Loddon Highlands
Water Supply Protection Area
Groundwater Management Plan

Annual Report

For year ending 30 June 2017

Document Number: 4439877
Version: Final

Document History and Distribution

Versions

Version	Date	Author(s)	Notes
Draft v1	9 August 2017	Andrew Harbour	Document creation
Draft v2	11 August 2017	Brendan Cossens	Document edits and review
Draft v3	14 August 2017	Andrew Harbour	Document edits post review
Draft v4	21 August 2017	Brendan Cossens	Document review
Draft v5	23 August 2017	Jock Richardson	Document edits post review
Draft v6	5 September 2017	Andrew Harbour	Document edits post DELWP review
Final (v7)	25 September 2017	Jock Richardson	Document edits post review

Distribution

Version	Recipient(s)	Date	Notes
Draft v1	Brendan Cossens	10 August 2017	For peer review
Draft v3	Brendan Cossens	21 August 2017	For peer review
Draft v4	Jock Richardson	21 August 2017	For peer review
Draft v5	Matthew Pethybridge	25 August 2017	For review and endorsement
Draft v5	Anthony Jenkins (DELWP)	28 August 2017	For review and comment
Draft v6	Mark Bailey	6 September 2017	For review and endorsement
Final (v7)	Scott Barber	25 September 2017	For review and endorsement
Final (v7)	Pat Lennon	27 September 2017	For review and approval

Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the Loddon Highlands Water Supply Protection Area Groundwater Management Plan (the Plan) for the 2016/17 water year.

GMW is responsible for the implementation, administration and enforcement of the Plan which was approved by the Minister administering the *Water Act 1989* (the Minister) on 21 November 2012.

This report has been prepared in accordance with section 32C of the *Water Act 1989* (the Act).

This report provides an overview of the groundwater management activities in the Loddon Highlands Water Supply Protection Area and documents the successful operation under the Plan in the 2016/17 water year.

A copy of this report is available for inspection at the Tatura office of GMW, or for download from the GMW website.

Pat Lennon

MANAGING DIRECTOR

27.9.2017

Date

Executive summary

The Loddon Highlands Water Supply Protection Area Groundwater Management Plan was approved on 21 November 2012 by the Minister for Water.

The 2016/17 water year marks the fifth year of operation of the Plan.

Groundwater levels were higher in 2016/17 compared to the previous water year, which can largely be attributed to rainfall recharge due to wetter than average conditions.

Annual allocations for the 2016/17 water year were 100% in all management zones of the Loddon Highlands Water Supply Protection Area (WSPA), except in the Newlyn Zone where an annual allocation of 75% was declared.

Groundwater use in the 2016/17 water year was 27% (5,435 ML) of the total licensed volume in the Loddon Highlands WSPA. This is the lowest metered use in a water year since 2011/12.

There was moderate trade activity during the 2016/17 water year; 10 temporary licence transfers totalling 355 ML/yr and four permanent transfers totalling 76 ML/yr.

Licence holders in the Loddon Highlands WSPA are entitled to carryover a maximum of 15% of their unused licensed volume from water year to the next. A total of 2,936 ML has been carried over for use in the 2017/18 water year.

Groundwater monitoring and metering programmes continue to be successfully undertaken to support the objectives of the Plan.

The Plan is continuing to achieve its stated objectives.

Contents

1 Introduction

2.1 Purpose

This annual report has been prepared to meet the requirements of Prescription 7(a) of the Plan and section 32C of the Act.

This report provides an overview of groundwater management activities undertaken in accordance with the Plan from 1 July 2016 to 30 June 2017.

2.2 Water Supply Protection Area

The Loddon Highlands WSPA, declared in June 2010, extends from Newlyn and Learmonth in the south to Dunolly in the north, and includes the townships of Creswick, Waubra, Clunes, Talbot and Maryborough.

The Loddon Highlands WSPA incorporates groundwater resources to all depths.

There are seven management zones in the Loddon Highlands WSPA, which are the Talbot, Waubra, Ascot, Ullina, Newlyn, Blampied and Mollongghip Zones (Figure 1).

2.3 Groundwater Management Plan

The Plan was approved by the Minister for Water in accordance with section 32A(6) of the Act on 21 November 2012.

The objective of the Plan is to make sure that groundwater resources are managed in an equitable manner and so as to ensure the long term sustainability of those resources. More specifically, the plan seeks to:

- manage the resources to protect groundwater users and the environment;
- enable equitable access of groundwater resources to realise the potential for its use; and
- provide effective and transparent communication of Plan objectives, management rules and resource status.

GMW is responsible for the implementation, administration and enforcement of the Plan. A summary of GMW's activities in accordance with Plan prescriptions is presented in Appendix A.

A copy of the Plan can be downloaded from the GMW website: www.g-mwater.com.au

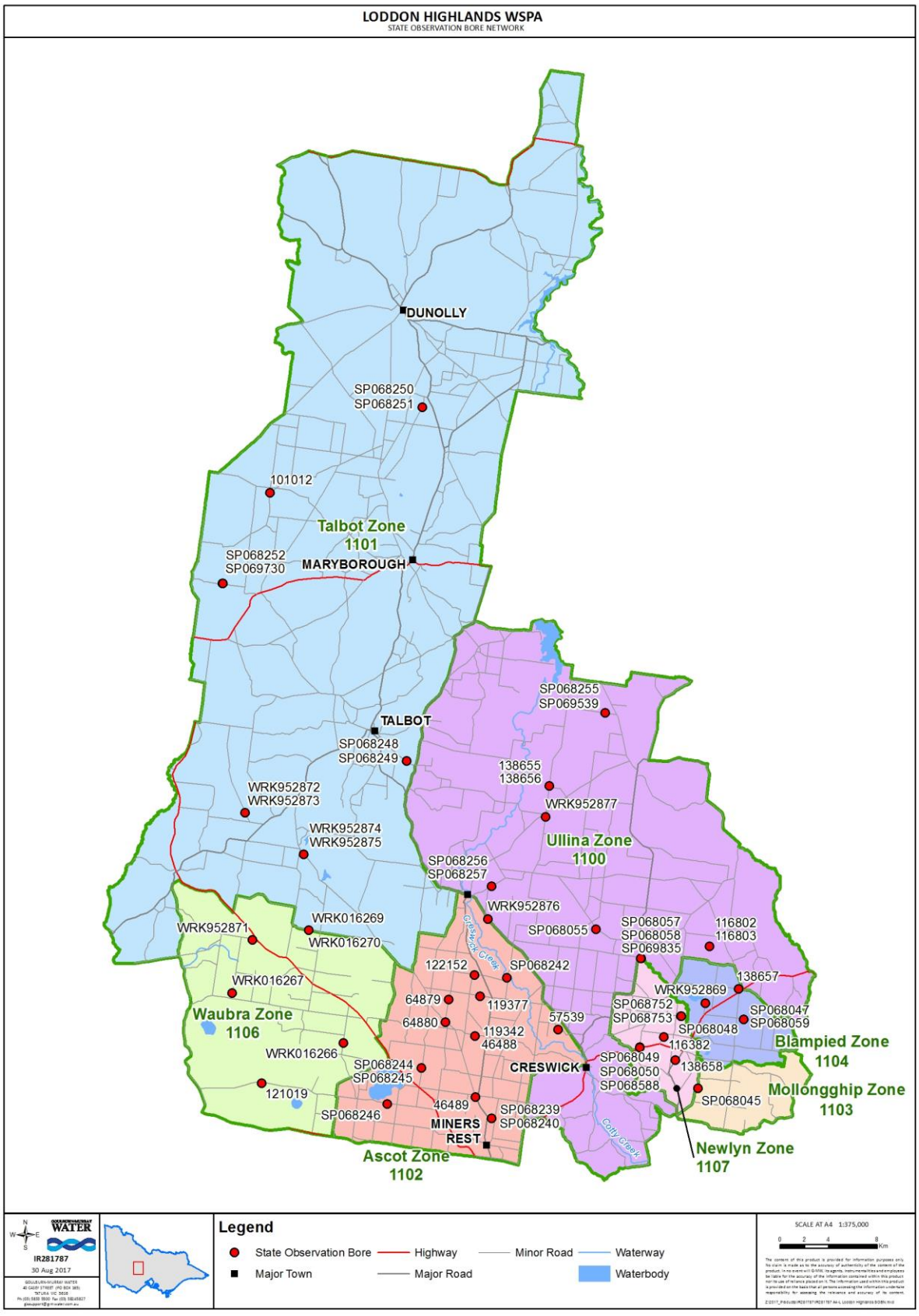


Figure 1 Loddon Highlands Water Supply Protection Area

2 Groundwater Management

2.1 Licence volume

The Minister declared the Permissible Consumptive Volume to be 20,697 megalitres per year (ML/yr) in March 2013 (Victorian Government Gazette, 2013).

The total groundwater licensed volume in the Loddon Highlands WSPA was 20,506.6 ML/yr (Table 1). This is a reduction of 160.4 ML/yr since 30 June 2016 (previously 20,667 ML/yr) due to the revocation of licences in the Talbot and Ascot management zones during the 2016/17 water year.

Table 1 Groundwater licensed volume in the Loddon Highlands WSPA (2016/17)

Management zone	Licences	Licensed bores	Licensed volume (ML/yr)
Ullina Zone – 1000	20	25	2,981.2
Talbot Zone – 1101	12	14	1,195.7
Ascot Zone – 1102	64	100	7,068.2
Mollongghip Zone – 1103	3	7	328.0
Blampied Zone – 1104	22	27	1,252.5
Waubra Zone – 1106	31	63	4,707.8
Newlyn Zone – 1107	26	46	2,973.2
Total	**178**	**282**	**20,506.6**

Note: Data extracted from the Victorian Water Register 30 June 2017.

2.2 Groundwater allocations

Allocations are a percentage of licensed volume that may be extracted in a given water year. They are determined by comparing average maximum groundwater recovery levels from key State observation bores against trigger levels stated in the Plan. Annual allocations are announced in September of each year based on the August groundwater level readings each year. Groundwater levels are monitored over spring and the allocations may be increased if there is sufficient recovery to November. The State observation bores used to determine seasonal allocations in each management zone are shown in Figure 1.

Table 2 State observation bores used to determine annual allocations

Management Zone	Bore number
Ascot Zone – 1102	64879, 64880, 122152, 119377, 119342
Blampied Zone – 1104	138657
Waubra Zone – 1106	WRK016266, WRK016267, WRK016269
Newlyn Zone – 1107	138658, 116382

Groundwater trigger levels and restrictions are in place for the Blampied, Newlyn, Ascot and Waubra management zones in the Plan due to:

- large total licensed volume;
- historical seasonal drawdown; and

- greater rates of groundwater level decline during dry periods.

Annual allocations were initially announced in September 2016. The Newlyn Zone had an initial allocation of 50%, and the Ascot and Blampied management zones had an initial allocation of 75%. The Waubra Zone had an allocation of 100%.

Further groundwater level recovery in spring allowed the allocations to be increased to 75% in the Newlyn Zone and 100% in the Blampied and Ascot Zones (Figure 2).

Figure 2 Average maximum groundwater recovery levels to November 2016 compared to trigger levels

2.3 Groundwater use

Metered use in the Loddon Highlands WSPA in 2016/17 was 5,435.3 ML. This equates to 27% of licensed volume which is the lowest recorded use in a water year since 2011/12 (Figure 3).

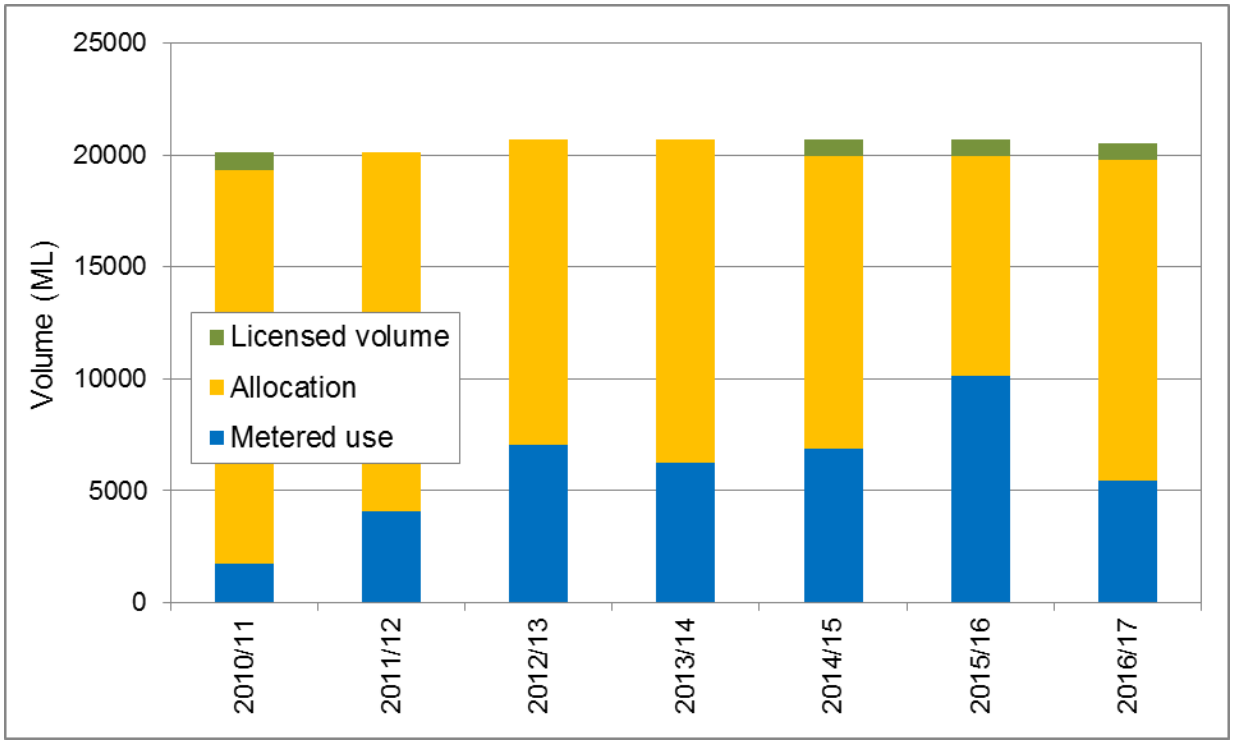


Figure 3 Total licensed volume, allocation and metered use in the Loddon Highlands WSPA

Metered use was highest in the Ascot Zone where the most licence volume is held. Licence holders in the Blampied Zone used the greatest percentage of licensed volume (Table 3).

Table 3 Metered use by management zone in 2016/17

Management zone	Licensed volume (ML/yr)	Total use (ML)	Proportion of total licensed volume used
Ullina Zone – 1000	2,981.2	265.8	9%
Talbot Zone – 1101	1,195.7	292.1	24%
Ascot Zone – 1102	7,068.2	2,348.0	33%
Mollongghip Zone – 1103	328.0	99.0	30%
Blampied Zone – 1104	1,252.5	567.1	45%
Waubra Zone – 1106	4,707.8	803.8	17%
Newlyn Zone – 1107	2,973.2	1,059.5	36%
Total	**20,506.6**	**5,435.3**	**27%**

Note: Data extracted from Irrigation Planning Module on 1 July 2017.

2.4 Rainfall

Rainfall data from the Bureau of Meteorology (BoM) weather station at Clunes is provided in Figure 4 as an indicator of trends across the WSPA. The data shows that rainfall was generally above average in the early-1970s; remained relatively steady to the mid-1990s; and was below average until the high rainfall events in 2010/11. In recent years rainfall has mostly been below average which has resulted in reduced recharge to the groundwater system; however, the 2016/17 season was wetter.

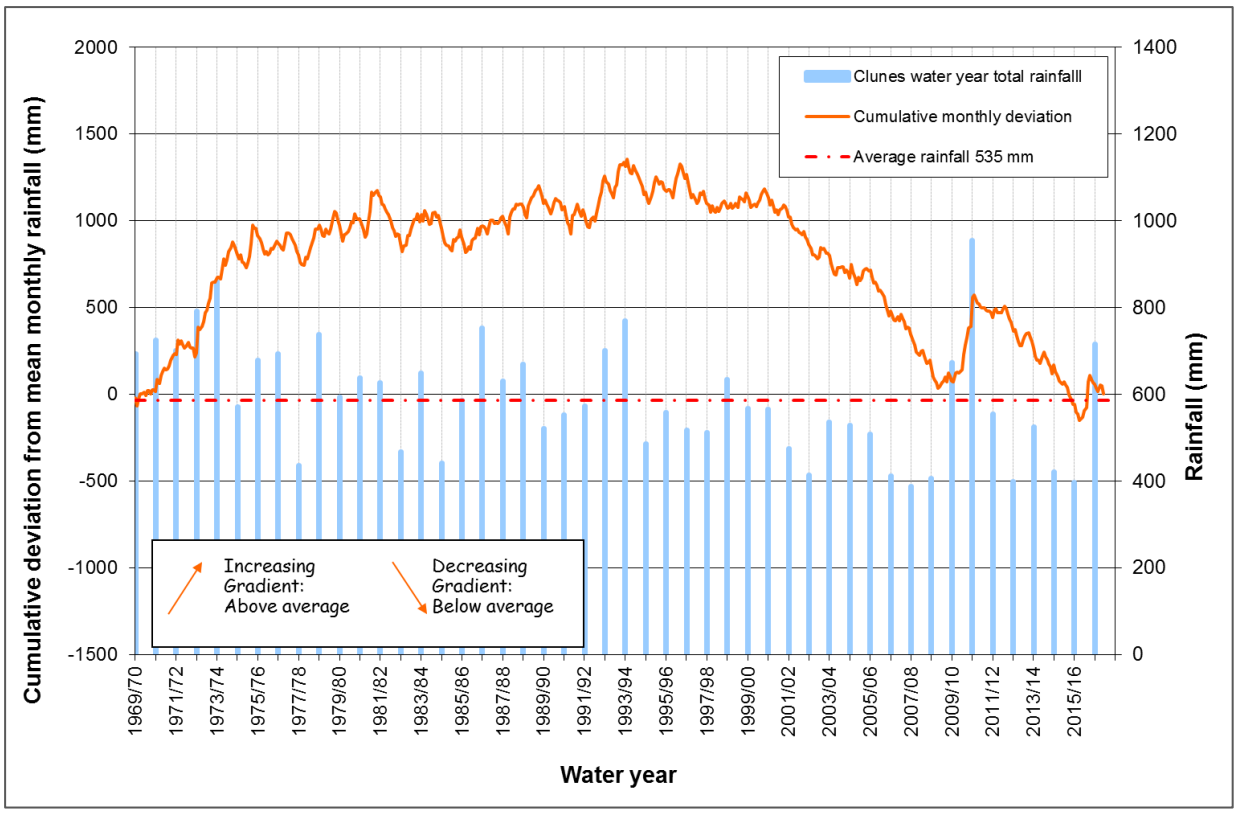


Figure 4 Rainfall at Clunes (BoM station 088015)

2.5 Groundwater licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licensed volume. In 2016/17 there were 10 temporary transfer transactions for a total of 354.9 ML and four permanent transfer transactions for a total of 76 ML/yr. This level of transfer activity is less than in recent water years (Figure 5).

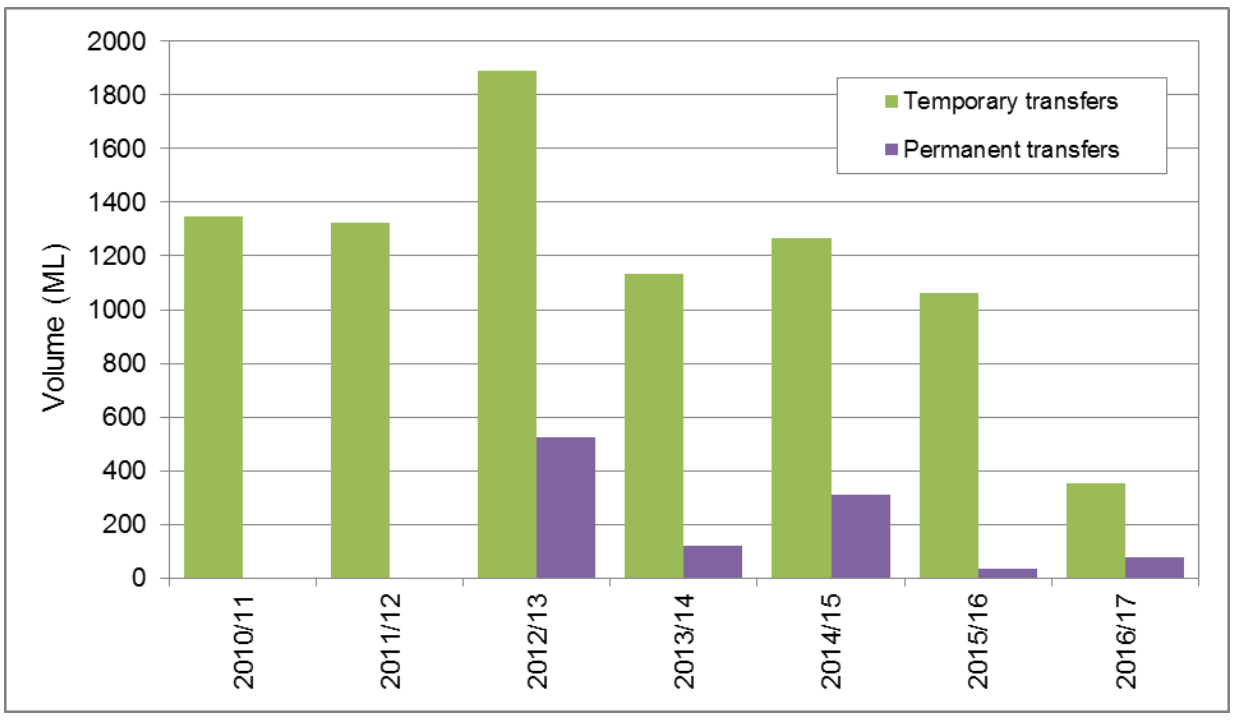


Figure 5 Total licensed volumes transferred in the Loddon Highlands WSPA

The majority of temporary transfers occurred within the same management zones (Table 4). There was some trading between zones, with 60 ML temporarily transferred into the Mollongghip Zone, 33.7 ML into the Ullina Zone and 20 ML into the Talbot Zone. There was a total of 93.7 ML/yr temporarily transferred out of the Newlyn Zone, and 20 ML/yr out of the Waubra Zone.

There were also three permanent transfers within the same management zones and one permanent transfer of 10 ML/yr from the Newlyn Zone to the Mollongghip Zone.

Table 4 Licence transfers in the Loddon Highlands WSPA in 2016/17

Management zone	Temporary				Permanent			
	Transfer from		Transfer to		Transfer from		Transfer to	
	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)
Ullina Zone – 1000	0	0.0	1	33.7	0	0.0	0	0.0
Talbot Zone – 1101	0	0.0	1	20.0	0	0.0	0	0.0
Ascot Zone – 1102	1	65.0	1	65.0	2	36.0	2	36.0
Mollongghip Zone – 1103	0	0.0	1	60.0	0	0.0	1	10.0
Blampied Zone – 1104	3	108.0	3	108.0	1	30.0	1	30.0
Waubra Zone – 1106	1	20.0	0	0.0	0	0.0	0	0.0
Newlyn Zone – 1107	5	161.9	3	68.2	1	10.0	0	0.0
Total	**10**	**354.9**	**10**	**354.9**	**4**	**76.0**	**4**	**76**

2.6 Carryover

The Minister declared that groundwater licence holders in the Loddon Highlands WSPA were authorised to take carryover in November 2012 (Victorian Government Gazette, 2012).

In the Loddon Highlands WSPA licence holders may carryover up to a maximum of 15% of their unused licensed volume for use in the subsequent water year.

In 2016/17 there was a total of 2,789 ML of carryover available to licence holders in the Loddon Highlands WSPA. At the conclusion of the 2016/17 water year, groundwater licence holders in the Loddon Highlands WSPA were able to carryover 2,936 ML into the 2017/18 water year.

2.7 Metering

There were 236 active meters in the Loddon Highlands WSPA as of 30 June 2017. There were eight meter-related activities undertaken in 2016/17, including inspections, maintenance and battery replacements (Table 5).

All meters were read at least twice during the 2016/17 water year.

Table 5 Metering activities

Metering activity	Year ending 30 June 2017
Total number of meters	236
Number of meters installed	1
Number of meters replaced	0
Meter maintenance events	8
Total number of meter reads	472

2.8 Domestic and stock bores installed

Domestic and stock use is not required to be licensed as it is a private right under section 8 of the Act.

The installation of a bore for domestic and stock use requires a bore construction licence. Upon completion of a bore, a bore completion report (BCR) is required to be submitted to GMW; details from this report are documented in the Water Measurement Information System at http://data.water.vic.gov.au/monitoring.htm.

During the 2016/17 water year in the Loddon Highlands WSPA, 20 domestic and stock bore construction licences were issued by GMW and the Victorian Water Register (combined) and one domestic and stock BCR was received and processed by GMW.

2.9 Licence compliance

There were no prosecutions or convictions relating to groundwater matters in the Loddon Highlands WSPA in 2016/17.

There were four incidents of unauthorised take and use of groundwater. These incidents have been investigated and GMW has taken action in accordance with the National Framework for Compliance and Enforcement of Systems for Water Resource Management (DSEWPC, 2012). This includes verbal and written notification not to take water without authorisation; a direction to apply to transfer licensed volume to account for use; and providing information on groundwater licence transfer options.

3 Monitoring Program

3.1 Groundwater levels

The Department of Environment, Land, Water and Planning (DELWP) monitored 59 bores from the State Observation Bore Network on a quarterly basis in the Loddon Highlands WSPA (Figure 1) during the 2016/17 water year.

GMW conducted monthly monitoring of 31 key State observation bores identified in Schedule 1 of the Plan (Appendix B) where practicable.

Groundwater recovery levels had been declining since the wet conditions experienced in 2010/11 largely in response to reduced rainfall recharge. Groundwater recovery levels were generally higher in 2016/17 which can be largely attributed to increased rainfall recharge. Groundwater levels remain within historical ranges.

Seasonal drawdown was typically less than 6 m across the WSPA, which is lower than recent years due to reduced groundwater extractions. In the Ascot Zone, where the greatest volume of groundwater was extracted, drawdown up to 11 m was recorded in bore 119377 (Figure 6).

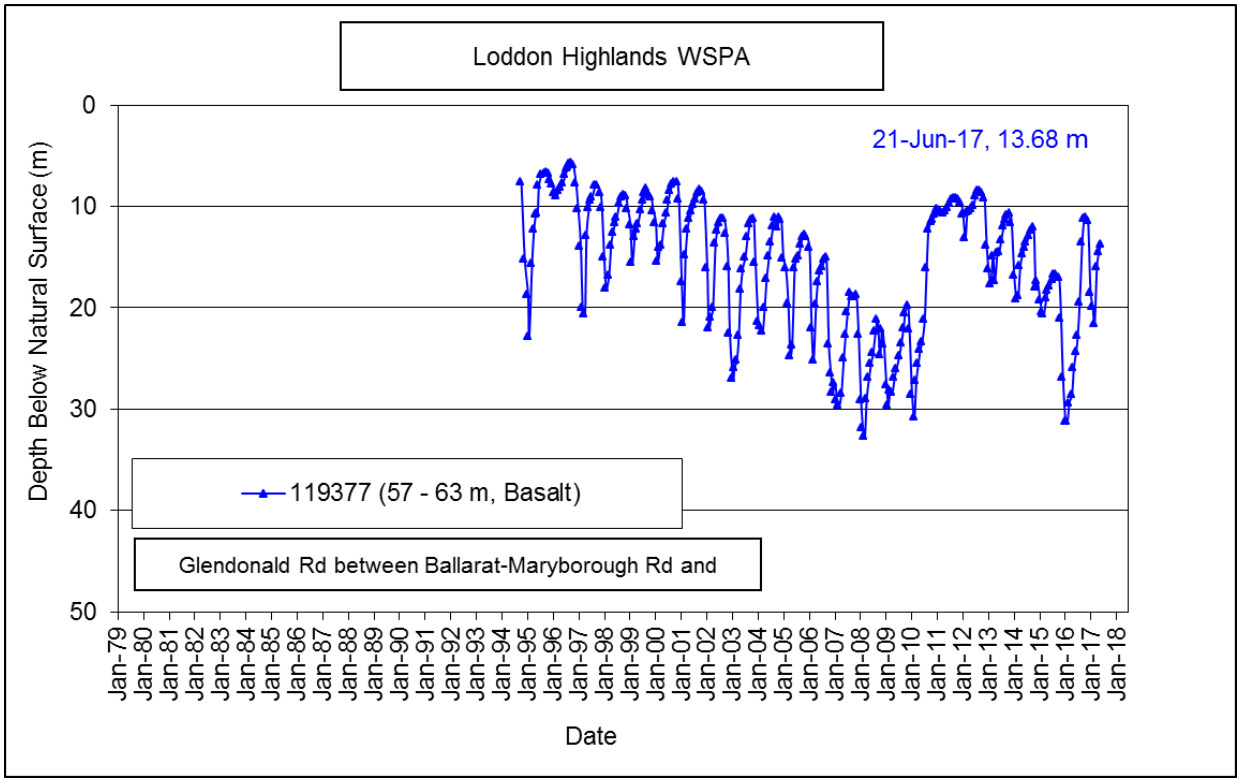


Figure 6 Hydrograph for bore 119377

3.2 Groundwater quality

Groundwater quality testing was undertaken by taking samples from two nested State observation bore sites in the Loddon Highlands WSPA. Nested sites feature two or more bores in close proximity, each monitoring a different aquifer. The State observation bores used for water quality testing are located in the Talbot and Ullina Zones and monitor groundwater in both the Deep Lead and basalt aquifers.

Groundwater chemistry results are presented in Appendix C. The analysis indicates that groundwater salinity levels are higher in the basalt aquifers than the underlying Deep Lead aquifers at both sites

(Table 6). Ongoing annual monitoring of these bores will enable natural variance to be established and any trends in groundwater quality to be observed.

Table 6 Salinity of groundwater in key monitoring bores in the Loddon Highlands WSPA

Bore number	Management zone	Bore screened interval / Aquifer screened	Groundwater salinity – EC					
			Jun-2012	Sep-2012	Mar-2014	Oct-2014	Oct-2015	Dec-2016
SP069539	Ullina Zone – 1000	114.2 – 119.9 m (Deep Lead)	1,760	1,680	1,620	1,680	1,820	1,660
SP068255	Ullina Zone – 1000	33.1 – 35.9 m (Basalt)	6,350	7,130	6,830	6,840	6,790	6,429
SP069730	Talbot Zone – 1101	92.2 – 97.8 m (Deep Lead)	2,260	2,390	2,180	2,110	2,360	2,184
SP068252	Talbot Zone – 1101	57 – 60 m (Basalt)	3,720	4,050	3,690	3,520	3,950	3,345

Note: EC is the electrical conductivity @ 25^{o}C measured in µS/cm

Groundwater salinity data from Central Highlands Water (CHW) licensed and monitoring bores has also been used to assess any changes in groundwater quality. Data is obtained from the CHW bore fields at Newlyn (Forest Hill), Ascot (Learmonth), Ullina (Clunes), Waubra (Waubra) and Talbot (Bung Bong) Zones (Figure 7). The data indicates that groundwater salinity levels are relatively stable and within historical ranges.

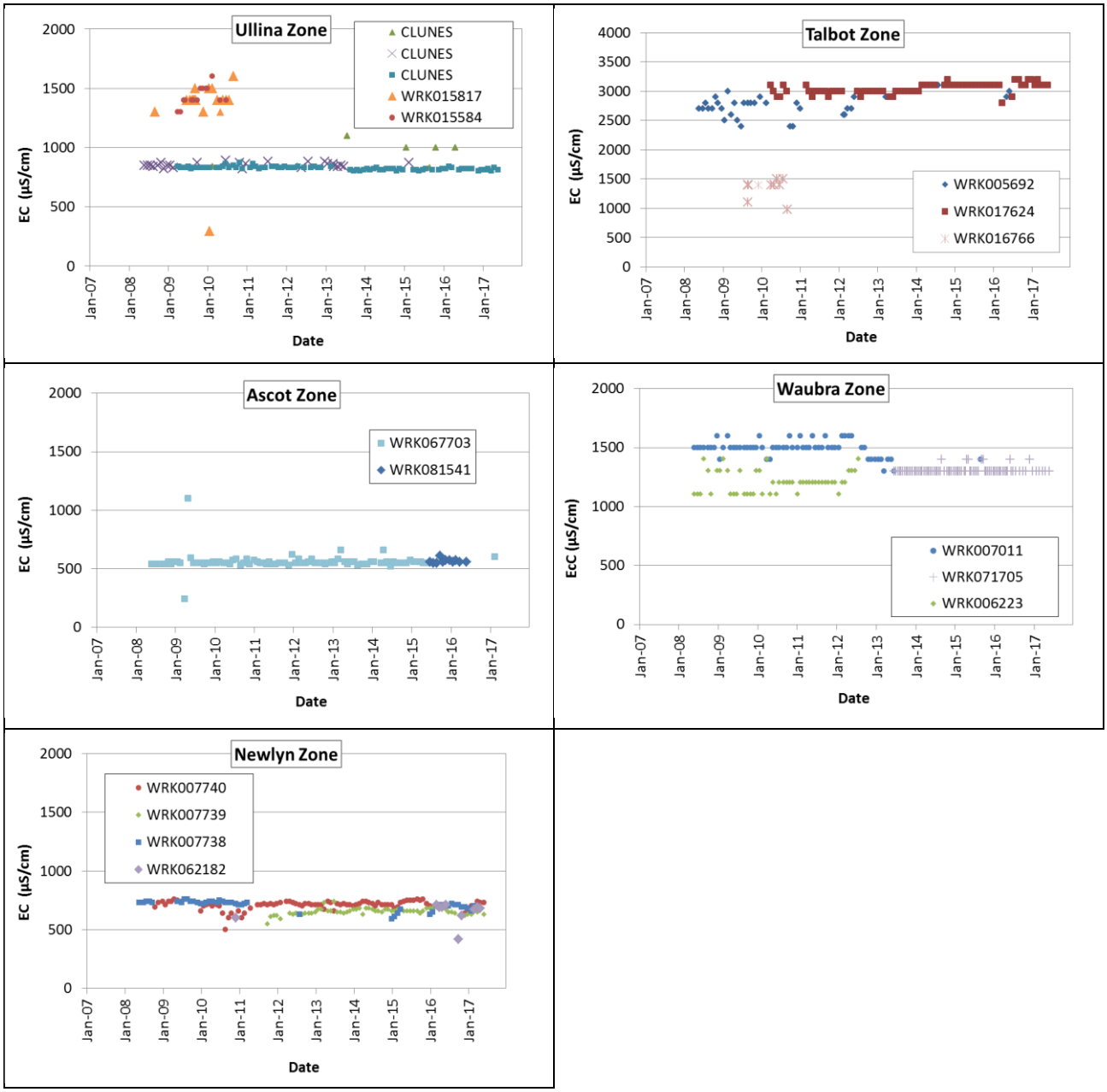


Figure 7 Groundwater salinity monitoring results from Central Highlands Water bores

4 Future Management Considerations

4.1 Groundwater Reference Committee

The Groundwater Reference Committee, appointed in accordance with Prescription 7(c) of the Plan, met on 6 September 2016.

Key points of discussion included:

- Effectiveness of communications with customers
- Resource update
- Plan implementation, including
    - Metered use
    - Trading
    - Carryover
    - Groundwater level response
    - Groundwater salinity
- Technical investigations
- Policy development
- Watermatch

There were two actions from the meeting:

1. Ensure members get earlier advice of committee meetings
2. Provide information to Groundwater Reference Committee as early as possible so they can answer questions

4.2 Management plan review

Prescription 7(d) of the Plan states that the Corporation will undertake a review of the Plan after 5 years from approval. Accordingly, GMW will commence with a review of the Plan in 2017/18.

5 References

Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2012. National Framework for Compliance and Enforcement of Systems for Water Resource Management. Viewed 28 August 2014; http://www.environment.gov.au/system/files/resources/d4367a3b-28a9-430d-a869-2effbda8a447/files/ris-water-compliance-enforcement.pdf

Bureau of Meteorology (BoM), 2017. Climate Statistics for Australian Sites – Clunes station number 088015. Retrieved 20 August 2017; http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=088015

Department of Sustainability and Environment, 2012. Loddon Highlands Water Supply Protection Area Groundwater Management Plan November 2012. Department of Sustainability and Environment, Melbourne

Victorian Government, 2012. Victorian Government Gazette No. S389 Wednesday 21 November 2012. Victoria Government, Melbourne

Victorian Government, 2013. Victorian Government Gazette No. G10 Thursday 7 March 2013. Victoria Government, Melbourne

Appendix A – Assessment of activities against Plan prescriptions

RESOURCE MANAGEMENT

Prescription	Activity	Compliant
Prescription 1: Carryover The Corporation shall: a) Apply to the Minister for Water to declare the availability of carryover in the Loddon Highlands WSPA up to a maximum of 15% of licence entitlement that will not be subject to restriction in the form of allocations. b) Consult with the Groundwater Reference Committee about the need to alter the percentage of carryover.	The Minister declared that licence holders in the Loddon Highlands WSPA may carryover up to 15% licensed volume from November 2012.	Yes
Prescription 2: Triggers and restrictions The Corporation shall: a) By 15 September each year determine the maximum seasonal groundwater recovery level in the relevant bore/s, or its replacement, and corresponding seasonal allocation as detailed in the Plan. b) Determine a seasonal allocation for the relevant zone based on the outcomes of a review of available data. The review will be undertaken when the 50% allocation is triggered in the Blampied, Newlyn or Ascot Zone. The Corporation shall consult with the Groundwater Reference Committee during the review. c) Determine a seasonal allocation for the Waubra Zone and consult with Groundwater Reference Committee. d) Announce seasonal allocations by listing them on its website; sending letters to all licence holders and placing public notices in local newspapers. e) Review allocations based on groundwater level readings to November each year and announce an increase if triggered.	GMW announced allocations by 15 September 2016. Initially allocations were 50% in the Newlyn Zone; 75% in the Ascot and Blampied Zones; and 100% in the Waubra Zone. Further groundwater level recovery in spring allowed the allocations to be increased to 75% in the Newlyn Zone and 100% in the Blampied and Ascot Zones. GMW announced allocations by listing them on their website, sending letters to all licence holders and placing public notices in local newspapers.	Yes
Prescription 3: Trading between zones The Corporation may approve a temporary or permanent transfer of groundwater licence entitlement under section 62 of the Water Act 1989 provided section 53 matters have been considered and the following conditions are satisfied: a) The permanent transfer of licence entitlement is between zones as specified in the Plan. b) The temporary transfer of licence entitlement is between zones as specified in the Plan. c) Despite (b) above, a temporary transfer of licence entitlement may be considered where bores are located within 2.5 km of each other across an internal zone boundary.	GMW processed 10 transactions for temporary transfer of licence totalling 354.9 ML and 4 transactions for permanent transfer of licence totalling 76 ML in 2016/17. All transfers were compliant with Prescription 3.	Yes

<table>
<tr><td>d) Licence entitlement may be temporarily traded into, or out of, the Loddon Highlands WSPA provided that the PCV is not exceeded.</td><td></td><td></td></tr>
<tr><td>Prescription 4: Groundwater level interference
The Corporation may approve an application to take and use groundwater under section 51 or a transfer under section 62 of the Water Act 1989 provided that section 53 matters have been considered and the following conditions are satisfied:
a) Licence entitlement may be temporarily or permanently transferred up to 1,000 ML/yr within 2.5 km radius of a licensed bore.
b) Where the licence entitlement within a 2.5 km radius of a licensed bore exceeds 1,000 ML/yr then:
<table><tr><td>(i). For temporary transfer of licence entitlement</td><td>1. Trade with usage in any one season limited to 115% of entitlement, whether it occurs through trade or carryover (this could include transferring from outside the 2.5 km radius); or
2. Trade from others within 2.5 km radius of the applicant’s bore for usage to exceed 115% of entitlement; or
3. Assess the application to consider other relevant information such as historical use and, if required undertake detailed investigations, when seeking to use more than 115% of your licence entitlement to demonstrate no unacceptable impacts are likely to occur. This could include transferring from outside the 2.5 km radius.</td></tr><tr><td>(ii). For permanent transfer of licence entitlement</td><td>1. Trade from others within 2.5 km radius of the applicant’s bore; or
2. Undertake detailed investigations to demonstrate no unacceptable impacts are likely to occur. This could include transferring from outside the 2.5 km radius.</td></tr></table></td><td>GMW processed all groundwater licence applications in accordance with Plan Prescription 4.</td><td>Yes</td></tr>
</table>

MONITORING PROGRAM

Prescription	Activity	Compliant
Prescription 5: Groundwater monitoring The Corporation shall: (a) Obtain monthly groundwater level readings, where practicable, from State observation bores listed in Schedule 1 or their replacement (up to 288 readings per season). (b) Establish a targeted groundwater salinity monitoring program to collect and analyse groundwater samples from selected licensed bores each year.	GMW obtained monthly groundwater level readings from bores listed in Schedule 1 of the Plan where practicable. GMW used groundwater salinity monitoring data provided by Central Highlands Water from their urban supply bores to fulfil the requirements of a targeted salinity monitoring	Yes

(c) Collect groundwater samples from selected State observation bores identified in Schedule 1 where practicable, or their replacement, and send them to a NATA accredited laboratory for analysis.	program. GMW collected groundwater samples from nested State observation bores identified in Schedule 1 and sent them to a NATA accredited laboratory for analysis.	
Prescription 6: Metered licensed use The Corporation shall: (a) Ensure that a meter is fitted to all operational licensed bores. (b) Read each meter at least twice each season.	GMW ensured that use was accounted for each operational licensed bore and read each meter in January/February and May/June during 2016/17.	Yes

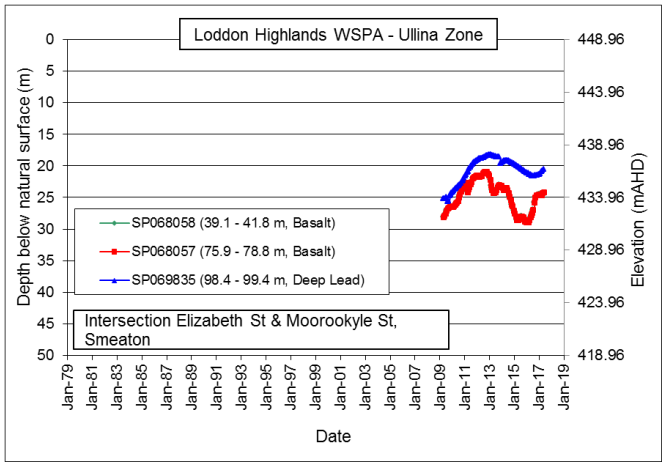
PLAN IMPLEMENTATION

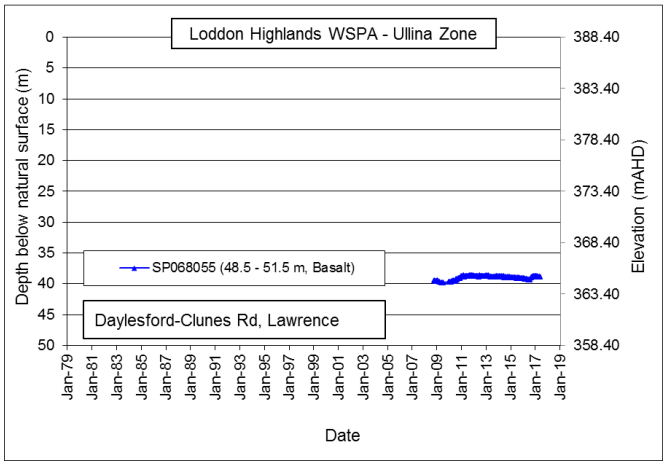
Prescription	Activity	Compliant
Prescription 7: Plan implementation The Corporation shall: (a) By 30 September each year: (i). prepare an annual report on the administration and enforcement of the Plan for the Minister for Water and relevant agencies. (ii). mail a newsletter to groundwater licence holders, and domestic and stock users upon request, summarising the outcomes in the annual report. (b) Post on its website the Plan; annual report, newsletters and groundwater level monitoring results. (c) Meet with a Groundwater Reference Committee at least once each year to report on the implementation of the Plan and consider the need to review the Plan. (d) Undertake a review of the Plan after five years from its approval, or sooner if warranted by any prescription contained within the Plan.	GMW has prepared this annual report for the 2016/17 water year on administration and enforcement of the Plan for the Minister and relevant agencies and sent a newsletter to licence holders summarising the information in this report. GMW has posted on its website the Plan, this annual report and a water year summary newsletter. GMW updates hydrographs of groundwater levels every three months on its website. GMW met with the Groundwater Reference Committee in September 2016 to discuss the implementation of the Plan.	Yes

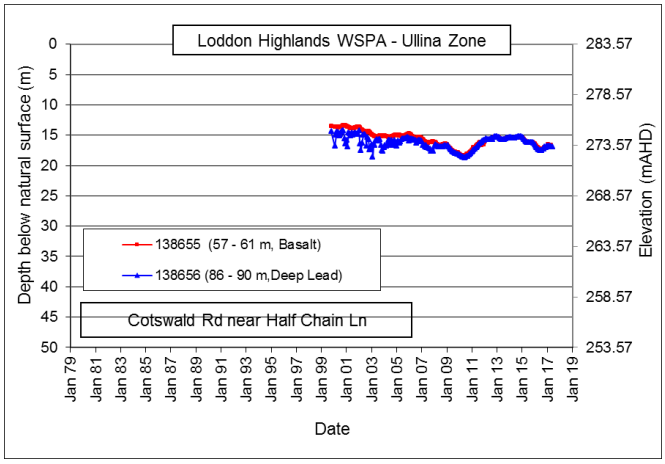
Appendix B – Hydrographs for key monitoring bores listed in the Plan

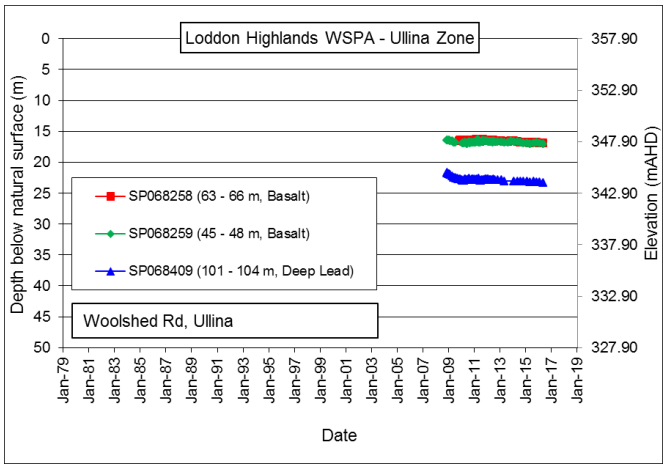
Further groundwater level information from other State observation bores is available on the Water Measurement Information System at http://data.water.vic.gov.au/monitoring.htm

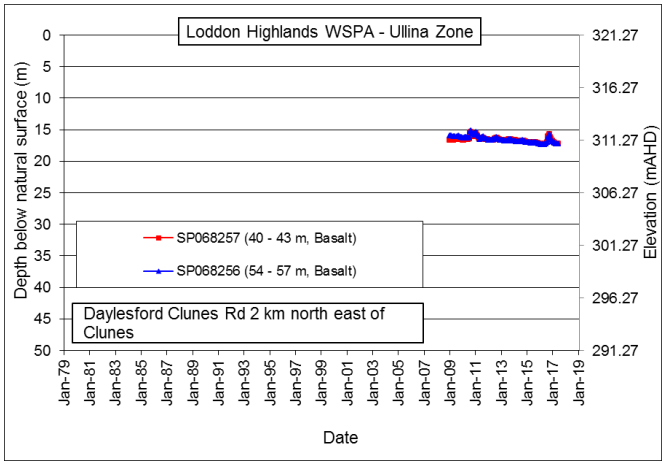
Ullina Zone – 1100

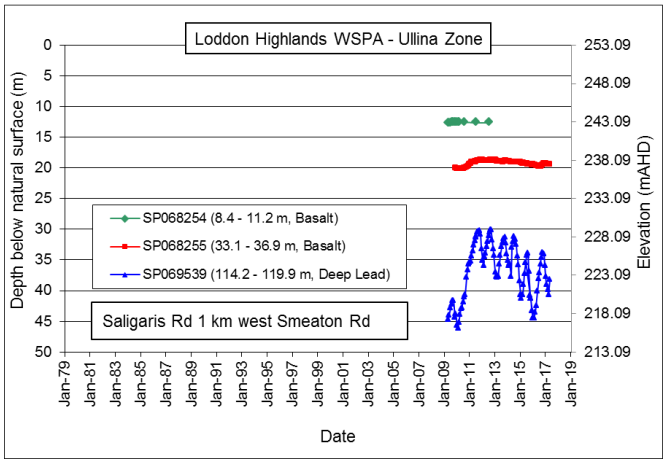




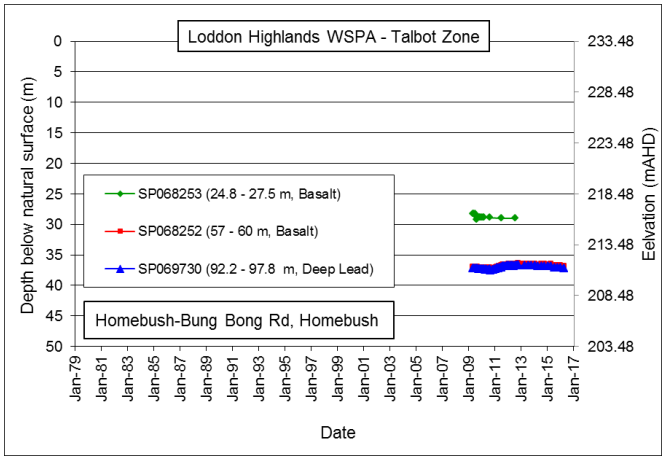




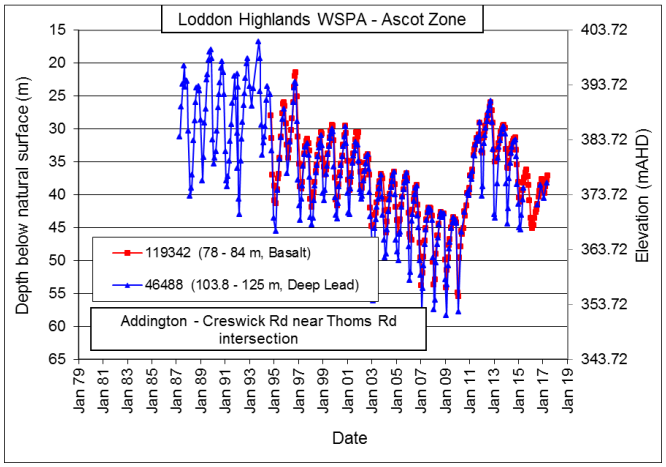


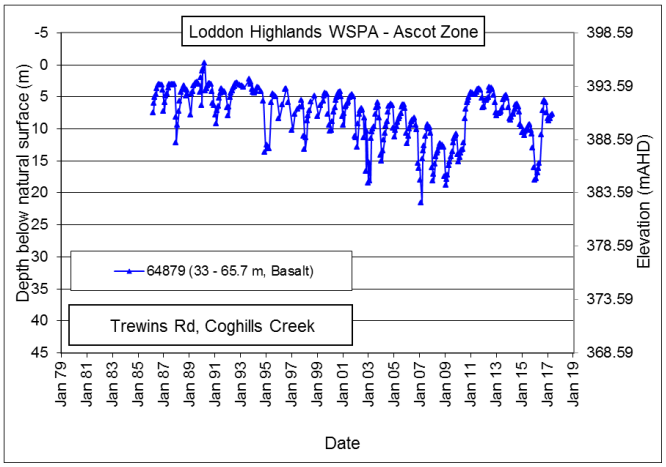


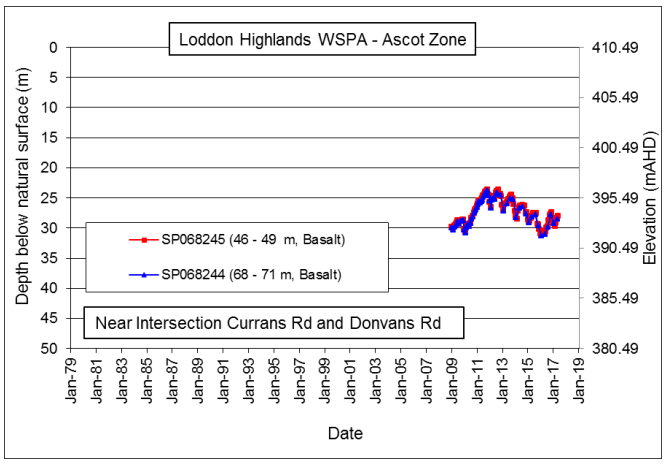
Talbot Zone – 1101

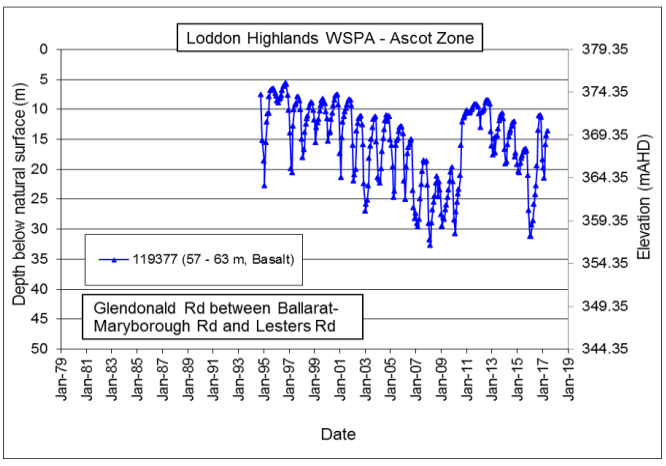


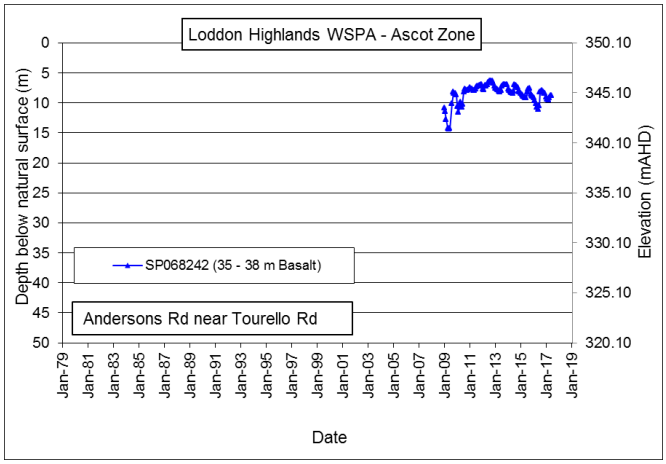
Ascot Zone – 1102

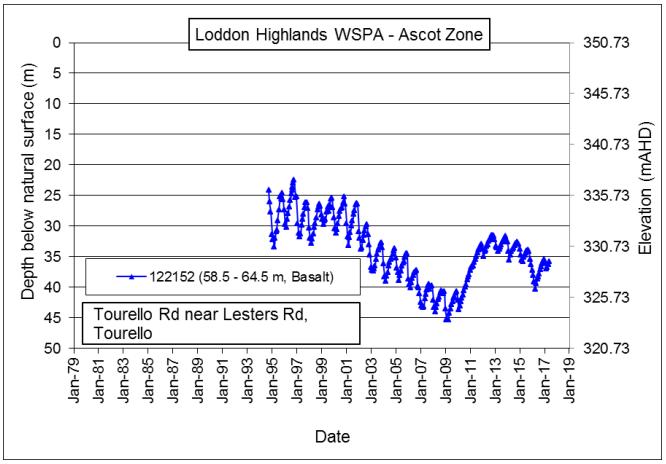


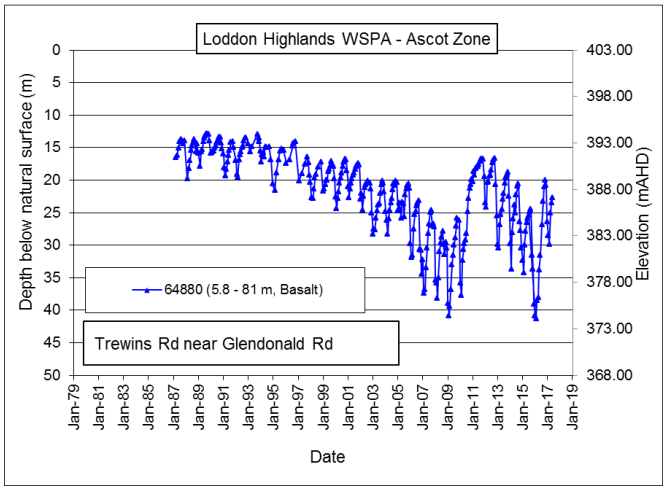




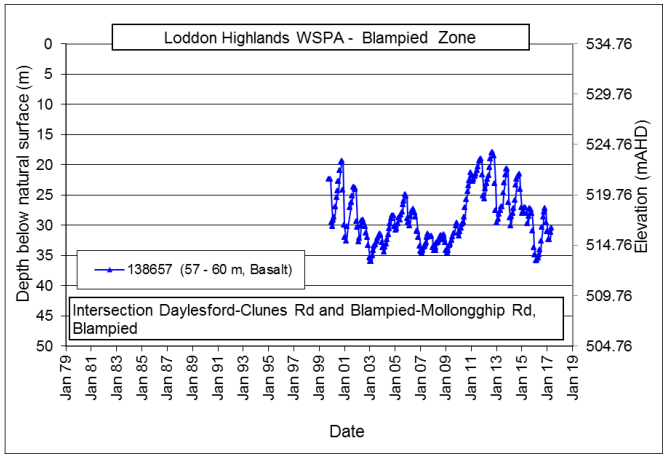


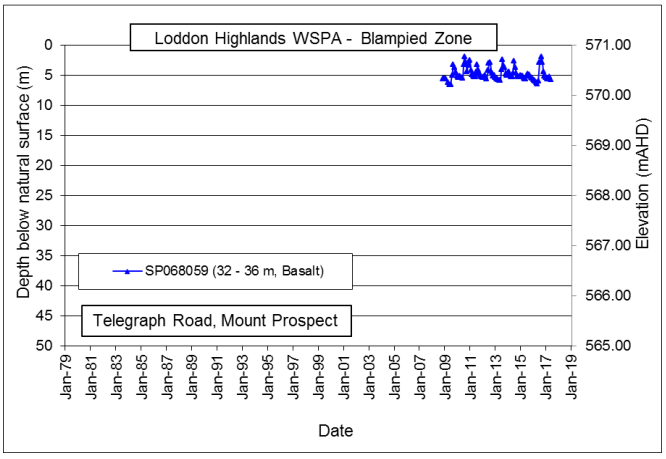




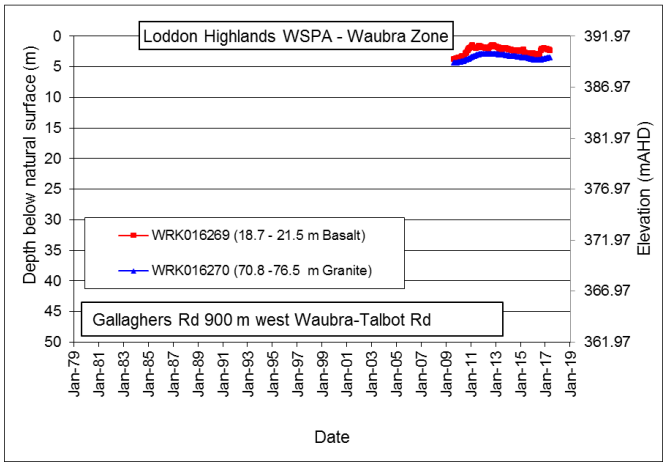


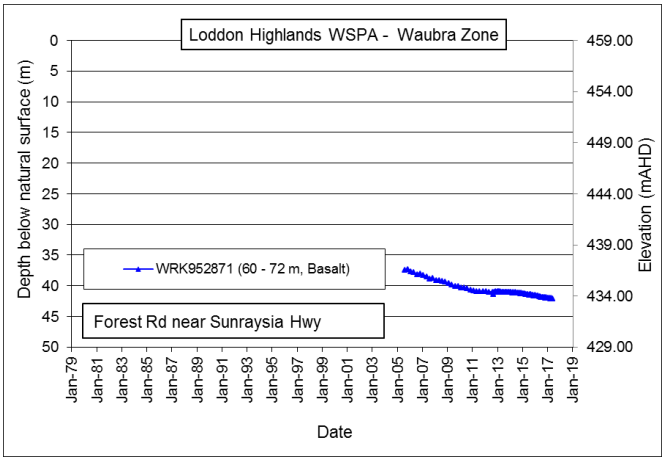
Blampied Zone – 1104

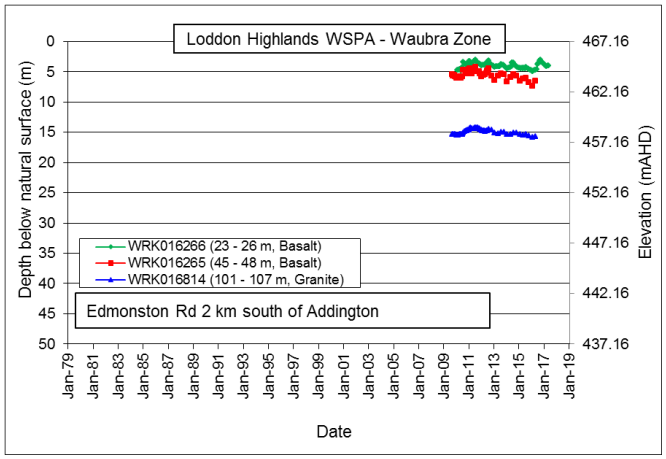


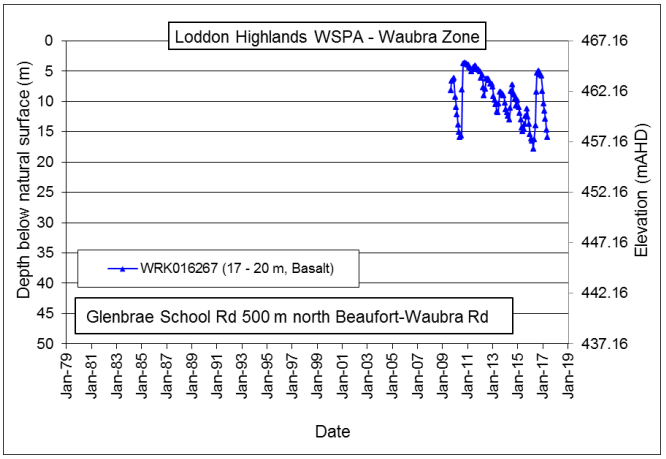


Waubra Zone – 1106

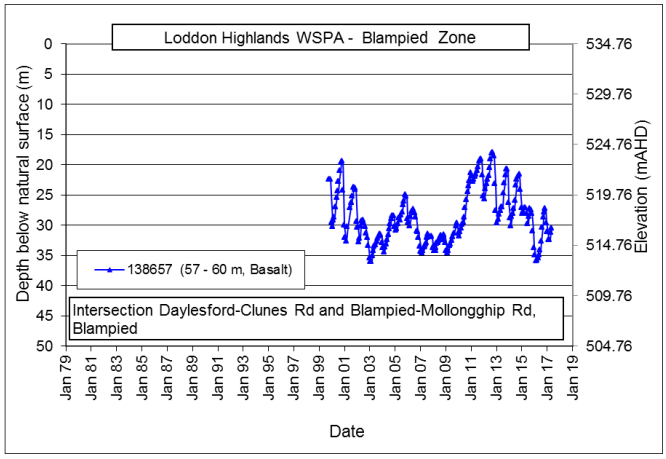


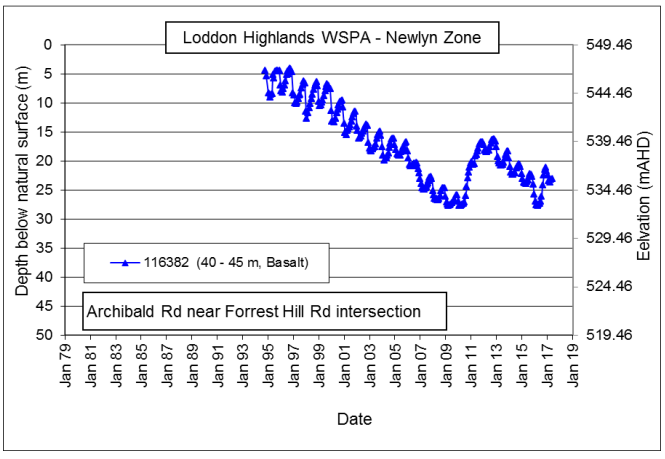


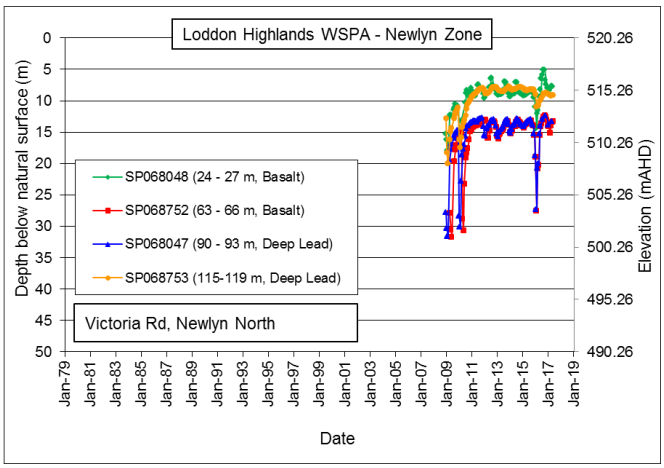


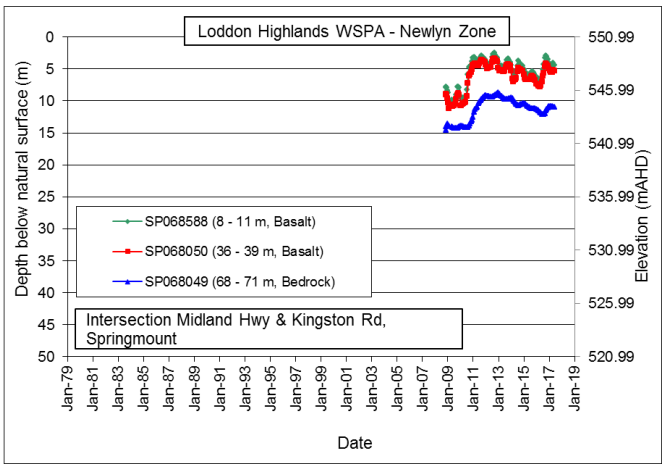


Newlyn Zone – 1107






Loddon Highlands WSPA - Newlyn Zone
Depth below natural surface (m)
Elevation (mAHD)
SP068048 (24 - 27 m, Basalt)
SP068752 (63 - 66 m, Basalt)
SP068047 (90 - 93 m, Deep Lead)
SP068753 (115-119 m, Deep Lead)
Victoria Rd, Newlyn North
Date


Loddon Highlands WSPA - Newlyn Zone
Depth below natural surface (m)
Elevation (mAHD)
SP068588 (8 - 11 m, Basalt)
SP068050 (36 - 39 m, Basalt)
SP068049 (68 - 71 m, Bedrock)
Intersection Midland Hwy & Kingston Rd, Springmount
Date

Appendix C – Groundwater chemistry from nested State observation bores

		Bore:	SP069539	SP068255	SP069730	SP068252
		Aquifer:	Deep Lead	Basalt	Deep Lead	Basalt
		Date:	10/12/2016	10/12/2016	10/12/2016	10/12/2016
Analyte	**Unit**					
Conductivity @ 25°C	µS/cm		1700	6300	2200	3400
pH Colour	–		6.7	7.8	7.4	7.5
Total Alkalinity, as CaCO3	mg/l		2	2	2	2
Bicarbonate Alkalinity, as CaCO3	mg/l		380	240	270	290
Dissolved Oxygen	ppm		0.71	7.03	5.79	6.83
Sulphate, as SO4	mg/l		31	310	70	140
Total Alkalinity, as CaCO3	mg/L		380	240	270	290
Calcium, as Ca	mg/L		41	110	55	77
Chloride, as Cl	mg/L		330	2000	550	930
Hydroxide Alkalinity, as CaCO3	mg/L		2	2	2	2
Potassium, as K	mg/L		8.4	12	5.5	7
Sodium, as Na	mg/L		180	600	220	320
Ammonia, as N	mg/L		<0.1	<0.1	<0.1	<0.1
Nitrate, as N	mg/L		0.01	4.1	1.6	4.2
Total Kjeldahl Nitrogen, as N	mg/L		<0.1	<0.1	0.2	0.2
Total Nitrogen, as N	mg/L		<0.1	4.3	1.7	4.4
Arsenic, as As	mg/L		0.001	0.001	0.003	0.002
Iron, dissolved as Fe	mg/L		0.31	0.05	<0.01	<0.01
Mercury, as Hg	mg/L		<0.001	<0.001	<0.001	<0.001
Magnesium, as Mg	mg/L		63	310	90	150
Manganese, dissolved as Mn	mg/L		0.083	<0.001	<0.001	<0.001
Total Dissolved Solids @ 180°C	mg/L		800	3700	1100	1800
Turbidity, NTU	NTU		0.3	0.5	14	0.6
Phosphorus, total as P	mg/L		<0.01	0.08	0.13	0.11
total organic carbon (TOC)	mg/L		0.6	0.8	0.5	0.9
Lead, dissolved (ICP-MS)	mg/L		<0.001	<0.001	<0.001	<0.001
Nickel, dissolved (ICP-MS)	mg/L		<0.001	<0.001	<0.001	<0.001
Cadmium, dissolved (ICP-MS)	mg/L		<0.001	<0.001	<0.001	<0.001
Chromium, dissolved (ICP-MS)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper, dissolved (ICP-MS)	mg/L		<0.001	<0.001	<0.001	<0.001
Zinc, dissolved (ICP-MS)	mg/L		0.019	0.007	0.002	0.003