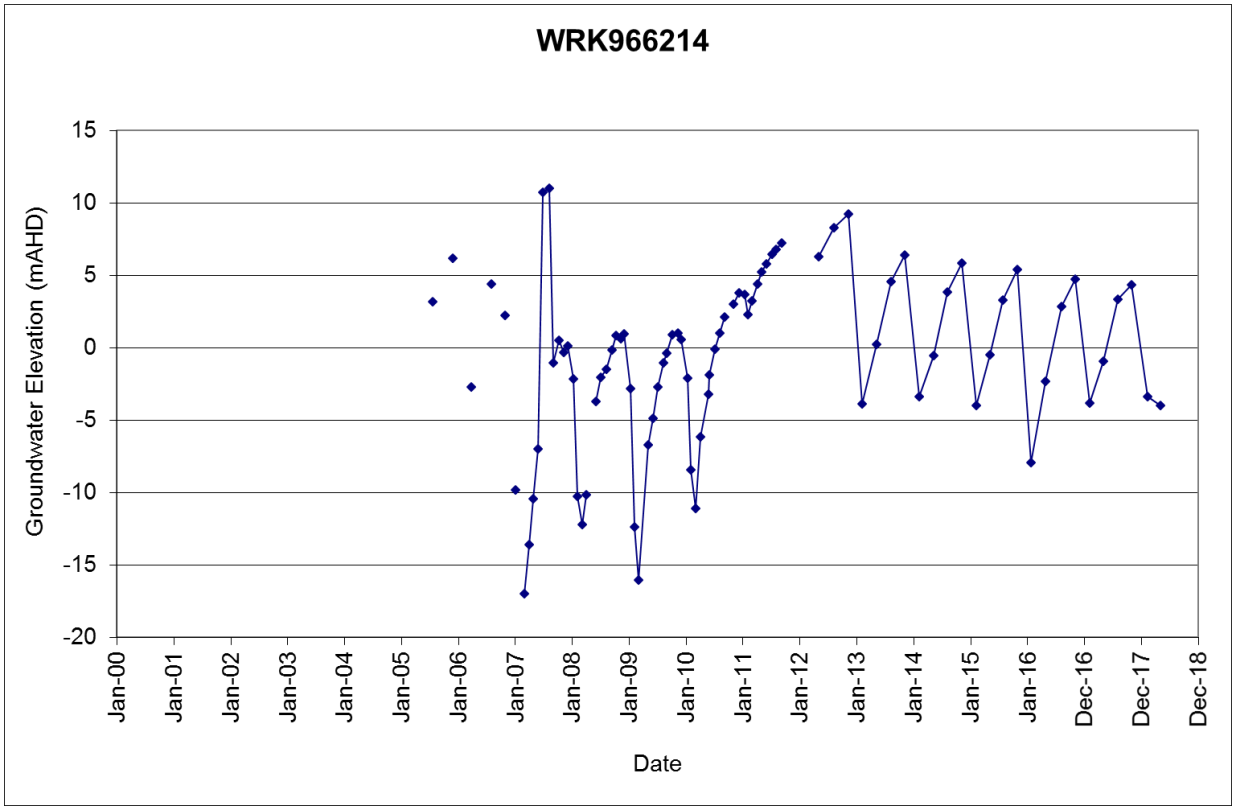

126975 - Zone 2A, 41-49m, Older Volcanics
Groundwater Elevation (mAHD)
40
38
36
34
32
30
28
26
24
22
20
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Date

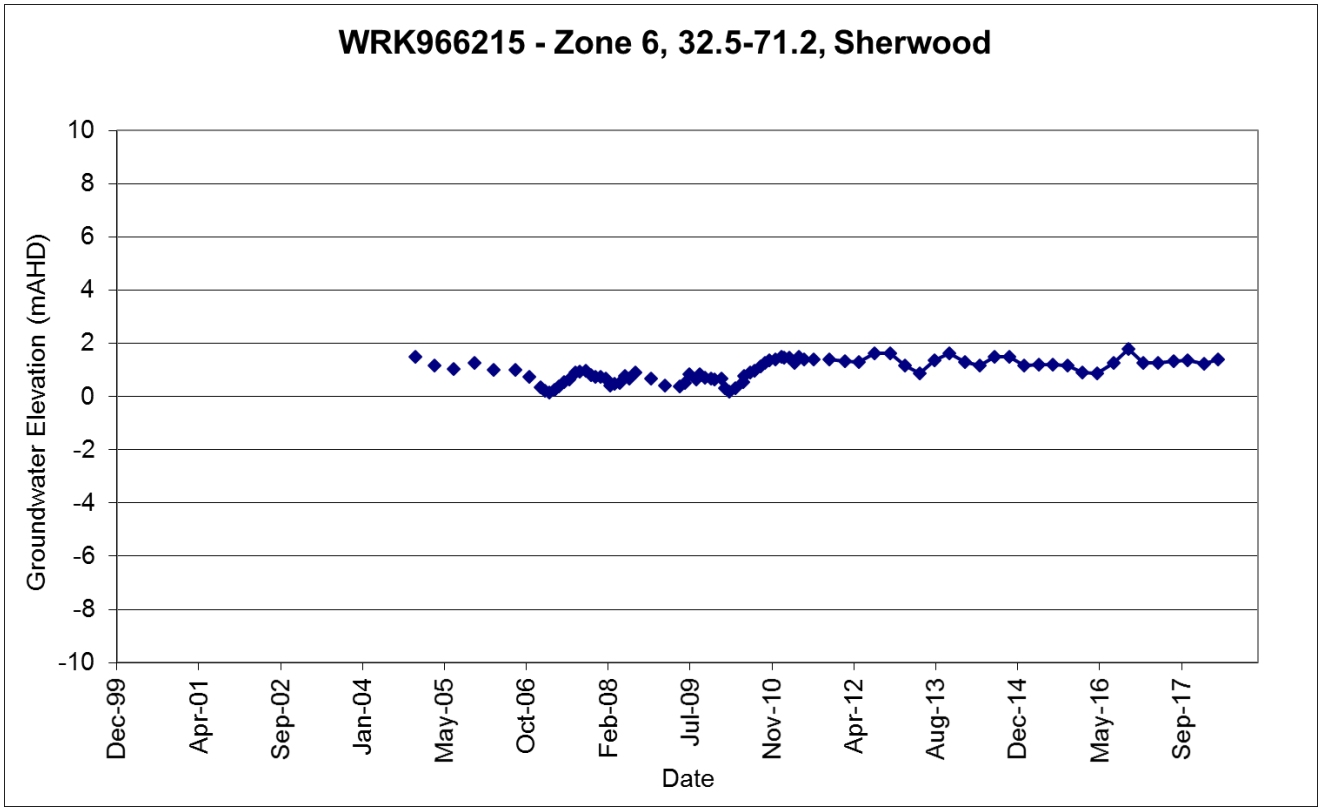

145259 - Zone 7, 37-40m, Westernport
Groundwater Elevation (mAHD)
20
18
16
14
12
10
8
6
4
2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date

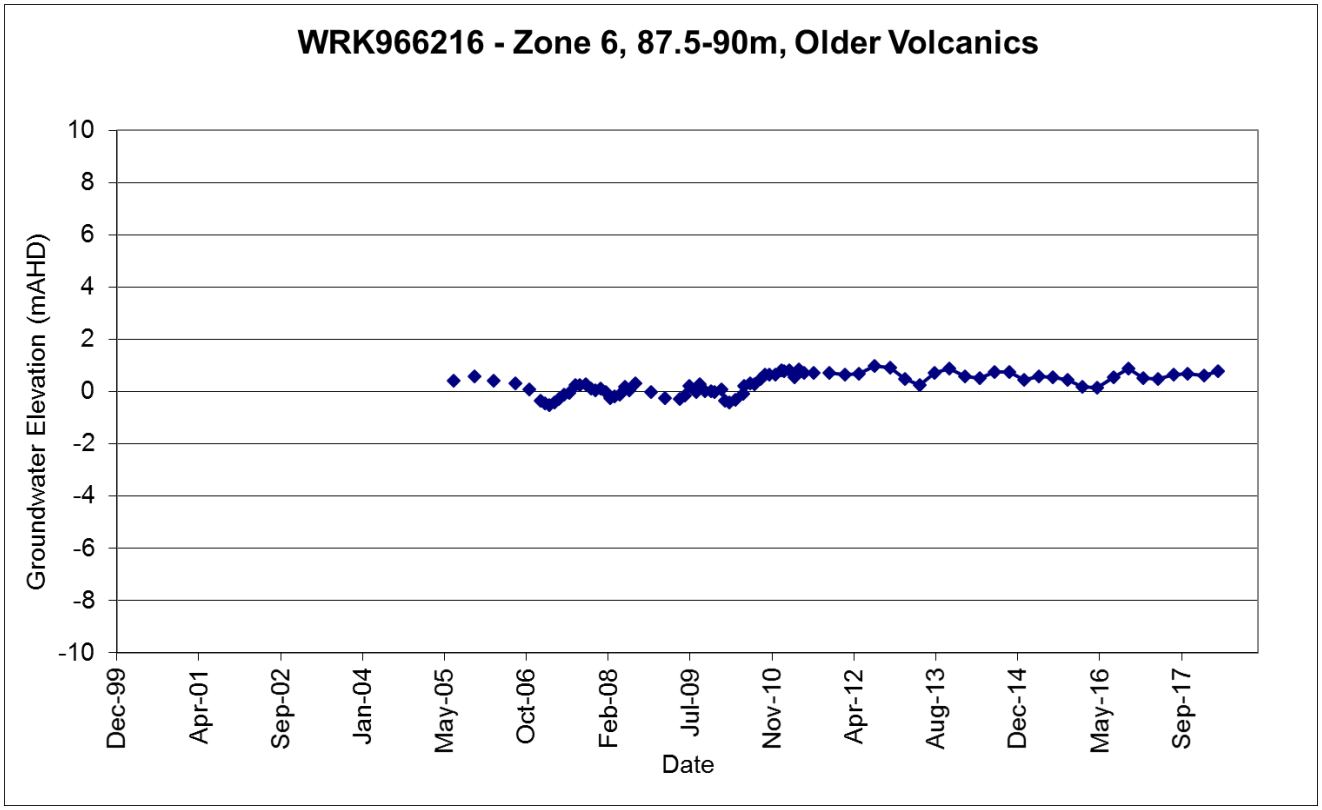

145260 - Zone 7, 165-168m, Childers
Groundwater Elevation (mAHD)
40
38
36
34
32
30
28
26
24
22
20
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
Dec-18
Date

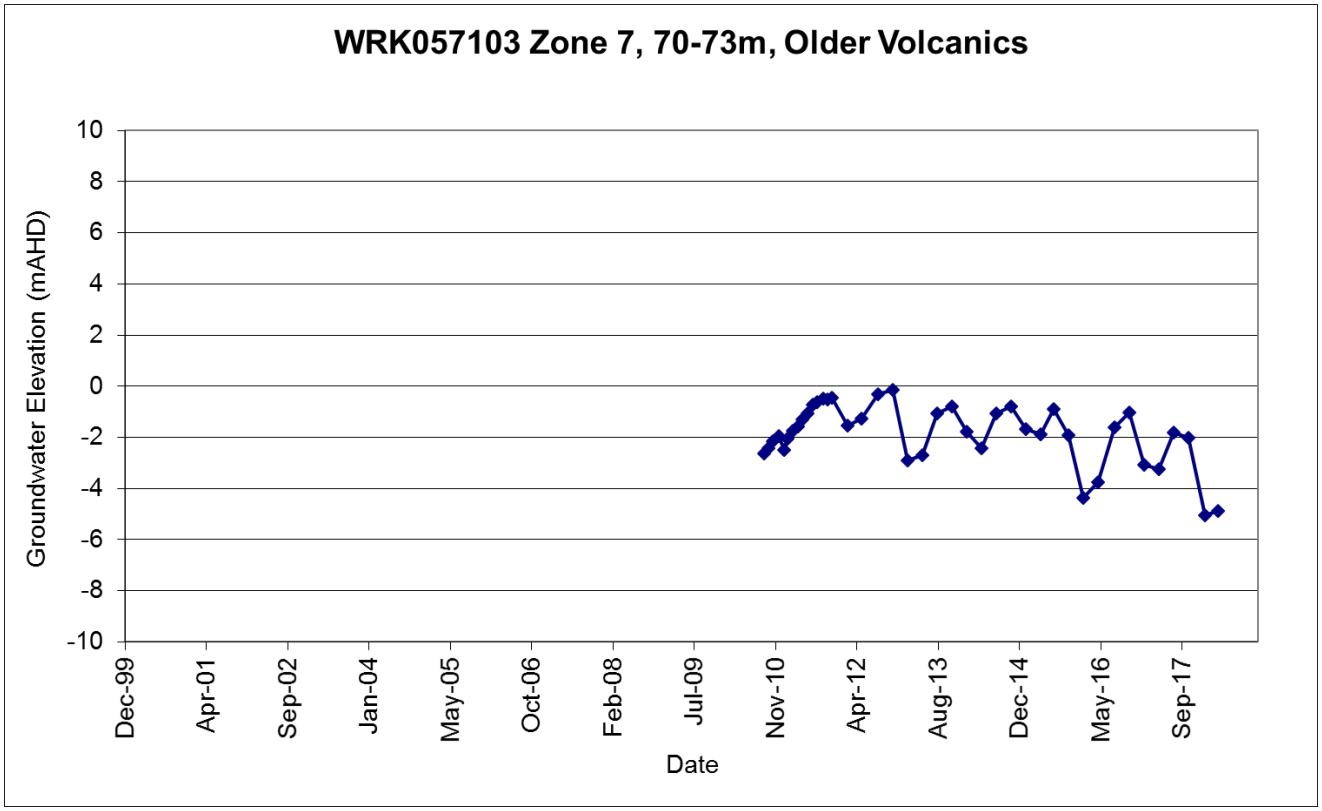

145261 - Zone 7, 67-70m, Westernport
Groundwater Elevation (mAHD)
20
18
16
14
12
10
8
6
4
2
0
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
Dec-18
Date

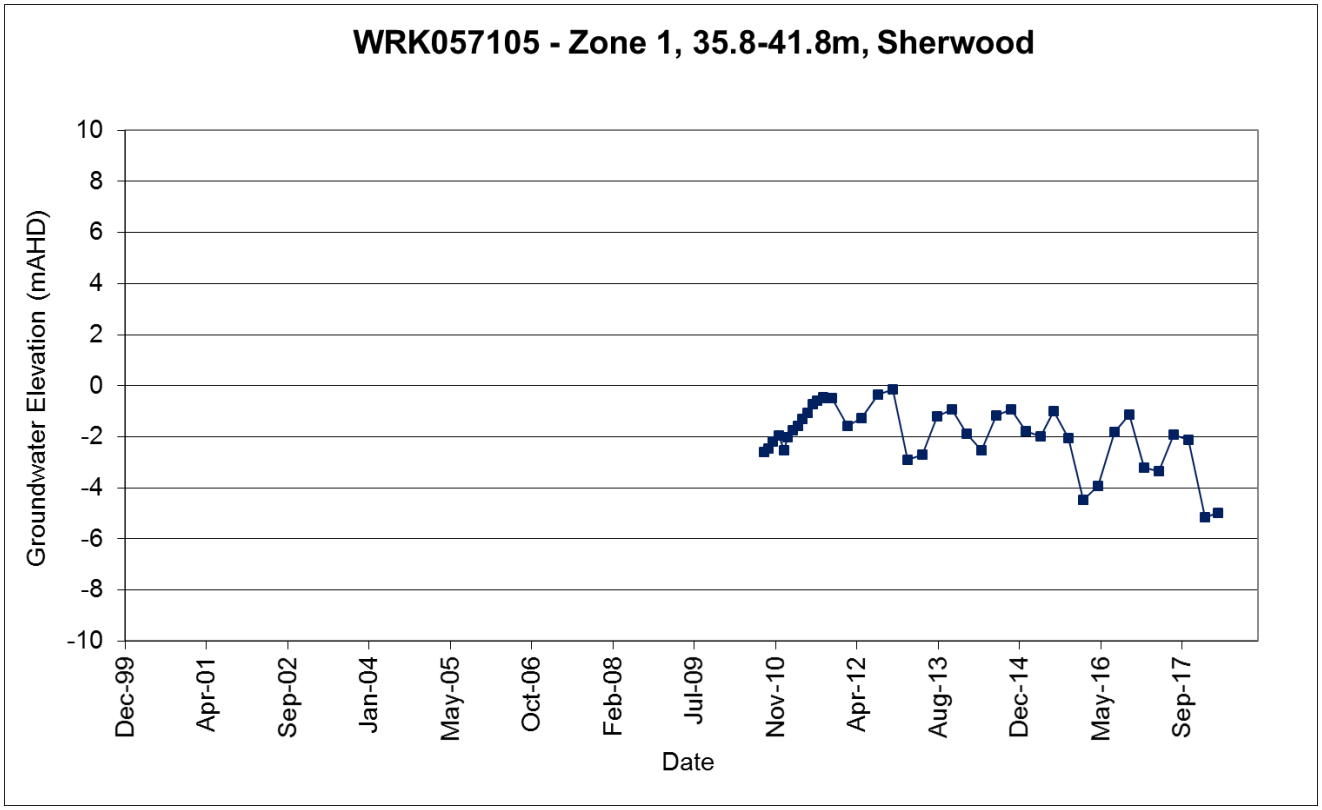

145262 - Zone 7, 205-208m, Childers
Groundwater Elevation (mAHD)
20
18
16
14
12
10
8
6
4
2
0
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date

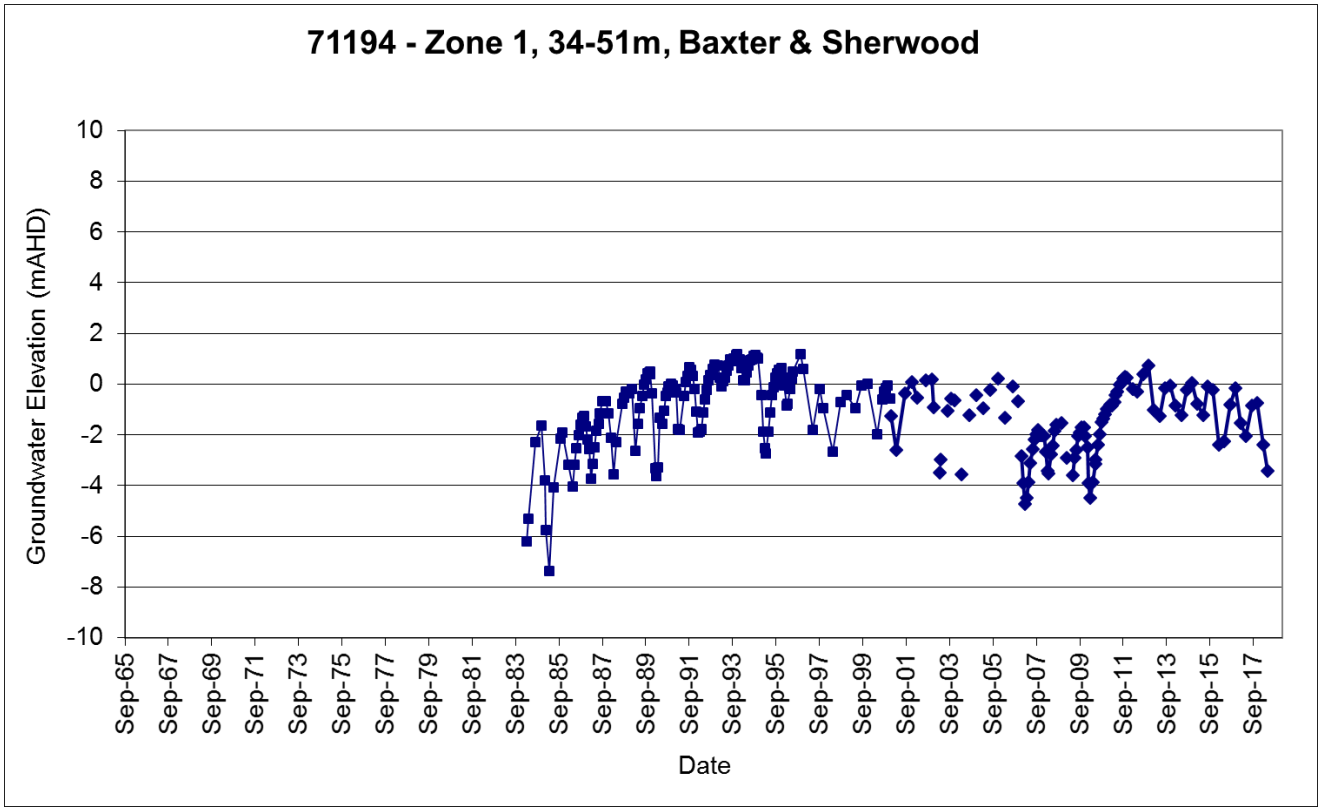

WRK966214
Groundwater Elevation (mAHD)
15
10
5
0
-5
-10
-15
-20
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Dec-16
Dec-17
Dec-18
Date

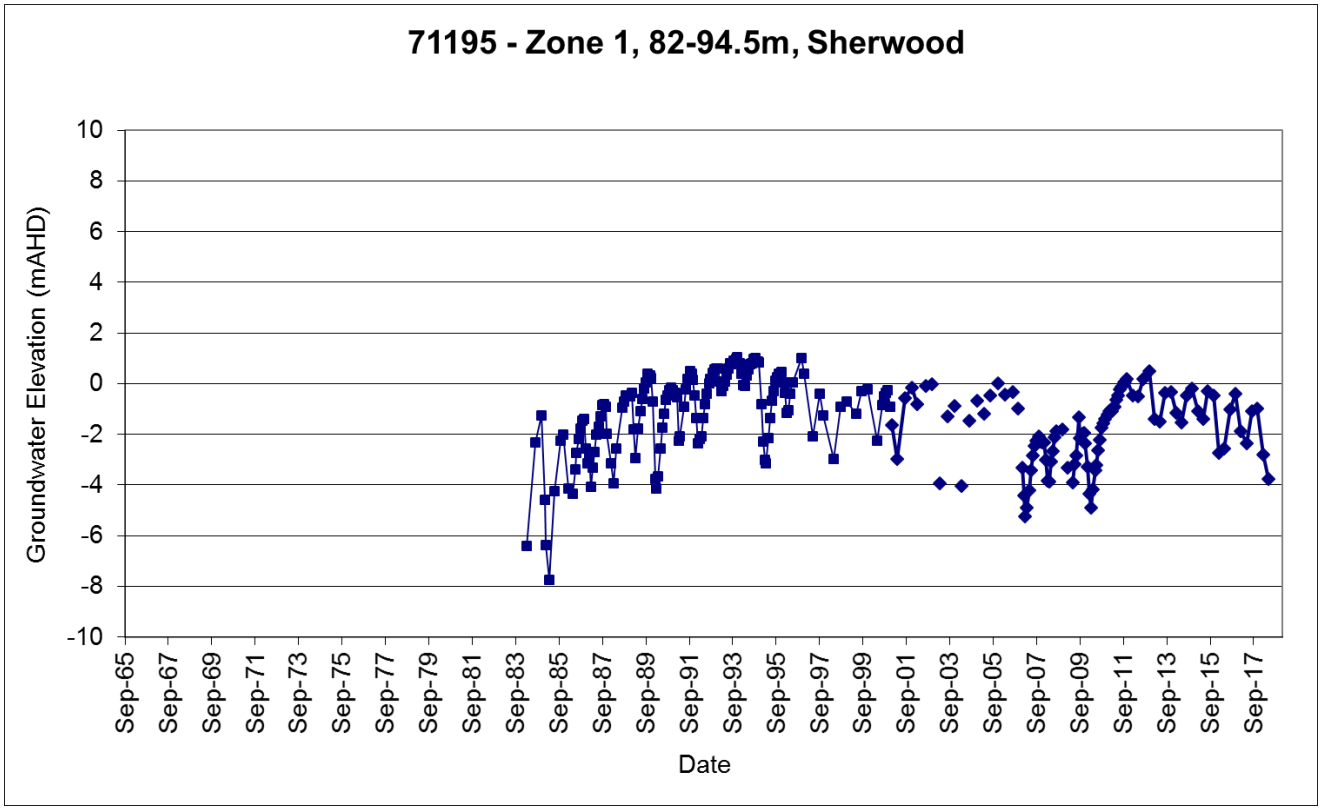

WRK966215 - Zone 6, 32.5-71.2, Sherwood
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date

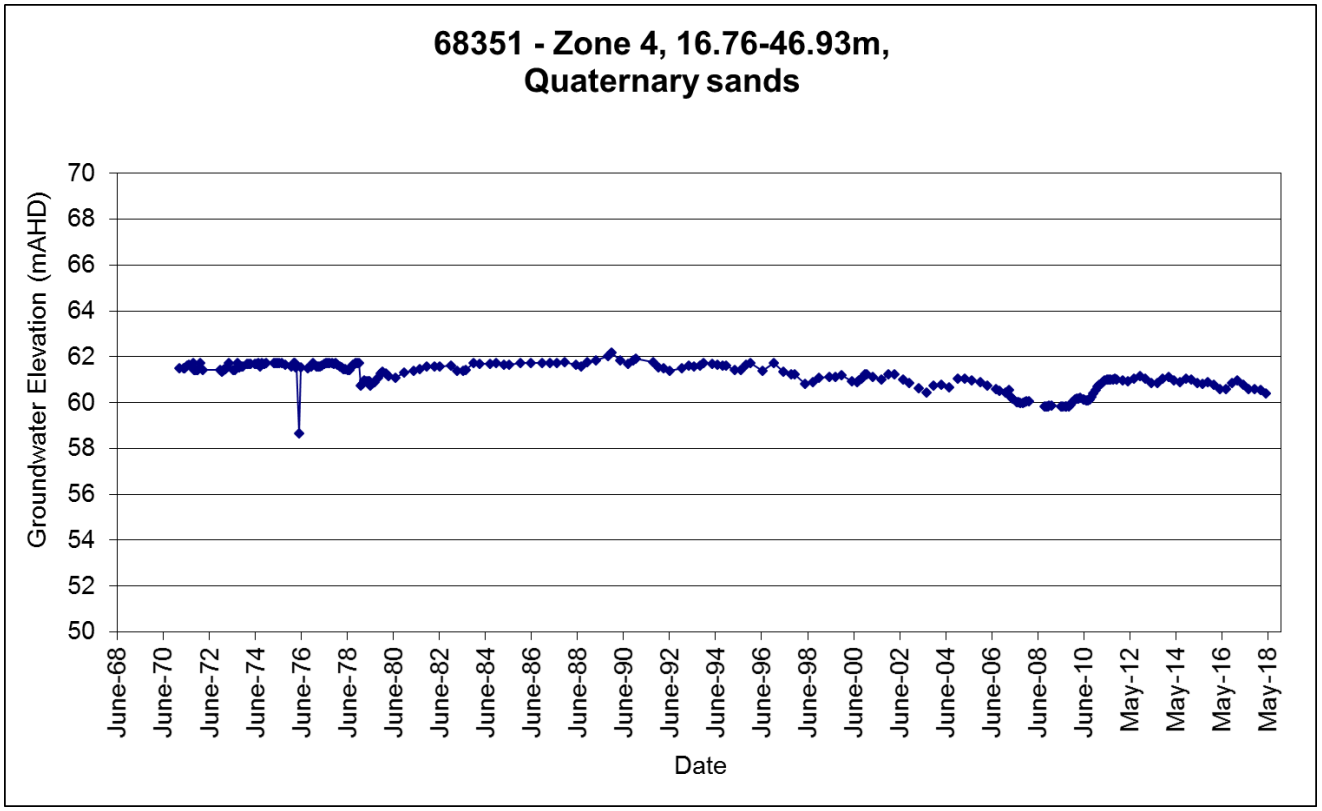

WRK966216 - Zone 6, 87.5-90m, Older Volcanics
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date

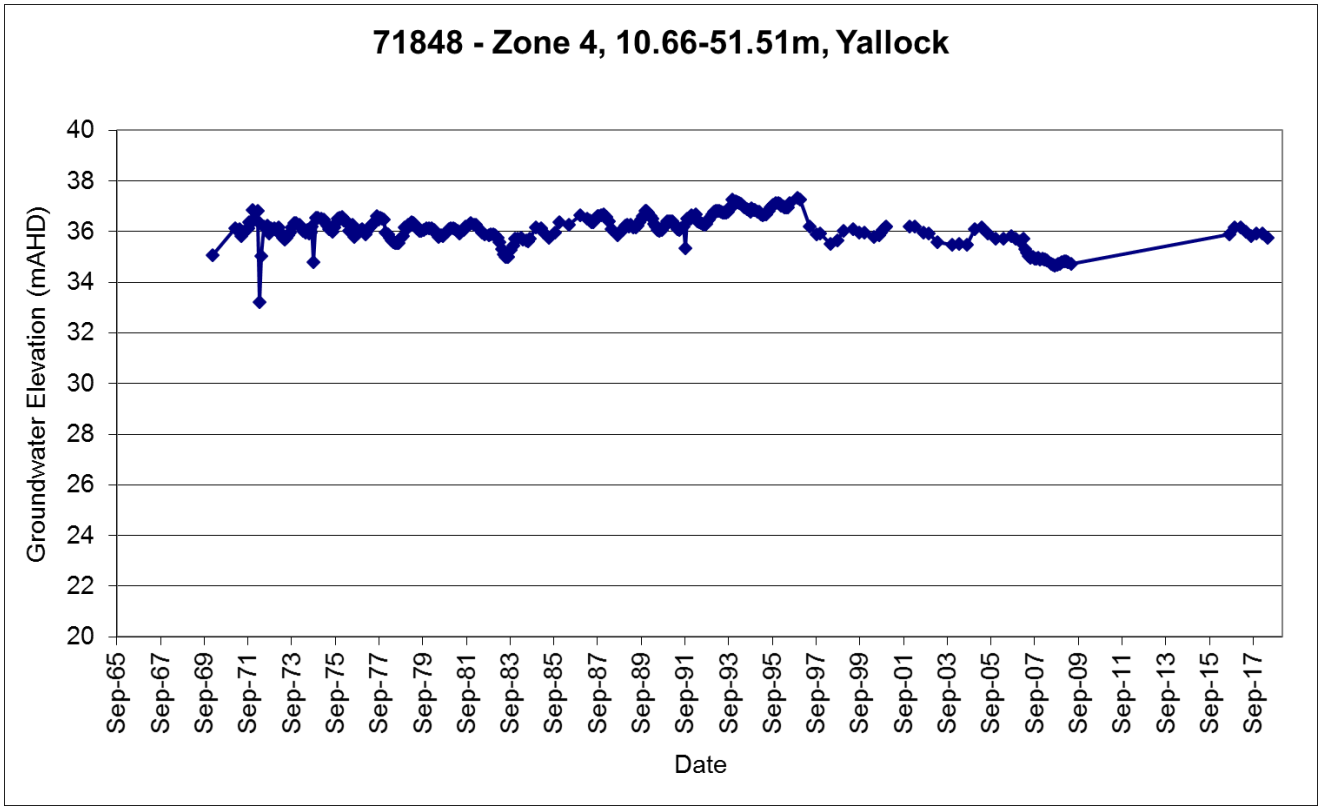

WRK057103 Zone 7, 70-73m, Older Volcanics
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date


WRK057105 - Zone 1, 35.8-41.8m, Sherwood
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date

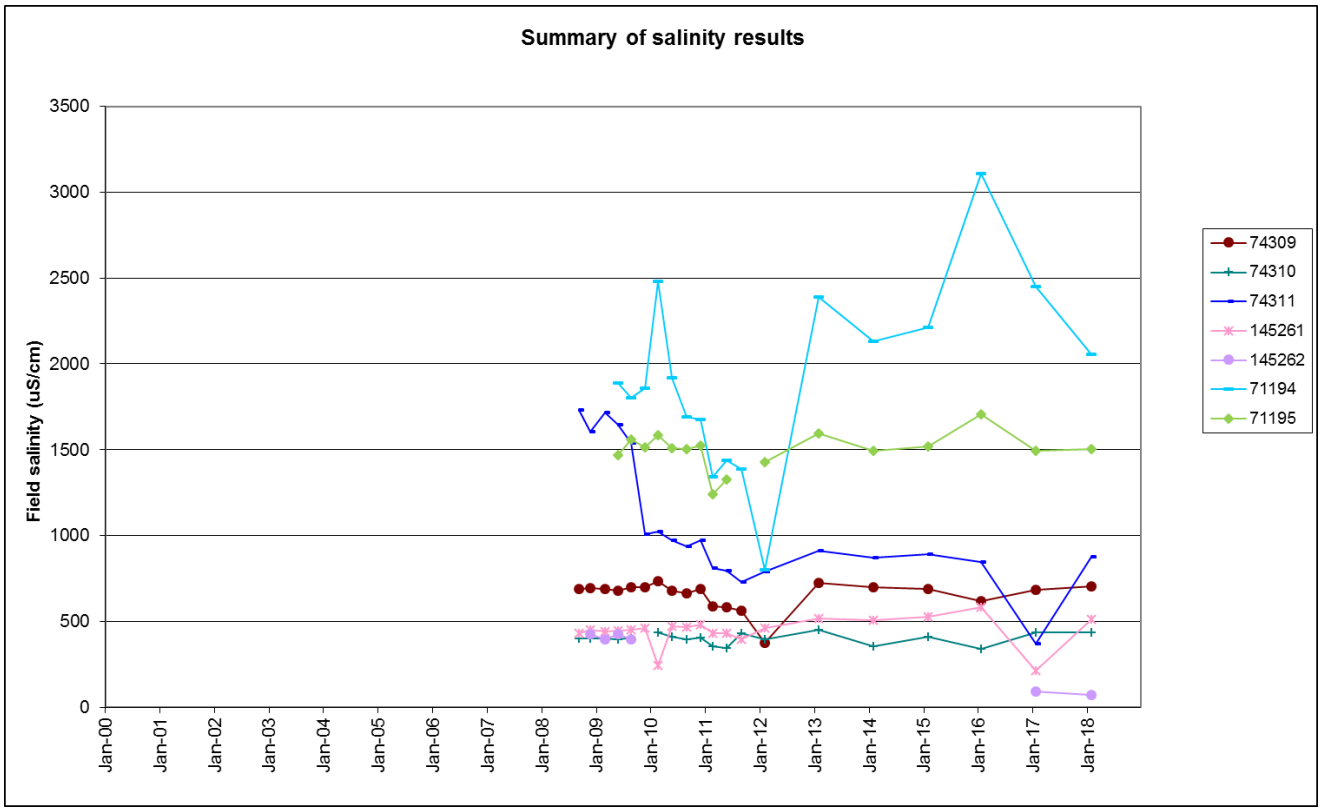

71194 - Zone 1, 34-51m, Baxter & Sherwood
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date

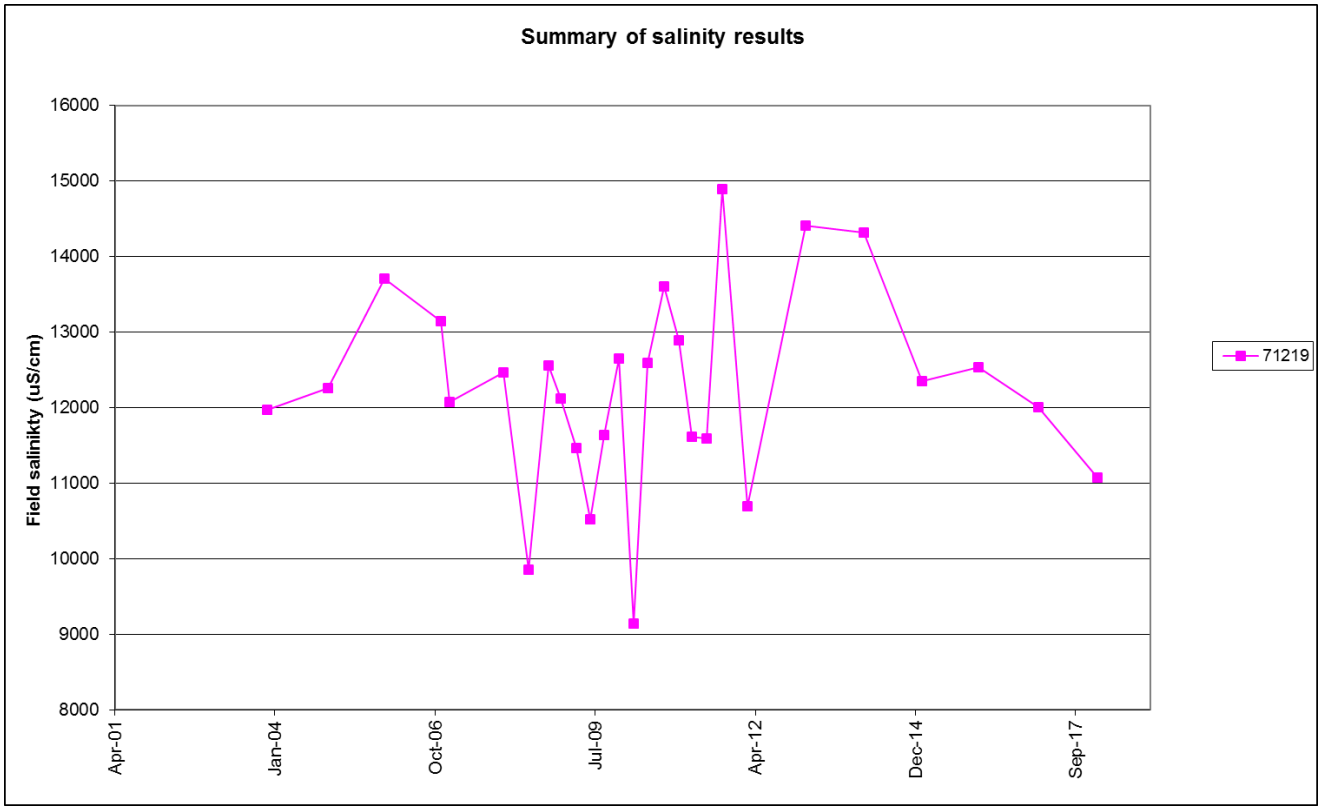

71195 - Zone 1, 82-94.5m, Sherwood
Groundwater Elevation (mAHD)
10
8
6
4
2
0
-2
-4
-6
-8
-10
Sep-65
Sep-67
Sep-69
Sep-71
Sep-73
Sep-75
Sep-77
Sep-79
Sep-81
Sep-83
Sep-85
Sep-87
Sep-89
Sep-91
Sep-93
Sep-95
Sep-97
Sep-99
Sep-01
Sep-03
Sep-05
Sep-07
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Date


68351 - Zone 4, 16.76-46.93m,
Quaternary sands
Groundwater Elevation (mAHD)
70
68
66
64
62
60
58
56
54
52
50
June-68
June-70
June-72
June-74
June-76
June-78
June-80
June-82
June-84
June-86
June-88
June-90
June-92
June-94
June-96
June-98
June-00
June-02
June-04
June-06
June-08
June-10
May-12
May-14
May-16
May-18
Date



5.1.4 Salinity




Summary of salinity results
Field salinikty (uS/cm)
16000
15000
14000
13000
12000
11000
10000
9000
8000
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
71219