

# Gunbower / Leitchville Groundwater Applicants Update



Delivering for our region and our future



1800 013 357

# Agenda



1. Welcome – Ann Telford, General Manager Customers & Stakeholders - GMW
2. Overview – Matt Pethybridge, Groundwater & Streams Manager - GMW
3. GHD technical assessment – Jeff Morgan, Senior Hydrogeologist - GHD
4. Determining groundwater licence volumes – Nick O'Halloran, Senior Irrigation Officer - Agriculture Victoria
5. Licence assessments – Matt Pethybridge - GMW
6. What's next / wrap up – Ann Telford - GMW



# Overview

Matt Pethybridge - GMW

# Overview - background



- Since we last met back in February, GHD Pty Ltd (GHD) were engaged by GMW to undertake a technical assessment of the ground water resources.
- The high levels of salinity were identified as a risk by GMW and its partner agency – Agriculture Victoria. We have been working together to expedite the process.
- GMW has a number of requirements under the Water Act 1989 including the applications of licences and the protection of the resource itself.
- Today, we have invited you to discuss the results and recommendations of the GHD report as we work through a process to consider licence applications.

# Overview - responsibilities



GMW	GHD	Agriculture Victoria
<ul style="list-style-type: none"><li>• Responsible delegate for the Minister for Water, in Northern Victoria for the management of water resources</li><li>• Minister for Water's Delegate for all water licencing</li></ul>	<ul style="list-style-type: none"><li>• Expert consultant in hydrogeology</li><li>• Engaged by GMW to undertake a hydrogeological assessment on the Gunbower / Torrumbarry area</li></ul>	<ul style="list-style-type: none"><li>• Responsible for sustainable agricultural guidelines</li><li>• Provide advice to GMW on the management of saline groundwater</li></ul>

# Overview - update on current applications



- GMW paused the assessment of applications.
- We acknowledge the delays while information regarding the groundwater resource was obtained.
- Applications are at various stages of processing.

# Overview – assessment



- Purpose of the study
- Background
- Study findings:
  - currently **5,600 ML/yr** available
  - currently **1,945 ML/yr** already licensed in the area
  - an additional **3,655 ML/yr** can be allocated

# Overview – assessment cont'd

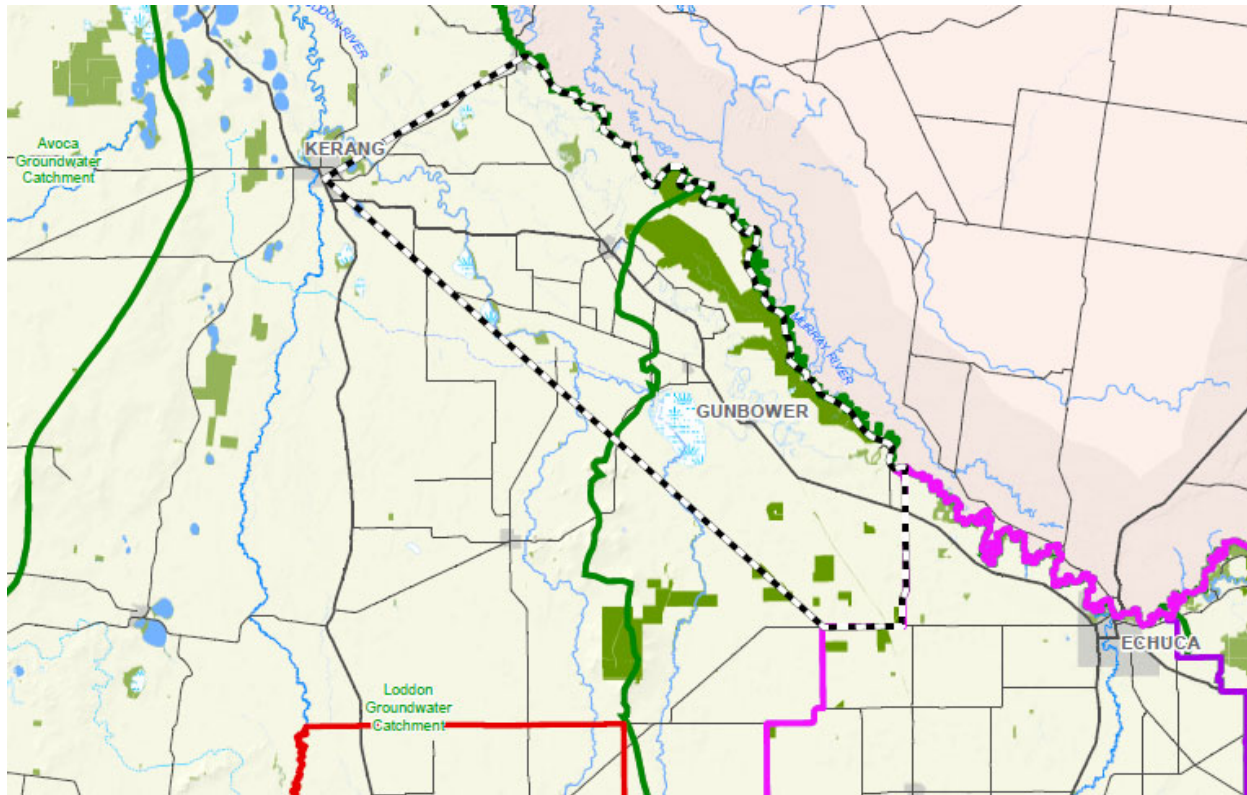


- Groundwater resources
- Risks identified
- Recommendations made by GHD include:
  - Limit initial licence entitlements to **5,600 ML/year** within the focus area.
  - Undertake further technical investigations to assess the potential impacts of additional extraction
  - Complete further work in regards to determine available groundwater entitlements





# Gunbower Area Hydrogeological Assessment



•**Jeff Morgan**  
Senior Hydrogeologist

# Project Drivers & Objectives


















- Drivers

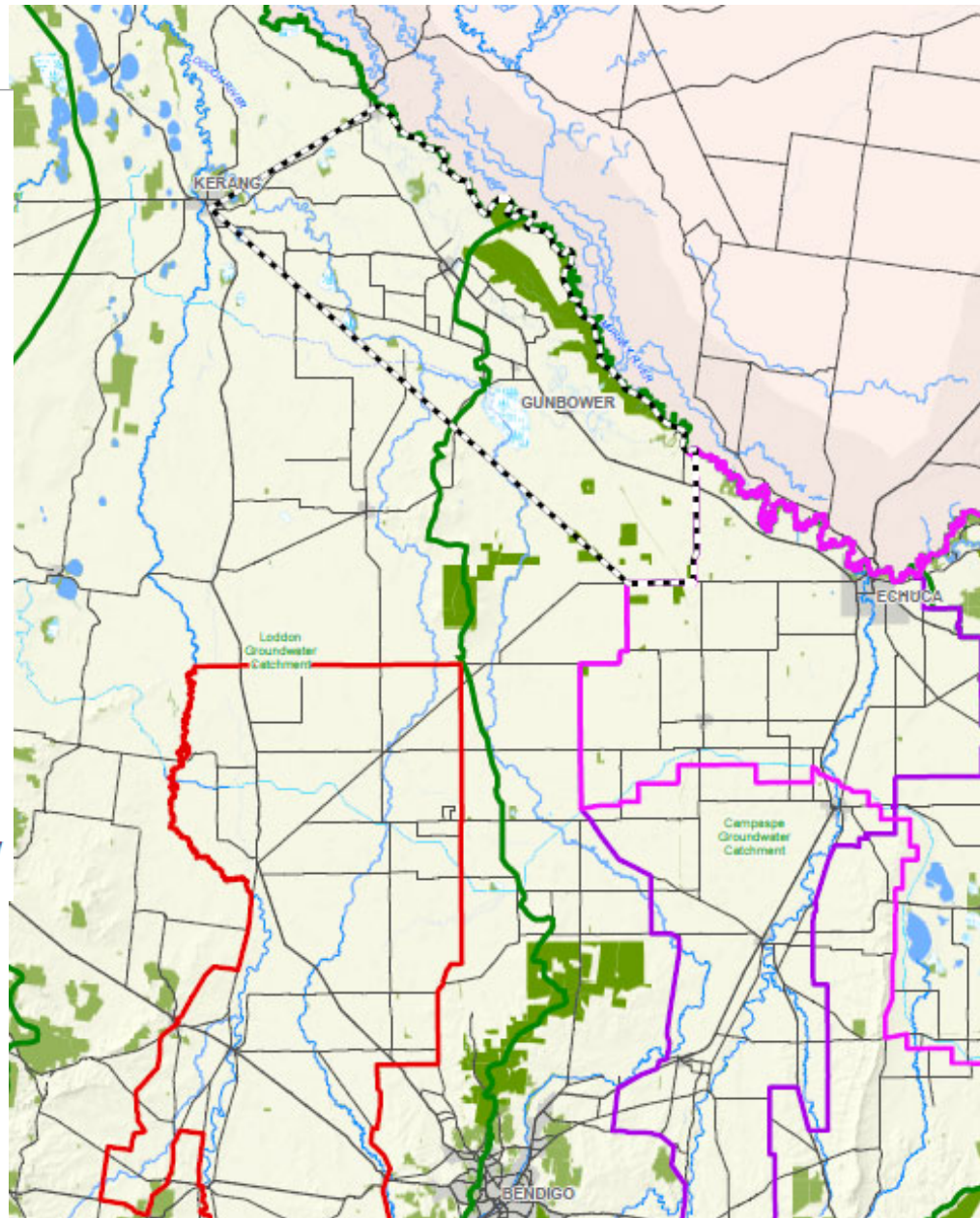
- An increase in exploration and licence applications for extraction from the deep lead around the township of Gunbower.
- This is an Unincorporated Area (ie.no local management system in place) .

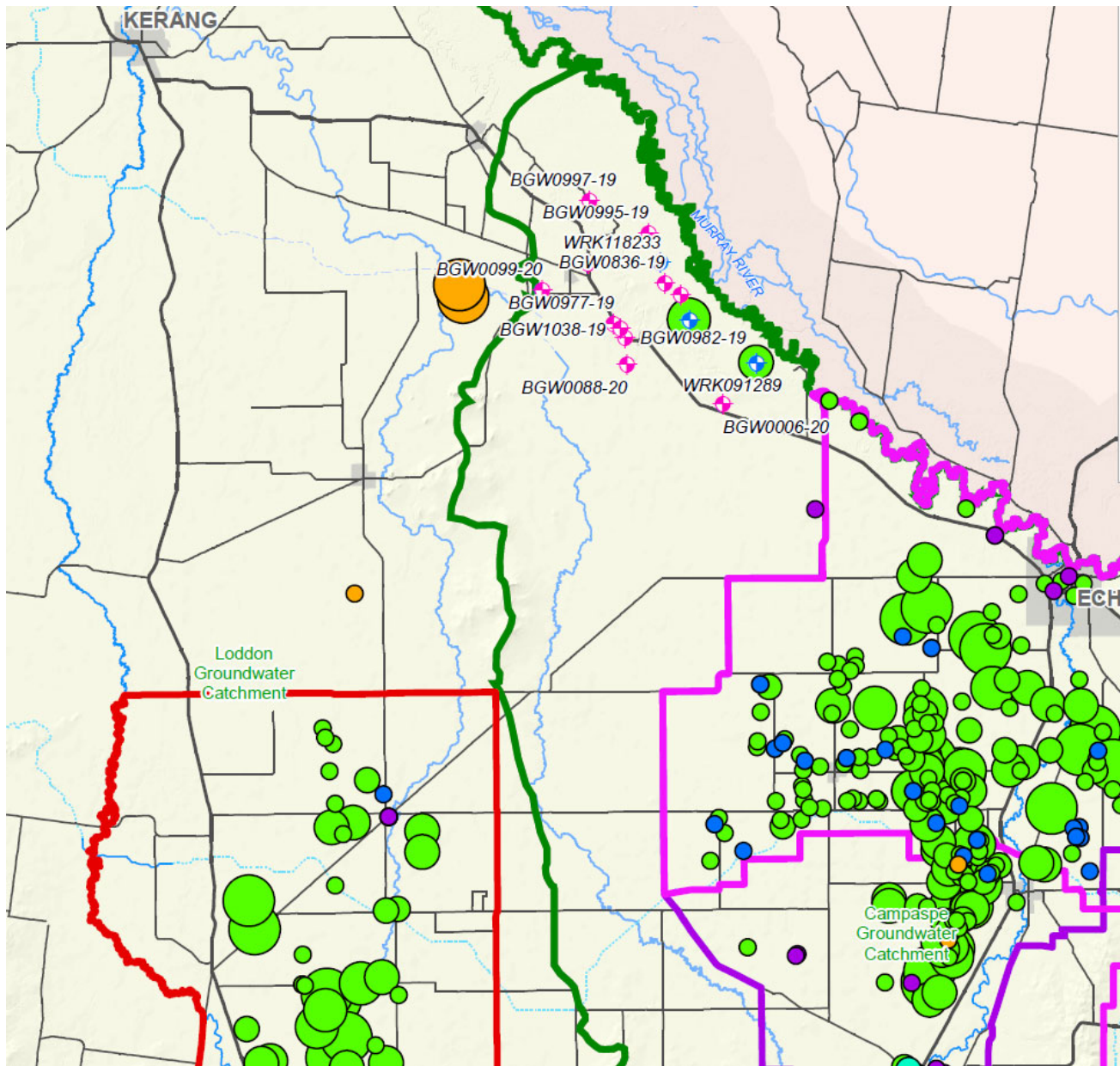
- Project Objective

- to inform the development of a sustainable yield (SY) for the deep lead aquifer in the Gunbower region.
- Aquifer Sustainable Yield? –
  - Not cause continual groundwater decline.
  - Not cause adverse impacts on groundwater dependent values (ie other users, groundwater quality, groundwater dependent ecosystems).
- First stage assessment; based on a desktop hydrogeological assessment

**Legend**

-  Focus area
-  Mid Loddon GMA
-  Shepparton Irrigation Region GMA
-  Lower Campaspe Valley WSPA
-  Groundwater catchment unit boundaries
-  Highway
-  Arterial
-  River
-  Stream
-  Watercourse
-  Flat
-  Lake
-  Swamp
-  National Parks
-  Other Parks
-  Township boundary
-  NSW





# Project Methodology:

## **Task 1: Hydrogeological Data Review:**

- Gather all available hydrogeological data.

## **Task 2: Hydrogeological Conceptualisation:**

Based on the available data, develop the Conceptual Hydrogeological Model (CHM) for the aquifer system in this area, including:

- identification of the impacts/risk of groundwater extraction
- level of interaction with the other GMUs.

## **Task 3: Preliminary estimate of aquifer recharge (throughflow):**

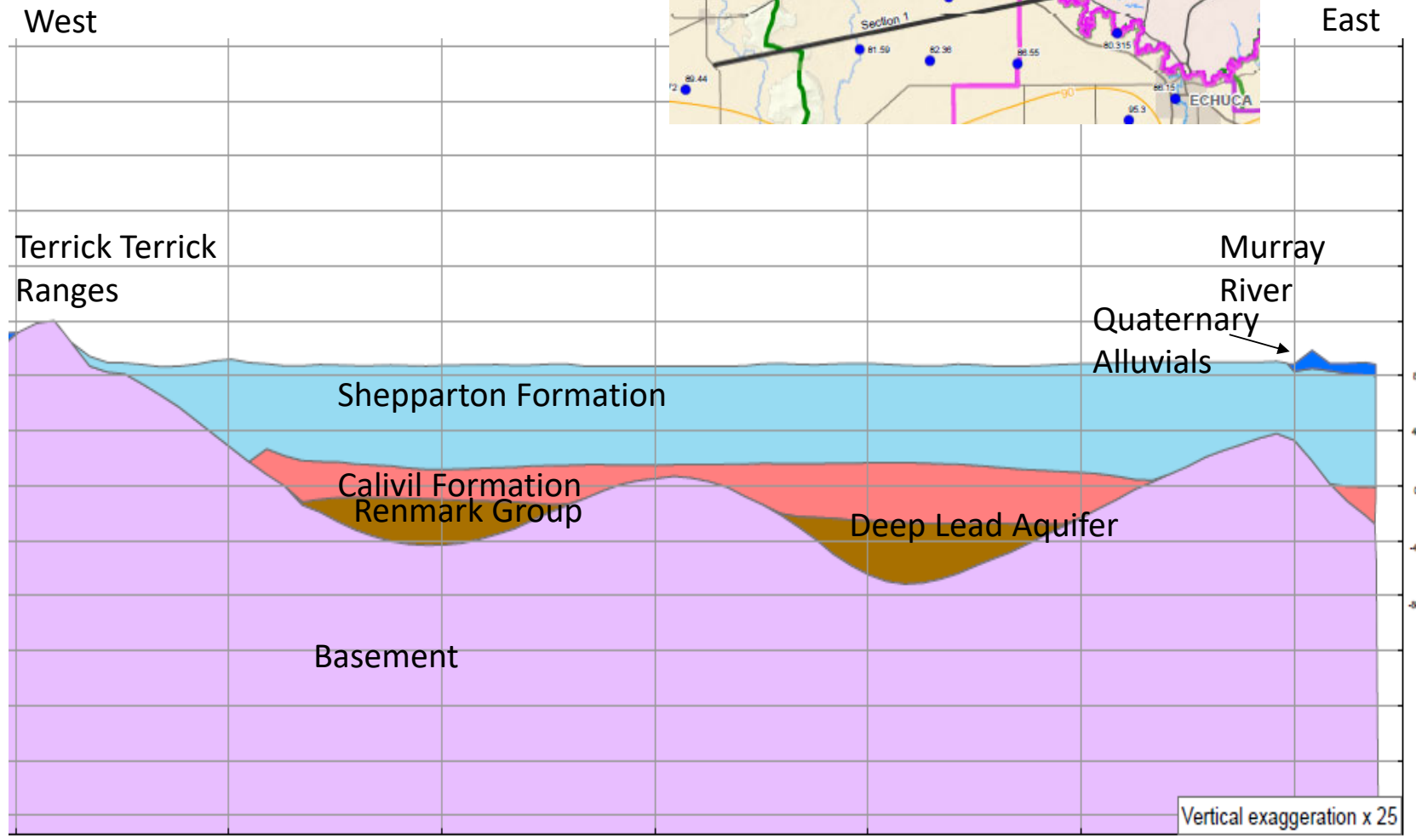
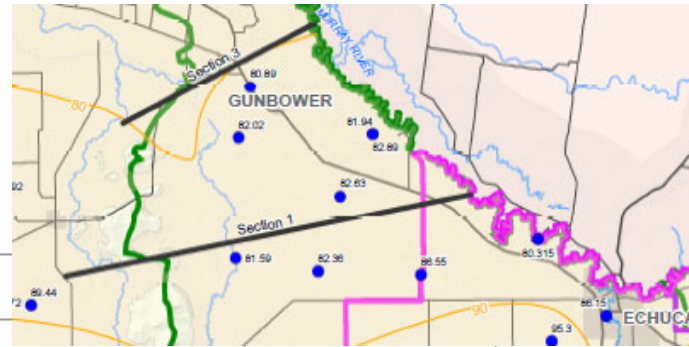
As first past assessment of the limits of the resource (SY), the annual throughflow in the aquifer system was estimated.

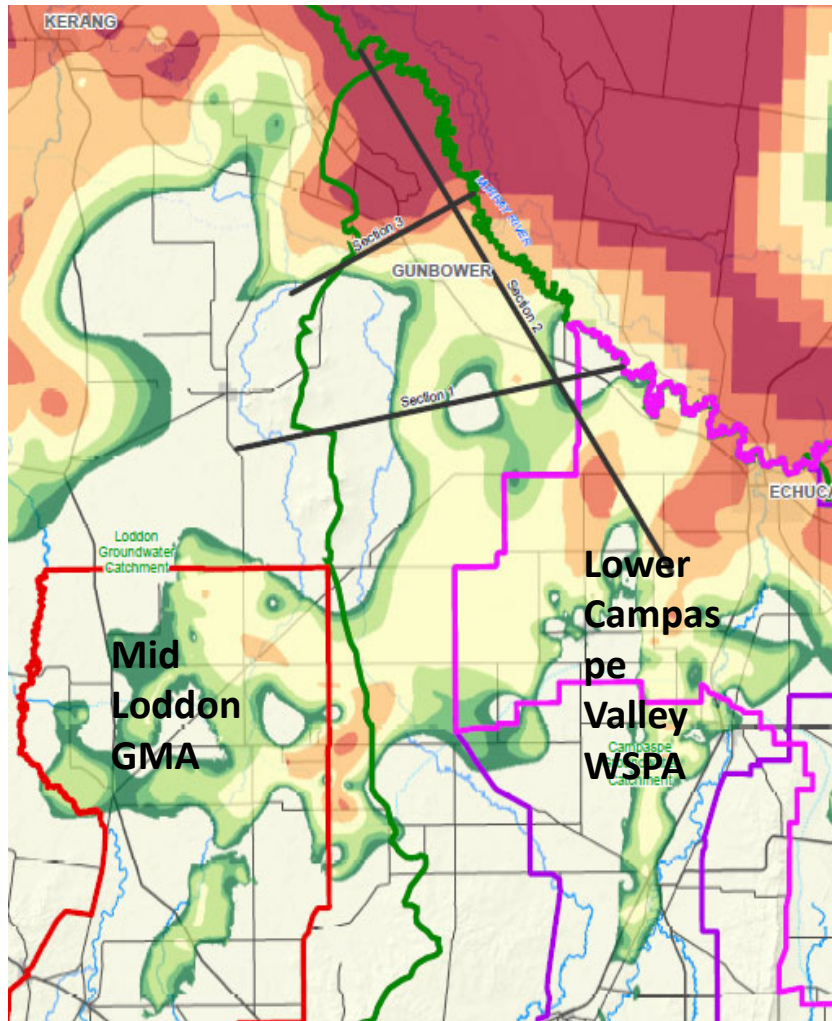
## **Task 4 : Reporting**

Including:

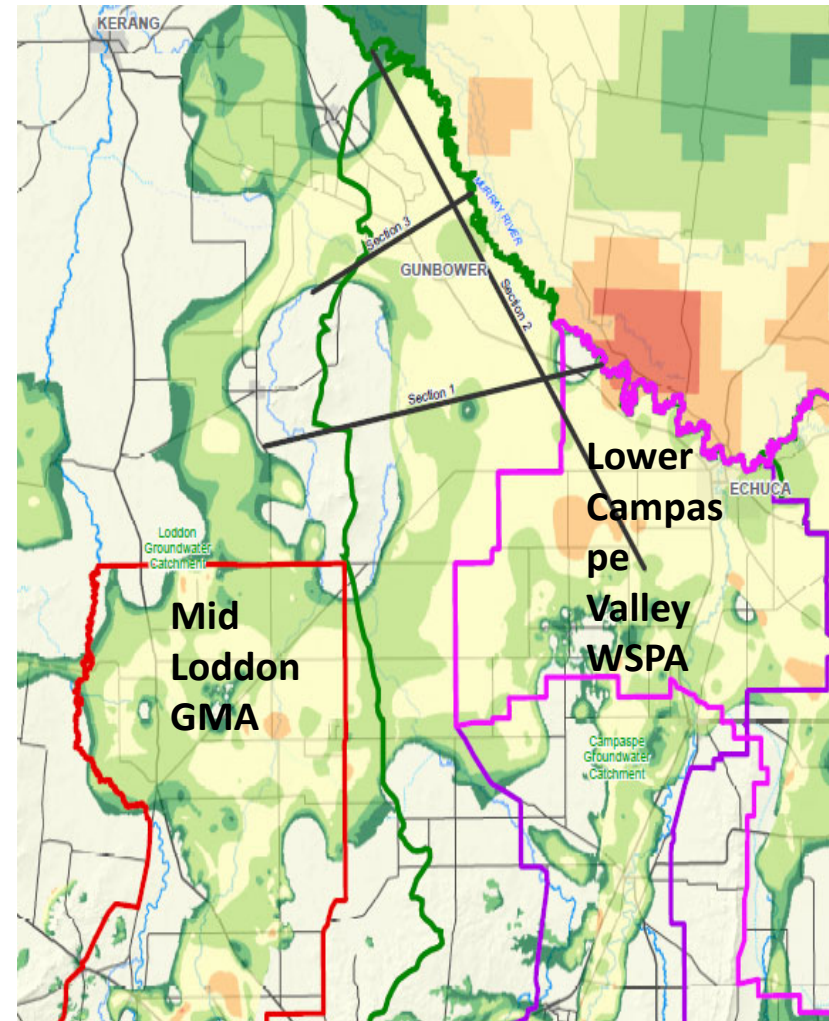
- identify any key data gaps
- recommendation on further work

# Hydrogeology

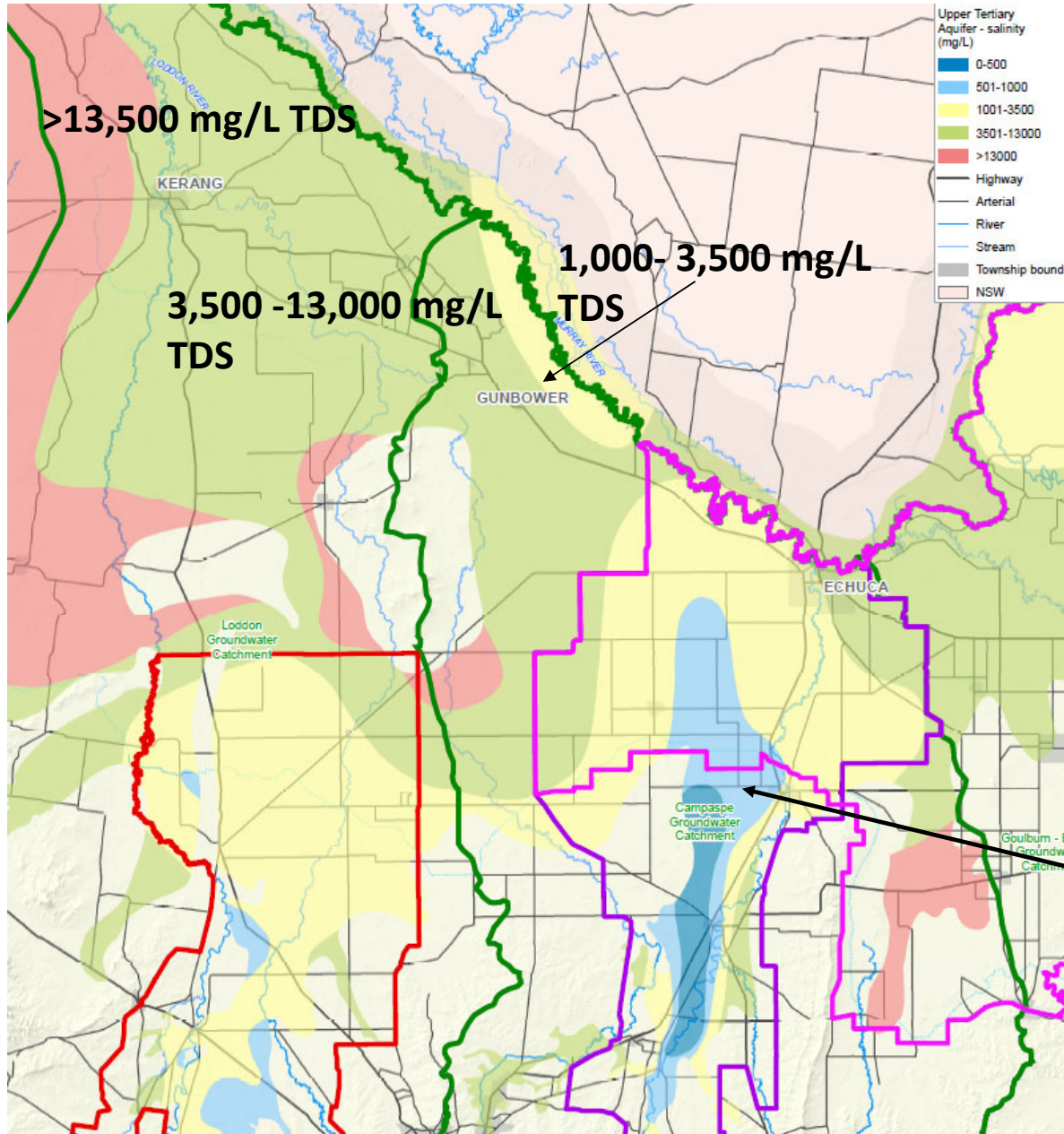




**Renmark Formation Thickness and extent**



**Calivil Group Thickness and extent**



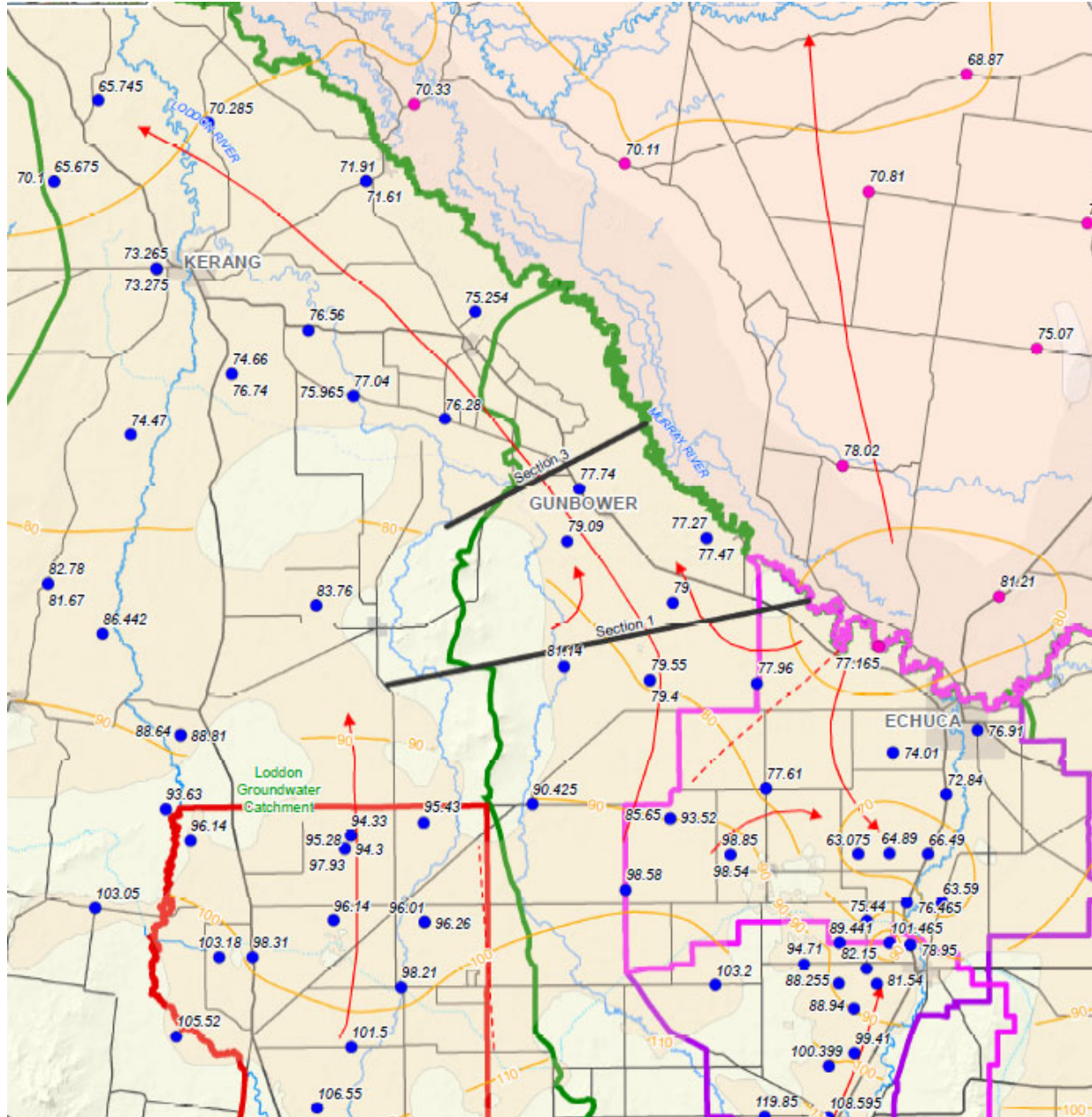
Gunbower bores

Salinity:

- 2,600-3,700mg/L TDS

Lower TDS interpreted in the Gunbower area than surrounding area





### Groundwater Flow

- N to S generally
- Drawdown in LCV

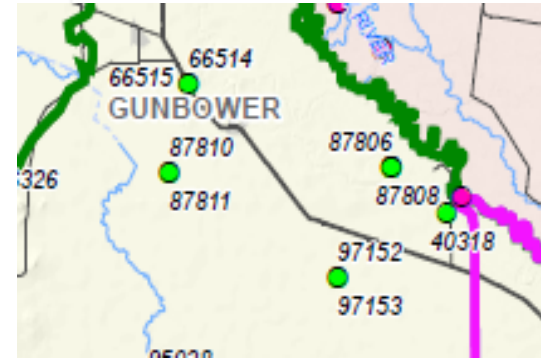
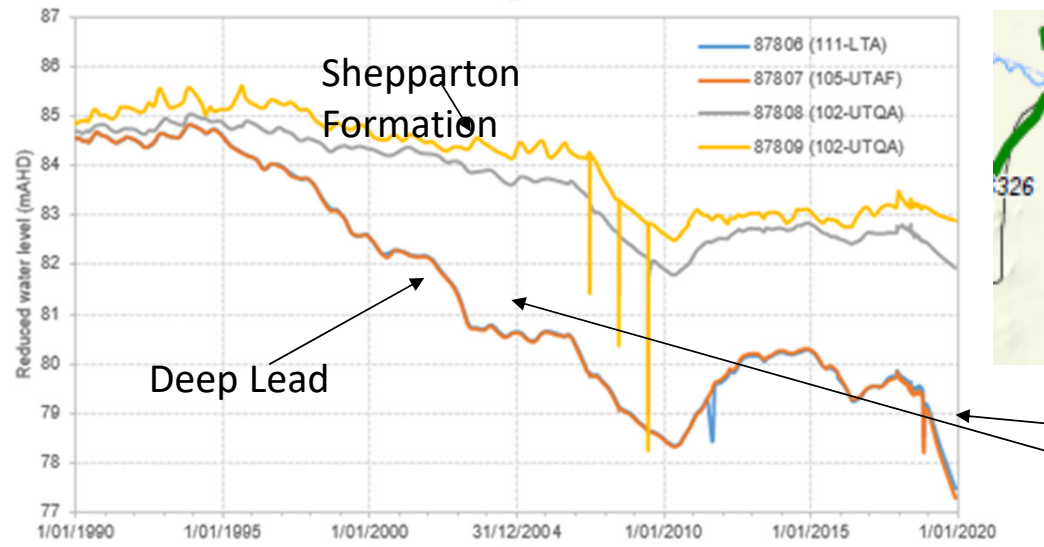
# Groundwater use

Groundwater entitlement and use in the region was reviewed for the four water system sources

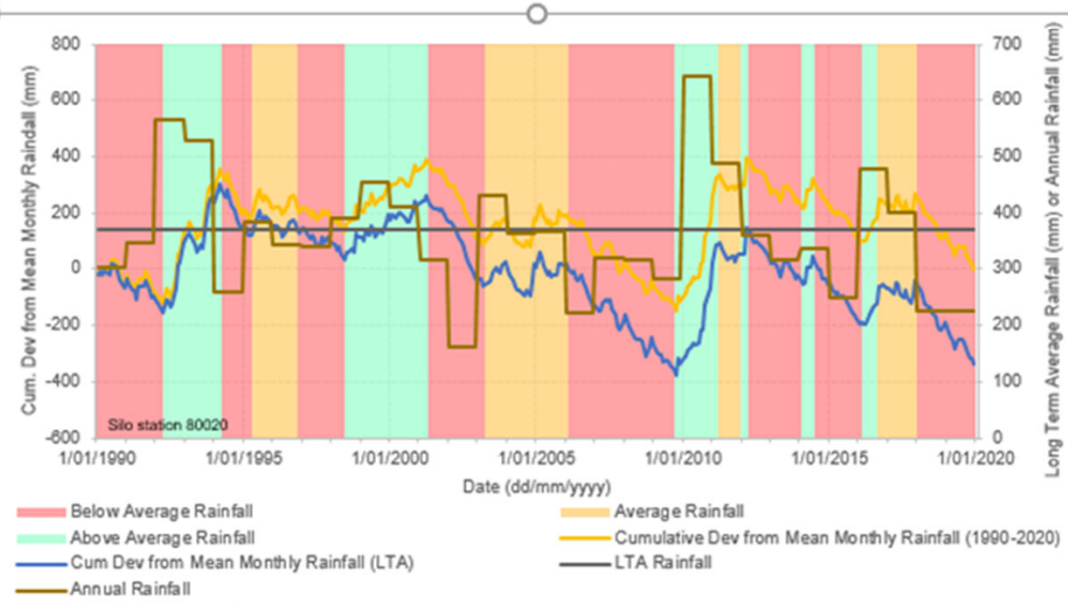
Water System Source <sup>xx</sup>	Current licenced volume (ML) <sup>xx</sup>	2016/17 (ML) <sup>xx</sup>		2017/18 (ML) <sup>xx</sup>		2018/19 (ML) <sup>xx</sup>	
		Volume (ML) <sup>xx</sup>	% licenced volume <sup>xx</sup>	Volume (ML) <sup>xx</sup>	% licenced volume <sup>xx</sup>	Volume (ML) <sup>xx</sup>	% licenced volume <sup>xx</sup>
Lower Campaspe Valley WSPA <sup>xx</sup>	55,860 <sup>xx</sup>	24,383 <sup>xx</sup>	44% <sup>xx</sup>	37,409 <sup>xx</sup>	67% <sup>xx</sup>	50,259 <sup>xx</sup>	90% <sup>xx</sup>
Mid Loddon GMA <sup>xx</sup>	33,927 <sup>xx</sup>	12,285 <sup>xx</sup>	36% <sup>xx</sup>	24,152 <sup>xx</sup>	71% <sup>xx</sup>	30,300 <sup>xx</sup>	89% <sup>xx</sup>
Shepparton Irrigation Region GMA <sup>xx</sup>	185,321 <sup>xx</sup>	54,220 <sup>xx</sup>	29% <sup>xx</sup>	76,610 <sup>xx</sup>	41% <sup>xx</sup>	93,828 <sup>xx</sup>	51% <sup>xx</sup>
Unincorporated <sup>xx</sup>	34,748 <sup>xx</sup>	1,816 <sup>xx</sup>	5% <sup>xx</sup>	3,008 <sup>xx</sup>	9% <sup>xx</sup>	4,061 <sup>xx</sup>	12% <sup>xx</sup>
<b>Grand Total<sup>xx</sup></b>	<b>309,856<sup>xx</sup></b>	<b>92,704<sup>xx</sup></b>	<b>30%<sup>xx</sup></b>	<b>141,179<sup>xx</sup></b>	<b>46%<sup>xx</sup></b>	<b>178,448<sup>xx</sup></b>	<b>58%<sup>xx</sup></b>

- In last 5 years- generally highest use in 2019, lowest in 2016
- LCV WSPA and Mid Loddon – around 90% use of entitlement in 2019

# Groundwater Level Trends

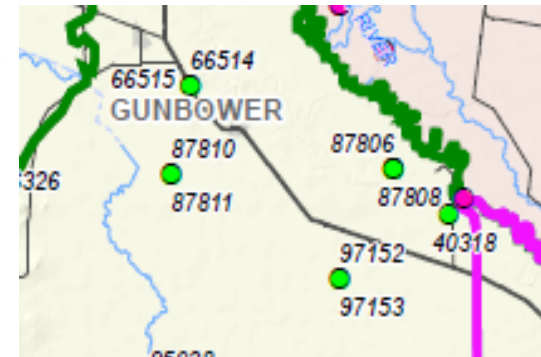
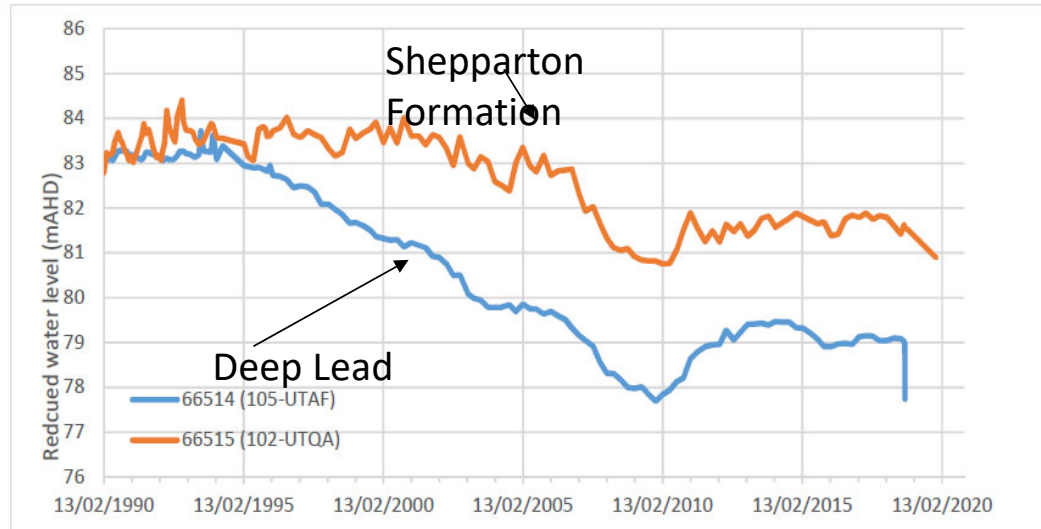


2m decline last 2 years  
Continuous Declining trend from around 1995

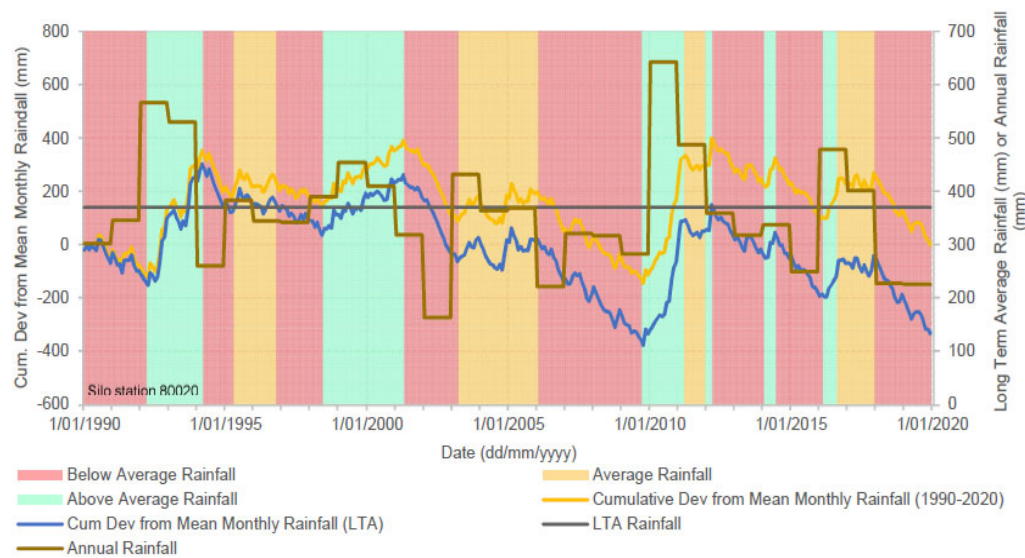


Similar to LCV  
WSPA: regional response

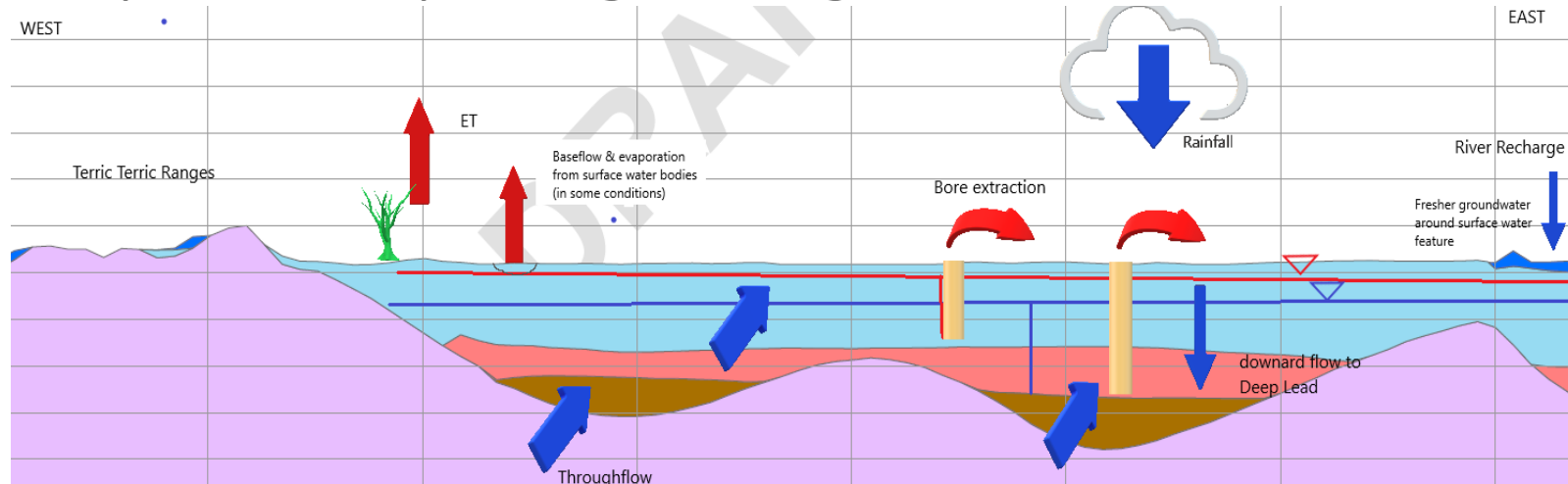
# Groundwater Level Trends



- 66514/15
- Further from LCV WSPA – same trends



# Conceptual Hydrogeological Model



- Deep Lead Aquifer :
- Recharge Processes:
- Downward Leakage from Shepparton Formation aquifer
- Throughflow from adjacent areas

Deep Lead Aquifer:

Discharge Processes:

- Upwards Leakage to Shepparton Formation aquifer (some conditions)
- Throughflow to adjacent areas (i.e. further west into the Murray Basin/NSW)
- Extraction

# Risks Associated with Additional Extraction from the Gunbower Area

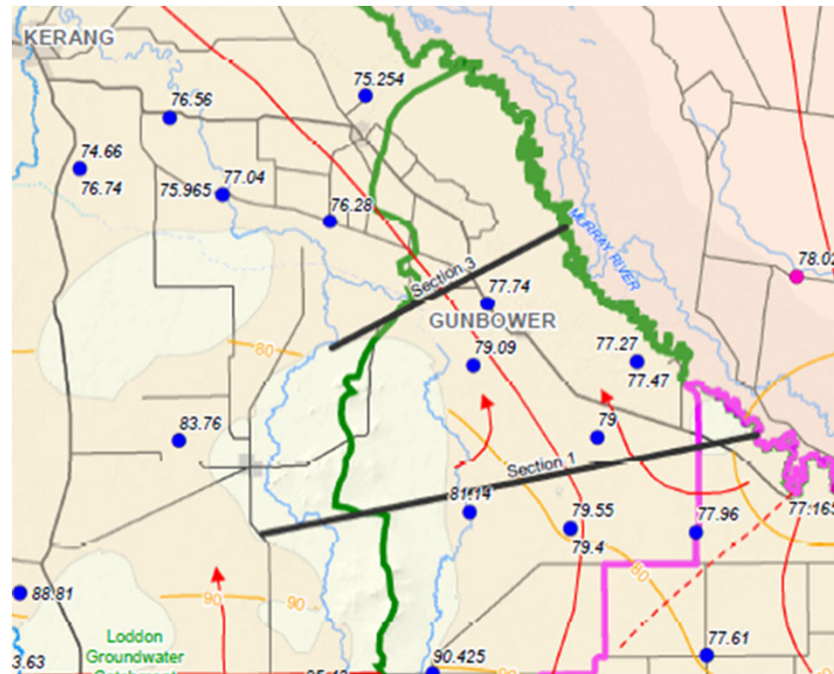
- Based on the hydrogeological conceptualisation: GHD completed a qualitative assessment of the risks associated with increased long term extraction from the Deep lead aquifer in the area.
- The objective being to identify key/high risks that may require prioritisation for further investigation, technical assessment or focus for monitoring plans, when GMW consider additional applications.
- **Considered impacts:**
  - Impact on Deep Lead aquifer sustainability (ie. gw levels and quality in the Gunbower Area).
  - Impact on Shepparton Formation aquifer sustainability (Gunbower Area).
  - Impact on surface water features and GDEs.
  - Impact on existing Deep Lead aquifer existing bores (Gunbower area).
  - Impact on Deep Lead aquifer sustainability (Adjacent LCV WSPA).
  - Impact on Deep Lead aquifer sustainability (Adjacent Mid Loddon WSPA).
  - Impact on Deep Lead aquifer sustainability (In NSW).

The following were considered **high risks**, associated with increased extraction from the Gunbower area :

- **Groundwater salinity impacts:**
  - Salinity in the Gunbower region may increase due to additional extraction, as the area of potential development is slightly fresher than the surrounding area.
- **Impact on the Deep Lead aquifer sustainability (in the Adjacent LCV WSPA).**
  - Fully allocated
  - Triggers in place to restrict extraction if groundwater levels decline
  - Potentially over allocated /extraction already
  - Under stress , particularly under dry climate/high extraction
  - Groundwater in Gunbower not sourced from this WSPA, but there is potential for interaction under drier climate/additional extraction
- **Climate change impacts:**
  - Potential to influence groundwater recharge and long term sustainability of Deep Lead aquifer system (Gunbower & other GMUs).

# Aquifer Throughflow estimation

- As a first pass assessment of the sustainable yield of the resource in the Gunbower area, the annual throughflow in the deep lead aquifer in the Gunbower area has been calculated.
- The throughflow estimate is based on the Darcy Equation:
  - $Q$  (Flow) =  
 $K$  (hydraulic conductivity)  $\times$   
 $A$  (cross sectional area)  $\times$   
 $i$  (hydraulic gradient).
- Used two cross sections :
  - upgradient and downgradient areas
- Hydraulic gradient:
  - from the potentiometric figures





# Aquifer Throughflow estimation

- **Aquifer Hydraulic Conductivity (K):** regional data
- To assess the throughflow sensitivity two K cases were assumed:
  - **Median K:**
    - Calivil Formation: 60 m/day. Median from CDM smith, 2016.
    - Renmark formation: 116 m/day. Median from CDM smith, 2016.
  - **High K :**
    - Calivil and Renmark Formation: 185 m/day. Applicable to Murray trench (Nolan ITU, 2001a) and considered realistic based on existing bore yields in the area (ie >50 L/sec to 250 L/sec)

# Aquifer Throughflow estimation

Component	Median K-Case	High K-Case
(a) Up-gradient Throughflow (Section 1) (ML/year)	5,103	12,276
(b) Down-gradient Throughflow (Section 3) (ML/year)	7,221	17,240
(b-a) Difference in Throughflow	2,118	4,964
(c) Existing Extraction (Licenced) in area	700	700
(b+c) Estimated Available Throughflow	7,920	17,940

- As a more conservative approach, considering the likely variability of the hydraulic conductivity of the deep lead aquifer, the median K case is considered most applicable. Therefore groundwater available for extraction in the Gunbower area is estimated to be approximately 8,000 ML/year, with a low confidence rating.
- Low confidence rating, the main reason being the uncertainty in regards to the aquifer parameters with no local pumping tests to validate the aquifer parameters used in the assessment.
- Considering the uncertainties associated with local aquifer parameters, it was recommended restricting licensing to 70% of the median throughflow at Gunbower (i.e. 5,600 ML/year), accepting the risks identified and also considering groundwater declines noted in the Millennium drought
- IF this volume is extracted what are the other potential impacts ?
  - We expect groundwater decline would stabilize in this area but what are the other impacts across the region

# Conclusions

- **The high risks** associated the increased groundwater extraction from the Deep Leads aquifer in the Gunbower area, included:
  - Groundwater quality decline (i.e. salinity increase) due to additional extraction.
  - Impact on Deep Lead aquifer sustainability in the adjacent Lower Campaspe Valley WSPA.
  - Climate change impacts on aquifer recharge and long term sustainability.
- **Aquifer Throughflow**
  - As a first pass assessment of the sustainable yield of the resource, groundwater available for extraction in the Gunbower area is estimated to be approximately 8,000 ML/year, with a low confidence rating and recognising the high risks noted above.

# Recommendations

## 1. Limit entitlements to 5.600 ML/year.

- 70% of the median throughflow calculated, considering the uncertainties associated with local aquifer parameters.
- While further investigations are completed to assess the potential impacts of additional extraction and to provide a more technically rigorous sustainable yield estimate.

## 2. Complete further technical investigations:

- Pumping tests: As a priority, to further inform the throughflow estimations.
- Numerical groundwater modelling: to assess the potential impact of additional extraction on existing groundwater users (i.e. nearby GMU/cross border), overlying aquifer system and surface water features. The potential high risk impacts include the nearby LCV WSPA, warrants a more rigorous technical assessment, to quantify the sustainable yield as a connected resource.
- Monitoring of gw quality in surrounding and adjacent observation bores to identify any longer term changes.

## 3. Bore Licensing Conditions

## 4. Further work to be completed in regards to the management in NSW



[www.ghd.com](http://www.ghd.com)

# Question time



Please type your first name into the chat section and I will ask you unmute your microphone to ask a question.

OR

Type your question in the chat section and it will be read out for you.



# Determining groundwater licence volumes

Nick O'Halloran, Tatura  
20<sup>th</sup> August 2020

AGRICULTURE VICTORIA



## Principles for determining licence volume

### Guiding policies from Water Act 1989:

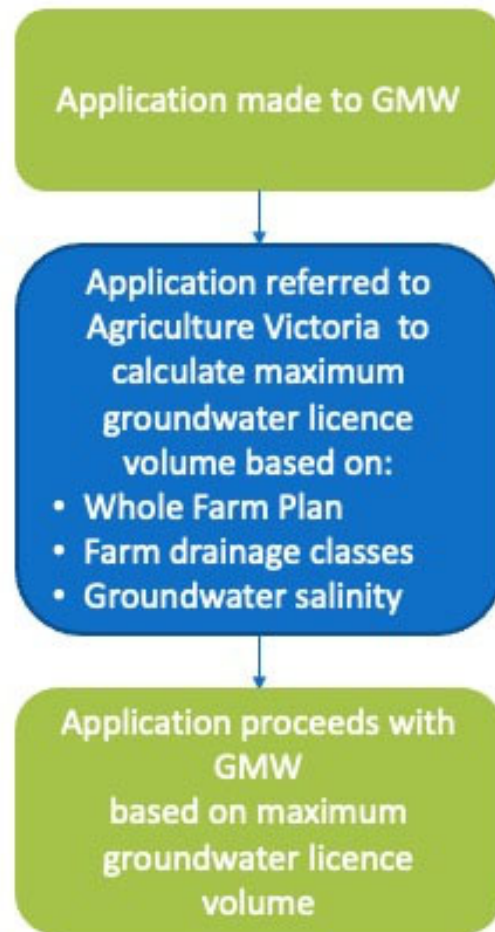
- Policy for managing Take and Use licences
- Standard water use conditions

### Requires appropriate management to minimise both short and long terms impacts:

- managing groundwater infiltration
- managing disposal of drainage water
- minimising salinity – of both soil and downstream waterways
- protecting biodiversity, and
- minimising cumulative impacts of water use



## The process for determining licence volume



Agriculture Victoria are available to provide assistance throughout the process

## Step 1: Calculate maximum application rate (MAR)

MAR = maximum application rate (ML/ha) from all irrigation water sources

Requires a Whole Farm Plan that identifies:

- area proposed to be irrigated with groundwater
- area currently supplied by surface irrigation water
- area with access to off-farm drainage and drainage re-use

MAR for Drainage Classes from the Standard Water Use Conditions



Area with **both**  
off-farm drainage and  
drainage re-use (ha) × 10 ML/ha

Area with **either**  
off-farm drainage or  
drainage re-use (ha) × 7.2 ML/ha

Area with **no**  
off-farm drainage or  
drainage re-use (ha) × 5.0 ML/ha

## Step 2: Calculate groundwater component of the maximum application rate (MAR)

Target average salinity from all sources is **800EC**

We consider the volume (ML/ha) and salinity level (EC) of each water source, and adjust groundwater and channel water volume to achieve an average salinity level of **800EC**

- groundwater  $\approx$  5000 EC (measured salinity of your bore)
- channel water  $\approx$  150 EC
- rainfall  $\approx$  0 EC

Note: 10 ML/ha/year at 800 EC this equates to 5.1 t salt applied

Groundwater component of MAR (ML/ha) x total area (ha)  
= maximum groundwater licence volume (ML)

## An example – 100ha property

Step 1: Calculate MAR

50 ha with off farm drainage AND re-use

- $10\text{ML/ha} \times 50\text{ha} = 500\text{ML}$

50 ha with re-use drainage only

- $7.2\text{ML/ha} \times 50\text{ha} = 360\text{ML}$

Zero ha with no off farm drainage or re-use

- $5\text{ML/ha} \times 0\text{ha} = 0\text{ML}$

Maximum application rate from all irrigation water sources

MAR = 860ML over 100ha or 8.6ML/ha

## An example – 100ha property (continued)

Step 2: Calculate groundwater component of MAR

Target average salinity 800 EC

Ave MAR 8.6 ML/ha		
Groundwater 1.8 ML/ha 5000 EC	Channel water 6.8 ML/ha 150 EC	Rainfall 4 ML/ha (400 mm) 0 EC



For 100 ha maximum groundwater licence volume = 181ML

## Examples of maximum groundwater licence volumes

	Drainage		Groundwater component of MAR	Total irrigable area (ha)	
	Re-use only	Off-farm & re-use		100	200
<b>Scenario 1</b>	0%	100%	2.0 ML/ha	200 ML	400 ML
<b>Scenario 2</b>	50%	50%	1.8 ML/ha	181 ML	362 ML
<b>Scenario 3</b>	0%	0%	1.3 ML/ha	133 ML	266 ML

## Next steps

- Applications will be referred to Agriculture Victoria from GMW
- Contact Agricultural Victoria staff directly:
  - To calculate an indicative maximum groundwater licence volume before progressing your application further
  - For information on risks and best management practices for irrigating with saline groundwater or other irrigation related enquiries
  - Nick O'Halloran: 0438 321 528  
[nick.ohalloran@agriculture.vic.gov.au](mailto:nick.ohalloran@agriculture.vic.gov.au)

# Question time



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# Licence assessments

## Presented by Matt Pethybridge

# Overview: licence assessments



- Consideration for licence assessment
- Licence assessment: Key matters to be taken into account under Section 40 of the Water Act 1989

# Considerations for licence assessment



- Overall groundwater resource
- Secondary impacts from the use of high salinity water (use of water)
- Legal requirement on GMW
- Assessment under Section 40 of the Water Act

# GMW's licensing process



Key matters to consider (s.40 of the Water Act 1989):

- Potential for impact on existing water uses
- Consider future water availability and quality
- Impacts on waterways and aquifers
- Environmental features (e.g. groundwater dependent ecosystems)
- Relevant groundwater management plan and objectives
- Use of the water
- Considering the needs of other potential applicants
- Permissible Consumptive Volume (i.e. a cap on licence entitlement)

# Question time



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# What's next



For Customers:

- GMW will contact you over the next week (once you have had time to review all the information) to discuss your options in more detail.
- In the meantime, if you have any questions please contact the following GMW staff:
  - Matt Pethybridge: 03 5826 3702
  - Dale McGraw: 03 5450 5301
  - Scott Ridges: 03 5826 3485

For GMW:

- We will further consider the licensing approach to ensure we fully address the Water Act.



# Thank you for attending

How did you find our information session today?  
Please enter a number in the chat box before you leave.

1. Very poor 2. Poor 3. Okay 4. Good 5. Very Good



Thank you



### Contact us

 1800 013 357

 [www.gmwater.com.au](http://www.gmwater.com.au)

 40 Casey Street, Tatura