

West Campaspe Groundwater Management Area Local Management Plan

October 2024



Excellence



Honesty



Accountability



Courage



Caring

Acknowledgement of Country

Goulburn-Murray Water respectfully acknowledges the Aboriginal and Torres Strait Islander communities of Victoria and pays respect to their Elders past, present and emerging.

We commit to building meaningful partnerships that create value for First Peoples through genuine engagement and collaboration.

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Endorsement

This Local Management Plan (the Plan) has been developed for the West Campaspe Groundwater Management Area (GMA) to provide a framework for managing groundwater resources. The Plan includes guidance and information to Goulburn-Murray Water's (GMW) existing and potential customers about the take and use of groundwater in this area.

The Plan sets simple rules for the take and use of the resource which are intended to be administered alongside the Victorian Government's policies recognising Traditional Owners access rights to water.

The Plan seeks to strike a balance between recognising the benefit of taking groundwater while supporting the protection of productive land and high value environmental assets such as wetlands, waterways, and other groundwater dependent ecosystems during critical dry periods. The use of groundwater of varying salinities and how it can provide benefits when incorporated into irrigation plans are also considered throughout the Plan.

The Plan will be periodically reviewed, particularly as changes to Victoria's water legislation and groundwater management framework take effect and as information about groundwater resources and the impacts of climate change improves. GMW will continue to work with our customers, Traditional Owners, local communities and other stakeholders to ensure that the Plan is reviewed and updated as necessary.

GMW would like to acknowledge the input of all existing groundwater licence holders, Traditional Owners and agency representatives who have contributed to the development of this plan.



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Date: 5 August 2024

Glossary

Term/Acronym	Description
Act	Water Act 1989 (Victoria)
AHD	The reference level for groundwater levels is the Australian Height Datum (AHD), the geodetic datum for altitude measurement in Australia. It is the mean sea level for 1966-1968 and is assigned the value of zero.
Aquifer	A geological structure or formation or an artificial land fill permeated or capable of being permeated permanently or intermittently with water.
D&S	Domestic and Stock
GMA	Groundwater Management Area
GMW	Goulburn-Murray Water Rural Water Corporation acting as a delegate of the Minister
Groundwater entitlement	Licensed volume of groundwater specified as megalitres per year
Groundwater licence	Licence issued to take and use groundwater under section 51 of the Act
L/sec	Litres per second (1 L/s equals approximately 0.0864 ML/day)
m	Metre
ML	Megalitre or one million litres
PCV	Permissible Consumptive Volume is the volume of groundwater that the Minister has declared may be extracted from a defined area in a season
The Plan	The West Campaspe Groundwater Management Area local management plan
Season	Period of 12 months commencing 1 July
SOBN	State Observation Bore Network
Trade	Transfer of groundwater entitlement (see section 62 of the Act)
Zone	A part of a Groundwater Management Area defined for management purposes

Salinity Converter (DNRE 2006)

Electrical Conductivity (EC units)	Parts Per Million (PPM)
20000	12800
15000	9600
10000	6400
8000	5120
5000	3200
2000	1280
1000	640
500	320
200	128
100	64
50	32
0	0

CAUTION:

Always determine the units your salinity meter measures before using this information.

Also check your returned salinity sample letter from Goulburn-Murray Water so that you are using consistent units - it will ensure you get your conversion right every time.

SALINITY

Extreme

High

Medium

Low

Remember that EC units are expressed in micro-siemens/cm at 25°C ($\mu\text{S}/\text{cm}$) and that:

1000 EC = 1000 $\mu\text{S}/\text{cm}$ = 640 ppm = 1 dS/m

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Quick reference guide to Plan rules

Rule 1. Use of saline groundwater for irrigation (page 14)

- a) Upon receiving an application for either a new groundwater licence or transfer of a licence for irrigation purposes, GMW will refer the application to Agriculture Victoria for consideration against the Irrigation Development Guidelines (IDGs).
- b) Recommendations under the IDG's to GMW will form a cap on the volume that can be applied for at an individual property level, for irrigation purposes.
- c) Groundwater licence applications for uses involving desalination or other than irrigation will be assessed on an individual basis.
- d) Failure to implement an IDG or any other requirements for the management of saline water associated with a groundwater licence may result in suspension from use, cancellation, or non-renewal of a licence.

Rule 2. Managing entitlement limits to groundwater (page 25)

- a) Subject to rule 2(b), licence volumes from Deep Lead Resources within the Gunbower Zone are limited to 5,200 ML/year.
- b) Where an application in the Gunbower Zone arises that may exceed 5,200 ML/year, GMW will require detailed technical assessment to be undertaken at the expense of the applicant.
- c) Where an application arises near the GMA boundary, applicants may be required to undertake detailed technical investigation as part of any application.
- d) Subject to GMW's consideration of rule 2(c), applicants may be required to purchase licensed groundwater entitlement from an adjoining GMA to establish a licence.

Rule 3. Transfer of licensed entitlements to groundwater (page 26)

- a) Transfers of licensed groundwater will be limited to the consideration of "sufficient hydrological connectivity" required by the Murray Darling Basin Plan.
- b) Any person looking to purchase additional entitlement will be limited to a maximum property-based limit advised to GMW by the IDG process.
- c) Applicants may be required to undertake technical investigation in the same way as applicants to new licences if there are identified risk factors associated with the application.
- d) Any application to transfer entitlement may be referred to relevant agencies for advice, depending on the range of risks identified by the authority.

Rule 4. Monitoring groundwater use (page 27)

- a) Metering requirements will be consistent with GMW's metering policy.
- b) GMW will read flow meters on licensed bores at least once annually and record use in the Victorian Water Register.

Rule 5. Monitoring the impacts of groundwater extraction (page 31)

- a) GMW will provide information from key bores on a dedicated page on its website, including Deep Lead bore 66514, and associated Shepparton Formation Bore 66515.
- b) GMW will review the adequacy of existing groundwater level monitoring over time, as development occurs the bores may vary.
- c) Any changes to monitored salinity levels will be reported in a newsletter which will be published on a dedicated page by 15 November in each year.

1. Introduction

Goulburn-Murray Water (GMW) is responsible for managing and administering groundwater use under delegation from the Victorian Minister for Water. These responsibilities include developing and implementing local management plans.

A local management plan (LMP) is a tool developed by a Rural Water Corporation to communicate and manage risks to the groundwater resource in a defined area. An LMP's aim is to communicate the considerations that will be made by the corporation in making decisions under the *Water Act 1989* (the Act).

This LMP has been developed to provide groundwater users and potential applicants with information about how groundwater is to be managed in the West Campaspe Groundwater Management Area (the GMA). An LMP is not a Statutory Management Plan within the meaning of sections 27 to 32 of the Act, hence provides greater flexibility to adapt to changes, policies, or knowledge.

Rules in the context of an LMP should be read as how the delegate for the Minister for Water will interpret requirements of the Act when assessing applications for licences, either for bore construction or for take and use of groundwater. The Rules presented in LMPs have been developed in consultation with stakeholders and Traditional Owners.

In the case of the West Campaspe GMA, the groundwater resource is not highly developed, however this LMP has been developed to protect values within the GMA and the adjacent management areas from the potential impacts of any significant, or inappropriate development within the area. The Plan should be read in conjunction with the Act, in particular, sections 40, 51, 53, 56, 67, 68 and 71.

1.1. Why develop a Local Management Plan?

The Plan has been developed in response to an increasing interest in the use of saline groundwater resources in Northern Victoria. A rush of applications for bore construction and associated take and use licences in the Gunbower and Leitchville areas in 2020 highlighted the need for GMW to develop and communicate requirements for new licence applicants and stakeholders to ensure the sustainable and equitable management of resources.

In 2020, GMW commissioned the consultancy GHD Pty Ltd, to undertake the *Gunbower Area Hydrogeological Assessment* which highlighted the need to protect the existing productive value of groundwater in the area that is now defined as the West Campaspe GMA. The work also highlighted the need to protect neighbouring groundwater management units and protect the study area from potential groundwater level and salinisation impacts.

The Plan provides opportunity to demonstrate the use of best practice in the management and assessment of licences to stakeholders and Traditional Owners.

1.2. Local Management Plan objectives

The aim of the Plan is to provide for the equitable sharing of groundwater between licensed groundwater users as well as to protect the environment, cultural values and ensure the long-term sustainability of the groundwater resource.

To meet this aim, the following specific objectives have been developed:

- Protect social, economic, environmental and cultural groundwater dependent values, including waterways and wetlands within the GMA;

- Protect the water resources of the adjacent Lower Campaspe Valley Water Supply Protection Area (Groundwater) from potential over development of surrounding groundwater resources;
- Protect aquifers within the GMA and neighbouring groundwater management units from salinisation;
- Protect the environment and agricultural productive base from the potential impacts of saline groundwater use;
- Improve understanding of groundwater management through effective communication with Traditional Owners, groundwater users and stakeholders;
- Recognise the value of existing entitlements and agricultural development through cost effective adaptive management; and
- Develop clear and transparent rules to guide and inform both current and prospective groundwater users within the GMA.

The performance of the Plan against these objectives will be reviewed annually with any findings summarised in a newsletter that will be available to all groundwater licence holders in the West Campaspe GMA via the GMW website.

2. The West Campaspe Groundwater Management Area

The West Campaspe GMA is located in the Campaspe groundwater catchment in northern Victoria and is within the Murray Darling Basin. The GMA which covers an area of 1,695 km² extends 110 km from Huntly, north of Bendigo to Torrumbarry and Cohuna on the Murray River.

The GMA includes the townships of Huntly, Gunbower and Leitchville.

The western boundary at the time of writing is the proposed Loddon Plains GMA and the eastern boundary is the Lower Campaspe Valley (Groundwater) Water Supply Protection Area (WSPA).

The map showing the GMA is shown in Figure 1.

2.1. Traditional Owners within Plan area

The Plan boundary occurs across the area of three First Nations Groups (known for the purposes of policy as Traditional Owners) which include the following:

- Barapa Barapa
- Dja Dja Wurrung
- Yorta Yorta

Both Dja Dja Wurrung and Yorta Yorta Clans are Registered Aboriginal Parties (RAPs) under the *Aboriginal Heritage Act 2006* within the GMA. At the time of writing Barapa Barapa have an application with the Victorian Government for recognition of RAP status.

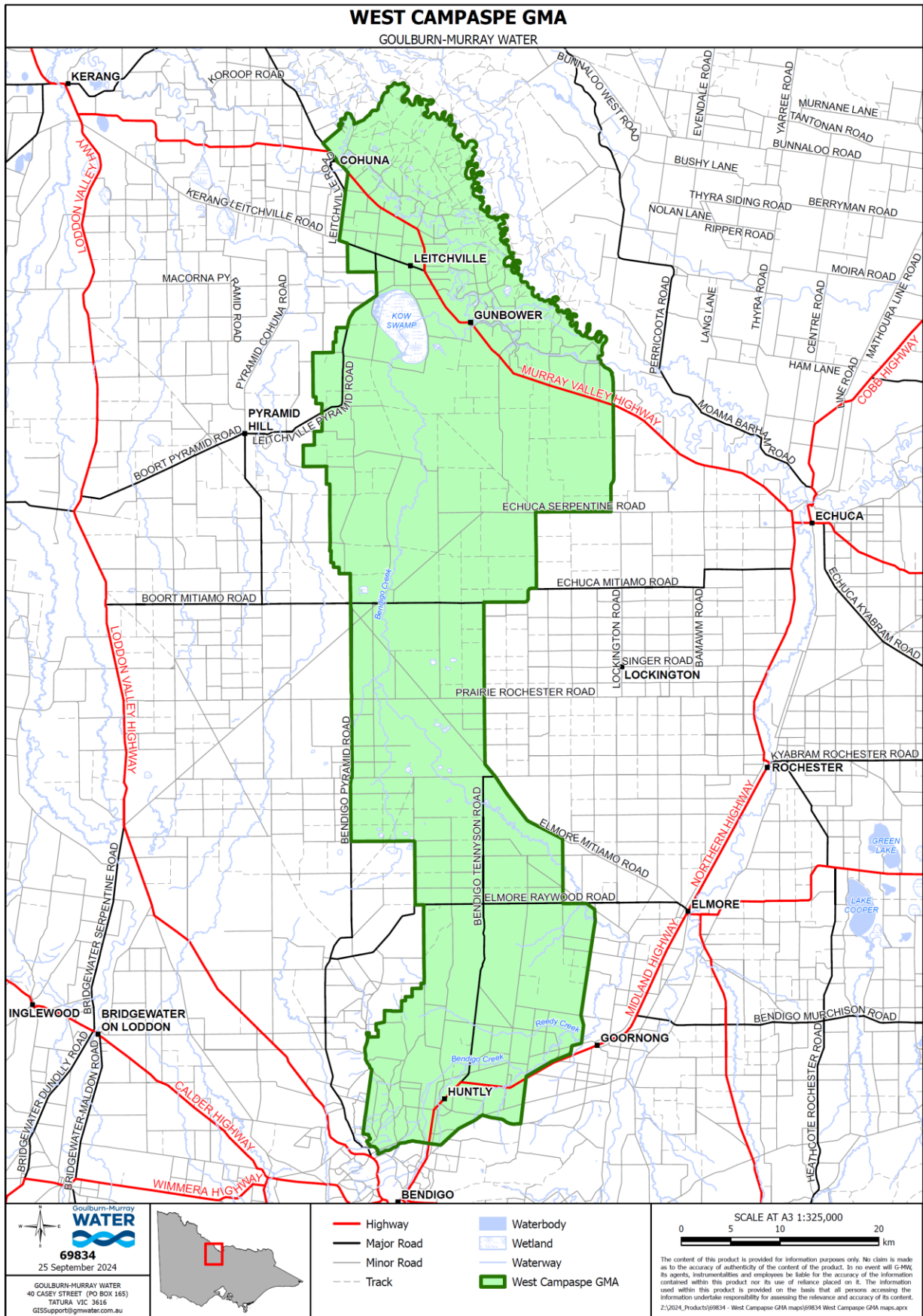


Figure 1 West Campaspe Groundwater Management Area

3. The groundwater system

Groundwater in the West Campaspe GMA flows from south to north towards the boundary of the Murray River. As the area mostly overlays significant deep alluvial deposits known as the northern Victorian sedimentary plain, flow is contributed from both the adjacent Loddon and Campaspe groundwater systems, hence both groundwater systems are hydraulically connected at depth.

Beginning in the hills of the upper Loddon and Campaspe rivers, groundwater flows progressively into the deeper sedimentary alluvial aquifer system before continuing north into the Northern Plains.

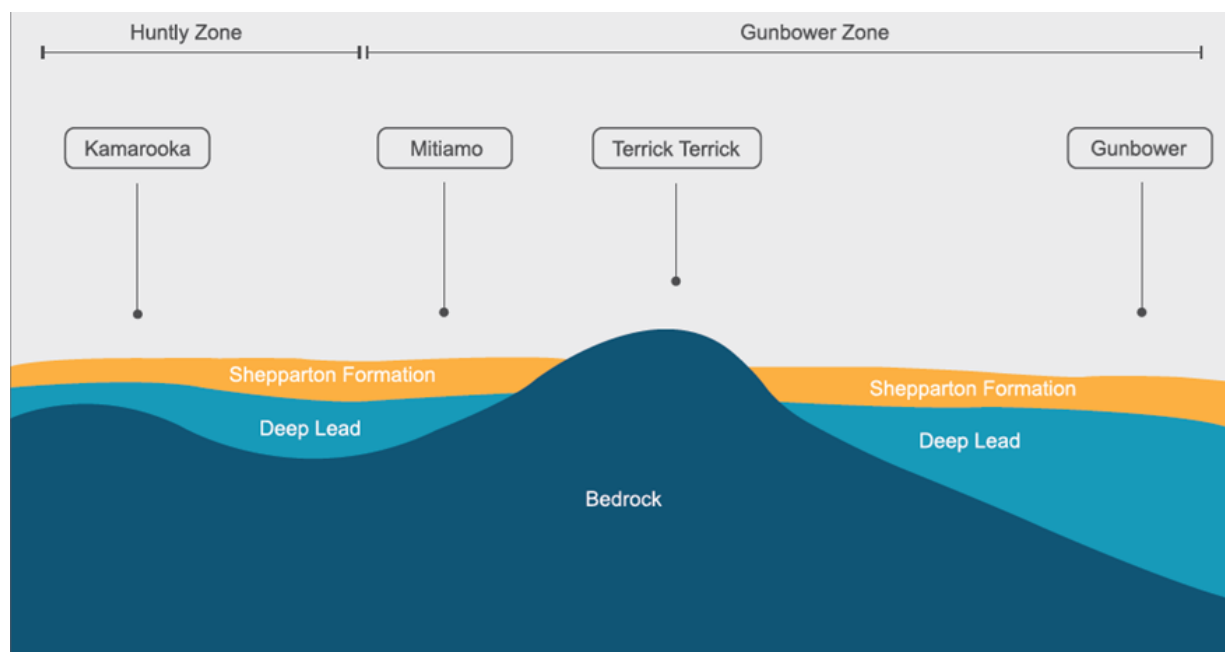


Figure 2 Generalised Aquifers and land features in the West Campaspe Groundwater Catchment

Figure 2 shows the generalised aquifer development in the West Campaspe Groundwater Catchment. Note that the figure is a simple cross section representation for illustrative purposes and is not to scale.

Aquifers may take the form of cracks known as fractures or faults (bedrock aquifers) and deeply buried layers of sands known as alluvial aquifers (Shepparton Formation and Deep Lead Aquifer).

The alluvial aquifers, which water can now move over, occur as a result of previous high energy environments which buried ancient waterways that existed many millions of years ago.

3.1. Shepparton Formation

The Shepparton Formation consists of soils and clays with lenses of sands and gravels that occur from the surface. Across the GMA, the Shepparton Formation is variable and can be as shallow as 10 m in some places however ranges from 40 m – 80 m thick on the plains. Commonly the Shepparton Formation is the thickest towards the north of the GMA but may be very thin to absent towards the mid-section of the GMA associated with elevated or exposed bedrock.

The Shepparton Formation is described as having layers of varying permeability, often incorporating formations known as shoestring sands, which may include partially old, trapped water. The Shepparton Formation is considered a moderate to low yielding aquifer and salinity recorded is greater than 3,500 mg/L but can range as low as 1,000 mg/L.

3.2. Deep Lead

The Deep Lead is a general description of deep alluvial deposits that occur at depth comprising sands and gravels overlain by clay layers. The description is applied to two aquifer formations known as the Calivil (Mid Tertiary Alluvial Aquifer) and the deeper Renmark (Lower Tertiary Alluvial Aquifer) formations which effectively operate as one system. In general, the Deep Lead can be accessed at a greater depth in the north of the GMA and shallower in the south, such as in the Huntly/Bagshot area.

The known extent and depth of the Calivil Formation aquifer is shown below in

Figure 3. The Renmark (Lower Tertiary Alluvial) aquifer is not shown on this map however covers a similar area as the Calivil Formation.

In the northern zone, the Deep Lead is present at a depth from around 90 m to 120 m and can be between 50 m to 60 m thick. The systems are overlain by thick clays which create a hydraulic separation from the overlying Shepparton Formation. In the Gunbower area, the Deep Lead aquifer thickness varies between 25 m to 75 m, with a higher yield potential. Bore yields here are known to be between 25 litres per second (~2 ML/d) and up to 50 litres per second (~4 ML/d) in some cases.

Figure 3 also shows that Deep Lead deposits are largely absent south of the Elmore-Raywood Road, however alluvial deposits are present at varying depths within the east-west connection to the existing Lower Campaspe Valley WSPA.

3.3. Bedrock Aquifer

The bedrock aquifer underlies the entire GMA, with outcropping at various locations from Kamarooka to Terrick Terrick National Park and Pyramid Hill.

The bedrock aquifer across the area has fractures, folds and fault lines which can store or transmit water. In general water held in these structures is poor yielding, often containing saline water that is unsuitable for irrigated agriculture without treatment and is often expensive to source or utilise for productive purposes.

As the Plan does not include rules associated with the take and use of water from the bedrock system, the specifics are not further discussed. The general rules established by this plan (such as use of saline water) in relation to licence applications apply to all groundwater resources.

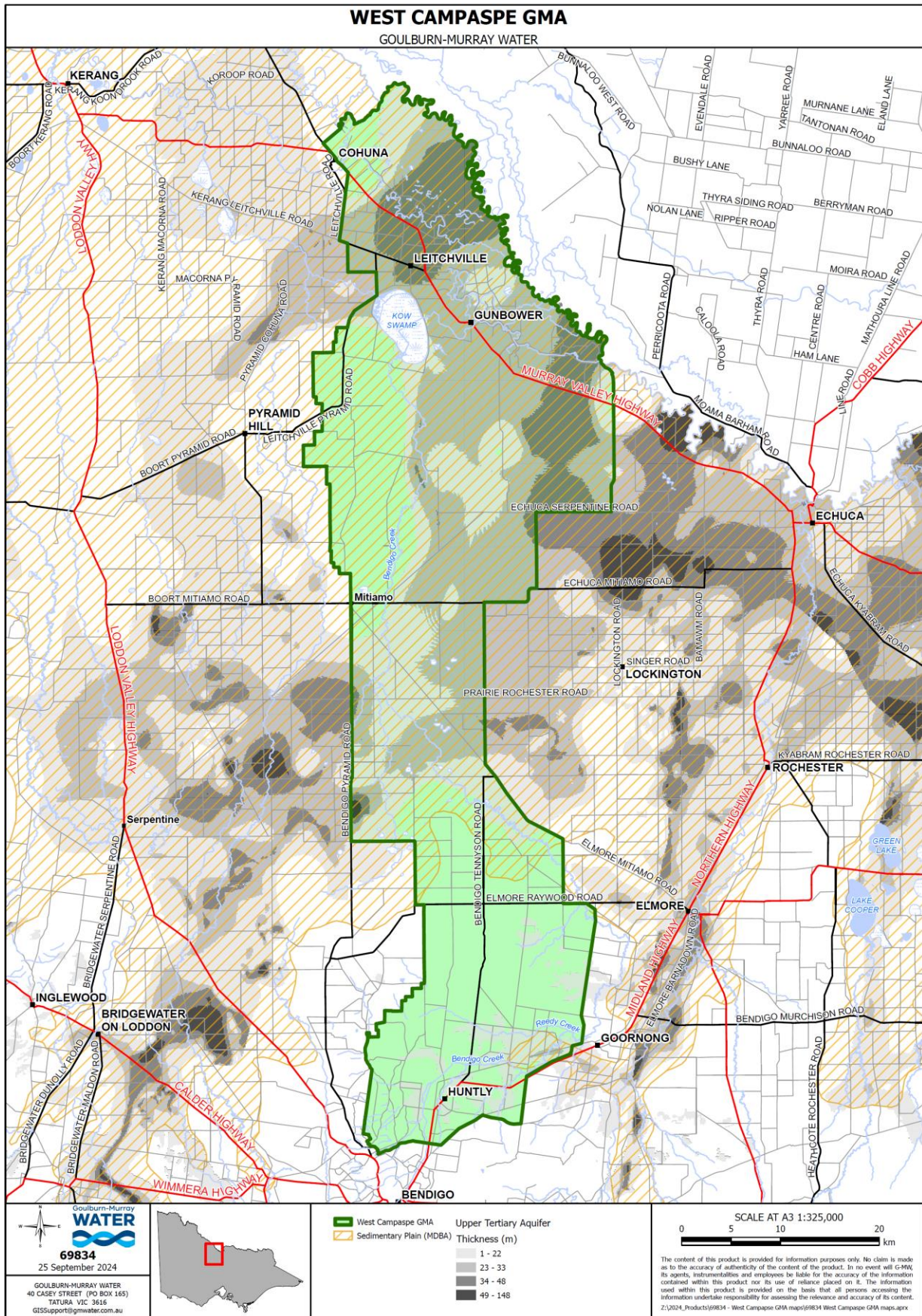


Figure 3 Thickness of Deep Lead Aquifers (Upper Tertiary Aquifer) in the West Campaspe GMA

4. Groundwater salinity

Salinity can be variable across the GMA, both within the Deep Lead and Shepparton formations. The salinity across the GMA is generally considered to be too high to irrigate with as a primary source without the removal of salts or mixing with other water in a practice known as shandyng. Salinities measured within the Deep Lead systems range from 4,700 mg/l (about 8,600 $\mu\text{S}/\text{cm}$) around Leitchville and have been recorded as high as 9,600 mg/l (up to 15,000 $\mu\text{S}/\text{cm}$) in the Bagshot and Huntly area near Bendigo.

Areas of salinity higher than 13,000 mg/L (approximately 20,000 $\mu\text{S}/\text{cm}$) have been measured within the Calivil Formation at the fringes of the Terrick Terrick Ranges in proximity to the Gunbower and Leitchville areas. A detailed examination of salinity across the GMA can be found in the *Gunbower Area Hydrogeological Assessment*, by GHD (2020) which is available on the GMW website.

The cumulative impacts of groundwater pumping in an area can result in a reduction in pressure in the aquifer which leads to a drawdown in groundwater levels. Significant reductions in groundwater pressures, particularly in Deep Lead aquifers can be transmitted over large areas and if excessive, can result in highly saline groundwater moving into areas from where it is otherwise prevented under pre-extraction conditions.

Changes to the salinity of large aquifer systems such as the Deep Leads are mostly irreversible, therefore a precautionary approach to the level of entitlement granted is required to ensure the maintenance of the resource for future generations.

Note: Licensed groundwater users who would like to test their groundwater for salinity, can contact GMW to request a sample bottle. GMW will test the sample and provide results.

4.1. Use of saline groundwater

In assessing an application for a new groundwater licence, GMW must consider any potential impacts to the environment or other authorised uses of water. These considerations also extend to the potential consequence of saline water use including impacts to the sustainability of its use on agricultural production and the risk for the movement of salt through the soil profile. Impacts can include salinisation of shallow aquifers and migration of salt to neighbouring properties and other features such as waterways.

GMW partners with relevant agencies, including the North Central Catchment Management Authority (NCCMA) and Agriculture Victoria to provide advice on the potential impacts of saline water use associated with new groundwater licence applications – including the transfer of licences. The process uses the Irrigation Development Guidelines (IDGs) in which requirements for the extraction of saline water are determined by Agriculture Victoria. The result is the development of an Irrigation Development Plan (IDP) which must be implemented by the developer. The IDGs can be found on the NCCMA website.

GMW will refer new applications and/or transfers from other licence holders to Agriculture Victoria who will determine a maximum volume of groundwater that can be applied to a property. The advice received will form a cap to the total entitlement that can be considered for an individual property.

In general, in consideration of other entitlements available to the applicant, the goal will be to maintain a net applied application of saline water of no more than 800 $\mu\text{S}/\text{cm}$. Considerations which may allow for application of higher levels of salt may include on-farm works to improve management and monitoring of salt accumulation, use of water over a larger area, or with additional sources for shandyng.

Failure of a licence holder to develop or implement the requirements of an approved IDP may result in suspension from use of a licence, cancellation or non-renewal following expiration of the licence term.

The requirement to undertake the IDG process relates only to applications where saline groundwater is to be applied directly for irrigation purposes. Applications for commercial use, or those that involve desalinisation of groundwater, will be assessed on an individual basis. The complexity of these applications requires approvals for the management of desalinated brine from other agencies and are beyond the scope of this Plan. These will be dealt with on an individual basis.

Please note that irrigation with water of a salinity of 8,600 $\mu\text{S}/\text{cm}$, results in the application of approximately 4.7 tonnes of salt in each megalitre of water. For example, application of 200 ML of water of this salinity results in 940 tonnes of salt to a property in a year.

Rule 1. Use of saline groundwater for irrigation

- a) Upon receiving an application for a new groundwater licence or a transfer of a licence for irrigation purposes, GMW will refer the application to Agriculture Victoria for consideration against the Irrigation Development Guidelines (IDGs).
- b) Recommendations under the IDGs to GMW will form a cap on the volume that can be applied for at an individual property, for irrigation purposes.
- c) Groundwater licence applications for uses involving desalination or other than irrigation will be assessed on an individual basis.
- d) Failure to implement an IDP or any other requirements for the management of saline water associated with a groundwater licence may result in suspension from use, cancellation, or non-renewal of a licence.

5. Assessing licence applications

GMW conducts both a field-based inspection and a technical assessment against relevant databases to determine the likely potential for interaction for all works licence and groundwater licence applications. GMW uses qualified and experienced staff along with hydrogeological modelling tools to assess potential risks of an application. GMW may require advertising and notification requirements of potentially affected parties which may vary depending on the likely risks of the application. Where necessary, GMW refers applications to relevant agencies, or organisations to determine potential values that may be affected.

Processes used by GMW to develop a high level of confidence regarding the potential impacts of applications include:

- Site based inspections for applications, including identification of key features and risks against relevant sections of the Act;
- Advertising and notifications of applications, including opportunity for submissions from people or organisations whose interests may be affected;
- Referral to relevant agencies regarding environmental values of Groundwater Dependant Ecosystems – Compliance with the *Ministerial Guidelines for High Value Groundwater Dependant Ecosystems 2015*, or its replacement;
- Hydrogeological investigations (Groundwater Pumping Impact Assessments) with emphasis on assessing both real world and theoretical impacts to identified assets;
- Use of conservative entitlement allocations;
- Maintenance of a Pump Testing Database for Aquifer Parameters;
- Employment of qualified and experienced staff;
- Use of expert external review of applications where required;
- Use of an extensive groundwater monitoring network.

When additional information is required for GMW to make a decision, GMW will request further information from the applicant in consideration of sections 51(2)(b)(ii) of the Act, or section 67(2)(b)(ii) in the case of works (i.e. bore construction). Depending on the circumstances, this may occur at either the application for construction of a bore or at the stage of application for a new groundwater licence or transfer of entitlement (or both together).

Failure to provide required information or to a required standard will result in an application being incomplete and refused. Where risk factors have been identified that require additional analysis and interpretation of technical information, an additional fee may be required by GMW to finalise assessment of the application.

5.1. Considering impacts to values

Groundwater extraction has the potential to impact on a range of values, including environmental features such as wetlands and river flow. The potential impacts of groundwater extraction vary depending on the local geology, the aquifer that water is taken from, proximity to features, and/or the cumulative impacts of extraction. In general, groundwater taken from deep bores which target deep aquifers will have low to negligible risks to surface water features, whereas those arising from shallow bores, particularly in proximity to wetlands, waterways or other features may require complex investigation.

Groundwater from bores targeting deeper aquifers tend to be more likely to have smaller individual impacts across large areas but have different risks, such as the potential to cause long term impacts to the resource such as salinisation or other existing users targeting the same aquifer system.

Applications for groundwater to be taken from deep bores which are generally constructed to target water in Deep Lead aquifers tend to be associated with large applications to take and use groundwater to justify the high cost of bore construction.

Groundwater extraction can alter the water level within wetlands from shallow groundwater extraction by increasing leakage, or by reducing upward pressures that brings groundwater to the surface. These impacts if they occur can be seasonal or long term. Extraction near surface water features, rivers, streams, or wetlands also has the potential to impact on water resources by draining water that has been deliberately added to these systems, either for consumptive, environmental or cultural purposes from the Environmental Water Reserve, which is entitlement set aside for the environment. Water from the Environmental Water Reserve is a legal entitlement for the environment which must be protected.

Potential impacts to groundwater dependant ecosystems relate to the values maintained by groundwater, both at a local and regional scale but also potential interaction the wetland in question and the aquifer being accessed. Changes to groundwater that interacts with water features, or other aspects such as tree roots can alter vegetation communities or change the condition of wetlands.

Key considerations in determining the potential impacts on wetlands and other features affected by groundwater pumping relate to the extent of hydrogeological connection. Key variables include the source of water (targeted aquifer), clay layering, proximity and scale of extraction and the attributes of the groundwater system that affect how any impacts might occur. The potential impact of extraction from shallow bores is shown in Figure 4 below.

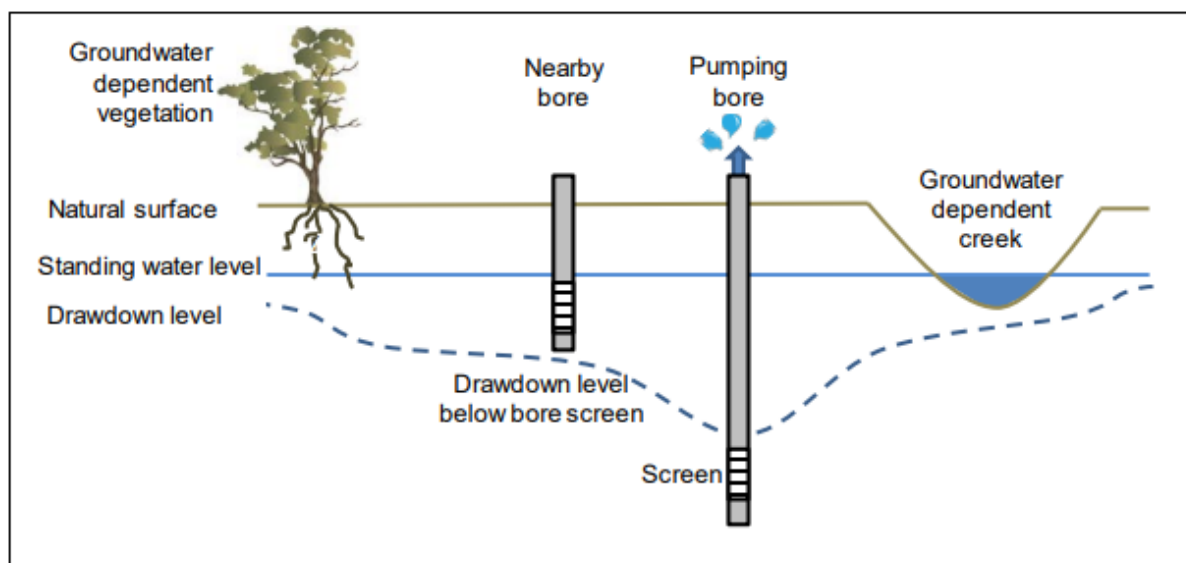


Figure 4 Potential Impact to Groundwater Dependant Values Associated with Pumping from shallow bores.

Figure 4 is a representation of how groundwater pumping lowers the groundwater level around the bore being pumped. This decline in groundwater level is referred to as a drawdown cone. The extent of drawdown depends primarily on the properties of the aquifer, as well as the pumping rate and duration. Drawdown decreases with distance from the pumping bore.

In general, groundwater taken from Deep Lead systems within the northern part of the GMA will have limited to negligible interaction with overlying wetlands across the GMA due to significant deep layering of clays that isolate groundwater in what is known as a confined aquifer system. Impacts could occur in areas of intensive extraction and/or an area where this clay layering may be less developed.

5.2. Groundwater dependent values

Groundwater Dependent Ecosystems (GDEs) are defined as ecosystems which rely in part or in full on groundwater for their existence or health. Types of GDEs include the following:

- Aquatic GDEs
- Terrestrial GDEs
- Subterranean GDEs

Aquatic GDEs are those such as gaining rivers and streams which obtain groundwater by seepage, contributing to surface water flows. These gaining streams can be observed during drought periods where surface water flows have dried with only pools of water present in the streambed. These pools are often the surface expression of groundwater and are important refuges for aquatic flora and fauna. The Murray River and Gunbower Creek have both been identified as gaining streams from groundwater in the Gunbower area (GHD, 2020).

Terrestrial GDEs are often the most obvious as groundwater supports the growth of flora species such as Eucalypts which can be either located in a riparian environment or further away from rivers and streams in stands of trees. These flora species rely on the sub-surface expression of groundwater to support their growth. Subterranean GDEs are ecosystems which exist within the aquifers and often contain unique biota that only exist underground. In consultation with groundwater users and stakeholders, various groundwater dependent values have been identified within the West Campaspe GMA. These values have informed the development of the management objectives.

The Bureau of Meteorology GDE Atlas identified that there are moderate to high potential GDEs in the Gunbower area. North of Gunbower there is high potential for groundwater interaction with Gunbower Creek, and there is a moderate potential for groundwater interaction with the Murray River (GHD 2020). Within the West Campaspe GMA there are numerous surface water features, however those such as Gow (Kow) swamp have not been classified as a GDE because of their reliance on surface water runoff from flooding and from the delivery of surface water from the irrigation channel network.

Figure 5 shows kayakers learning about cultural sites within Gunbower Forest. They also provide an economic value for irrigation and commercial purposes.



Figure 5 Kayakers enjoy learning about cultural sites such as the Wedding Tree in Gunbower Forest

5.3. Waterways and wetlands

Waterways and wetlands within the West Campaspe GMA are shown in Figure 7. The area contains numerous ephemeral wetlands, many with important environmental and cultural values. Waterways in the GMA supply water to the internationally significant Gunbower Forest which is listed under the Ramsar Convention. The Gunbower Forest Ramsar Site covers an area of 20,218 ha and includes Gunbower National Park, Gunbower State Forest, River Murray Reserve and Spence Bridge Education Area (DEPI, 2013).

The main streams are the Murray River, Gunbower Creek and Bendigo Creek which flows into Mount Hope Creek that feeds into Gow (Kow) Swamp. The GMA also contains many depressions, spatially associated with ephemeral waterways, forming periodically inundated areas.

The Murray River forms the northern boundary of the GMA and is a regulated river supplying environmental water, urban, irrigation and domestic and stock water to users. The Gunbower Creek is a natural tributary of the Murray River and flows through the floodplain of the Murray River (Figure 6).

This water system has been modified to supply irrigation water within the Torrumbarry Irrigation Area and is also a popular recreational area within the GMA.



Figure 6 Gunbower creek at Gunbower

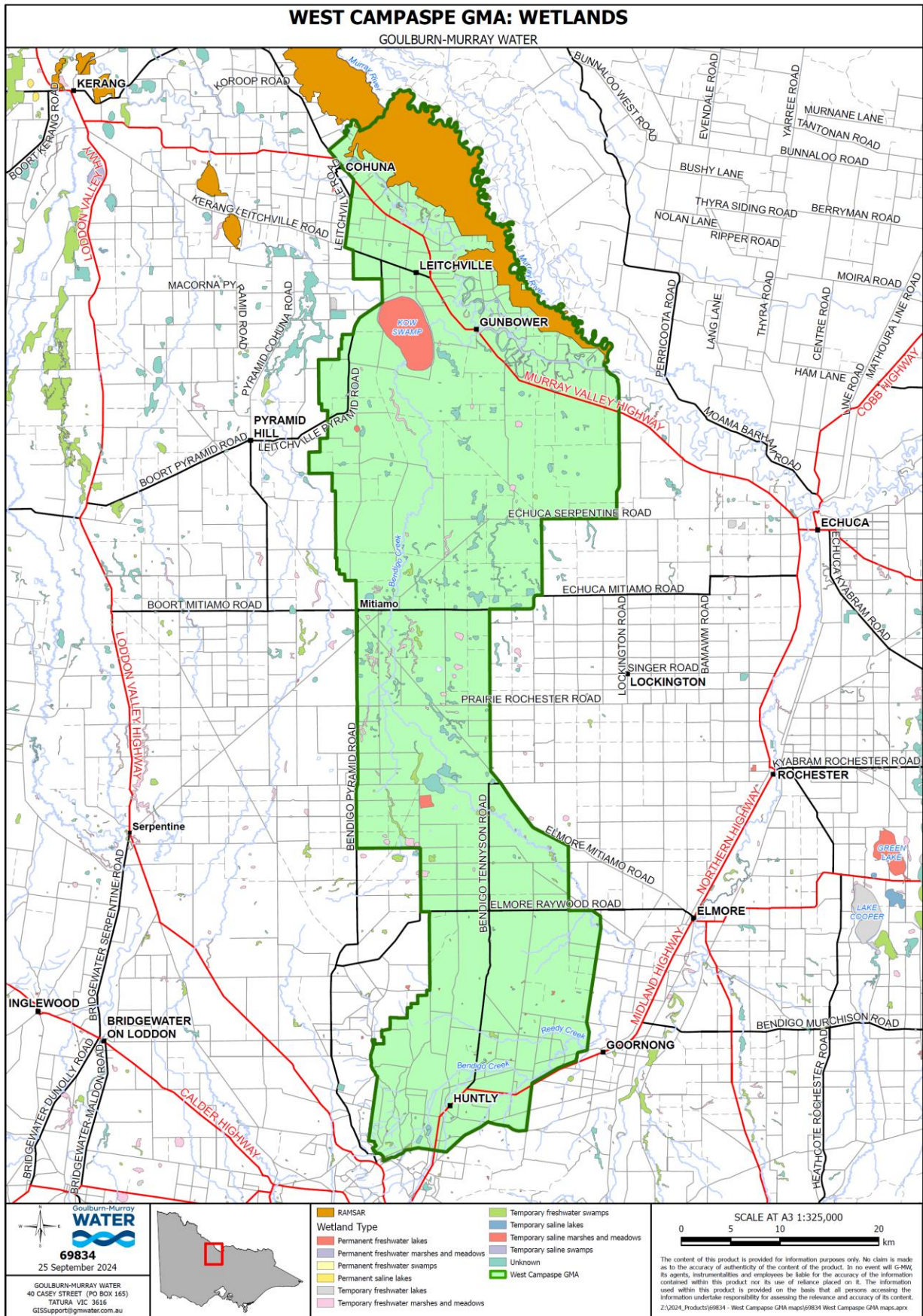


Figure 7 Wetlands and waterways in the West Campaspe GMA

5.4. Shallow groundwater licence applications

Applicants should be aware that groundwater taken from shallow groundwater systems has the highest potential to impact on water features such as wetlands, GDEs or waterways and associated cultural values.

Every application received by GMW is assessed on its merits because the circumstances of every application are different. This means the nature of the proposed extraction, including, distance from water dependant features and other authorised users, hydrogeology, volumes sought and their intended use. Similar considerations apply to both bore construction (section 67) and take and use applications for a licensed entitlement (section 51).

Where the hydrogeology of a site is not well understood, GMW strongly advises applicants to conduct test drilling under the supervision of a qualified hydrogeologist to inform an application for a production bore for irrigation or commercial purposes. GMW may also require the applicant to employ the services of relevant professionals to ascertain any additional information required to decide on an application, for instance, if the construction details of an existing bore intended for irrigation use are not well known.

Note: Licences to construct bores contain a minimum setback requirement from waterways or works such as irrigation channels. GMW does not include arbitrary acceptable distance criteria for applications for taking water, rather the assessment is based on a high level of understanding of the risks an individual application may pose.

Where issues are identified as part of the application process, GMW will advise applicants of potential risks in siting bores, or application for an associated licence to take and use water as part of the application process.

5.5. Consideration of impacts to cultural water values

In the development of this Plan, GMW has consulted with Traditional Owners and the NCCMA and is looking to build on the knowledge, understanding and experience of Traditional Owners.

Cultural teachings associated with water were identified through consultation as a significant value.

Wetlands within and adjacent to the GMA including the Gunbower Forest have significant environmental and cultural values. Important cultural locations are known to exist in the area include scarred trees, rock shelters, cooking mounds, shell middens and sacred burial sites (NCCMA, 2020).

It was identified that consideration of cultural values must be improved and GMW will continue to engage with the Victorian Government, Traditional Owner groups and relevant agencies to develop collaborative partnerships to support decision making and increase the quality of information sources.

GMW is committed to working with Traditional Owners in the future management of water resources, which includes achieving outcomes through *Water is Life: Traditional Owner Access to Water Roadmap* (DELWP 2022).

Water is Life, Traditional Owner Access to Water Roadmap can be viewed [here](#).

6. Management zones

The West Campaspe GMA is separated into two management zones, the Gunbower Zone (1185) and the Huntly Zone (1186).

The area south of the Elmore-Raywood Road is referred to as the Huntly Zone, which corresponds to the Murray Darling Basin Plan (MDBP) Highlands Zone. The area contains smaller Deep Lead systems orientated in an east-west direction and joins to the Lower Campaspe Valley WSPA. These lead systems are separated from the sedimentary plain to the north by an elevated area encompassing Kamarooka and the Greater Bendigo National Park.

The Huntly Zone contains a larger deep lead aquifer referred to as the Huntly Deep Lead which lies to the north of Greater Bendigo. The Huntly Deep Lead is largely separated from the Lower Campaspe Valley WSPA Deep Lead system by faulting and an associated uplift of bedrock and is known to be highly saline.

Figure 8 shows the areas where sedimentary deposits are located with the boundary of the Elmore-Raywood Road, which effectively delineates a line above where deposits of Deep Lead aquifer systems are likely to be found and corresponds to the boundary of the area defined as the Sedimentary Plain for the purposes of the MDBP's Sustainable Diversion Limits. This zone is referred to as the Gunbower Zone.

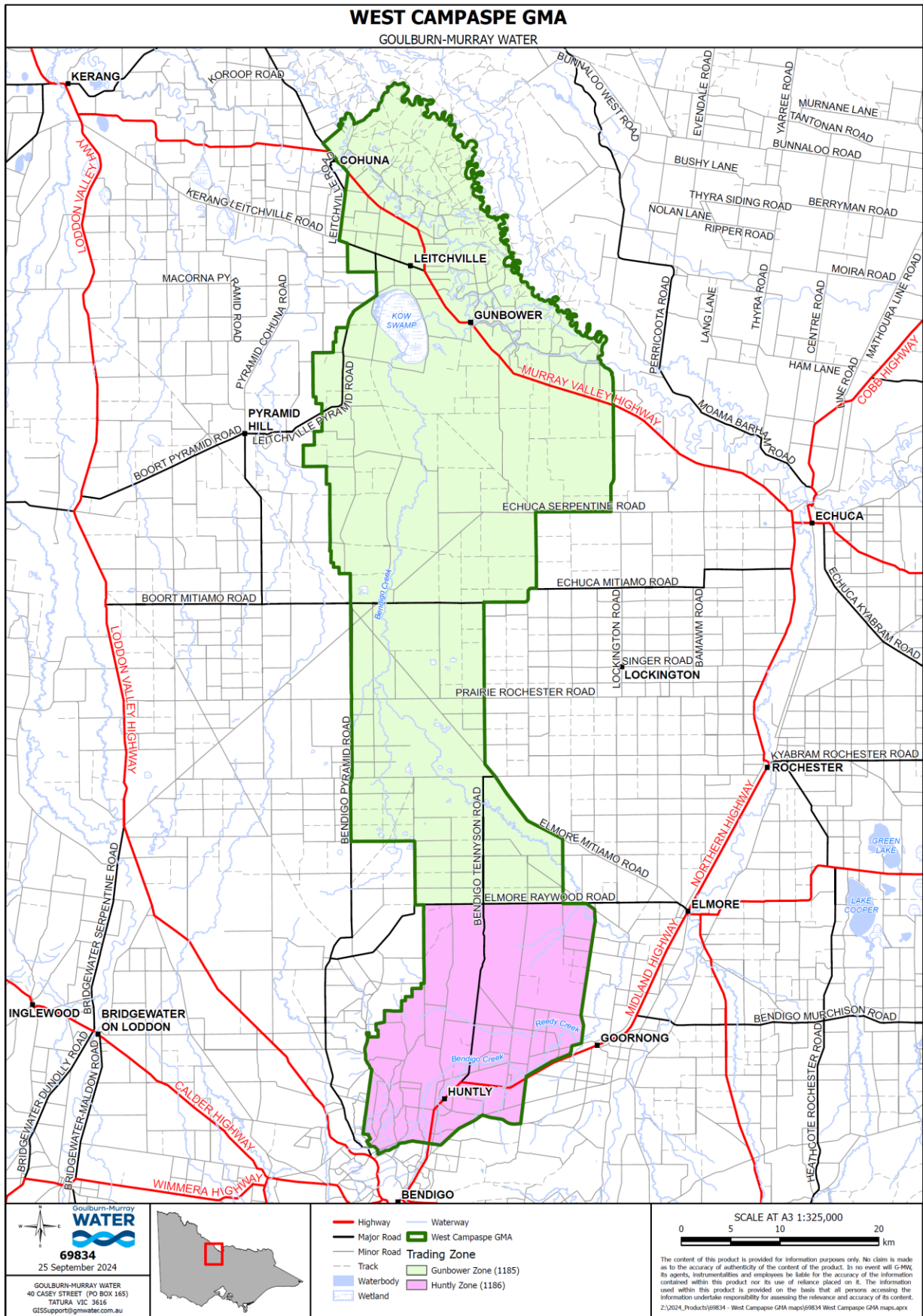


Figure 8 Gunbower and Huntly Zone boundaries

7. Managing limits to groundwater entitlements

The West Campaspe GMA covers an area adjacent to the existing Lower Campaspe Valley WSPA which is an area with high groundwater commitment levels and subject to regular restrictions to ensure sustainable management. The potential issues associated with extraction in the GMA highlight the need for conservative management to mitigate potential salinity risks, which would permanently impact the environmental, agricultural, cultural and community values associated with this groundwater resource.

At the time of writing, entitlements to groundwater total seven take and use licences, for a combined volume of 2,453 ML/year. Licences are concentrated mainly in the Gunbower and Leitchville areas of the Gunbower Zone.

In 2020 following a rapid increase in applications for groundwater licences in the Gunbower/Leitchville areas, GMW commissioned a resource assessment which was undertaken by the consultancy GHD. The assessment concluded that a licensable volume (cap) of up to 5,200 ML/year should be adopted for a study area that included most of the deep lead covering Gunbower, Leitchville to Cohuna. After careful consideration of this recommendation, GMW has adopted a precautionary approach and has adopted this value across a larger area given that much of the GMA lies directly adjacent to the Lower Campaspe Valley WSPA and represents an extension of the same deep lead aquifer system. The cap will apply to the issue of new licences from the Deep Lead aquifer system for the Gunbower Zone.

GMW considers 5,200 ML/year to be the volume above which risks of potential impacts to the adjoining Lower Campaspe Valley WSPA and aquifer salinisation increase significantly, particularly in proximity to the WSPA boundary. Applications will still be considered for licence volumes above the limit however applicants will be required to undertake significant technical assessment at their own cost. A description of the considerations required to inform decisions above the zone limit are included in the technical assessment (GHD, 2020).

7.1. Applications near the GMA boundaries

Applicants should be aware that despite the limit being reached or not, applications in proximity to the boundaries of GMA will be considered on their merits. This is to limit the potential for development to impact on existing use within the adjoining management areas. In particular, the existing Lower Campaspe Valley WSPA is already highly developed and carefully managed by GMW in accordance with the Lower Campaspe Valley WSPA (Groundwater) Management Plan 2012 and the associated Ministerially Declared Permissible Annual volume.

Applicants may be required to undertake technical work to determine the degree of interaction with neighbouring management boundaries. In some cases, this may require applicants to transfer from a licence in those areas if, in the opinion of the delegate for the Minister for Water, water resources in that area may be impacted.

No licence limit has been adopted for the shallow groundwater resource, or within the Huntly Zone. As noted previously the resource is limited and largely too saline for irrigation without significant and costly treatment. As for all applications any submission will be assessed against the potential for interaction with surface water features and will be assessed against the IDGs.

Applicants are advised that applications that might cause the Gunbower licence limit to be exceeded will be required to undertake significant technical assessment to accompany any application. The corporation requires this information to inform a decision under section 51(2) of the Water Act.

Rule 2. Managing entitlement limits to groundwater

- a) Subject to rule 2(b), licence volumes from Deep Lead Resources within the Gunbower Zone are limited to 5,200 ML/year.
- b) Where an application in the Gunbower Zone arises that may exceed 5,200 ML/year, GMW will require detailed technical assessment to be undertaken at the expense of the applicant.
- c) Where an application arises near the GMA boundary, applicants may be required to undertake detailed technical investigation as part of any application.
- d) Subject to GMW's consideration of rule 2(c), applicants may be required to purchase licensed groundwater entitlement from an adjoining groundwater management area to establish a licence.

8. Transfer of licensed groundwater entitlements

A person who owns or has an interest in land and a bore may apply to transfer licensed groundwater entitlement to, or from another person. All applications must be assessed against relevant sections of the Act, namely section 62, which references sections 53, and 40. A person may apply for a transfer either on a permanent basis, or temporarily, for up to five years.

Given the GMA is not subject to a formal cap (Permissible Consumptive Volume) under section 22 of the Act, the potential exists that the cost of applications to transfer licensed groundwater entitlement from an already licensed user may be less than purchasing new entitlement from GMW. The fee associated with the purchase of entitlement from GMW is referred to as a Capital Charge which is subject to change annually and can be found on GMW's website.

When considering the relative costs of development, potential applicants either for purchase of Capital Charge water, or that from another user, should factor in the potential costs of technical investigations. This is particularly the case if making an application in proximity to water features, other licensed users or if a property is near any of the GMA boundaries.

In addition to the matters discussed above, all applications will be assessed against the requirements of the Act and the MDBP. It should be noted that the MDBP requires that transfers only occur from areas that are hydraulically connected. This means that in most cases existing licence holders will be limited to transfer to other applicants with bores within the same aquifer system. For example, where bores access water from the Deep Lead, transfers will be limited to other users with bores accessing water from the Deep Lead. These rules will also apply similarly for licences within the Shepparton Formation or Fractured Bedrock. In most cases this will mean that transfer opportunities may be limited to transfer between licences if the existing entitlement is associated with a different aquifer system.

As has been described, the resource within the GMA is considered to be saline. This means that excessive use has the potential to impact on both the environment and agricultural production. Potential purchasers should note that applications will be assessed against a volume limit that is considered sustainable, which for most existing users has already been determined for each property through the IDG process. Assessment of a safe volume for irrigation is conducted by Agriculture Victoria, who provide advice to GMW in any licence consideration.

This means that for most existing groundwater licence holders, in general, no increase in licensed volume will be permitted. Exceptions may occur, if the circumstances of the existing licence change. For example, if there is a significant freshening of water taken from the bore, the land area that the water is to be used on is increased, or the treatment of saline water (involving the removal of salt) is incorporated into the irrigation management plans.

The assessment applicable to temporary (limited terms arrangements) or permanent transfers is the same, given the resources is saline. Advertising for all transfers will be required at the applicant's expense.

It is recommended that anyone contemplating the transfer of entitlement contact GMW to discuss opportunities and risks prior to making an application. It is strongly recommended that if a person is contemplating transferring licensed entitlement from another licence holder, that payment be made to that person subject to the outcome of GMW's assessment of any application.

Rule 3. Transfer of licensed entitlements to groundwater

- a) Transfers of licensed groundwater will be limited to the consideration of "sufficient hydrological connectivity" required by the Murray Darling Basin Plan.
- b) Any person looking to purchase additional entitlement will be limited to a maximum property-based limit advised to GMW by the IDG process.
- c) Applicants may be required to undertake technical investigation in the same way as applicants for new licences, if there are identified risk factors associated with the application.
- d) Any application to transfer entitlement may be referred to relevant agencies for advice, depending on the range of risks identified by the authority.

9. Monitoring groundwater use

Licensed bores will be metered in consideration of GMW metering policy which can be found on the GMW website. This means that currently any licence to take groundwater of 20 ML/year or more for a licensable purpose such as irrigation, commercial or industrial purposes will be metered at the applicant's expense. The type of meter and design will be determined by a Customer Service Officer who will oversee the meter purchase, installation, and ongoing maintenance and replacement of the meter. Metering may be required below the 20 ML/year threshold at the discretion of the Minister's Delegate.

All meters will be read at least once per year which will generally be at the end of the water year, this provides a start meter reading for the following season. All meter reading and usage information is recorded by GMW and entered into the Victorian Water Register.

Should licence holders use groundwater after the end of season meter reading has been taken, the onus is on the licence holder to report the new end of season meter reading otherwise the use will go against the new season.

Rule 4. Monitoring groundwater use

- a) Metering requirements will be consistent with GMW's metering policy.
- b) GMW will read flow meters on licensed bores at least once annually and record use in the Victorian Water Register.

10. Groundwater level monitoring

GMW monitors changes to groundwater levels and quality through use of bores established by the Victorian Government known as the State Observation Bore Network (SOBN).

There are 26 SOBN bores located within the West Campaspe GMA. A list of SOBN bores within the GMA is shown in Table 1.

Some of these bores are in nested sites where there are multiple bores screened at different depths and in different aquifers which allows observations to be made on aspects of aquifer management including, groundwater levels within each aquifer, hydraulic connectivity between aquifers and/or water quality including salinity.



Figure 9 Nested State Observation Bore site in the West Campaspe GMA showing bores that monitor different aquifer layers.

The observation bores are either monitored on a monthly, quarterly or hourly basis via telemetering. Baseline information is available for a number of bores which is sufficient for monitoring any long-term changes to the groundwater resource within the GMA.

The spatial and depth distribution of the existing monitoring network provides the opportunity to monitor changes across the GMA including depth to groundwater levels and where necessary, water quality parameters such as salinity.

GMW will review monitoring coverage on an as needs basis, to address any change in risks, including with any new development. This process will ensure that available funds are spent on the highest priority concerns which can be used to inform management outcomes associated with the use of groundwater.

GMW will report each year on the bores shaded in the table below and hydrographs will be located on a dedicated West Campaspe GMA webpage.

Table 1 State Observation Bores within the West Campaspe GMA (key bores shaded)

SOBN Bore	Depth (m)	Screened Level (m)	Monitoring Status	Aquifer	Nested with
66514	178	116.2 - 123.5	Active	Deep Lead (Calivil)	66515
66515	17.5	7 - 14	Active	Shepparton Formation	66514
87806	196.6	156.0 - 162	Active	Deep Lead (Renmark)	87807, 87808, 87809
87807	135.35	122 - 128	Active	Deep Lead (Calivil)	87806, 87808, 87809
87808	62	50 - 60	Active	Shepparton Formation	87806, 87807, 87809
87809	20	12 - 15 m	Active	Shepparton Formation	87806, 87807, 87808
87810	133.9	96.85 - 99.85	Active	Deep Lead (Renmark)	87811
87811	17.5	4 - 16	Inactive	Shepparton Formation	87810
97152	145	107 - 110.3	Inactive	Deep Lead (Calivil)	97153
97153	20.5	11.5 - 17.5	Inactive	Shepparton Formation	97152
95039	12.5	7.5 - 12.5	Inactive	Shepparton Formation	95038
95038	157	86.7 - 90.05	Inactive	Deep Lead (Calivil)	95039
95040	120	82.5 - 85.5	Active	Deep Lead (Calivil)	95041, 95042
95041	75	66 - 69	Active	Deep Lead (Calivil)	95040, 95042
95042	28	20 - 26	Active	Shepparton Formation	95040, 95041
97150	147.7	75.0 - 81.0	Inactive	Deep Lead (Calivil)	97151
97151	22.5	15.0 - 20.0	Inactive	Shepparton Formation	97150
100503	155	65.73 - 69.0	Active	Shepparton Formation	100504, 100505
100504	23	17 - 23	Active	Shepparton Formation	100503, 100505
100505	7	65.73 - 69	Active	Shepparton Formation	100503, 100504
68963	84	66 - 84	Active	Shepparton Formation	68964
68964	10	3 - 7	Active	Shepparton Formation	68963
65873	45	35 - 39	Inactive	Shepparton Formation	65874
65874	9	7 - 8	Active	Shepparton Formation	65873
79723	86.6	64.52 - 69.62	Inactive	Shepparton Formation	79724
79724	12	7.5 - 10.5	Active	Shepparton Formation	79723

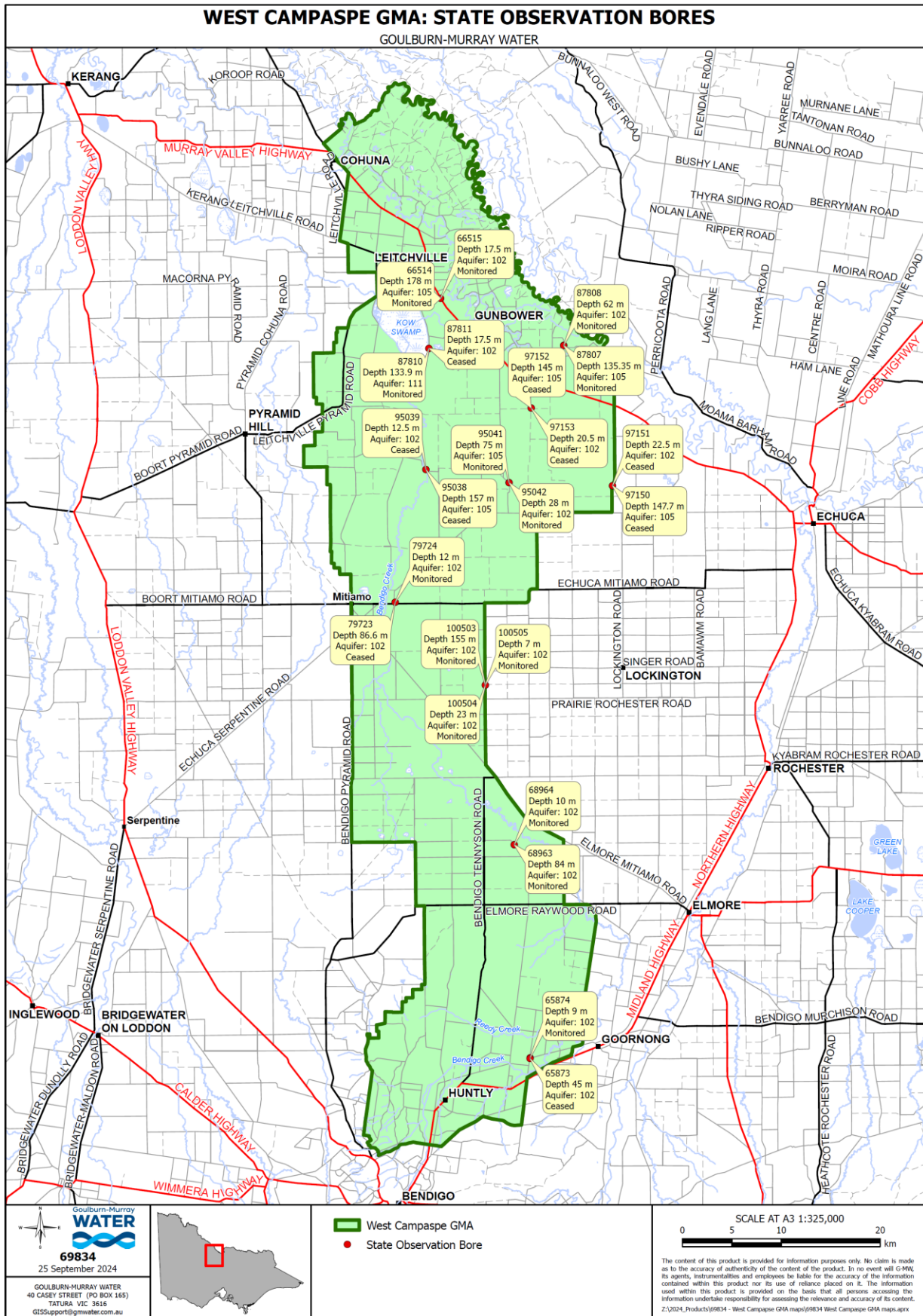


Figure 10 Location and depth of State Observation Bores in the West Campaspe GMA

The nested sites at the intersection of the Murray Valley Highway near Hancock’s Road at Gunbower are the most suitable bores to monitor groundwater levels in the northern area of the GMA, being close to existing licensed groundwater users.

Each of the Deep Lead bores identified in Table 1 have associated monitored bores screened in the Shepparton Formation (nested bores), which can also be used to determine if impacts from Deep Lead pumping also occurs in the shallower aquifers.

Initially, GMW will concentrate on monitoring and reporting of groundwater levels within the shaded key bores identified in Table 1.

Figure 11 shows groundwater levels recorded from nested SOBNS bores 66514 and 66515. Both bores are currently telemetered sites which capture hourly changes in levels. The minor increase in levels post July 2022 was a result of large-scale flooding.

Note: Bores under the SOBNS network are subject to regular assessment and replaced periodically or rationalised based on need. This may result in the need to alter the list of monitored bores. GMW will consult with the Victorian Government on any proposed changes and/or explain any changes in an annual newsletter on GMW’s website. GMW may also add additional bores depending on where any development occurs, particularly if at significant scale.

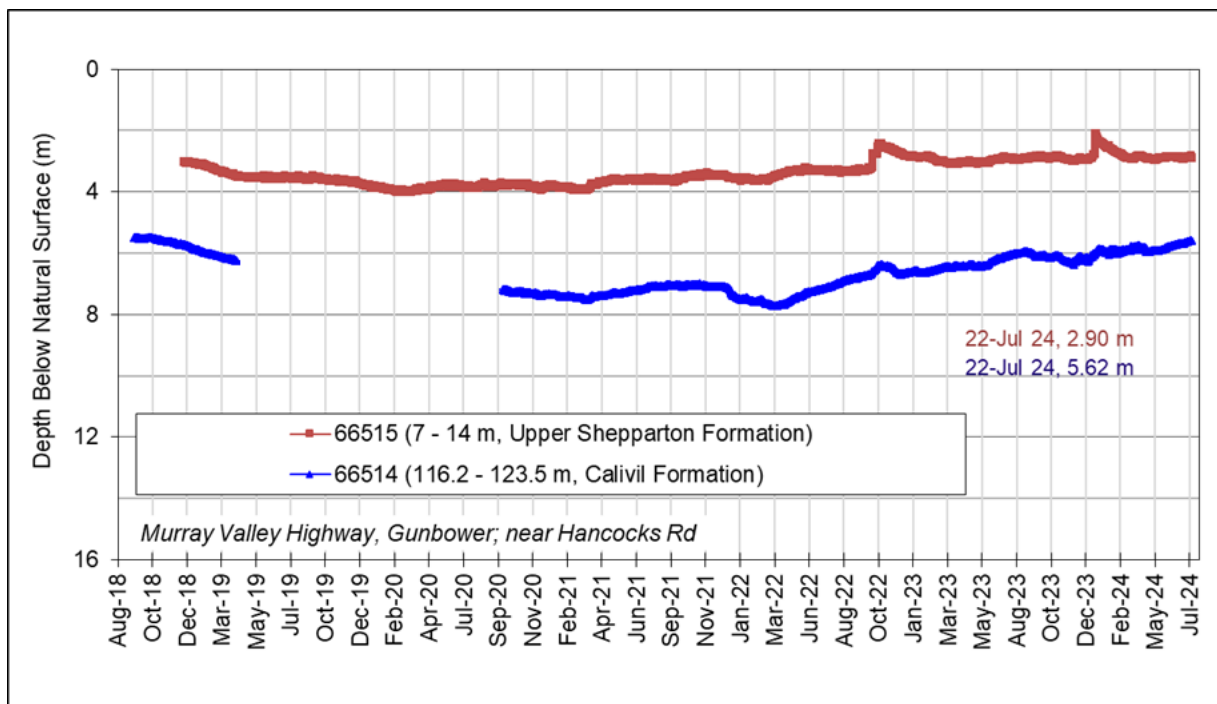


Figure 11 Groundwater levels recorded from monitoring bores 66514 and 66515.

Rule 5. Monitoring the impacts of groundwater extraction

- a) GMW will provide information from key bores on a dedicated page on its website, including Deep Lead bore 66514, and associated Shepparton Formation Bore 66515.
- b) GMW will review the adequacy of existing groundwater level monitoring over time, as development occurs the bores may vary.
- c) Any changes to monitored salinity levels will be reported in a newsletter which will be published on a dedicated page by 15 November in each year.

11. Groundwater salinity monitoring

GMW commenced monitoring water quality of SOBn bore 66514 in 2020 located on the Murray Valley Highway near Hancock's Road at Gunbower. GMW will continue to monitor groundwater salinity from this bore on an annual basis and will investigate further should water quality improve or decline. As at 15 November 2023, the salinity of this bore was measured at 6,033 $\mu\text{S}/\text{cm}$, approximately 3,943 mg/L.

Groundwater quality in private bores located between the Murray River and Gunbower Creek have been reported to be fresher, between 1,000 to 3,500 mg/L TDS which is likely a result of Deep Lead aquifer receiving recharge from the overlying Shepparton Formation, which in turn receives recharge from the Murray River during high flow and flooding events. This is consistent with the process described in GHD 2020. GMW will continue to monitor for any changes to salinity levels and include monitoring results in an annual newsletter.

Additional bores may be added to the monitoring network for regular monitoring against the plan, depending on the patterns of development that occur over time in the GMA. The monitoring of additional bores will be undertaken at GMW's discretion.

A simple salinity converter table can be seen on page 4, this may assist comparing EC to PPM measurements. Other calculators for other units can be found online, please contact GMW if you require any assistance to understand salinity measurements.

12. Plan implementation and reporting

The West Campaspe GMA LMP is effective immediately from the time the final version is published on the GMW website.

An annual newsletter will be completed at the end of each water year and will be posted on the GMW website prior to 15 November each year. This newsletter will detail the previous water year's licence volume, use and groundwater monitoring program.

13. Plan review and amendment

Although GMW has used its best efforts to produce an initial plan for implementation in the GMA, GMW acknowledges that large scale groundwater use in the area is relatively untested. As outlined in this document GMW is undertaking a range of monitoring to inform how the system behaves over time within what is considered to be a reasonable level of risk and what this may mean for management.

Many aspects of the Plan can be considered as benchmarks to assess change. Similarly, changes to policies, legislation or other matters that may impact on the Plan may need to be incorporated over time.

GMW will review available monitoring information and relevant policy over time. Any matters that may indicate a need for change will be highlighted where possible in an annual review through the Annual Newsletter mentioned above. Any proposed changes to rules will involve consultation with licence holders, customer committees and the broader community prior to implementation.

14. References

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