Annual Report 2017/18

West Wimmera Groundwater Management Area

July 2017 to June 2018

EXECUTIVE SUMMARY

This report details GWMWater's activities in administering the West Wimmera Groundwater Management Strategy 2011 (The Strategy) during the period 1 July 2017 to 30 June 2018. This report is also available on the GWMWater website www.gwmwater.org.au.

Status of the Groundwater Resource

Groundwater levels and metered extraction have continued to be monitored in the West Wimmera Groundwater Management Area (GMA). The data indicates that groundwater levels are responding to the level of extraction as expected. Where there is intensive extraction and use, there is a decline in groundwater level (such as Neuarpur), and where extraction is more disperse, groundwater levels are generally stable. Salinity remains relatively stable based on samples obtained.

Groundwater use

A total volume of 27,310 megalitres was extracted from the Tertiary Limestone Aquifer in 2017/18 which is less than half of the total licensed volume in the GMA. While being well within the volume available, this was the largest volume extracted recorded for some time. Usage in Neuarpur Sub-zone 1 was the highest recorded since 2007. Three licensees used more than their available volume.

Reviews and Projects

In late 2017, GWMWater, with funding provided by the Department of Environment, Land, Water and Planning installed remote meter reading devices on meters in the Neuarpur and Apsley zones. These devices send daily groundwater usage information to GWMWater, which will ultimately be accessible by the licence holder through our Customer Portal.

In early 2018, consultants GHD completed the five year technical review of the West Wimmera Groundwater Management Strategy. GHD reviewed groundwater level, quality and extraction data, as well as climate data and used this information to critically appraise the observed trends against the objectives of the 2011 Strategy, and provided recommendations based on their work.

During this reporting year GWMWater also undertook a project to improve the understanding of the origins of the groundwater relied upon for the Edenhope urban supply. Based on age dating of the samples collected the average age of groundwater was around 12,670 years old. This information is valuable in planning for the longevity of the borefield in terms of water quality and quantity available.

GWMWater looks forward to continuing its relationship with the West Wimmera GMA Implementation Committee in preparing a supporting document for the Strategy, which will utilise the outcomes and recommendations of the technical review to guide groundwater management in the West Wimmera GMA into the future.

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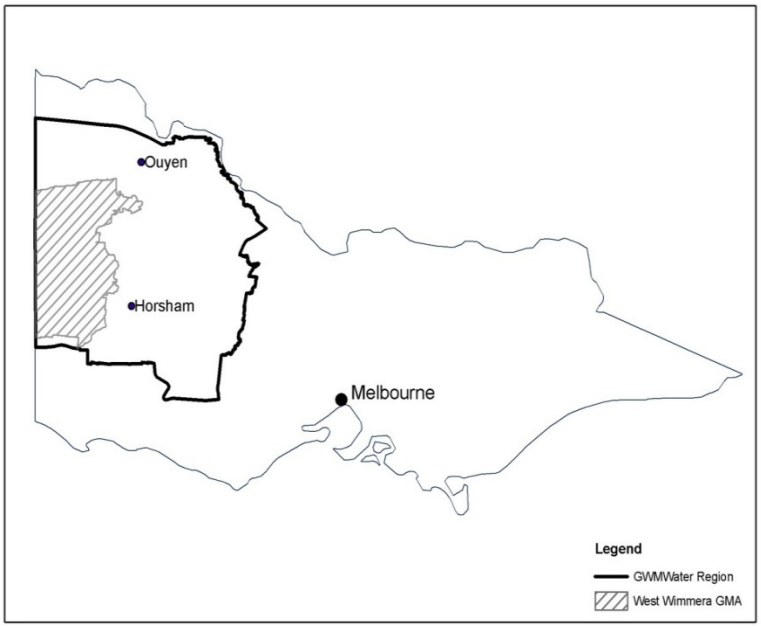
1. Introduction

The West Wimmera Groundwater Management Area (GMA) is in the far west of Victoria (as indicated in Figure 1), extending from north of the Glenelg River to the Big Desert, and east from the South Australian border to the Wimmera River. Groundwater is the primary source of water for irrigation, urban, stock and domestic supply in the region.

Figure 1: Location of West Wimmera GMA



The West Wimmera GMA is generally underlain by three main aquifers which vary in thickness, yield and water quality. The aquifers are the shallow Pliocene (Parilla) Sands Aquifer (PSA), Tertiary Limestone Aquifer (TLA) and the deeper Tertiary Confined Sands Aquifer (TCSA). For much of the area there are layers of clay between the aquifers. The West Wimmera Groundwater Management Strategy (the 'Strategy') contains further information regarding description of the groundwater resources. The Strategy can be found at https://www.gwmwater.org.au/connecting-services/groundwater/west-wimmera-groundwater-management-area.

The Tertiary Limestone Aquifer (TLA) is the focus for groundwater management in the West Wimmera GMA. The TLA is the resource that is primarily used for stock and domestic, irrigation and town supplies across the area, due to its water quality and yield.

The status of the groundwater resource varies within the West Wimmera GMA. Most of the GMA shows stable groundwater trends, however, some parts have been exhibiting declining groundwater levels. Through the development of the groundwater management strategy for the area, management zones were established to represent areas that have common management requirements. These were determined by hydrogeology, the management objective (stable groundwater trends) or other distinguishing characteristic such as intensity of licences and use.

The objective of the Strategy is to ensure the groundwater resource of the area is managed in an equitable manner to achieve the long-term sustainability of the resource and maintain the social, environmental and economic benefits that groundwater provides to the region.

As represented in Figure 2, the zones for the West Wimmera GMA are:

- Big Desert
- Northern (including Yanipy sub-zone)
- Little Desert
- Neuarpur Zone (sub-zones 1 and 2)
- Gymbowen
- Southern, with sub-zones Apsley, Langkoop, Edenhope and Ullswater

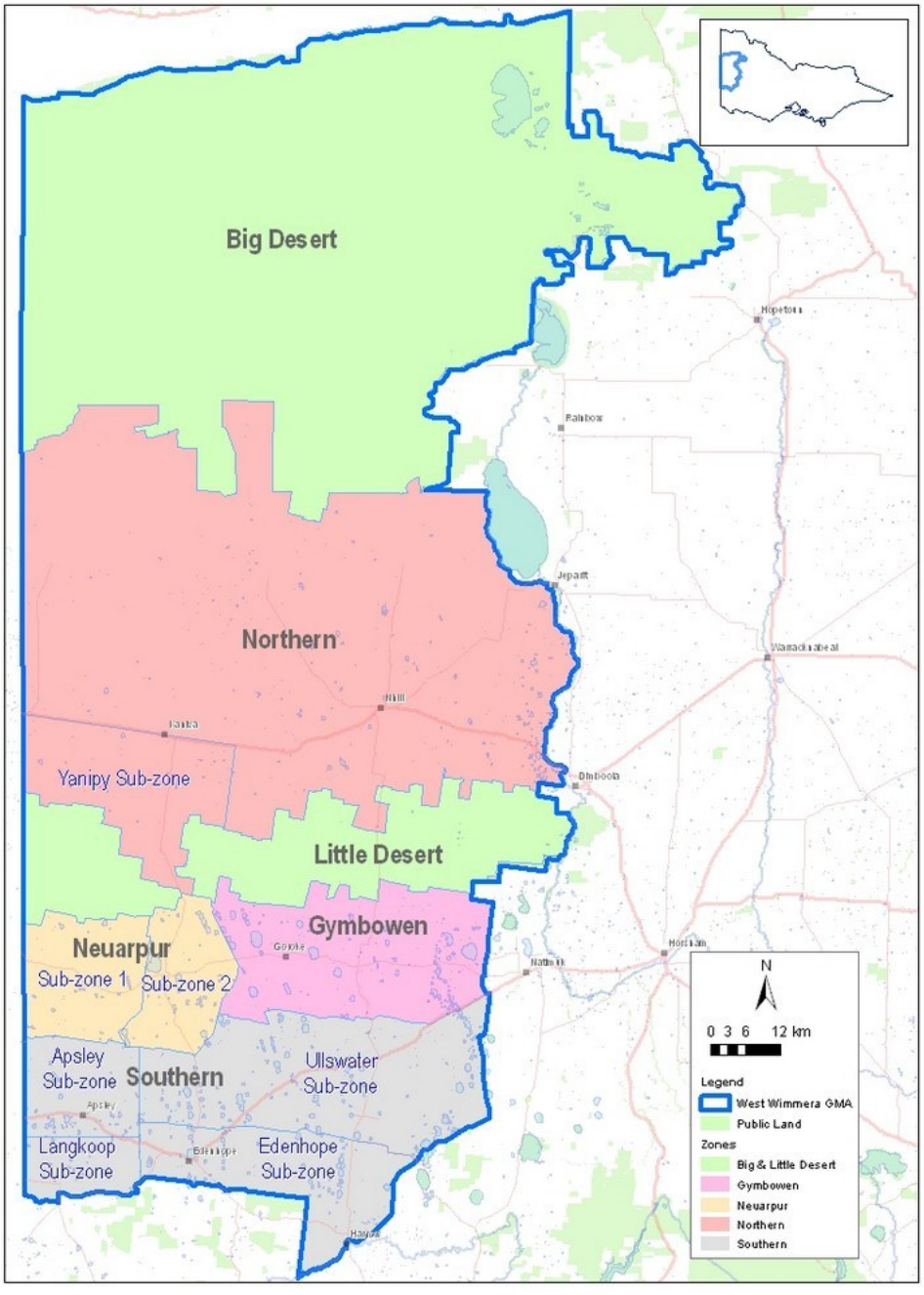


Figure 2: Zones of the West Wimmera GMA

The Strategy outlines the status of the TLA resource, expressed in terms of the general groundwater levels in the zone and objectives for each zone (or sub-zone) as at 2011. This is summarised in the following table.

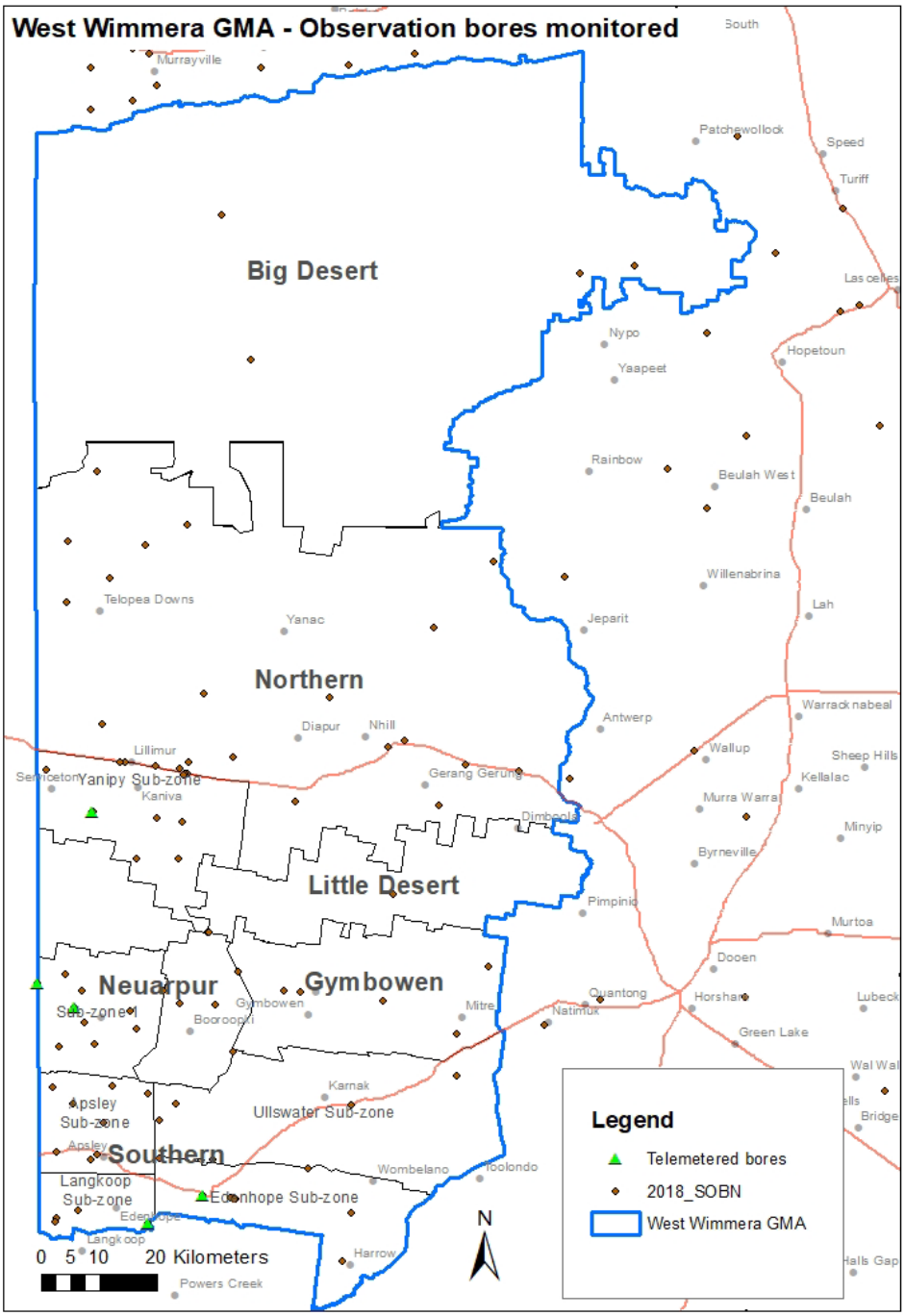
Table 1: Zone groundwater status and management objectives (Extracted from West Wimmera Groundwater Management Strategy, 2011)

Zone/sub-zone	Groundwater Status (in 2011)	Management Objective and Related Actions
Big Desert	Stable	Limit groundwater diversions to maintain current stable groundwater levels.
Northern	Generally stable	Maintain stable trends across the zone, allowing: • Trade out of, but not into the Yanipy sub-zone where there is existing high intensity of use. • New entitlements within the area subject to an acceptable level of intensity of entitlements.
Little Desert	Stable	Limit groundwater diversions to maintain current stable groundwater levels
Neuarpur sub-zone 1	Consistently declining	Achieve stabilised groundwater levels over a period of about 20 year.
Neuarpur sub-zone 2	Stable	Maintain stable levels. No additional entitlement allowed. Limited trade from Neuarpur sub-zone 1 to Neuarpur sub-zone 2. No trade from Neuarpur sub-zone 2 to Neuarpur sub-zone 1.
Gymbowen	Stable	Maintain stable trends. Allow new developments subject to a maximum allowable intensity of use. Release parcels of water progressively to ensure that stable levels are maintained with each parcel release.
Southern – Apsley and Langkoop,	Declining trends, but with some potential for recharge thought to occur.	Stabilise groundwater levels. Review water levels in five years. No additional entitlements allowed. If declining trends continue, introduce seasonal restrictions. No trade will be permitted between sub-zones of the Southern Zone until a review of data in 5 years.
Southern - Edenhope	Limited information available, declining levels in southern fringe.	Stabilise levels, limited development permitted. Additional volume of 200 ML in parcels up to 20 ML.
Southern - Ullswater	Limited information, but near stable trends.	Maintain stable trends, limited development permitted. Additional volume of 500 ML in parcels up to 50 ML. To be reviewed in five years.

2. Water Levels

Groundwater levels are measured quarterly in dedicated observation bores located throughout the West Wimmera GMA. There are a greater number of observation bores located in the vicinity of concentrated groundwater extraction. There is generally an observation bore within five kilometres of an active licence of greater than 200 ML. Figure 3 illustrates the location of observation bores monitored during the 2017/18 period in the GMA. The West Wimmera Groundwater Strategy Technical Review (see 5.1) recommended a number of unmonitored observation bores be returned to the active monitoring program, which were added in 2018.

Figure 3: Observation bores monitored during 2017/18



Graphs illustrating groundwater levels over time in a number of selected observation bores are illustrated in Appendix 1. Table 2 provides the summarised observed groundwater status by zone (or sub-zone).

Table 2: Observed groundwater status over the 2017/18 period.

Zone/sub-zone	Groundwater Status 2018	Comment
Big Desert	Stable	Little to no groundwater extraction.
Northern	Generally stable, localised drawdown noted	Yanipy sub-zone - seasonal trend of drawdown and recovery is evident in bores located close to where there is a higher volume extraction for irrigation, and there is some localised residual drawdown. Overall stable trend for the Northern zone.
Little Desert	Stable	Little to no groundwater extraction.
Neuarpur sub-zone 1	Declining	Rate of decline reduced since 2010 (discussed further in section 2.1).
Neuarpur sub-zone 2	Stable	
Gymbowen	Stable	
Southern – Apsley and Langkoop,	Generally stable	Groundwater level in this zone are influenced by climatic conditions. Some bores, particularly in the Langkoop sub-zone, are indicating a slight response with increasing groundwater levels.
Southern - Edenhope	Stable	
Southern - Ullswater	Stable	

2.1. Groundwater trend analysis Neuarpur Sub-zone 1

The Strategy recommended the introduction of restrictions on groundwater extraction to arrest the declining trends in groundwater levels in Neuarpur Sub-zone 1.

Groundwater entitlement in Neuarpur Sub-zone 1 has been restricted since the 2011/12 water year. The initial restriction was to 96% of licenced entitlement and increased by 4% each year until 2015/16 when restrictions reached their planned maximum of 80% of licence entitlement. Neuarpur Sub-zone 1 licence holders have remained at this level of restriction in 2017/18.

The restriction declarations are made following the annual assessment of the observed behavior of groundwater levels measured via the network of observation bores in Neuarpur Sub-zone 1.

Figure 4 illustrates the average rate of change in groundwater level in Neuarpur Sub-zone 1. This graph has been created as a means of assessing the overall groundwater trend in Neuarpur Sub-zone 1. This methodology averages the resource as a whole and is not dependent on any one bore, therefore avoids debate on representativeness and minimises bias based on bore location. To develop this average graph, the hydrographs for Neuarpur sub-zone 1 were examined, and all considered to be predominantly declining. They were clustered into three groups based on their general magnitude of decline and more recent

variations in trend. The rate of change in May each year has been determined and averaged for each observation bore group as illustrated.

The average rate of water level change graph shows the predominant trends, with the management target in Neuarpur Sub-zone 1 of stable water levels shown for comparison as a horizontal red line at 0m/year. Positive values (above the red line) indicate recovery in groundwater levels and negative values (below the red line) indicate a declining level compared to the previous year. The aim is to manage groundwater levels so that the average annual rate of change is 0 m/yr (on the red line) or better (above the red line) to allow for seasonal variance.

A similar technique is being used to develop average annual change graphs for the remaining management zones.

Figure 4: *Average rate of change in groundwater level in Neuarpur Sub-zone 1*

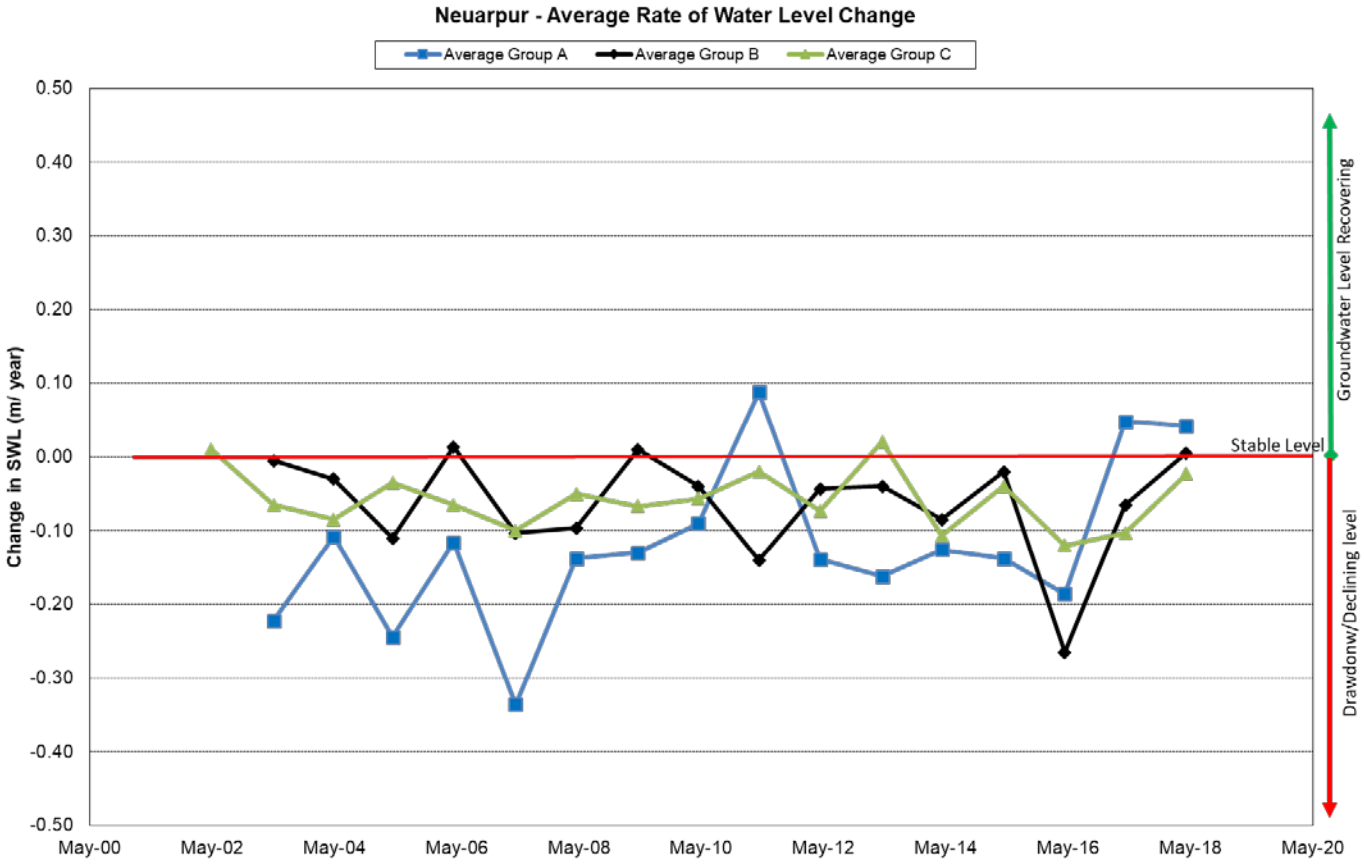
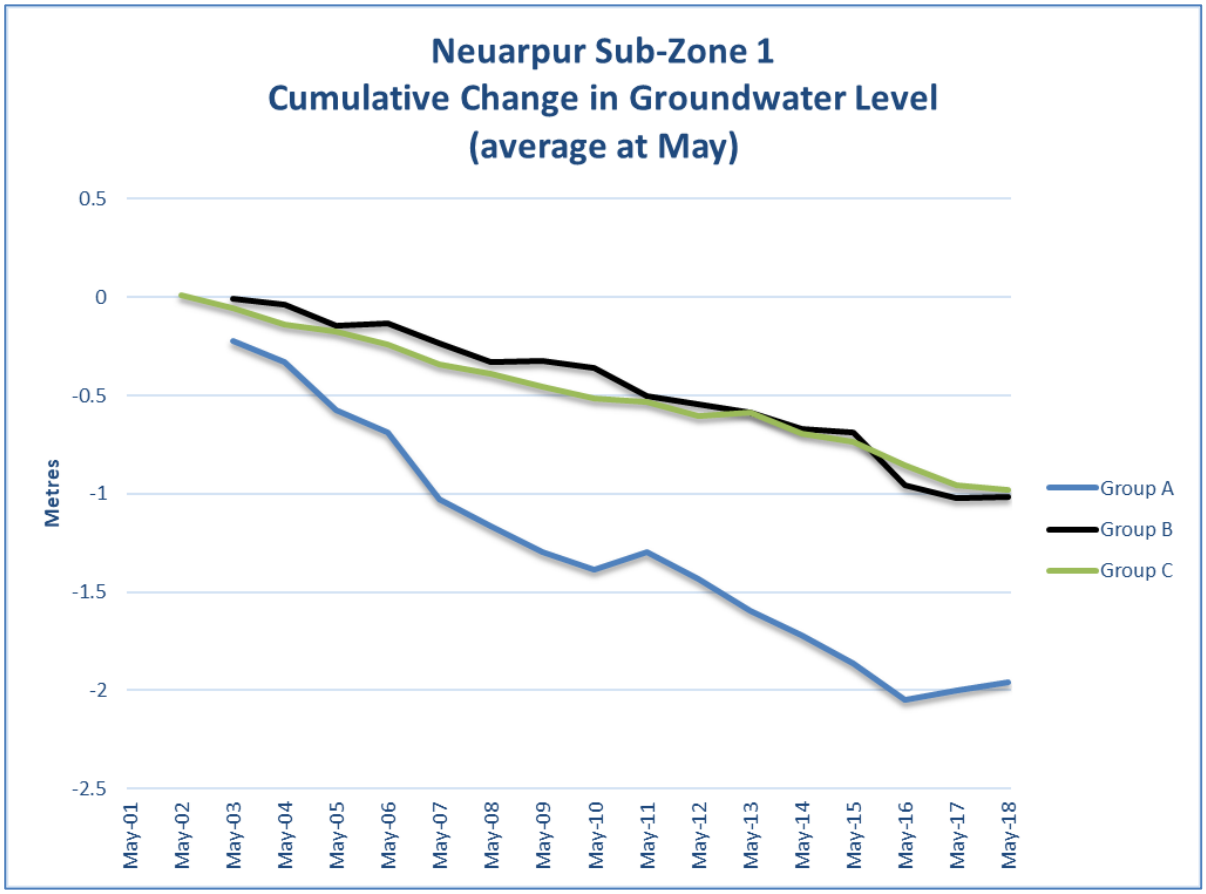


Figure 5 shows the cumulative rate of average change in groundwater level since 2002. While groundwater levels are declining where use is most concentrated, the rate of decline has eased slightly in recent years.

In terms of informing the decision making process for seasonal restrictions in Neuarpur Sub-zone 1, the rate of decline was sufficient to conclude that continuing restrictions at

80% of licence entitlement is required for 2018/19 irrigation season. Licence holders were advised of this decision in March 2018.

Figure 5: *Cumulative change in water level (since 2002)*



3. Water Quality

The location of bores screened to the TLA which had been monitored regularly for salinity (up until June 2016) as part of the SOBN contract are illustrated in Appendix 2. Annual salinity sampling of these bores will recommence where possible in 2018/19. Graphs illustrating a selection of the bores where data is collected are also illustrated in Appendix 2.

In general, the salinity of the TLA is low and less than 1,500 EC units (uS/cm) or 1,000 mg/L of Total Dissolved Solids (TDS) through the middle section of the GMA and less than 2,500 EC (1,500 mg/L TDS) across most of the remaining area. Towards the southern and northern boundaries, salinity typically ranges from 2,500 to 5,400 EC (1,500 to 3,500 mg/L TDS). There are small, isolated areas of higher salinity groundwater toward the south-west corner of the GMA and north of Kaniva.

The salinity of groundwater appears to be relatively stable in most of the bores and has not been identified as a resource management issue at this time.

4. Water Availability and Use

There are currently 171 groundwater licences in the West Wimmera GMA with a total entitlement volume of 53,603 ML. This year (2017/18), 82 licences were active and extracted a total volume of 27,310 ML (see Table 3 for use by zone). Extraction for irrigation and commercial purposes accounted for 26,982 ML, while 328 ML was used for urban town supply. Use in the previous year (2016/17) was 22,998 ML (see Table 4 and Figure 7 for a summary of usage in past years).

Within the GMA there are 200 meters used to measure the volume of groundwater being extracted through the licenced bores. Meters in Neuarpur and Apsley can be read remotely as required (see 5.2), while manual readings are taken for the remaining meters twice yearly, January/February (mid-irrigation season) and June (end of irrigation season). Domestic and stock use is not metered.

***Table 3**: Summary of groundwater use by management zone 2017/18.*

Zone	No of licences	Permanent Entitlement Volume ML	Usage 2017/18 ML
Neuarpur	48	24,691	17,086
Northern	78	22,345	7,920
Southern	35	5,615	1,858
Gymbowen	10	952	446
TOTAL	**171**	**53,603**	**27,310**

As discussed in Section 2.1, restrictions are being used to manage groundwater use in Neuarpur sub-zone 1 to address the declining groundwater levels observed in that area. The aim of restrictions to entitlements is to achieve stable groundwater levels in Neuarpur sub-zone 1 within 20 years (or 2031), with signs of stabilisation being evident within 10 years (or 2021).

All licences in Neuarpur Sub-zone 1 were restricted to 80% of entitlement in 2017/18, while licences within the remaining zones of the West Wimmera GMA have remained at 100% of licence entitlement.

As can be seen in Table 3, most water used in the West Wimmera GMA was extracted in the Neuarpur Zone. Figure 6 illustrates use as compared to the volume available for use over the past 15 years in the Neuarpur Zone. There had been a steady increase in use each year from 2010 to 2016 in the Neuarpur Zone. With a similar area under irrigation in 2016/17, the recorded use was approximately 1,500 ML less due climatic factors (timing of rainfall and temperature).

While there is less water technically available due to the 80%restriction to entitlement, there is no corresponding reduction in the volume being extracted in Neuarpur sub-zone 1 as total extraction has not yet reached the restricted volume.

Figure 6: *Neuarpur Zone water use, licence entitlement volume and allocation over time.*

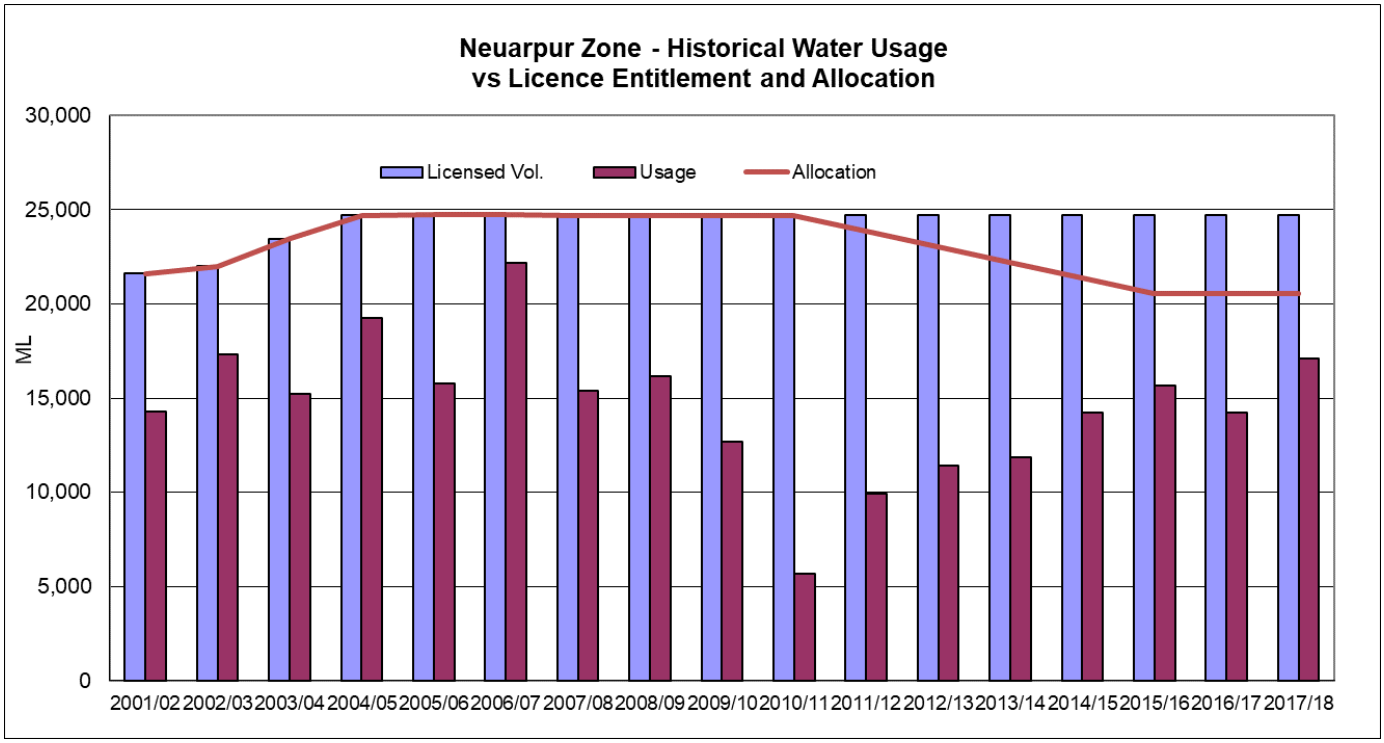
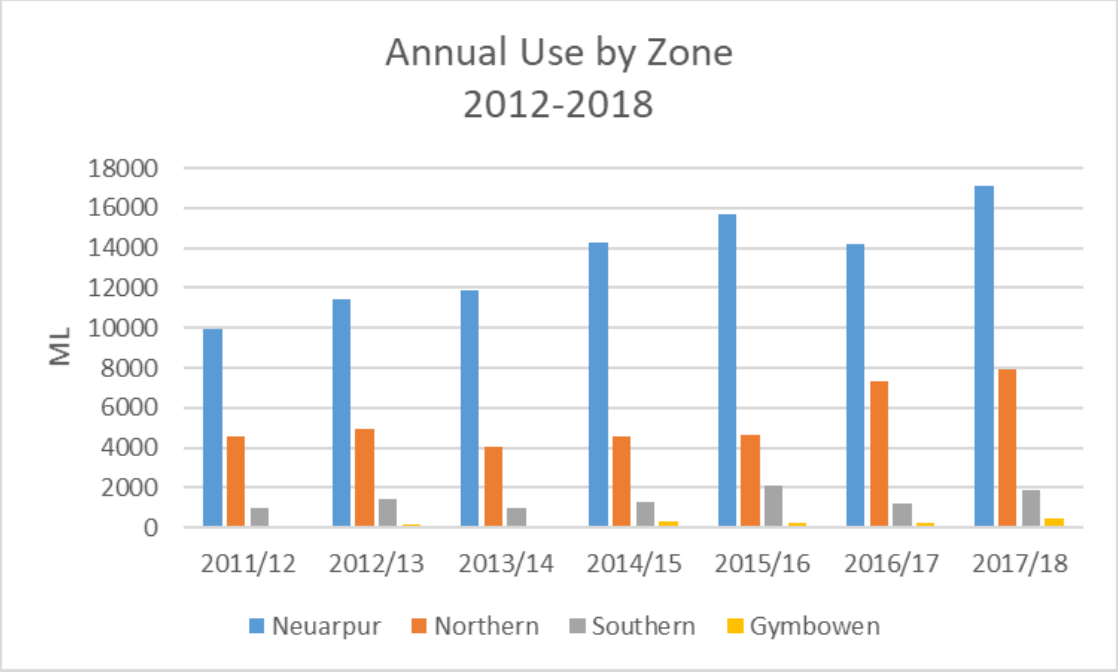


Table 4*: Summary of groundwater use by management zone since 2011/12*

Zone	Permanent Entitlement Volume ML	Use (ML)						
		2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Neuarpur	24,691	9,947	11,410	11,868	14,246	15,676	14,223	17,086
Northern	22,345	4,040	4,901	4,053	4,589	4,611	7,353	7,920
Southern	5,615	831	1,440	975	1,294	2,102.5	1,212	1,858
Gymbowen	952	29	164	69	291	268.5	209	446
TOTAL	**53,603**	**14,847**	**17,915**	**16,965**	**20,420**	**22,658**	**22,998**	**27,310**

Figure 7: *West Wimmera GMA Annual use by zone.*



4.1. Summary of groundwater trading 2017/18

Groundwater trading, either permanent or temporary, provides greater flexibility for new and existing users to manage production and establish new developments. Trading rules in the West Wimmera have been established to maximise opportunities for groundwater trading while preserving the management objective for each zone, protecting the integrity of the aquifer and minimising the potential for unacceptable impacts on existing groundwater users.

There were 11 temporary transfers of water entitlement, mostly in the Neuarpur Zone, to manage the volume of water available to these users.

Three permanent trades of water entitlement for a total volume of 625 ML occurred during 2017/18.

4.2. New Entitlement Volume

A total of 231 ML of new entitlement was licenced in 2017/18.

In April 2018, the Minister for Water approved an application made by GWMWater to increase the licence volume for the urban supply to the township of Harrow from 29 ML to 60 ML. This increased volume reflects the upper bound of historic annual use.

A new licence was issued in the Gymbowen Zone for 200 ML as a result of the Sale of Unallocated Water process which commenced in 2015.

4.3. Carryover

Carryover provides the ability for a licence holder's unused allocation to be used in the following water year. Unused allocation to an upper limit of 30% licence volume of may be carried over to the following year. In Neuarpur sub-zone 1, this equates to an upper limit of 30% of the total restricted volume available, while in the remainder of the GMA, licensees may carry over up to 30% of their full (un-restricted) licence entitlement, should it be unused.

Carryover was utilised by several licensees in 2017/18.

4.4. Licence Compliance

Through meter reading and compliance checks conducted by GWMWater, a number of potential instances of failure to comply with licence conditions were detected, some of which were resolved prior to the end of the 2017/18 season. Those licensees (three instances) who have been non-compliant with licence conditions (particularly overuse) have been issued with a Notice of Contravention under Section 151 of the *Water Act* by GWMWater. A Notice of Contravention specifies corrective action a licence holder must take, and any applicable timeframes for that action.

5. Project outcomes

5.1. Technical review of West Wimmera Groundwater Management Strategy

GHD Pty Ltd was engaged by to undertake the 5 year Technical Review of the West Wimmera Groundwater Management Strategy to assess whether the management objectives for each of the management zones are being met, and make recommendations to be considered for the ongoing management of groundwater in the West Wimmera GMA.

GHD conducted a monitoring review of groundwater level, quality and extraction data, as well as climate data, using this information to critically appraise the observed trends against the Management Strategy objectives.

GHD note in their report that although the management objectives have been generally satisfied over the last 5-year period, the review has only been able to assess the effectiveness of the West Wimmera Groundwater Management Strategy for the 5-6 year period it has been in place. It is recognised that stable groundwater levels identified in this review could quickly be impacted by factors such as prolonged low rainfall conditions being experienced (drought) and from increased extraction in some zones or sub-zones occurring in the future, including Northern, Yanipy, Neuarpur Sub-zones 1 and 2, Southern Apsley and Southern Langkoop.

GHD concluded that the current suite of management tools (i.e. the management rules) have been effective in managing the groundwater resources of the West Wimmera GMA. However, as noted, there is a risk of these objectives not being met in the future if a

significant increase in extraction volumes was to occur in some zones (i.e. where entitlement use is currently low) or prolonged dry climate conditions were experienced.

The declining groundwater trend in the Tertiary Limestone Aquifer in Neuarpur Sub-zone 1 was examined in detail. GHD recognised that the declining levels are driven by use within the Neuarpur Zone but are also likely to be influenced to some degree by groundwater use in the adjacent South Australian zones, 5A and 6A of the Border Designated Area, and the Apsley sub-zone.

The groundwater decline in the western side of the Apsley and Langkoop Sub-zones is also influenced by groundwater use in the adjacent South Australian zone 5A of the Border Designated Area.

GHD made number of recommendations following their review, which can be summarised into:

a) Restriction triggers

Based on the technical review, the current restriction of licences to 80% of licenced volume in Neuarpur sub-zone 1 should remain in place. New restrictions are not recommended for any other zones/sub-zone.

For the moderate risk zones and sub-zones (Northern, Yanipy, Neuarpur Sub-zones 1 and 2, Southern Apsley and Southern Langkoop) it was recommended that a plan be implemented which can definitively identify a significant change in groundwater level trend, including the setting a trigger level for when restrictions may be required to protect the sustainability of the resource.

b) Monitoring

In general, the current groundwater monitoring program in place was assessed to be adequate. However, some minor recommendations have been made for GWMWater's consideration:

- For **groundwater level monitoring** it was recommended a selection of existing observation bores be added to the active monitoring network to improve spatial and aquifer system coverage. They also recommend the construction of two new strategically located observation bores.
- For **water quality monitoring**, some additional quality monitoring was recommended for the Edenhope sub-zone where a slight rising salinity trend has been identified, however this is based on the results from one monitoring bore only.

c) Management Rules

In assessing the effectiveness of the existing management tools, GHD recognised the current Management Zones, Permissible Consumptive Volumes (limit on extraction in a zone), carryover provisions, and localised bore interference management (by installation of monitoring bore(s), are sound and do not require alteration.

Modifications to the some of the existing management rules were recommended to improve their effectiveness in either protecting the resource, or removing unnecessary trading restrictions.

The proposed modifications include:

- Entitlement Intensity Rule – simplify the assessment method
- Trading Rules – allow trade between Ullswater and Edenhope sub-zones
- Annual Reporting – include more detailed analysis to identify any ongoing decline on a yearly basis for each zone.

In summary, GHD prepared a comprehensive technical review using the available groundwater level, quality and extraction data and provided a number of recommendations that can be incorporated into a supplementary document to the 2011 West Wimmera Groundwater Management Strategy to further guide groundwater management in the GMA until the next periodic review.

5.2. Neuarpur / Apsley Remote Telemetry Project - Remote meter reading

The Neuarpur / Apsley Remote Telemetry Project is a joint initiative of the Department of Environment, Land, Water and Planning (DELWP) and GWMWater. The project objective is to record and electronically deliver daily groundwater usage information to GWMWater and into the Victorian Water Register.

In late 2017 a contractor undertook the installation of remote telemetry devices on all groundwater meters within the Neuarpur sub-zone 1 and 2, and the Apsley sub- zone on behalf of GWMWater.

The ability for a remote telemetry unit to accurately capture the volume of water passing through a meter and transmit it successfully back to the receiving server is critical to the success of the project. Data verification by way of comparing physical meter readings with the remote telemetry unit reading was undertaken and found to be within acceptable accounting errors (<0.005%).

Groundwater usage captured through this project will be used in conjunction with regional water level information to better inform the relationship between groundwater extraction and changes in groundwater level. It is also intended that metered extraction information will be made available to the licence holder through GWMWater's Customer Portal in a subsequent stage of this project.

5.3. Edenhope borefield radiocarbon analysis

In late 2017 GWMWater undertook groundwater sampling and analysis of the production bores from the Edenhope town supply borefield to better understand the security of supply risks. While this was not a recommendation of the West Wimmera Groundwater Management Strategy, the information obtained provides an improved understanding of the groundwater resource in that area of the GMA.

The samples collected from the three production bores were submitted to a geoscience and isotope research laboratory in New Zealand for radiocarbon dating

The laboratory results indicated the following age of groundwater from the Edenhope township production bores:
Bore No.1: 8,915 years (± 77 years)
Bore No.2: 17,542 years (± 274 years)
Bore No.3: 11,554 years (± 116 years)

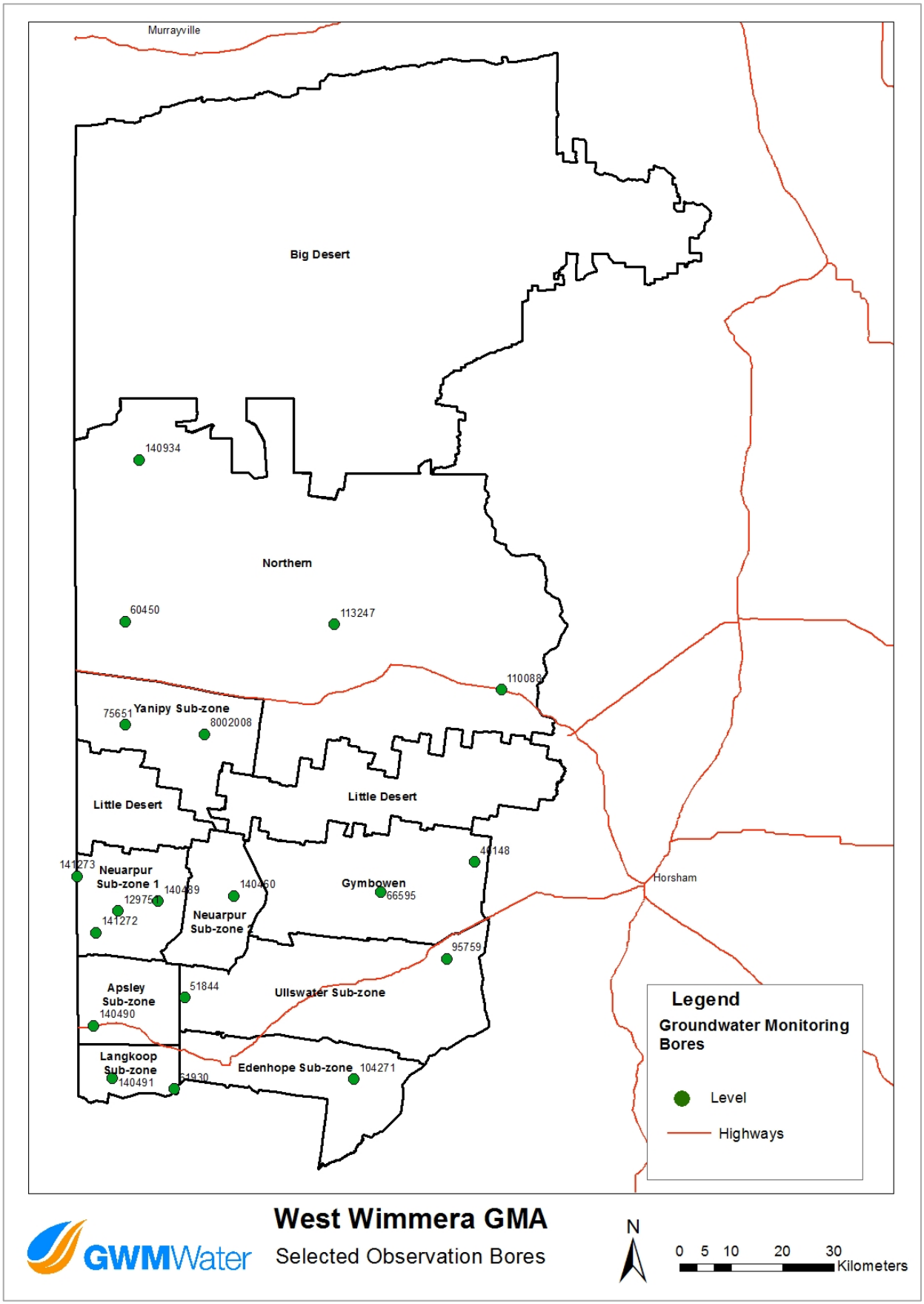
These results were forwarded to consultant hydrogeologists at GHD to provide expert interpretation of the results.

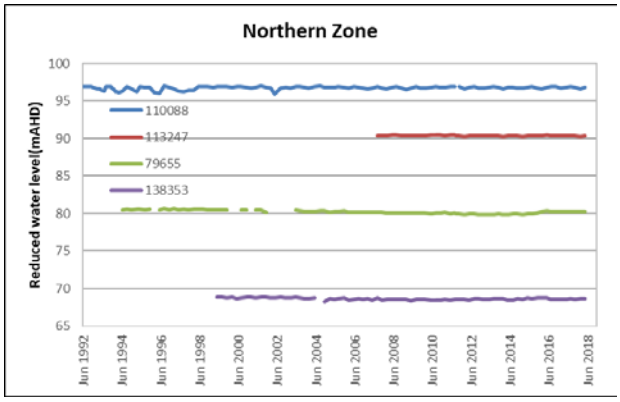
GHD made the following observations:

- Groundwater is considerably younger than the rocks which form the aquifer it is extracted from (i.e. the water was not present at the time of rock formation).
- There is likely to be limited direct recharge from rainfall due to the nature of the aquifer, which is supported by the groundwater age.
- Through flow from a distal source is likely to be the primary recharge process.
- Based on groundwater age and aquifer properties, GHD computed groundwater flow within the aquifer and estimated that potential recharge was likely to have occurred at locations between 3 and 13km from the borefield.

The results of the radiocarbon dating confirmed that the groundwater supply is not directly recharging as a result of rainfall, and further investigation as to the extent of the fresh water resource was recommended.

Appendix 1
Selected observation bores and hydrographs




Northern Zone
Reduced water level(mAHD)
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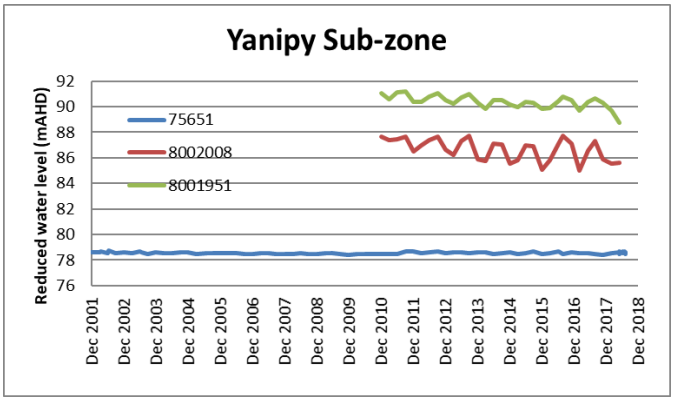
79655
138353


Yanipy Sub-zone
Reduced water level (mAHD)
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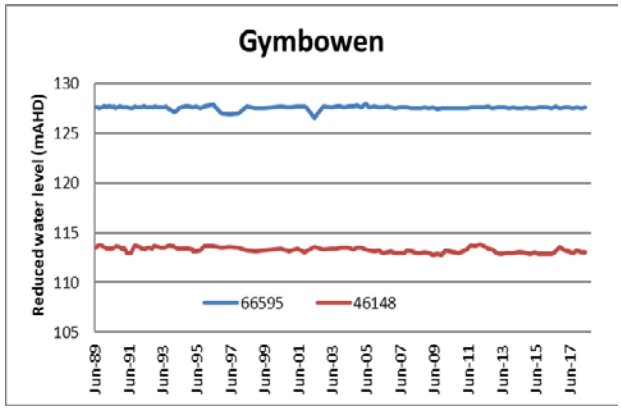
8001951


Gymbowen
Reduced water level (mAHD)
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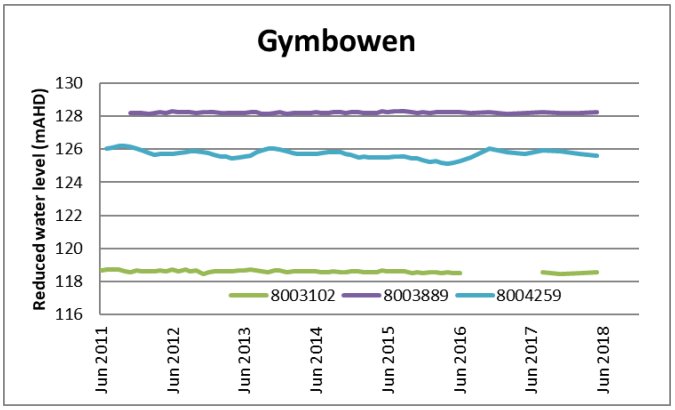
46148


Gymbowen
Reduced water level (mAHD)
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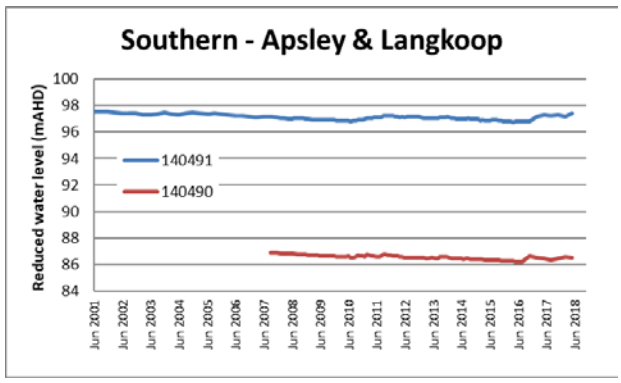
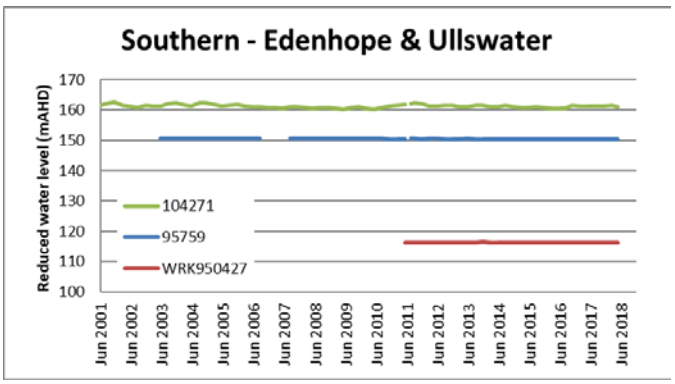
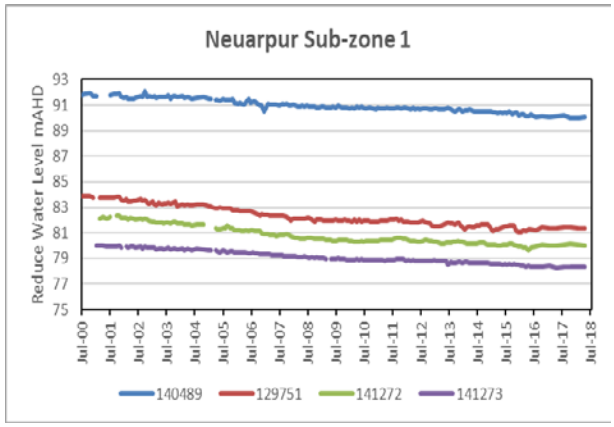
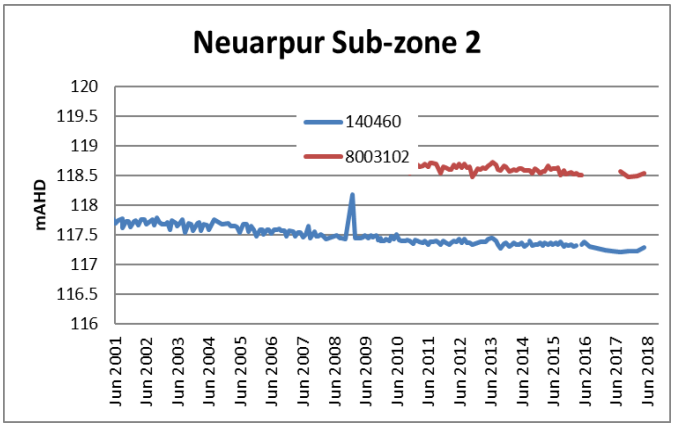
8004259

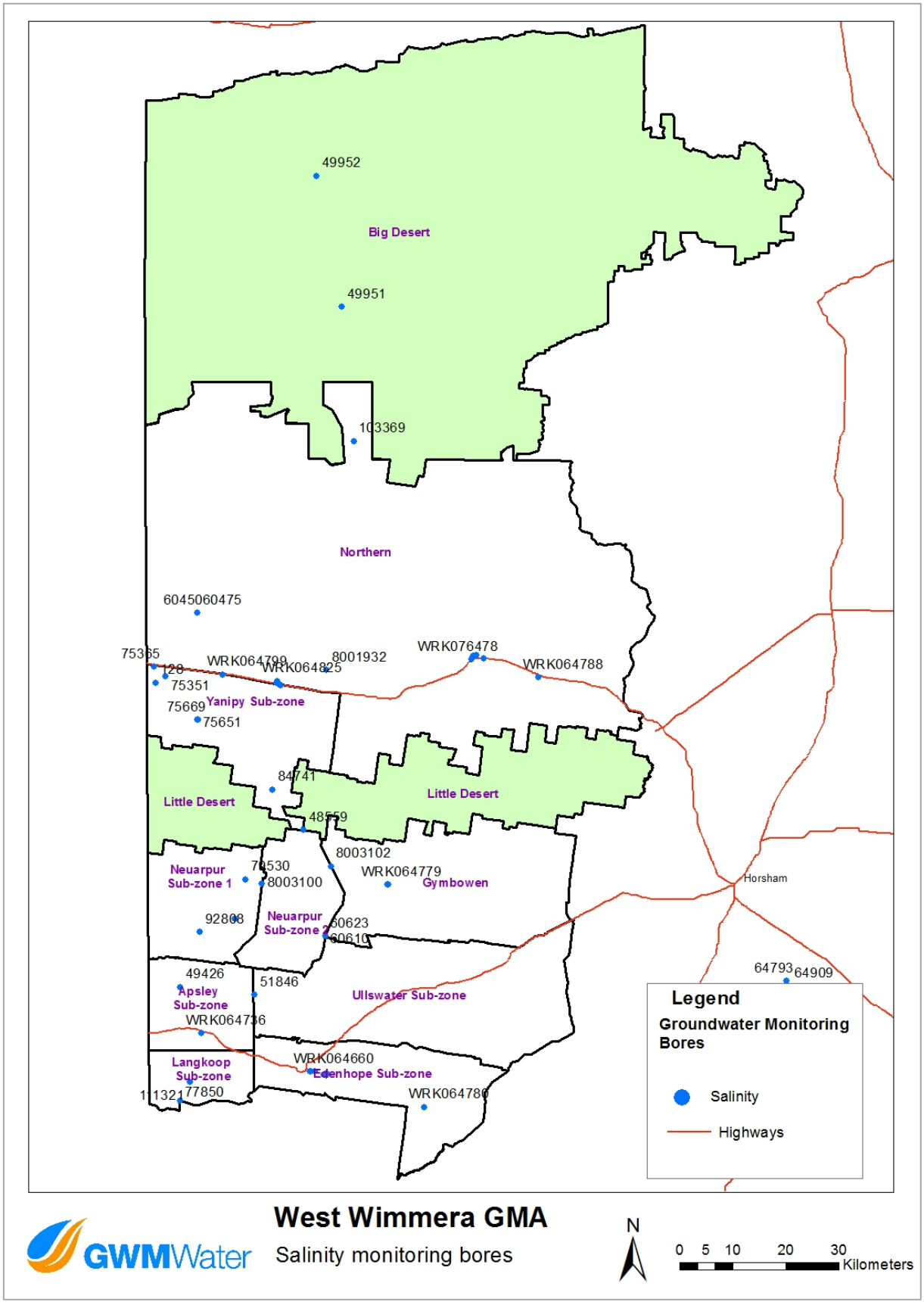
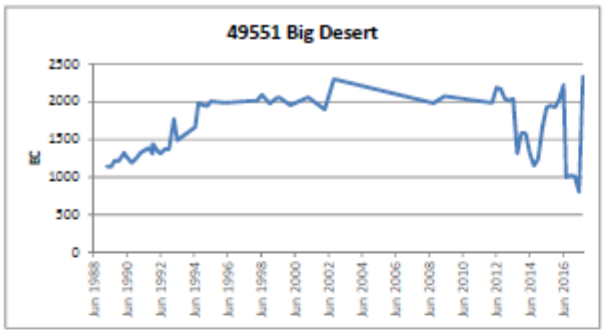
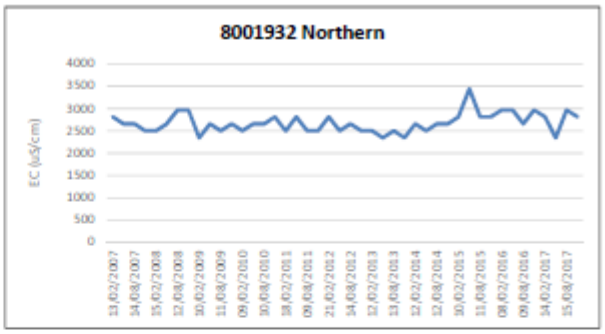
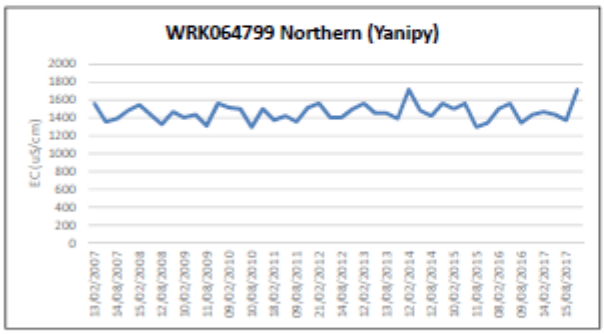
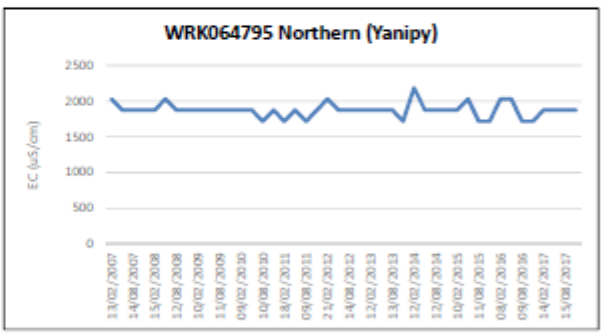
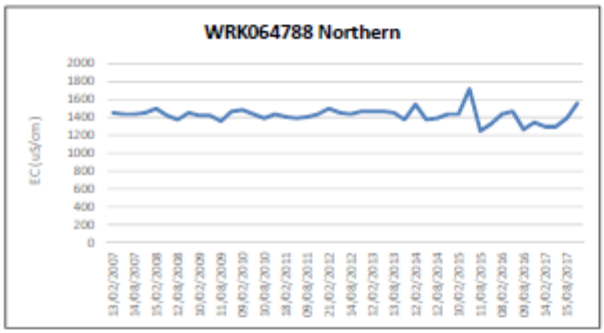
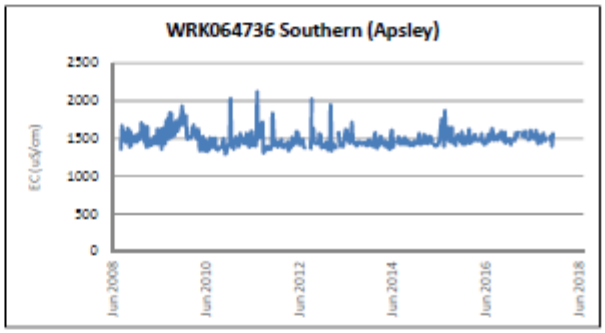
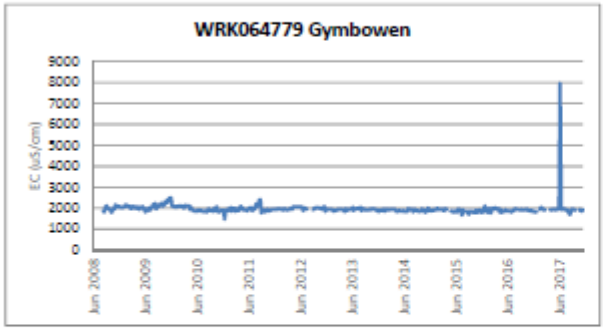
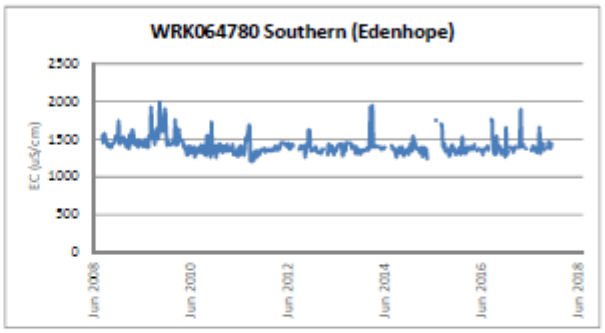
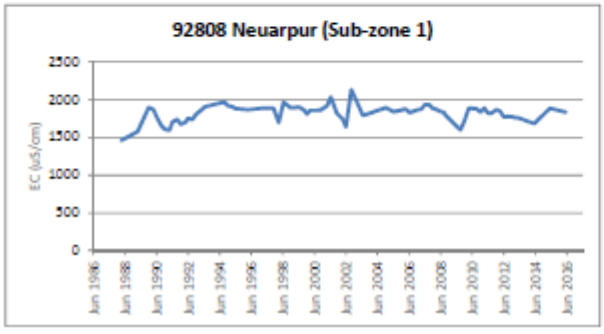
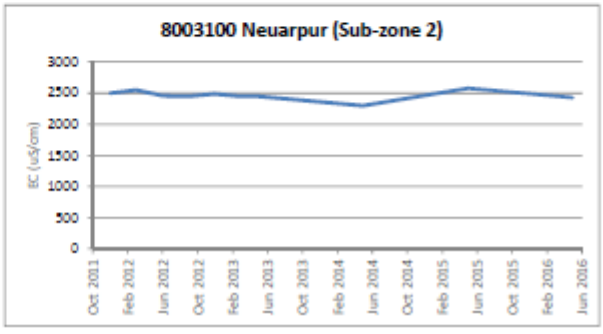

Southern - Apsley & Langkoop
Reduced water level (mAHD)
140491
140490


Southern - Edenhope & Ullswater
Reduced water level (mAHD)
104271
95759
WRK950427


Neuarpur Sub-zone 1
Reduce Water Level mAHD
140489
129751
141272
141273


Neuarpur Sub-zone 2
mAHD
140460
8003102

Appendix 2
Salinity monitoring locations and results



Salinity monitoring bore data (selected sites)