GROUNDWATER SUSTAINABLE YIELD ASSESSMENT: METHODOLOGY REPORT

Part 7 Sustainable Yield Synthesis paper – Semi-confined Aquifers Synthesis Approach (DEECA)

Energy, Environment and Climate Action

Acknowledgements

The Sustainable Yield Assessment for Victoria was undertaken by DEECA in collaboration with Southern Rural Water, Goulburn–Murray Water, Grampians Wimmera Mallee Water and Lower Murray water corporations.

A technical advisory panel provided specialist advice in the development of the assessment method. The panel comprised specialists from Deakin University (Prof. Wendy Timms), Jacobs (Dr Richard Evans) and HydroGeoLogic (Mr Hugh Middlemis).

The assessment was completed with contributions from external industry specialists, who developed the technical details of the methodology and carried out assessments of groundwater resources. These included Jacobs Pty Ltd, GHD Pty Ltd, CDM Smith Pty Ltd, HARC Pty Ltd and Monash University (Dr Tim Peterson).

Authors

Groundwater Assessment and Modelling team, Water Resources Strategy, Department of Energy, Environment and Climate Action. 8 Nicolson Street, East Melbourne 3002.

Editor

Scientel Pty Ltd, 8 Latrobe Street, Melbourne 3000

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it.

We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

DEECA is committed to genuinely partnering with Victorian Traditional Owners and Victoria's Aboriginal community to progress their aspirations.

ISBN 978-1-76176-767-8 (Pdf/Online/MS Word)

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About this report

This report outlines the technical approach and methodology of the Sustainable Yield (SY) project. The Victorian Department of Energy, Environment, and Climate Action (DEECA) developed the methodology in partnership with:

- Contractors Jacobs, GHD Pty Ltd and CDM Smith, who were responsible for developing the technical aspects of the methodology and conducting assessments of groundwater resources.
- Representatives from Southern Rural Water Corporation, Goulburn-Murray Rural Water Corporation, Grampians Wimmera Mallee Rural Water Corporation, and the DEECA Environmental Waterways and Water Licensing Policy teams, who possessed extensive experience and expertise in water and groundwater resource management and policy, and offered advice on technical, management and policy aspects of the project.
- A technical review panel, consisting of 3 subject matter experts in groundwater assessment and modelling, who provided expert peer review of the methodologies.

The methodology was developed in stages so that assessments could be undertaken in parallel with the methodology refinement. This enabled DEECA to meet the project completion date of June 2024. The methodology is described and reported in 8 parts:

- Part 1: Methodology overview
- Part 2: Confined aquifers – throughflow method (report by (Jacobs, 2024))
- Part 3: Confined aquifers – drawdown-use method (report by (GHD Pty Ltd, 2024))
- Part 4: Unconfined aquifers – recharge estimation and drawdown-use methods (report by (CDM Smith, 2025)
- Part 5: Sustainable Yield synthesis paper – confined aquifers synthesis approach (DEECA)
- Part 6: Sustainable Yield synthesis paper – semi-confined aquifers mapping approach (DEECA)
- Part 7: Sustainable Yield synthesis paper – semi-confined aquifers synthesis approach (DEECA) (this report)
- Part 8: Sustainable Yield synthesis paper – Mapping, Boundaries, and Naming Conventions for Confined Aquifer UAs (DEECA)

Part 1, the methodology overview provides context for the project by discussing its drivers, current resources and understanding, expected outcomes, objectives, outputs, scope, and principles for the proposed approach to the methodology.

Parts 2 to 8 of the methodology provide additional details of the methods. Parts 2 to 4 were developed and reported on by the contractors, and parts 5 to 8 were developed by DEECA.

This paper presents Part 7 of the Methodology Report.

Summary

The DEECA conducted a statewide groundwater SY assessment to estimate sustainable yield volumes for confined and unconfined aquifers. Some aquifers in Victoria exhibit characteristics of both, classified as semi-confined aquifers, which are hydraulically connected through permeable layers and may function as a single resource.

To prevent double accounting of groundwater resources in semi-confined aquifers, we analysed Suite hydrographs (groups of monitoring bores with similar groundwater level responses) for Groundwater Management Units (GMU) and nested bores for Unincorporated Areas (UA) across Victoria to evaluate degree of connectivity. Two key parameters were used:

- **Correlation coefficient (R):** Measures groundwater level trend similarity.
- **Fluctuation ratio (FR):** Compares water level variations between upper and lower aquifers.

Based on these parameters, connectivity was classified as:

- **Highly connected:** R > 90% and 0.8 < FR < 1.2
- **Partially connected:** 60% < R < 90% and 0.4 < FR < 0.8 or 1.2 < FR < 1.6
- **No significant connection:** R < 60% and FR < 0.4 or FR > 1.6

The following principles guide SY estimation for semi-confined aquifers:

- **Highly connected aquifers** - a single SY volume based on unconfined aquifer assessment.
- **Partially connected aquifers** - a single SY volume from unconfined assessment, but further refinement is needed.
- **Aquifers with no significant connection** - separate SY volume based on respective confined or unconfined assessments.

This approach ensures more accurate and sustainable groundwater management in semi-confined aquifers across Victoria.

1. Purpose

This paper discusses an approach to estimate sustainable yield for "semi-confined" aquifers based on the methods previously developed for confined and unconfined aquifers.

2. Background

DEECA undertook a statewide assessment of groundwater sustainable yield. The primary objective of this assessment was to estimate the sustainable yield volume for both confined and unconfined aquifers across the State. Each type of aquifer shows distinctive features of groundwater level responses to recharge and pumping. Different approaches have been developed for these aquifer types to estimate sustainable yield volumes.

There are areas in Victoria where aquifers may exhibit characteristics of both confined and unconfined systems, and which may be described as semi-confined aquifers. Often, these resources are identified as distinct aquifers but function as a single resource.

The development of a method to estimate sustainable yield for these semi-confined aquifers is necessary to prevent the double accounting of groundwater resources. This paper addresses this issue to ensure accurate accounting and management of semi-confined aquifer groundwater resources.

Victoria's semi-confined aquifers have been previously mapped, and detailed information is available in the DEECA "Technical Method Paper - Mapping semi-confined aquifers". The outcome of this technical paper is semi-confined GMUs and UAs across the State, which are provided in the **Table 1** and **Table 2**.

Table 1. Semi-confined GMUs across the State

GMU	GMU depth range (m)	VAF layers	Target VAF and Formations
Mid Loddon	All formations below surface	Upper Layer (UL): QA, UTB, UTQA Middle Layer (ML): UTAF	UL: UTB (Newer Volcanics – highlands only) UTQA (Shepparton) ML: UTAF (Calivil)
Mid Goulburn 1070 (overlain by Shepparton I.R. GMA)	All formations from 25 metres below ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA (Shepparton I.R. GMA) UTQA (Upper Shepparton - Shepparton I.R. GMA) UTQA (Lower Shepparton - Mid Goulburn 1070 GMA) ML: UTAF	UL: UTQA (Lower Shepperton) ML: UTAF (Calivil)
Mid Goulburn 1071	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepperton) ML: UTAF (Calivil)
West Goulburn North (overlain by	All formations from 25 metres below ground surface	UL: QA (Shepparton I.R. GMA)	UL: UTQA (Lower Shepperton) ML: UTAF (Calivil)

GMU	GMU depth range (m)	VAF layers	Target VAF and Formations
Shepparton I.R. GMA)		UTQA (Upper Shepparton - Shepparton I.R. GMA) UTQA (Lower Shepparton - West Goulburn North GMA) ML: UTAF	
Lower Campaspe Valley	All formations below the surface with the exception of all formations from the surface to 25 metres below the surface north of the Waranga West Channel	UL: QA, UTB, UTQA ML: UTAF	UL: UTB (Newer Volcanics – highlands only), UTQA (Shepparton) ML: UTAF (Calivil)
Broken	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)
Lower Ovens	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)
Kiewa	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)

Table 2. Semi-confined UAs across the State

UA	UA depth range (m)	Available VAF layers	Target VAF and Formations
North of Mid Loddon (UTAF-NE2)	All formations below the surface	UP: QA, UTQA ML: UTAM, UTAF	UP: UTQA (Shepparton) ML: UTAM (Parilla Sand), UTAF (Calivil)
West of Mid Loddon (UTAF-NE1)	All formations below the surface	UP: QA, UTQA ML: UTAM, UTAF	UP: UTQA (Shepparton) ML: UTAM (Parilla Sand), UTAF (Calivil)
Northwest Port Philip (UTAF-PP1)	All formations below the surface	UL: QA, UTB ML: UTAF, UMTD	UL: UTB (Newer Volcanics) ML: UTAF (Brighton Group)

3. Degree of connectivity of semi-confined aquifers

A semi-confined aquifer is an aquifer that is hydraulically connected to an underlying aquifer through a permeable layer, such as clay lenses, an aquitard, or fractures in the confining layer. The overlying aquifer may be either unconfined or confined. We assessed Suite hydrographs/nested bores in upper and middle layers of the Victorian Aquifer Framework (VAF) to understand the connectivity degree of semi-confined aquifers (as shown in **Table 3**). The VAF is vertically divided into four layers.

The degree of connectivity for semi-confined aquifers is primarily determined by analysing two key parameters: trend similarity and magnitude of fluctuations observed in Suite hydrographs/nested bores. These parameters are used both visually and quantitatively to assess the connectivity between upper and middle aquifers in semi-confined GMUs and UAs.

Hydrographs of the upper and middle aquifers are visually examined to compare trends over time, which helps identify connectivity. Then, the R and the FR are calculated to quantify the degree of connectivity. The R is determined by calculating the correlation between the annual groundwater level time series of the upper and lower aquifers. This coefficient is used to quantify the similarity in groundwater level trends between the upper and middle aquifers over the same period. The FR is calculated by first identifying the highest and lowest groundwater levels in both aquifers on an annual basis. The fluctuation magnitude of the lower aquifer is then divided by that of the upper aquifer for each year. The average of these yearly FRs across the entire time series is considered as the FR. Suite hydrographs / nested bores were classified based on the following rules

- If R>90% and 0.8<FR<1.2, it shows highly connected semi-confined aquifers.
- If 60%<R<90% and 0.4<FR<0.8 or 1.2<FR<1.6, it shows partially connected semi-confined aquifers.
- If R<60% and 0.4>FR>1.6, it shows no significant connections between the aquifers.

Table 3. Statewide aquifers and aquitards availability across the major sedimentary basins

Layer	VAF Name	Otway Basin	Central Coast Basin	Gippsland Basin	Murray Basin – Northwest	Murray Basin – Northeast
Upper Layer (UL)	Quaternary Aquifer (QA – 100)					
	Upper Tertiary/Quaternary Basalt Aquifer (UTB – 101)			Absent	Absent	
	Upper Tertiary/Quaternary Aquifer (UTQA – 102)	Absent	Absent			
	Upper Tertiary/Quaternary Aquitard (UTQD – 103)	Absent	Absent			Absent
Middle Layer (ML)	Upper Tertiary Aquifer (Marine) (UTAM – 104)			Absent		
	Upper Tertiary Aquifer (Fluvial) (UTAF – 105)					
	Upper Tertiary Aquitard (UTD – 106)	Absent	Absent			Absent
	Upper Mid-Tertiary Aquifer (UMTA – 107)					Absent
	Upper Mid-Tertiary Aquitard (UMTD – 108)					Absent
Lower Layer (LL)	Lower Mid-Tertiary Aquifer (LMTA – 109)				Absent	Absent
	(Lower) Tertiary Basalts (LTB-112)		Absent	Absent	Absent	Absent
	Lower Mid-Tertiary Aquitard (LMTD – 110)					Absent
	(Lower) Tertiary Basalts (LTB-112)				Absent	Absent
	Lower Tertiary Aquifer (LTA – 111)					
	Lower Tertiary Basalts (LTB-112)				Absent	
Basement (BSE)	Cretaceous and Permian Sediments (CPS – 113)		Absent	Absent		
	Mesozoic and Palaeozoic Bedrock (BSE - 114)					

Table 4. Semi-confined GMUs across the State and their degree of connectivity

GMU	GMU depth range (m)	VAF layers	Target VAF and Formations	Compared Suite hydrographs	Correlation coefficient	Fluctuation ratio	Degree of connectivity
Mid Loddon	All formations below surface	Upper Layer (UL): QA, UTB, UTQA Middle Layer (ML): UTAF	UL: UTB (Newer Volcanics – highlands only) UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_K_2 ML: M_F_2	82%	1.9	Partially connected
Mid Goulburn 1070 (overlain by Shepparton I.R. GMA)	All formations from 25 metres below ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA (Shepparton I.R. GMA) UTQA (Upper Shepparton - Shepparton I.R. GMA) UTQA (Lower Shepparton - Mid Goulburn 1070 GMA) ML: UTAF	UL: UTQA (Lower Shepparton) ML: UTAF (Calivil)	UL: U_QQ_3 ML: M_I_2	46%	6.7	No significant connection
Mid Goulburn 1071	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_QQ_3 ML: No hydrograph			Not assessed – middle layer Suite hydrograph is not available

GMU	GMU depth range (m)	VAF layers	Target VAF and Formations	Compared Suite hydrographs	Correlation coefficient	Fluctuation ratio	Degree of connectivity
West Goulburn North (overlain by Shepparton I.R. GMA)	All formations from 25 metres below ground surface	UL: QA (Shepparton I.R. GMA) UTQA (Upper Shepparton - Shepparton I.R. GMA) UTQA (Lower Shepparton - West Goulburn North GMA) ML: UTAF	UL: UTQA (Lower Shepperton) ML: UTAF (Calivil)	UL: U_Q_3 (Shepparton I.R. GMA) ML: No hydrograph			Not assessed – middle layer Suite hydrograph is not available
Lower Campaspe Valley	All formations below the surface with the exception of all formations from the surface to 25 metres below the surface north of the Waranga West Channel	UL: QA, UTB, UTQA ML: UTAF	UL: UTB (Newer Volcanics – highlands only), UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_N_4 ML: M_H_1	71%	19.3	Partially connected

GMU	GMU depth range (m)	VAF layers	Target VAF and Formations	Compared Suite hydrographs	Correlation coefficient	Fluctuation ratio	Degree of connectivity
Broken	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_Q_4 U_Q_3 (Shepparton I.R. GMA) U_R_9 U_S_2 U_QQ_1 U_QQ_2 U_QQ_3 (Mid Goulburn 1070) ML: M_I_2 (Katunga) M_J_9	82%	3.2	Partially connected
Lower Ovens	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_T_1 ML: M_L_1	90%	1.1	Highly connected
Kiewa	All formations from ground surface to 50 metres into bedrock or 200 metres from the surface (whichever is the greater depth)	UL: QA, UTQA ML: UTAF	UL: UTQA (Shepparton) ML: UTAF (Calivil)	UL: U_W_1 U_W_2 ML: M_N_1	62%	0.7	Partially connected

Table 5. Semi-confined UAs across the State and their degree of connectivity

UA	UA depth range (m)	Available VAF layers	Target VAF and Formations	Available Suites	Available nested bores hydrographs	Degree of connection
North of Mid Loddon (UTAF-NE2)	All formations below the surface	UP: QA, UTQA ML: UTAM, UTAF	UP: UTQA (Shepparton) ML: UTAM (Parilla Sand), UTAF (Calivil)	UP: U_K_3, U_K_4, U_K_5, U_K_6, U_N_5, U_N_3, U_N_4, U_O_9, U_P_1 ML: M_H_3, M_F_3, M_F_4, M_G_8	(97151 [UTQA], 97150 [UTAF]) (87808 [UTQA], 878089 [UTQA], 87807 [UTAF], 87806 [LTA]) (76762 [UTQA], 76761 [UTAF], 76760 [LTA]) (66515 [UTQA], 66514 [UTAF])	Partially connected
West of Mid Loddon (UTAF-NE1)	All formations below the surface	UP: QA, UTQA ML: UTAM, UTAF	UP: UTQA (Shepparton) ML: UTAM (Parilla Sand), UTAF (Calivil)	UP: U_BB_9, U_H_9, U_J_2, U_K_4, U_L_8 ML: M_F_4	(50977 [UTQA], 50976 [UTAF])	Highly connected
Northwest Port Philip (UTAF-PP1)	All formations below the surface	UL: QA, UTB ML: UTAF, UMTD	UL: UTB (Newer Volcanics) ML: UTAF (Brighton Group)	UP: U_AO_1, U_AO_3, U_AP_1, U_AP_2, U_AR_1 ML: No Suite	There is a lack of nested bores covering different VAF layers.	It is not assessed.

Hydrographs of two semi-confined aquifers showing partial and high degrees of connectivity are presented in **Table 6** and **Table 7** as examples. The hydrographs of the other GMUs and UAs are provided in **Appendix 1** and **Appendix 2**, respectively. According to **Table 6**, the hydrographs of the upper and middle layers of Lower Ovens Groundwater Management Area (GMA) show nearly identical trends and similar magnitudes of fluctuations. This visual inspection is supported by quantified measures, with a R of 90% and a FR of 1.1, indicating a high degree of connectivity. According to **Table 7**, the hydrographs of the upper and middle layers of Mid Loddon GMA show similar but not identical trends, and the middle aquifer exhibits different fluctuations compared to the upper aquifer. This visual inspection is supported by quantified measures, with a R of 82% and a FR of 1.9, indicating a partial degree of connectivity.

Table 6. Example of the highly connected semi-confined aquifer – Lower Ovens GMA

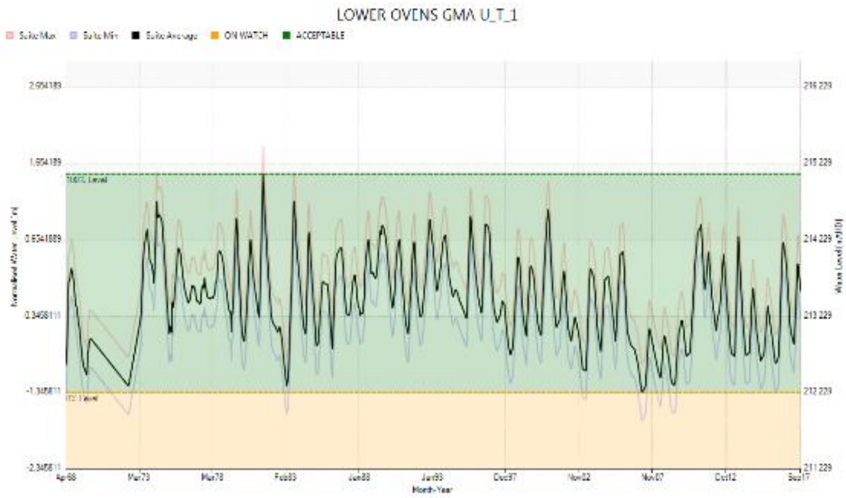
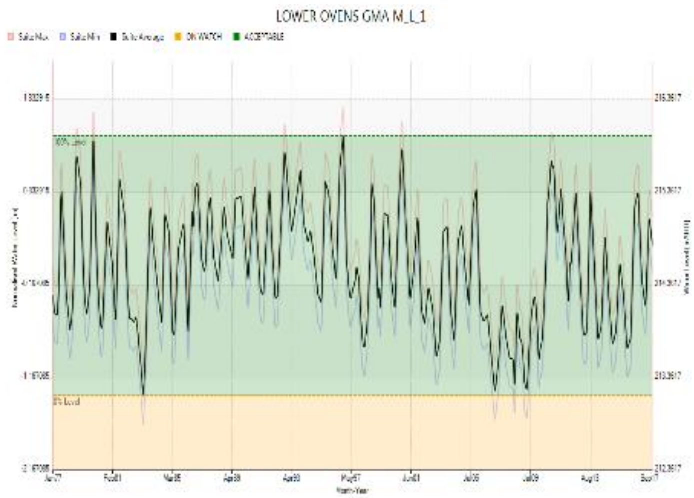
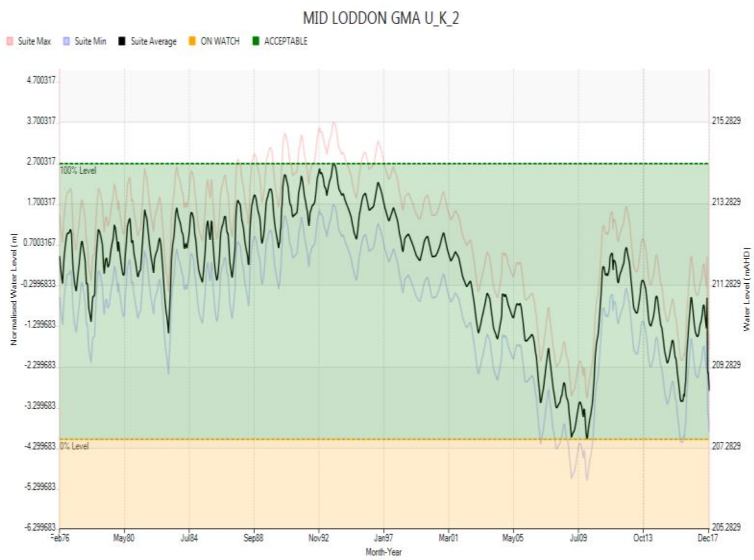
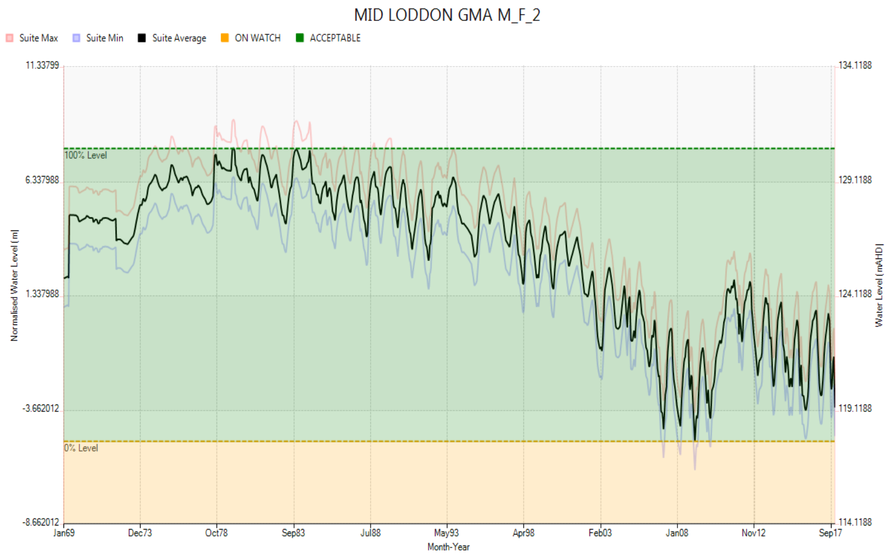
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	

Table 7. Example of the partially connected semi-confined aquifer – Mid Loddon GMA

<table>
<tr><th>VAF Layer</th><th>Suite Hydrograph</th></tr>
<tr><td>Upper layer</td><td>
</td></tr>
<tr><td>Middle layer</td><td>
</td></tr>
</table>

4. Synthesis approach for estimating sustainable yield volume in semi-confined aquifers

For the purposes of estimating sustainable yield for the semi-confined aquifers to prevent the double accounting of groundwater resources the following principles are applied:

1. Semi-confined aquifers that are highly connected (R>90% and 0.8<FR<1.2), a single sustainable yield volume is proposed for both aquifers based on unconfined assessment.
2. Semi-confined aquifers that show no significant connections between the aquifers (R<60% and 0.4>FR>1.6) have separate sustainable yield for each aquifer based the assessment method for the respective aquifer.
3. Semi-confined aquifers that are partially connected (60%<R<90% and 0.4<FR<0.8 or 1.2<FR<1.6), a single sustainable yield volume is proposed based on the unconfined aquifer assessment for both aquifers. However, it is acknowledged that further investigation is needed to refine the sustainable yield estimation if independent sustainable yield volumes are required for each aquifer.

4.1. Highly connected semi-confined aquifers

The significant hydraulic connection between the upper unconfined and lower confined aquifers suggests that recharge from the unconfined aquifer is the primary source of groundwater for both layers. The throughflow of the confined aquifer maybe indicative of the recharge from rainfall. As a result, estimating a sustainable yield volume for each aquifer based on unconfined assessment method and for the confined aquifer based on the confined assessment method may overestimate (double account) the available resource for the confined aquifer. Therefore, to avoid the potential for double accounting the Semi-confined aquifers that are highly connected (R>90% and 0.8<FR<1.2) a single sustainable yield volume is proposed for both aquifers based on assessment method for the unconfined aquifer.

4.2. Semi-confined aquifers with no significant connections

Semi-confined aquifers with no significant connections between the unconfined and confined aquifers exhibit weak hydraulic connectivity. The potential for double accounting is minimal. Therefore, the sustainable yield volume for these aquifers should be set for each aquifer separately based on the assessment method relating to the aquifer.

4.3. Partially connected semi-confined aquifers

In partially connected semi-confined aquifers, inter-aquifer flow can occur, introducing the potential for double accounting, though to a lesser extent than in highly connected systems. The complexity of quantifying this flow requires more detailed data than what is currently available through the SY Project, and further analysis is necessary. Applying either the approach used for highly connected aquifers, or the one used for aquifers with no significant connection may yield overly conservative or non-conservative sustainable yield results. Therefore, for partially connected semi-confined aquifers (60% < R < 90% and 0.4 < FR < 0.8 or 1.2 < FR < 1.6), a single sustainable yield volume is proposed based on the unconfined aquifer assessment, to prevent the potential for double accounting. However, it is acknowledged that further investigation is needed to refine the sustainable yield estimation if independent sustainable yield volumes are required for each aquifer. Given the partial connectivity, it is presumed that the sustainable yield volume of the confined aquifer is a subset of the sustainable yield volume of the unconfined aquifer. Therefore, the sustainable yield volume for these aquifers is estimated through the unconfined aquifer assessment.

5. Limitations and uncertainties of the semi-confined aquifer synthesis

The synthesis approach for estimating sustainable yield in semi-confined aquifers is based on a classification of aquifer connectivity using R and FR. While this method provides a structured framework for groundwater resource assessment, several limitations and uncertainties should be acknowledged:

4. The degree of hydraulic connectivity between upper and lower aquifers is inferred from current available monitoring bore hydrographs. However, climate variability and future extraction patterns may alter groundwater dynamics, potentially affecting the assumed degree of connectivity.
5. The classification thresholds for R and FR (e.g., R > 90% for high connectivity) are based on statistical correlations that may not fully capture complex groundwater flow dynamics.
6. Localised geological variations, such as heterogeneities in aquitard permeability, may result in inconsistencies that are not well-represented by the defined connectivity categories.
7. Current assessments do not account for potential changes in land use and groundwater demands, which could impact the assumed degree of connectivity.
8. By choosing the unconfined sustainable yield volume for partially semi-confined aquifers, the climate variability range is included in the sustainable yield volume attributed to unconfined SY assessment which may introduce additional uncertainties in the semi-confined sustainable yield volume.

References

CDM Smith. (2025). *Review Of Groundwater Sustainable Yield: Unconfined and Semi-confined Aquifers.* Melbourne: CDM Smith.

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GHD Pty Ltd. (2024). *Technical Assessment of State Wide Groundwater Sustainable Yields Confined Aquifers :Stage 2 (Statewide) report.* Melbourne: GHD Ltd Pty.

Jacobs. (2024). *Confined Aquifer Throughflow Assessment - Updated Methof and Phase B State-wide Rollout.* Melbourne: Jacobs.

Appendix 1

Suite hydrographs for the semi-confined GMUs

Table A1-1. Suite hydrographs of Mid Goulburn 1070 GMA for upper and middle layers

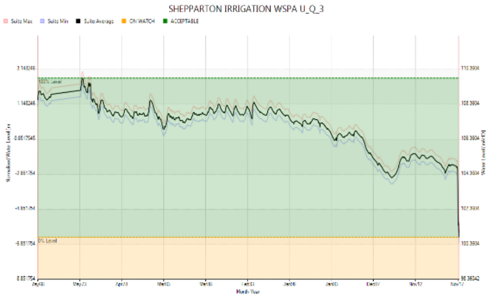
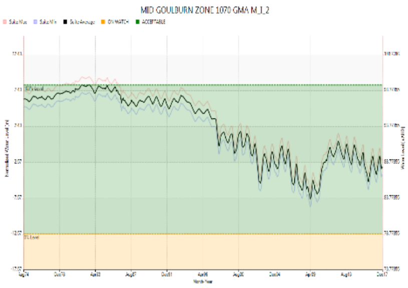
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	

Table A1-2. Suite hydrographs of Mid Goulburn 1071 GMA for upper and middle layers

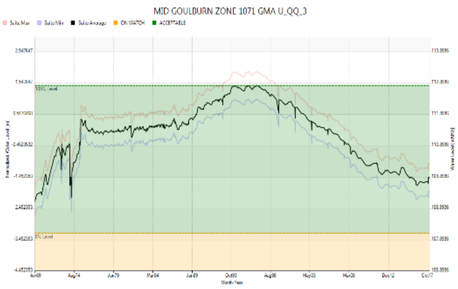
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	Not available

Table A1-3

Table A1-3. Suite hydrographs of West Goulburn North GMA for upper and middle layers

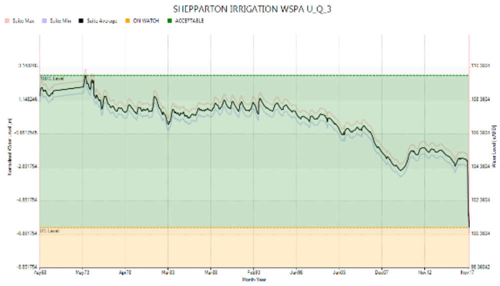
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	Not available

Table A1-4. Suite hydrographs of Lower Campaspe Valley GMA for upper and middle layers

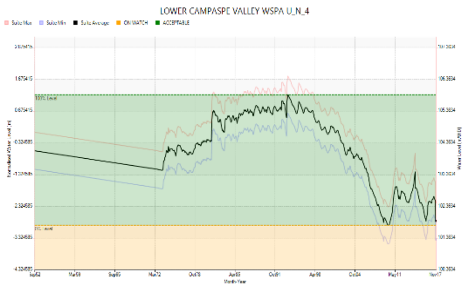
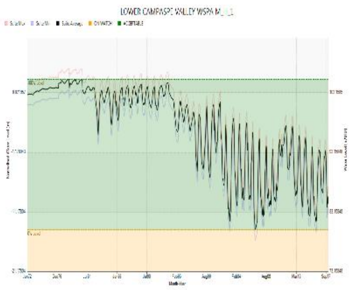
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	 

Table A1-5. Suite hydrographs of Broken GMA for upper and middle layers

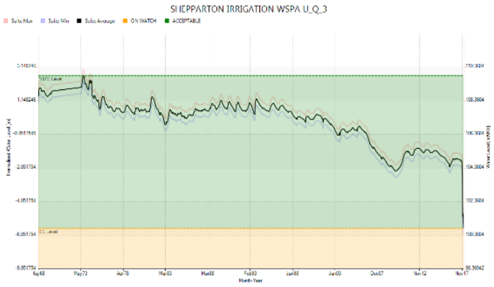
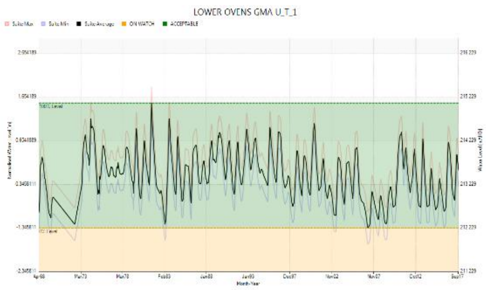
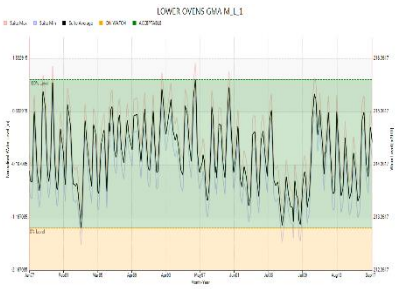
VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	

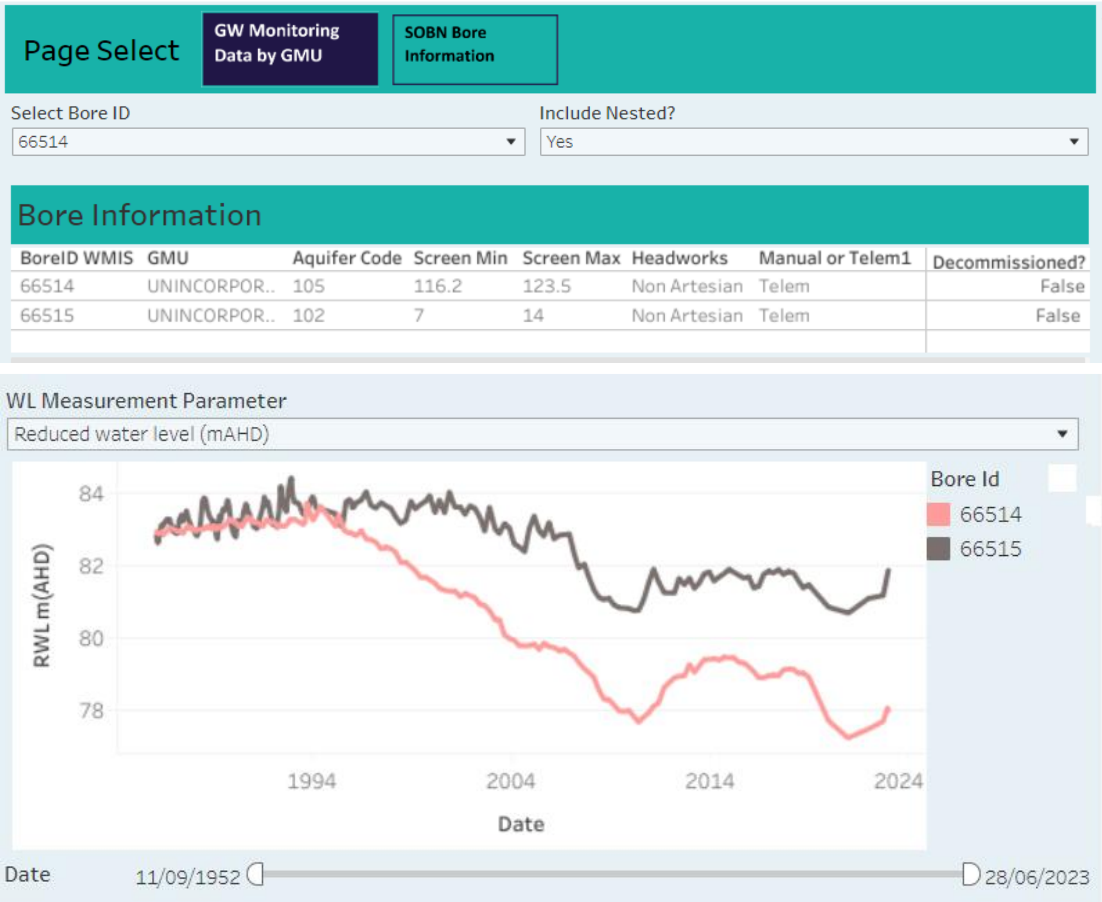
Table A1-6. Suite hydrographs of Lower Ovens GMA for upper and middle layers

VAF Layer	Suite Hydrograph
Upper layer	
Middle layer	

Appendix 2

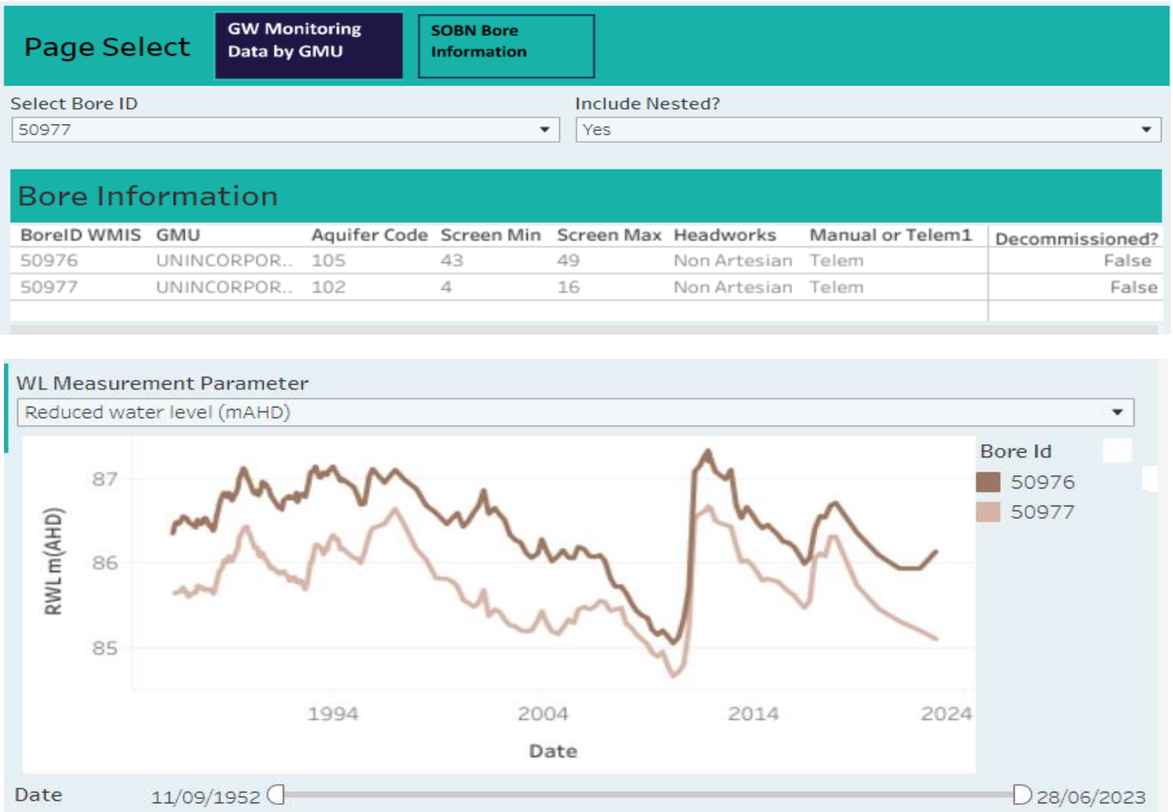
Nested bore hydrographs for the semi-confined GMUs

Table A2-1. Nested bore hydrographs for the semi-confined UTAF-NE2 UA



BoreID WMIS	GMU	Aquifer Code	Screen Min	Screen Max	Headworks	Manual or Telem1	Decommissioned?
66514	UNINCORPOR..	105	116.2	123.5	Non Artesian	Telem	False
66515	UNINCORPOR..	102	7	14	Non Artesian	Telem	False

Table A2-2. Nested bore hydrographs for the semi-confined UTAF-NE1 UA



BoreID WMIS	GMU	Aquifer Code	Screen Min	Screen Max	Headworks	Manual or Telem1	Decommissioned?
50976	UNINCORPOR..	105	43	49	Non Artesian	Telem	False
50977	UNINCORPOR..	102	4	16	Non Artesian	Telem	False

Table A2-3. Nested bore hydrographs for the semi-confined UTAF-PP1 UA

There is no nested bore within this UA