Blackwater Mine

PRC Plan Hydrogeology Assessment – Revision 3

Whitehaven Blackwater Pty Ltd

Level 31, 12 Creek Street
Brisbane QLD 4000 Australia

SLR Consulting Australia

Level 16, 175 Eagle Street, Brisbane QLD 4000,
Australia

SLR Project No.: 620.040199.00017

28 September 2026

Revision: 3.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	8 May 2026	Sharon Hulbert	Ines Epari	Ines Epari
2.0	14 May 2026	Sharon Hulbert	Ines Epari	Ines Epari
3.0	28 September 2026	Sharon Hulbert	Kelly-Jane Wallis	Ines Epari

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Whitehaven Blackwater Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Basis of Report i
1.0 Introduction 1
1.1 Background 1
1.2 Final Landform 2
1.3 Objectives 6
1.4 Guideline Criteria 6
2.0 Physical Setting 8
2.1 Climate 8
2.2 Topography and Drainage 11
2.3 BWM Mining 13
2.3.1 Historical Mining Activities 13
2.3.2 Current and Future Mining 14
2.3.3 Surface Water Management 16
2.3.4 Mine Pit Groundwater Inflow 17
3.0 Geology 19
3.1 Regional Geology 19
3.1.1 Structural Geology 23
3.2 Local Geology 23
3.2.1 Quaternary Sediments 23
3.2.2 Tertiary Sediments and Basalt 23
3.2.3 Triassic Clematis Group 24
3.2.4 Triassic Rewan Group 24
3.2.5 Permian Rangal Coal Measures 24
3.2.6 Burngrove Formation 25
4.0 Hydrogeology 26
4.1 BWM Groundwater Monitoring 26
4.1.1 BWM EA Monitoring Bores 26
4.1.2 BWM Non EA Monitoring Bores 29
4.2 Hydraulic Properties 52
4.2.1 Site-Specific Hydraulic Conductivity Data 52
4.2.2 Hydraulic Conductivity Ranges 54
4.2.3 Faulting 54
4.3 Groundwater Distribution, Flow, Rechange and Outflow 56
4.3.1 Quaternary Sediments (Alluvium) 56
4.3.2 Tertiary Sediments 58

4.3.3 Clematis Group 60
4.3.4 Rewan Group 60
4.3.5 Rangal Coal Measures 63
4.3.6 Burngrove Formation 69
5.0 Baseline Water Quality 71
5.1.1 Groundwater Typing 71
5.1.2 Salinity 75
5.1.3 Beneficial Groundwater Use 76
5.2 Groundwater Receptors 84
5.2.1 Anthropogenic 84
5.2.2 Groundwater Dependent Ecosystems 86
5.2.3 Springs 87
5.2.4 Wetlands 88
6.0 Conceptual Site Models – End of Mining 90
6.1 General 90
6.2 End of Mining 92
7.0 Potential Impacts 95
7.1 Groundwater System at End of Mining 95
7.2 Groundwater System Post Mining 95
8.0 Groundwater Modelling 96
8.1 Model Details 96
8.2 PRC Plan Landform 4.1 Model 96
8.2.1 Model Setup 96
8.2.2 Integration with Residual Void Water Balance 100
8.2.3 Residual Void Lake Recovery 101
8.2.4 Residual Void Groundwater Inflow 110
8.2.5 Predicted Groundwater Levels 119
8.2.6 Flow Path Simulation 133
9.0 Conceptual Site Model - Post Mining 139
10.0 References 142

Tables in Text

Table 1-1 Guideline Requirements 7
Table 2-1 Total Monthly Rainfall, Evaporation and Evapotranspiration (January 1970 to February 2026) 9
Table 2-2 BWM Historic Mining Areas and Basal Target Seams 13

Table 2-3 BWM Key Surface Water Management Locations 16
Table 3-1 Summary of Stratigraphy in the Study Area 20
Table 4-1 EA Monitoring Bores 27
Table 4-2 Quaternary Sediments Groundwater Monitoring Network 30
Table 4-3 Tertiary Sediments and Basalt Groundwater Monitoring Network 33
Table 4-4 Triassic Rewan Group Groundwater Monitoring Network 37
Table 4-5 Rangal Coal Measures Groundwater Monitoring Network 40
Table 4-6 Burngrove Groundwater Monitoring Network 44
Table 4-7 Spoil Groundwater Monitoring Network 47
Table 4-8 Vibrating Wire Piezometers 50
Table 5-1 Environmental Values of Comet and Mackenzie Groundwaters of the Fitzroy Basin 77
Table 5-2 Water Quality Objectives for Fitzroy Sub-basin Environmental Values 79
Table 5-3 Fitzroy Basin Zone 35 and Zone 36 WQOs for groundwater resources (aquatic ecosystem protection) (DEHP, 2011a and 2011b) 80
Table 5-4 Percentage of Analysed Bores in Aquifer with 80th Percentile Groundwater Quality Data Above Relevant Guideline for one or more Analyte (refer Appendix A) 82
Table 5-5 Results of Combined Registered Bore Search and Available Bore Census within 5 km of EA Boundary 84
Table 8-1 Post Mining Model Stress Periods 96
Table 8-2 Predicted Freeboard in the Residual Voids at Equilibrium 109
Table 8-3 Predicted Difference between Void Lake Levels and Shallow Formations 110
Table 8-4 Equilibrium Groundwater Inflow to the Residual Voids 119

Figures in Text

Figure 1-1 Blackwater Mine Location 3
Figure 1-2 BWM Mining Areas 4
Figure 1-3 Post Mining Landform 5
Figure 2-1 Monthly Rainfall at the BWM Site Station and SILO Data Location (2017-2024) 9
Figure 2-2 Average Monthly Evaporation, Evapotranspiration, Rainfall and Temperature (January 1970 to February 2026) 10
Figure 2-3 Cumulative Rainfall Departure and Total Monthly Rainfall 10
Figure 2-4 Average Daily Water Levels in Blackwater Creek D/S 11
Figure 2-5 Topography and Drainage 12
Figure 2-6 Historical and Future BWM Mine Progression 15
Figure 2-7 Current BWM Water Storage Areas 18
Figure 3-1 Surface Geology and Drillholes Targeting Alluvium 21

Figure 3-2 Solid Geology 22
Figure 3-3 Schematic Seam Stratigraphy and Split Diagram (BMA, 2014) 25
Figure 4-1 BWM Groundwater Monitoring Network – EA Monitoring Bores 28
Figure 4-2 BWM Groundwater Monitoring Network (Non EA Bores) – Quaternary Sediments 31
Figure 4-3 BWM Groundwater Monitoring Network (Non EA Bores) – Tertiary Sediments and Basalt 35
Figure 4-4 BWM Groundwater Monitoring Network (Non EA Bores) – Rewan Group 38
Figure 4-5 BWM Groundwater Monitoring Network (Non EA Bores) – Rangal Coal Measures 42
Figure 4-6 BWM Groundwater Monitoring Network (Non EA Bores) – Burngrove Formation 45
Figure 4-7 BWM Groundwater Monitoring Network (Non EA Bores) – Spoil 48
Figure 4-8 BWM Groundwater Monitoring Network (Non EA Bores) – Vibrating Wire Piezometers 51
Figure 4-9 Graphical Summary of Results for all Site-Specific Hydraulic Conductivity Testing 53
Figure 4-10 Histogram of Horizontal Hydraulic Conductivity Distribution 54
Figure 4-11 Faulting Conceptual Model Developed by Coffey (2014) 55
Figure 4-12 Groundwater Level (mAHD) – Alluvium 57
Figure 4-13 Groundwater Level (mBTOC) – Alluvium 58
Figure 4-14 Groundwater Levels (mAHD) – Tertiary EA Bores (MB21 and BWM_MB17_02) 59
Figure 4-15 Groundwater Levels (mAHD) – Tertiary EA Bore (continued) (BWM_MB15_01) 59
Figure 4-16 Groundwater Levels (mAHD) – Rewan Group 61
Figure 4-17 Groundwater Flow Direction in the Rewan Group (BWM North) 62
Figure 4-18 Groundwater Levels (mAHD) – Rangal Coal Measures EA Bores (BWM North Area) 63
Figure 4-19 Groundwater Levels (mAHD) – Rangal Coal Measures (Southern Area) 65
Figure 4-20 MB16 Groundwater Level (mAHD) – (Laleham Underground Mine) 66
Figure 4-21 Groundwater Level Contours – Aries Seam 68
Figure 4-22 Groundwater Levels (mAHD) – Burngrove Formation EA Bores 69
Figure 4-23 Groundwater Flow Direction in the Burngrove Formation (BWM North) 70
Figure 5-1 Durov Diagram – Alluvium 71
Figure 5-2 Durov Diagram – Tertiary Strata 72
Figure 5-3 Durov Diagram – Rewan Group 73
Figure 5-4 Durov Diagram – RCM (North BWM) 74
Figure 5-5 Durov Diagram – RCM (South BWM) 74

Figure 5-6 Durov Diagram – Burngrove Formation 75
Figure 5-7 Salinity Ranking by Hydrostratigraphic Unit 76
Figure 5-8 Groundwater Management Areas, Fitzroy Basin Groundwater Zones, and Chemistry Zones 81
Figure 5-9 Private Bores 85
Figure 5-10 Groundwater Dependent Ecosystem Mapping 89
Figure 6-1 Conceptual Hydrogeological Model of BWM Groundwater System – General for BWM Northern Area (End of Mining) 93
Figure 6-2 Conceptual Hydrogeological Model of BWM Groundwater System – General for BWM Southern Area (End of Mining) 94
Figure 8-1 Simulated Spoil Emplacement 99
Figure 8-2 Residual Void Recovery Model Conceptual Diagram 100
Figure 8-3 Simulated Void Water Level Recovery – Ramp 8 101
Figure 8-4 Simulated Void Water Level Recovery – Bonnie Doon 102
Figure 8-5 Simulated Void Water Level Recovery – Mimosa/Besgrove 102
Figure 8-6 Simulated Void Water Level Recovery – Deep Creek 103
Figure 8-7 Simulated Void Water Level Recovery – Stewarton North 103
Figure 8-8 Simulated Void Water Level Recovery – Stewarton South 104
Figure 8-9 Simulated Void Water Level Recovery – Kenmare 104
Figure 8-10 Simulated Void Water Level Recovery – Togara/North Marshmead 105
Figure 8-11 Simulated Void Water Level Recovery – South Marshmead 105
Figure 8-12 Simulated Void Water Level Recovery – Kennedy West 106
Figure 8-13 Simulated Void Water Level Recovery – Comet Downs East 106
Figure 8-14 Simulated Void Water Level Recovery – R74 107
Figure 8-15 Simulated Void Water Level Recovery – South Ballamoo 107
Figure 8-16 Simulated Void Water Level Recovery – Tannyfoil 108
Figure 8-17 Simulated Void Water Level Recovery – R30 108
Figure 8-18 Predicted Void Groundwater Inflows – Ramp 8 111
Figure 8-19 Predicted Void Groundwater Inflows – Bonnie Doon 111
Figure 8-20 Predicted Void Groundwater Inflows – Mimosa/Besgrove 112
Figure 8-21 Predicted Void Groundwater Inflows – Deep Creek 112
Figure 8-22 Predicted Void Groundwater Inflows – Stewarton North 113
Figure 8-23 Predicted Void Groundwater Inflows – Stewarton South 113
Figure 8-24 Predicted Void Groundwater Inflows – Kenmare 114
Figure 8-25 Predicted Void Groundwater Inflows – Togara / North Marshmead 114
Figure 8-26 Predicted Void Groundwater Inflows – South Marshmead 115
Figure 8-27 Predicted Void Groundwater Inflows – Kennedy West 115

Figure 8-28 Predicted Void Groundwater Inflows – Comet Downs East 116
Figure 8-29 Predicted Void Groundwater Inflows – R74 116
Figure 8-30 Predicted Void Groundwater Inflows – South Ballamoo 117
Figure 8-31 Predicted Void Groundwater Inflows – Tannyfoil 117
Figure 8-32 Predicted Void Groundwater Inflows – R30 118
Figure 8-33 Predicted Water Table Elevation – Post-mining Equilibrium 121
Figure 8-34 Predicted Groundwater Levels in the Aries Seam (Layer 8) – Post-mining Equilibrium 122
Figure 8-35 Predicted Groundwater Levels in the Castor Seam (Layer 10) – Post-mining Equilibrium 123
Figure 8-36 Predicted Groundwater Levels in the Pollux Seam (Layer 12) – Post-mining Equilibrium 124
Figure 8-37 Predicted Groundwater Levels in the Burngrove Formation (Layer 16) – Post-mining Equilibrium 125
Figure 8-38 Potential Receptor Predictive Hydrograph Locations 128
Figure 8-39 Water Table Hydrographs at Potential GDEs (GDE1 to GDE4) 129
Figure 8-40 Water Table Hydrographs at Potential GDEs (GDE5 to GDE8) 130
Figure 8-41 Water Table Hydrographs at Potential GDEs (GDE9 to GDE12) 131
Figure 8-42 Water Table Hydrographs at Potential GDEs (GDE13) 132
Figure 8-43 Starting Location of Particles 135
Figure 8-44 Predicted Movement of Particles – Post Mining (2094 – 4040) 136
Figure 8-45 Predicted Movement of Particles – Post Mining Equilibrium (2641 – 4040) 138
Figure 9-1 Conceptual Model of BWM Groundwater System – BWM Northern Area (Post Mining) 140
Figure 9-2 Conceptual Model of BWM Groundwater System – BWM Southern Area (Post Mining) 141

Appendices

Appendix A **80th Percentile Summary Statistics and Comparison to Guideline Values**
Appendix B **Groundwater Modelling Technical Report**
Appendix C **Post Mining Period Starting Heads**
Appendix D **Predictive Hydrographs Adjacent Final Void Lakes**
Appendix E **Predictive Hydrographs at Third-Party Bores**

1.0 Introduction

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Whitehaven Blackwater Pty Ltd (Whitehaven) to undertake a hydrogeological assessment supporting Revision 3 of the Blackwater Mine (BWM) Progressive Rehabilitation and Closure Plan (PRC Plan). This hydrogeological assessment is undertaken in accordance with the relevant requirements of the Queensland Government Department of Environment and Science (DES) Guideline: Progressive Rehabilitation and Closure Plans (DES Reference: ESR/2019/4964, version 3.01, effective 16 September 2024) - "the Guideline" and will be integrated into the design of the rehabilitation strategies and selection of post mining land uses (PMLUs) and Non-use Management Areas (NUMAs) within the BWM PRC Plan.

The BWM is located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (**Figure 1-1**).

The BWM produces up to approximately 19 million tonnes per annum of (Mtpa) of Run-of-Mine (RoM) coal equating to approximately 16 Mtpa of product coal. The BWM strike length includes mining occurring in a number of separate and/or adjoining pits (**Figure 1-2**). Existing infrastructure is located primarily on ML1760 and includes a Train Load-out Facility (TLF) and coal stockpiles, RoM stockpiles, Coal Handling and Preparation Plant (CHPP), water management infrastructure and supporting infrastructure (i.e., roads, powerlines, laydown areas, workshop and administration areas).

BWM operates under Environmental Authority (EA) EPML00717813. The following Mining Leases (ML's) are included in the EA (**Figure 1-1**):

- ML1759
- ML1760
- ML1761
- ML1762
- ML1767
- ML70329
- ML1771
- ML1772
- ML1829
- ML1860
- ML1862
- ML1773
- ML1792
- ML1800
- ML1812
- ML1907
- ML70091
- ML70103
- ML70104
- ML70139
- ML70167

The most recent hydrogeological study relevant to the BWM PRC Plan is that undertaken for the BWM North Extension Project (SLR, 2026a), that included a post-mining assessment. That body of work has been drawn upon as directly relevant to this hydrogeological assessment, including the development of conceptual and numerical groundwater models for BWM as documented within SLR (2026a and 2026b).

For the purposes of this report:

- The Project Area is synonymous with the EA boundary (i.e. the area subject to EA EPML00717813) and is shown on **Figure 1-1**.
- The Study Area is the regional area surrounding the Project Area considered in detail within this report (**Figure 1-1**). The Study Area is also synonymous with the numerical groundwater model domain as discussed in **Section 8.0**.

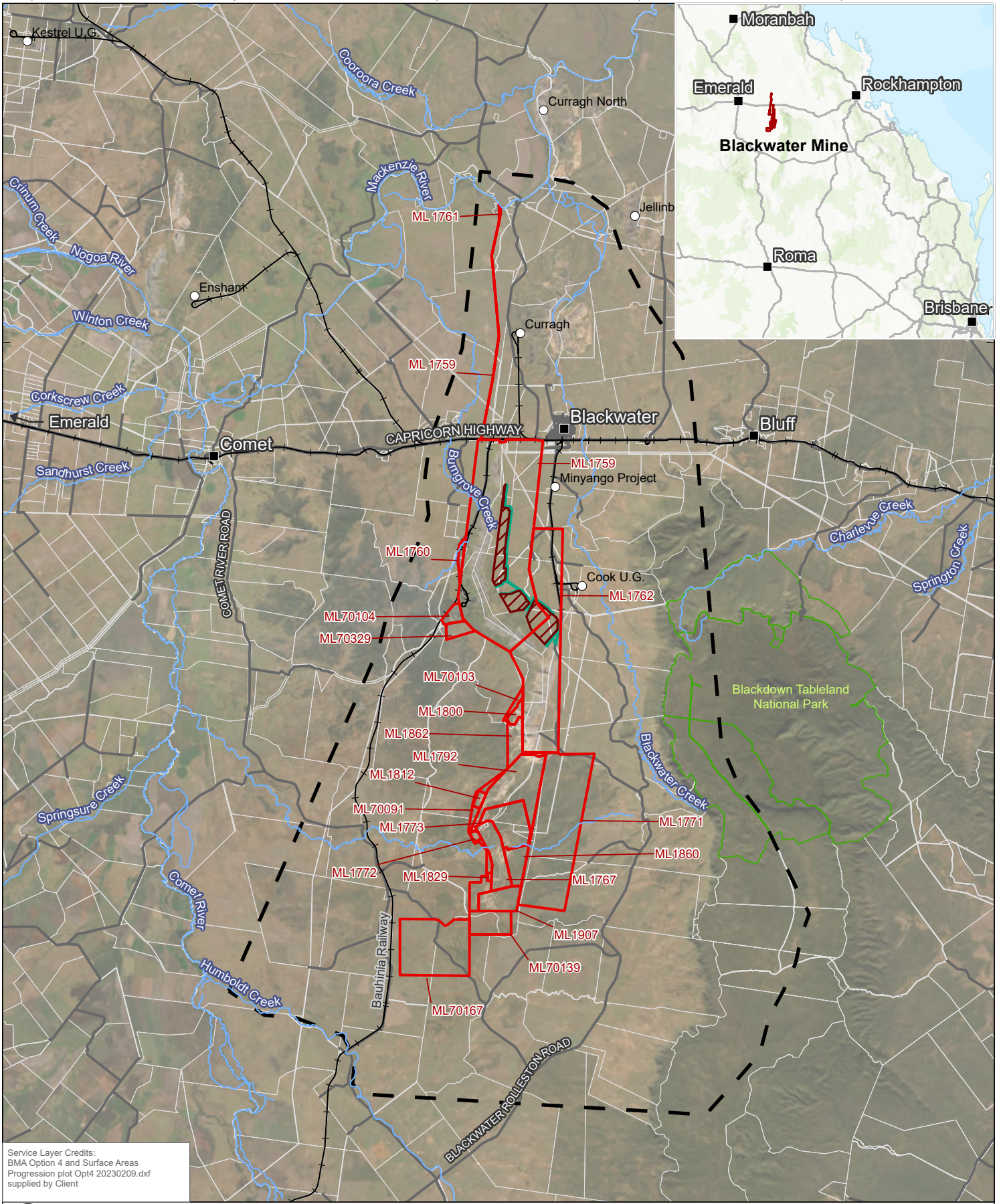
Mining commenced at BWM in 1967 and has included the extraction of coal through open cut strip mining from a series of pits (**Figure 1-2**). There were also six historical underground mining operations within the EA boundary (**Figure 1-2**):

- Kenmare Underground
- Laleham Underground
- Ballamoo Underground
- Highwall Mining (Augering)
- Sirius Creek No 1 Underground
- Sirius Creek No 2 Underground

1.2 Final Landform

The post-mining final landform relevant to this hydrogeological assessment, denoted “Final Landform Design 4.1” (Landform 4.1), was provided by Whitehaven and is shown as **Figure 1-3**. The final landform contains 15 residual voids/void areas, as shown on **Figure 1-3**, from north to south:

- Ramp 8;
- Bonnie Doon;
- Mimosa/Besgrove;
- R30;
- Deep Creek;
- Stewarton North;
- Stewarton South;
- Tannyfoil;
- South Ballamoo;
- Kenmare;
- R74;
- Togara/ North Marshmead;
- South Marshmead;
- Kennedy West; and
- Comet Downs East.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:500,000 at A4
Project Number:	620.040199
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

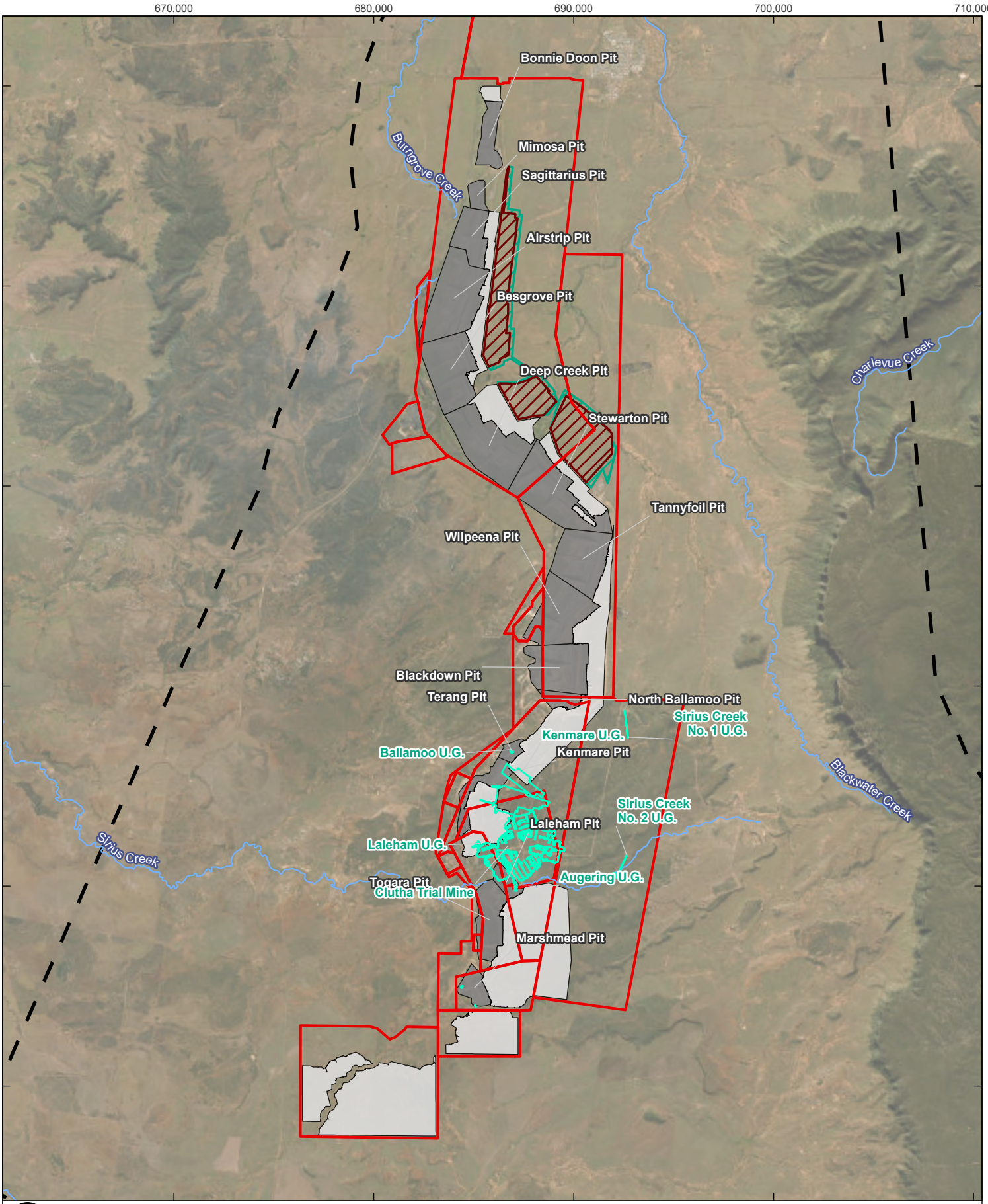
BLACKWATER MINE LOCATION

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 1-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F01_01_Project Location



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199.00017
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

LEGEND

- Watercourse
- Historical Underground Mine
- BWM Mining Lease
- GIA Study Area
- Future Pit Extent
- Historical Pit Extent
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

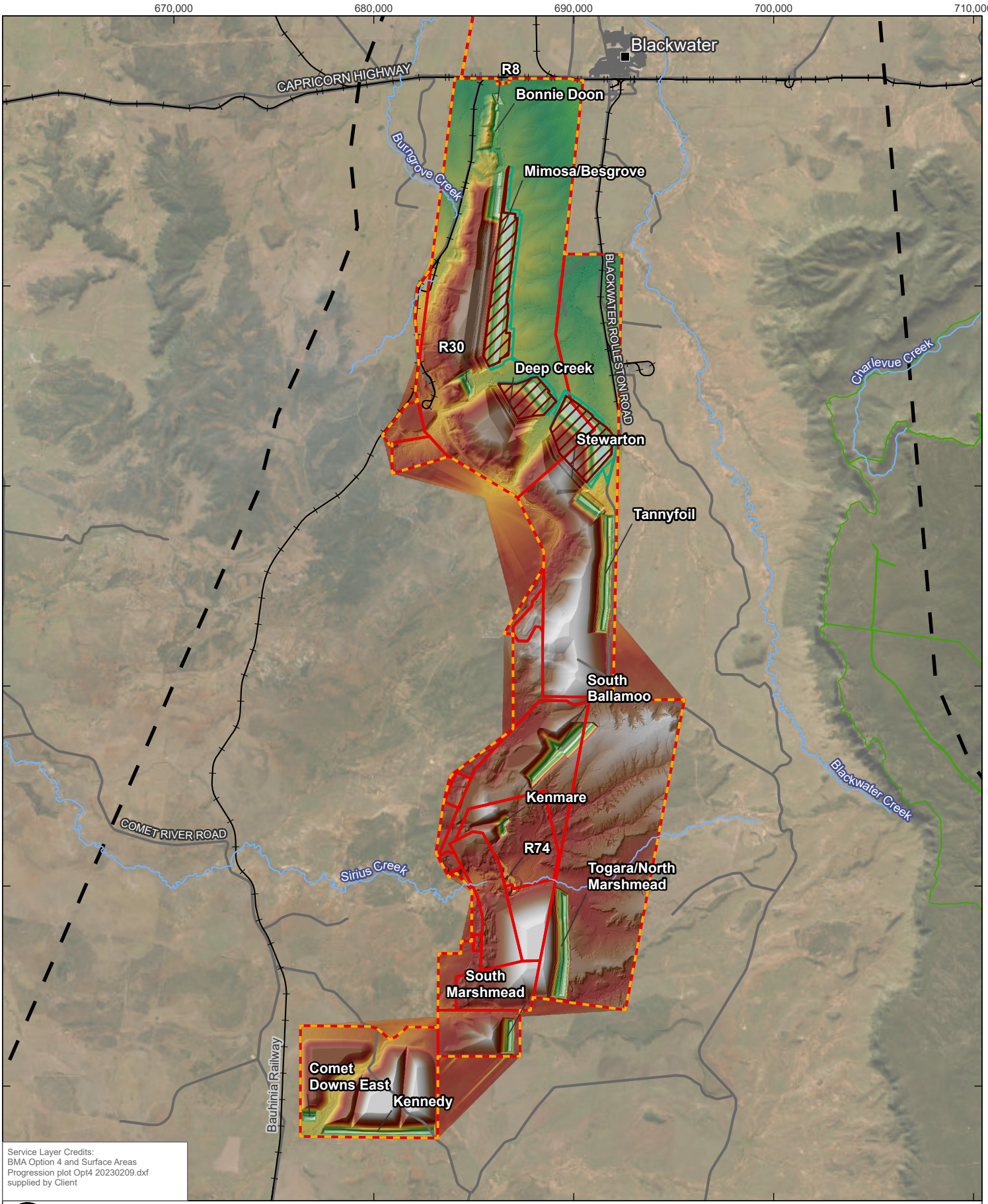
BWM MINING AREAS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 1-2

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F01_02_BWM_Mining_Areas



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

LEGEND

- City/Town
- Railway
- Road
- Watercourse
- Study Area
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- National Park
- **Final Landform Elevation (mAHD)**
  - 450
  - -5
- Proposed Infrastructure Area
- Proposed Open Cut Extension

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

POST MINING LANDFORM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 1-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F01_3_Post Mining Landform

1.3 Objectives

The primary objective of the hydrogeological assessment is to assess the potential groundwater related impacts at BWM at completion of mining and until conditions stabilise post rehabilitation (i.e. groundwater equilibrium). A focus of the hydrogeological assessment is demonstrating suitability of the final landform for the intended post mining land uses (PLMUs) with respect of the BWM groundwater system. As such, the key specific objectives adopted in this assessment from which to demonstrate this suitability are:

- That the final landform is non-polluting with respect to groundwater:
    - The final landform overall is demonstrated to be a sink for groundwater, including groundwater contained within spoil.
    - Final void lake levels remain below shallow groundwater bearing units, i.e. there is sufficient freeboard to negate risk of void water discharge to any shallow groundwater system.
- That there are minimal additional impacts to groundwater receptors post-closure caused by the final landform that have not already occurred as a result of approved mining:
    - Little to no additional groundwater drawdown at potential Groundwater Dependent Ecosystem (GDE) locations.
    - Little to no additional groundwater drawdown at anthropogenic bore users.

Potential impacts associated with mine-related sources of potential groundwater contamination at BWM are being assessed for the PRC Plan by separate specific assessments. Consequently, this hydrogeology assessment focuses on the larger scale potential impacts to the site groundwater system.

1.4 Guideline Criteria

As discussed in **Section 1.1**, this hydrogeology assessment is undertaken consistent with the Guideline: Progressive Rehabilitation and Closure Plans (ESR/2019/4964). A cross reference between the relevant Guideline requirements with respect of groundwater and specific components of this assessment is provided in **Table 1-1**.

Table 1-1 Guideline Requirements

Guideline Requirement	Section of this Report
Section 3.6.1 General rehabilitation practices – Hydrogeology	
Determining the groundwater occurrence including the existence of, and depth to, aquifers and aquitards	**Section 4.0** **Section 4.3**
Locating groundwater recharge and discharge locations locally and regionally	**Section 4.3**
Groundwater quality within each of the aquifers and from surface expressions (i.e. seeps and springs)	**Section 5.0**
Current and potential future uses of groundwater including existing groundwater extraction bores	**Section 5.1.3** **Section 5.2**
Groundwater flow direction and velocity, including field tests to determine hydraulic conductivity	**Section 4.1.1**
The development of potentiometric mapping and hydro stratigraphic cross sections	**Section 4.3** **Section 6.0**
Groundwater modelling to determine contaminant transport and potential changes to groundwater level from dewatering or waste storage.	**Section 8.0**
Section 3.6.4 Underground mining – Hydrogeology	
An assessment of groundwater interactions and potential lowering of groundwater levels	**Section 8.2.5**
The development of a hydrogeological conceptual model	**Section 6.0** **Section 9.0**
A numerical model to enable analytical assessment of the hydrological evolution within the underground workings post closure	**Section 8.0**

2.0 Physical Setting

2.1 Climate

The climate of the Study Area is sub-humid/sub-tropical, with a distinct wet and dry season. Historical climate data was obtained for the period from January 1970 to February 2026 from the Scientific Information for Landowners (SILO) database (Queensland Government, 2025). Data from the BWM weather station is limited to a short record of rainfall data. Therefore, the SILO climate record for grid point data -23.70, 148.85, which lies within the EA Boundary, is used to understand long-term climate trends. Rainfall data from the BWM site weather station is only available from January 2016 to January 2025. A comparison between monthly rainfall, as recorded at the BWM site weather station, and monthly rainfall from the SILO climate record is presented on **Figure 2-1** for the most recent year of complete available data (being 2024). The two data sets generally correlate well over the overlapping period, which justifies using the SILO climate record data to understand long-term climate trends and the climate input for the Project groundwater modelling (**Section 8.0**).

Long-term average monthly rainfall, Moreton's areal actual evapotranspiration and Class A Pan evaporation from SILO is presented in **Table 2-1**. The Study Area is characterised by a long-term average rainfall of approximately 549 mm per year, with wetter conditions during the summer months of December, January and February and relatively dry conditions during the remainder of the year. As shown in **Figure 2-2** average monthly evaporation and evapotranspiration exceed rainfall in all months. Within the Study Area, the highest rate of evapotranspiration occurs along creek lines, where the water table is closer to ground surface and deeper-rooted vegetation is present.

To place rainfall over the years into an historical context, cumulative rainfall departure (CRD) was calculated for the period of January 1970 to February 2026 (**Figure 2-3**). This is a summation of the monthly departures of rainfall from the long-term average monthly rainfall. A rising slope in the CRD plot indicates periods of rainfall above the long-term average, as is the case from March 2022 to December 2022, whereas a falling slope indicates periods when rainfall is below the long-term average (e.g. February 2018 to September 2021). Rainfall volumes over the more recent period of the record (i.e. December 2022 to February 2026) have been reasonably average, as is indicated by the roughly horizontal trend in the CRD (**Figure 2-3**).

In addition, the CRD is used to assess the recharge of groundwater via rainfall. Where observed groundwater level trends mimic the pattern of the CRD curve, it is considered that natural fluctuations in the groundwater table can result from temporal changes in rainfall recharge to groundwater systems. Typically, changes in groundwater elevation can reflect the deviation between the long-term monthly (or yearly) average rainfall, and the actual rainfall, as illustrated by the CRD. The CRD and observed groundwater levels are discussed as a means to characterise climatic conditions within the assessment of groundwater levels (see **Section 4.3**).

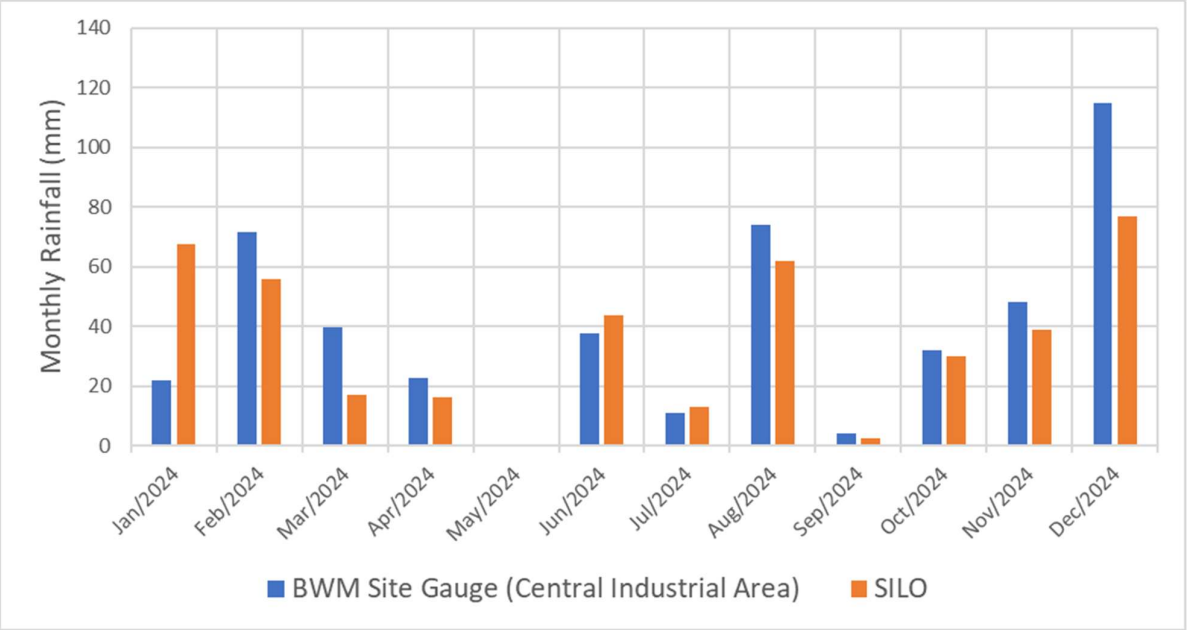


Figure 2-1 Monthly Rainfall at the BWM Site Station and SILO Data Location (2017-2024)

Table 2-1 Total Monthly Rainfall, Evaporation and Evapotranspiration (January 1970 to February 2026)

Average Total Monthly	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	89	74	49	29	32	23	22	17	23	45	62	84	549
Evaporation (class A Pan) (mm)	230	186	189	148	114	90	99	130	171	213	225	241	2,037
Evapotranspiration (Moreton's areal actual) (mm)	135	114	106	68	43	31	35	52	71	99	115	134	1,002

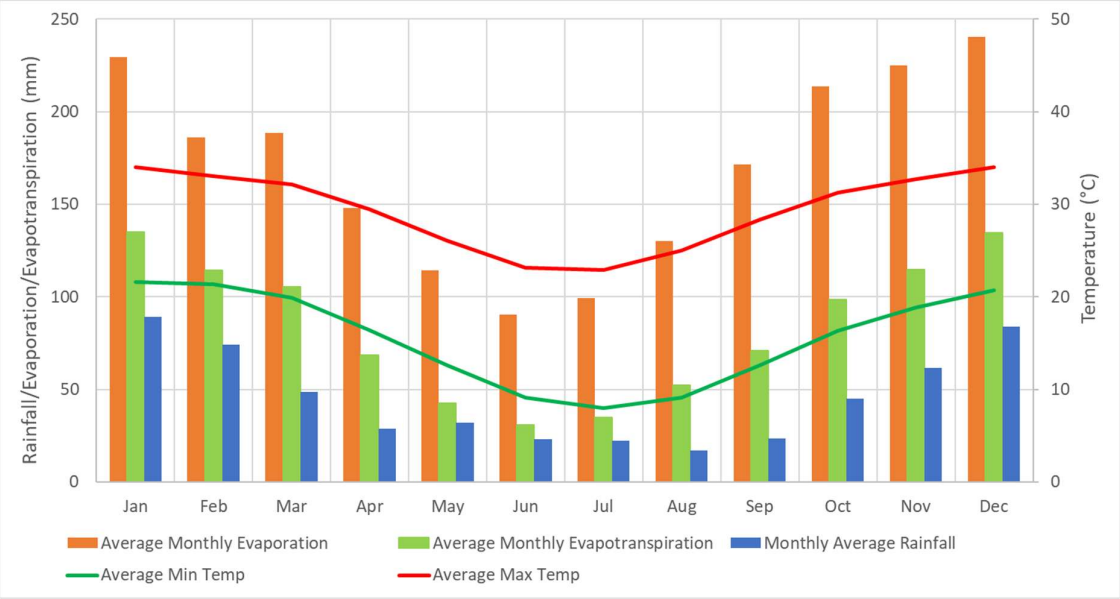


Figure 2-2 Average Monthly Evaporation, Evapotranspiration, Rainfall and Temperature (January 1970 to February 2026)

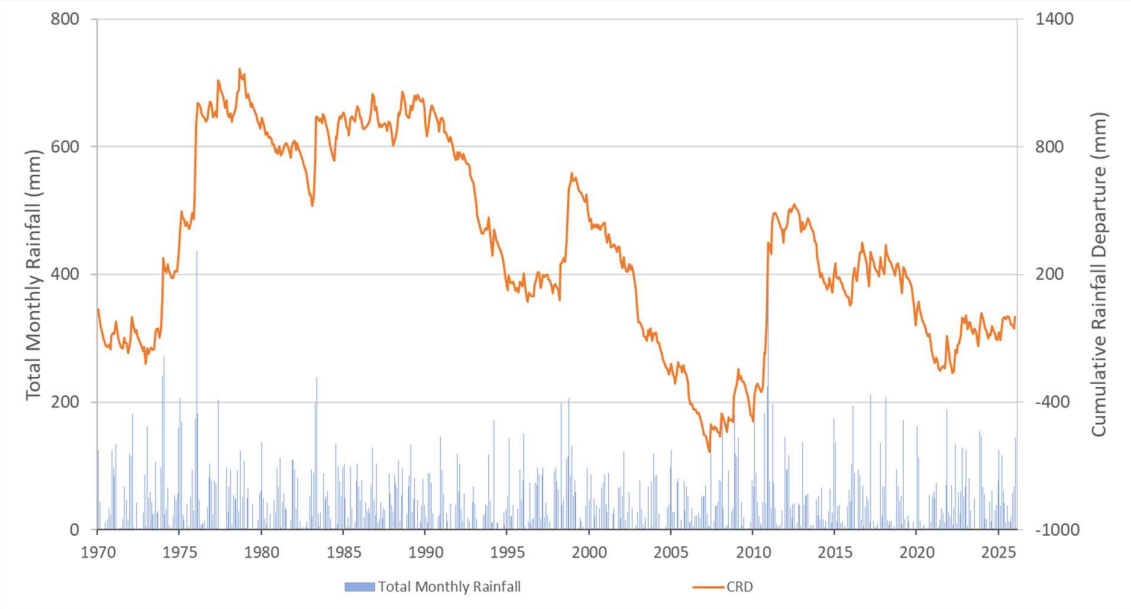


Figure 2-3 Cumulative Rainfall Departure and Total Monthly Rainfall

2.2 Topography and Drainage

The Study Area topography is relatively flat, with elevations of 280 mAHD in the south to around 150 mAHD in the north, at an average gradient of between 1:100 and 1:240. To the south of BWM, there are hills with elevations around 350 mAHD, which form the catchment divide between the Mackenzie and the Comet sub-catchments (**Figure 2-5**).

Approximately 10 to 15 km to the east of BWM, toward the eastern boundary of the Study Area, there is an escarpment formed by outcrop of the Clematis Group sandstone, which reaches an elevation up to 750 mAHD.

BWM is located across two surface sub-catchments of the Water Plan (Fitzroy Basin) 2011:

- The Upper Mackenzie sub-catchment, which is located within the northern portion of BWM and,
- The Comet sub-catchment, which is located within the southern portion of BWM (**Figure 2-5**).

The surface drainage comprises several ephemeral creeks that are tributaries of the Mackenzie and Comet Rivers. Creeks that flow in the Upper Mackenzie sub-catchment drain from south to north towards the Mackenzie River, whilst creeks that flow in the Comet sub-catchment drain from east to west towards the Comet River. The Project Area is located in the Mackenzie sub-catchment and the most prominent drainage feature in the area is Blackwater Creek.

The ephemeral creeks have intermittent flow, and typically only contain water after high intensity rainfall events (AGE, 2003). **Figure 2-4** shows the average daily water level in Blackwater Creek (Blackwater Creek D/S monitoring point as shown on **Figure 2-5**) compared to the daily rainfall (SILO climate record, refer to **Section 2.1**). After large rainfall events, generally considered to exceed approximately 30 mm/day, flow is recorded in the creek. Creek flows subsequently recede during drier periods.

Groundwater interaction with ephemeral creeks is considered unlikely within the Study Area.

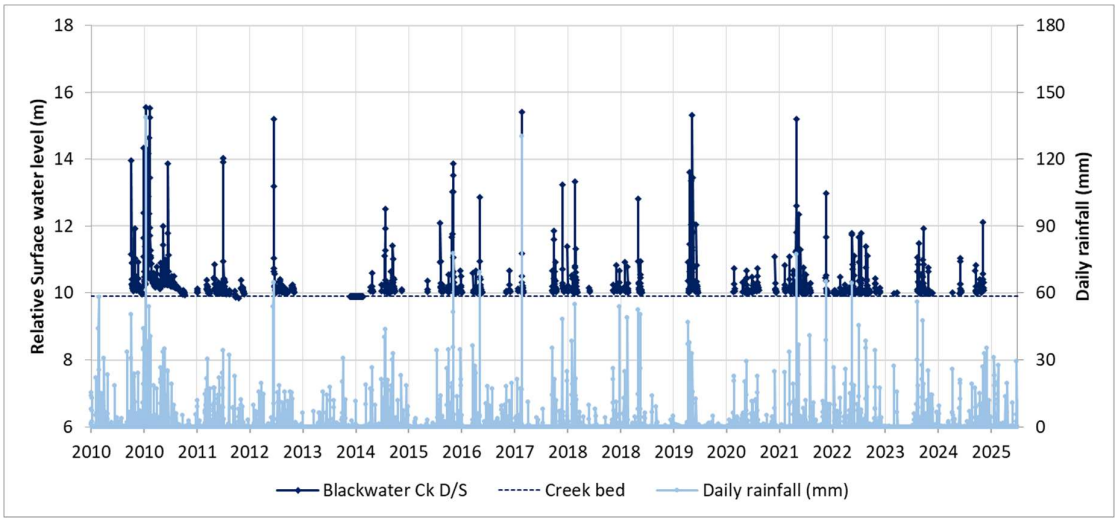
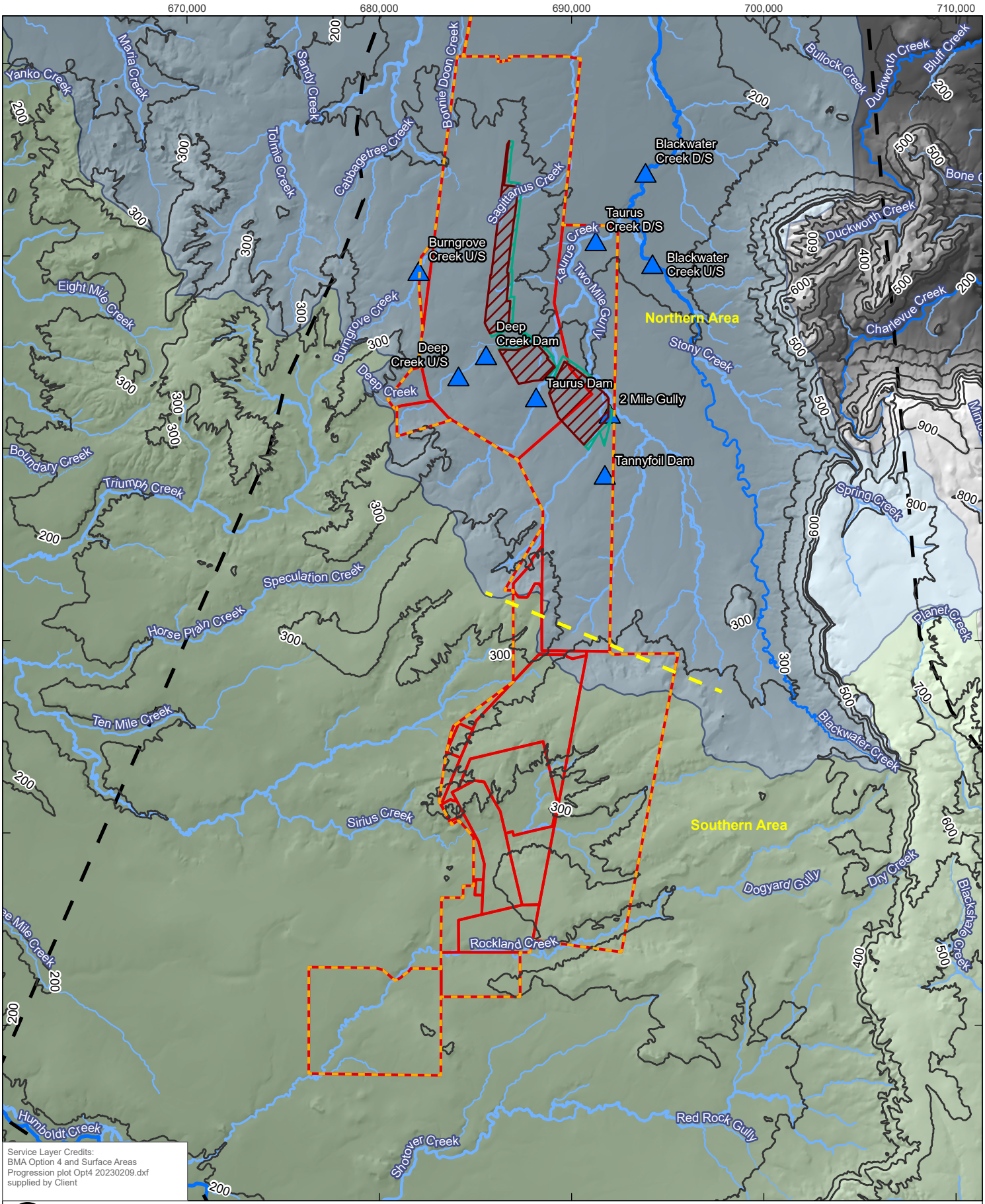


Figure 2-4 Average Daily Water Levels in Blackwater Creek D/S



DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F02_4_Topography and Drainage

2.3 BWM Mining

This section outlines the historical mine progression and future mining plan at BWM, as relevant to assessing the effect of BWM on the groundwater system post-closure. This is considered important since post-closure groundwater conditions will in part be dictated by the conditions that are present as a result of existing mining activities at the time of closure.

2.3.1 Historical Mining Activities

BWM began operations in 1967. **Table 2-2** lists the operating areas of BWM with the estimate of commencement date and target seams. **Figure 2-6** provides a locality plan and timing for historic BWM mining. Note that prior to the early 2000's, BWM operated as two separate mining operations, commonly denoted "Blackwater" and "South Blackwater", which were merged in late 2000 with BMA's acquisition of the South Blackwater operation.

In all pits, spoil is deposited to the west of mine void adjacent to the pit ramps. The primary mine operations area including stockpile, workshops, coal processing facility and three tailings storage areas (CHPP Tailings Storage in the north of BWM, and R72 Tailings Storage Dam and R74 Tailings Storage Dam in the central part of BWM; see **Section 2.3.3**).

In addition to open pit mining operations, there are multiple historical underground mines located within the Project Area as shown on **Figure 1-2** and detailed in **Table 2-2**.

Table 2-2 BWM Historic Mining Areas and Basal Target Seams

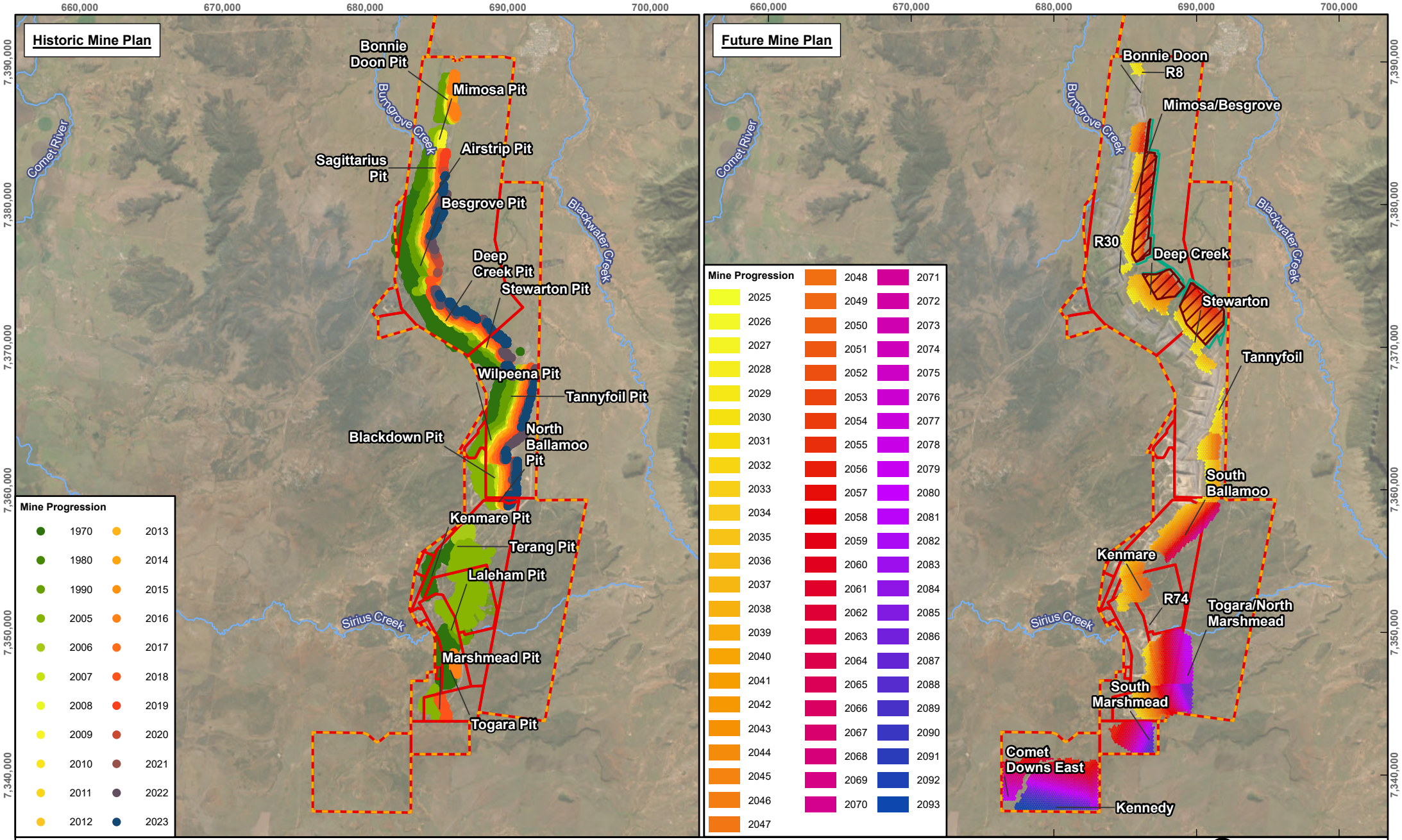
Mine Area Name	Mining Commenced	Mining Completed	Deepest Target Seam
Open Pit Mining			
Bonnie Doon Pit/R08N	1998 – 2002	2016	P1U
Mimosa Pit	2002 - 2003		P1L (part of final void Mimosa/Besgrove)
Sagittarius Pit	1973 - 1978	2088	P1L (part of final void Mimosa/Besgrove)
Airstrip Pit	1973 - 1978	2061	P1L (part of final void Mimosa/Besgrove)
Besgrove Pit	1973 - 1978	2065	P1L (part of final void Mimosa/Besgrove)
Deep Creek Pit	1973	2049	P1L
Stewarton Pit	1973	2039	P1L
Tannyfoil Pit	1973 - 1978	2039	P1L
Wilpeena Pit	1973 - 1978	2040	P1L
Blackdown Pit	1984 - 1993	2048	P1L
North Ballamoo Pit	1984 - 1993	2094	P1L
Terang Pit	1973 - 1978	2090	L1
Kenmare Pit	prior to 1978	2094	L1
Laleham Pit	prior to 1973	2090	TR75
Togara Pit	1973 - 1984	2109	L10
Marshmead Pit	1984 - 1993	2109	L10
Underground Mining			
Kenmare Underground Mine	1994 - 1997[^]	Kenmare 1 2001[^] Kenmare 2 incorporated to surface excavation[^]	Pollux[^]

Mine Area Name	Mining Commenced	Mining Completed	Deepest Target Seam
Augering Underground Mine			
Ballamoo Underground Mine			
Clutha Trial Mine			Aries^
Laleham Underground Mine	1969^	2001*	Pollux^
Sirius Creek No. 1. Underground Mine		1970s*	Aries^
Sirius Creek No. 2. Underground Mine		1970s*	Aries^

^ Byrnes Geotechnical (2024)
* EMM (2021)

2.3.2 Current and Future Mining

Mining at BWM is expected to continue on the current approved operations until July 2113. The current mine plan, with polygons indicating timing for mine strip extraction is provided on **Figure 2-6**. This involves continued mining targeting economic areas of Rangal Coal Measures seams dipping down generally eastwards in the north and central parts of BWM and east/southeast in the southern part of BWM, with basal depth of mine void increasing in conjunction with the dipping geology.



Scale: 1:340,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 05-May-2026
Project Number: 620.040199

Watercourse

Project Area (Environmental Authorities boundary)

BWM Mining Lease

Proposed Infrastructure Area

Proposed Open Cut Extension

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

HISTORICAL AND FUTURE MINE PROGRESSION

FIGURE 2-6

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F02_6_Historical and Future Mine Progression without SA7

2.3.3 Surface Water Management

Surface water management practices are relevant to this hydrogeological assessment through potential for interaction in seepage to or from mining water handling areas. The water storage areas at BWM are shown on **Figure 2-7** and information for key surface water management locations considered to have potential to interact with local groundwater is provided in **Table 2-3**.

Table 2-3 BWM Key Surface Water Management Locations

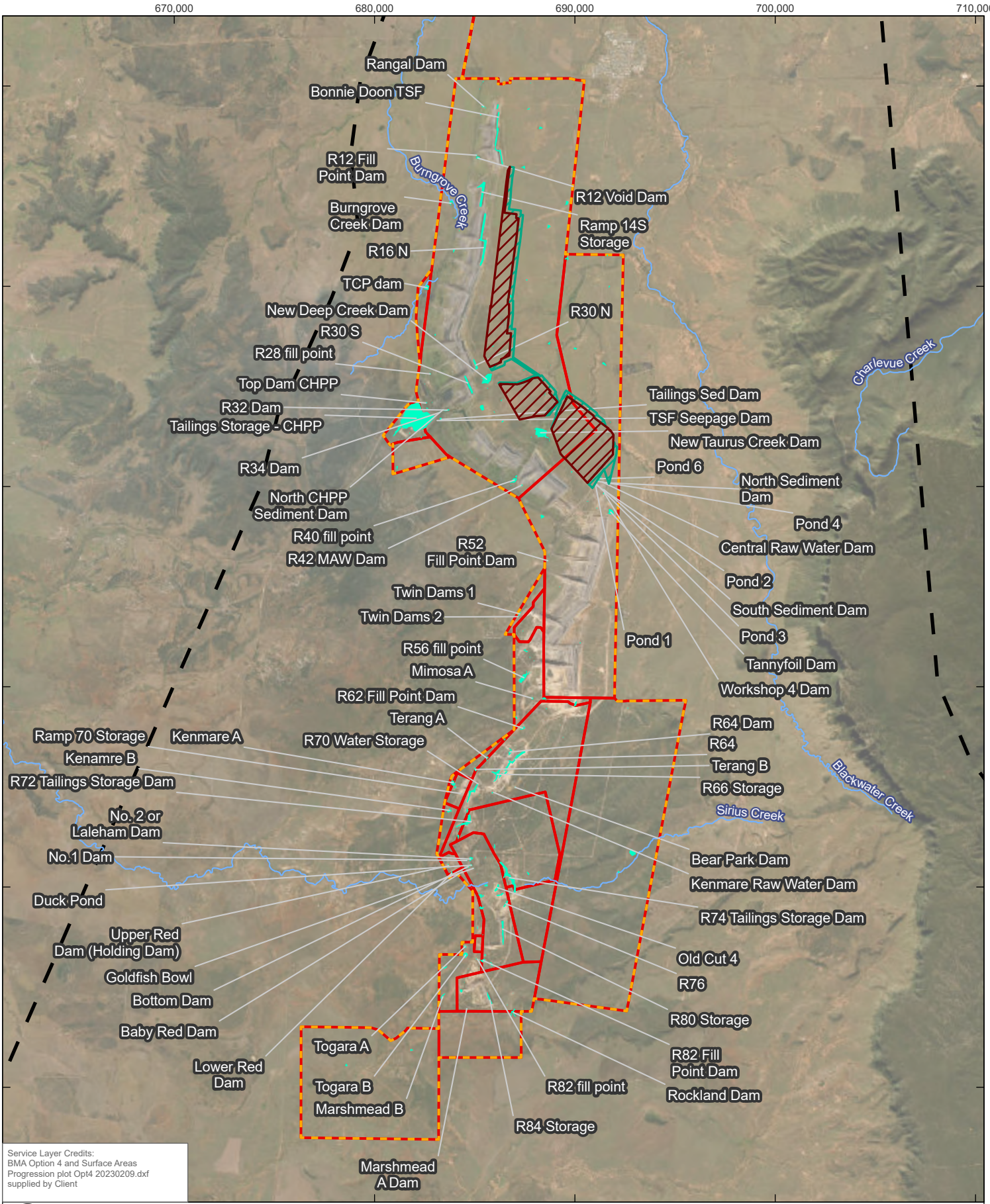
Water Storage Name	Type	Area (ha)	Last Recorded Storage RL Date	Last Recorded Storage RL (mAHD)
Tailings Storage – CHPP	Tailings	147.1		
Bonnie Doon TSF	Tailings	17.8	19/10/2025	143 – 146.6*
Duckpond	Dam	0.8	19/10/2025	266.3
Lower Red Dam	Dam	1.6	19/10/2025	267.5
New Deep Creek	Dam	16.7	19/10/2025	213.3
New Taurus Creek Dam	Dam	22.8	19/10/2025	213.2
Old Cut 4 (ramp74 dam)	Dam	4.1	19/10/2025	254.5
Ramp 10 N-North (ramp 8N)	Pit water	4.0	19/10/2025	145.0
Ramp 12 Dam (fill point void)	Dam	0.6	18/11/2024	195.9
Ramp 14 South	Pit water	17.4	19/10/2025	184.0
Ramp 16	Pit water	29.3	19/10/2025	118.4
Ramp 30 South	Pit water	9.3	19/10/2025	150.3
Ramp 64 & 66 (RL281.2-285)	Pit water	24.3	19/10/2025	283.1
Ramp 70	Pit water	9.1	19/10/2025	277.6
Ramp 72 Tailings	Tailings	12.1	19/10/2025	287.0
Ramp 74 Tailings	Tailings	23.9	19/10/2025	247.2
Ramp 76	Pit water	2.5	19/10/2025	241.7
Ramp 80	Pit water	8.9	19/10/2025	243.5
Ramp 84	Pit water	4.7	19/10/2025	215.1
SBW Bottom Dam	Dam	0.9	19/10/2025	274.5
SBW No2 (Laleham) Dam	Dam	2.7	19/10/2025	274.3
Tannyfoil Dam	Dam	5.6	19/10/2025	234.1
TCP Storage	Dam	4.6	19/10/2025	223.1
Upper Red (Holding) Dam	Dam	0.9	19/10/2025	276.6

* level range including tailings and water

2.3.4 Mine Pit Groundwater Inflow

During active mining operations, groundwater inflows to active pit voids are generally small in volume and do not need to be actively managed via advance dewatering or other groundwater management methods, with evaporation from the pit walls and floors accounting for most of the groundwater volume. Small volumes of groundwater inflow requiring management within active mine pits, when they occur, are generally managed via the use of in-pit sumps to capture water that is then used or circulated via the Mine water management system for use in coal washing and for dust suppression purposes.

Numerical groundwater modelling completed by SLR (2026b) indicated that groundwater inflows to the current BWM operation (year 2026) approximate 2,600 ML/year (~4.38 ML/day). Annual pit inflows calculated by Whitehaven from the latest site water balance calibration for the most recent complete water year, being 1st July 2024 to 30 June 2025, were estimated to be 821 ML/yr (~2.25 ML/day) (S. Peignelin, pers. Comm., 22 July 2025). This difference is to be expected as site water balance models typically account only for groundwater physically managed within the water system. They do not include water lost through passive evaporation from pit walls and floors or water retained in mined rock, which are volumes accounted for within a numerical groundwater model.



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

LEGEND

- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Study Area
- Water Storage Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

CURRENT BWM WATER STORAGE AREAS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-7

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F02_07_Current Blackwater Water Storage Areas

3.0 Geology

3.1 Regional Geology

BWM is located in the Bowen Basin, which is one of five major foreland sedimentary basins formed along the eastern side of Australia during the Permian geologic period. The Bowen Basin is the largest productive coal basin in Australia. The north-south oriented Bowen Basin stretches from Townsville in the north, to the Queensland-New South Wales border in the south.

The stratigraphic sequence of the Study Area is presented in **Table 3-1**. From youngest to oldest, the stratigraphic sequence across the Study Area primarily comprises unconsolidated Quaternary aged sediments that unconformably overlie consolidated Triassic and Permian aged sequences (**Figure 3-1).** The Permian and Triassic strata form regular layered fluvio-deltaic sedimentary sequences, while the Quaternary sediments are more complex and irregular. The coal deposits extracted from BWM are found within the Rangal Coal Measures, which is the uppermost Permian unit (**Figure 3-2**).

Overlying the consolidated basal units, Tertiary sediments and basalt, and Quaternary alluvium, are present as cover. At the eastern extents of the Study Area, the Triassic aged Clematis Group outcrops with a dramatic change in topography associated with the comparatively weathering resistant sandstones of that geologic unit (refer to **Section 2.2**).

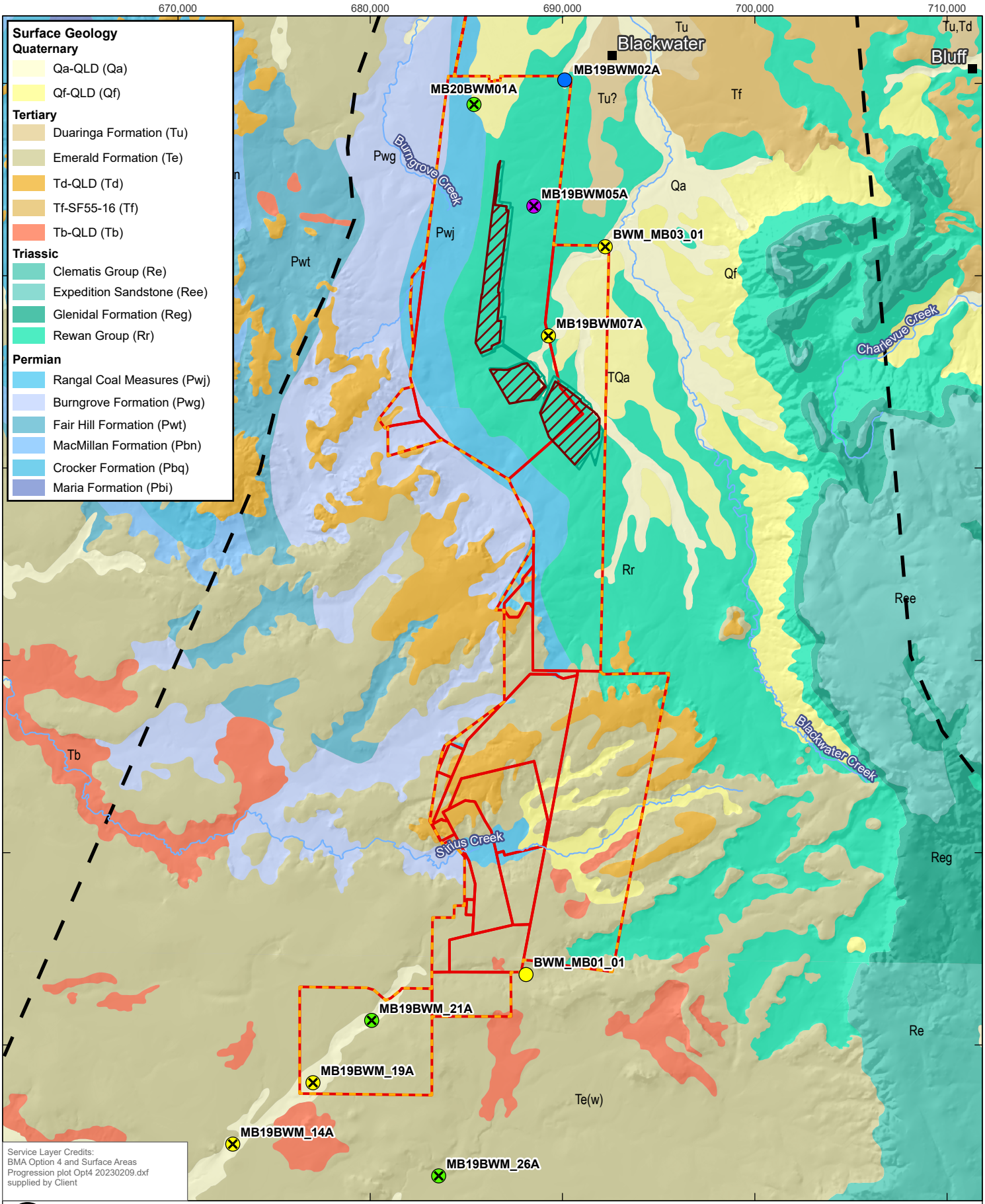
Each of the main stratigraphic units relevant to BWM are discussed in **Section 3.2.1** to **Section 3.2.6**, and the structural geology is discussed in **Section 3.1.1**.

Table 3-1 Summary of Stratigraphy in the Study Area

Age	Unit	Thickness (m)	Description
Quaternary	Alluvium	0.5 - 12	Alluvium - silt, clay, sand and gravel.
Tertiary	Basalt	30	Weathered basalt soils, residual basalt. Moderately weathered and fresh basalt.
	Sediments/ sedimentary units	30	Clays, sandstones, sands, gravels, often poorly consolidated (Tu, Te(w), Tf and TQa). Regional mapping shows highly weathered Tertiary sediments display some areas of duricrust (Td) and partially cemented fanglomerate (Tf)
Triassic	Clematis Group	100-800	Weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate.
	Rewan Group	50-300	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base); deposited in a fluvial-lacustrine environment. Occurs 2m to 6m above the Aries seam.
Permian	Rangal Coal Measures	100	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams. Coal seams include the Aries, Castor, Pollux and Orion and Pisces seams. The Pollux and Orion seams commonly coalesce into a single seam, which is referred as the Argo seam.
	Burngrove Formation	170	Sandstones, siltstones and mudstones, and banded coal seams frequently interbedded with tuff and tuffaceous mudstones. Coal seams include the Virgo and Leo seams.

Note: Source AGE (2008), AGE (2013) and EMM (2019).





0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:260,000 at A4
Project Number:	620.040199
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

LEGEND

- City/Town
- Watercourse
- Study Area
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Dry

Drilling Targeting Alluvium

- Alluvium
- Tertiary
- Rewan
- Rewan (weathered)

- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

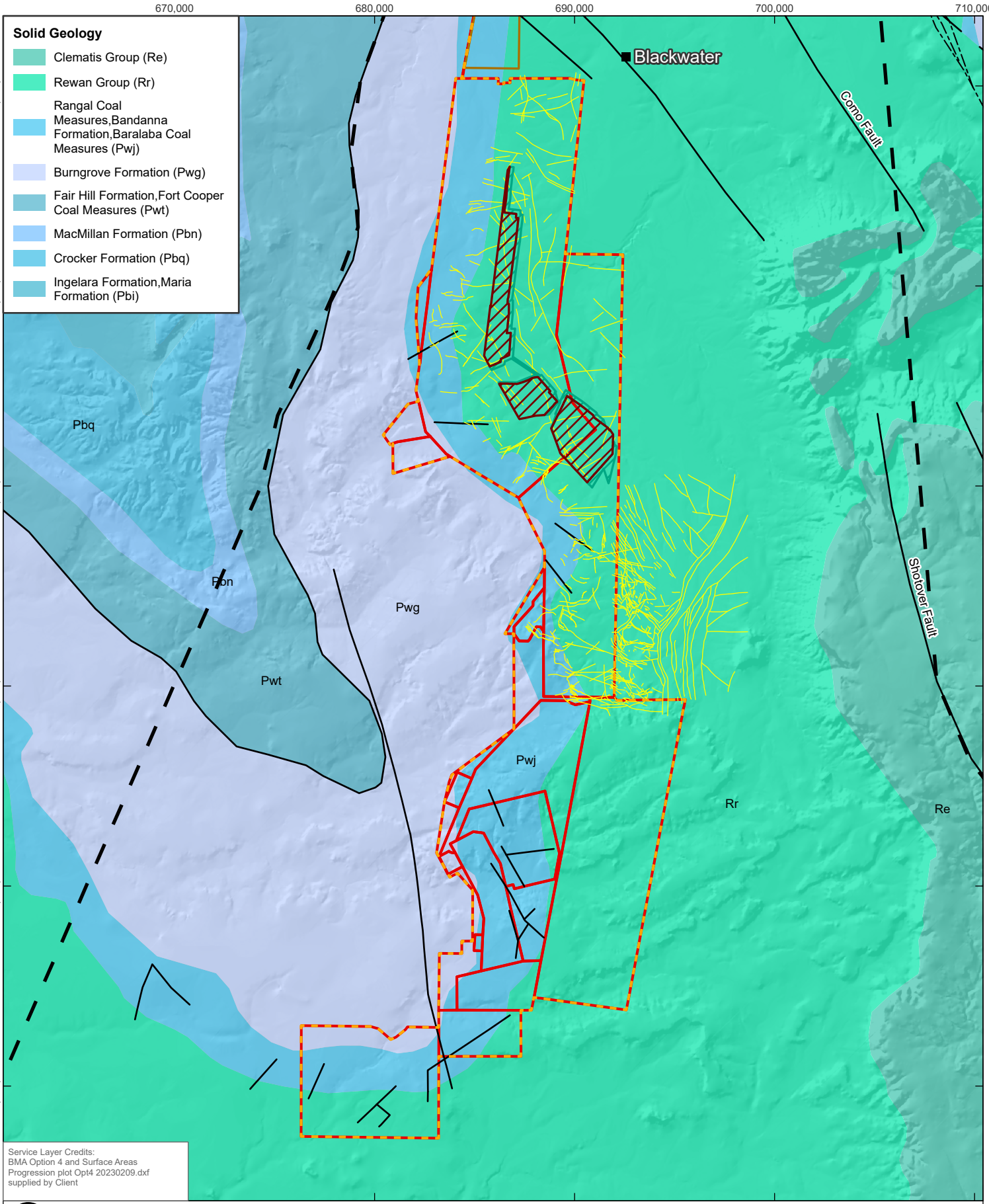
SURFACE GEOLOGY AND DRILLHOLES TARGETING ALLUVIUM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 3-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F03_1_Surface Geology



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	05-May-2026
Drawn by:	JWP

Rev3

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

SOLID GEOLOGY

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 3-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F03_2_Solid Geology

3.1.1 Structural Geology

The structural geology in the region is characterised by gently folded consolidated sediments and a major north to north-west striking fault system which forms the Jellinbah Thrust fault system (AGE, 2013). A series of easterly dipping thrust faults occur parallel to the Jellinbah Thrust, including the Shotover Fault (occurring to the east of the Study Area where the Clematis Group outcrops) and the Como Fault that runs through the Curragh Mine (**Figure 3-2**) (Mallet et al., 1985). Regionally the structure is defined as a faulted monoclinal limb (AGE, 2013).

The strata in the vicinity of the BWM are heavily influenced by a series of easterly dipping, north to northwest striking faults (AGE, 2008). The Shotover Fault is of major importance as there is a displacement of up to 3,000 m (AGE, 2013). Locally, thrust faulting that occurs within the BWM may be attributed to thrusts occurring in the footwall of the Shotover Fault. Local structure is influenced by strike slip movement of basement rocks. Local fault displacement is reported to be less than five meters on average but can reach up to 20 m (AGE, 2008). **Figure 3-2** also shows the numerous local faults mapped within the Study Area. The local faults were mapped by historical tenement holders (BM Alliance Coal Operations Pty Ltd [BMA]) and the regional faults were sourced from the public database (Qld Government, 2004).

3.2 Local Geology

The geology of the Project Area is discussed in **Sections 3.2.1** to **3.2.6** below.

3.2.1 Quaternary Sediments

The Quaternary alluvial sediments unconformably overlie the Triassic Rewan Group and Permian coal measures. The unit consists of a thin surficial cover of generally unconsolidated clays, silts, sands and gravels associated with floodplains of the major drainage channels, primarily Blackwater Creek. Drilling data from within the Study Area shows that the alluvial sequence varies from approximately 0.5 to 16 m thick.

Recent drilling at BWM has shown that alluvium associated with the creeks, is not always present and extents are limited. In 2020, four bores were attempted to be installed into the alluvium near north BWM (Taurus Creek, Sagittarius Creek and Two Mile Gully), however only one drillhole at Taurus Creek found sufficient alluvial sediments which was completed as a dry bore (AGE, 2020). In 2021 another bore targeted the alluvium at Sagittarius Creek, however upon drilling, the alluvial sediments were again deemed insufficient at the site, so the bore was installed into the underlying Rewan Group instead (HydroFS, 2021). Further discussion of drilling attempts in the alluvium and groundwater occurrence is provided in **Section 4.3.1.** Based on these investigations, it is considered that the extent of the alluvium within the Study Area is likely smaller than mapped on the regional surface geology map. **Figure 3-1** shows the location of the drilling that attempted to target to the alluvium, whilst illustrating what unit the bores were resultingly screened in.

3.2.2 Tertiary Sediments and Basalt

Tertiary and basalt units unconformably overlie the Triassic and Permian units. The unit consists primarily of unconsolidated/weathered Tertiary Sediments and weathered

claystone, siltstone and sandstones. The unit varies in thickness ranging from 5 to 50 m with a maximum thickness of 115 m, typically thicker to the south.

Based on drilling results, the Tertiary sediments in the southern Project Area are thicker on average than in the northern Project Area. In this area they primarily consist of claystone, siltstones, sandstones and interbedded basalt of the Emerald Formation.

Toward the south and southwest of the Project Area, basalt flows are present (**Figure 3-1**). The basalts have been described as having varying degrees of weathering and thickness, from moderately weathered thin flows (intersected in ML 70167 in the Humboldt area) to thicker and more fresh flows (intersected slightly further north in ML 70139 in the South Marshmead area). The basalt flows vary in thickness ranging from to 10 to 42 m (AGE, 2003).

3.2.3 Triassic Clematis Group

The Clematis Group unconformably overlies the Rewan Group and outcrops on the eastern margins of the Study Area, where it forms an elevated plateau and escarpment (**Figure 3-2**).

The unit is comprised of weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate. In the Study Area, the Clematis Group is made up of the Glenidal Formation and Expedition Sandstone members which are estimated to form an average thickness in the range of 100 to 800 m (Geoscience Australia, 2021).

3.2.4 Triassic Rewan Group

The Rewan Group overlies the Permian coal measures and occurs as in-fill material, thickening to the east with the dip of the coal measures, and thins to the west where the coal measures occur at outcrop (**Figure 3-1**). Where present, the Rewan Group has a distinct greenish tint (non-marine deposits containing glauconite) and is composed of siltstone and mudstone, with interbeds of lithic and volcanic sandstones.

Based on exploration drill holes and groundwater bore holes in the Study Area, the Rewan Group is comprised of siltstone and mudstone, with interbeds of lithic and volcanic sandstones and is of variable thickness ranging between approximately 50 to 300 m.

3.2.5 Permian Rangal Coal Measures

The Rangal Coal Measures (RCM) underlie the Rewan Group and outcrop to the west of the Project Area (**Figure 3-1**). This unit consists of interbedded sandstone, siltstone, mudstone, and coal with tuff (towards the base) and has a thickness of up to 100 m in the Study Area. The three main economic coal seams are the Aries, Castor and Pollux Seam. This naming convention applied regionally. For operational reasons, the coal seams follow a different naming convention at BWM: Aries Seam is referred to as the Top Seam, the Castor Seam is referred to as the Middle Seam and the Pollux Seam is referred to as the Lower Seam.

The splitting and occurrence of these seams is shown in **Figure 3-3.** The principal coal seams in the BWM area (from top to bottom) are the Top Seam (also known as TFULL), Middle Seam (MFULL) and Middle split (MB), Lower Seam (LFULL) and Lower split (L01). Minor seams include the Upper Top (UT), Top Rider (TR), Middle Rider (MR) and Lower and Upper Rider (LUR) seams.

The Pollux and Orion seams create the thick Argo seam (CD) in the southern South Blackwater Mine area. To the north, the Orion and Pollux Seams coalesce into the Lower (LFULL) Seam. This seam splits into the lower split (L01) and the Middle seam (MFULL). Between the Deep Creek/Wilpeena and Blackwater pit areas the Middle Seam coalesces with the Aries and Castor Seams.

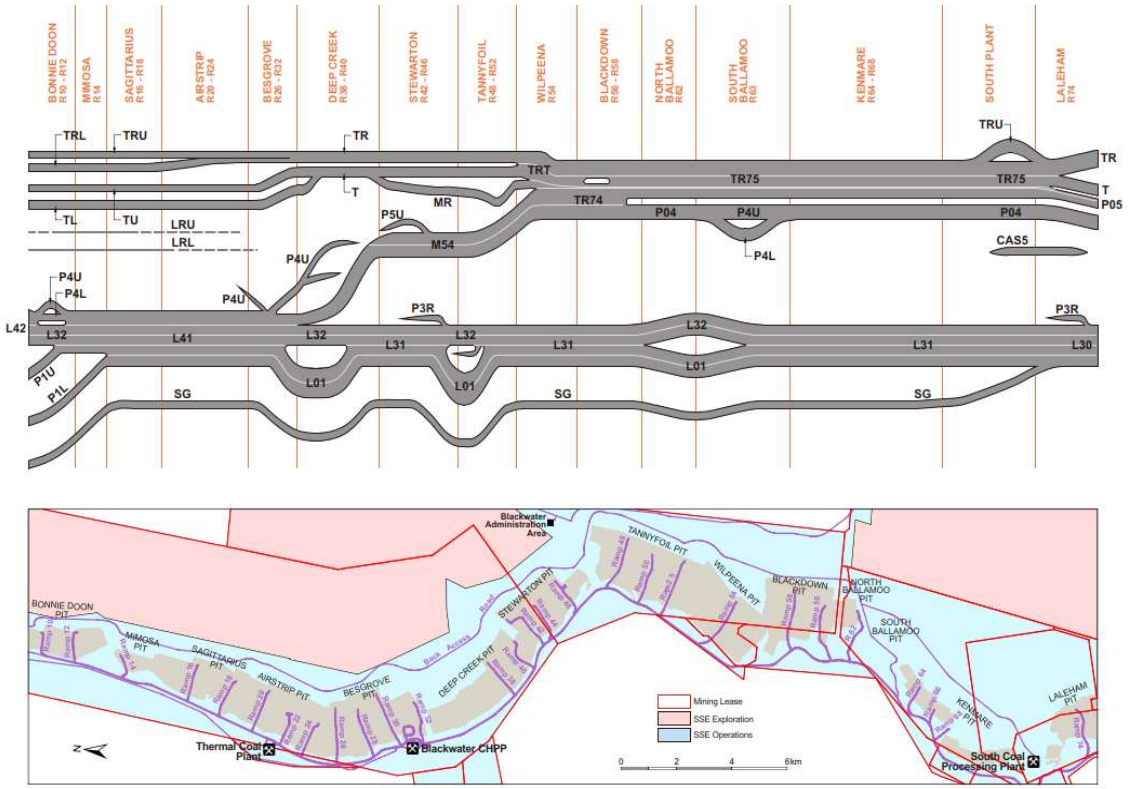


Figure 3-3 Schematic Seam Stratigraphy and Split Diagram (BMA, 2014)

3.2.6 Burngrove Formation

The Burngrove Formation is comprised of mudstone, siltstone, sandstone, coal and tuff. The RCM conformably overlie the coal bearing Burngrove Formation. The Burngrove Formation is equivalent to the Fort Cooper Coal Measures elsewhere in the Bowen Basin and is considered the basement formation for this assessment.

4.0 Hydrogeology

This section discusses each of the hydrogeological units relevant to the Project, describing groundwater hydrology (groundwater occurrence, hydraulic gradients, recharge and discharge), hydraulic properties, groundwater quality, and groundwater use and management. The conceptual hydrogeological model for the Study Area, refined with the most recent groundwater monitoring dataset with a focus on the Project, is summarised in **Section 6.1**.

The local hydrostratigraphic units are described below, from the shallowest (Alluvium) to the deepest (Burngrove Formation):

- **Alluvium** - Alluvial deposits are associated with local creeks. In recent years, the alluvium local to the Study Area has been found dry.
- **Tertiary Sediments and Basalt** - Unconsolidated surface layer of weathered rock (also referred to as regolith) which may provide a preferential flow pathway for groundwater if levels exceed the base of weathering.
- **Clematis Group** - outcrops on the eastern margins of the Study Area, where it forms an elevated plateau. The unit is comprised of weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate.
- **Rewan Group** - A regional scale aquitard comprising mudstones interbedded with siltstone and fine to medium grained labile sandstone. However, permeability testing indicates hydraulic conductivity values may be higher in the upper weathered zone of the unit.
- **Rangal Coal Measures (RCM)** - Previous investigations (EMM, 2020) identified this formation as a regional aquifer. Groundwater flow is primarily within the coal seams (via interconnected cleats and fractures), which are confined by low permeability overburden and interburden that essentially form aquitards. The coal measures are highly faulted resulting in “compartmentalisation” with coal seams juxtaposed against lower permeability interburden. Recharge to this unit occurs via direct infiltration where the unit outcrops or sub-crops.
- **Burngrove Formation** - outcrops to the west of BWM and dips east below the Rangal Coal Measures. It is largely regarded an aquitard comprising interbedded siltstone, carbonaceous and tuffaceous shales, mudstone, and thin coal seams. However, several landholder bores are apparently screened within this formation locally (assuming the registered bore database aquifer attribution is correct) suggesting it includes permeable horizons that can support low yields. This formation is considered the basement for the purposes of this assessment.

4.1 BWM Groundwater Monitoring

Figure 4-1 to **Figure 4-8** and **Table 4-1** to **Table 4-8** show the BWM groundwater monitoring network bores for which data is available for this assessment. Data used for this assessment has been collected from 144 monitoring bores and four Vibrating Wire Piezometers (VWPs). The period for which groundwater quality and groundwater level data is available from these bores is also listed in the tables below.

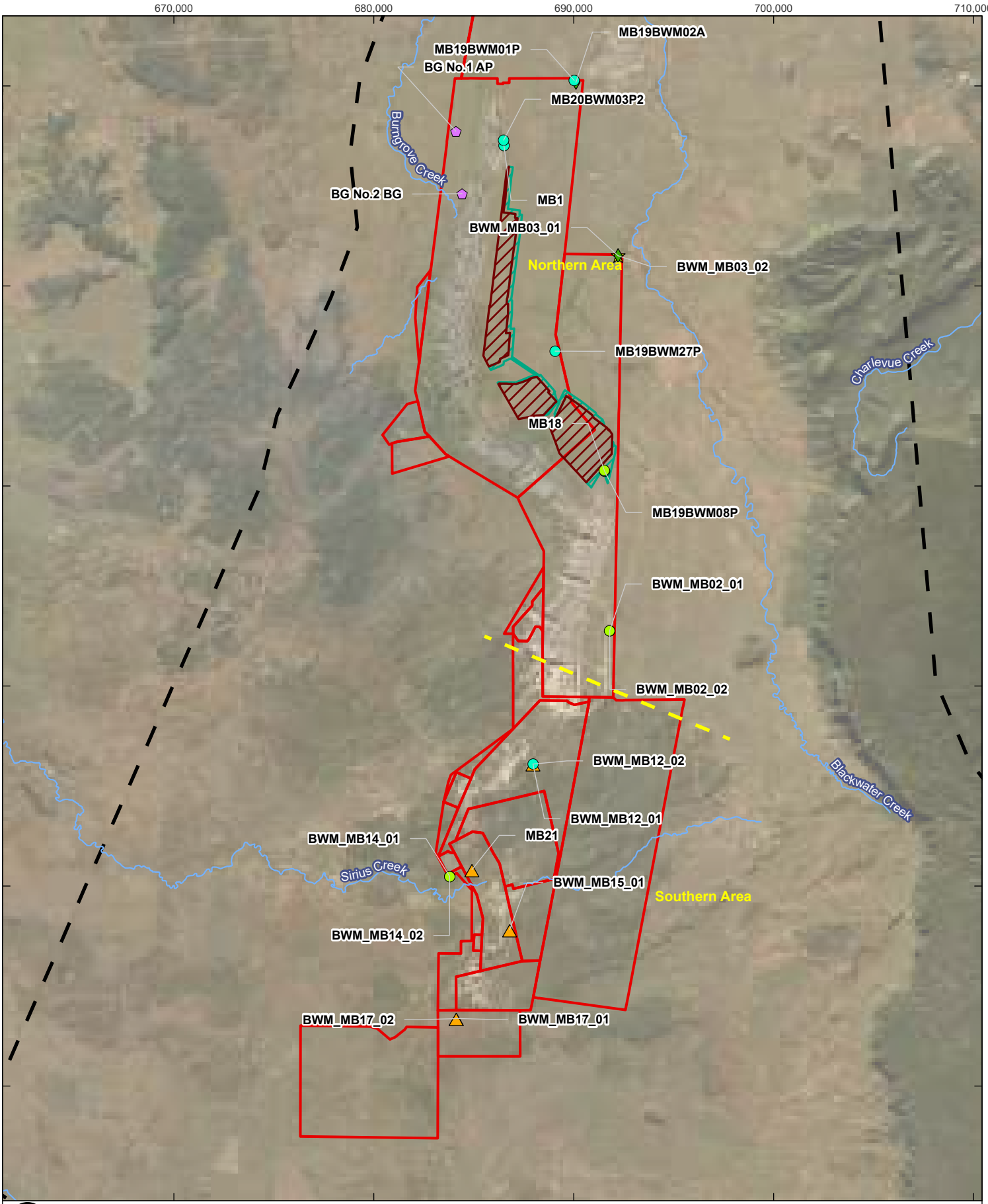
4.1.1 BWM EA Monitoring Bores

There is a total of 21 EA monitoring bores across BWM. Details of these bores are shown in **Table 4-1** with their locality shown in **Figure 4-1**.

Table 4-1 EA Monitoring Bores

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
BWM_MB03_01	692223	7381510	181.98	12	8 - 11	Alluvium	BWM South	Active (dry)	26/11/2024	26/11/2024	-	-
BWM_MB12_01	687961	7356102	332.79	24	16-22	Tertiary	BWM South	Active (dry)	30/05/2022	30/01/2025	-	-
BWM_MB15_01	686794	7347807	321.39	16.43	10.43 - 16.43	Tertiary	BWM South	Active	22/05/2022	4/03/2025	23/08/2023	4/03/2025
BWM_MB17_01	684127	7343376	262.29	18	12 - 18	Tertiary Basalt	BWM South	Active (dry)	22/08/2022	4/03/2025	-	-
BWM_MB17_02	684119	7343373	262.38	29	22 - 28	Tertiary	BWM South	Active	22/08/2022	4/03/2025	25/08/2023	4/03/2025
MB21	684905	7350813	264.23	31	25 - 31	Tertiary Sediments	BWM South	Active	31/08/2009	4/03/2025	31/08/2009	4/03/2025
MB19BWM02A	690112	7390183	168.87	15	12 - 15	Weathered Rewan	BWM North	Active	17/12/2019	5/03/2025	30/06/2020	5/03/2025
BWM_MB03_02	692220	7381519	182.13	42	35 - 41	Rewan	BWM South	Active	21/08/2023	26/11/2024	21/08/2023	8/03/2025
BWM_MB02_01	691791	7362760	259.73	28.4	22.3 - 28.3	RCM (OB)	BWM North	Active	16/08/2023	28/01/2025	16/08/2023	8/03/2025
MB18	691528	7370782	221.41	40.6	37.6 - 40.6	RCM (Sandstone OB)	BWM North	Active	1/09/2009	8/03/2025	1/09/2009	8/03/2025
BWM_MB14_01	683797	7350477	267.75	25	18 - 24	RCM (IB)	BWM South	Active	28/01/2023	4/03/2025	14/06/2022	4/03/2025
BWM_MB14_02	683798	7350466	267.74	152	144 - 150	RCM (Sandstone OB)	BWM South	Active	21/04/2022	4/03/2025	14/06/2022	4/03/2025
MB1	686514	7387022	201.16	60	54 - 60	RCM (Aries)	BWM North	Active	1/09/2009	3/03/2025	1/09/2009	3/03/2025
MB19BWM01P	690024	7390277	168.58	171	168 - 171	RCM (Aries)	BWM North	Active	17/12/2019	26/11/2024	15/06/2020	26/11/2024
MB19BWM27P	689070	7376739	197.35	189	180 - 189	RCM (Aries & siltstone)	BWM North	Active	19/12/2019	6/03/2025	30/06/2020	6/03/2025
MB20BWM03P2	686490	7387289	199.62	109	98 - 107	(RCM, Castor and Pollux)	BWM North	Active	25/02/2021	3/03/2025	10/02/2021	3/03/2025
BWM_MB02_02	691803	7362756	259.85	153.5	144 - 150	RCM (Castor)	BWM North	Active	16/08/2023	31/01/2025	29/09/2020	8/03/2025
MB19BWM08P	691544	7370740	221.67	190	184 - 190	RCM (Aries Seam & Siltstone)	BWM North	Active	29/06/2020	25/11/2024	30/06/2020	8/03/2025
BWM_MB12_02	687969	7356097	333.56	159	155 - 158	RCM (Castor)	BWM South	Active	30/05/2022	30/01/2025	17/08/2023	8/03/2025
BG No.1 AP	684107	7387742	200.46	72.9	63.6 - 72.9	Burngrove	BWM North	Active	19/01/2012	5/03/2025	28/12/2011	5/03/2025
BG No.2 BG	684414	7384622	211.79	38.5	32.3 - 38.5	Burngrove	BWM North	Active	19/01/2012	5/03/2025	28/12/2011	5/03/2025

O/I = overburden/interburden
1 Coordinates GDA 2020 Zone 55



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	RB

LEGEND

Groundwater Monitoring Location

- Alluvium
- Tertiary
- Rewan
- RCM (Coal)
- RCM Overburden/Interburden
- Burngrove

- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- BWM EA BORES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_1_Groundwater Monitoring Network (BWM EA Bores)

4.1.2 BWM Non EA Monitoring Bores

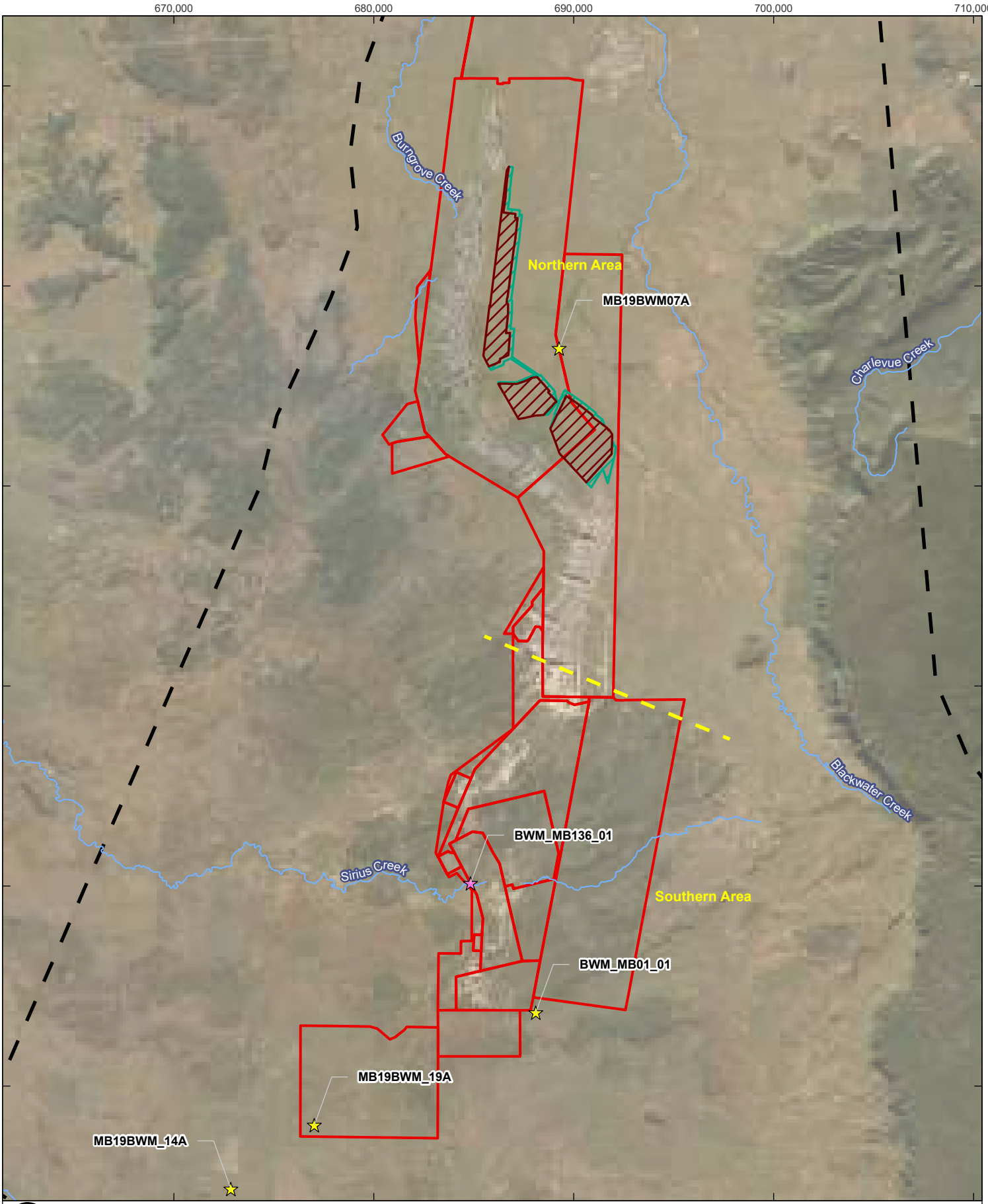
4.1.2.1 Quaternary Sediments

The BWM groundwater monitoring network for the alluvium is shown in **Table 4-2** and **Figure 4-2**. The monitoring network comprises a total of six monitoring bores (one of which is a current EA bore and thus is not presented here but in **Section 4.1.1**), installed at depths ranging from 7 to 16 mBGL, with available data between 2019 and 2025. All excluding one, which was located to the south of the BWM operations, are observed to be dry.

Table 4-2 Quaternary Sediments Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
MB19BWM07A	689271	7376875	196.5	7	4 - 7	Alluvium	BWM North	Active (dry)	18/12/2019	22/06/2023	30/06/2020	22/06/2023
BWM_MB01_01	688102	7343664	271.04	16	10 - 16	Alluvium	BWM South	Active	17/03/2023	20/11/2024	17/03/2023	20/07/2023
MB19BWM_14A	672849	7334846	205.84	7.5	6 - 7	Alluvium	BWM South	Active (dry)	4/08/2022	27/06/2023	-	-
MB19BWM_19A	677022	7338038	224.72	14.5	9 - 12	Alluvium	BWM South	Active (dry)	4/08/2022	27/06/2023	-	-
BWM_MB136_01	684837	7350128	256.26	8.3	4.0 - 7.0	Alluvium/ Burngrove	BWM South	Active (dry)	18/10/2024	31/01/2025	-	-

1 Coordinates GDA 2020 Zone 55



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- Alluvium
- Alluvium/ Burngrove
- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- QUATERNARY SEDIMENTS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_2_Groundwater Monitoring Network (Quaternary Sediments)

4.1.2.2 Tertiary Sediments and Basalt

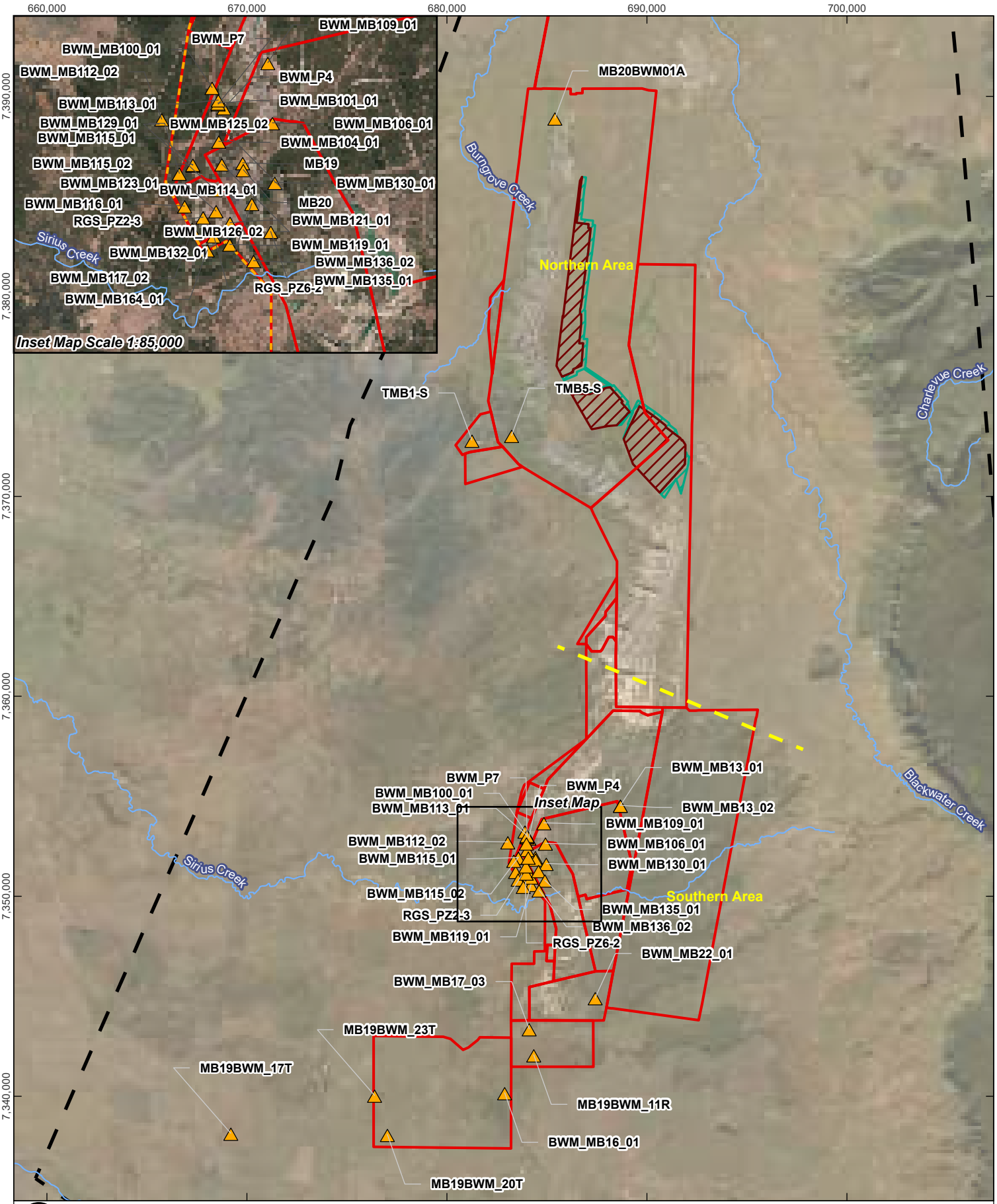
The BWM non-EA groundwater monitoring network for the Tertiary Sediments and Basalt is shown in **Table 4-3** and **Figure 4-3**. This network includes 47 monitoring bores (five of which are current EA bores and thus not presented here but in **Section 4.1.1**), installed at depths from 4.5 to 56 mBGL, with available data between 2009 and 2025. Of these, 24 bores are currently dry.

Table 4-3 Tertiary Sediments and Basalt Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
MB20BWM01A	685396	7388908	187.76	9.5	6.5 - 9.5	Tertiary	BWM North	Active	21/06/2023	30/01/2025	-	-
TMB5-S	683230	7373039	239.06	15	12 - 15	Tertiary	BWM North	Active	17/01/2024	27/11/2024	27/11/2024	27/11/2024
TMB1-S	681249	7372800	259.53	16	13 - 16	Tertiary	BWM North	Active	18/01/2024	29/11/2024	29/11/2024	29/11/2024
BWM_MB13_01	688667	7354548	301.14	4.5	2.5 - 4.5	Tertiary	BWM South	Active (dry)	23/08/2022	29/01/2025	-	-
BWM_MB13_02	688672	7354546	300.53*	22	16 - 22	Tertiary	BWM South	Active (dry)	21/08/2022	29/01/2025	-	-
BWM_MB16_01	682882	7340174	283.63	56	49 - 55	Tertiary	BWM South	Active	19/08/2022	20/11/2024	-	-
BWM_MB17_03	684111	7343371	262.46	46	40 - 46	Tertiary	BWM South	Active	22/08/2022	25/09/2024	-	-
BWM_MB22_01	687412	7344924	286.17	26.5	21 - 26.5	Basalt	BWM South	Active	17/03/2023	20/11/2024	17/03/2023	17/03/2023
BWM_P4	684098	7352908	284.44	15.5	12.5 - 15.5	Tertiary (clay)	BWM South	Active	26/01/2023	10/09/2024	26/01/2023	28/09/2023
BWM_P7	684002	7352973	284.95	15.5	12.4 - 15.4	Tertiary (clay)	BWM South	Active	26/01/2023	10/09/2024	26/01/2023	28/09/2023
MB19	684418	7351975	310.7	19.7	13.7 - 19.7	Tertiary	BWM South	Unknown	31/08/2009	31/01/2025	31/08/2009	30/05/2012
MB19BWM_11R	684338	7342067	290.92	41.4	35.43 - 41.43	Tertiary (Basalt)	BWM South	Active (dry)	2/02/2023	27/06/2023	-	-
MB19BWM_17T	669191	7338149	226.31	32.5	26 - 32	Tertiary	BWM South	Active (dry)	6/11/2022	27/06/2023	-	-
MB19BWM_20T	677019	7338087	224.5	30.5	24 - 30	Tertiary (Sandstone with minor basalt)	BWM South	Active (dry)	20/09/2022	27/06/2023	-	-
MB19BWM_23T	676379	7340051	238.87	43.5	36.26 - 42.26	Tertiary	BWM South	Active (dry)	19/08/2022	27/06/2023	-	-
MB19BWM_26A	683558	7333194	226.86	15.5	9 - 15	Tertiary	BWM South	Active	26/05/2022	20/11/2024	-	-
MB20	684428	7351856	311.58	31.6	25.6 - 31.6	Tertiary	BWM South	Active (dry)	20/10/2009	31/01/2025	27/07/2009	11/02/2021
RGS_PZ2-3	683745	7351052	285.56	10.5	6 - 10.5	Tertiary	BWM South	Active	29/01/2023	11/06/2024	29/01/2023	26/09/2023
RGS_PZ6-2	683925	7350731	276.64	6.5	3.5 - 6.5	Tertiary Clays (fractured zone)	BWM South	Active	30/01/2023	12/06/2024	30/01/2023	29/09/2023
BWM_MB100_01	683897	7353255	304.36	17.5	10.5 - 16.5	Tertiary	BWM South	Active (dry)	23/08/2022	15/10/2024	-	-
BWM_MB101_01	683996	7352990	285	28	19 - 28	Tertiary (Clays, weathered sandstone)	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB104_01	684011	7352341	309.2	20	13.5 - 19.5	Tertiary	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB106_01	684923	7352654	307.81	32.5	26 - 32	Tertiary	BWM South	Active	15/10/2024	15/10/2024	-	-
BWM_MB109_01	684845	7353676	316.31	36	29.5 - 35.5	Tertiary	BWM South	Active (dry)	22/10/2024	22/10/2024	-	-
BWM_MB112_02	683041	7352718	269.92	21.4	15 - 21	Tertiary	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB113_01	684003	7353042	285.51	13.5	7 - 10	Tertiary	BWM South	Active	15/10/2024	15/10/2024	-	-
BWM_MB114_01	683973	7352659	295.95	20.4	12.3 - 16.3	Tertiary	BWM South	Active	15/10/2024	15/10/2024	-	-
BWM_MB115_01	683572	7351933	310.44	12	8.5 - 11.5	Tertiary	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB115_02	683570	7351947	310.48	25.3	18.5 - 24.5	Tertiary	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB116_01	683431	7351240	304.83	12.9	9.4 - 12.4	Tertiary	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB117_02	683557	7350857	302.84	29.5	21.9 - 27.9	Tertiary	BWM South	Active	16/10/2024	16/10/2024	-	-
BWM_MB119_01	684198	7350590	281.36	19	15.5 - 18.5	Tertiary	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB121_01	684202	7350959	307.11	18.5	10.5 - 16.5	Tertiary	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB123_01	683965	7351157	307.03	8.8	5.2 - 8.2	Tertiary	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB125_02	683948	7351517	307.97	42.5	36 - 42	Tertiary	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB126_02	684063	7351953	312.14	32.5	26 - 32	Tertiary	BWM South	Active	8/11/2024	8/11/2024	-	-

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
BWM_MB129_01	683340	7351795	306.52	20.4	14 - 20	Tertiary	BWM South	Active (dry)	5/11/2024	5/11/2024	-	-
BWM_MB130_01	684963	7351640	281.62	18	14.0 - 17.0	Tertiary into RCM OB	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB132_01	684573	7351281	288.66	19	12.5 - 18.5	Tertiary	BWM South	Active (dry)	22/10/2024	22/10/2024	-	-
BWM_MB135_01	684895	7350808	263.75	12	6.5 - 9.5	Tertiary	BWM South	Active (dry)	18/10/2024	18/10/2024	-	-
BWM_MB136_02	684603	7350311	255.41	21.5	15.0 - 21.0	Tertiary	BWM South	Active	18/10/2024	18/10/2024	-	-
BWM_MB164_01	683816	7350493	269.25	15.3	8.5 - 14.5	Tertiary (Silty clay)	BWM South	Active	16/10/2024	16/10/2024	-	-

O/I = overburden/interburden
1 Coordinates GDA 2020 Zone 55
* Ground Level



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- Tertiary

- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- TERTIARY

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_3_Groundwater Monitoring Network (Tertiary)

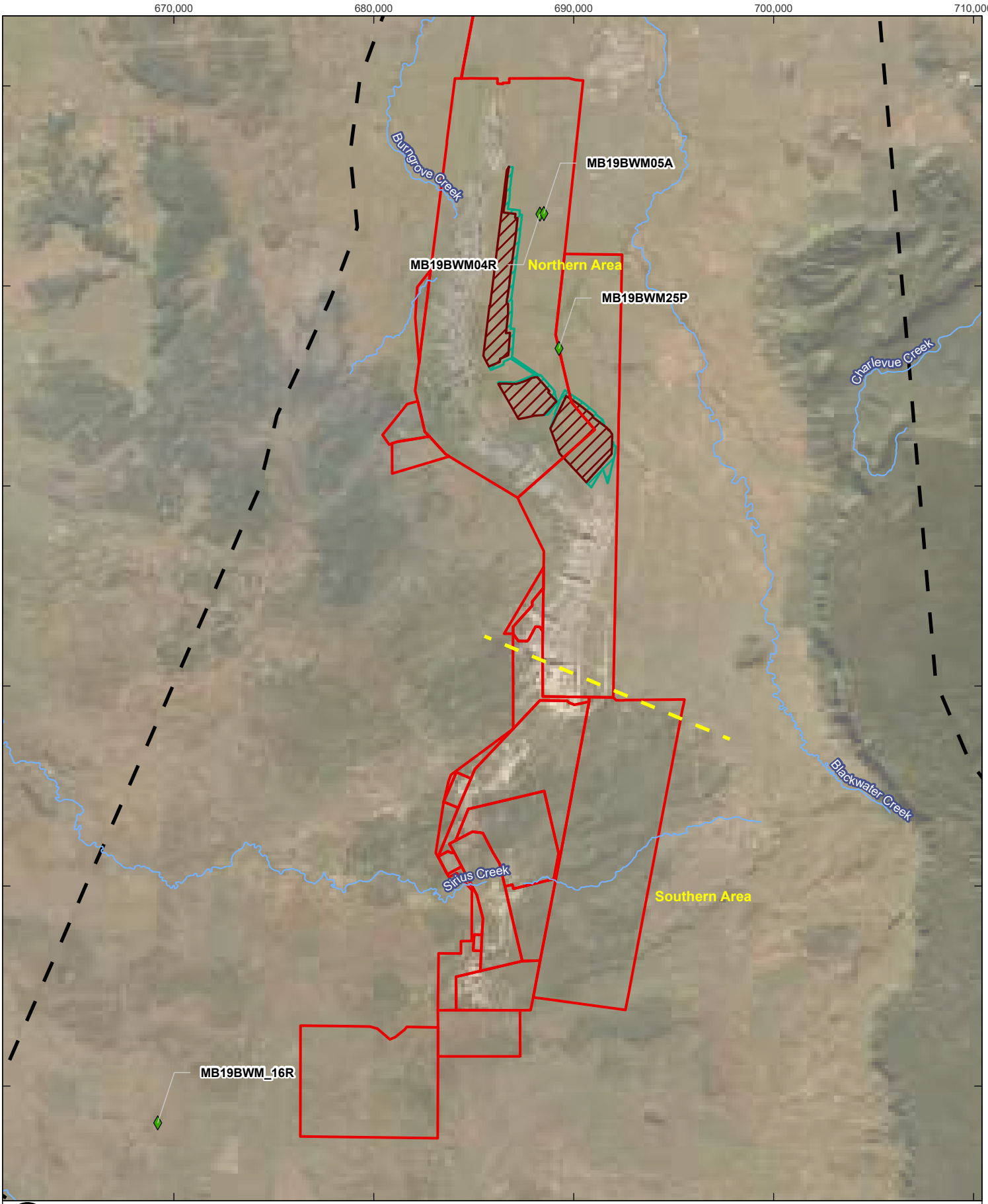
4.1.2.3 Triassic Rewan Group

The BWM non-EA groundwater monitoring network for the Triassic Rewan Group includes a total of six monitoring bores (two of which are current EA bores, thus not presented here but in **Section 4.1.1**). Bores are installed at depths ranging from 15 to 95 mBGL, with available data between 2023 and 2025. Bore details and their locality are shown in **Table 4-4** and **Figure 4-4** respectively.

Table 4-4 Triassic Rewan Group Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
MB19BWM04R	688307	7383595	200.9	80	71 - 80	Rewan	BWM North	Active	30/06/2020	21/06/2023	30/06/2020	26/09/2023
MB19BWM05A	688507	7383623	199.57	15	9 - 15	Weathered Rewan	BWM North	Active (dry)[2]	18/12/2019	21/06/2023	30/06/2020	21/06/2023
MB19BWM25P	689262	7376881	196.42	20	17 - 20	Rewan	BWM North	Active	1/07/2020	22/06/2023	30/06/2020	26/09/2023
MB19BWM_16R	669188	7338156	226.26	95	87 - 93	Rewan	BWM South	Active	6/11/2022	19/11/2024	31/01/2023	12/09/2023

1 Coordinates GDA 2020 Zone 55
2 bore forms part of the groundwater network and is currently monitored, however, it is currently dry



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- Rewan

- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- REWAN GROUP

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_4_Groundwater Monitoring Network (Rewan Group)

4.1.2.4 Rangal Coal Measures

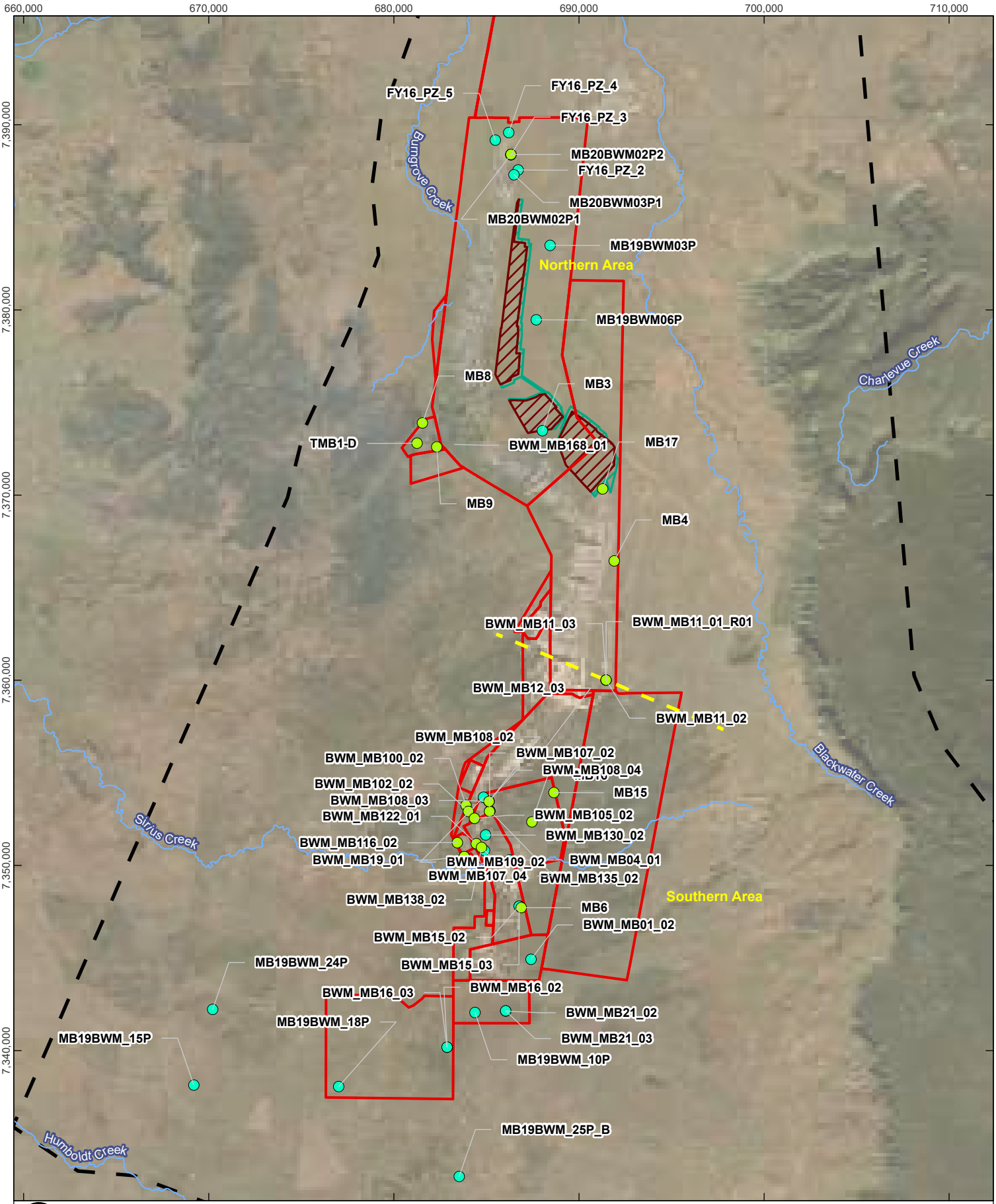
BWM non-EA groundwater monitoring bores targeting the Rangal Coal Measures are shown in **Table 4-5** and **Figure 4-5** and comprises a total of 51 monitoring bores. The bores are installed at depths ranging from 17 to 231.5 mBGL, with available data between 2009 and 2025, and six bores observed as dry.

Table 4-5 Rangal Coal Measures Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
FY16_PZ_2	686714	7387555	200.03	104.7	100.7 - 103.7	Pollux	BWM North	Active	26/11/2020	21/06/2023	26/11/2020	27/09/2023
FY16_PZ_3	686322	7388372	193.48	82.5	72.5 - 81.5	Pollux	BWM North	Active	25/11/2020	30/01/2025	23/03/2021	21/06/2023
FY16_PZ_4	686206	7389577	191	54	50 - 53	Pollux	BWM North	Active	25/11/2020	30/01/2025	25/11/2020	27/09/2023
FY16_PZ_5	685482	7389168	186.97	53.5	49.5 - 52.5	Pollux	BWM North	Active	25/11/2020	30/01/2025	25/11/2020	27/09/2023
MB19BWM03P	688442	7383483	199.39	231.5	222.5 - 231.5	Aries & Siltstone	BWM North	Active	30/06/2020	21/06/2023	30/06/2020	26/09/2023
MB19BWM06P	687694	7379464	209.64	186	180 - 186	Siltstone & Aries	BWM North	Active	30/06/2020	21/06/2023	30/06/2020	21/06/2023
MB20BWM02P1	686325	7388395	192.86	36	30 - 36	IB (Sandstone)	BWM North	Active	24/03/2021	30/01/2025	24/03/2021	21/06/2023
MB20BWM02P2	686321	7388395	192.92	66	60 - 66	Castor	BWM North	Active	25/02/2021	30/01/2025	25/02/2021	27/09/2023
MB20BWM03P1	686489	7387296	199.44	86	80 - 86	Castor	BWM North	Active	24/03/2021	30/01/2025	10/02/2021	27/09/2023
MB3	688026	7373479	219.99	78.2	73.6 - 78.2	Aries	BWM North	Active	1/09/2009	6/11/2022	12/01/2010	15/05/2023
MB8	681544	7373895	271.76*	17	14 - 17	OB/IB?	BWM North	Unknown	1/09/2009	14/06/2024	1/09/2009	29/11/2023
MB9	682318	7372602	249.08	18	15 - 18	OB/IB?	BWM North	Active	1/09/2009	22/11/2024	1/09/2009	22/11/2024
TMB1-D	681252	7372802	259.56	36	31 - 36	IB	BWM North	Active	18/01/2024	29/11/2024	29/11/2024	29/11/2024
BWM_MB11_01_R01	691464	7360014	300.66	90.4	85 - 88	OB	BWM Central	Active	2/05/2022	22/01/2024	-	-
BWM_MB11_02	691466	7360007	300.85	115.25	112.25 -115.25	Castor	BWM Central	Active	4/05/2022	23/01/2025	23/01/2025	23/01/2025
BWM_MB11_03	691459	7360009	300.62	136.2	121.2 - 127.2	Pollux	BWM Central	Active	29/04/2022	23/01/2025	23/01/2025	23/01/2025
MB17	691280	7370333	227.2	67	-	OB (Sandstone)	BWM Central	Decommissioned	1/09/2009	26/02/2020	1/09/2009	26/02/2020
MB4	691908	7366445	250.25	49.8 (52)	Unknown	OB (Sandstone)	BWM Central	Decommissioned	31/08/2009	28/11/2019	31/08/2009	28/11/2019
BWM_MB01_02	687411	7344932	286.32	128	120 - 122	Castor	BWM South	Active	17/02/2023	20/11/2024	18/02/2023	16/08/2023
BWM_MB04_01	686247	7350296	259.3*	28.5	22 - 28	Castor	BWM South	Unknown	29/01/2023	12/06/2024	29/01/2023	28/09/2023
BWM_MB12_03	687977	7356091	334.03	180	172.72-178.28	Pollux	BWM South	Active	24/05/2022	29/01/2025	-	-
BWM_MB15_02	686779	7347804	321.21	126	114 - 120	Pollux	BWM South	Active	22/05/2022	24/01/2025	24/01/2025	24/01/2025
BWM_MB15_03	686768	7347802	320.93	84.9	78.9 - 84.9	Castor	BWM South	Active	22/05/2022	24/01/2024	24/01/2025	24/01/2025
BWM_MB16_02	682883	7340184	283.25	86	79 - 85	Castor	BWM South	Active	19/08/2022	20/11/2024	-	-
BWM_MB16_03	682875	7340188	283.29	113	106.5 - 112.5	Pollux	BWM South	Active	27/11/2022	20/11/2024	31/01/2023	12/09/2023
BWM_MB168_01	683280	7372735	241.21	26.5	20 - 26	Coal		Active	-	-	-	-
BWM_MB19_01	683803	7350482	267.87	42	34 - 40	OB	BWM South	Active	18/03/2023	24/05/2023	18/03/2023	24/05/2023
BWM_MB21_02	686043	7342140	305.08	129.4	123 - 129	Aries	BWM South	Active	6/03/2023	21/11/2024	3/03/2023	3/03/2023
BWM_MB21_03	686041	7342148	305.1	163.9	153 - 159	Pollux	BWM South	Active	6/03/2023	21/11/2024	2/03/2023	2/03/2023
MB15	688648	7353936	296.89	140	None, open borehole 51.8-140	Coal in Laleham UG area (EMM, 2021)	BWM South	Decommissioned	20/10/2009	17/08/2022	20/10/2009	18/02/2023
MB16	687458	7352353	281.51	109	None, open borehole 23.6-109	OB in Kenmare UG goaf area (EMM, 2021)	BWM South	Decommissioned	20/10/2009	6/11/2022	20/10/2009	18/02/2023
MB19BWM_10P	684383	7342058	291.38	103	96.5-102.5	Aries	BWM South	Active	28/02/2023	21/11/2024	28/02/2023	15/05/2023
MB19BWM_15P	669194	7338140	226.52	140	131.7 - 137.7	Aries	BWM South	Active	1/10/2022	11/12/2023	31/01/2023	12/09/2023
MB19BWM_18P	677019	7338061	224.57	85	78.5 - 84.5	Aries	BWM South	Active	31/07/2022	11/12/2023	1/02/2023	12/09/2023
MB19BWM_24P	670211	7342228	229.43	68.5	62 - 68	Aries	BWM South	Active	1/02/2023	19/11/2024	1/02/2023	12/09/2023
MB19BWM_25P_B	683532	7333206	227	133.5	127 - 133	Aries	BWM South	Active	11/06/2022	12/12/2023	31/01/2023	7/09/2023

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
MB6	686881	7347723	320.21	19.36 (49.7)	12.6 - 26.5	OB	BWM South	Unknown	31/08/2009	6/11/2022	31/08/2009	6/11/2022
BWM_MB122_01	684453	7351176	317.52	39.5	35 - 38	OB	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB130_02	684959	7351646	281.68	29.5	23.0 - 29.0	Pollux	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB135_02	684899	7350805	263.92	33	17.0 - 23.0	Aries	BWM South	Active	18/10/2024	18/10/2024	-	-
BWM_MB138_02	684736	7350972	276.26	26	19.5 - 25.5	IB	BWM South	Active	19/10/2024	19/10/2024	-	-
BWM_MB100_02	683897	7353250	304.38	38.5	31.5 - 37.5	IB	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB102_02	684026	7352919	284.31	46	39 - 45	IB	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB105_02	684356	7352543	308.04	20.4	14 - 20	Weathered OB	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB107_02	685169	7352920	314.82	34.5	29.5 - 32.5	Weathered OB	BWM South	Active (dry)	20/10/2024	20/10/2024	-	-
BWM_MB107_04	685192	7352941	315.81	87	80.5 - 86.5	Weathered RCM (Pollux 32/31/L01 seam)	BWM South	Active	20/10/2024	20/10/2024	-	-
BWM_MB108_02	685140	7353456	314.71	33	27 - 33	Weathered OB	BWM South	Active (dry)	20/10/2024	20/10/2024	-	-
BWM_MB108_03	685137	7353463	314.67	59.5	47.35 - 59.35	Aries	BWM South	Active (dry)	20/10/2024	20/10/2024	-	-
BWM_MB108_04	685132	7353470	314.72	89	80 - 86	Pollux	BWM South	Active	20/10/2024	20/10/2024	-	-
BWM_MB109_02	684843	7353684	316.18	77	65 - 71	Pollux	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB116_02	683430	7351232	304.88	24.5	18.8 - 22.8	Weathered OB	BWM South	Active	16/10/2024	16/10/2024	-	-

O/I = overburden/interburden
1 Coordinates GDA 2020 Zone 55
* Ground Level



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:270,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- RCM (Coal)
- RCM Overburden/Interburden

- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Infrastructure Area
- Proposed Open Cut Extension

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- RANGAL COAL MEASURES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-5

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_5_Groundwater Monitoring Network (Rangal Coal Measures)

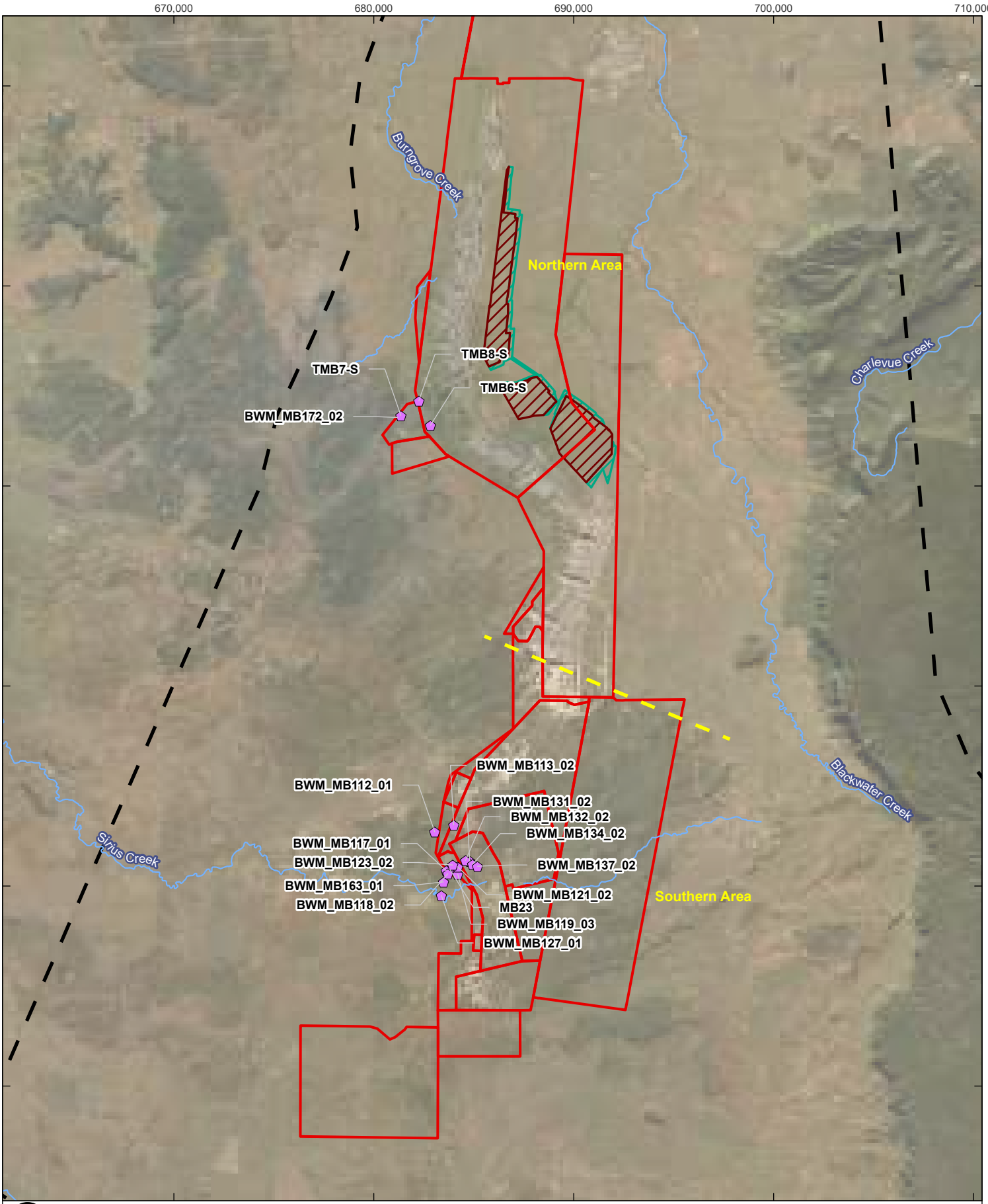
4.1.2.5 Burngrove Formation

The BWM non-EA groundwater monitoring network for the Burngrove Formation is shown in **Table 4-6** and **Figure 4-6**. The network consists of a total of 18 monitoring bores. The bores are installed at depths ranging from 8 to 72.9 mBGL, with available data between 2012 and 2025, with five observed as dry.

Table 4-6 Burngrove Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
BWM_MB172_02	681182.8	7373429	270.3	59.5	49.5-58.5	Burngrove	BWM North	Active	-	-	-	-
MB23	683792	7350850	278.95	24	18 - 24	Burngrove	BWM South	Active	27/01/2023	14/08/2024	27/01/2023	27/09/2023
TMB6-S	682831	7373037	242.09	10	8 - 10	Burngrove (weathered mudstone)	BWM North	Active	17/01/2024	30/11/2024	30/11/2024	30/11/2024
TMB7-S	681355	7373520	263.51	10	7 - 10	Weathered Burngrove	BWM North	Active	18/01/2024	14/06/2024	-	-
TMB8-S	682255	7374259	257.4	36	30 - 36	Burngrove	BWM North	Active	18/01/2024	27/11/2024	27/11/2024	27/11/2024
BWM_MB112_01	683043	7352714	270.06	12.5	9 - 12	Burngrove	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB113_02	683999	7353052	285.64	30.5	20 - 29	Burngrove (Mudstone and siltstone)	BWM South	Active (dry)	15/10/2024	15/10/2024	-	-
BWM_MB117_01	683622	7350774	302.25	39.3	32.8 - 38.8	Burngrove (sandstone)	BWM South	Active	16/10/2024	16/10/2024	-	-
BWM_MB118_02	683708	7350621	278.28	28	21.5 - 27.5	Burngrove (sandstone)	BWM South	Active	16/10/2024	16/10/2024	-	-
BWM_MB119_03	684197	7350597	281.48	29.3	25.8 - 28.8	Burngrove (sandstone)	BWM South	Active (dry)	16/10/2024	16/10/2024	-	-
BWM_MB121_02	684196	7350960	307.29	32.5	23 - 32	Burngrove (sandstone)	BWM South	Active	16/10/2024	16/10/2024	-	-
BWM_MB123_02	683946	7351056	303.87	30	23 - 29	Burngrove (sandstone)	BWM South	Active	16/10/2024	16/10/2024	-	-
BWM_MB127_01	683379	7349529	248.26	11.5	7.9 - 10.9	Burngrove (sandstone)	BWM South	Active (dry)	5/11/2024	5/11/2024	-	-
BWM_MB131_02	684803	7351242	279.25	23	14.5 - 20.5	Burngrove (sandstone)	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB132_02	684591	7351283	288.83	29.5	23.0 - 29.0	Burngrove (sandstone)	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB134_02	684943	7351085	277.8	39.5	36.0 - 39.0	Burngrove (sandstone)	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB137_02	685185	7350987	280.35	30	23.5 - 29.5	Burngrove	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB163_01	683486	7350205	257.4	8	3 - 6	Weathered Burngrove	BWM South	Active (dry)	5/11/2024	5/11/2024	-	-

O/I = overburden/interburden
1 Coordinates GDA 2020 Zone 55
* Ground Level



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- Burngrove
- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- BURNGROVE FORMATION

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-6

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_6_Groundwater Monitoring Network (Burngrove Formation)

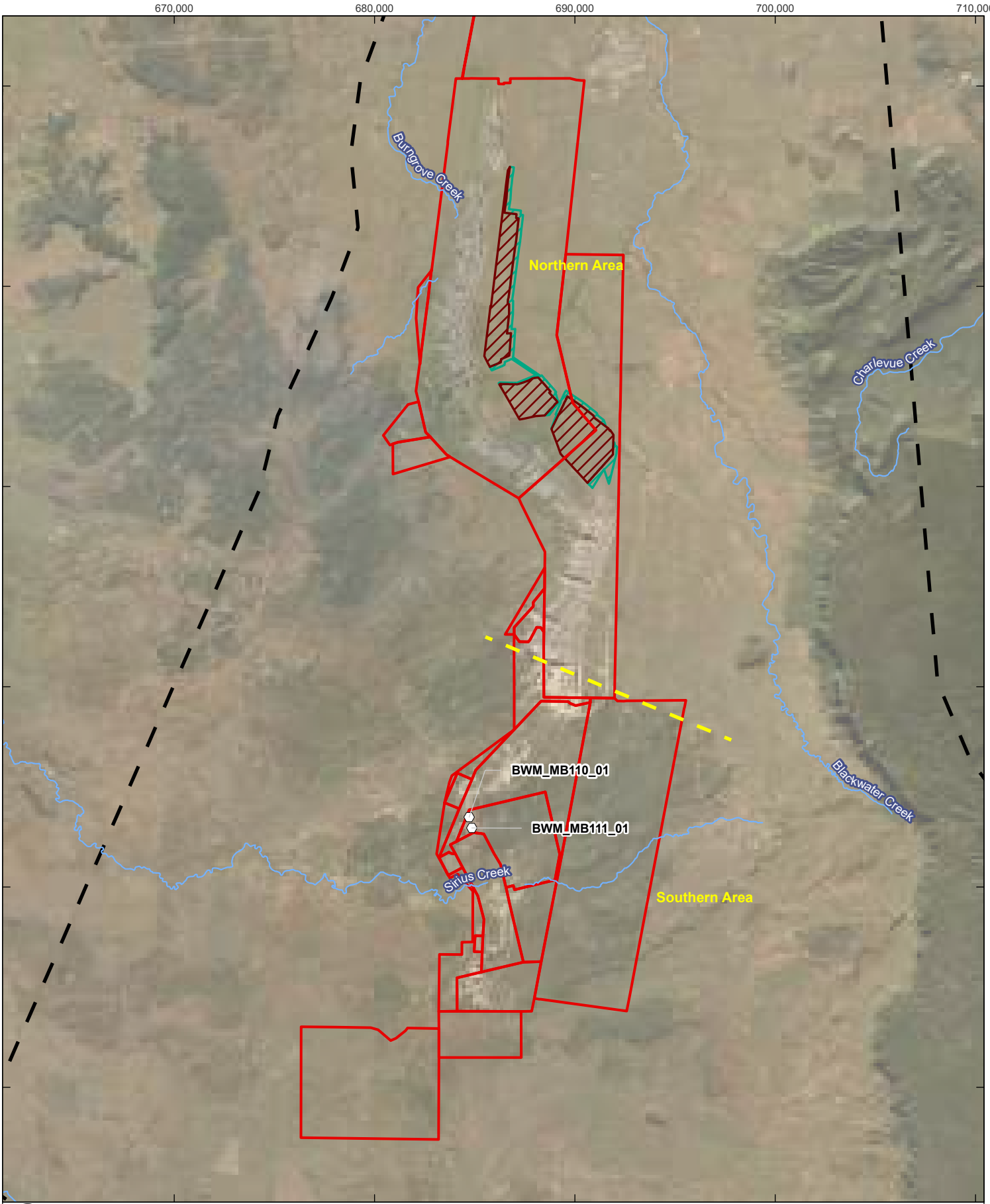
4.1.2.6 Spoil

Groundwater monitoring bores targeting spoil are shown in **Table 4-7** and **Figure 4-7** and include a total of two bores (one of which is dry), installed at depths ranging from 26 to 35.5 mBGL, with available data in 2024.

Table 4-7 Spoil Groundwater Monitoring Network

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Screened Interval (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
BWM_MB110_01	684722	7353488	288.47	36	26 - 32	Mine spoil (tailings)	BWM South	Active	22/10/2024	22/10/2024	-	-
BWM_MB111_01	684855	7352949	304.65	39	26.5 - 35.5	Mine spoil (tailings)	BWM South	Active (dry)	22/10/2024	22/10/2024	-	-

1 Coordinates GDA 2020 Zone 55
* Ground Level



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- Spoil
- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- SPOIL

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-7

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_7_Groundwater Monitoring Network (Spoil)

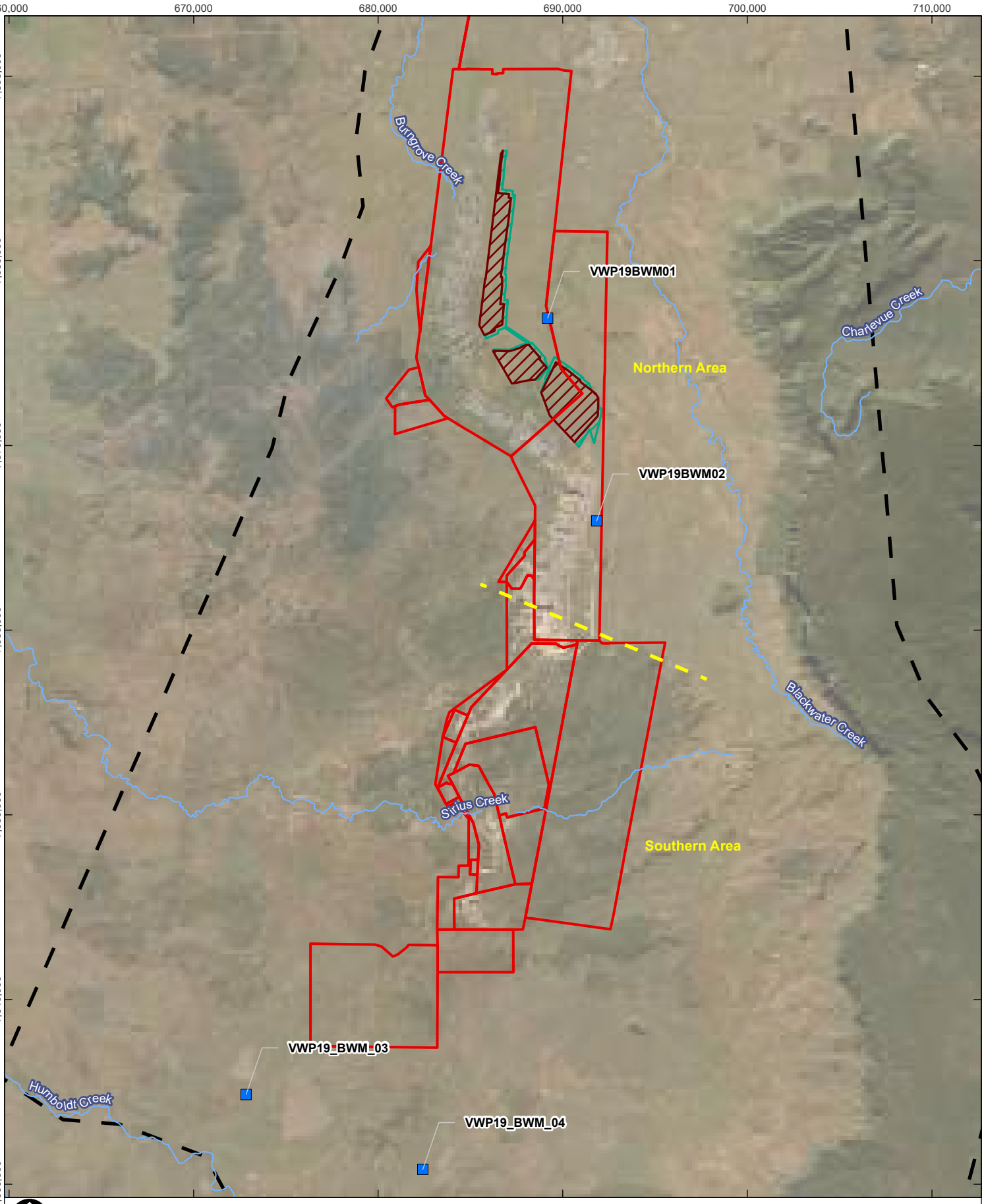
4.1.2.7 Vibrating Wire Piezometers

Four Vibrating Wire Piezometers (VWPs) are installed at BWM, two of which are located in the north and two in the south of BWM. Details for the VWPs, including sensor depths, are provided in **Table 4-8** with their locations shown in **Figure 4-8**.

Table 4-8 Vibrating Wire Piezometers

Bore	Easting[1]	Northing[1]	TOC (mAHD)	Depth (mBGL)	Sensor Depths (mBGL)	Monitored Unit	BWM Area	Status	Data Availability (dates)			
									min WL	max WL	min WQ	max WQ
VWP19BWM01	689179	7376894	198	271.5	46 / 104 / 125 / 154 / 186	RCM OB / RCM OB / Aries / RCM IB / Pollux	BWM North	Unknown[2]	22/12/2019	22/11/2022	-	-
VWP19BWM02	691840	7365921	249	174	87.5 / 101 / 112 / 127 / 149	RCM OB / Aries / Castor / Pollux / Orion	BWM North	Unknown	22/04/2020	22/07/2022	-	-
VWP19_BWM_03	672843	7334855	206.57	190.75	40 / 100 / 155.5 / 160 / 182.5	Rewan / RCM OB / Aries / Castor / Argo	BWM South	Active	15/08/2022	15/02/2024	-	-
VWP19_BWM_04	682417	7330805	226.16	190.75	42 / 88 / 112.5 / 143.5 / 153.5	Rewan / Rewan/ Aries / Castor / Argo	BWM South	Active	15/09/2022	15/02/2024	-	-

1 Coordinates GDA 2020 Zone 55
2 status unknown as not currently monitored, and not located in recent survey and may or ma not still be in existence



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:270,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

Groundwater Monitoring Location

- VWP

- Watercourse
- Area
- BWM Mining Lease
- GIA Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MONITORING NETWORK- VIBRATING WIRE PIEZOMETERS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-8

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F04_8_Groundwater Monitoring Network (Vibrating Wire Piezometers)

4.2 Hydraulic Properties

Study Area groundwater hydraulic testing includes slug (rising and falling head) tests performed on monitoring bores as well as drill stem testing. This section includes a summary of the available field hydraulic data (**Section 4.2.1**) and comparison to reported hydraulic properties within literature ranges (**Section 4.2.2**).

4.2.1 Site-Specific Hydraulic Conductivity Data

The database of available field results for horizontal hydraulic conductivity (Kh) in the Study Area is presented graphically as **Figure 4-9**. Field tests from various sources are symbolised separately on the plot.

Figure 4-9 shows that the one available test for the alluvium has an estimated hydraulic conductivity result of 0.4 m/day.

Estimated hydraulic conductivity of the Tertiary strata ranges from 0.0001 to 11.3 m/day.

Hydraulic conductivity estimates for the Rewan Group were variable, ranging from 0.0002 to a relatively high 31.6 m/day.

As shown on **Figure 4-9** the estimated hydraulic conductivity for the coal seams of the RCM are variable, ranging from 0.00003 to a spuriously high 513 m/day. It is noted that for these notably high hydraulic conductivity estimates are generally recorded in the RCM around the Red Dam area and are possibly influenced by the presence of underground mining or voids and therefore may not accurately reflect the primary hydraulic conductivity of the formation (WSP, 2024). Higher hydraulic conductivity estimates for the RCM are generally noted in the southern part of BWM, while hydraulic conductivities appear to be much lower in the north of BWM (EMM, 2021). This is supported by the more recent testing available for areas in the south of BWM conducted by AGE (2023) as shown on the figure.

Hydraulic conductivity estimates produced for the interburden of the RCM ranged from 0.00001 to 14.5 m/day. These estimates were also recorded in the RCM around the Red Dam area and hence as noted above may not be reflective of the primary hydraulic conductivity of the formation (WSP, 2024) as the hydraulic conductivity in the interburden would generally be expected to be relatively low.

Hydraulic conductivity estimates were also produced for the interburden ranging from 0.75 to 1.75 m/day resulting, from pumping tests conducted by AGC (1990) as reported in EMM (2021), however the test depth is not reported and therefore they are not included in the figure.

Estimated hydraulic conductivity recorded in the shallow Burngrove formation around the Red Dam area by WSP (2024) ranged from 0.00002 to 34.9 m/day. Again, as mentioned above notably high estimates may not be reflective of the primary hydraulic conductivity of the formation (WSP, 2024).

Estimated hydraulic conductivity for the coal seams of the Burngrove Formation were at a very low 0.000017 m/day for two tests conducted in the Virgo and Leo/Aquarius Seams.

Estimated hydraulic conductivity recorded in the Spoil around the Red Dam area by WSP (2024) ranged from 0.00003 to 7.1 m/day.

Figure 4-9 shows that the hydraulic conductivity of the RCM generally declines with depth, due to increasing overburden pressure reducing the aperture of secondary porosity features. This is typical of the Permian coal measures in the Bowen Basin (e.g. SLR, 2021).

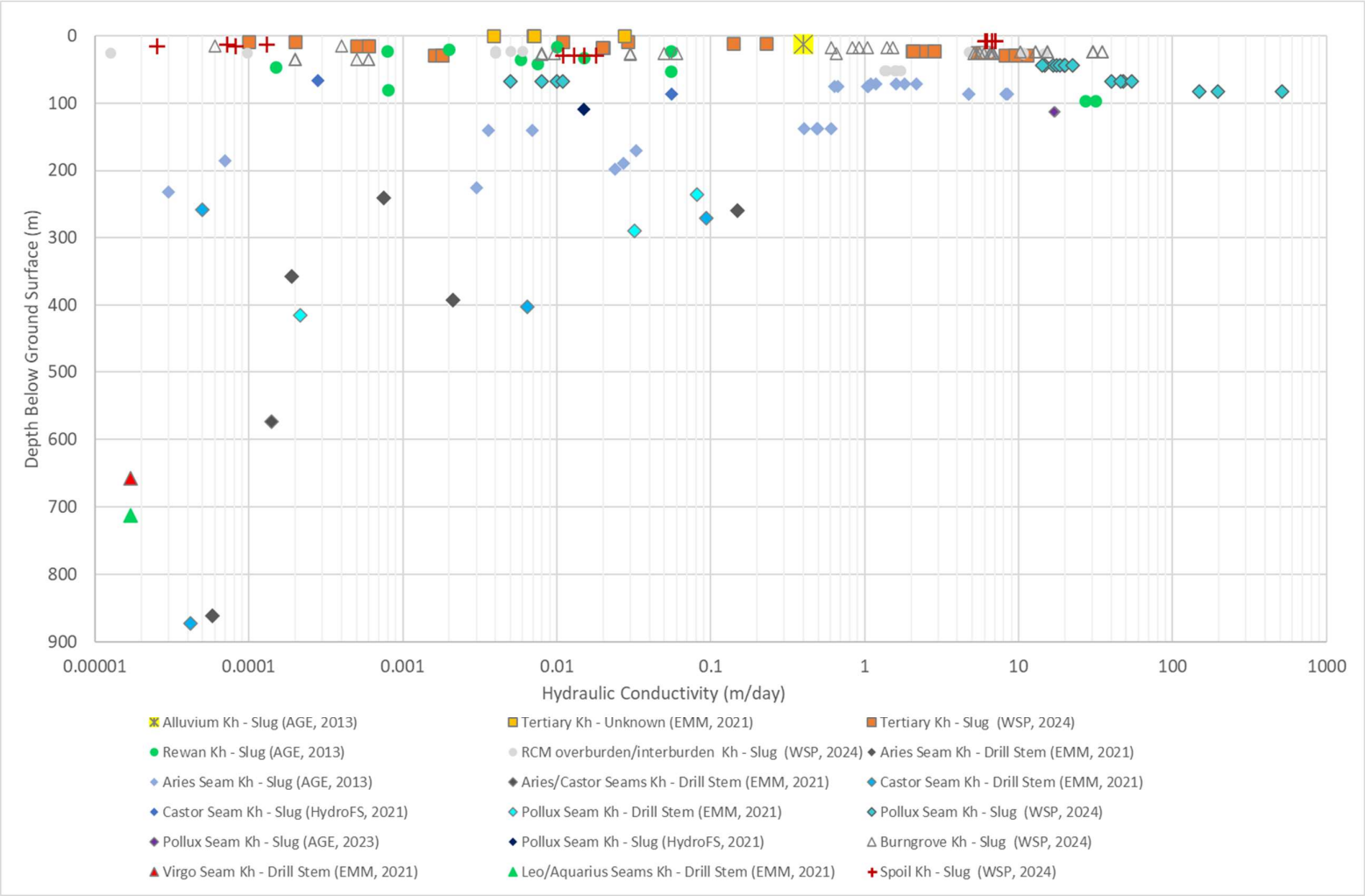
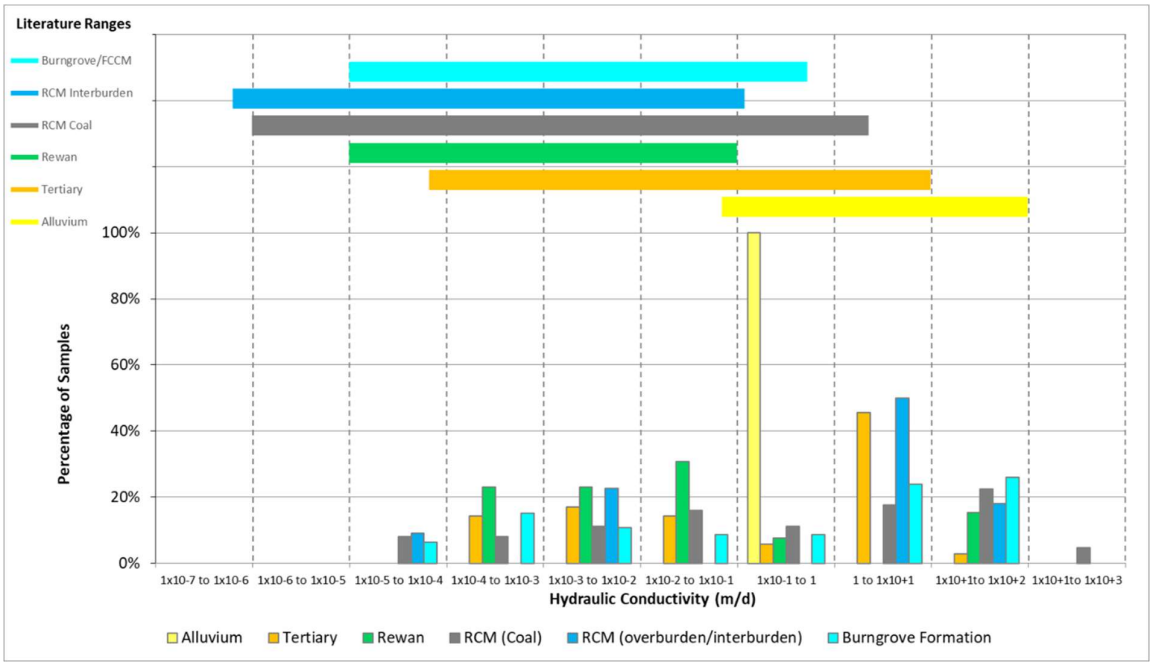


Figure 4-9 Graphical Summary of Results for all Site-Specific Hydraulic Conductivity Testing

4.2.2 Hydraulic Conductivity Ranges

A histogram of the spread of estimated horizontal hydraulic conductivity from field testing at BWM is presented in **Figure 4-10**. The results are compared to the range of horizontal hydraulic conductivity obtained from publicly available data based on a number of other studies within the Bowen Basin (SLR, 2023c).



RCM = Rangal Coal Measures, RCM IB = Rangal Coal Measures Interburden, FCCM = Fort Cooper Coal Measures

Figure 4-10 Histogram of Horizontal Hydraulic Conductivity Distribution

The comparison shows that the majority of field results for alluvium, Tertiary strata, Rewan Group, RCM and Burngrove Formation within the Study Area generally fall within the range of field data collected through other studies across the Bowen Basin. The exception to this as mentioned above includes the estimates produced by WSP (2024) for the RCM and Burngrove around the Red Dam area and are possibly influenced by the presence of underground mining or voids and therefore may not accurately reflect the primary hydraulic conductivity of the formation (WSP, 2024). Additionally, results recorded from one bore in the Rewan Group (i.e. MB19BWM_16R) are higher than expected when compared to the documented ranges from literature, reflecting the fact that some parts of the Rewan Group has higher hydraulic conductivity. Results recorded for the RCM coal seams from one bores (BWM_MB16_03) was also higher than expected when compared to literature values. It is expected that in general across the Study Area the coal seams of the RCM and Burngrove Formation have a higher hydraulic conductivity than the majority of the interburden/overburden, consistent with many other regional studies (e.g. SLR, 2021). This is due to the dual porosity of the coal seams, with a primary matrix porosity and a second (dominant) porosity provided by fractures (joints and cleats), which supports the concept of the coal seams themselves forming the dominant groundwater zones of the Permian units.

4.2.3 Faulting

As discussed in **Section 3.1.1**, the strata in the vicinity of the Project Area is heavily influenced by a series of easterly dipping, north to northwest striking faults.

As identified by Jourde et al. (2002), faulting can result in higher permeabilities within strata parallel with the fault plane, and lower permeabilities within strata perpendicular to the fault plane. However, this can also be dependent on whether faults are currently active (Paul et al., 2009). Faulting has been inactive within the Bowen Basin for over 140 million years (Clark et al., 2011), indicating that the fault zones are less likely to act as conduits to flow; this relates to filling of the fractured pore spaces over time through hydrothermal alteration and mineralisation (Uysal et al., 2000). Drill core logs from the Bowen Basin generally show that where fractures and faults have been geologically logged, many fractures are "healed" with calcite and siderite. This indicates that although the system contains a fracture network, many of the existing fractures are cemented, which reduces the effective permeability of the fracture when compared to any open fracture network (SLR, 2021).

Site specific testing of the faults has not been undertaken to derive hydraulic properties of the fault zones or assess whether the faults act as conduits or barrier to groundwater flow. However, they are anticipated to act more as barriers than conduits because the faults compartmentalise the coal seam geology and Permian groundwater flow is dominated by water movement within these seams.

Based on a detailed literature review of the effect of faulting on groundwater flow, Coffey (2014) has developed a conceptual model for fault zone hydraulic characterisation in the Bowen Basin (**Figure 4-11**), largely based on Jourde et al. (2002) and Flodin et al., (2001). This conceptualisation provides a means of inferring hydraulic conductivities of the fault core and the fault damage zone from regional hydraulic conductivity, with the fault core typically one to three orders of magnitude lower conductivity than the regional host rock, and the damage zone approximately an order of magnitude higher.

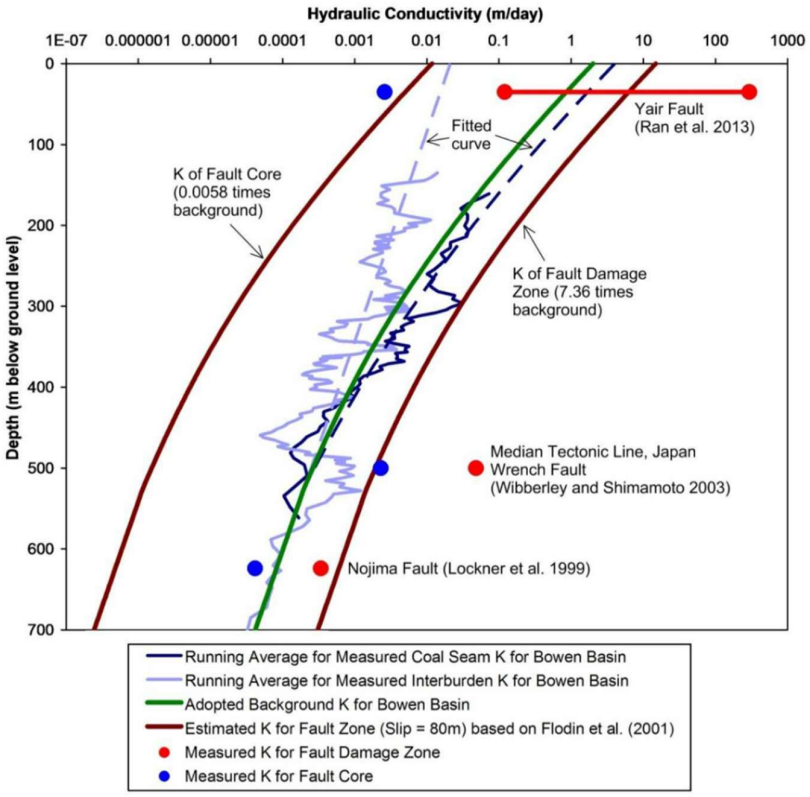


Figure 4-11 Faulting Conceptual Model Developed by Coffey (2014)

For this assessment, only one major fault, the Shotover Fault, was included in the groundwater model (refer to **Section 8.0**). The Shotover Fault is located approximately 15 km east of the EA boundary, near the eastern edge of the model boundary. It is an east dipping thrust fault with a displacement of up to 3,000 m (Mallet, 1988). As mentioned above, fault zones within the model boundary are likely to be "healed" with mineralisation, reducing effective permeability. This suggests that the Shotover Fault is more likely to act as a hydraulic barrier. In line with the IESC (2021) Explanatory Note: Characterisation and Modelling of Geological Fault Zones (Murray & Power, 2021), the Shotover Fault has been classified under Scenario A2: a fault acting as a barrier based on conceptual evidence, as no site-specific hydraulic testing has been undertaken. This classification reflects the current understanding that the fault core has significantly lower hydraulic conductivity than the surrounding host rock, and supports its representation as a no-flow boundary in the groundwater model.

This fault, the Shotover Fault, was included as a no flow boundary, based on the understanding that the fault core has a lower hydraulic conductivity than the host rock.

4.3 Groundwater Distribution, Flow, Rechange and Outflow

4.3.1 Quaternary Sediments (Alluvium)

Based on recent drilling at BWM (**Section 3.2.1**), it is considered that the horizontal extent of the Quaternary alluvium within the Study Area is likely smaller than mapped on the regional surface geology map (**Figure 3-1**).

Recent drilling campaigns targeting the alluvium in the north of BWM (2020 and 2021) revealed either an absence of alluvium, and/or dry conditions. In 2020, four bores were planned to be installed into the alluvium at north BWM, however only one of the four locations (bore MB19BWM07A at Taurus Creek) was able to be installed into the alluvium, which was then found to be unsaturated (AGE, 2020). Two bores were planned to be installed into the Two Mile Gully alluvium but did not intersect alluvium and were grouted up. A further two bores targeting the Sagittarius Creek alluvium were attempted to be installed, with one intersecting alluvium (MB19BWM02A) that was found to be unsaturated, and the other (MB19BWM05A) intersecting possible alluvium or possible Tertiary sediments that were also unsaturated. These two drillholes in Sagittarius Creek were converted to monitoring bores targeting the shallow weathered Rewan Group instead, where first shallow groundwater was found. Another bore (BWM_MB03_01) installed into the Taurus Creek alluvium, drilled in 2020 (EMM, 2021) has also been dry since installation.

In 2021, during an additional drilling campaign, bore MB20BWM01A initially targeted alluvium (near a small unnamed tributary of Bonnie Doon Creek) but again due to the lack of alluvial sediments at the site, the bore was installed into the water table in the shallow Rewan Group (HydroFS, 2021). In 2023, five additional bores were installed in the alluvium of Rockland Creek (four bores) and Shotover Creek (one bore) in the south of BWM, two of which (MB19BWM_14A and MB19BWM_19A) found the alluvium to be unsaturated.

Drilling results indicate that where the alluvium is present, it is generally dry, with saturated areas only found in few locations. There are six active BWM monitoring bores screened in the alluvium that have been considered for this assessment (**Figure 3-1**), however only one BWM_MB01_01 at Rockland Creek, just outside the eastern edge of the EA boundary, is saturated (**Figure 4-12** and **Figure 4-13**). It is noted however that there is no mapped alluvium in this area, rather the surface geology in the area is mapped as Tertiary sediments. Furthermore, the bore log shows the screened interval to be "clay sand, weathered" indicating that the bore may actually be screened in the Tertiary sediments or weathered Permian, rather than alluvium. The short data record available for this bore shows groundwater level elevation to range between approximately 15 to 16 mBTOC (255 to 256



mAHD) (**Figure 4-12** and **Figure 4-13**). The relatively deep recorded depth to groundwater of approximately 15 m below ground level where alluvial groundwater is encountered indicates a distinct lack of connection with any surface water features, and is also likely beyond the rooting depth of any terrestrial vegetation species.

Due to the general lack of saturated monitoring locations in the alluvium, and the limited period of data available, it is not possible to assess correlation with rainfall (and therefore recharge) based on these bores. However, based on a review of available groundwater level data for the neighbouring Minyango Project that was conducted by AGE (2013), recharge to the alluvium is suggested to be limited. Of the four bores installed into the alluvium at Minyango Project, three were also dry. The only bore that encountered water (Minyango-MB9) revealed a limited saturated thickness of less than 0.8 m, with a depth to water level of 10.8 mBGL. The monitoring data for MB9 showed a steady decline between December 2012 to September 2013, and showed no correlation with rainfall. AGE (2013) determined that, for bore MB9, recharge is likely limited by the surficial clay above alluvium and that the alluvium is likely compartmentalised, with limited connectivity between saturated alluvium areas, separated by clay lenses and outcropping bedrock. Where saturated, the alluvium may facilitate recharge to underlying geological units. Discharge from this aquifer is generally considered to be via evapotranspiration and leakage to underlying aquifers.

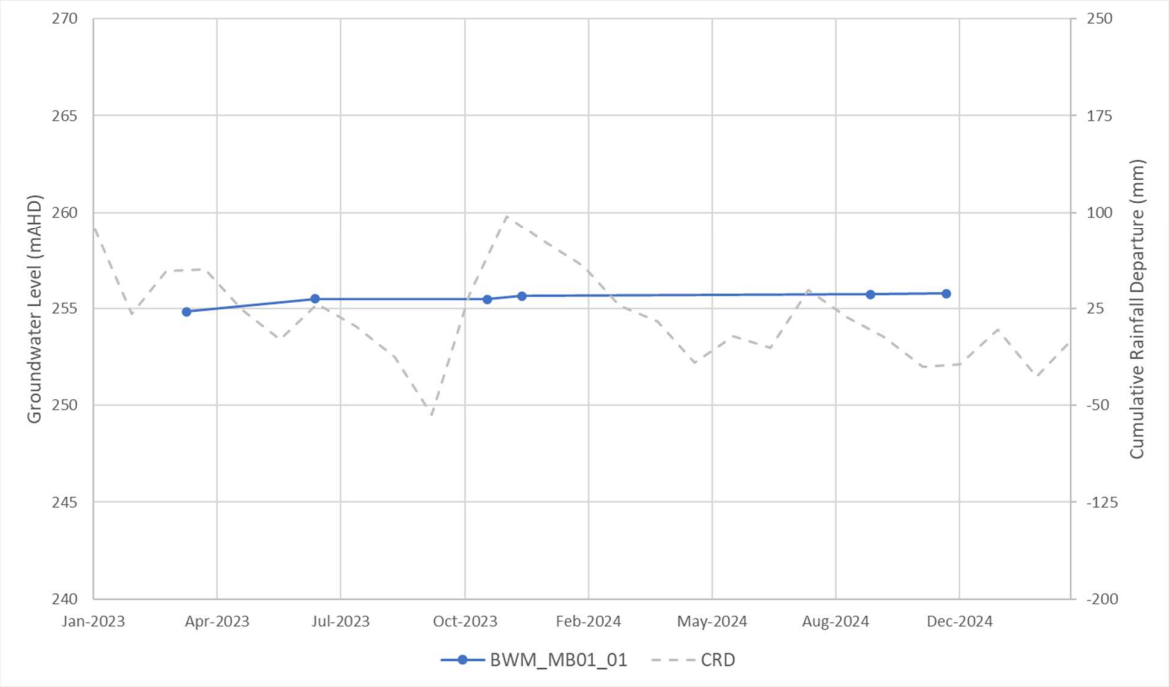


Figure 4-12 Groundwater Level (mAHD) – Alluvium

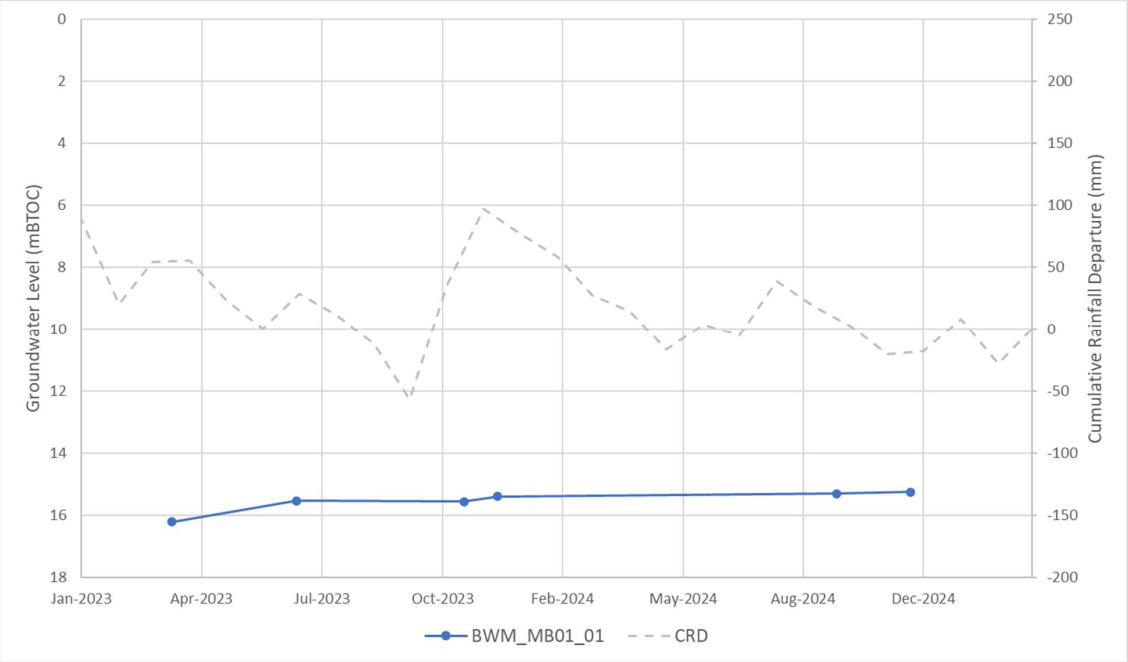


Figure 4-13 Groundwater Level (mBTOC) – Alluvium

Due to the general lack of saturated monitoring locations in the alluvium within the Study Area, it is not possible to map groundwater contours for this unit, nor is it likely that a widespread flow system in the alluvium exists. However, where saturation does exist, groundwater flow in the alluvium is expected to be controlled by topography and mimic surface water flow directions, with flow towards the north at North Blackwater and towards the southwest at South Blackwater.

4.3.2 Tertiary Sediments

The Tertiary unit forms the surficial (water table) aquifer, where the groundwater table exceeds the base of the unit (that is, in some locations at BWM the Tertiary unit is 'dry' and therefore does not form an aquifer). Groundwater levels for the three monitoring bores screening the Tertiary Sediments vary from approximately 240 mAHD (BWM_MB17_02) to 305 mAHD (BWM_MB15_01) (**Figure 4-14** and **Figure 4-15**). Bores BWM_MB12_01 and BWM_MB17_01 are also Tertiary EA bores but have been recorded as dry since installation so do not appear on the figures.

Groundwater levels in the Tertiary EA bores range from approximately 242 to 306 mAHD and 15 to 20 mBTOC. The longest monitoring record is available from MB21, which shows there has been a steady decrease in groundwater level since 2011, interrupted only by relatively short-term responses to large rainfall events. This long-term decline reflects a long-term response following the very high rainfall observed in 2011 and/or drawdown from mining. Groundwater levels in BWM_MB15_01 and BWM_MB17_02 over the relatively short monitoring period have remained stable, showing no response to rainfall trends or any mine-related influences. This is consistent with the conceptualisation of the Tertiary unit, where recharge from rainfall infiltration is expected to be low due to the presence of surficial clays. Notably, bore BWM_MB15_01 sits at the highest ground elevation of any of the Tertiary EA bores and hence has the highest groundwater level elevation of any of the Tertiary EA bores, noting that the natural water table elevation typically forms a subdued reflection of topography.

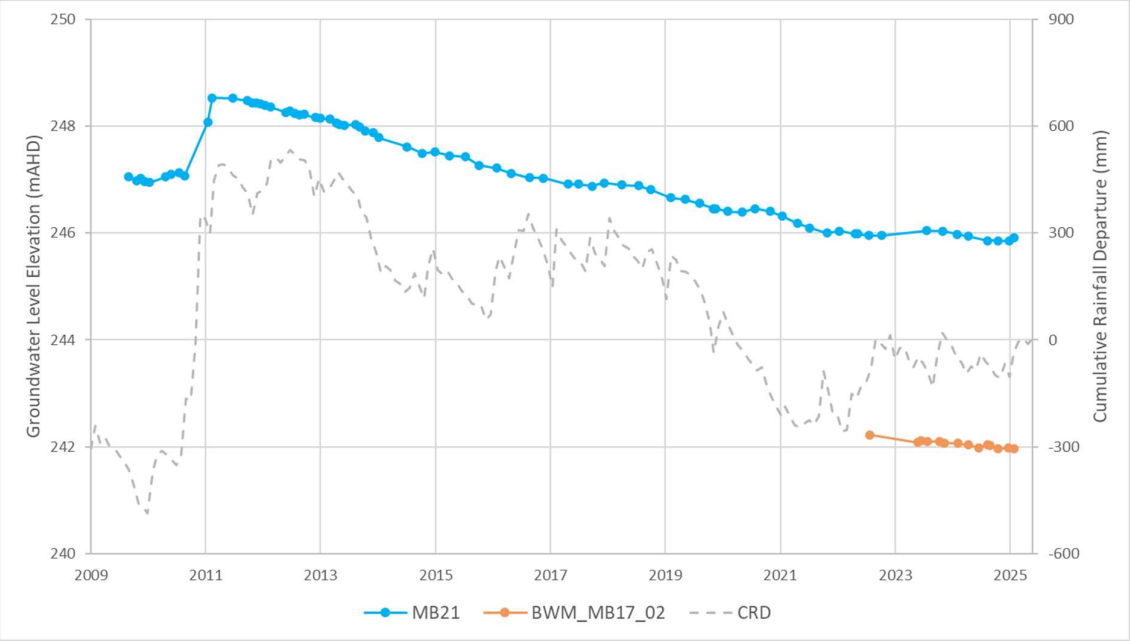


Figure 4-14 Groundwater Levels (mAHD) – Tertiary EA Bores (MB21 and BWM_MB17_02)

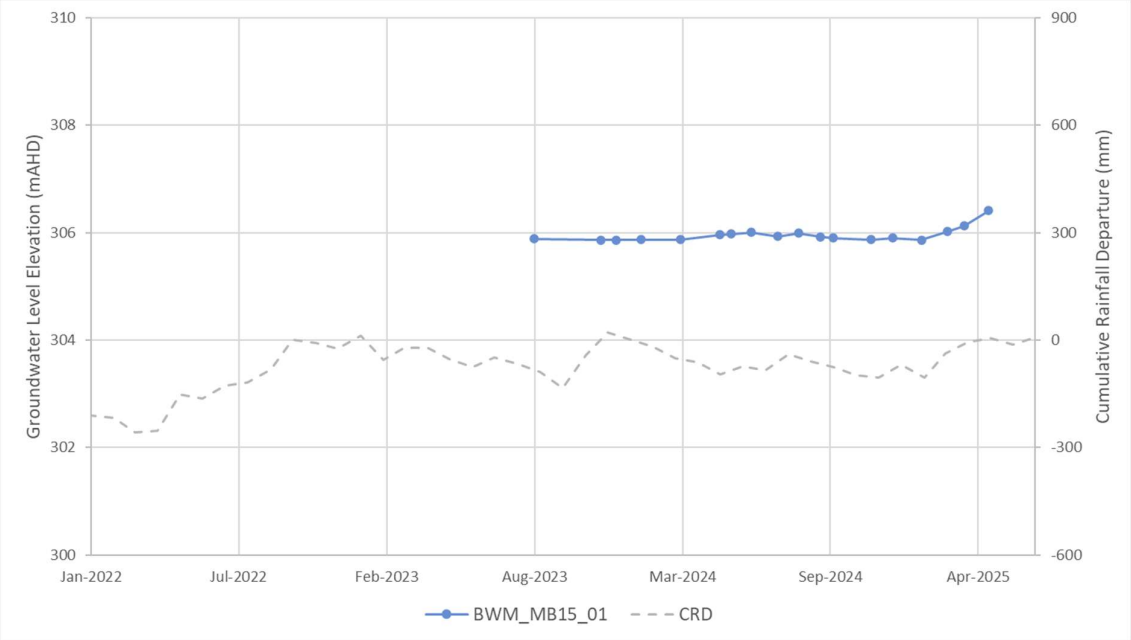


Figure 4-15 Groundwater Levels (mAHD) – Tertiary EA Bore (continued) (BWM_MB15_01)

Across the BWM site, groundwater flow in the Tertiary unit is expected to generally follow topography (where not influenced locally by mining activities), with natural outflow from the unit considered to be primarily through evapotranspiration and leakage to underlying aquifers. Similar to the alluvium, groundwater flow in the Tertiary units is expected to be controlled by topography and flow towards the north at North Blackwater and towards the southwest at South Blackwater.

4.3.3 Clematis Group

The aquifer forming Clematis Group sandstones are distinguished by coarse grain size, with less interbedded shale and siltstone than the non-aquifer forming Clematis Group units. There are no registered bores within the Clematis Group sandstone, as the sandstone outcrops in elevated rugged areas in Arthur's Bluff State Forest, Shotover State Forest and Blackdown Tableland National Park. Claystones of the Rewan Group directly underlie the Clematis Group, forming an aquitard between the Clematis Group and the deeper Permian Coal Measures.

4.3.4 Rewan Group

Regionally across the Bowen Basin, the Rewan Group is considered an aquitard (DNRM, 2016), given its low yielding nature, with any groundwater having limited potential for beneficial use due to the typically fine-grained, clay-bound nature of the sediments. Although, it is noted, that local permeability may be sporadically higher in the upper weathered zone of the unit permitting minor groundwater storage and transmission.

Groundwater level data for the two BWM EA bores installed into the Rewan Group is provided as (**Figure 4-16**). The monitoring data shows groundwater levels in these bores range between approximately 161 to 170 mAHD.

Both bores show stable groundwater levels with little variation in groundwater level over the monitoring record, approximately 1 m for MB19BWM02A and 0.1 m for BWM_MB03_02. The small 1 m increase occurring in MB19BWM02A between mid-2020 and early 2023 appears to be a subdued response to a relatively sustained period of above average rainfall. MB19BWM02A and BWM_MB03_02 generally show stable water levels over the monitoring record with no response to short term rainfall CRD peaks, indicating a degree of insulation from short term recharge events.

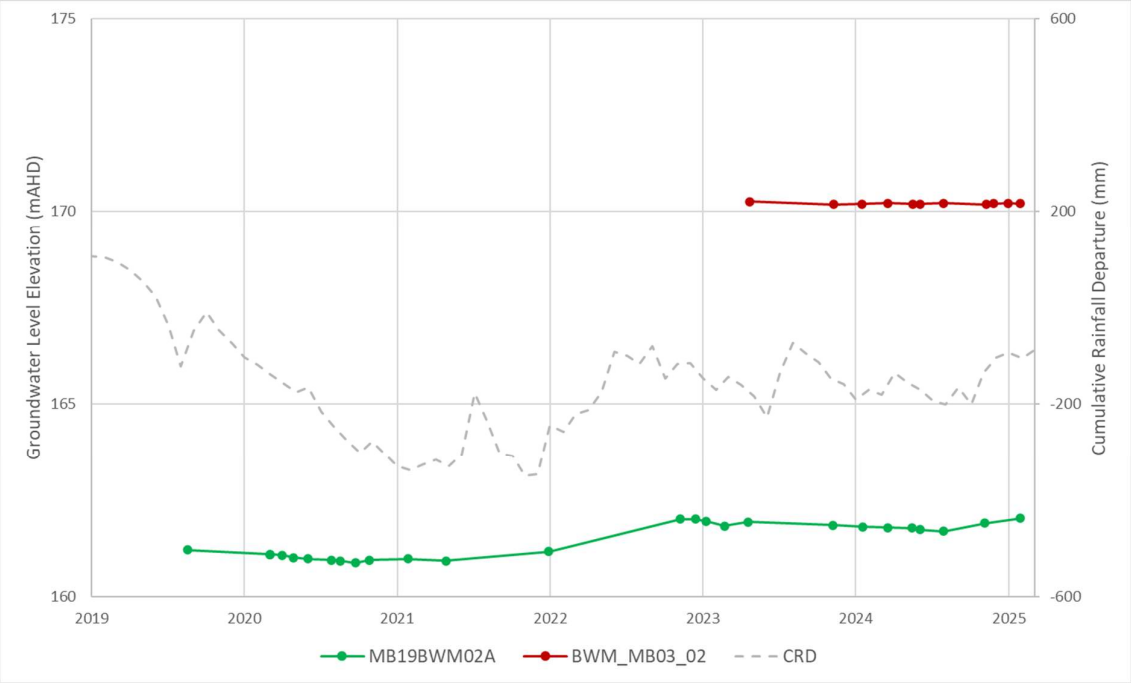
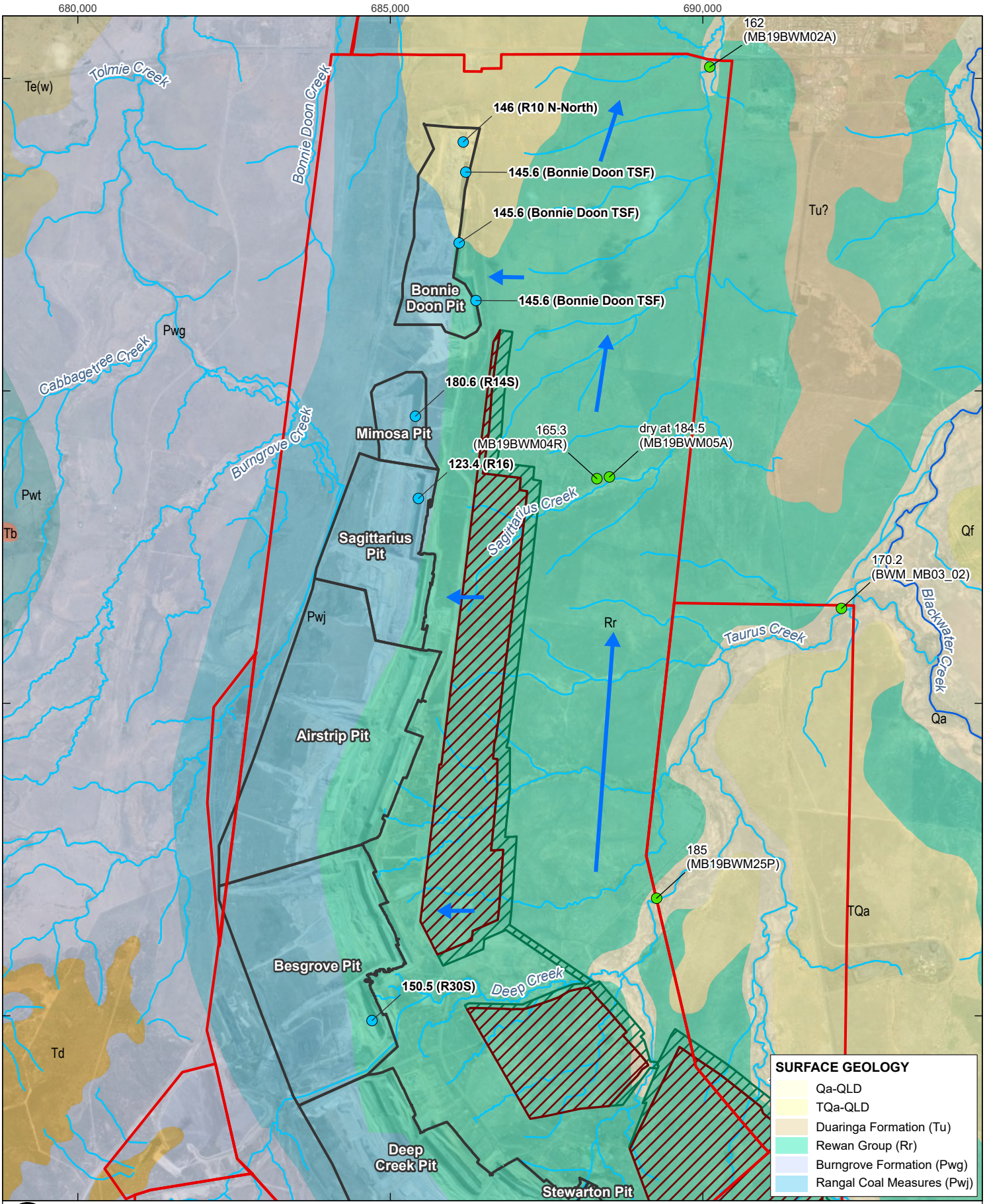


Figure 4-16 Groundwater Levels (mAHD) – Rewan Group

Recharge to the Rewan Group is expected to occur via leakage from the overlying Quaternary and Tertiary units. Recharge rates are likely very low due to the low hydraulic conductivity of the interbedded fine grained clay horizons restricting infiltration. This is supported by elevated salinity (see **Section 5.1.2**) which is consistent with high groundwater residence times concentrating salts.

Outflow from this unit is expected to be through lateral flow, with low vertical hydraulic conductivity limiting potential leakage to underlying units. The suggested insulation of this unit from recharge events makes it unlikely that there would be short term (post-rainfall) groundwater pressure increases sufficient as to discharge to surface water features.

Available groundwater levels from the monitoring bores grouped in the northern area indicate a flow toward the north of BWM (i.e. consistent with topographical gradients) and potentially (if the Rewan Group is saturated in this area) also locally towards the pits that report lake levels significantly below the groundwater levels in the nearest bores screened in the Rewan Group (**Figure 4-17**). As shown on **Figure 4-4** there is only one bore screened in the Rewan Group in BWM south however, groundwater flow in the southern portion of BWM is also expected to follow topography, with a flow direction towards the south and southwest.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:80,000 at A4
Project Number:	640.031809.00001
Date Drawn:	05-May-2026
Drawn by:	AS

LEGEND

- Water Level - mAHD (Pit)
- Bore (Groundwater Level – mAHD)
- Groundwater Flow Direction
- Major Watercourse
- Minor Watercourse
- BWM Mining Lease
- Historical Pit Extent
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER FLOW DIRECTION IN THE REWAN GROUP (BWM NORTH)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-17

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F05_16 Groundwater Flow Direction in the Rewan Group (BWM North)

4.3.5 Rangal Coal Measures

The following conceptualisation of groundwater distribution, flow, recharge and outflow for the RCM is discussed separately for the North (**Section 4.3.5.1**) and South (**Section 4.3.5.2**) areas of BWM as shown on **Figure 2-5**. This division is a reflection of the very large north-south strike length of BWM and fact that, broadly, the Permian groundwater system appears divided across BWM on the basis of the broad scale topographically driven surface water catchments, being the upper Mackenzie River sub-catchment for North and Central BWM and the Comet River sub-catchment for South BWM.

4.3.5.1 BWM North Area

Groundwater level data for the RCM EA bores in the BWM North area (**Figure 2-5**) is shown on **Figure 4-18**. Groundwater levels from these bores range from approximately 143 to 245 mAHD.

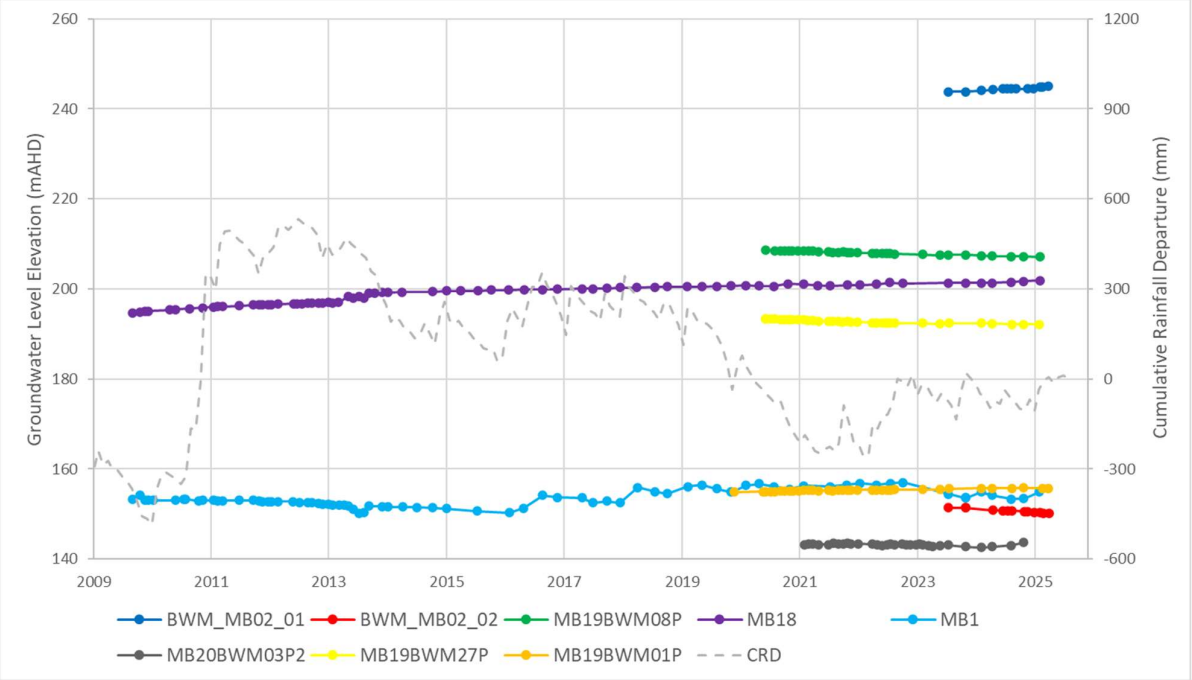


Figure 4-18 Groundwater Levels (mAHD) – Rangal Coal Measures EA Bores (BWM North Area)

A comparison of the groundwater level trends shown against the Cumulative Rainfall Departure (CRD) indicates that the groundwater regime in the RCM is somewhat insulated from short term climatic effects. As shown on **Figure 4-18**, groundwater elevation at MB1 (monitoring the Aries seam), which has the longest monitoring record, gradually but marginally increased between the cessation of Bonnie Doon Pit mining in 2016 and the beginning of 2023, before declining slightly in 2024 but remaining relatively steady thereafter. Given this bore has a groundwater elevation well above the nearby pit water levels, this is considered to be a hydraulic response of the RCM recovering following the removal of dewatering stressors, rather than an indication of recharge from pit lakes. The monitoring record at MB20BWM03P2 (monitoring the Castor/Pollux seams) which also monitors the area of the RCM immediately east of the Bonnie Doon Pit / in-pit Tailings Storage Facility (TSF) area shows relatively stable groundwater levels over its monitoring record. MB19BWM01P and MB19BWM27P also monitor the Aries seam and show little

variation in water level over the monitoring record, with MB19BWM01P steadily increasing approximately 0.8 m and MB19BWM27P steadily declining approximately 1.2 m. Groundwater elevation at MB19BWM27P is notably higher than the other EA bores monitoring the Aries seam (i.e. MB1 and MB19BWM01P), reflective of an overall south to north inferred groundwater flow direction. Groundwater elevation is also lowest at MB20BWM03P2 monitoring the Castor/Pollux seams below the Aries seam, indicating a downwards hydraulic gradient (and flow potential) from the Aries seam to the Castor/Pollux seams.

Relatively low groundwater levels at BWM_MB02_02 are taken to indicate a drawdown influence from mining activities attributable to its location between BWM's Blackdown and Wilpeena Pits to the west of the bore, and the Cook Colliery underground mine to the east outside of the BWM mining lease and EA boundary. Bore MB18, which is screened in the RCM overburden, has the longest monitoring record and shows an overall increasing trend in groundwater level from 2010 to current. MB19BWM08P shows a groundwater level of around 207 mAHD, whereas the groundwater level at adjacent shallower MB18 is around 202 mAHD, indicating an upwards hydraulic gradient from the confined coal seams into the aquitard overburden material. BWM_MB02_02 (Castor Seam) and BWM_MB02_01 (screened in the shallow overburden) show approximately 90 m of head separation, indicating a downwards hydraulic gradient and flow potential.

4.3.5.2 BWM South Area

Groundwater level data for the RCM EA bores in the BWM South area (**Figure 2-5** is shown on **Figure 4-19**. Groundwater levels from these bores range from approximately 234 to 275 mAHD, and display a relatively stable monitoring record. Likewise with the RCM bores across BWM North, the comparison of the groundwater level trends shown against the CRD indicate that the groundwater regime in the RCM is somewhat insulated from short term climatic effects. BWM_MB12_02 monitors the castor seam and shows little variation in water level over the monitoring record, with approximately 1.9 m increase between 2022 and 2023, and only around 0.1 m variation since. BWM_14_01 and BWM_14_02 both monitor the overburden and also show little variation in water level, with both bores steadily increasing approximately 0.3 m over the monitoring record. Notably, BWM_14_01 (shallow overburden) and BWM_14_02 (deep overburden) show approximately 12 m of head separation, indicating a downwards hydraulic gradient.

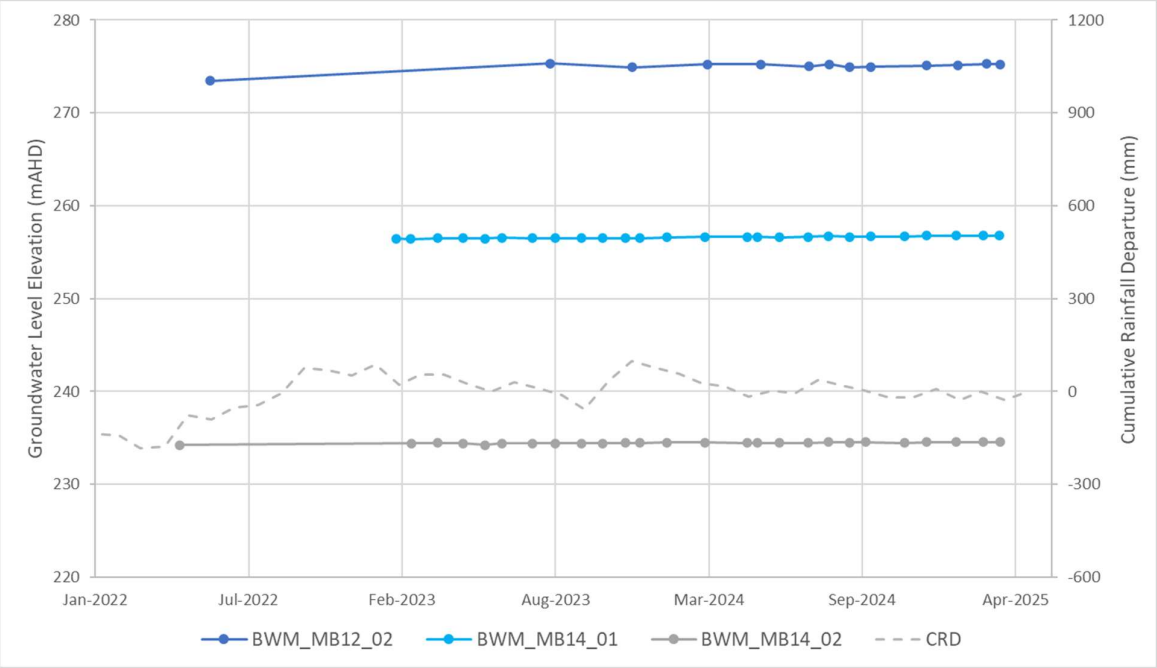


Figure 4-19 Groundwater Levels (mAHD) – Rangal Coal Measures (Southern Area)

Available groundwater levels for the now decommissioned bore MB16 are shown in **Figure 4-20**. MB16 is suggested by EMM (2021) to monitor the Aries Seam (or Aries Seam workings) within the extent the historic Laleham Underground Mine, which extracted coal from the Aries to the Pollux Seams (Byrnes Geotechnical, 2024). Groundwater levels at MB16 were approximately 223 mAHD (58 mBGL) prior to 2015, after which a gradual increase in water level occurred to approximately 243 (39 mBGL) mAHD to 2018 before stabilising. This water level increase of approximately 19 m is likely to be related to partial recovery of water in the underground workings (EMM, 2021), i.e. reflooding. Groundwater levels at MB16 are noted to remain significantly lower in elevation than water storage elevations within the Kenmare pit (287.4 to 276.6 mAHD, see **Section 2.3.3**), suggesting there remains the potential for groundwater movement towards the underground workings from water stored in this pit. The groundwater levels at MB16 are also marginally lower in elevation than the most recent pit lake level recorded within the Ramp 74/Laleham pit (246.4 mAHD), though the difference is relatively small and suggests that the underground workings may have essentially reached close to hydraulic equilibrium with the Ramp 74/Laleham pit.

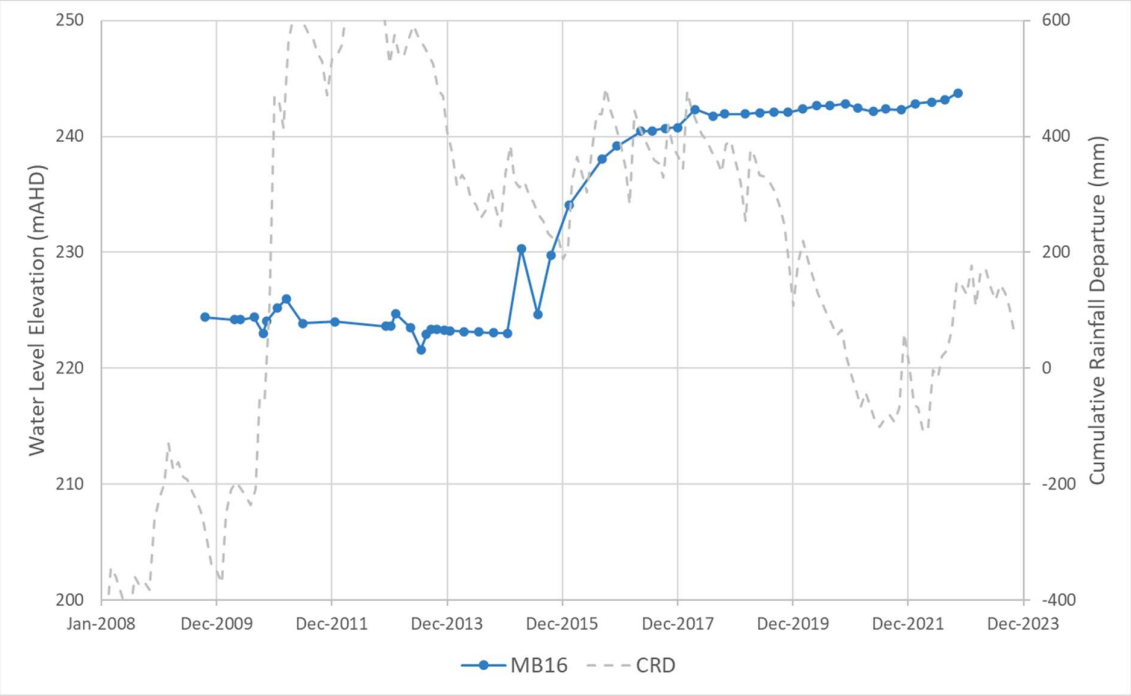


Figure 4-20 MB16 Groundwater Level (mAHD) – (Laleham Underground Mine)

4.3.5.3 Summary

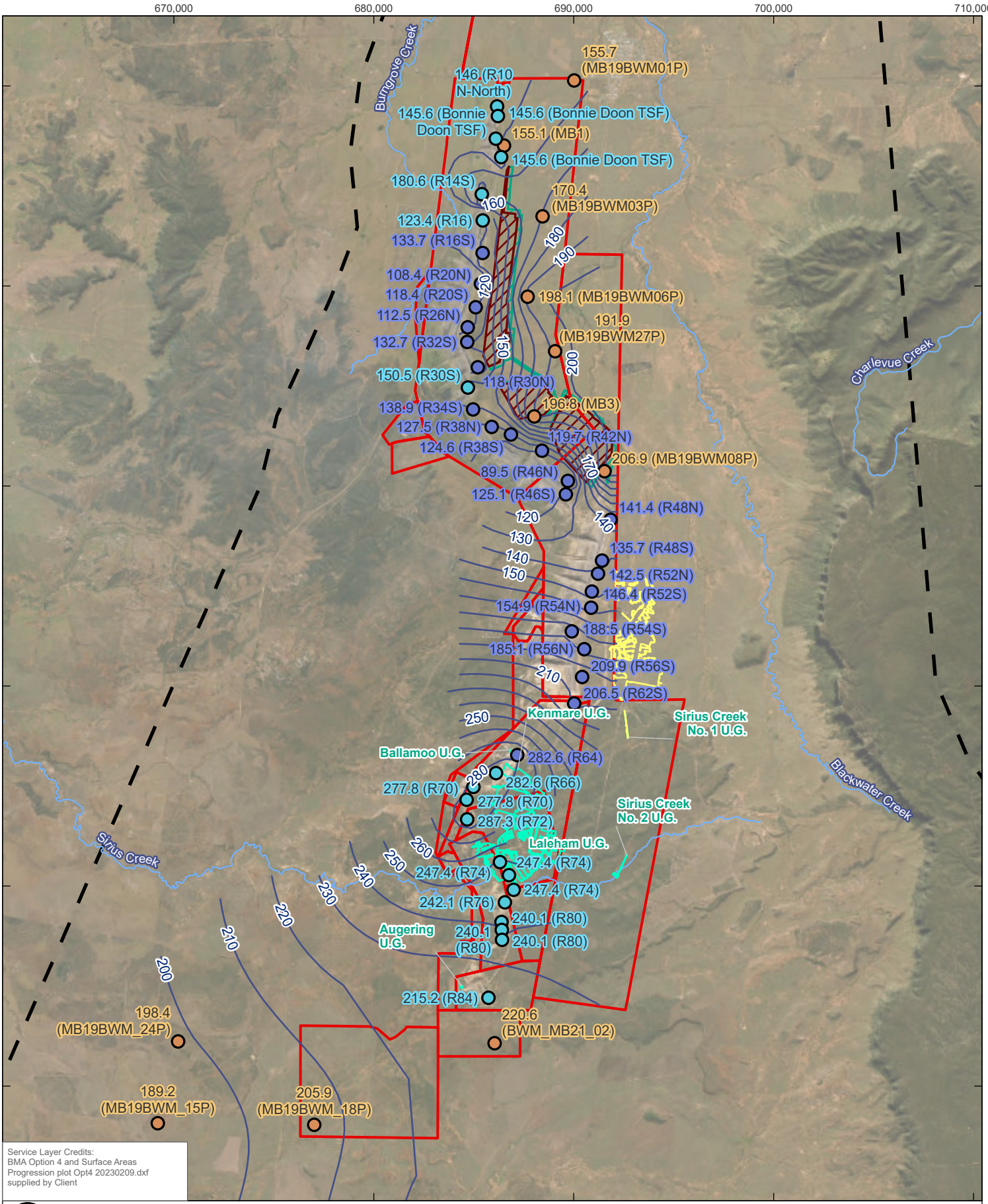
A comparison of groundwater level trends for all BWM bores screened in the RCM coal seams against the CRD indicates that the groundwater regime in the RCM coal seams is somewhat insulated from short term climatic effects, though depth and conductivity of the monitored horizon clearly influences this response. Through hydraulic connection with the mining areas, it is apparent that there is some response in regional groundwater levels to mining depressurisation.

Groundwater quality in the RCM coal seams is mostly saline (**Section 5.1.2**), which suggests long residence times related to low recharge rates and increased water-rock interaction. Recharge to the coal seams is expected to occur primarily via leakage from the overlying Quaternary and Tertiary units, with greater recharge occurring in areas where the seams subcrop and outcrop. Based on the inferred hydraulic gradients between overburden and coal seams, this is likely limited to the overburden horizons, with coal seam recharge occurring through mine surface water storages where the seams are hydraulically connected to the storages. Outflow from the RCM is considered to be primarily through inflow to active mining areas, within the cone of depression. Where groundwater is not influenced by the cone of depression, outflow will occur downdip following regional flow path to the east.

Groundwater level contours for the Aries Seam are shown as **Figure 4-21**. The Aries Seam was selected as it has the highest number of data points and most recent data available for analysis, and it is expected that other coal seams would exhibit similar flow patterns. The contours are based on the most recently available groundwater level measurements from bores screened in the Aries Seam. The most recent available pit water levels are also included in the mapping to assist with the interpretation of RCM groundwater flow direction as it provides an indication of the groundwater level in the RCM directly adjacent to the pit, since there is direct hydraulic connection between the pits and the RCM. Where there are no in-pit water storages, the base elevation of the pits (based on most recently available LiDAR in February 2024) are also shown as groundwater levels must be below the base of the pits

in the case of dry pits, with any groundwater inflow passively managed through evaporation and the use of in pit sumps.

As shown on **Figure 4-21**, the groundwater flow direction in the BWM north area is locally predominantly towards the mine pits, consistent with discharge to the active mine pits. In the southern area of BWM, the flow direction within the Aries Seam is dominated by the local influence of elevated in-pit water storages at Kenmare Pit. In the far south, the potentiometric mapping indicates a groundwater divide present just north of Sirius Creek, consistent with the surface catchment divide (refer **Section 2.2**), with groundwater flow from northeast to southwest. As mentioned above, it is expected that the lower coal seams would exhibit similar flow patterns, however this does not apply to the Castor, Pollux and Orion seams in the area of the Cook Colliery. In this area the groundwater flow direction in these seams would be dominated by the local influence of dewatering, with the local groundwater flow direction therefore predominantly towards Cook Colliery.



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	05-May-2026
Drawn by:	RB

LEGEND

Elevation (mAHD)

- Base Elevation - mAHD (Pit Ramp)
- Base of Pit - mAHD (Pit)
- Water Level - mAHD (Bore)
- Water Level - mAHD (Pit)
- Groundwater Elevation Contour (mAHD)
- Watercourse
- Current Underground Mine
- Historical Underground Mine
- GIA Study Area
- BWM Mining Lease
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER LEVEL CONTOURS – ARIES SEAM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-21

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F05_20_GWL Levels Aries Seam

4.3.6 Burngrove Formation

There are two monitoring bores installed in the Burngrove Formation, both are located to the northwest of the Project. **Figure 4-22** show the groundwater levels in these bores, 'BG No.1 AP' and 'BG No.2 BG'.

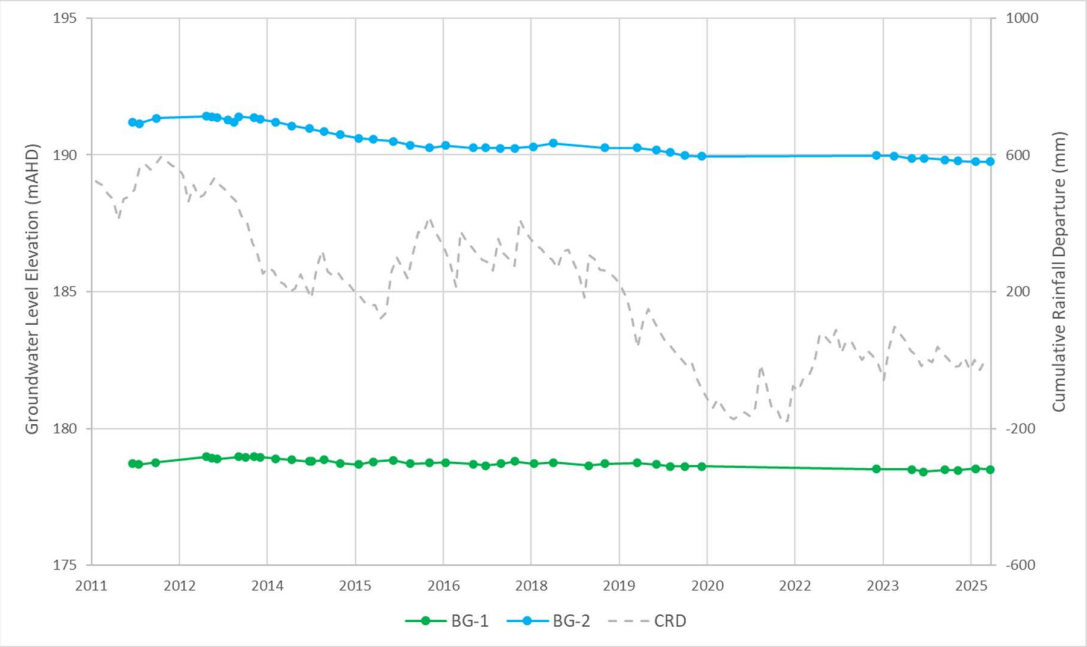
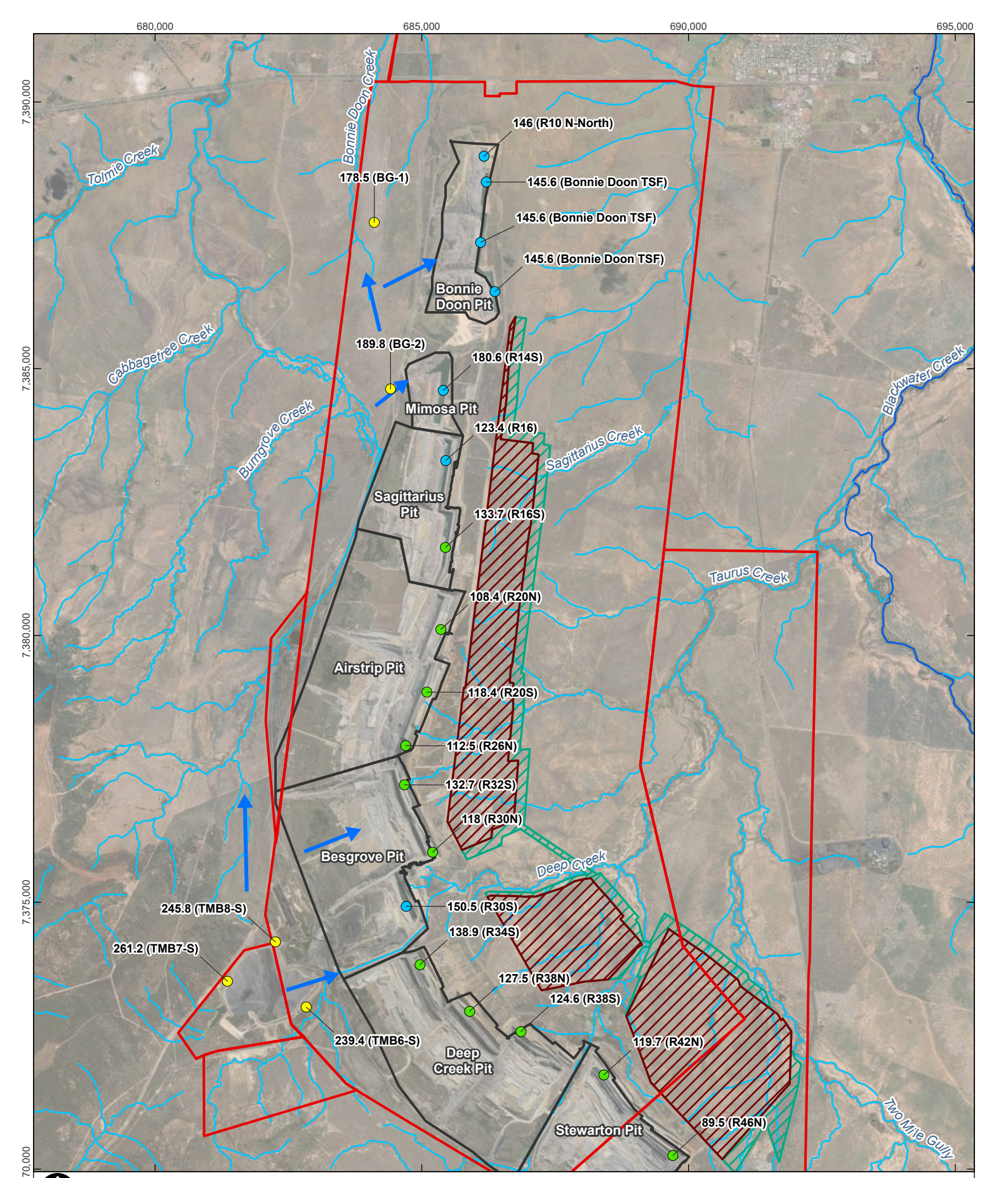


Figure 4-22 Groundwater Levels (mAHD) – Burngrove Formation EA Bores

The monitoring data shows groundwater levels in these bores range between approximately 178 to 191 mAHD. Both bores show little variation in groundwater level over the monitoring record, approximately 0.5 m for BG-1, and 1 m for BG-2. These variations are consistent with the overall long-term decline of the CRD over the corresponding monitoring record. Groundwater levels in these bores do not seem to respond to short term increases in the CRD, suggesting low rates of rainfall-derived recharge in these areas. Recharge to the Burngrove Formation would occur primarily where the formation outcrops along the west of the Project Area (**Figure 3-1**). Outflow from this formation is expected to be through lateral flow in the direction of regional groundwater flow, with some upwards leakage to the depressurised RCM.

The groundwater flow direction at BWM north is inferred to be overall towards the north-northwest consistent with topographical gradients and surface water flow patterns. The local flow direction near the pits is towards the northeast, consistent with the concept of local groundwater discharge to the pits. It is noted that the magnitude of the local hydraulic gradient towards the pits (east-northeast) is much greater than the north-northwest flow component as inferred by the larger head difference between data points over a shorter distance. This indicates that that magnitude of groundwater flow towards the pits is significantly greater than groundwater flow to the north-northwest. In the area of the NCPP, the local flow direction is towards the east, consistent with the drainage line that runs towards Deep Creek. As shown on **Figure 4-1** and **Figure 4-6** the only other bores screened in the Burngrove Formation in BWM south are grouped closely around the Red Dam area and hence are not useful in inferring regional flow direction, however, groundwater flow in the southern portion of BWM is expected to follow topography, with a flow direction towards the south and southwest.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:90,000 at A4
Project Number:	640.031809.00001
Date Drawn:	05-May-2026
Drawn by:	RB

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER FLOW DIRECTION IN THE BURNGROVE FORMATION (BWM NORTH)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-23

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F05_22_GW Flow Direction in the Burngrove Formation (BWM North)

5.0 Baseline Water Quality

5.1.1 Groundwater Typing

The proportions of major anions and cations were used to determine the hydrochemical facies of groundwaters sampled at BWM. The anion-cation balance, pH and EC of historical data from BWM monitoring bores is displayed on the Durov diagrams in **Figure 5-1** to **Figure 5-6**. The diagrams are split by aquifer and area, including bores in the alluvium (**Figure 5-1**), Tertiary (**Figure 5-2**), Rewan Group (**Figure 5-3**) and RCM at BWM north (**Figure 5-4**), RCM at BWM south (**Figure 5-5**) and the Burngrove Formation (**Figure 5-6**). There is a high degree of observed variability in groundwater quality between hydrostratigraphic units, and between individual bores within individual hydrostratigraphic units.

Records from alluvium groundwater quality sampling only include one bore across three samples (**Figure 5-1**). The data from this bore shows a Na-Cl groundwater type with a neutral pH and variable EC results ranging from 6,900 to 23,800 µS/cm.

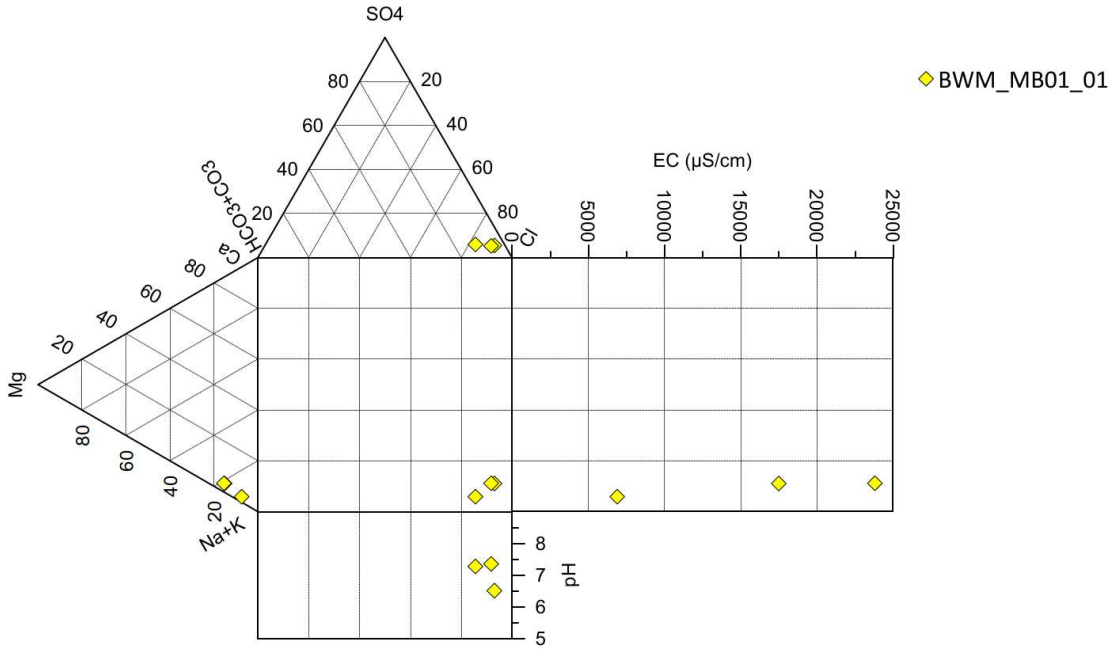


Figure 5-1 Durov Diagram – Alluvium

A Durov diagram for the monitoring bores screened within the Tertiary strata is presented as **Figure 5-2**. The bores are screened within the sediments/weathered strata of the Tertiary and located at BWM south. Bores MB21 and BWM_MB15_01 records a Na-Cl type groundwater, while BWM_17_02 records a Na-CO3-HCO3 water type.

The influence of HCO3 on the water chemistry of BWM_17_02 records, along with the comparatively fresh EC (500 µS/cm) is suggestive of direct rainfall recharge at this location. This direct recharge may be an influence of infiltration from Rockland Creek, located 150 m north of the bore

Historical groundwater data from the Tertiary strata bores shows an EC range of from 500 to 16,800 µS/cm with a median of 13,500 µS/cm. pH data ranges from 3.3 to 8.4 with a median of 7.4. Bore BWM_MB15_01 has a notably low pH of 3.3 and relatively saline EC value (6160 µS/cm).

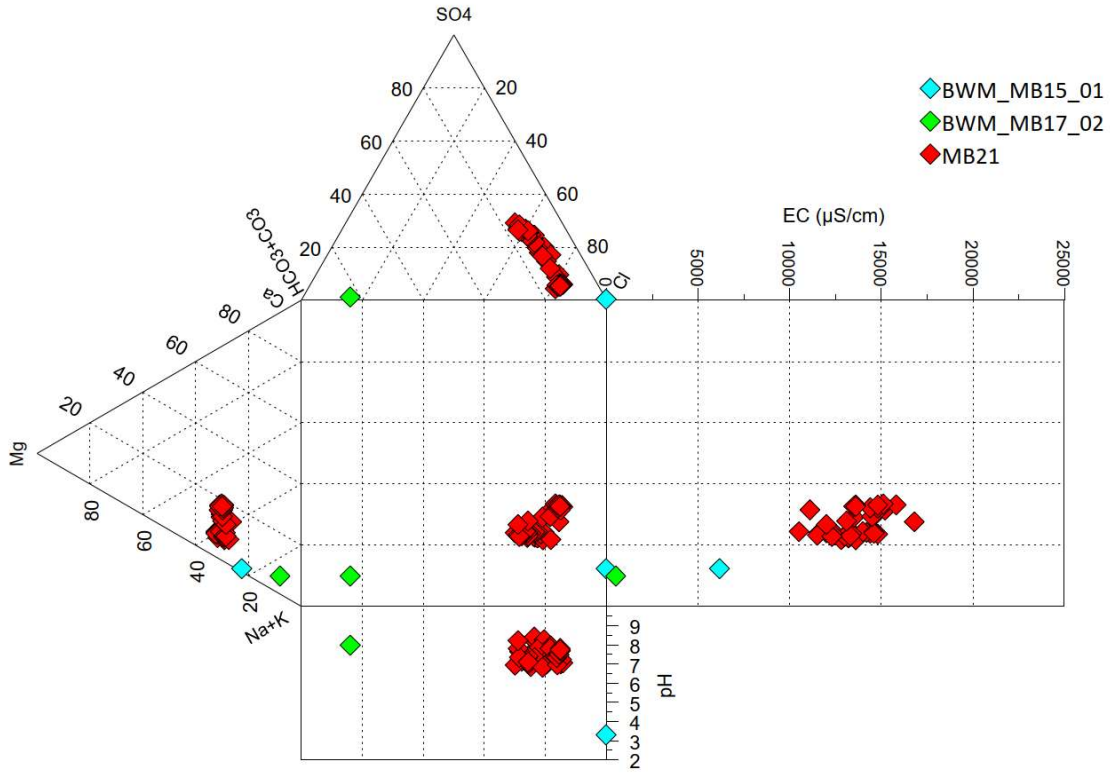


Figure 5-2 Durov Diagram – Tertiary Strata

Bores BWM_MB03_02 and MB19BWM02A are screened in the and record Na-Cl type groundwaters (**Figure 5-3**). Both bores record relatively high EC values ranging approximately 30,500 to 40,000 µS/cm. Recorded pH from bores in the Rewan Group ranges from mildly acidic to mildly alkaline (pH range 6.8 to 7.8), with a median pH of 7.2.

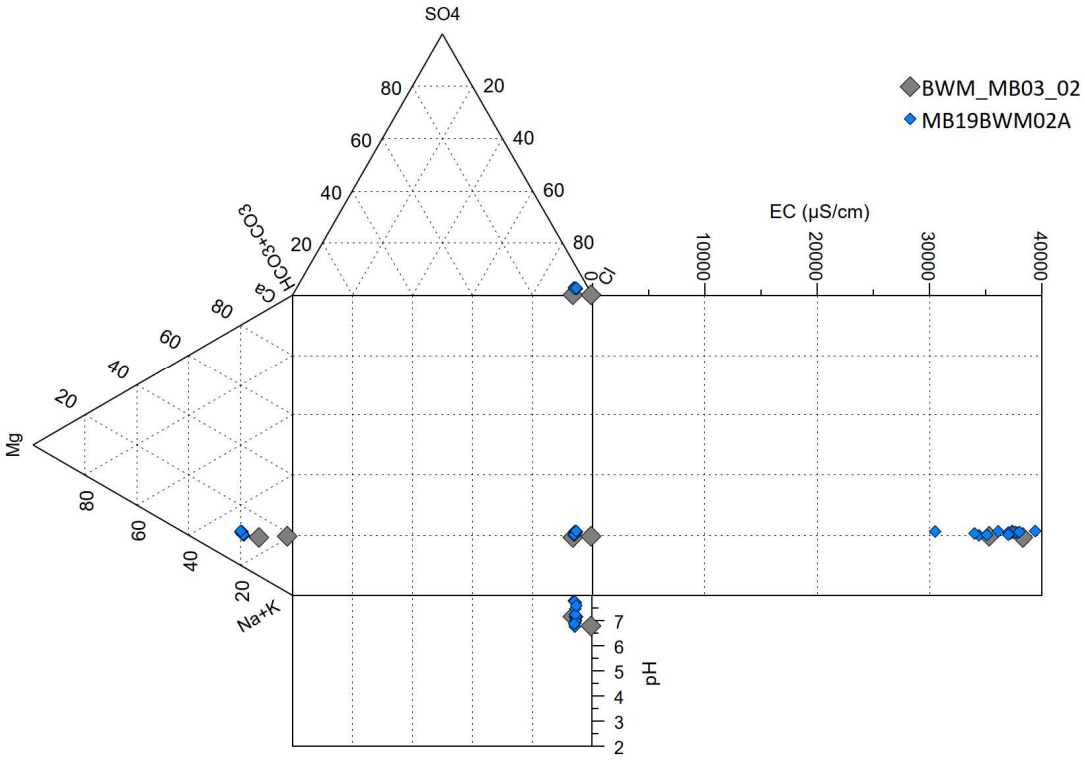


Figure 5-3 Durov Diagram – Rewan Group

The chemical analysis of groundwater from 11 bores targeting the RCM is shown on **Figure 5-4** to **Figure 5-5**. Results from these bores indicate that groundwater within this unit is generally Na-Cl water type. Exceptions to this the five bores , namely BWM_MB02_01, BWM_MB12_02, MB19BWM08P, MB19BWM27P, and BWM_MB14_02. These bores show distinctly different groundwater types, plotting as Na-Cl-HCO3 types.

Groundwater in the RCM generally has a median EC of 17,300 µS/cm, but ranges from 1,870 to 36,900 µS/cm. Recorded pH is generally neutral (median value of 7.7), however the data ranges from values between 6.9 to 11.9. Outliers occur, with high pH (of between 9 and 12) at bores MB19BWM01P, MB19BWM01P,. The elevated pH at these bores is likely unrepresentative of natural conditions and may be due to water interaction with residual cement grout from the bore construction.

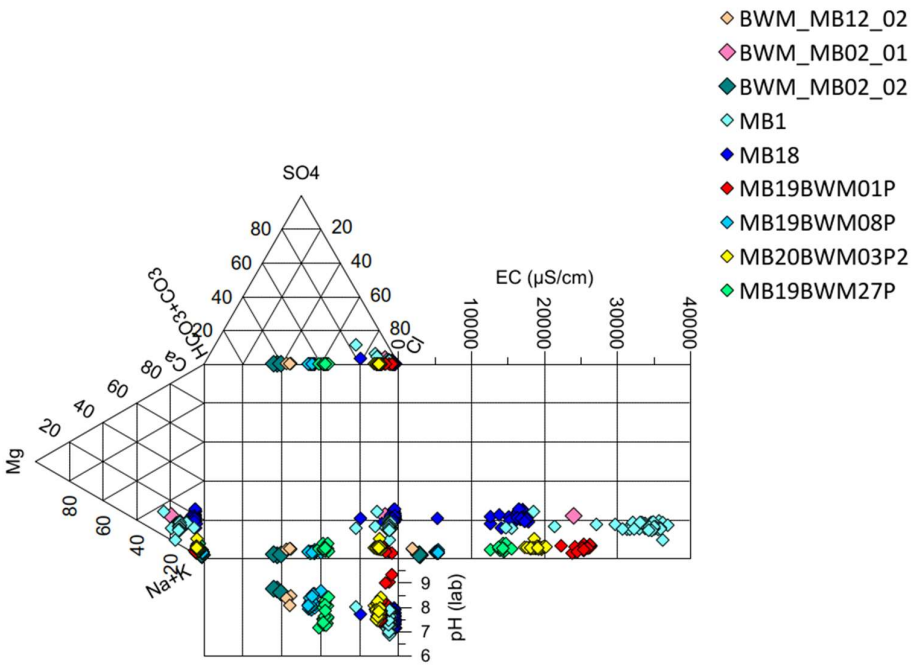


Figure 5-4 Durov Diagram – RCM (North BWM)

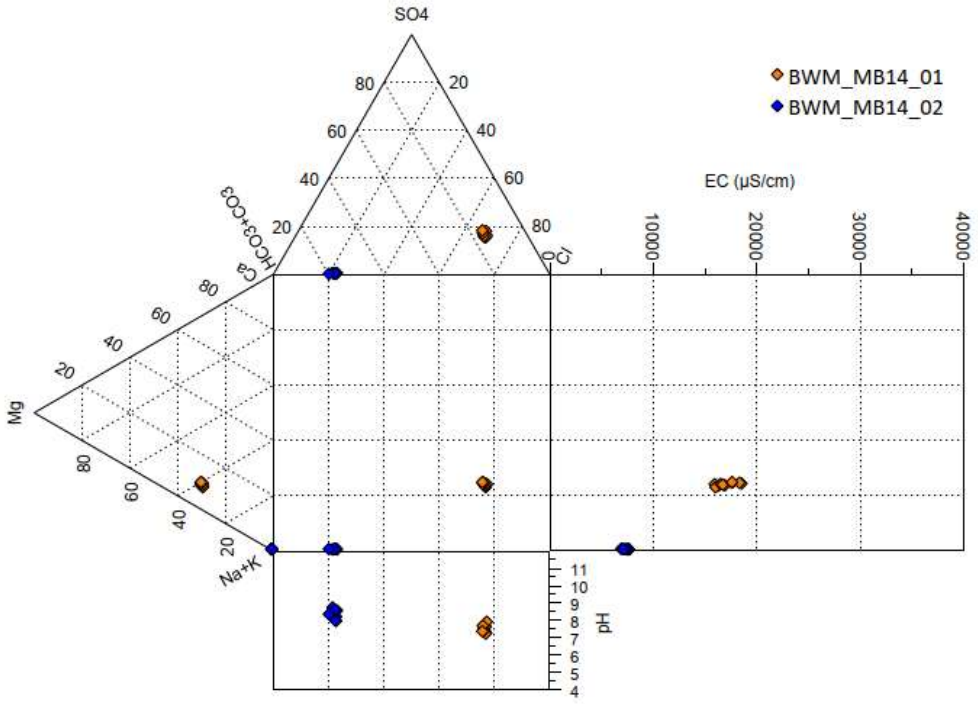


Figure 5-5 Durov Diagram – RCM (South BWM)

Groundwater from two bores screened in the Burngrove Formation record Na-Cl groundwater type (**Figure 5-6**). The results are tightly clustered which suggests that groundwater in the Burngrove Formation has a distinct water chemistry. Groundwater has a median EC of 12,500 µS/cm and ranges from 6,190 to 21,500 µS/cm. pH data shows a range from 7.10 to 8.9, with a median value of 8 indicating the groundwater pH is generally around neutral to slightly alkaline.

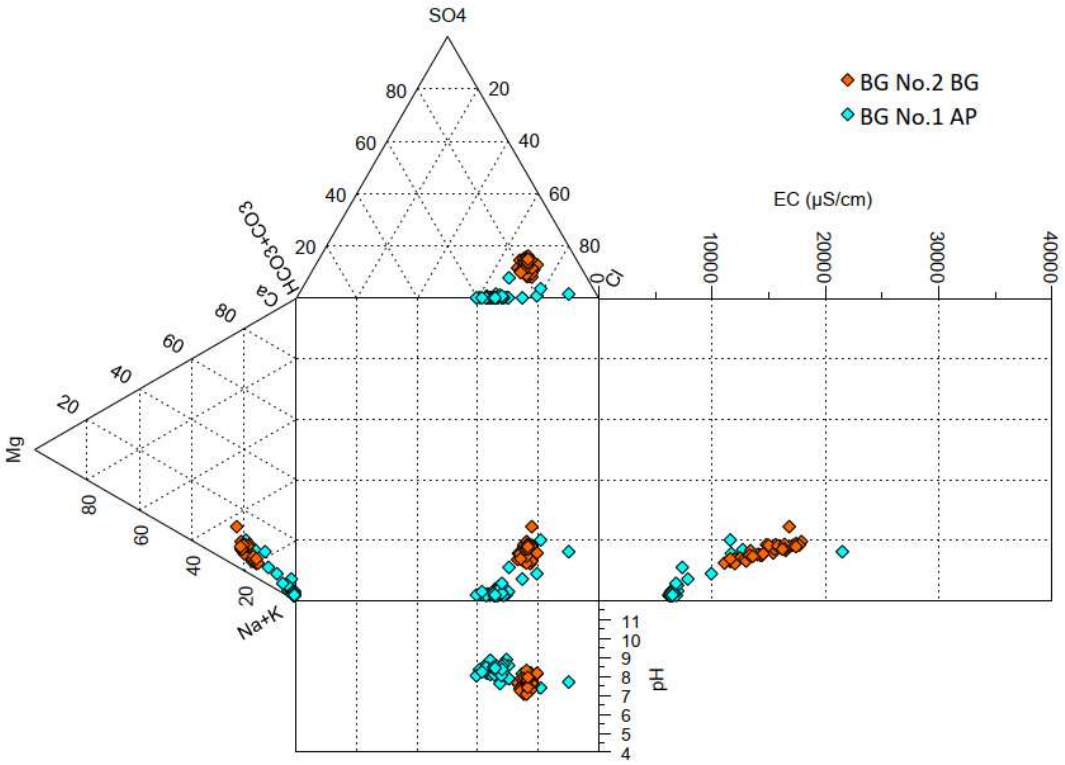


Figure 5-6 Durov Diagram – Burngrove Formation

5.1.2 Salinity

Salinity is a key constraint to water management and groundwater use by receptors and can be described by total dissolved solid (TDS) concentrations. **Figure 5-7** presents the TDS data associated with waters screened in the various hydrostratigraphic units for BWM monitoring bores. Salinity ranges represented on **Figure 5-7** are defined by the Food and Agriculture Organization of the United Nations (FAO, 2013).

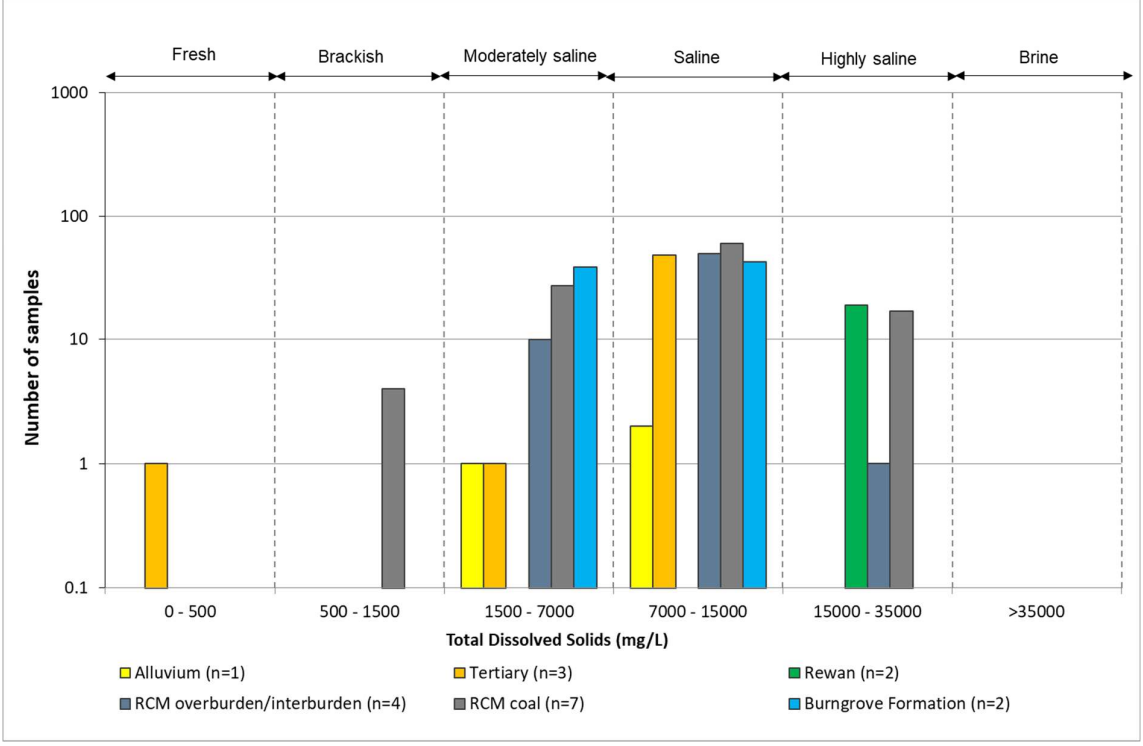
The graph shows that available data from one bore in the alluvium records TDS ranging from moderately saline to saline, with an average TDS of 8,983 mg/L and range between 4,250 mg/L and 11,600 mg/L.

Groundwater in the Tertiary strata ranges from fresh to saline, with an average TDS of 9,427 mg/L and range between 363 and 11,700 mg/L.

In the Rewan Group, groundwater ranges from moderately saline to saline, with an average TDS of 25,126 and range between 19,600 and 30,800 mg/L.

Within the RCM, groundwater ranges from brackish to highly saline, with bores that screen coal seams recording an average TDS of 9,481 and range between 1,000 to 17,000 mg/L, and bores screening interburden/overburden recording average TDS of10,400 and range between 3,250 to 18,500 mg/L.

In the Burngrove Formation, groundwater ranges from moderately saline to saline, with an average TDS of 6,964 mg/L and range between 3,250 and 14,400 mg/L.



Note: n = number of bores

Figure 5-7 Salinity Ranking by Hydrostratigraphic Unit

5.1.3 Beneficial Groundwater Use

5.1.3.1 Potentially Relevant Environmental Values and Guidelines

The Project Area lies mainly within the Highlands Groundwater Management Area (GMA) of the Fitzroy Basin under the *Water Plan (Fitzroy Basin) 2011* (**Figure 5-8**). The Highlands GMA consists of the following:

- Highlands Groundwater Unit 1, containing the aquifers of the Quaternary alluvium associated with the Sandy Creek Alluvium sub-area (to the distant northwest of BWM but not located within the Study Area); and
- Highlands Groundwater Unit 2, containing all subartesian aquifers within the Highlands GMA other than the aquifers included in Highlands Groundwater Unit 1.

Volumetric limits apply to extraction of groundwater within the GMA for non-stock and domestic purposes.

Groundwater resources in the Study Area are also scheduled under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water and Wetland Biodiversity), as Comet Groundwaters (for the southern part of BWM within the Comet sub-catchment (DEHP, 2011a)) and Mackenzie Groundwaters (for the northern part of BWM within the Upper Mackenzie sub-catchment (DEHP, 2011b)) of the Fitzroy Basin water plan (WQ1310) (**Figure 5-8**). The legislated environmental values (EVs) for these Groundwaters (**Table 5-1**) are:

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock water;
- Primary recreation (Comet Groundwaters only);
- Drinking water;
- Industrial use; and
- Cultural and spiritual values.

Also shown in **Table 5-1** is a comparison of those WQOs to potentially applicable based on the results of the EMM (2019) bore census (see **Section 5.2.1**). EMM (2021) concluded that based on the bores that were surveyed in the 2019 bore census *"the environmental values for groundwater in the area are limited to farm supply/use, stock water and industrial use (.ie mining). Aquatic ecosystems may also be associated with shallow alluvial systems" (***Table 5-1**).

Table 5-1 Environmental Values of Comet and Mackenzie Groundwaters of the Fitzroy Basin

Environmental Values (DEHP, 2011a, 2011b)												
Fitzroy Basin Water Plan (WQ1310) Sub-catchment	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human Consumer	Primary Recreation	Secondary Recreation	Visual Recreation	Drinking water	Industrial use	Cultural and spiritual values
Comet Groundwaters	☑	☑	☑	☑			☑			☑	☑	☑
Mackenzie Groundwaters	☑	☑	☑	☑						☑	☑	☑
Potentially Locally Applicable based on EMM (2019) bore census	☑		☑	☑							☑	

The EPP Water and Wetland Biodiversity provides water quality objectives (WQOs) for the scheduled EVs in WQ1310. WQOs are long-term goals for water quality management and the purpose of the WQOs is to support and protect EVs. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and

protect the designated EVs for those waters. They are based on scientific criteria or water quality guidelines but may be modified by other inputs (e.g. social, cultural, economic).

Where groundwater quality analysis results exceed a particular WQO for a particular EV, it is considered indicative that the groundwater may be unsuitable for supporting that particular EV.

The WQ1310 WQOs for groundwater relevant to BWM are shown **Table 5-2**.

Table 5-2 Water Quality Objectives for Fitzroy Sub-basin Environmental Values

Water Quality Indicator	Unit	ADWG Guidelines[1]		Mackenzie River Sub-basin EVs			Comet River Sub-basin EVs		
		ADWG Guidelines Health	ADWG Guidelines Aesthetic	Irrigation[2]	Stock[3]	Aquatic 95%[4]	Irrigation[5]	Stock[6]	Aquatic 95%[4]
pH	-	-	6.5 to 8.5	-	-	6.5 to 8.5	-	-	6.5 to 8.5
TDS	mg/L	-	600		5000[7]	-		5000[7]	-
Chloride	mg/L	-	250	-	-	-	-	-	-
Sodium	mg/L	-	180	-	-	-	-	-	-
Aluminium	mg/L	-	0.2	5	5	0.055	5	5	0.055
Arsenic	mg/L	0.01	-	0.1	0.5	0.024	0.1	0.5	0.024
Beryllium	mg/L	0.06	-	0.1	-	-	0.1	-	-
Boron	mg/L	4	-	0.5	5	-	0.5	5	-
Cadmium	mg/L	0.002	-	0.01	0.01	0.0002	0.01	0.01	0.0002
Chromium	mg/L	0.05	-	0.1	1	0.001	0.1	1	0.001
Cobalt	mg/L	-	-	0.05	1	-	0.05	1	-
Copper	mg/L	2	1	0.2	1[6]	0.0014	0.2	1[6]	0.0014
Fluoride	mg/L	1.5	-	1	2	-	1	2	-
Iron	mg/L	-	0.3	0.2	-	-	0.2	-	-
Lead	mg/L	0.01	-	2	0.1	0.0034	2	0.1	0.0034
Lithium	mg/L	-	-	2.5	-	-	2.5	-	-
Manganese	mg/L	0.5	0.1	0.2	-	1.9	0.2	-	1.9
Mercury	mg/L	0.001	-	0.002	0.002	0.0006	0.002	0.002	0.0006
Molybdenum	mg/L	0.05	-	0.01	0.15	-	0.01	0.15	-
Nickel	mg/L	0.02	-	0.2	1	0.011	0.2	1	0.011
Selenium	mg/L	0.01	-	0.02	0.02	0.005	0.02	0.02	0.005
Silver	mg/L	0.1	-	-	-	0.05	-	-	0.05
Uranium	mg/L	0.02	-	0.01	0.2	-	0.01	0.2	-
Vanadium	mg/L	-	-	0.1	-	-	0.1	-	-
Zinc	mg/L	-	3	2	20	0.008	2	20	0.008

1. NHMRC (2025) Australian Drinking Water Guidelines
2. Table 9 of DEHP (2011b) Mackenzie River Sub-basin Environmental Values and Water Quality Objectives: Irrigation water (Long term value)
3. Table 10 and Table 11 of DEHP (2011b) Mackenzie River Sub-basin Environmental Values and Water Quality Objectives: Stock value)
4. ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% for protection and 99% for bioaccumulating contaminants)
5. Table 9 of DEHP (2011a) Comet River Sub-basin Environmental Values and Water Quality Objectives: Irrigation water (Long term value)
6. Table 10 and Table 11 of DEHP (2011a) Comet River Sub-basin Environmental Values and Water Quality Objectives: Stock value
7. Relevant guideline value for cattle

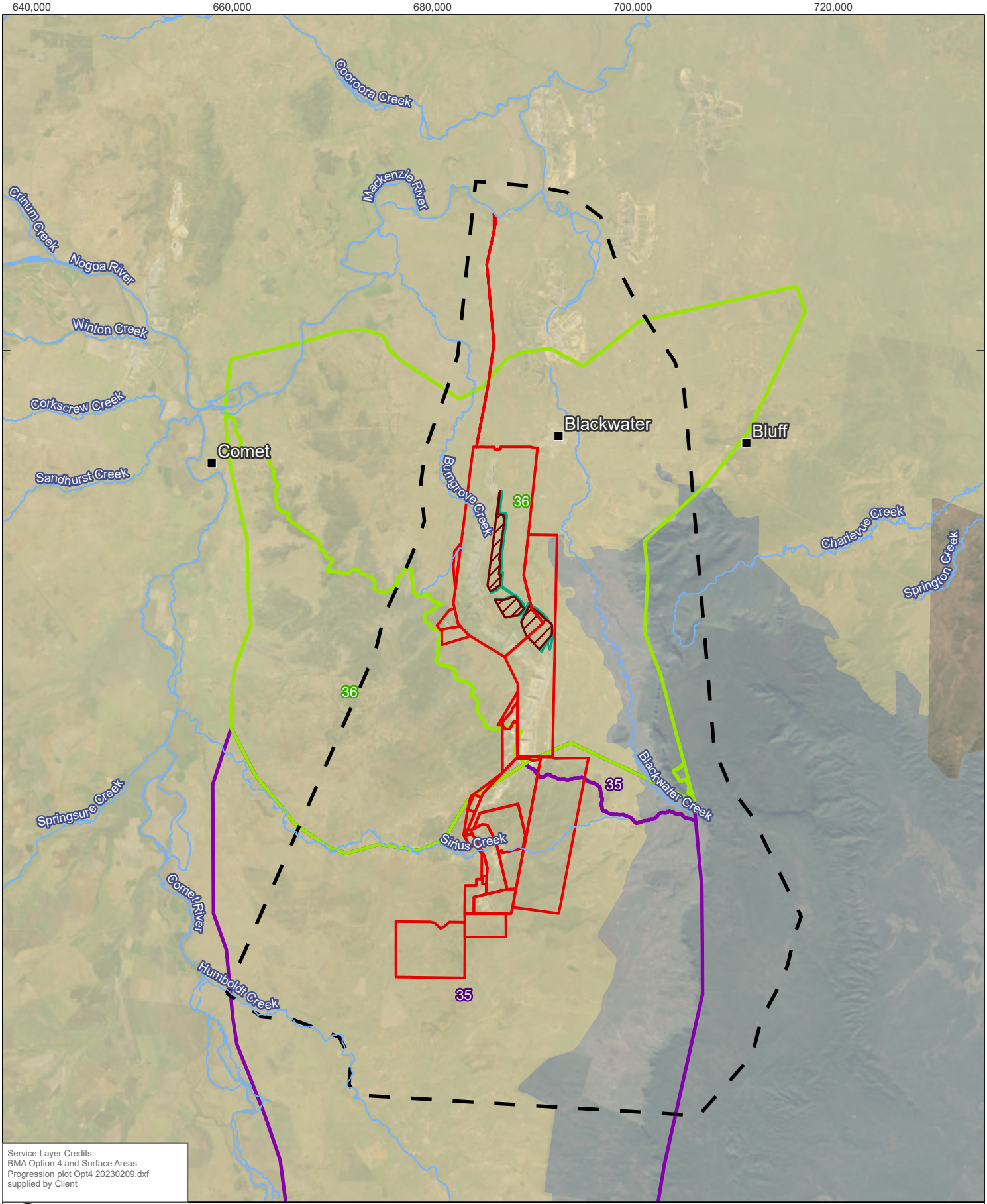


The EPP Water and Wetland Biodiversity also provides limited WQOs specifically for underground aquatic ecosystem protection in Fitzroy Basin groundwaters. These WQOs vary across the Fitzroy Basin and are defined on the basis of groundwater Chemistry Zones. The applicable Chemistry Zones for BWM include the Fitzroy Groundwater Zone 35 and Zone 36 (**Figure 5-8** and **Table 5-3**) which are characterised as sodic dominant at levels of dissolved material that classify general water quality as low to moderate salinity (Zone 36) and saline (Zone 35).

These WQOs are classified by groundwater depth ('shallow' being <30 m depth, and 'deep' being >30 m depth) and are summarised below. The management intent of each WQO zone is to maintain each of 20th, 50th and 80th percentile values.

Table 5-3 Fitzroy Basin Zone 35 and Zone 36 WQOs for groundwater resources (aquatic ecosystem protection) (DEHP, 2011a and 2011b)

Water Quality Indicator	Unit	Zone 35 Shallow Groundwater (<30m)			Zone 35 Deep Groundwater (>30m)			Zone 36 Shallow Groundwater (<30m)			Zone 36 Deep Groundwater (>30m)		
Percentile	-	20th	50th	80th	20th	50th	80th	20th	50th	80th	20th	50th	80th
EC	(µS/cm)	84	870	1983	4103	9375	13604	3100	6300	7410	3475	4150	7255
Hardness as CaCO3	(mg/L)	37	124	430	401	1216	1905	323	363	528	288	354	619
pH	(mg/L)	7.59	7.6	7.93	7.37	7.6	8.01	7.7	7.80	8.35	8.21	8.3	8.66
Alkalinity	(mg/L)	122	320	556	92	189	311	316	600	843	460	572	1322
Ca	(mg/L)	6	14	81	33	146	366	42	53	105	23	45	75
Mg	(mg/L)	3	27	58	45	204	226	46	56	72	44	74	106
Na	(mg/L)	59	113	256	465	1750	2555	590	1404	1511	520	830	1748
Cl	(mg/L)	54	86	392	1079	3316	5368	610	1885	2373	793	1000	1945
SO4	(mg/L)	5	11	25	0	20	122	2	5	120	84	115	210
HCO3	(mg/L)	42	333	646	126	268	376	372	732	1021	541	640	1549
NO3	(mg/L)	0.15	1.4	9.6	0	0.1	0.5	1	4.25	7.50	0.65	2	2.9
SiO2	(mg/L)	43	68	72	9	18	76	25	43	60	32	43	81
F	(mg/L)	0.1	0.2	0.5	0.06	0.3	0.5	0.285	0.3	0.39	0.31	0.4	1.12
Fe	(mg/L)	-	-	-	0	0.01	0.047	0.02	0.02	0.02	0.02	0.02	0.047
Mn	(mg/L)	-	-	-	0.01	0.04	2.495	0.02	0.045	0.07	0.02	0.02	0.047
Zn	(mg/L)	-	-	-	0.01	0.14	0.27	-	-	-	-	-	-
Cu	(mg/L)	-	-	-	0	0.005	0.01	-	-	-	-	-	-



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:500,000 at A4
Project Number:	640.031809.00001
Date Drawn:	05-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER MANAGEMENT AREAS AND CHEMISTRY ZONES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-8

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_F02_01_Groundwater Management Areas and Chemistry Zones

5.1.3.2 Comparison of Groundwater Quality to Potentially Relevant Guidelines

In order to understand the possible utilisation of groundwater resources within the Study Area, given the scheduled EVs discussed above, the available groundwater quality data have been compared to the:

- Australian Drinking Water Guidelines (ADWG) (NRMMC, 2011).
- ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% protection).
- Fitzroy Basin Groundwater Water Quality Objectives: Aquatic ecosystems (Zones 35 and Zone 36).
- Mackenzie and Comet River Sub-basin Environmental Values and Water Quality Objectives: stock and irrigation.

A comparison of these guidelines to the 80th percentile of available historical water quality data for each BWM EA monitoring bore is presented as **Appendix A**. A summary of **Appendix A** is provided in **Table 5-4** as the percentage of analysed bores with 80th percentile groundwater quality data above the relevant guideline for one or more analyte. This is further discussed in detail in the below text.

Table 5-4 Percentage of Analysed Bores in Aquifer with 80th Percentile Groundwater Quality Data Above Relevant Guideline for one or more Analyte (refer Appendix A)

Aquifer	Number of bores Analysed	ADWG Guidelines Health[1]	ADWG Guidelines Aesthetic[1]	Irrigation[2]	Stock[3]	Aquatic 95%[4]	80th %ile WQO limit[5]
Alluvium	1	100%	100%	100%	100%	100%	100%
Tertiary	3	100%	33%	100%	100%	67%	100%
Rewan	2	100%	100%	100%	100%	100%	100%
Permian (north)	9	100%	44%	100%	100%	78%	44%
Permian (south)	2	100%	100%	100%	100%	50%	100%
Burngrove Formation	2	100%	50%	100%	50%	50%	100%

1. NHMRC, NRMMC (2011) Australian Drinking Water Guidelines
2. Table 9 of DEHP (2011a) Comet River Sub-basin / Table 9 of DEHP (2011b) Mackenzie River Sub-basin Environmental Values and Water Quality Objectives: Irrigation water (Long term value).
3. Table 10 and Table 11 of DEHP (2011b) Mackenzie River Sub-basin Environmental Values and Water Quality Objectives: Stock.
4. ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% protection).
5. Fitzroy Basin Zone 35 and Zone 36 WQOs for groundwater resources (aquatic ecosystem protection) (DEHP, 2011a and 2011b)

Quaternary Sediments

Water quality data from one bore in the alluvium with available data shows that concentrations from most analytes are generally higher than the relevant Fitzroy Basin WQOs for aquatic ecosystem protection. Alluvium groundwater data also indicates it is generally not suitable for supporting the Aquatic Ecosystems EV with respect to copper and zinc. The 80th percentile concentrations of the alluvium data also indicate the alluvial groundwater is generally unsuitable to support the Drinking Water EV with respect to



chloride, sodium and manganese and TDS, the Irrigation EV with respect to boron, manganese and uranium, and the Stock Watering EV with respect to TDS (salinity).

Tertiary Sediments

Groundwater quality data, where groundwater is present in the Tertiary sediments/regolith, shows that collectively it is not considered a suitable groundwater resource for drinking and irrigation due to exceedances above Fitzroy Basin WQOs with respect to beryllium, nickel, lead, fluoride and manganese or TDS and boron, iron, manganese, fluoride and molybdenum respectively (see **Appendix A**). Monitoring data from the Tertiary bores show that analyte concentrations exceed the relevant Fitzroy Basin WQOs for Aquatic Ecosystem protection across all three analysed bores, particularly for dissolved metals (see **Appendix A**). The monitoring data also shows that of the Tertiary bores, only one of two bores showed water quality above the Stock EV guideline with respect to fluoride, aluminium and TDS (see **Appendix A**).

Triassic Rewan Group

Groundwater quality data from two bores screened in the Rewan Group shows that most analyte concentrations are generally higher than the relevant Fitzroy Basin WQOs for Aquatic Ecosystem protection. The data also indicates it is generally not suitable for supporting the Aquatic Ecosystems EV with respect to most relevant metal concentrations (**Appendix A**). The monitoring bore data also suggests that it is generally not suitable for supporting the Drinking Water, Stock, Irrigation EVs (**Appendix A**).

Rangal Coal Measures

As with the Alluvium, Tertiary and Rewan Group, RCM monitoring bore data shows concentrations of most analytes are generally higher than the relevant Fitzroy Basin WQOs for Aquatic Ecosystem protection. RCM monitoring bore data generally suggests that RCM groundwater in the Project Area is unsuitable to support the Aquatic Ecosystems EVs with respect to pH, cadmium, chromium, copper, nickel, lead, selenium or zinc and the Drinking Water EV with respect to selenium, manganese or fluoride (see **Appendix A**). The RCM monitoring bore data also generally suggests that RCM groundwater in the Project Area is also unsuitable to support the irrigation water EV with respect to boron, iron, molybdenum, manganese, selenium or uranium. The monitoring bore data shows water quality generally above the Stock water EV guideline with respect to selenium and TDS (**Appendix A**).

Burngrove Formation

Groundwater quality data is available from two bores screened in the Burngrove Formation namely bores BG No.1 AP and BG No.2 BG located in the north of the Project Area.

Burngrove Formation groundwater data also indicates it is generally not suitable for supporting the Aquatic Ecosystems EV with respect to selenium and nickel. Groundwater does not meet the Drinking Water EV criteria with respect to pH, iron, manganese, sodium, chloride or TDS and the Irrigation EV with respect to boron or iron. The monitoring bore data indicates only one exceedance in TDS at bore BG No.2 BG above the Fitzroy Basin WQOs for Stock Watering.

Summary

In summary, the comparison of available groundwater quality data from the BWM monitoring bores shows that all hydrostratigraphic units at BWM generally exhibit water quality that exceeds some of the relevant parameter criteria for the scheduled EVs.

5.2 Groundwater Receptors

This section reviews the groundwater receptors, both anthropogenic (groundwater bore users) and environmental (GDEs, springs and wetlands).

5.2.1 Anthropogenic

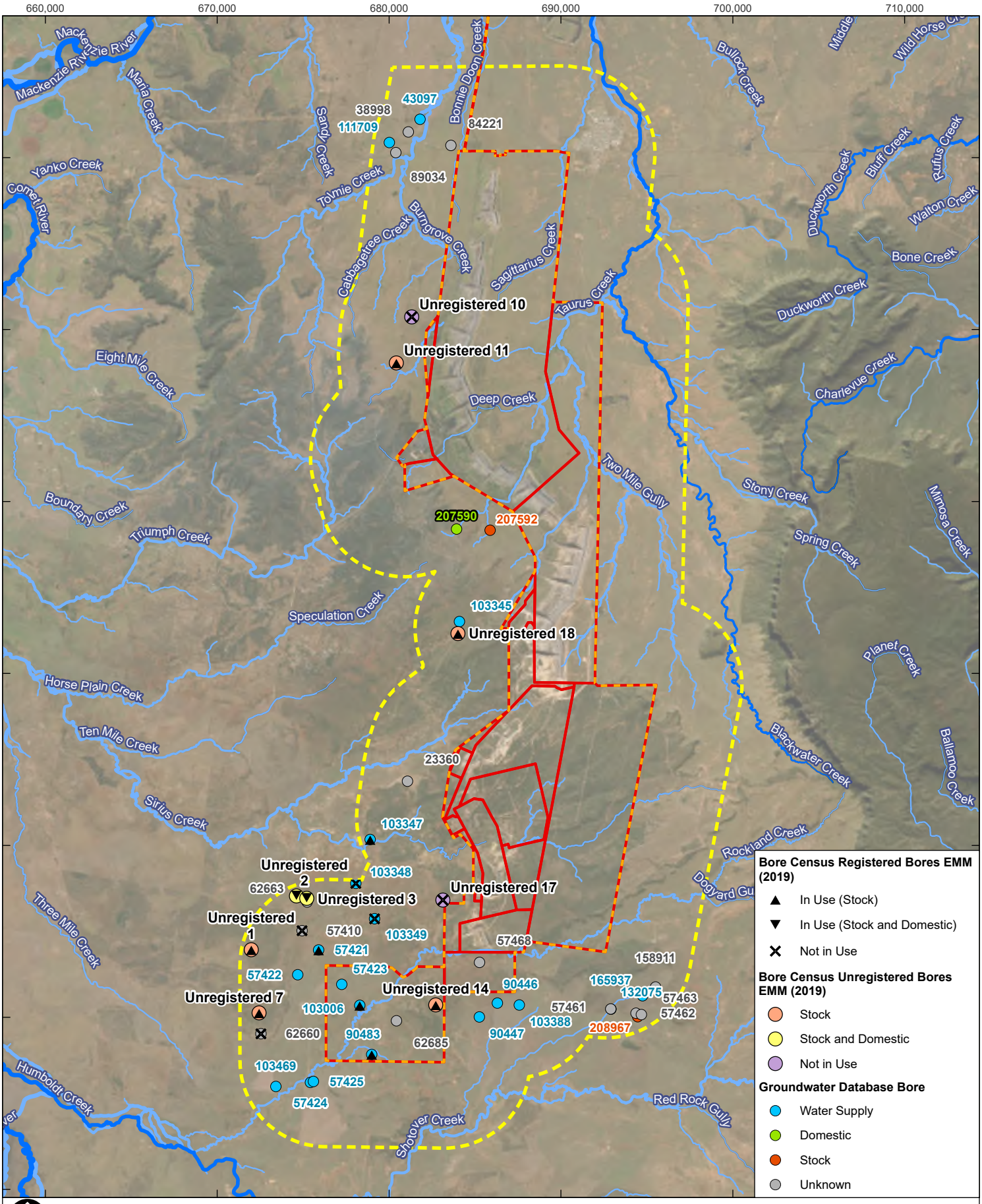
A search of the Queensland Government's Registered Groundwater Bore Database (GWDB) (DRDMW, 2026) was carried out for registered bores within 5 km of the EA boundary. The search returned 315 registered bores.

The landholder bore census conducted at BWM North by EMM (2019) was also reviewed. Within 5 km of the EA boundary a total of 18 bores were visited during the census, including 9 registered bores and 9 unregistered bores (**Figure 5-9**).

The results of the combined registered bore search and review of the available bore census within 5 km of the EA boundary are shown in **Table 5-5**. Overall, the review identified a total of 44 third-party / potential third-party bores, with uses as water supply (19), stock (7), stock and domestic (2), domestic (1), unknown (13) and not in use (2). It should be noted that the uses listed in the table are a result of the combined review (including not in use) and that only 18 of the 44 identified third-party bores within 5 km of the EA boundary have been subject to a bore census. A previous revised bore search undertaken for the BWM North area (see SLR, 2025b) similarly identified some bores in the area had not been subject to a bore census. Given this, it is recommended to conduct a bore census for the remaining third-party bores identified. The objective of conducting a census would be to confirm the bores presence and potential usage (i.e. confirm their status as a potential receptor). It is also acknowledged that additional unregistered bores may be identified through discussions with the landholders as part of the census.

Table 5-5 Results of Combined Registered Bore Search and Available Bore Census within 5 km of EA Boundary

Use	Number	Third Party Bore?
Mine monitoring	238	No
Petroleum exploration	1	No
Sub-artesian monitoring	19	No
Water resource investigation	1	No
Water supply	19	Yes
Stock	7	Yes
Stock and domestic	2	Yes
Domestic	1	Yes
Unknown	13	Potential
Not in use (unregistered private bore)	2	Potential
Decommissioned	21	No
Total (excluding decommissioned)	**315**	



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:290,000 at A4
Project Number:	620.041706.00014
Date Drawn:	05-Feb-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

THIRD-PARTY BORES WITHIN 5 KM OF EA BOUNDARY

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE5-9

Path: H:\Projects-SLR\620-BNE\620-BNE\620.041706.00001 BWM EA Trigger and Network Rev\06 SLR Data\01 GIS\GIS\BWM EA Trigger and Network Review\BWM EA Trigger and Network Review.aprx\620041706_F05_10_Third-Party Bores within 5 km of EA Boundary

5.2.2 Groundwater Dependent Ecosystems

5.2.2.1 National Atlas of Groundwater Dependent Ecosystems

A groundwater dependent ecosystem (GDE) is a natural ecosystem that requires "access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services" (Richardson, S., et al., 2011).

The BoM's National Atlas of Groundwater Dependent Ecosystems (GDE Atlas) (BoM, 2017) classifies ecosystems based on the potential for dependence on groundwater through multiple lines of scientific evidence. Ecosystems have been mapped as either:

- High potential for groundwater dependence (indicating a strong possibility the ecosystem is interacting with groundwater);
- Moderate potential for groundwater dependence; or
- Low potential for groundwater dependence (indicating it is relatively unlikely the ecosystem will be interacting with groundwater and will include ecosystems that are not interacting with groundwater).

Desktop mapping of potential aquatic and terrestrial GDEs indicates that areas with possible high, moderate, and low potential for groundwater interaction occur in the vicinity of the Project Area (**Figure 5-10**).

Figure 5-10 shows that within the Study Area, approximately 15 km southeast of BWM there are two mapped known GDEs (springs) associated with the Clematis Group outcrop escarpment.

5.2.2.2 Local GDE Studies

Field investigations to verify the groundwater dependence of potential GDEs identified in the BoM GDE Atlas desktop mapping (i.e. ground-truthing investigations) have been undertaken in the vicinity of north BWM by EMM (2023a) for potential TGDEs, and EMM (2023b) for potential aquatic GDEs, E2M Pty Ltd (E2M) (2026) for TGDEs, and DPM Enviroscences Pty Ltd (DPM Enviroscences) (2026) for GDEs. The outcome of these investigations is summarised below. No ground-truthing local investigations have been undertaken in the vicinity of south BWM.

2023 Studies

Field surveys were undertaken that identified and characterised remnant regional ecosystem terrestrial vegetation within the vicinity of north BWM. EMM (2023a) then utilised depth to groundwater table mapping prepared by RDM Hydro et al. (2023) and information on maximum plant rooting depths for the identified vegetation species to assess whether the groundwater table was within the potential rooting depths of the vegetation, and thus if the vegetation may be reliant at least in part on groundwater. **T**he results of the work indicated that the riparian terrestrial vegetation associated with Taurus Creek (a tributary of Blackwater Creek) on the eastern margin of the Project Area and a very small area along Sagittarius Creek to the north of the Project Area may represent a TGDE. The terrestrial vegetation in this area consists of narrow linear communities that fringe the creek, with potential TGDE vegetation types consisting primarily of poplar box (*Eucalyptus populnea*), forest red gum *(Eucalyptus tereticornis*), or river red gum (*E. camaldulensis*) (EMM, 2023a).

Assessments to verify mapped potential aquatic GDEs include the field survey undertaken by EMM (2023b) in the vicinity of BWM North. The outcome of this survey is summarised by EMM (2023b) in the Aquatic Ecology Baseline Assessment Report as:

"Prolonged dry conditions in the lead-up to the December 2019 surveys provided ideal conditions for identifying surface expressions of groundwater (i.e. aquatic GDEs). However, no flows, salt seeps, hydrophytes, or other obvious indicators of aquatic GDEs were encountered. Further, the concentration and relative proportion of major anions and cations in surface water samples collected from the survey area in December 2019 and May 2020 showed no obvious groundwater influence. Field verification of riparian vegetation and aquatic habitats of the survey area found no obvious on-ground indicators of aquatic GDEs."

That is, the field verification of aquatic habitats in the vicinity of north BWM found no indicators of aquatic GDEs (EMM, 2023b) indicating that the BoM GDE Atlas mapping of potential GDEs in this area is potentially erroneous.

2026 Studies

DPM Environsciences completed an assessment in early 2026 to describe the aquatic values of the Project Area (the Study Area – being the BWM North region), identify any conservation significant species under the EPBC Act and Queensland *Nature Conservation Act 1992*, identify the potential for GDEs to occur, identify and describe any aquatic Matters of State or National Environmental Significance, assess impacts of the Project on aquatic and GDE values. The assessment of GDEs concluded:

"*Terrestrial GDEs occur within the Study Area in part of the riparian corridor of Taurus Creek. There is no evidence of surface expression or subterranean GDEs within the Study Area, both of which are unlikely to occur. The presence of stygofauna in an aquifer would indicate a subterranean GDE; however, no stygofauna were detected from five bores and five micropiezometers sampled as part of a pilot survey in both July and October 2025, and there is no evidence of stygofauna having previously been detected from within 5 km of the Study Area*" (DPM Environsciences, 2026).

This study generated the most up-to-date and comprehensive mapping of GDEs within the Study Area and this mapping has been adopted for the GDE assessments in the BWM North region herein.

E2M completed a Terrestrial Ecological Assessment including a further review of TGDEs within the Study Area based on the outcomes of the DPM Environsciences (2026) study. Preliminary desktop assessments identified potential TGDEs in the central extent of the Study Area around Taurus Creek, via the BoM GDE mapping, as previously identified. A field assessment of potential TGDEs defined by DPM Environsciences (2026) concluded the following:

"Based on the species composition of these communities, areas of these REs potentially access groundwater during dry periods, given the presence of E. coolabah and E. populnea, which can be facultative groundwater dependent species (Eamus et al., 2006; Kath et al., 2014; Roberts & Marston, 2000). Remnant vegetation on Two Mile Gully and further upstream on Taurus Creek is unlikely to constitute terrestrial GDEs as they generally contained species that do not represent ground-water dependent vegetation such as Acacia harpophylla and Terminalia oblongata. These species typically have a horizontal root system and are considered unlikely to be dependent on access to groundwater for long-term survival (DES, 2017)" (E2M, 2026).

Areas of TGDEs identified in BWM North are depicted in **Figure 5-10** (based on DPM Environsciences, 2026).

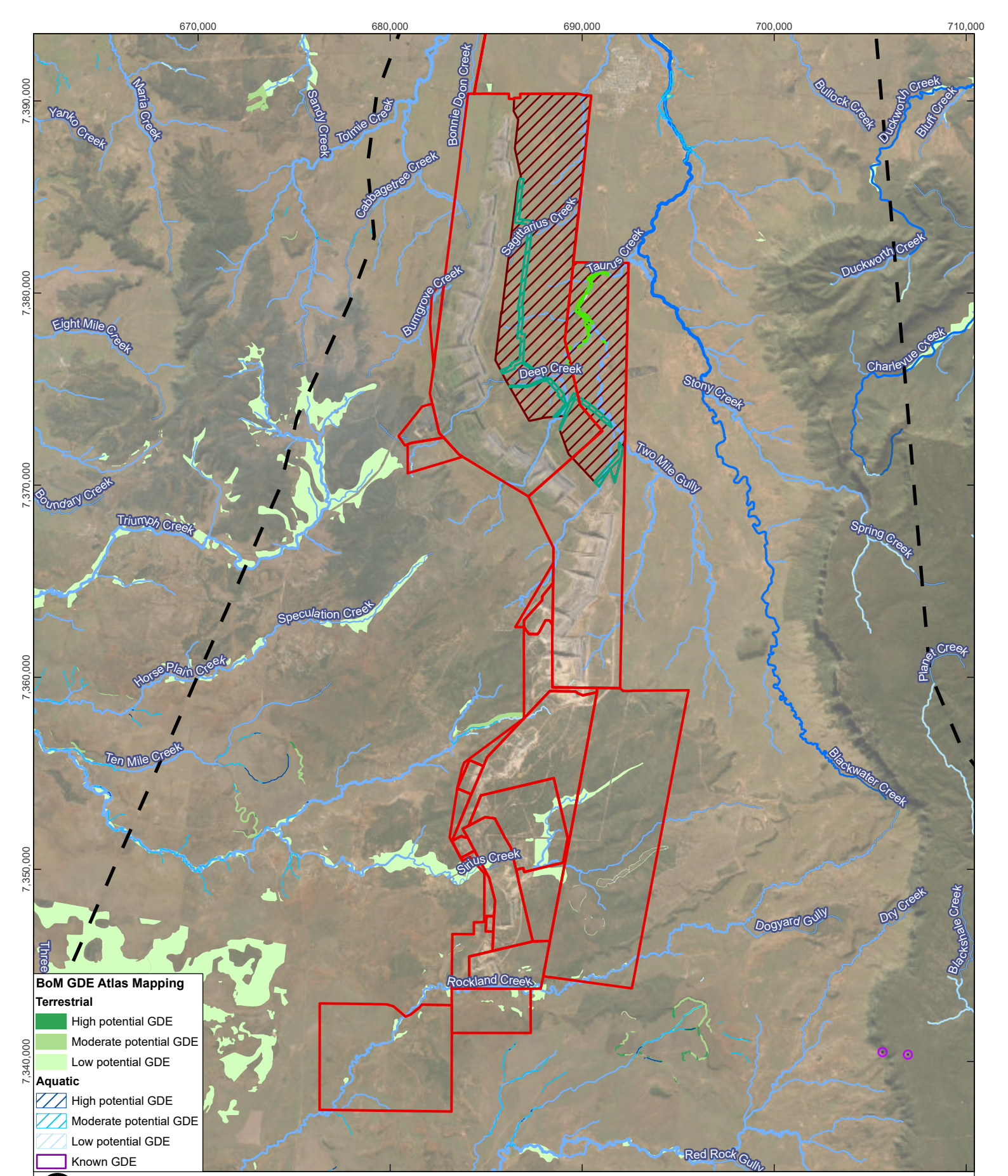
5.2.3 Springs

A search with the QSpatial Database showed that there are no registered springs within a 10 km buffer of the Project Area. The closest registered spring is located approximately 14.8 km southeast from the Project Area, a distance considered significant in the context of

the Project's potential groundwater related impacts such that this spring is not relevant to the Project's impact assessment.

5.2.4 Wetlands

A wetlands search was conducted using data downloaded from the QSpatial Catalogue. The downloaded dataset shows High Ecological Significance (HES) wetlands that are matters of state environmental significance. The dataset did not show any wetlands within a 10 km buffer of the Project Area. The closest wetland is located approximately 19.7 km southeast from the Project Area, a distance considered significant in the context of the Project's potential groundwater related impacts such that this wetland is not relevant to the Project's impact assessment.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	07-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

GROUNDWATER DEPENDENT ECOSYSTEM MAPPING

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-10

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F05_10_Groundwater Dependent Ecosystem Mapping

6.0 Conceptual Site Models – End of Mining

A conceptual hydrogeological model (CHM) of the groundwater regime has been developed based on the review of the hydrogeological information for the Study Area presented in the above report sections. The CHM of the groundwater regime is discussed in the below sections as general (**Section 6.1**) and end of mining (**Section 6.2**)

Visual representations of the CHM for the groundwater regime have been developed based on the hydrogeological data review presented above. CHMs have been developed showing the end of mining at north BWM (**Figure 6-1**) and the end of mining at south BWM (**Figure 6-2**).

6.1 General

The Project is located within the southern part of the Bowen Basin, which comprises Permian aged coal measures that have been folded into a syncline structure that strikes in a north-west to south-east direction.

The main hydrostratigraphic units relevant to the Study Area include:

- Alluvium – Alluvial deposits are associated with local creeks. In recent years, the alluvium local to the Project Area has been found to be limited in extent, and dry. The alluvium forms a localised unconfined aquifer where saturated water levels (i.e. the water table) is above the base of the alluvium
- Tertiary Sediments and Basalt –- Unconsolidated surface layer of weathered rock (also termed regolith) including Tertiary strata and basalt flows, which may provide a preferential flow pathway for groundwater if the groundwater table exceeds the base of weathering. The unit forms an unconfined aquifer when saturated.
- Clematis Group – Forms an unconfined aquifer where it outcrops at the eastern margin of the Study Area.
- Rewan Group – Considered a regional scale aquitard, however local permeability testing indicates hydraulic conductivity values may be higher in the upper weathered zone of the unit.
- Rangal Coal Measures – Coal seams of this unit form the primary regional aquifer. Groundwater flow is primarily within the coal seams (via interconnected cleats and fractures), which are confined by low permeability overburden and interburden that essentially form aquitards. The coal measures are highly locally faulted resulting in “compartmentalisation” with coal seams juxtaposed against lower permeability interburden.
- Burngrove Formation – Coal seams of this unit form a regional scale aquifer in conjunction with low permeability overburden and interburden that essentially form aquitards. Considered the basement formation for the purposes of this assessment.

The alluvium is often found to be limited in extent and thickness, and unsaturated, but may become temporarily saturated following rainfall recharge and occasional seepage from ephemeral creek streamflow. Groundwater levels in the unconfined alluvium, where saturated, are expected to be a subdued reflection of topography, with flow toward the north at north BWM and towards the southwest at south BWM. In rare occasions where the alluvium is found to be saturated, groundwater is predominantly restricted to the coarser grained alluvium (that can more easily transmit water). The coarser grained areas of alluvium are separated by clay lenses and outcropping bedrock, with limited connectivity between areas of saturated alluvium. The alluvium is considered to be recharged predominantly via occasional ephemeral stream flow (i.e. losing conditions), or via flooding.

Recharge to the alluvium also occurs via direct rainfall infiltration which occurs rapidly where there are no substantial clay barriers in the shallow subsurface. Overall, recharge is expected to be low due to the presence of surficial clays. On a regional scale, outflow occurs via evapotranspiration from vegetation growing along creek beds. Minor short duration baseflow events after significant rainfall/flooding are possible, however there was no data available to support or reject this hypothesis. Despite extensive drilling targeting the alluvium, groundwater quality data is only available from one alluvium monitoring bore (due to limited extent of the alluvium and areas of saturation where it exists). Data from this bore suggests that water quality in the alluvium ranges from moderately saline to saline and is generally unsuitable to be used for drinking water, stock, or irrigation purposes.

Within the Tertiary units, the strata is typically unsaturated at north BWM but saturated in the south BWM area. Similar to the alluvium, groundwater flow in the Tertiary units is expected to be controlled by topography and flow towards the north at north BWM (where present), and towards the southwest at south BWM. As per the alluvium, recharge to the Tertiary strata is expected to be low due to the presence of overlying clays. Outflow from the Tertiary aquifer is considered to be primarily through evapotranspiration and leakage to underlying aquifers. Water quality data for the Tertiary units is highly variable, ranging from fresh to saline, but generally indicates that Tertiary groundwater is unsuitable to be used for drinking water or irrigation purposes, while the water quality data from three of the four bores in the suggested suitable use for stock water purposes.

The Rewan Group is considered a regional scale aquitard, though still contains some saturated horizons. Due to its typically fine grained nature, the Rewan Group generally exhibits a low vertical hydraulic conductivity, resulting in limited hydraulic connection between the unit and the underlying/overlying units. Groundwater level data from the four saturated monitoring bores grouped in the northern area of BWM indicates a groundwater flow direction towards the north, which is consistent with topographical gradients. Groundwater flow in the Rewan Group in the southern portion of BWM is also expected to follow topography, with a flow direction towards the south and southwest. Recharge is expected to occur predominantly via leakage from the overlying units. Recharge rates are likely very low due to the low hydraulic conductivity of the unit restricting infiltration. Outflow is expected to occur via lateral flow, with the low hydraulic conductivity limiting significant leakage to underlying units. Water quality in the Rewan Group ranges from moderately saline to saline and is indicated to be generally unsuitable to be used for drinking water, stock, or irrigation purposes.

The RCM forms the main regional aquifer in the Study Area. Within the RCM, coal seams form the main groundwater bearing units, with low hydraulic conductivity interburden generally confining the individual seams. The coal seams are dual porosity in nature, with the secondary (dominant) porosity provided by fractures (joints and cleats). Hydraulic conductivity of the coal decreases with depth due to increasing overburden pressure reducing the aperture of fractures. Due to the confining nature of the interburden layers, flow is primarily horizontal through the coal seams, and recharge primarily occurs where the unit sub-crops. Outflow primarily occurs through inflow to active mining areas. To a much lesser degree, outflow also occurs through horizontal flow outside of the cone of depression formed by mining voids. Groundwater flow direction in the RCM in the vicinity of mining is towards the mine pit voids, consistent with discharge to the active mine pits.

Across the parts of BWM south that are unmined to date, flow direction is south to southwest, with a groundwater divide evident consistent with the surface catchment divide that runs between central and south BWM. Groundwater quality in the RCM ranges from brackish to highly saline and is generally indicated to be unsuitable for drinking water or irrigation purposes, while the water quality data from just over half of the bores suggested suitable use for stock watering purposes.

Groundwater occurrence in the Burngrove Formation is similar to the RCM, with coal seams forming the main aquifer in conjunction with low permeability overburden and interburden that essentially form aquitards. Based on the limited available data, groundwater flow direction in the Burngrove Formation is suggested to be from south to north at BWM north and north to south at BWM south (i.e. consistent with topography). Recharge to the Burngrove Formation is expected to occur where the unit outcrops along the western margin of the Project Area. Outflow from this formation is expected to be through lateral flow in the direction of regional groundwater flow, with some upwards leakage to the depressurised RCM. Groundwater quality is suggested to range from moderately saline to saline and is generally indicated to be unsuitable for drinking water, stock, or irrigation purposes.

6.2 End of Mining

A visual representation of the end of mining conceptual hydrogeological model is provided as **Figure 6-1** for the northern area of BWM and **Figure 6-2** for the southern area of BWM. These are generalised conceptual diagrams to indicate the likely encountered hydrogeological processes,

Based on an understanding of hydrogeological mechanisms and previous studies by SLR (2025a and 2025b), key features relevant to the discussion of potential groundwater impacts post-mining are likely to be:

- Groundwater level drawdown of the RCM, associated with passive dewatering into the active BWM mine pit voids. The magnitude of this drawdown will be most significant in the immediate vicinity of the pits, but extend northwards, eastwards and southwards of BWM by several kilometres.
- Mine pit voids capture any seepage from soil emplacements due to the hydraulic gradient orientated towards the mine void.
- Limited potential for groundwater level drawdown in the alluvium and Tertiary due to limited saturation, and poor lateral connection of water bearing zones.
- No groundwater level drawdown of the alluvium away from BWM.
- Limited potential for groundwater level drawdown impacts to potential terrestrial GDE’s due to the limited potential for groundwater level drawdown in the alluvium and Tertiary.
- No potential for groundwater quality impacts outside of BWM associated with spoil dumps, due to the inward groundwater flow gradients towards the pit voids capturing all potential seepage.

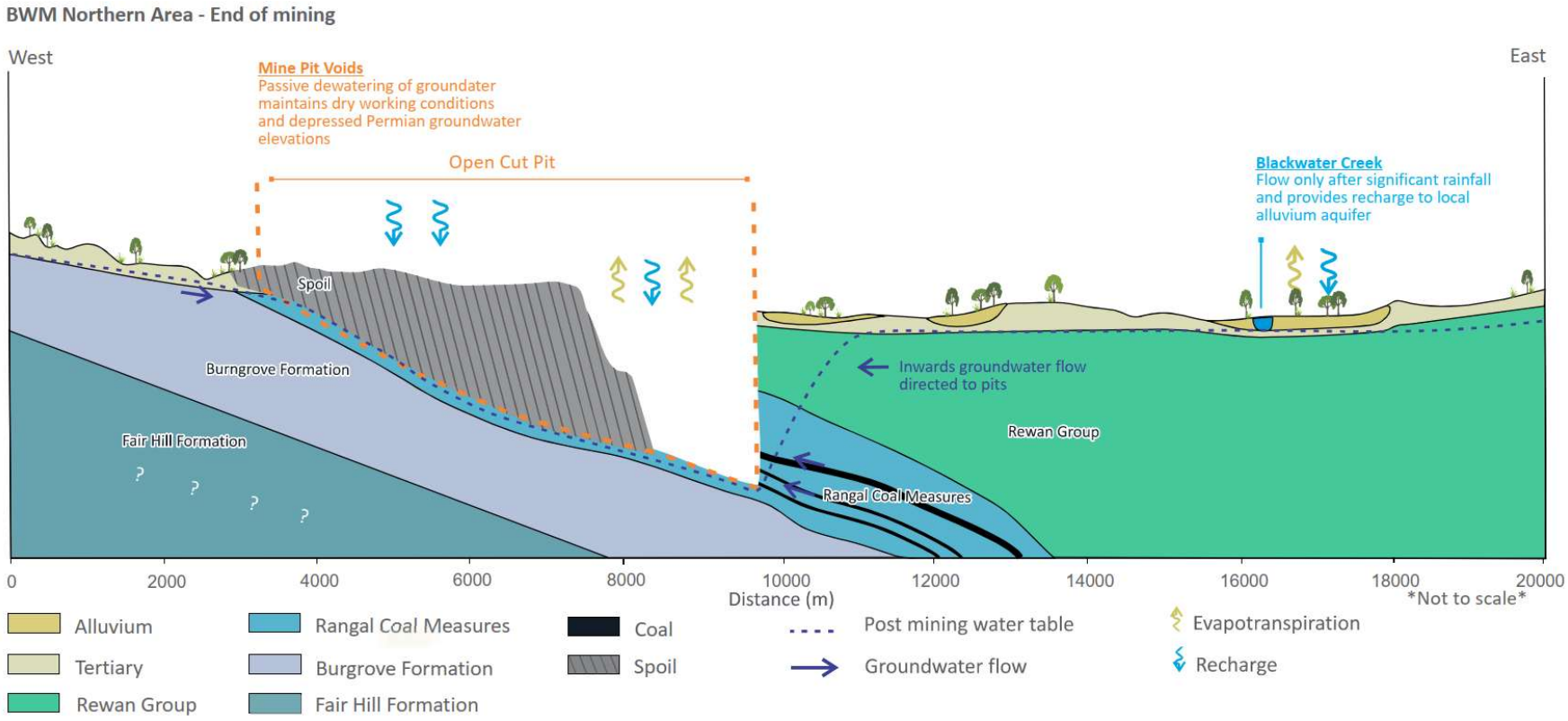


Figure 6-1 Conceptual Hydrogeological Model of BWM Groundwater System – General for BWM Northern Area (End of Mining)

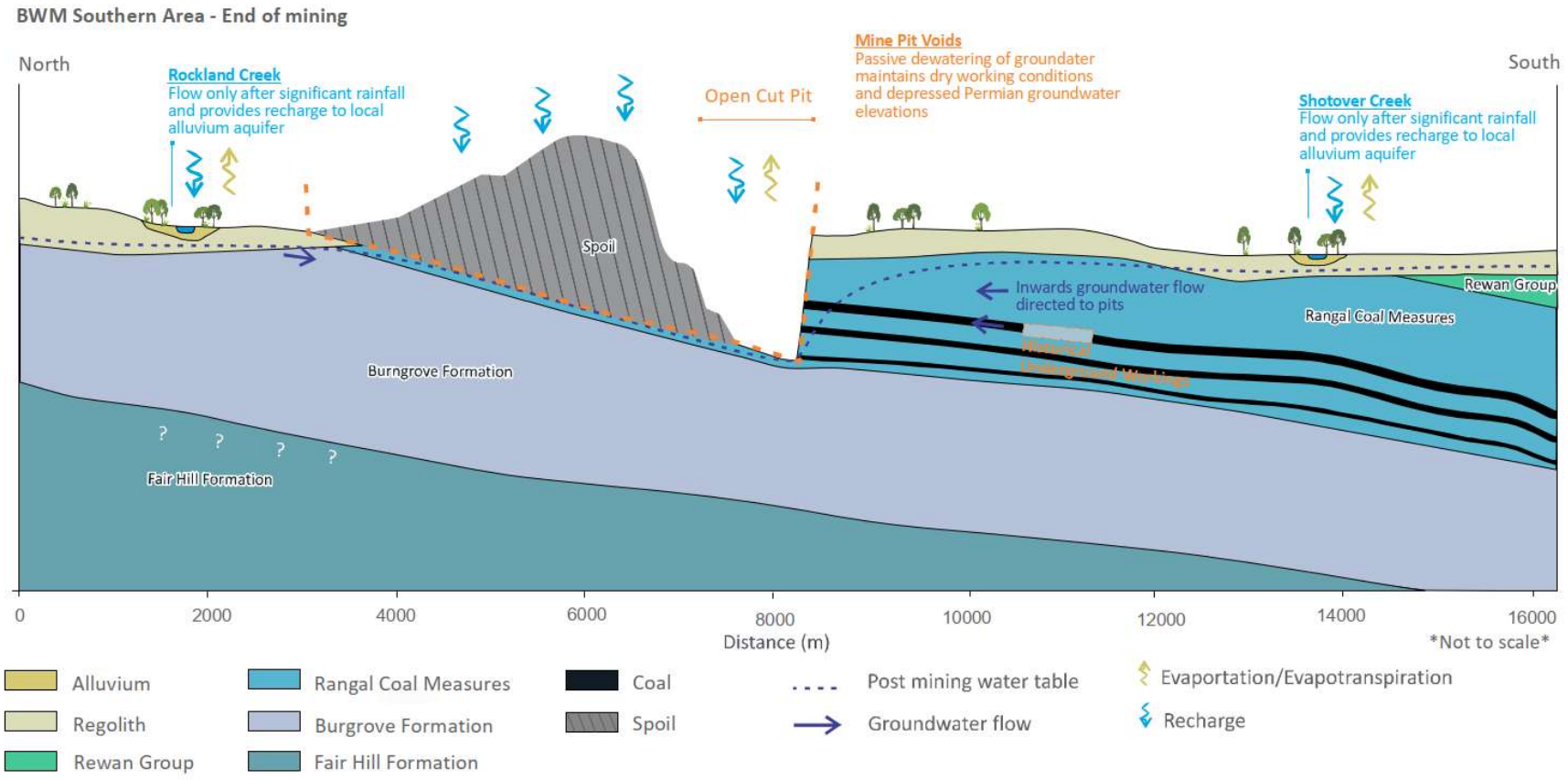


Figure 6-2 Conceptual Hydrogeological Model of BWM Groundwater System – General for BWM Southern Area (End of Mining)

7.0 Potential Impacts

7.1 Groundwater System at End of Mining

The SLR (2026a and 2026b) work has been interrogated to provide an indication of the predicted nature of the groundwater system at the end of mining, and potential groundwater system impacts that may arise at the end of mining.

These can be summarised as:

- Groundwater level drawdown of the RCM, associated with passive dewatering into the active BWM mine pit voids. The magnitude of this drawdown will be most significant in the immediate vicinity of the pits, but extend northwards, eastwards and southwards of BWM by several kilometres.
- Mine pit voids capture any seepage from spoil emplacements due to the local hydraulic gradient orientated towards the mine voids.
- Limited potential for groundwater level drawdown in the alluvium and Tertiary strata due to limited saturation, and poor lateral connection of water bearing zones.
- No groundwater level drawdown of the alluvium away from BWM.
- Limited potential for groundwater level drawdown impacts to potential terrestrial GDE's due to the limited potential for groundwater level drawdown in the alluvium and Tertiary strata.
- No potential for groundwater quality impacts outside of BWM associated with spoil dumps, due to the inward groundwater flow gradients towards the pit voids capturing all potential seepage.

7.2 Groundwater System Post Mining

SLR (2025a) conducted a post-mining assessment of the BWM final voids. The results of the assessment can be considered indicative of the potential impacts to the groundwater system in the post-closure period as relevant to this hydrogeology assessment, that will be investigated further by adopting the updated final landform for all of BWM consistent with the PRC Plan. The post-closure predicted groundwater system documented in the earlier work by SLR (2025a) can be summarised as:

- Residual void lake formation, with lake levels stabilising significantly below the pre-mining groundwater elevations and any shallow post-Permian strata, including the base of surficial weathering and shallow hydrostratigraphic units (i.e. alluvium and Tertiary strata).
- Partial groundwater system recovery outside the residual voids, primarily in the RCM. Ongoing groundwater discharge to the residual voids driven by the inwards hydraulic gradient between the void lakes and the surrounding groundwater system, and maintained by ongoing evaporative discharge from the void lakes keeping the residual void lakes as groundwater sinks.
- Potential for ongoing salinisation of the residual void lakes.
- No potential for groundwater quality impacts outside of BWM associated with spoil dumps, due to the inward groundwater flow gradients towards the residual voids continuing to capture all potential seepage.

The remainder of this report focuses on the detailed assessment of the PRC Plans final landform, i.e. an update to the SLR (2023a) post-mining potential impacts discussed above.

8.0 Groundwater Modelling

The potential post-closure groundwater impacts relevant to Revision 3 of the PRC Plan have been assessed using numerical groundwater modelling as described in the following sections.

8.1 Model Details

The BWM regional numerical groundwater model (the Model) was updated and recalibrated for Revision 2 of the PRC Plan. Further refinement and update was undertaken throughout the Blackwater North Extension Project, as described in the associated Modelling Technical Report (SLR, 2026b) provided here as **Appendix B**.

8.2 PRC Plan Landform 4.1 Model

8.2.1 Model Setup

The Model timing was extended to simulate approved mining until 2094 and simulate the post-mining landform from 2094 until post mining equilibrium. The post mining period in the model extends for 1,946 years (**Table 8-1**).

Table 8-1 Post Mining Model Stress Periods

Stress Period	Duration (years)	Starting Year	Ending Year
155	1	2094	2094
156	1	2095	2095
157	1	2096	2096
158	1	2097	2097
159	1	2098	2098
160	1	2099	2099
161	1	2100	2100
162	1	2101	2101
163	1	2102	2102
164	1	2103	2103
165	1	2104	2104
166	1	2105	2105
167	1	2106	2106
168	1	2107	2107
169	1	2108	2108
170	1	2109	2109
171	1	2110	2110
172	10	2111	2120
173	20	2121	2140
174	100	2141	2240

Stress Period	Duration (years)	Starting Year	Ending Year
175	100	2241	2340
176	100	2341	2440
177	100	2441	2540
178	100	2541	2640
179	100	2641	2740
180	100	2741	2840
181	100	2841	2940
182	100	2941	3040
183	100	3041	3140
184	100	3141	3240
185	100	3241	3340
186	100	3341	3440
187	100	3441	3540
188	100	3541	3640
189	100	3641	3740
190	100	3741	3840
191	100	3841	3940
192	100	3941	4040

8.2.1.1 Predictive Mining

Mining activities were simulated in the predictive model as an extension of the calibration period (i.e. same model setup but different areas being mined though to completion of mining). A detailed description of how mining was simulated in the model for the calibration period is provided in SLR, 2026b, with future mining simulated in the same manner.

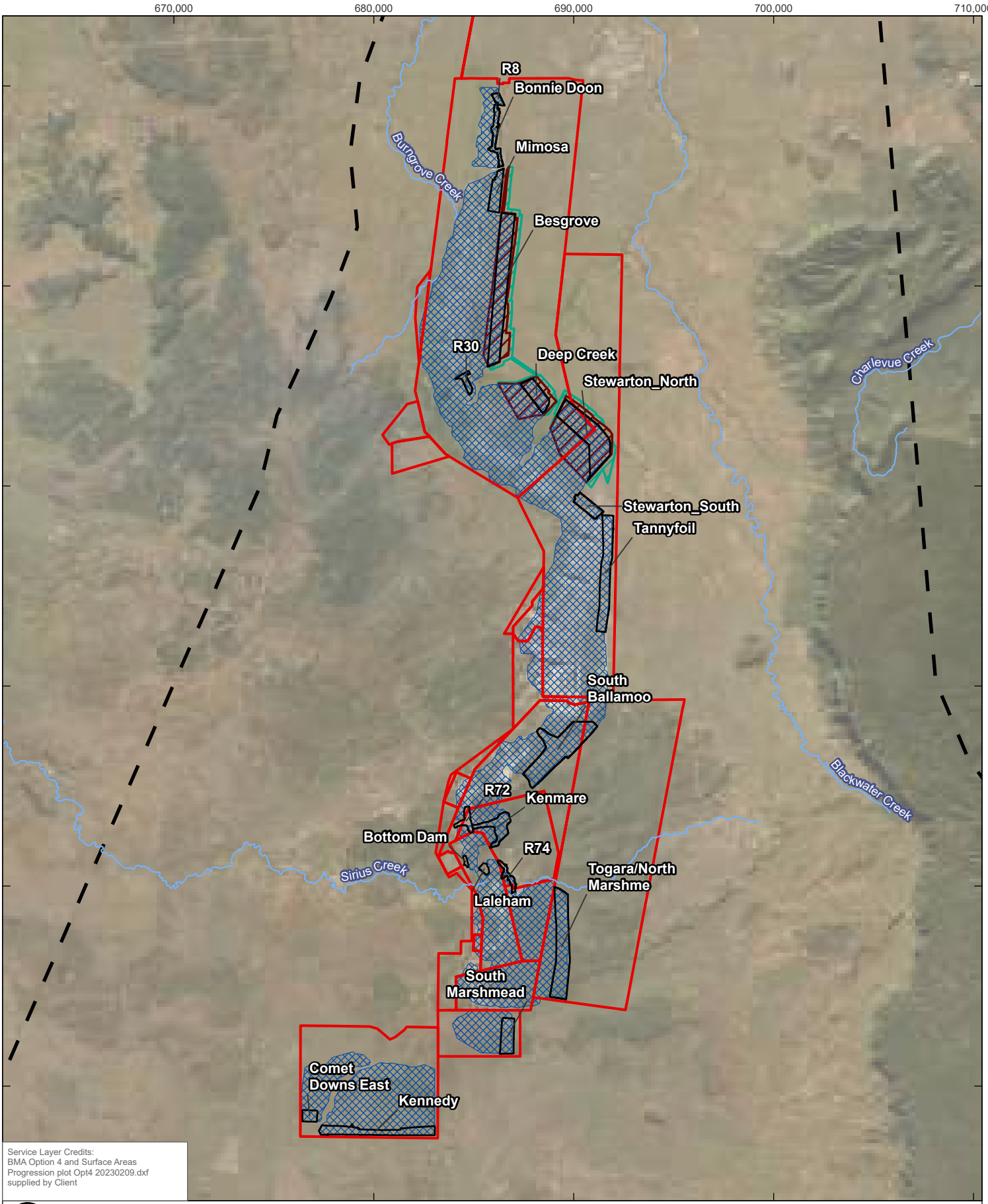
8.2.1.2 Predictive Post Mining

The PRC Plan's proposed final landform 4.1 was replicated in the post mining period of the model, including areas of spoil emplacement within mined out pits, the 15 proposed residual voids, and the three in-pit tailings emplacements at Bonnie Doon, Kenmare and Ramp 74. The distribution of modelled spoil emplacement is shown on Figure 8-1.

In the post mining period of the groundwater model, drain cells simulating the mining pits at BWM are removed to allow groundwater levels to equilibrate. The heads at the start of the post mining period for each relevant hydrostratigraphic unit are provided in **Appendix C**.

Climate related boundary conditions (i.e. recharge and evapotranspiration [ET]) in the post mining period were set constant, at their values consistent with stress period 1 of the model (i.e. long term average, refer to SLR, 2026b). Recharge and ET were not applied to the final voids (or associated in-pit tailings emplacements) themselves in the groundwater model, since the water balance model used iteratively with the groundwater model (see **Section 8.2.2**) accounts for these boundary conditions.

At the end of mining at BWM, the properties of the final void cells were converted to values representative of a void. The void cells were assigned high horizontal and vertical hydraulic conductivities (1,000 m/day) and storage parameters based on the compressibility of water (specific yield of 1.0, storage coefficient of 5.0×10^{-6} m^{-1}), to simulate free water movement within the final void. This approach is often referred to as a 'high-K' lake.



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	06-May-2026
Drawn by:	AS

LEGEND

- Watercourse
- BWM Mining Lease
- GIA Study Area
- Spoil Extent
- Void Extent
- Proposed Infrastructure Area
- Proposed Open Cut Extension

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

SIMULATED SPOIL EMPLACEMENT

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_01_Simulated_Spoil_Emplacement

8.2.2 Integration with Residual Void Water Balance

Figure 8-2 presents a conceptual diagram of the post-mining modelling setup adopted for this hydrogeological assessment. As shown in **Figure 8-2,** the residual voids will accumulate water over time due to direct rainfall, surface water runoff and groundwater inflow from both spoil and natural rock as groundwater levels recover. Whilst the numerical groundwater model can reliably account for the groundwater inflow component, the surface components of direct rainfall, surface water runoff, as well as evaporative loss from the void lake, are considered to be better accounted for within a surface water balance model. This is due to the inherently more refined nature of simulating those surface components within a water balance model, as compared to a numerical groundwater model.

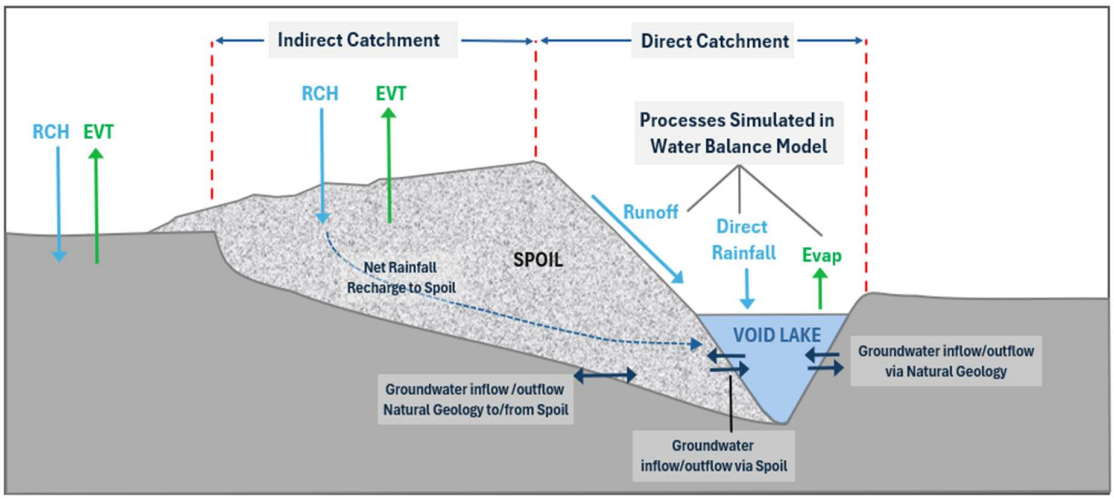


Figure 8-2 Residual Void Recovery Model Conceptual Diagram

The groundwater model was therefore used to predict the following fluxes to the residual voids:

- Groundwater inflow to the pit shell from the surrounding geology, including inflow from the natural geology to the spoil backfill and inflow from the natural geology directly to the residual voids; and
- Groundwater inflow originating from the indirect catchment (i.e. areas of spoil backfill that receive rainfall recharge that then flows through the spoil into the residual voids).

Void water levels were not predicted by the groundwater model but were estimated by the balance between groundwater inflow and the direct rainfall and rainfall runoff from the surrounding catchment against the evaporation loss from the lake surface through iterative surface water balance modelling.

The following methodology was used to allow convergence between the groundwater and water balance models with respect to void lakes. The groundwater modelling methodology involves a stepwise iterative process with the water balance model:

1 Initial predicted groundwater inflows with time to the voids from the groundwater model were incorporated in the initial water balance model.

2 The pit lake recovery levels and timings were then predicted by the water balance model, incorporating both groundwater and surface water fluxes and processes.

3 The void water elevations and recovery timings derived from the water balance modelling were then replicated within the numerical groundwater recovery model

using the time variant constant head boundary (CHD) condition, to refine the groundwater model prediction of void groundwater inflows and lake recovery.

4 Assessment was made to check that the refined groundwater model predictions for fluxes to the voids agree with what was used as input to the water balance modelling.

To avoid iterating many times between the groundwater model and the water balance model before reaching agreement, SLR used an automated process (using python code) that iterates between the groundwater model and the water balance model until a predefined convergence criteria is reached (Xiao et al., 2025). Not only does this automated process save time, it also allows reaching full convergence between the groundwater and the water balance model, increasing confidence in the modelling process.

8.2.3 Residual Void Lake Recovery

Figure 8-3 through **Figure 8-17** provide a graphical representation of the final simulated recovery of water levels in the residual voids for the year 2094 onwards, based on the iterative groundwater and surface water balance modelling. As mining activity ends in different years for each void prior to the closure year of 2094, the duration over which residual void lake levels recover in the plots is variable.

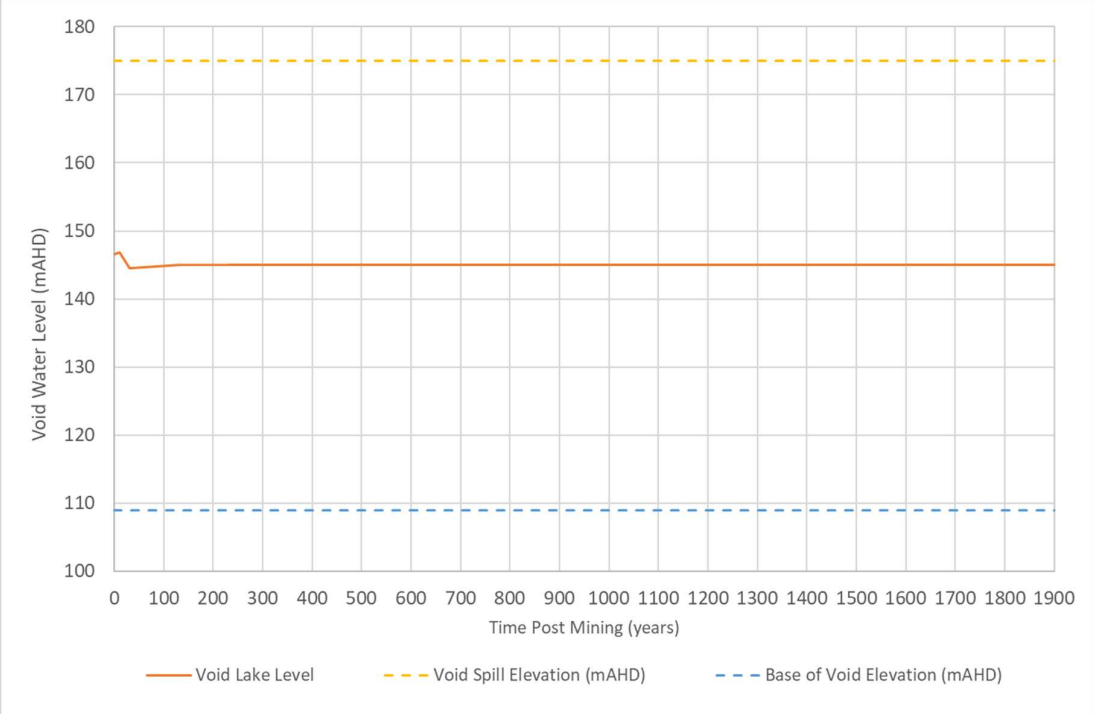


Figure 8-3 Simulated Void Water Level Recovery – Ramp 8

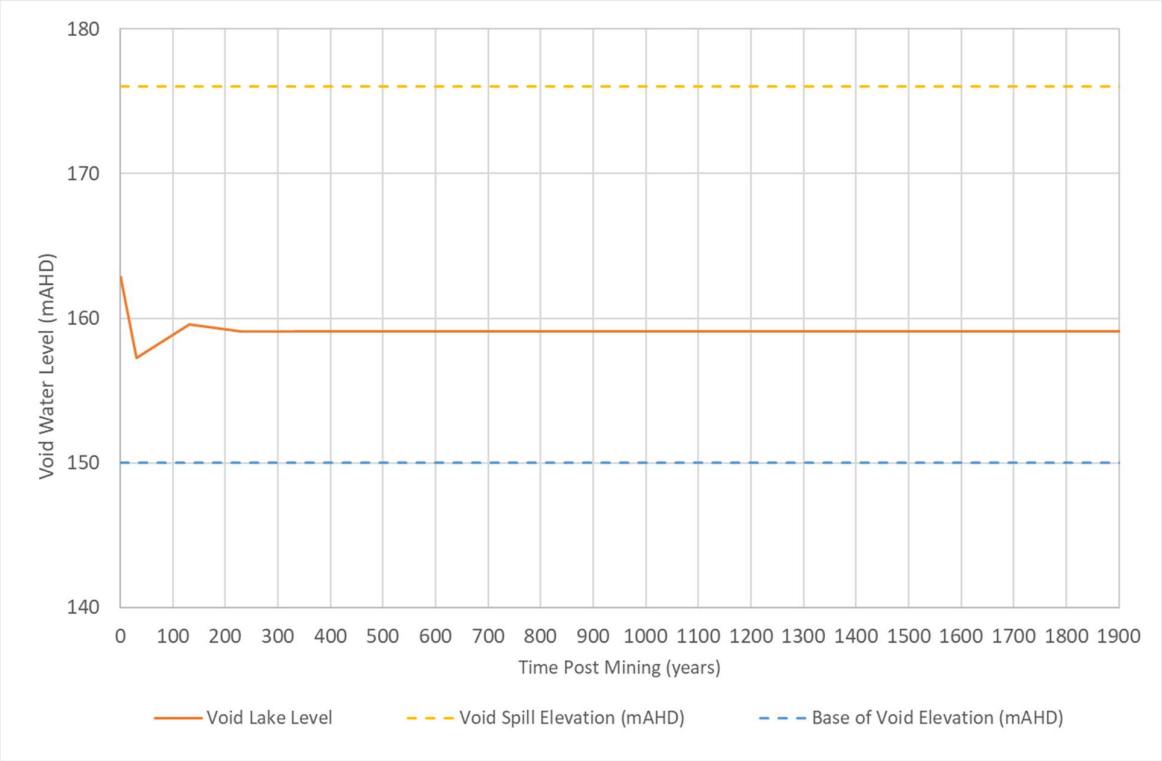


Figure 8-4 Simulated Void Water Level Recovery – Bonnie Doon

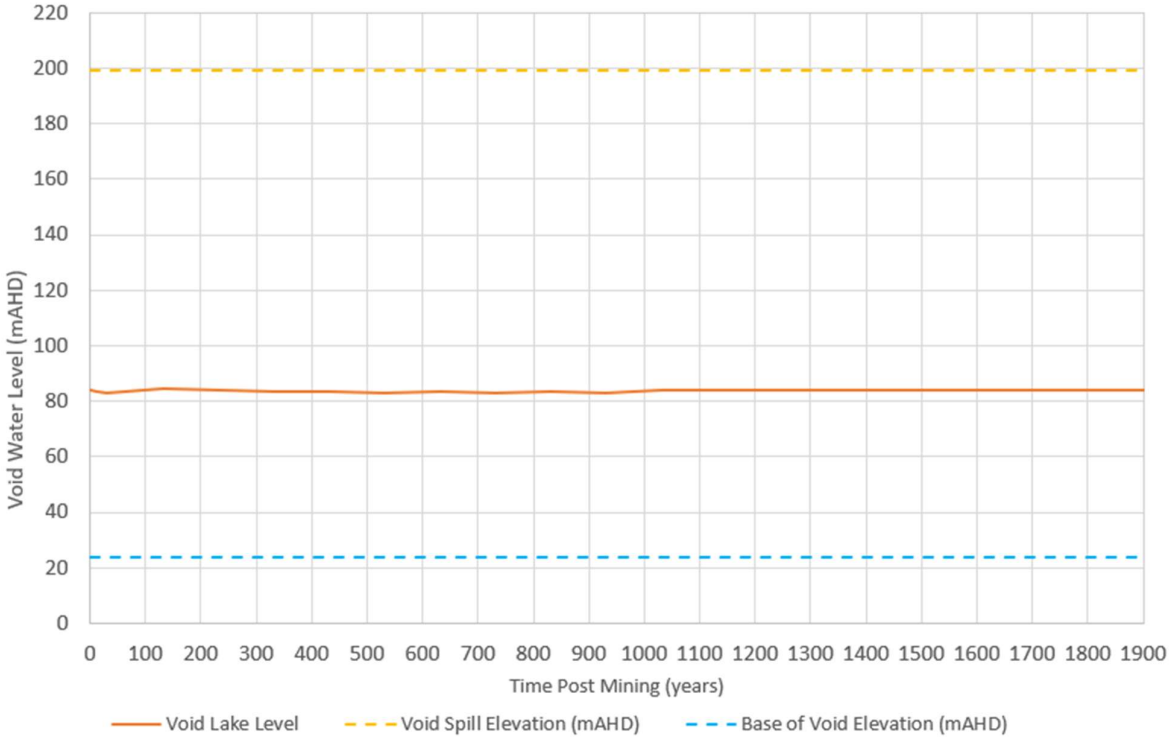


Figure 8-5 Simulated Void Water Level Recovery – Mimosa/Besgrove

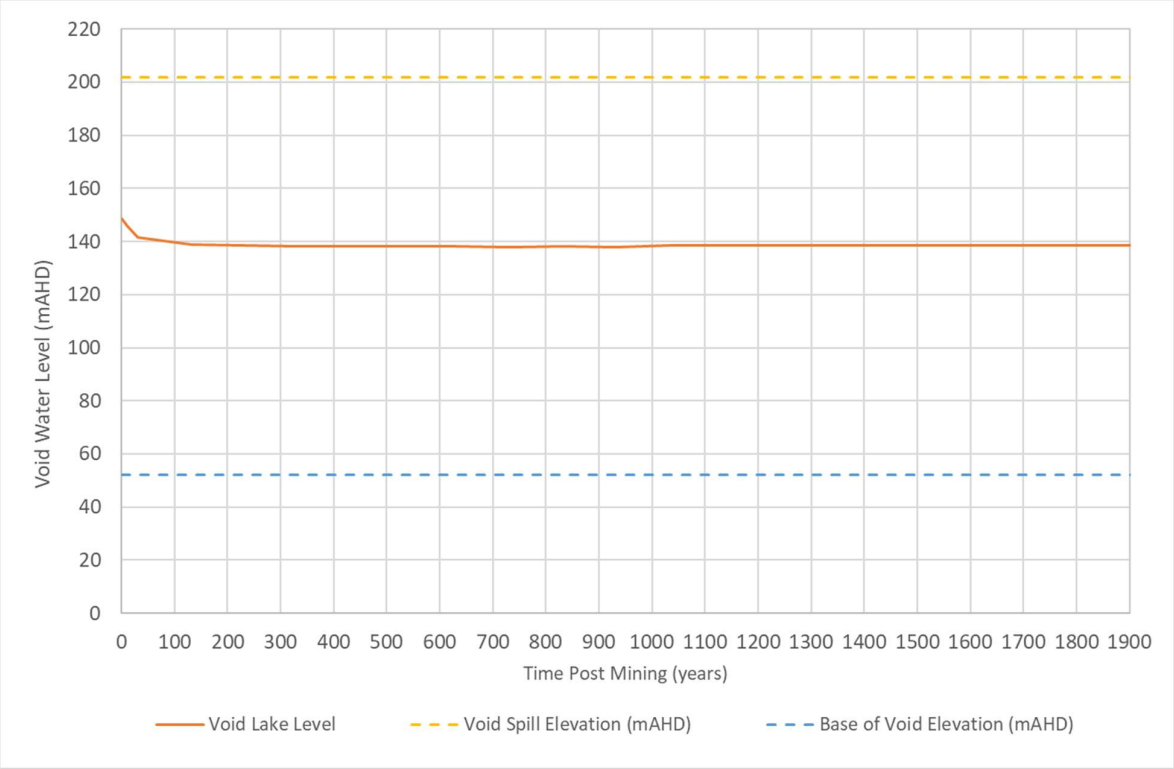


Figure 8-6 Simulated Void Water Level Recovery – Deep Creek

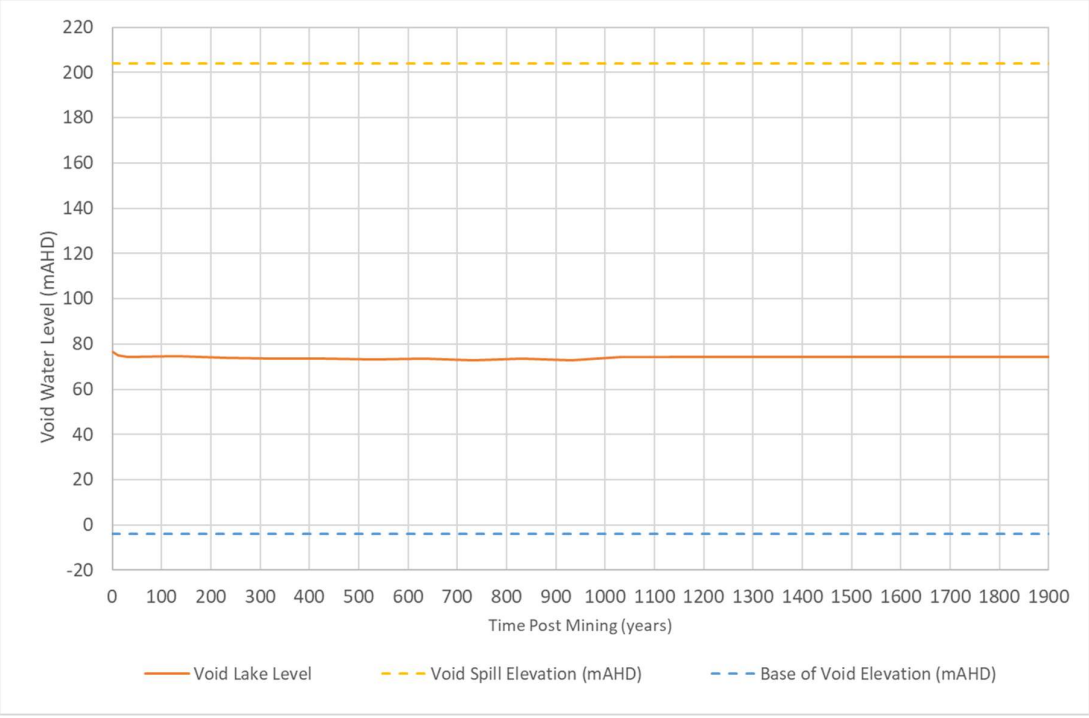


Figure 8-7 Simulated Void Water Level Recovery – Stewarton North

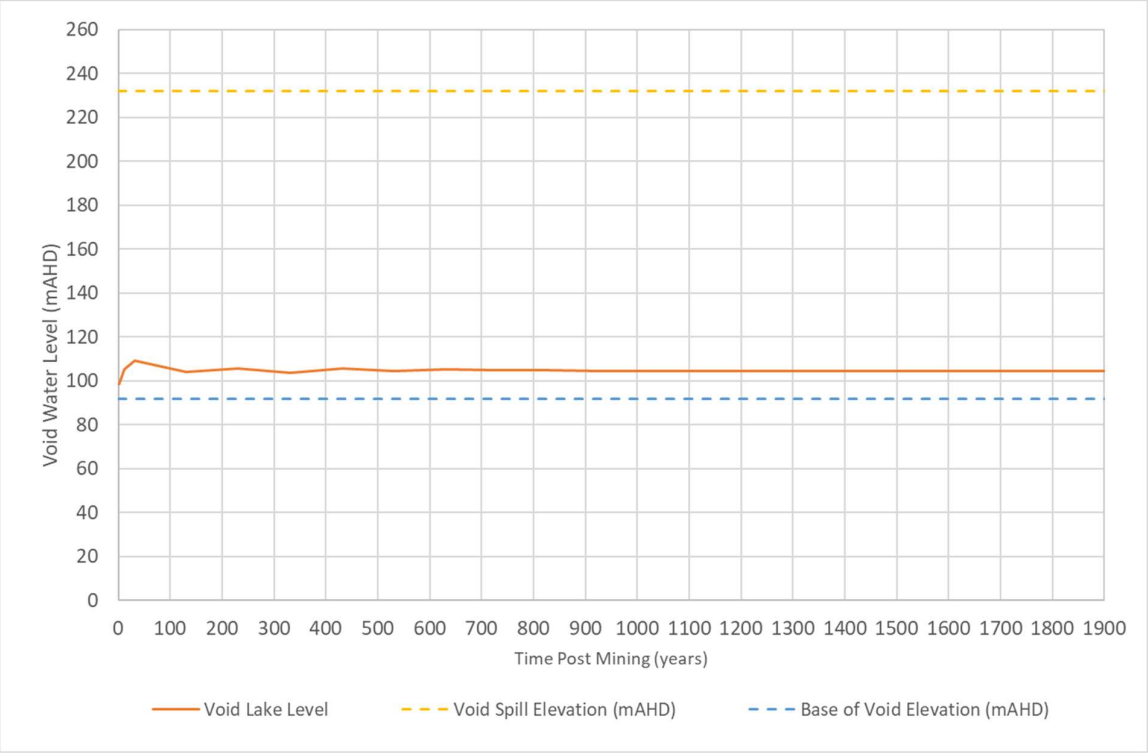


Figure 8-8 Simulated Void Water Level Recovery – Stewarton South

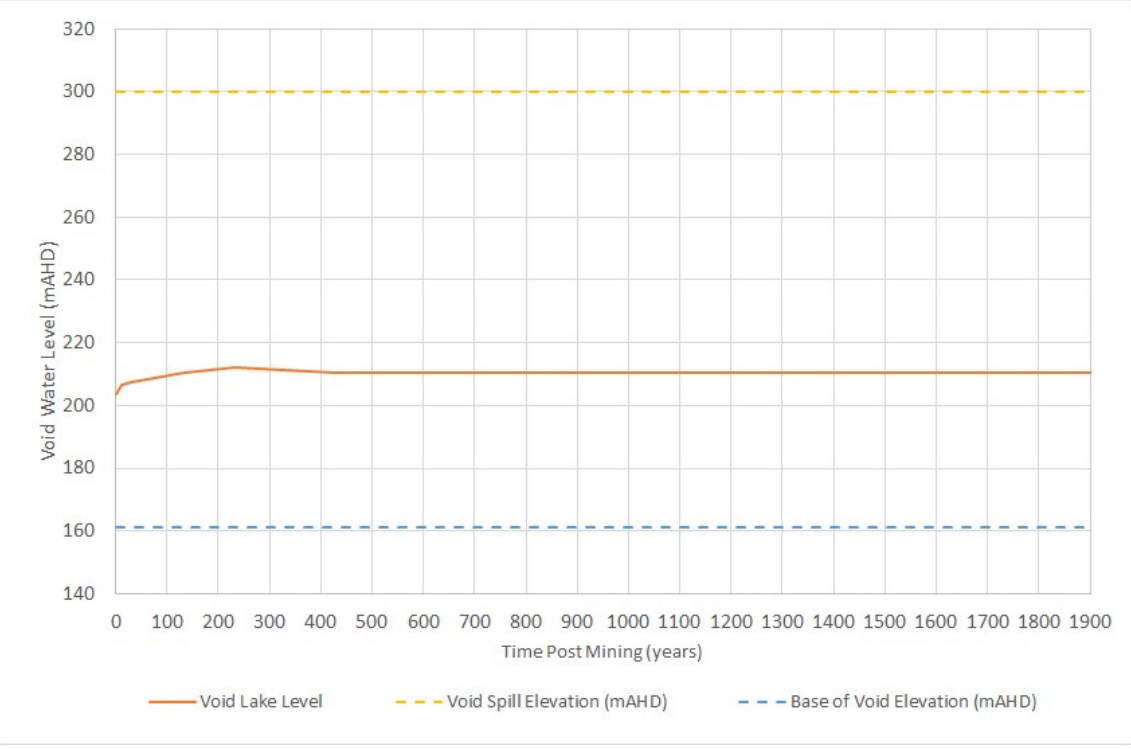


Figure 8-9 Simulated Void Water Level Recovery – Kenmare

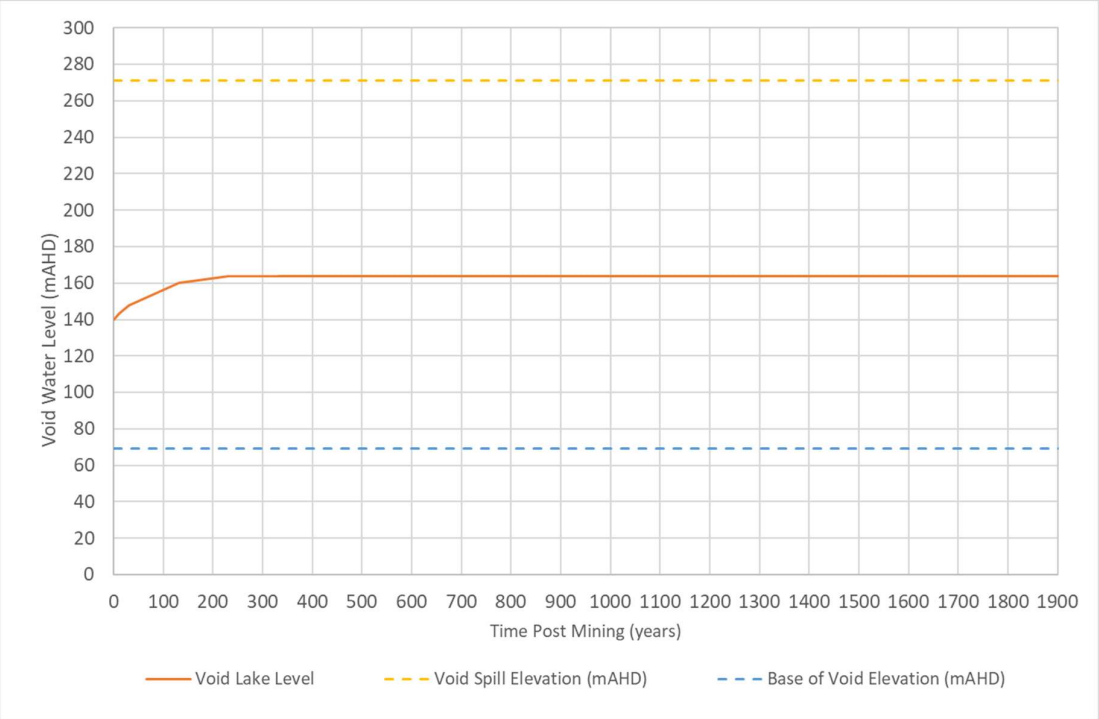


Figure 8-10 Simulated Void Water Level Recovery – Togara/North Marshmead

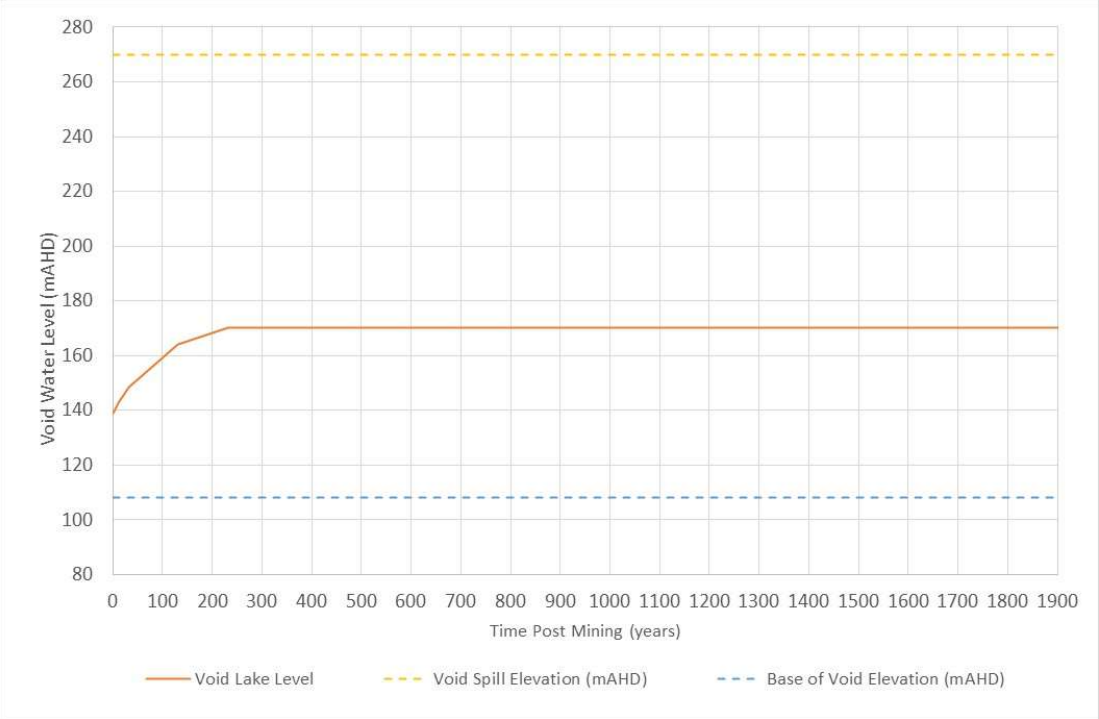


Figure 8-11 Simulated Void Water Level Recovery – South Marshmead

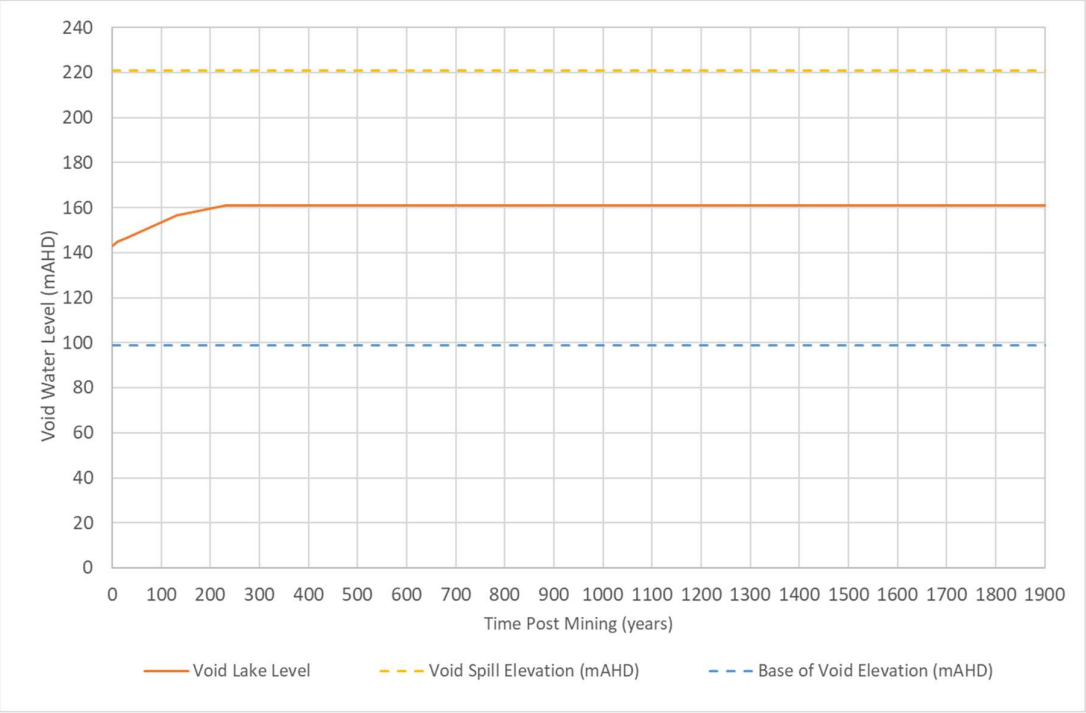


Figure 8-12 Simulated Void Water Level Recovery – Kennedy West

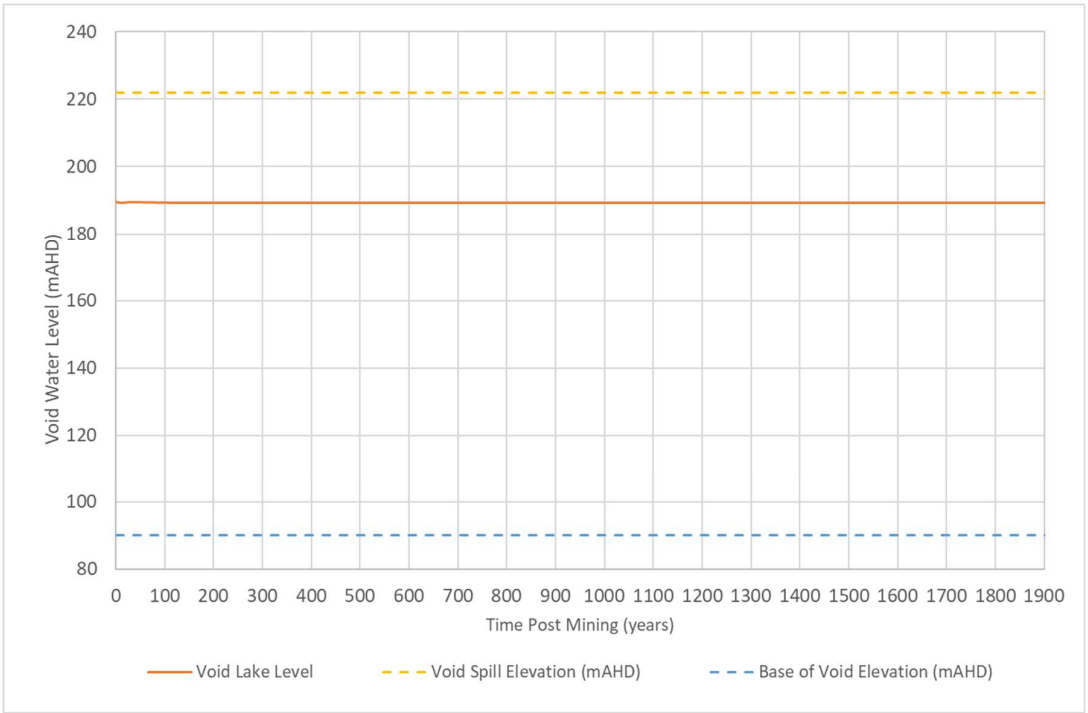


Figure 8-13 Simulated Void Water Level Recovery – Comet Downs East

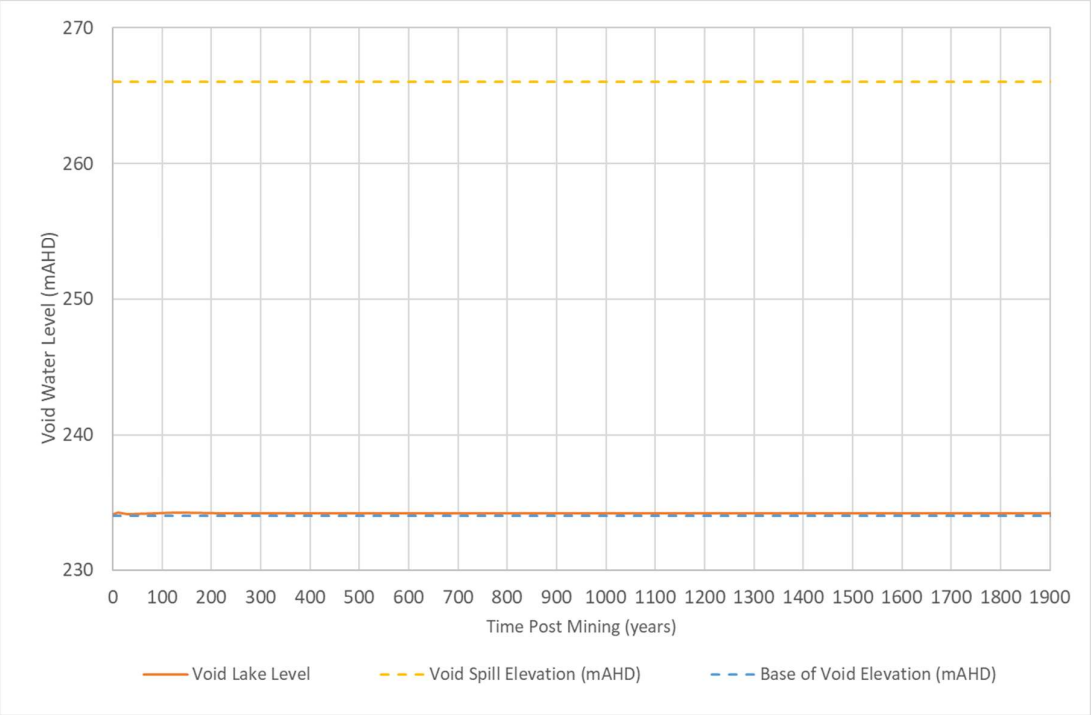


Figure 8-14 Simulated Void Water Level Recovery – R74

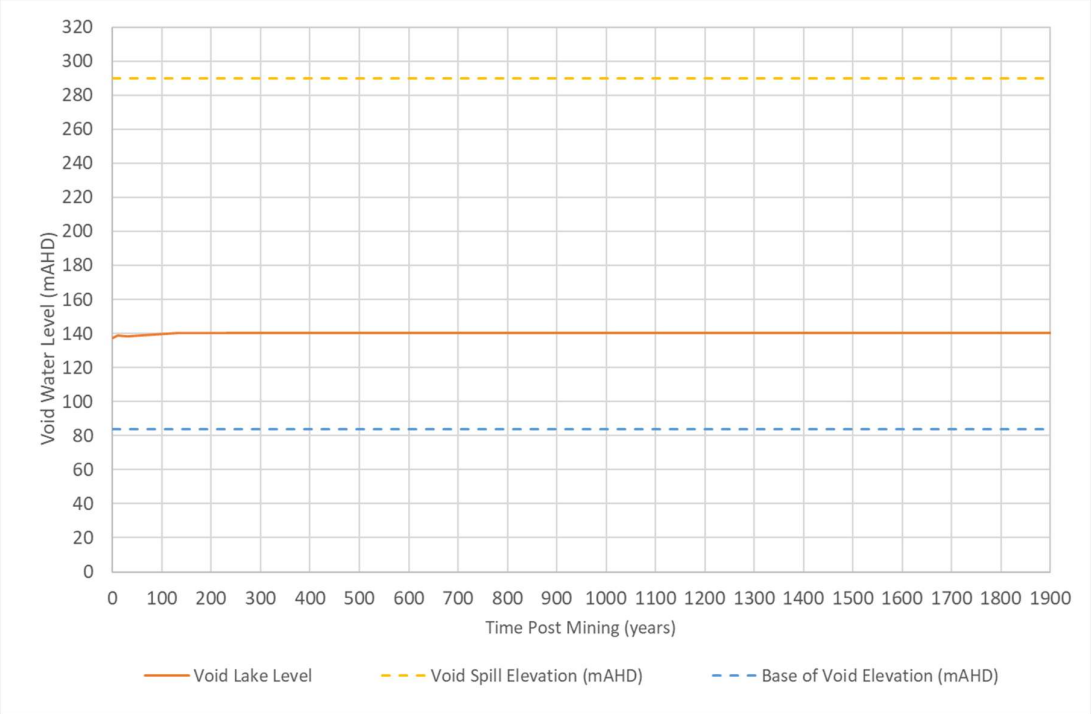


Figure 8-15 Simulated Void Water Level Recovery – South Ballamoo

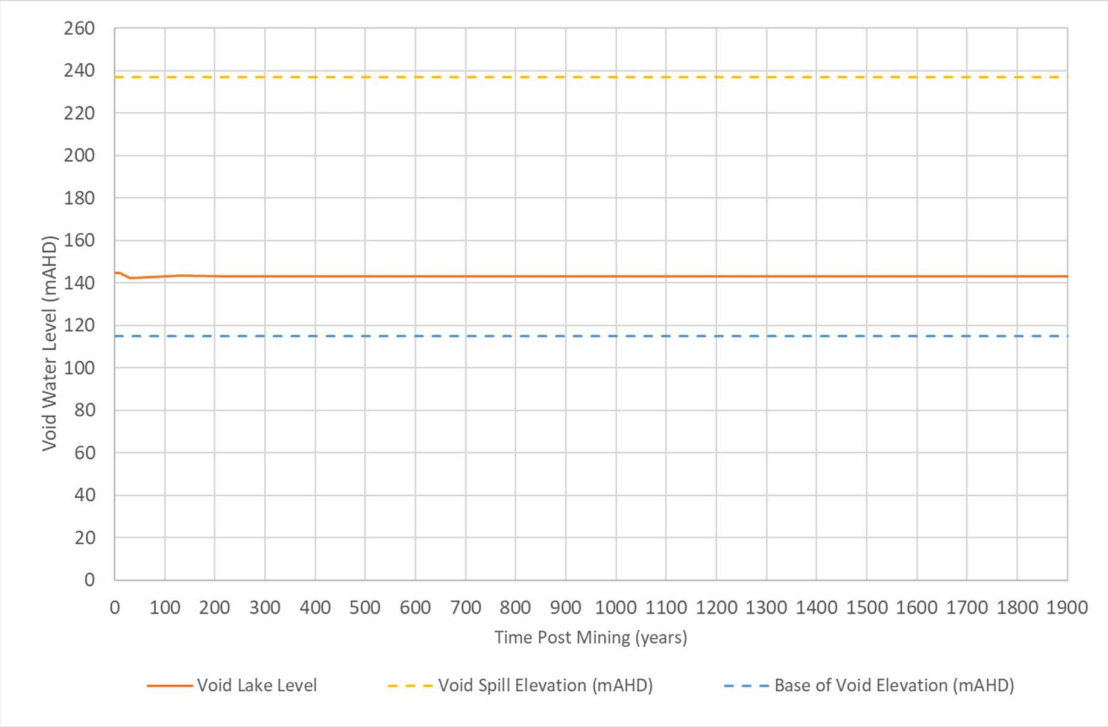


Figure 8-16 Simulated Void Water Level Recovery – Tannyfoil

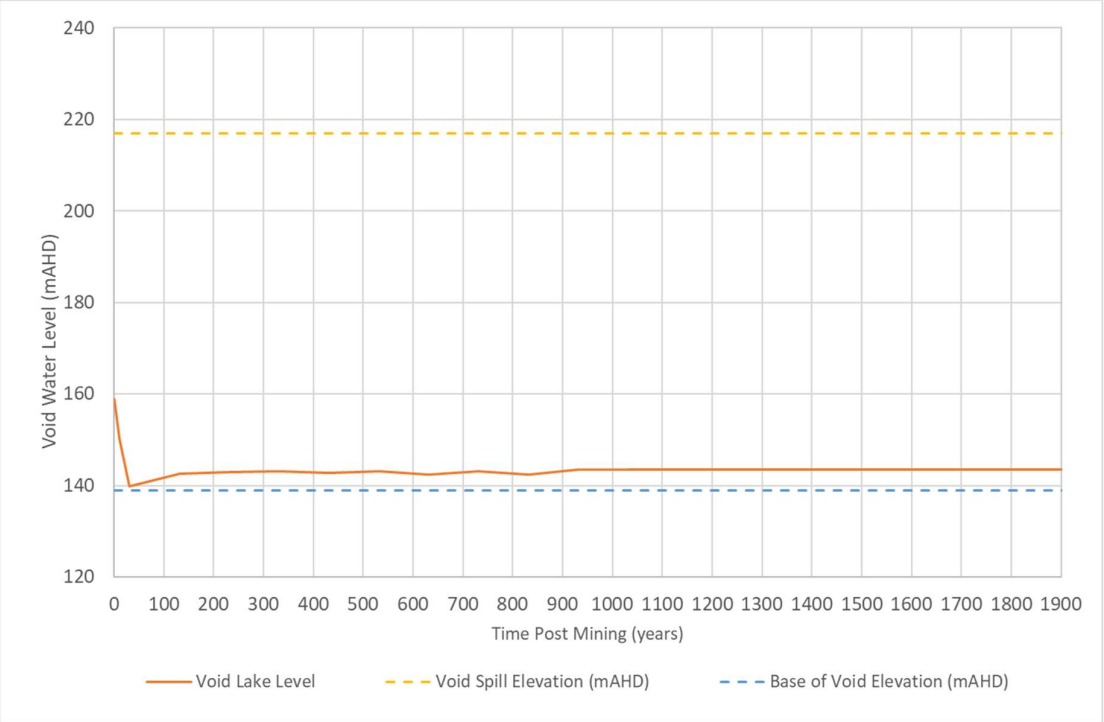


Figure 8-17 Simulated Void Water Level Recovery – R30

Figure 8-3 through **Figure 8-17** show that the residual void water level recovery is a process that takes decades to centuries, with the recovery rate generally declining as the lakes reach equilibrium conditions. For the majority of the residual voids, equilibrium water level conditions are reached after approximately 100 to 300 years. The freeboard for each of the residual voids (i.e. the difference in elevation between the long-term water levels in the residual voids and the landform crest spill level elevation) is shown in **Table 8-2**. Predicted void lake levels remain significantly below the surface 'spill' level for each of the residual voids.

Table 8-2 Predicted Freeboard in the Residual Voids at Equilibrium

Residual Void	Freeboard (m)
Ramp 8	30
Bonnie Doon	17
Mimosa/ Besgrove	115
Deep Creek	63
Stewarton North	130
Stewarton South	127
Kenmare	90
Togara/ North Marshmead	107
South Marshmead	100
Kennedy West	60
Comet Downs East	33
R74	32
South Ballamoo	84
Tannyfoil	94
R30	74

The difference in elevation between the long-term water levels in the residual voids and the lowest point of the base of the shallow geologic formations (model layers 1 and 2) adjacent the voids is as shown in **Table 8-3**. Predicted residual void lake levels remain significantly below the base of the shallow geologic formations for each of the residual voids, with the exception of Comet Downs East. Thus, for most voids, the modelling indicates that it is highly unlikely for a flux of water to leave the residual voids and enter the shallow geologic formations. For Comet Downs East the modelling predicts void lake level above the deeper weathering profile (i.e. base of regolith). This is discussed in detail in **Section 8.2.4** and **Section 8.2.6** in relation to the potential for flux of water to leave these voids via the weathering profile.

The predicted lake levels in the Kenmare residual void at equilibrium (215 mAHD) remain above the elevation of the Kenmare Underground and Laleham Underground workings that would be exposed in the void highwall (i.e. of the Pollux Seam at approximately 195 and 156 mAHD respectively). This indicates that the Kenmare Underground and Laleham Underground workings remain permanently flooded and there is no potential for oxidisation within the underground workings.



Table 8-3 Predicted Difference between Void Lake Levels and Shallow Formations

Residual Void	Lowest elevation of base of shallow unconsolidated sediments adjacent void (mAHD)	Difference between lowest elevation of base of shallow unconsolidated sediments adjacent void and void lake level (m)[1]	
		Start of Post-Mining	Post-Mining Equilibrium
Ramp 8	176	29	31
Bonnie Doon	175	12	16
Mimosa/ Besgrove	187	103	103
Deep Creek	204	55	65
Stewarton North	204	128	130
Stewarton South	204	105	99
Kenmare	269	52	54
Togara/ North Marshmead	251	111	87
South Marshmead	222	83	52
Kennedy West	187	44	26
Comet Downs East	188	-46	-1
R74	241	7	7
South Ballamoo	251	114	111
Tannyfoil	218	73	75
R30	210	63	67

[1] A positive number means the base of model layer 2 is that many metres higher than the void lake level

8.2.4 Residual Void Groundwater Inflow

The predicted groundwater inflows to the residual voids from the groundwater model are shown on **Figure 8-18** through **Figure 8-32**. The inflows are partitioned between that which flows into the residual voids through spoil (primarily on the low-wall side), and that which flows into the residual voids through surrounding natural geological formations via highwalls and end walls that remain exposed to the voids.

As mining activity ends in different years for each void, the duration over which groundwater levels in spoil and natural geology adjacent to the residual voids remain suppressed after mine closure (2094) is variable.

During early model stress periods prior to equilibrium, fluxes between the voids and adjacent spoil and bedrock formations is more temporally variable than towards the end of the recovery simulation, however despite this variability most voids still behave as net groundwater sinks for both spoil and non-spoil groundwater sources. The four exceptions to this are Ramp 30, Ramp 74, Stewarton South and Bonnie Doon residual voids, that show net negative groundwater inflow (i.e. net outwards flux). These residual voids are predicted to lose void water to adjacent voids via the natural geology between them at relatively small rates of 0.2, 2.3 and 0.04 and 0.14 ML/day respectively at post-mining equilibrium. Each of these voids with a net outwards flux have predicted lake elevations that are higher than the neighbouring voids (**Section 8.2.3**), resulting in a hydraulic gradient between the voids that drives this outwards flux from each void to its neighbouring void. This negative groundwater flux thus represents movement of water between voids, not flux away from the BWM site. The fate of this localised post-closure outwards flux of void water is discussed in **Section 8.2.6**.

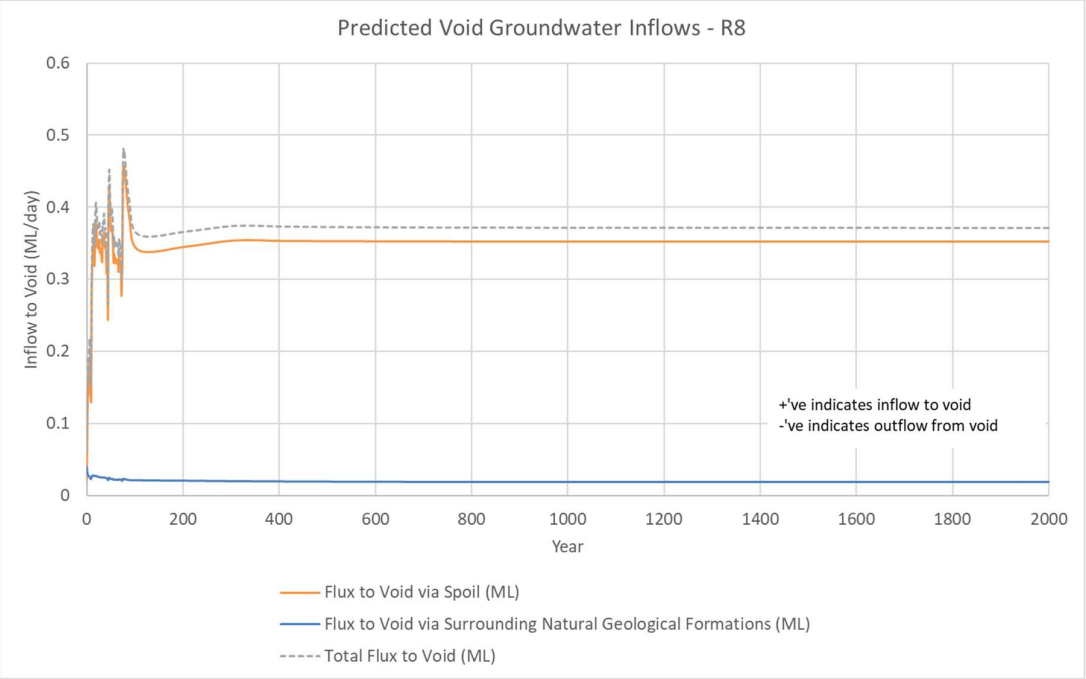


Figure 8-18 Predicted Void Groundwater Inflows – Ramp 8

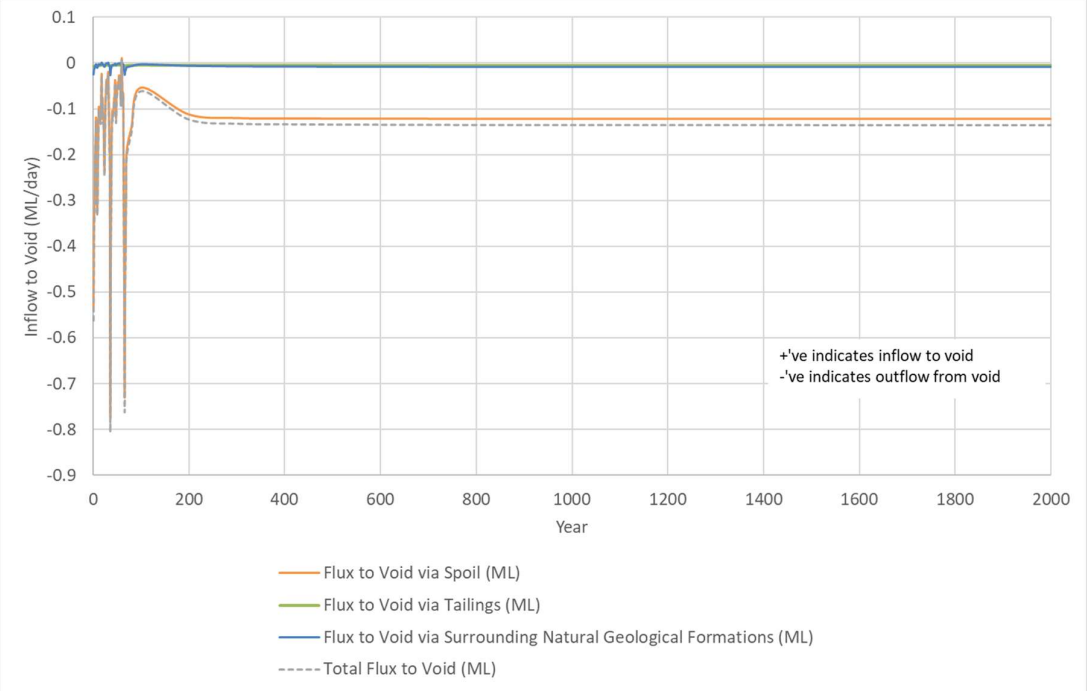


Figure 8-19 Predicted Void Groundwater Inflows – Bonnie Doon

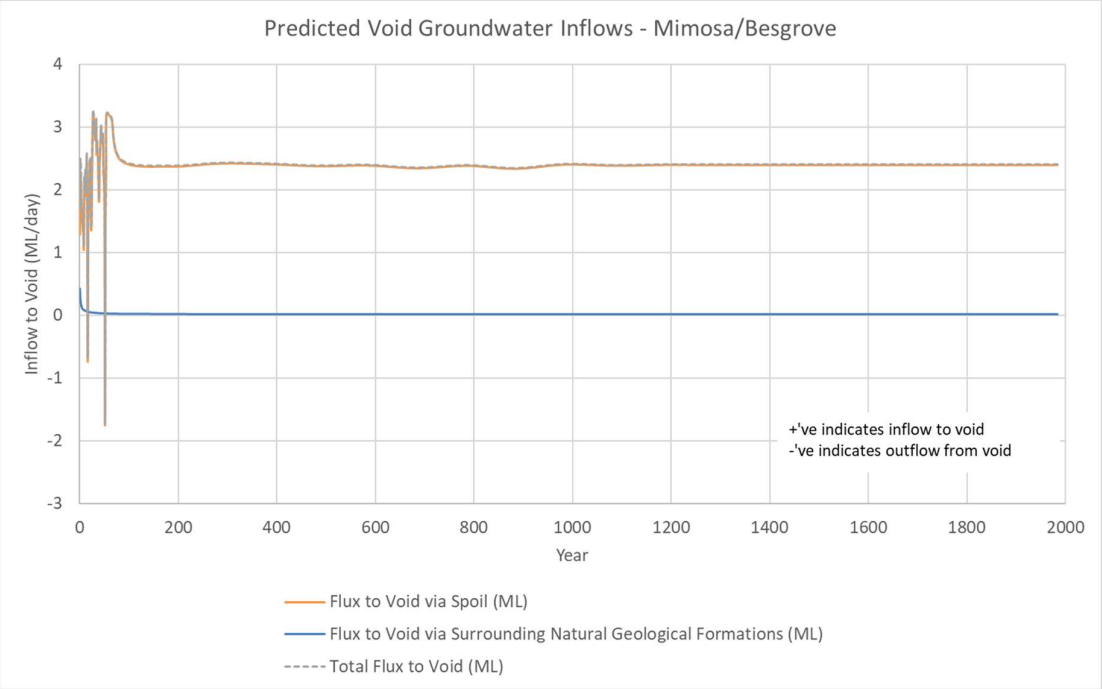


Figure 8-20 Predicted Void Groundwater Inflows – Mimosa/Besgrove

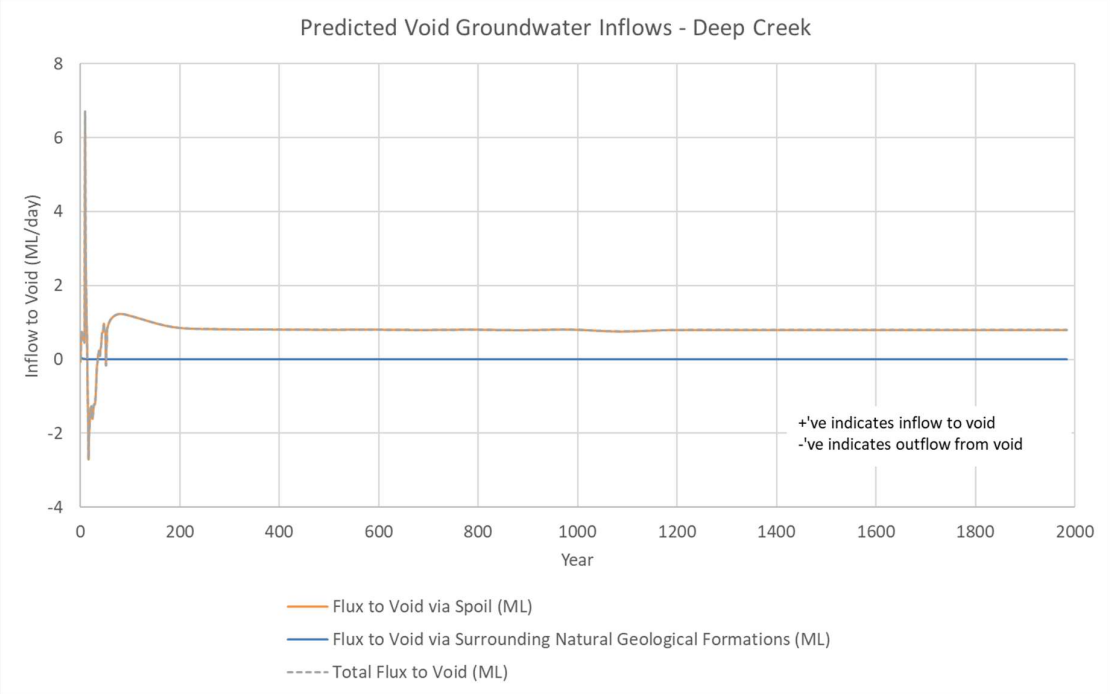


Figure 8-21 Predicted Void Groundwater Inflows – Deep Creek

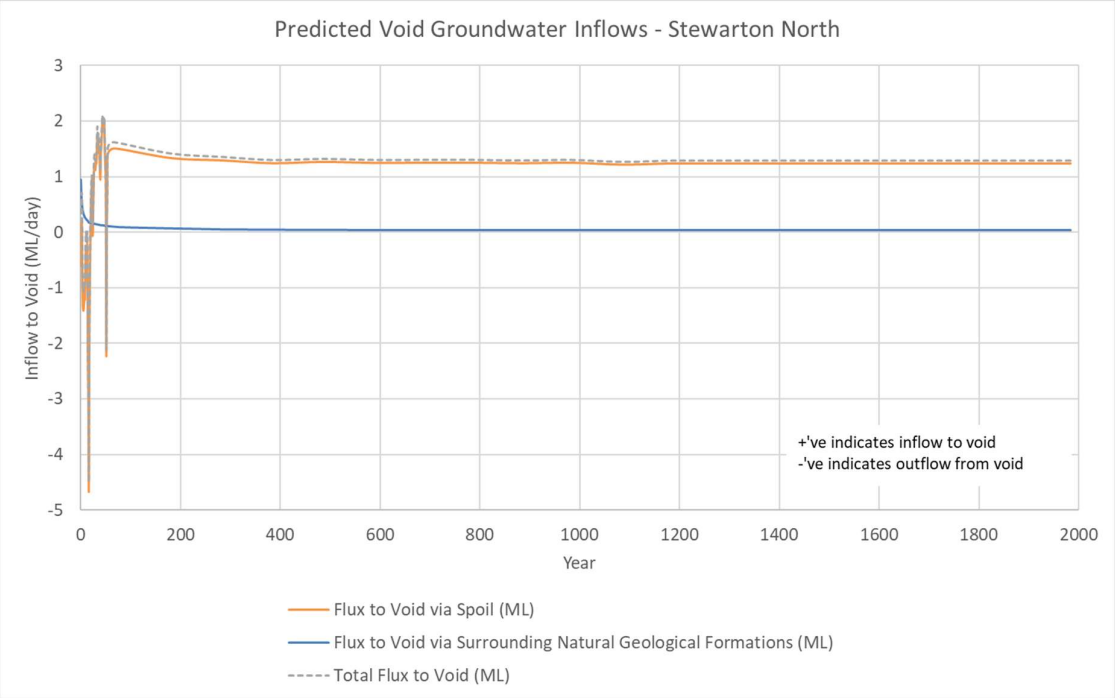


Figure 8-22 Predicted Void Groundwater Inflows – Stewarton North

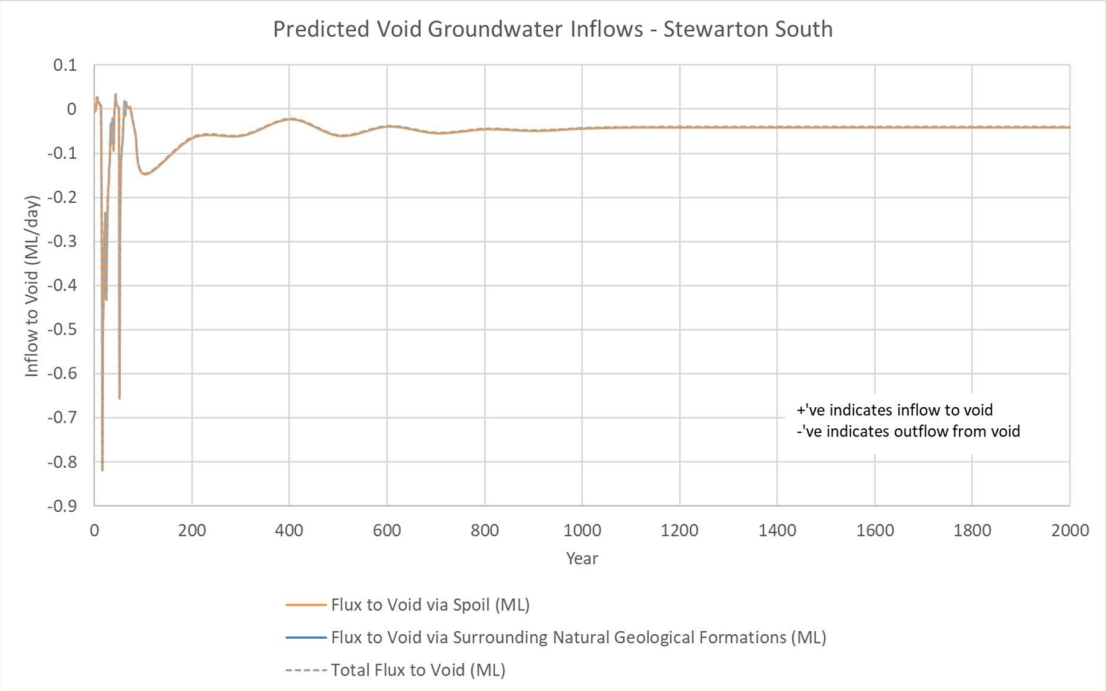


Figure 8-23 Predicted Void Groundwater Inflows – Stewarton South

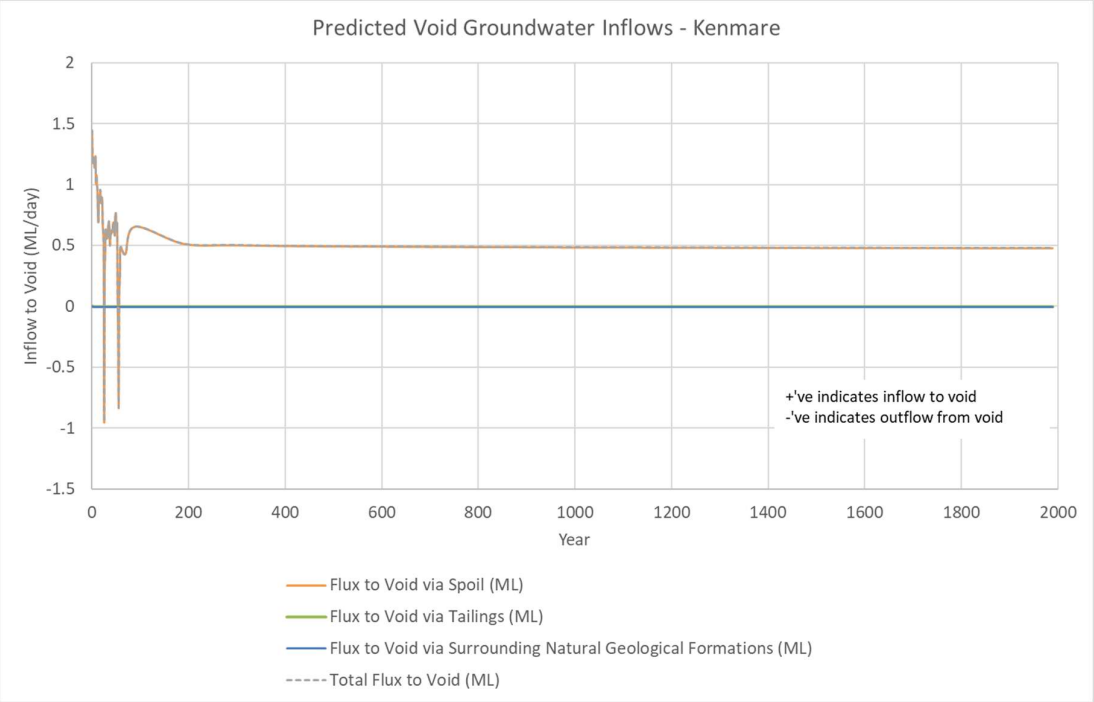


Figure 8-24 Predicted Void Groundwater Inflows – Kenmare

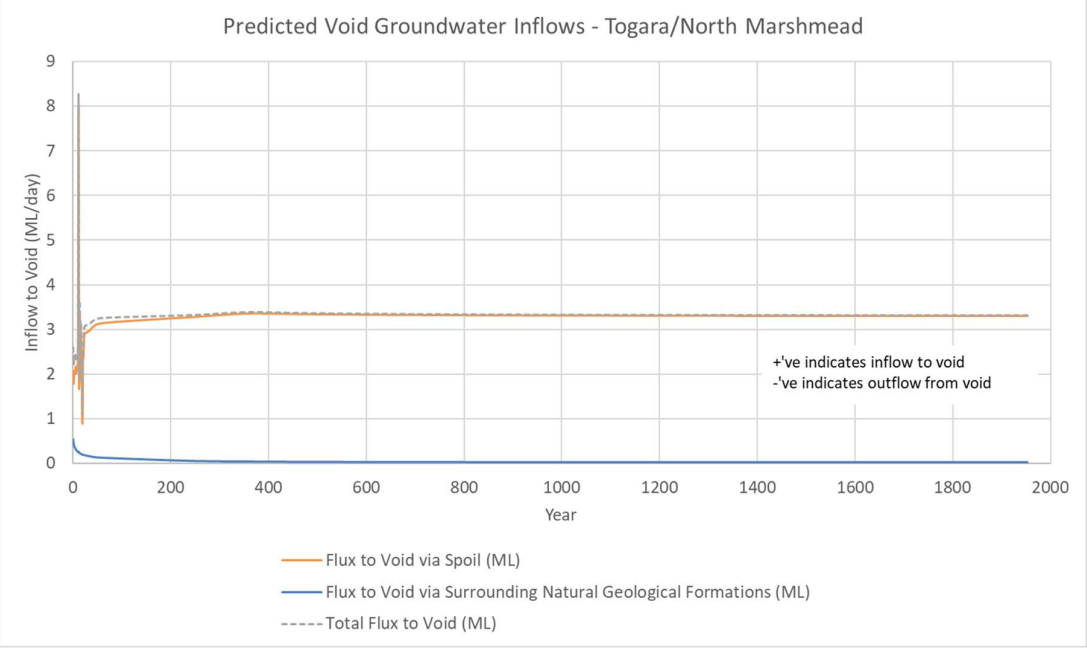


Figure 8-25 Predicted Void Groundwater Inflows – Togara / North Marshmead

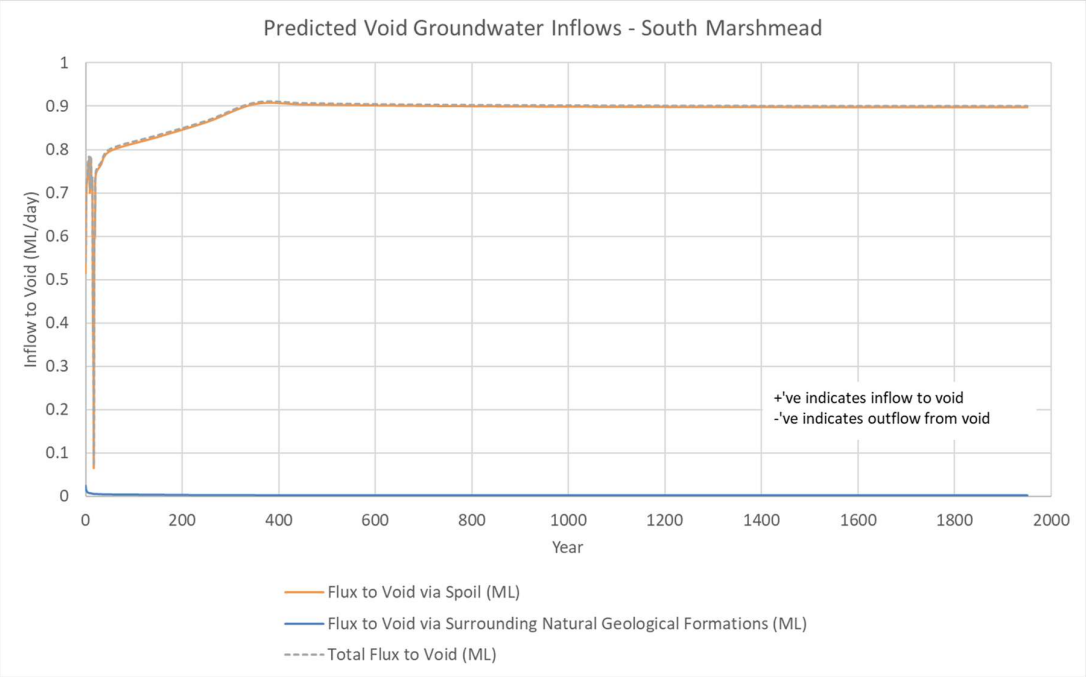


Figure 8-26 Predicted Void Groundwater Inflows – South Marshmead

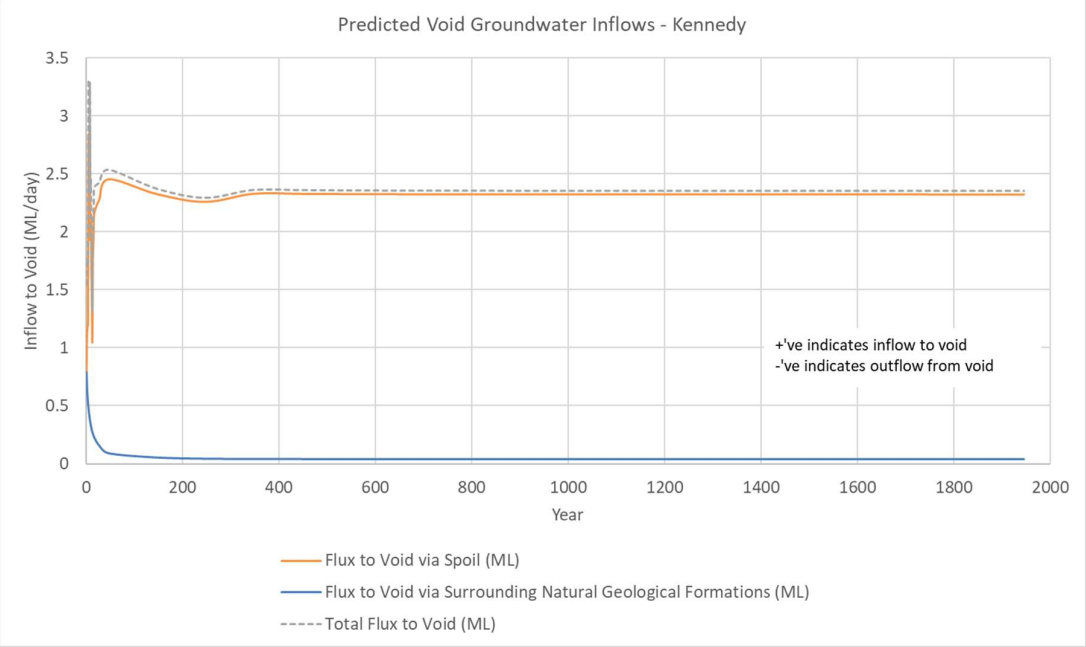


Figure 8-27 Predicted Void Groundwater Inflows – Kennedy West

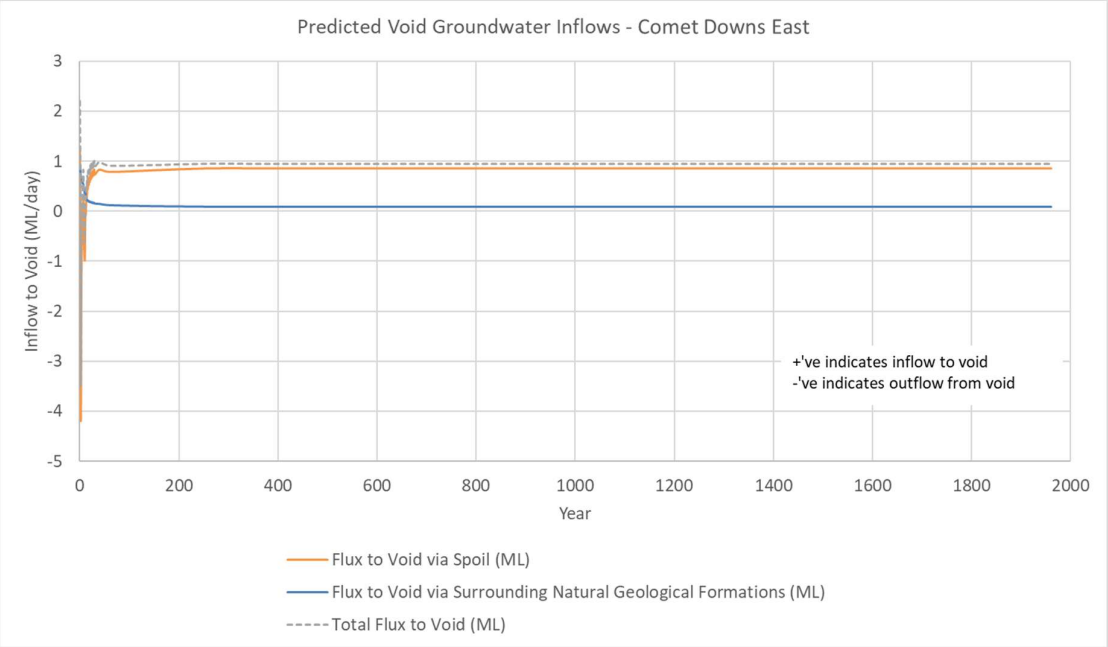


Figure 8-28 Predicted Void Groundwater Inflows – Comet Downs East

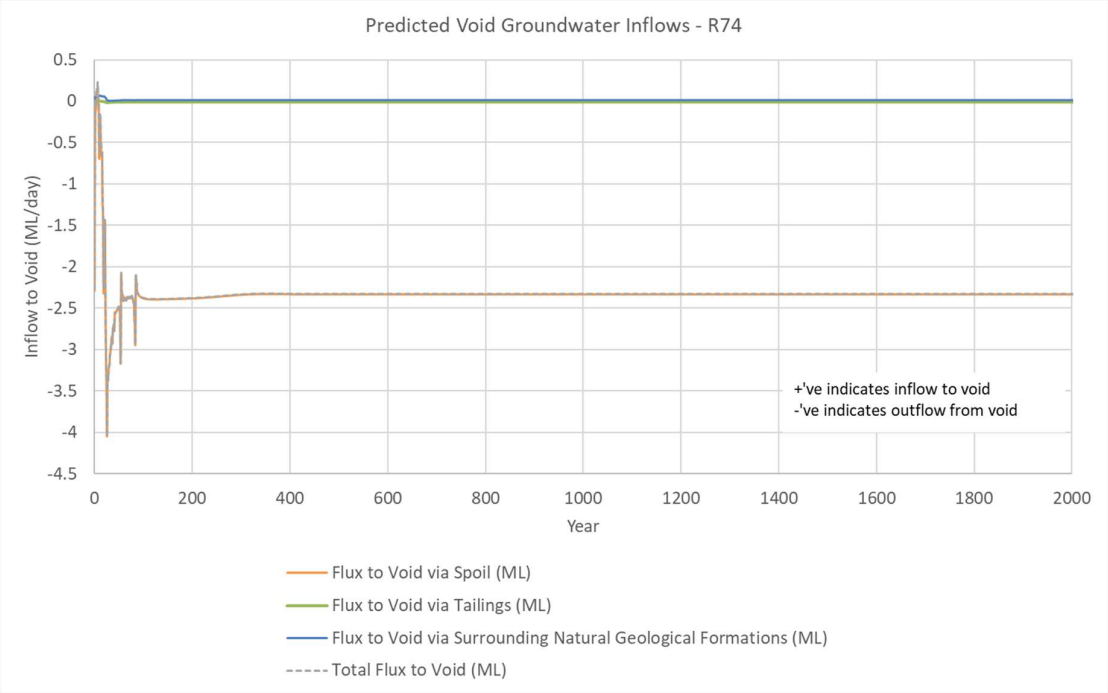


Figure 8-29 Predicted Void Groundwater Inflows – R74

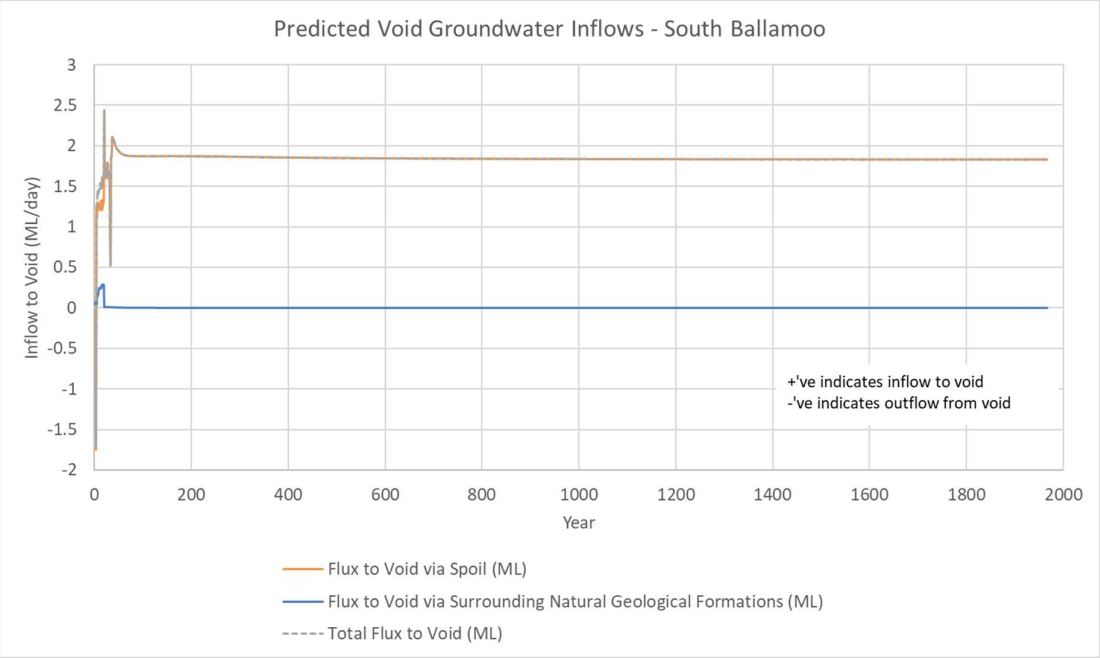


Figure 8-30 Predicted Void Groundwater Inflows – South Ballamoo

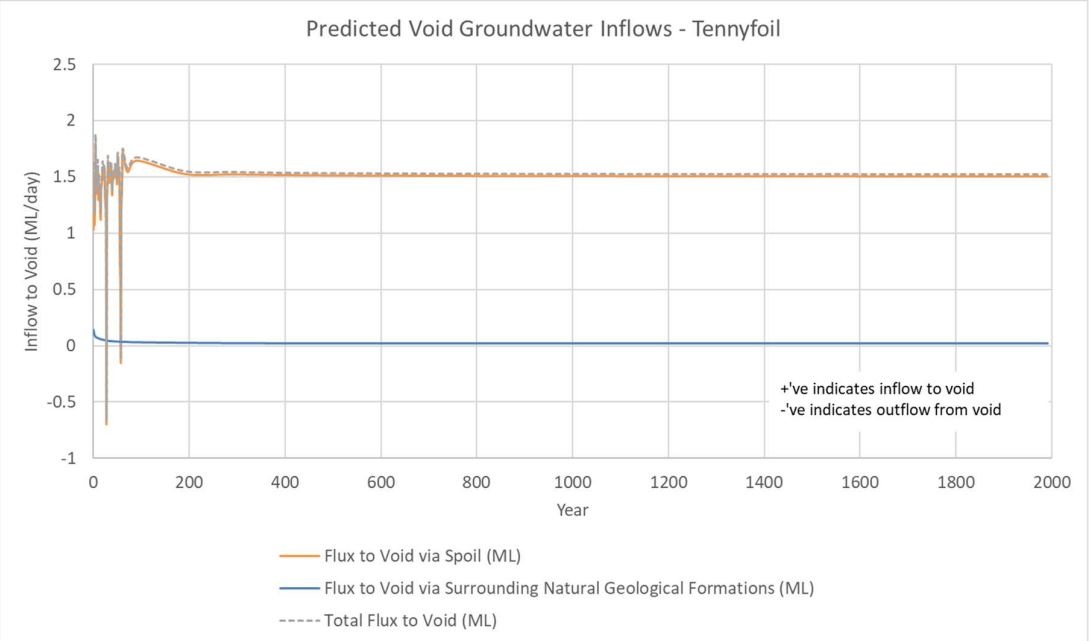


Figure 8-31 Predicted Void Groundwater Inflows – Tannyfoil

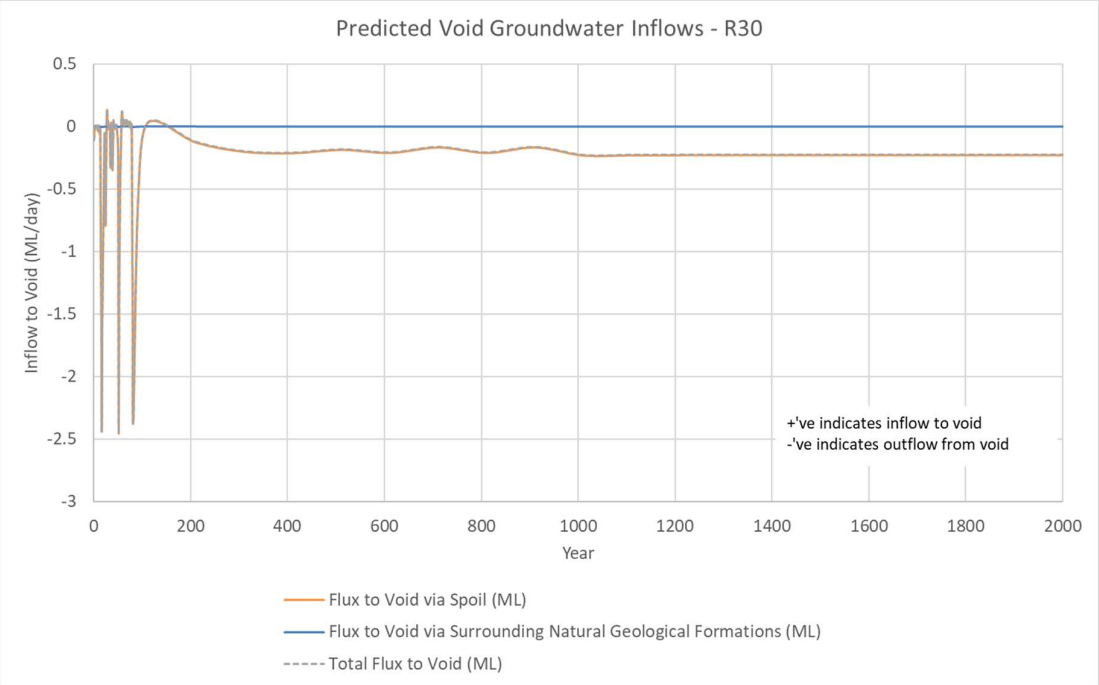


Figure 8-32 Predicted Void Groundwater Inflows – R30

Predicted equilibrium groundwater inflows to each of the residual voids are presented in **Table 8-4**. Model results indicate that across all the voids, spoil contributes between 90 % to 100% of the total net groundwater inflows to the void. The equilibrium groundwater inflows to each of the voids shown in **Table 8-4** represent a range of approximately 0 % to 70 % of the total volumetric inflow to each residual void's water balance, indicating that groundwater inflows plays an important role for some voids, but are not always the dominant driver of predicted residual void lake levels. This includes the volume of water moving between void and is not exclusively groundwater flowing towards the voids.

The equilibrium sink behaviour of the residual voids is driven by evaporative losses from the void lakes predicted by the Hydrobalance (2026) water balance model. The direct evaporation from the surface of the void lake maintains void lake levels that are lower than the surrounding groundwater levels in the long-term equilibrium state. All residual voids are predicted to behave as groundwater sinks at post-closure equilibrium with no net outflows to spoil or natural geology and the groundwater gradient remains towards the voids. As discussed previously Stewarton South, Ramp 30, Ramp 74 and Bonnie Doon residual voids have net negative fluxes via movements of water between final voids.

Stewarton South, Ramp 30, Bonnie Doon and Ramp 74 residual voids are predicted to lose void water to adjacent voids via the natural geology between the voids at relatively small rates as discussed above. Each of these voids have predicted lake elevations that are higher than the neighbouring voids (**Section 8.2.6**), resulting in a hydraulic gradient between the voids that drives this outwards flux from each void to its neighbouring void. This is the case between:

- Ramp 30 (143 mAHD) and Mimosa/Besgrove (83 mAHD);
- Bonnie Doon (159 mAHD) and Ramp 8 (145 mAHD); and
- Ramp 74 (234 mAHD) and Togara/North Marshmead (163 mAHD)
- Stewarton South (104 mAHD) and Stewarton North (74 mAHD) (**Table 8-4**).

Therefore, the outwards water flux from the four "source" voids is driven by, and would eventually be captured by, the adjacent voids with lower lake levels. The fate of this permanent post-closure outwards flux of void water is further explored in **Section 8.2.6**.

Table 8-4 Equilibrium Groundwater Inflow to the Residual Voids

Residual Void	Average Flux to Void via Spoil (ML/day)	Average Flux to Void via Tailings (ML/day)	Average Flux to Void via Surrounding Natural Geological Formations (ML/day)	Average Inflow Rate – Total (ML/day)
Bonnie Doon	-0.12	-0.01	-0.01	-0.14
R74	-2.33	-0.01	0.01	-2.32
Comet Downs East	0.85	0.00	0.10	0.94
Kennedy	2.31	0.00	0.04	2.36
South Marshmead	0.89	0.00	0.00	0.89
Togara/North Marshmead	3.29	0.00	0.03	3.33
Kenmare	0.49	0.00	0.00	0.50
South Ballamoo	1.83	0.00	0.00	1.83
Tannyfoil	1.51	0.00	0.02	1.52
Stewarton South	-0.05	0.00	0.00	-0.05
Stewarton North	1.23	0.00	0.05	1.28
Deep Creek	0.79	0.00	0.00	0.79
R30	-0.21	0.00	0.00	-0.21
Mimosa/Besgrove	2.38	0.00	0.02	2.40
Ramp 8	0.35	0	0.02	0.37

8.2.5 Predicted Groundwater Levels

8.2.5.1 Potentiometric Surface Mapping

The predicted equilibrium water table elevation adjacent the residual voids is shown on **Figure 8-33**. Predicted groundwater levels for the main groundwater bearing units surrounding the final landform – the Aries, Castor and Pollux Seams of the Rangal Coal Measures (model layers 8, 10 and 12) and the Burngrove Formation (model layer 14) - are shown on **Figure 8-34** to **Figure 8-37**.

Groundwater levels surrounding the residual voids are controlled by the predicted residual void lake levels, which in turn are controlled by the rate of evaporation from the void lakes balancing surface inflows and groundwater inflows to the lakes, including a component of groundwater that moves out of the natural geological formations into the residual voids via the spoil (refer **Table 8-4**). The conceptual relationship between these components is displayed in **Figure 8-2**. That is, predicted groundwater levels surrounding the residual voids



are a function of predicted lake levels, which as discussed in **Section 8.2.3**, are mostly dominantly controlled by surface water fluxes and maintained by evaporation.

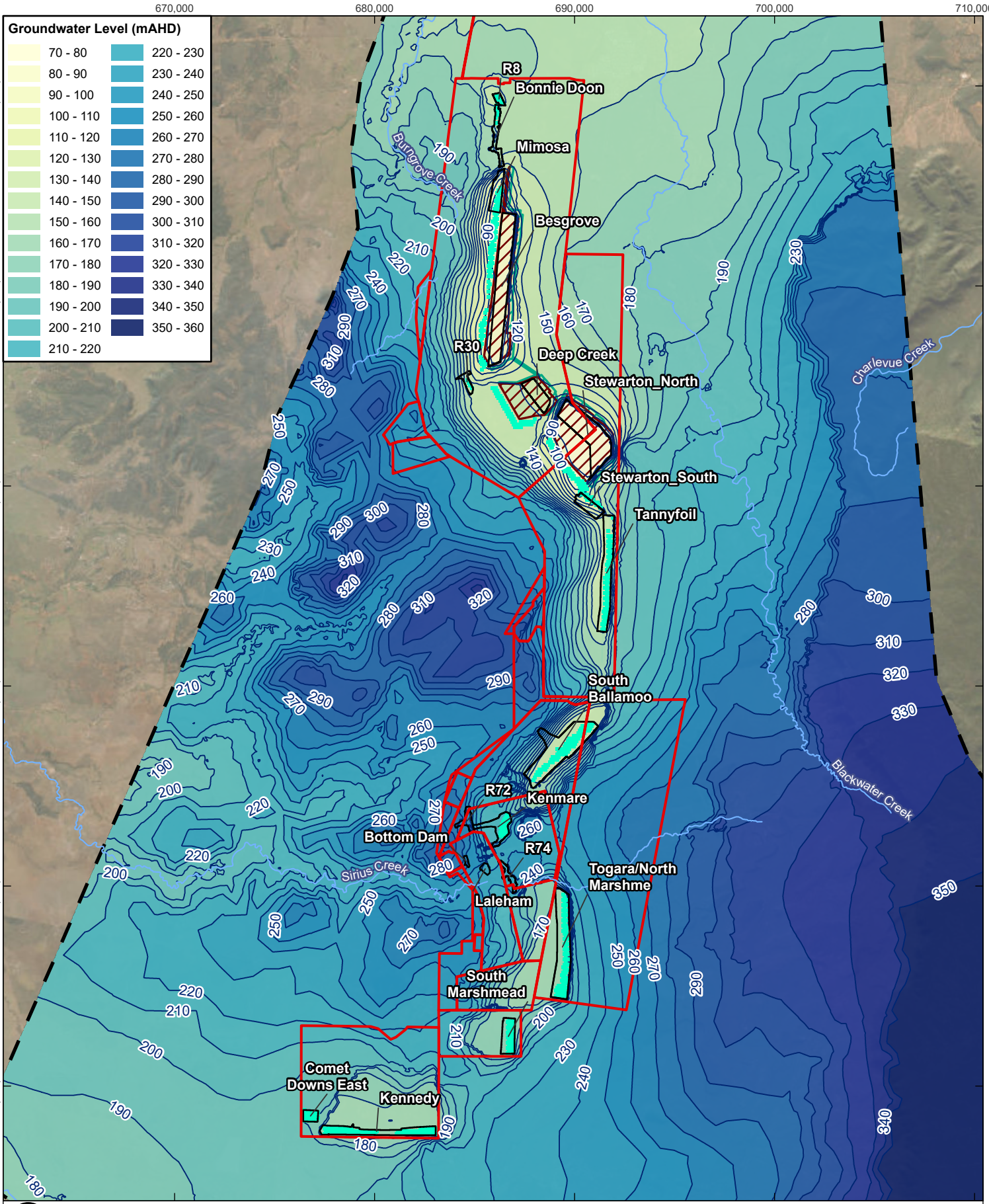
The predicted equilibrium water table elevation adjacent the residual voids is shown on **Figure 8-33**. The water table is predicted to remain depressed in the immediate vicinity of the residual voids in the long term, driven by the ongoing groundwater discharge to the residual void lakes and governed by the lake elevations themselves (**Figure 8-33**). That is, long term inwards groundwater flow gradients are maintained post-mining for the water table. Gradients in the natural rock away from the mining area and away from the residual voids are significantly smaller outside the BWM Area (with the exception of the steeper gradient observed distant to the east that occurs due to the Clematis Group escarpment). Relatively steep water table gradients also occur within the spoil emplacements to the west of the Mimosa/Besgrove, Stewarton North, Stewarton South, Tannyfoil, South Ballamoo, Kenmare, and Ramp 74 residual voids.

Predicted groundwater levels for the Aries, Castor and Pollux Seams of the Rangal Coal Measures (model layers 8, 10 and 12) and for the Burngrove Formation (model layer 16) are shown on **Figure 8-34** to **Figure 8-37**. Predicted groundwater levels for the Aries, Castor and Pollux Seams of the Rangal Coal Measures and for the Burngrove Formation indicate again that groundwater levels in the Permian sequence are predicted to remain depressed in the long term, driven by the ongoing groundwater discharge to the residual void lakes and governed by the lake elevations themselves.

The following summarises the model predicted stabilised groundwater levels as shown in **Figure 8-34** to **Figure 8-36** for the Aries, Castor and Pollux Seams:

- The Aries Seam is predicted to remain ‘dry’ in the long term across most of the mined area, with some saturation present predominantly along the east of the residual void areas. Additionally, dominant flow gradients towards the residual voids are apparent within the Aries Seam along the east of the BWM Area (**Figure 8-34**).
- The Castor Seam is predicted to remain saturated along most of the eastern margin of the mined area and within the south near the South Marshmead, Kennedy and Comet Downs East residual void areas. Dominant flow gradients in the Castor Seam are again apparent towards all the residual voids within the Aries Seam along the east of the BWM Area and surrounding Comet Downs East residual void (**Figure 8-35**).
- Predicted Pollux Seam groundwater levels show steeper gradients surrounding the southern and western side of the Besgrove, Stewarton North, South Ballamoo, R74, and Deep Creek residual voids, whilst the Togara/North Marshmead, Kenmare, Tannyfoil, and Stewarton South residual voids show steepest gradients along the western side of the residual voids. Gradients in the Pollux Seam are relatively flatter surrounding the Bonnie Doon residual void, to the east of Mimosa Besgrove, Deep Creek and Tannyfoil Residual voids and surrounding the South Marshmead, R74, Comet Downs East, and Kennedy residual voids (**Figure 8-36**).

Some saturation is predicted west of the residual voids in the model layers that formerly represented the coal seams (model layers 8, 10 and 12) but now represents emplaced spoil within former mining pits.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	21-May-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Level (mAHD)
- BWM Mining Lease
- GIA Study Area
- Void Extent
- Void Lake
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

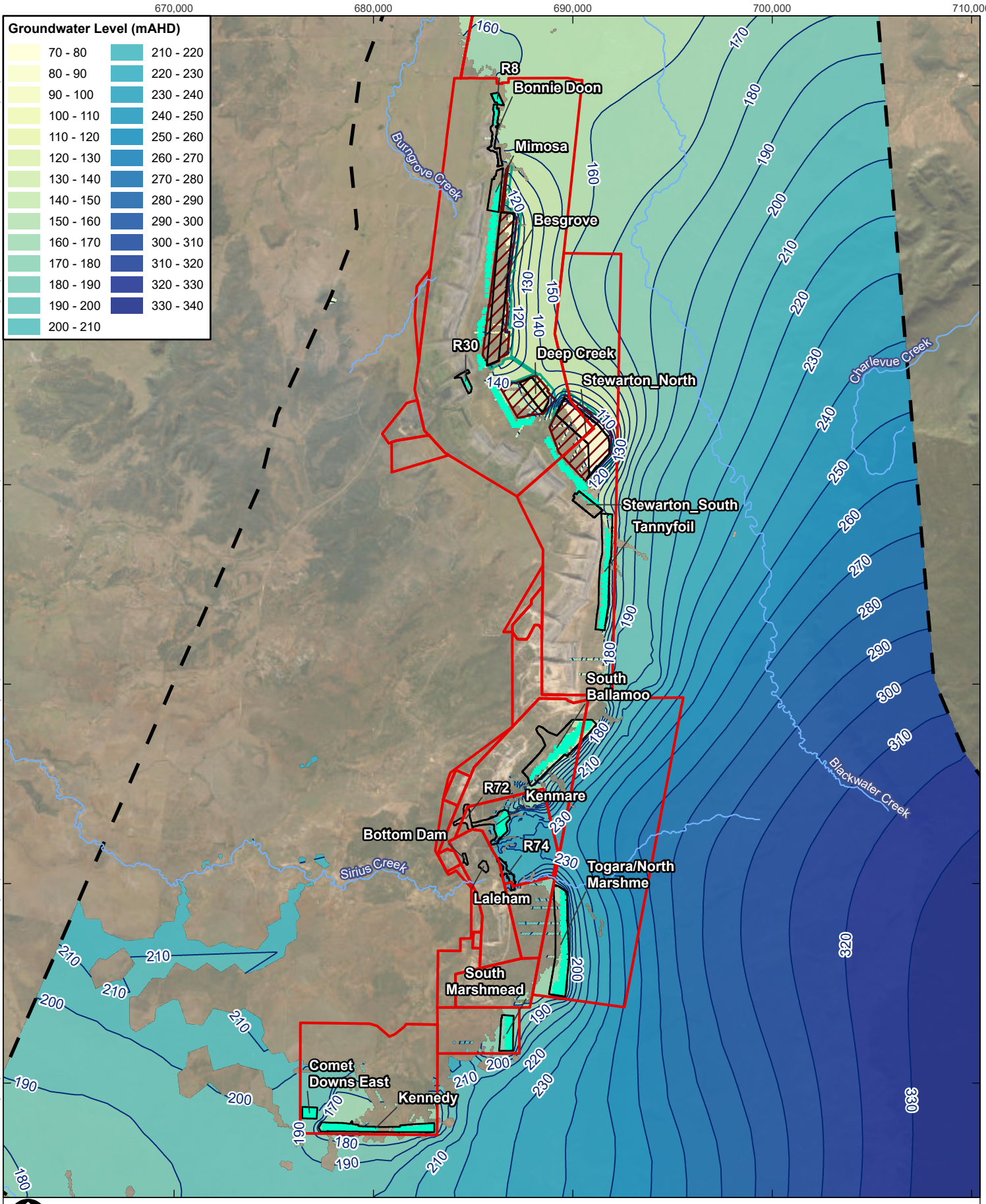
PREDICTED WATER TABLE ELEVATION – POST-MINING EQUILIBRIUM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-33

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_31_Predicted Water Table Elevation – PME



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	21-May-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Level (mAHD)
- BWM Mining Lease
- GIA Study Area
- Void Extent
- Void Lake
- Proposed Infrastructure Area
- Proposed Open Cut Extension

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

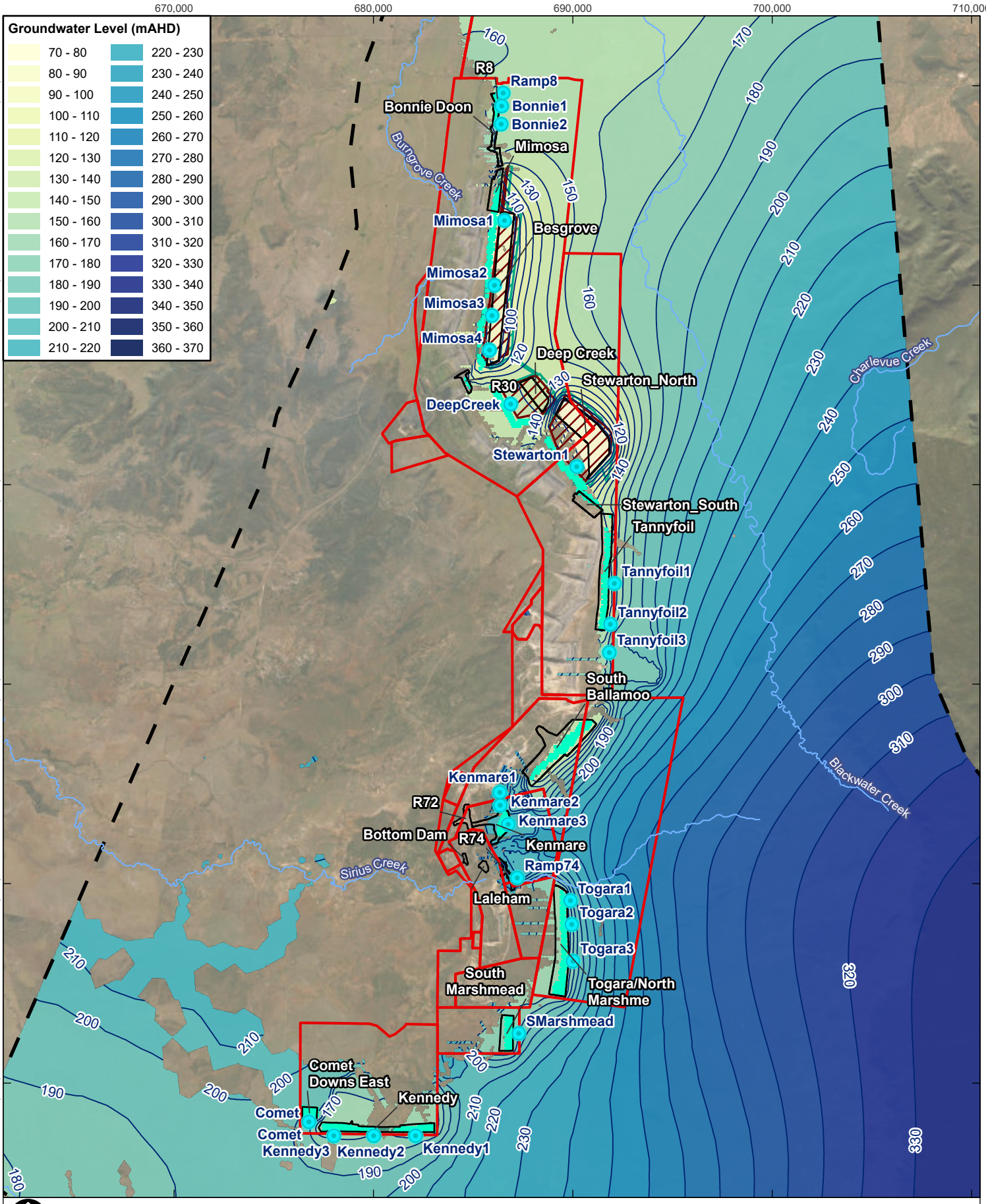
PREDICTED GROUNDWATER LEVELS IN THE ARIES SEAM (LAYER 8) – POST-MINING EQUILIBRIUM

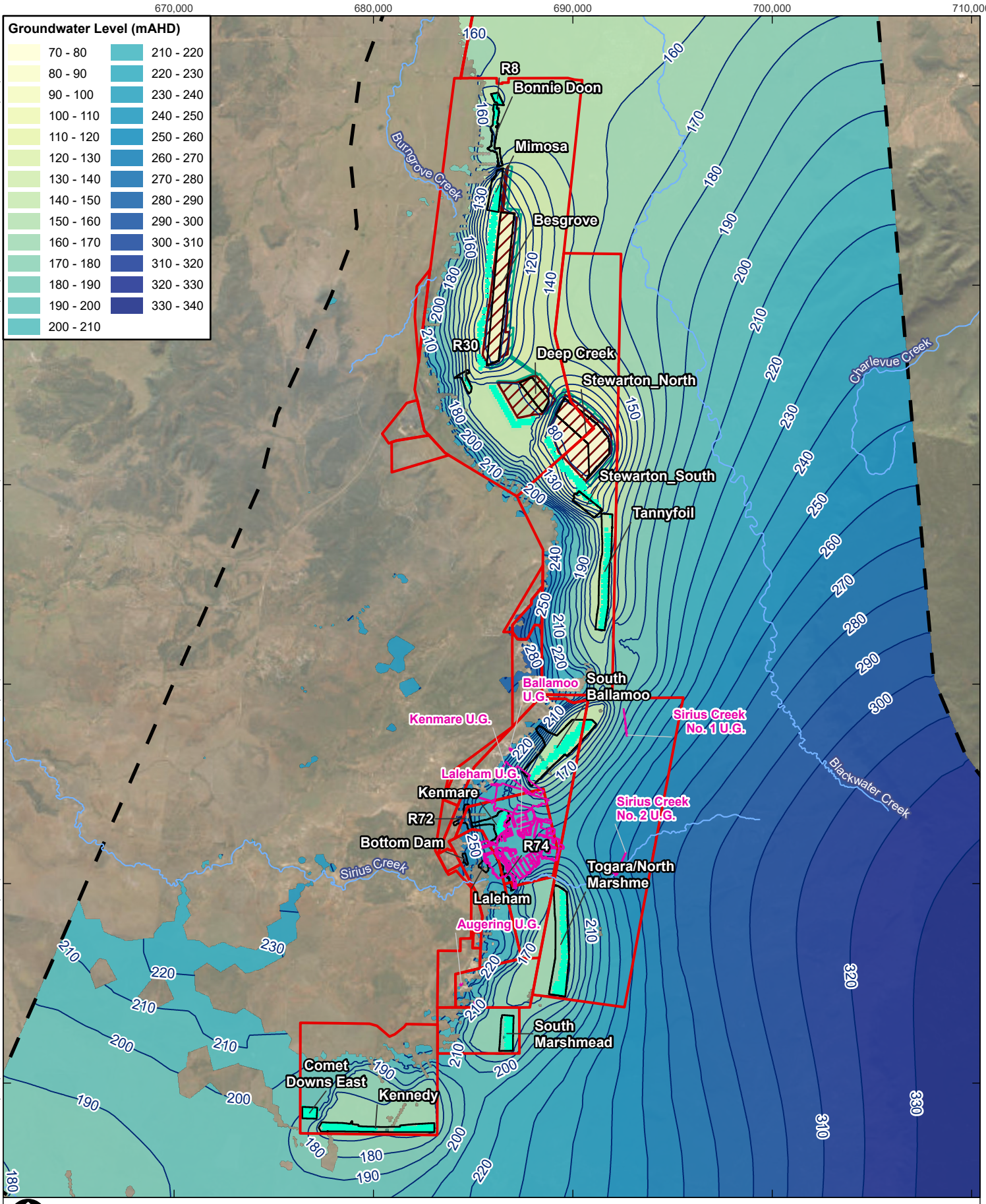
SLR

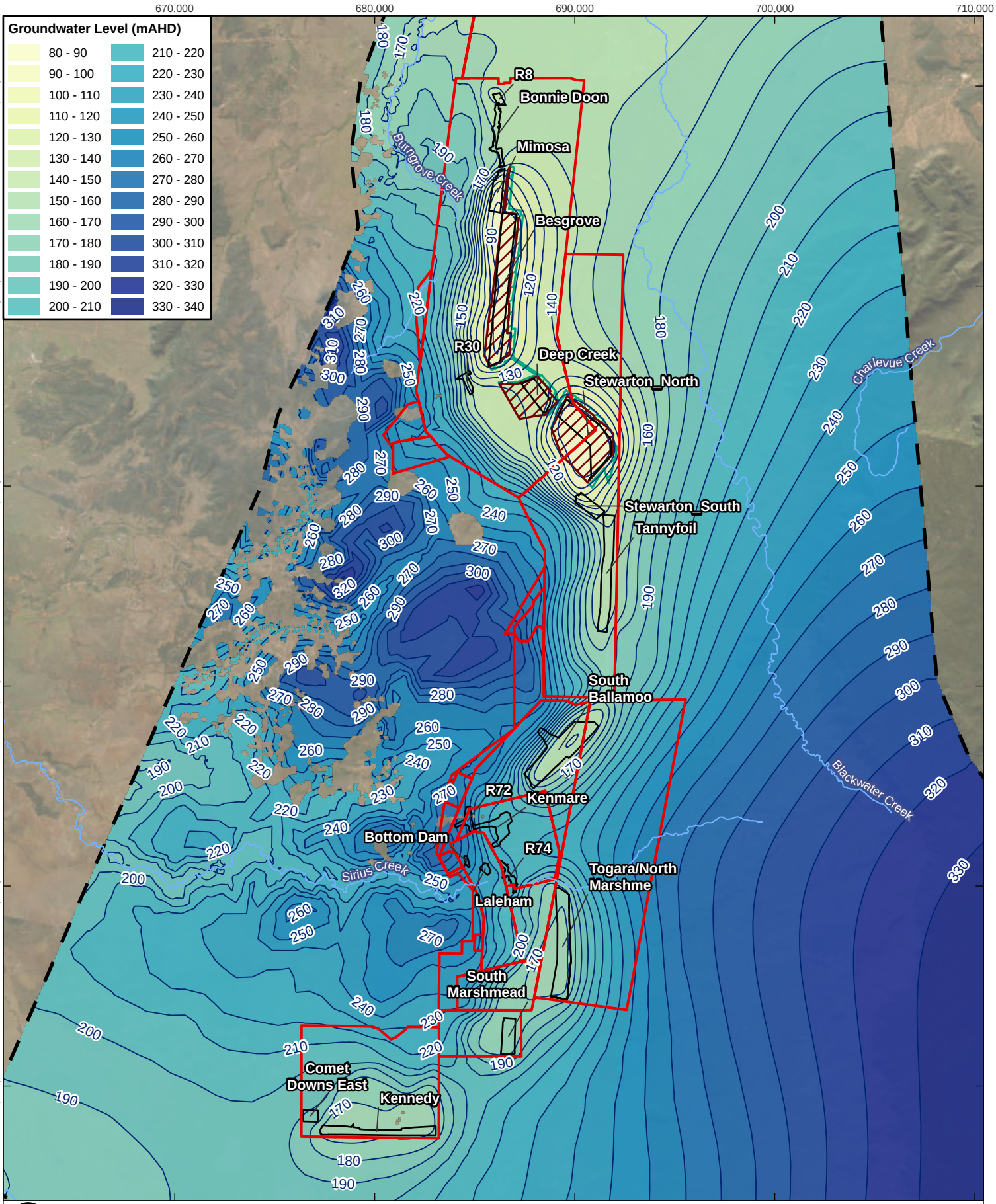
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-34

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_32_Predicted Groundwater Levels in the Aries Seam (Layer 8) – PME


Groundwater Level (mAHD)
70 - 80
80 - 90
90 - 100
100 - 110
110 - 120
120 - 130
130 - 140
140 - 150
150 - 160
160 - 170
170 - 180
180 - 190
190 - 200
200 - 210
210 - 220
220 - 230
230 - 240
240 - 250
250 - 260
260 - 270
270 - 280
280 - 290
290 - 300
300 - 310
310 - 320
320 - 330
330 - 340
340 - 350
350 - 360
360 - 370
670,000
680,000
690,000
700,000
710,000
7,390,000
7,380,000
7,370,000
7,360,000
7,350,000
7,340,000
R8
Ramp8
Bonnie Doon
Bonnie1
Bonnie2
Mimosa
Burngrove Creek
Mimosa1
Besgrove
Mimosa2
Mimosa3
Mimosa4
Deep Creek
R30
Stewarton_North
DeepCreek
Stewarton1
Charlevue Creek
Stewarton_South
Tannyfoil
Tannyfoil1
Tannyfoil2
Tannyfoil3
South Ballamoo
Kenmare1
R72
Kenmare2
Kenmare3
Bottom Dam
R74
Kenmare
Ramp74
Sirius Creek
Laleham
Togara1
Togara2
Togara3
South Marshmead
Togara/North Marshme
SMarshmead
Blackwater Creek
Comet Downs East
Kennedy
Comet
Comet
Kennedy3
Kennedy2
Kennedy1
0
2.5
5
km
LEGEND
Hydrograph Location
Watercourse
Groundwater Level (mAHD)
BWM Mining Lease
GIA Study Area
Void Extent
Void Lake
Proposed Infrastructure Area
Proposed Open Cut Extension
Coordinate System: GDA2020 MGA Zone 55
Scale: 1:250,000 at A4
Project Number: 620.040199
Date Drawn: 21-May-2026
Drawn by: AS
BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT
PREDICTED GROUNDWATER LEVELS IN THE CASTOR SEAM (LAYER 10) – POST-MINING EQUILIBRIUM
SLR
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.
FIGURE 8-35
Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_33_Predicted Groundwater Levels in the Castor Seam (Layer 10) – PME


Groundwater Level (mAHD)
70 - 80
80 - 90
90 - 100
100 - 110
110 - 120
120 - 130
130 - 140
140 - 150
150 - 160
160 - 170
170 - 180
180 - 190
190 - 200
200 - 210
210 - 220
220 - 230
230 - 240
240 - 250
250 - 260
260 - 270
270 - 280
280 - 290
290 - 300
300 - 310
310 - 320
320 - 330
330 - 340
670,000
680,000
690,000
700,000
710,000
7,390,000
7,380,000
7,370,000
7,360,000
7,350,000
7,340,000
R8
Bonnie Doon
Mimosa
Burngrove Creek
Besgrove
R30
Deep Creek
Stewarton_North
Stewarton_South
Tannyfoil
Charlevue Creek
Ballamoo U.G.
South Ballamoo
Kenmare U.G.
Sirius Creek No. 1 U.G.
Laleham U.G.
Kenmare
R72
Bottom Dam
R74
Sirius Creek
Sirius Creek No. 2 U.G.
Blackwater Creek
Togara/North Marshme
Laleham
Augering U.G.
South Marshmead
Comet Downs East
Kennedy
0
2.5
5
km
Coordinate System: GDA2020 MGA Zone 55
Scale: 1:250,000 at A4
Project Number: 620.040199
Date Drawn: 21-May-2026
Drawn by: AS
LEGEND
Historical Underground Mine
Watercourse
Groundwater Level (mAHD)
BWM Mining Lease
GIA Study Area
Void Extent
Void Lake
Proposed Infrastructure Area
Proposed Open Cut Extension
BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT
PREDICTED GROUNDWATER LEVELS IN THE POLLUX SEAM (LAYER 12) – POST-MINING EQUILIBRIUM
SLR
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.
FIGURE 8-36
Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_34_Predicted Groundwater Levels in the Pollux Seam (Layer 12) – PME



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	17-Sep-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Level (mAHD)
- BWM Mining Lease
- GIA Study Area
- Void Extent
- Void Lake
- Proposed Infrastructure Area
- Proposed Open Cut Extension

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

PREDICTED WATER LEVEL WITHIN BURNGROVE FORMATION (LAYER 16) – POST-MINING EQUILIBRIUM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-37

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_35_Predicted Groundwater Levels in the Burngrove Formation (Layer 16) – PME

8.2.5.2 Predictive Hydrographs Adjacent Void Lakes

Hydrographs showing the predicted change in groundwater levels over time for the shallow layers (Quaternary Sediments, Tertiary Sediments/Basalt and weathered regolith just outside of the residual voids are provided as **Appendix D**, with the hydrograph locations shown on **Figure 8-33**.

The vast majority of groundwater level drawdown in the Permian Coal Measures occurs pre-closure as a result of active extractive mining operations. Post-closure groundwater levels in the deeper coal seams recover from their lowest point that occurred during mining. However, most shallow groundwater units across the BWM Area show persistent drawdown post-recovery.

The hydrographs demonstrate very little effect on groundwater levels from the residual void inflow flux variability in the early post-closure period as shown and discussed in **Section 8.2.4**.

For most residual voids, lake levels remain below the base of weathering (regolith), except for Comet Downs East and R74 (as also presented previously on **Table 8-3**). However, the outflow from these lakes is captured by adjacent residual void lakes, as discussed in **Section 8.2.4** and further assessed in **Section 8.2.6.**

It should also be noted that, even if the hydrographs discussed above show that predicted groundwater levels just outside the residual voids can be relatively close to the predicted void lake levels for the Permian units, the potentiometric surface mapping (**Figure 8-33** to **Figure 8-37**) shows that only few hundred metres further distant from the residual voids, groundwater levels will be higher than the void lake levels, which will hydraulicly prevent any void lake from travelling any further than that, or in areas with flatter gradients, such as near Bonnie Doon, Stewarton South and Ramp 30, any outwards flux is recaptured by the voids in the long term post-mining due to the strong hydraulic gradients between adjacent voids. This is further demonstrated by the particle tracking in **Section 8.2.6**.

8.2.5.3 Groundwater Level Impacts to Potential Receptors

Predictive hydrographs have been derived from the groundwater model to understand the nature of likely groundwater level change in the interpreted source aquifer for identified potential natural and anthropogenic groundwater receptors in the vicinity of the Project Area (refer **Section 5.2**). The aim of the hydrographs is to assess the potential for additional impacts to these potential receptors in the period post-mining, i.e. identify additional potential impacts beyond those that have occurred during already approved mining operations that may be attributable to the PRC Plan's proposed final landform. The hydrographs are shown in **Figure 8-39** to **Figure 8-42** (Potential GDEs) and **Appendix E** (Third-Party bores) and locations shown in **Figure 8-38**.

Potential GDEs

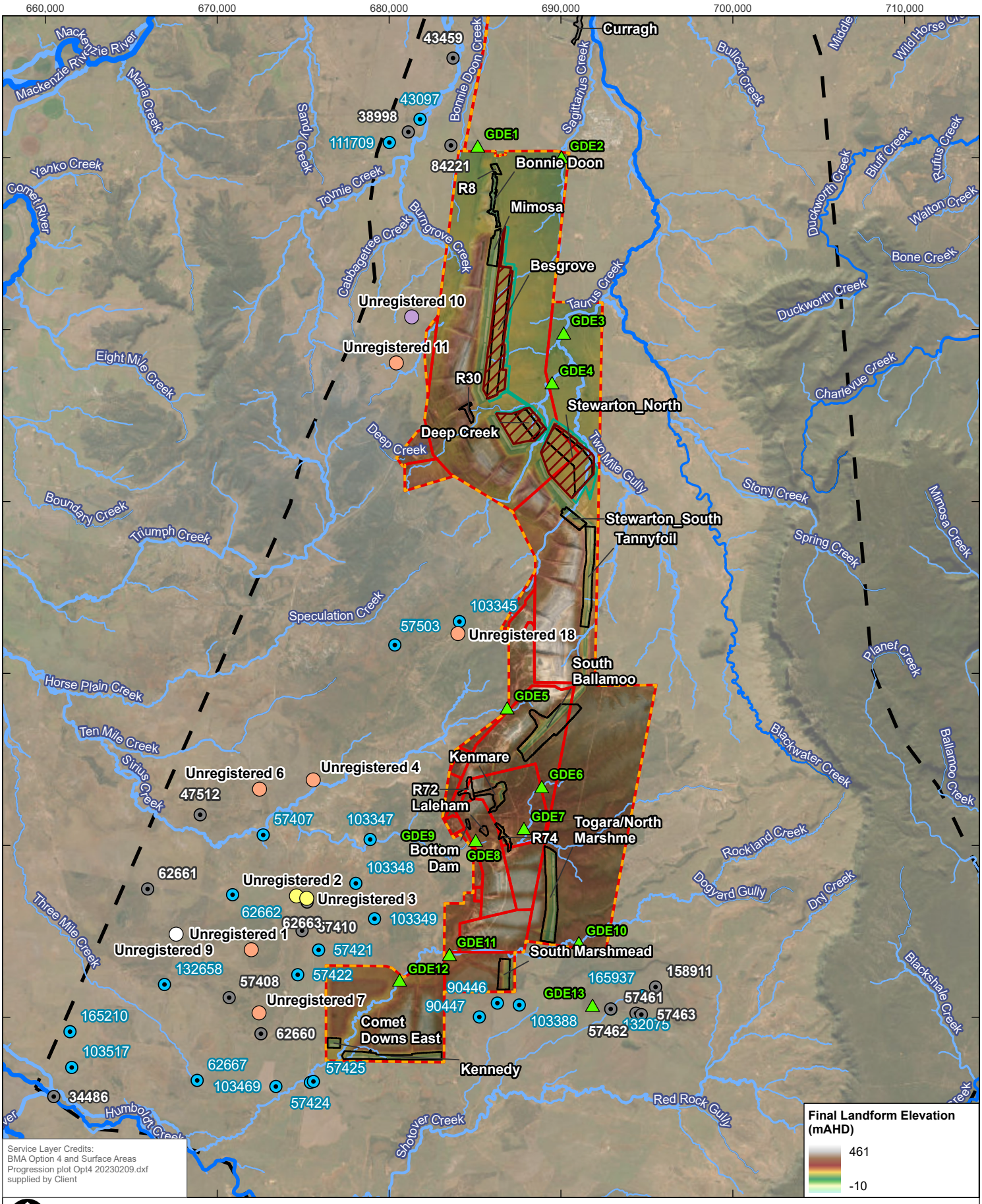
Predictive hydrographs for the water table at the potential GDE sites identified in and adjacent to the Project Area (refer **Section 5.2**) are shown in **Figure 8-39** to **Figure 8-42** with locations shown in **Figure 8-38**. The hydrographs indicate that several of the sites are unlikely to contain actual GDEs based on the significant predicted depth to groundwater of greater than approximately 8 to 10 m at those locations (sites GDE1 near Bonnie Doon Creek, GDE3 at Taurus Creek, GDE5 north of the Kenmare residual void, GDE6, GDE7 GDE8 and GDE9 near Sirius Creek, GDE11 at Rockland Creek, and GDE13 east of the South Marshmead residual void). That is, it is considered that a depth to groundwater table of 8 to 10 m or more is most likely too deep to be accessed by even the deepest-rooted terrestrial vegetation present, and therefore any vegetation present there would not be a GDE.



Of the potential GDE sites, GDE2 downstream Sagittarius Creek, GDE4 at Taurus Creek, and GDE10 and GDE12 downstream Rockland Creek show relatively shallow predicted water table depths.

The hydrographs indicate that much of the water table drawdown in the vicinity of potential GDEs is predicted to occur prior to the end of mining (i.e. associated with approved BWM mining operations), with any additional drawdown occurring over the post-mining period continuing the drawdown trends that commence prior to the end of mining. GDE10 is the only potential GDE to experience notable drawdown during the recovery simulation, with a decline in water level of up to approximately 12 m after the end of mining.

The shape of these hydrographs suggests that the additional drawdown impacts that occur in the post-mining period are residual impacts from approved active mining activities (i.e. a time lag from active mining), rather than new impacts caused by the PRC Plan's landform design; i.e. suggesting that the final landform is not contributing significantly to additional impacts at the potential GDE locations. This is a logical finding given that all residual voids are predicted to contain lakes with elevations significantly above the base of the void / maximum mining depth (refer **Section 8.2.6**).



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:290,000 at A4
Project Number:	620.040199
Date Drawn:	21-May-2026
Drawn by:	RB

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

POTENTIAL RECEPTOR PREDICTIVE HYDROGRAPH LOCATIONS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-38

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_38_Potential Receptor Predictive Hydrograph Locations

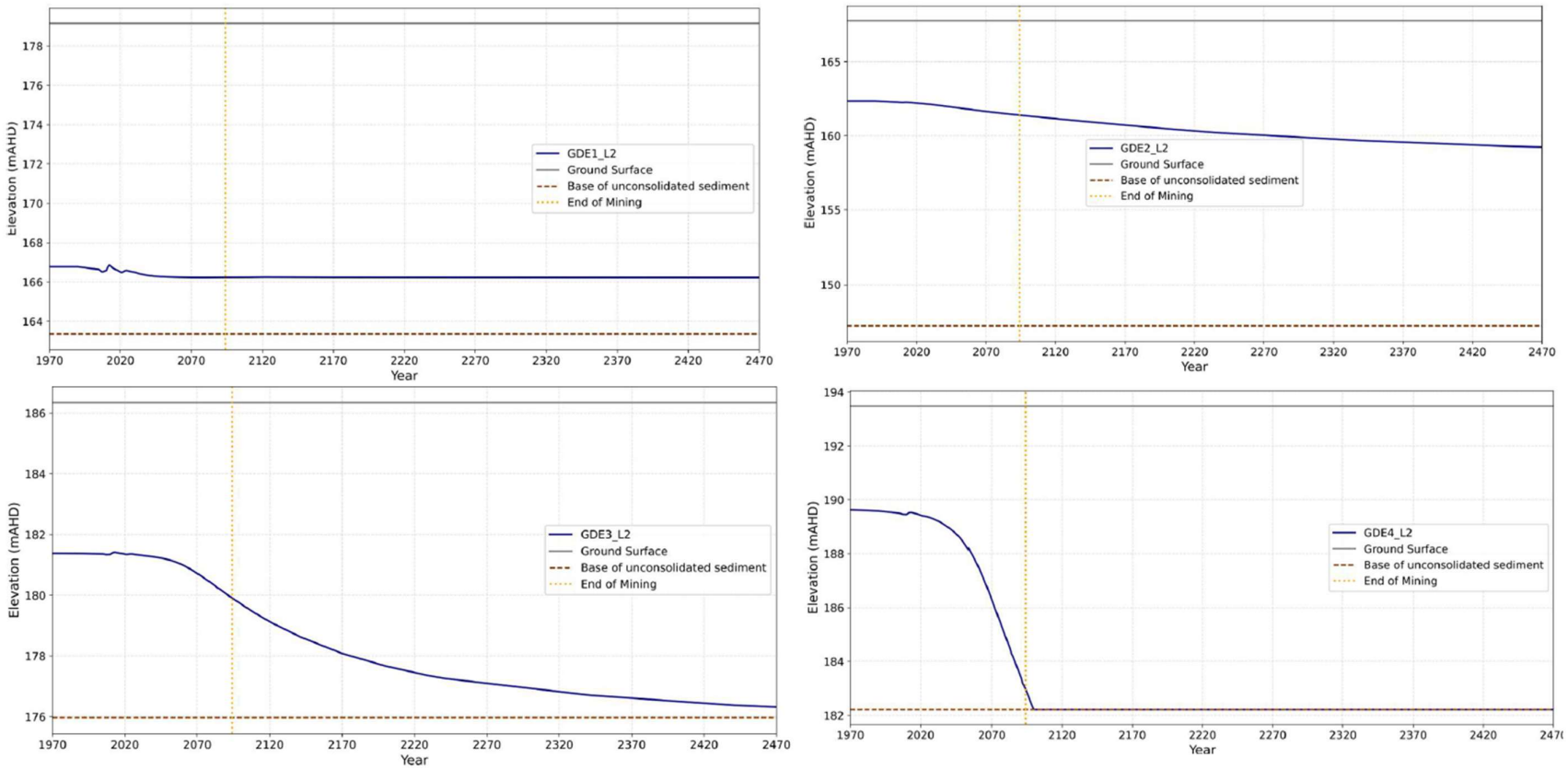


Figure 8-39 Water Table Hydrographs at Potential GDEs (GDE1 to GDE4)

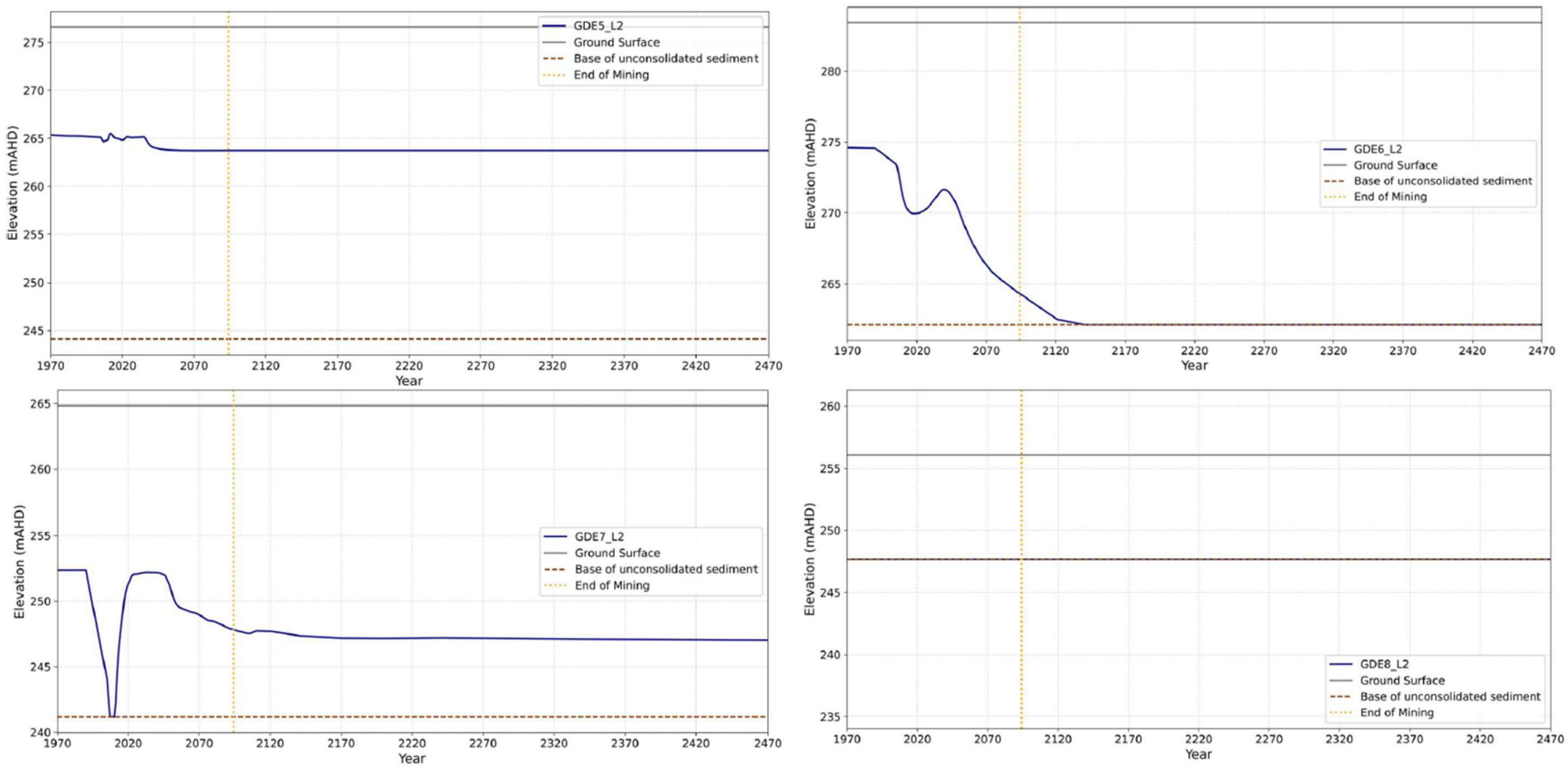


Figure 8-40 Water Table Hydrographs at Potential GDEs (GDE5 to GDE8)

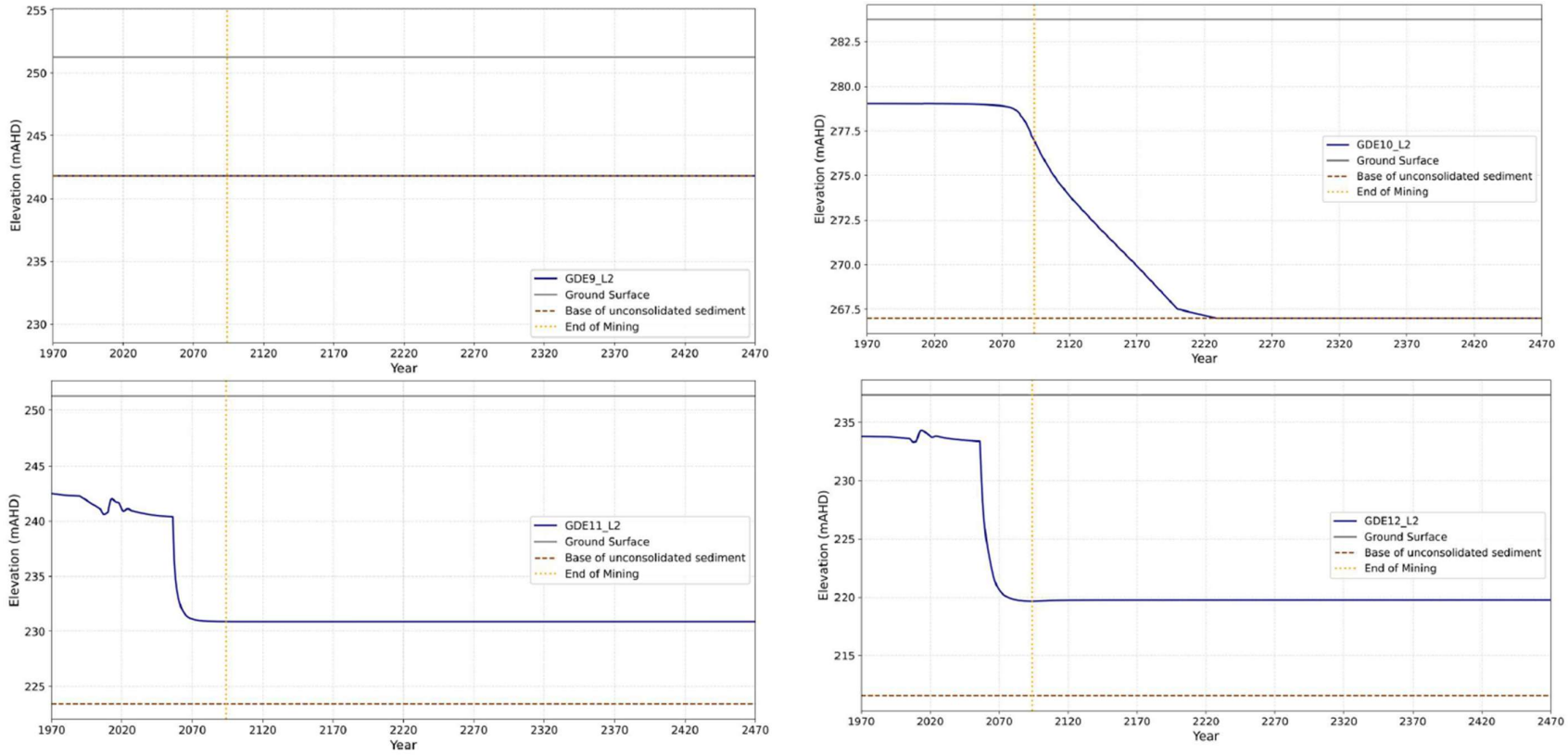


Figure 8-41 Water Table Hydrographs at Potential GDEs (GDE9 to GDE12)

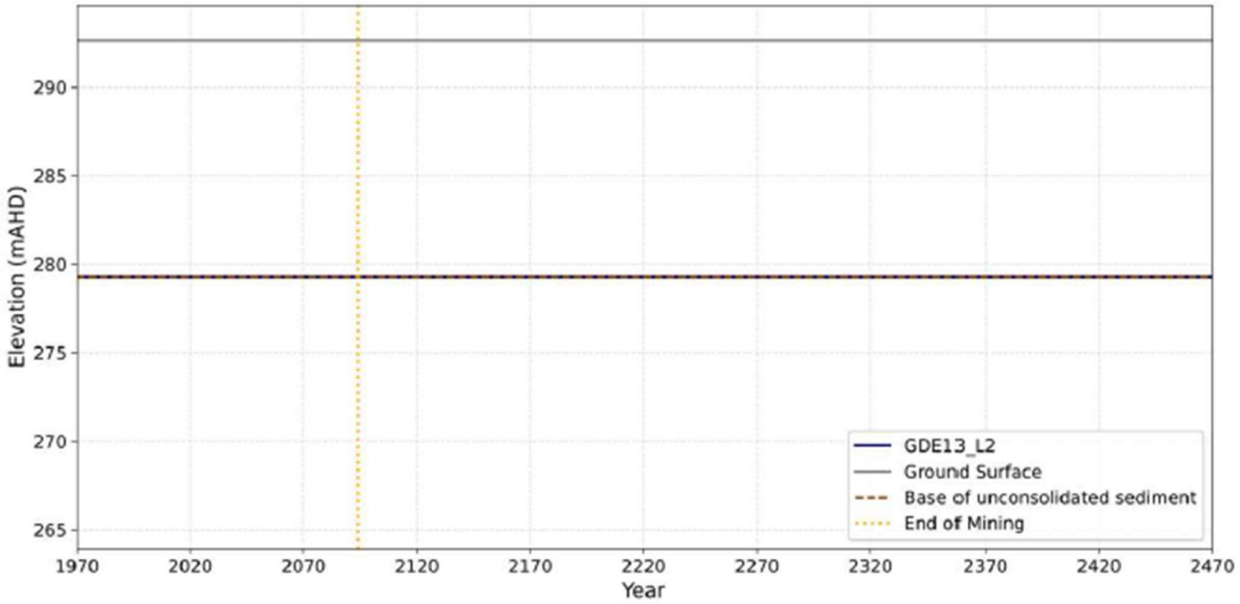


Figure 8-42 Water Table Hydrographs at Potential GDEs (GDE13)

Third Party Supply Bores

Predictive hydrographs for the 29 identified third party water supply bores surrounding the Project Area and within the Study Area with sufficient information to attribute a source aquifer (refer **Section 5.2.1**) are provided as **Appendix E** with locations shown on **Figure 8-38**. It is noted that bores interpreted to be screened in formations below the base of the groundwater model are not considered as they are interpreted to be below the base of the groundwater system that could be affected by BWM. The aim of the hydrographs is to assess the potential for additional impacts that may occur at these bores in the post-mining period. That is, to identify additional potential groundwater level impacts beyond those that have occurred during active mining operations through to closure in 2094, that may be attributable to the PRC Plans final landform.

As shown on the hydrographs of the bores interpreted to be in the weathered zone/regolith (model layer 2), no bore is predicted to experience additional groundwater drawdown over the post-mining period greater than the relevant 2 m drawdown 'bore trigger threshold' for unconsolidated aquifers identified in Chapter 3 of the *Water Act 2000* (Water Act).

The hydrograph for bore RN103388, interpreted to be in the Rewan Formation, shows a maximum of up to 13 m of additional drawdown predicted to occur during the post-mining period. This trend is interpreted to be a continuation of drawdown from approved mining but not an impact caused by the PRC Plan's final landform.

The hydrographs for bores RN57461, RN57462 also show groundwater levels in the Rewan Formation, as the interpreted model target layer (layer 2) is dry and hence the next layer down is included in the hydrographs so that a conservative assessment of potential impact can be undertaken. As shown on the hydrographs, up to 10 m to 15 m of additional drawdown is predicted to occur at these bores over the post-mining period. This trend is a continuation of drawdown from approved mining, not an impact caused by the PRC Plan's final landform.

As shown on the hydrographs for bores interpreted to be in Burngrove Formation, no bores are predicted with an additional post mining drawdown greater than the relevant 5 m drawdown 'bore trigger threshold' for consolidated aquifers identified in Chapter 3 of the Water Act 2000.

8.2.6 Flow Path Simulation

An analysis of the water movement within Landform 4.1 was undertaken to simulate and assess the movement and fate of water particles through the groundwater system post-mining.

8.2.6.1 Particle Tracking Setup

A number of particles were placed on the final landform and within the residual voids in the recovery groundwater model and the mod-PATH3DU code (S.S. Papadopulos & Associates, Inc., 2018) was used to simulate particle pathways along the groundwater flow field post mining. To run the mod-PATH3DU code the transient head outputs from the groundwater flow model were used by mod-PATH3DU to simulate particle flow path lines.

Figure 8-43 shows the initial location of particles on Landform 4.1. With the exception of particles placed within the underground mine workings adjacent to Laleham, the particles were placed at the surface of the model with the movement of the particles then recorded during the post-mining simulation. It should be noted that the mod-PATH3DU code automatically moves the particle from the model surface to the shallowest saturated layer at the commencement of the simulation. Mod-PATH3DU was configured to release the particles at the midpoint between the base of the first saturated layer and the water table. As



shown on **Figure 8-43** for many of the particles this represents the Permian layers (including areas of spoil backfill in model layers that represent Permian units pre-mining) as the shallow layers (Layers 1 and 2) are unsaturated across much of the BWM Area at the commencement of the post-mining simulation. The particles placed in the underground mines were configured to begin their simulation in the Pollux seam (Layer 12) to simulate the fate of water beginning in the flooded underground workings after mine closure.

8.2.6.2 Scenario 1 – Particles Released at the Commencement of Post-Mining

To estimate flow paths from the end of mining until post mining equilibrium, a first scenario was run with particles released at the start of the post mining period (year 2094) until the end of the post mining simulation period (year 4040).

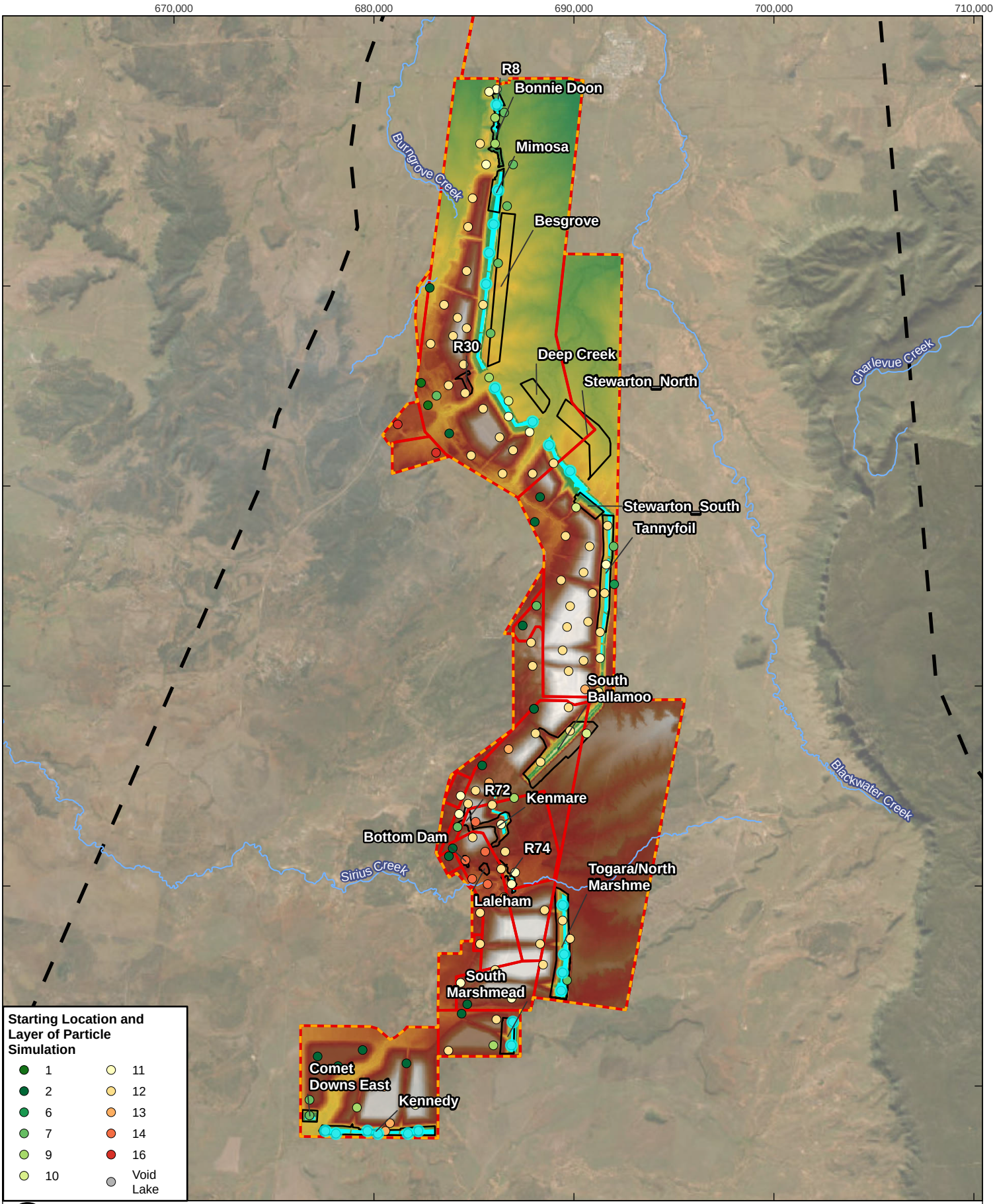
Figure 8-44 shows the predicted movement of water particles in the 1930-year post mining simulation of Landform 4.1. The colours along the predicted particle flow paths provide the model layer the particle was simulated to be moving through, with the green to red scale classification representing particles moving from shallow to deep model layers.

The colour changes along the paths on **Figure 8-44** indicate that particles situated within the shallower saturated layers at the beginning of the post-mining simulation generally move progressively toward deeper layers representing the Permian coal measures (or backfilled spoil where the coal measures has been mined out) over the post-mining period. However, particles that begin in the Pollux seam (Layer 12) and other deeper layers often are observed to move upwards to shallower layers over the course of the recovery simulation, as the saturated water levels in the spoil and aquifers adjacent to the residual voids recover to their long-term post-mining equilibrium state. The flow path analysis indicates the particles generally move toward the void lakes, with all of the particles captured in the voids.

As discussed in **Section 8.2.4**, fluxes from voids that are predicted to act as a source to the local groundwater are toward neighbourhood voids. This can be observed in the particle movements shown on **Figure 8-44** with:

- particles released to the west of Ramp 30 moving toward Mimosa/Besgrove;
- particles released to the southwest of Ramp 30 moving toward Deep Creek;
- particles released to the north of Bonnie Doon moving toward Ramp 8; and
- particles released to the east of Ramp 74 moving toward Togara/ North Marshmead.

No particles are predicted to travel outside of the mine lease in the 1930-year post mining simulation.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	22-Sep-2026
Drawn by:	AS

LEGEND

- Watercourse
- BWM Mining Lease
- Study Area
- Project Area (Environmental Authorities boundary)
- Void Extent
- Void Lake

Final Landform Elevation (mAHD)

461

-10

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

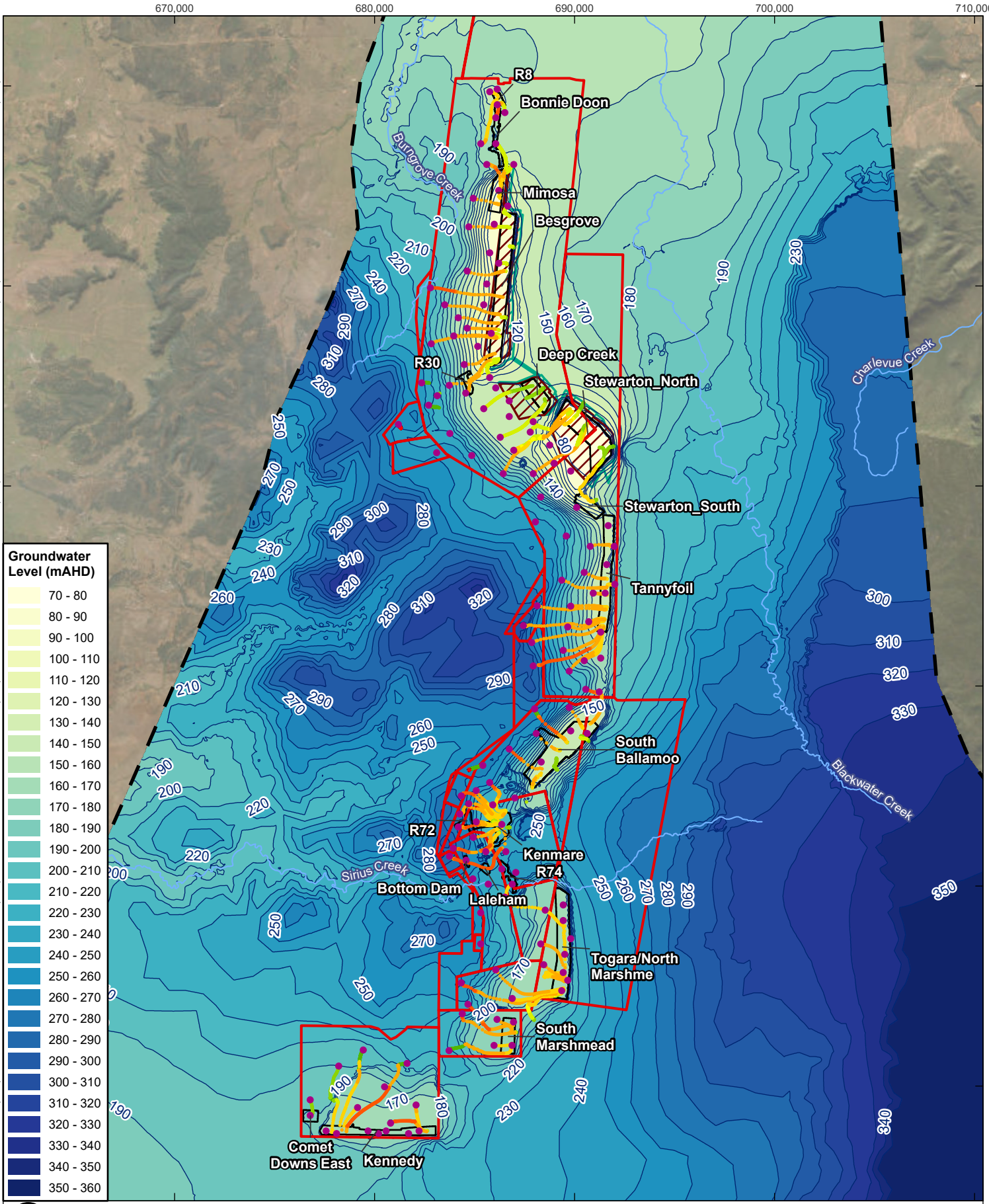
STARTING LOCATION OF PARTICLES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-43

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_41_Starting Location of Particles



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	21-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

PREDICTED MOVEMENT OF PARTICLES (2094 - 4040)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-44

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_44_Predicted Movement of Particles Post Mining (2094 - 4040)

It is noted that some particles appear to not be moving on **Figure 8-44** (i.e. only the starting location is shown on **Figure 8-44** but there is no subsequent particle track). These particles have been released in areas where the water table is simulated to be relatively close to the model surface (i.e. within the evapotranspiration depth reach), and they have been "captured" by simulated evapotranspiration.

8.2.6.3 Scenario 2 – Particles Released at Post-Mining Equilibrium

To estimate flow paths at post mining equilibrium, a second particle tracking scenario was run with particles released at post mining equilibrium (year 2641) and run for 1300 years until the end of the post mining period in the model (year 4040). Year 2641 was selected based on the final void hydrographs (**Section 8.2.3**), where all final voids have reach equilibrium (i.e. flat lined).

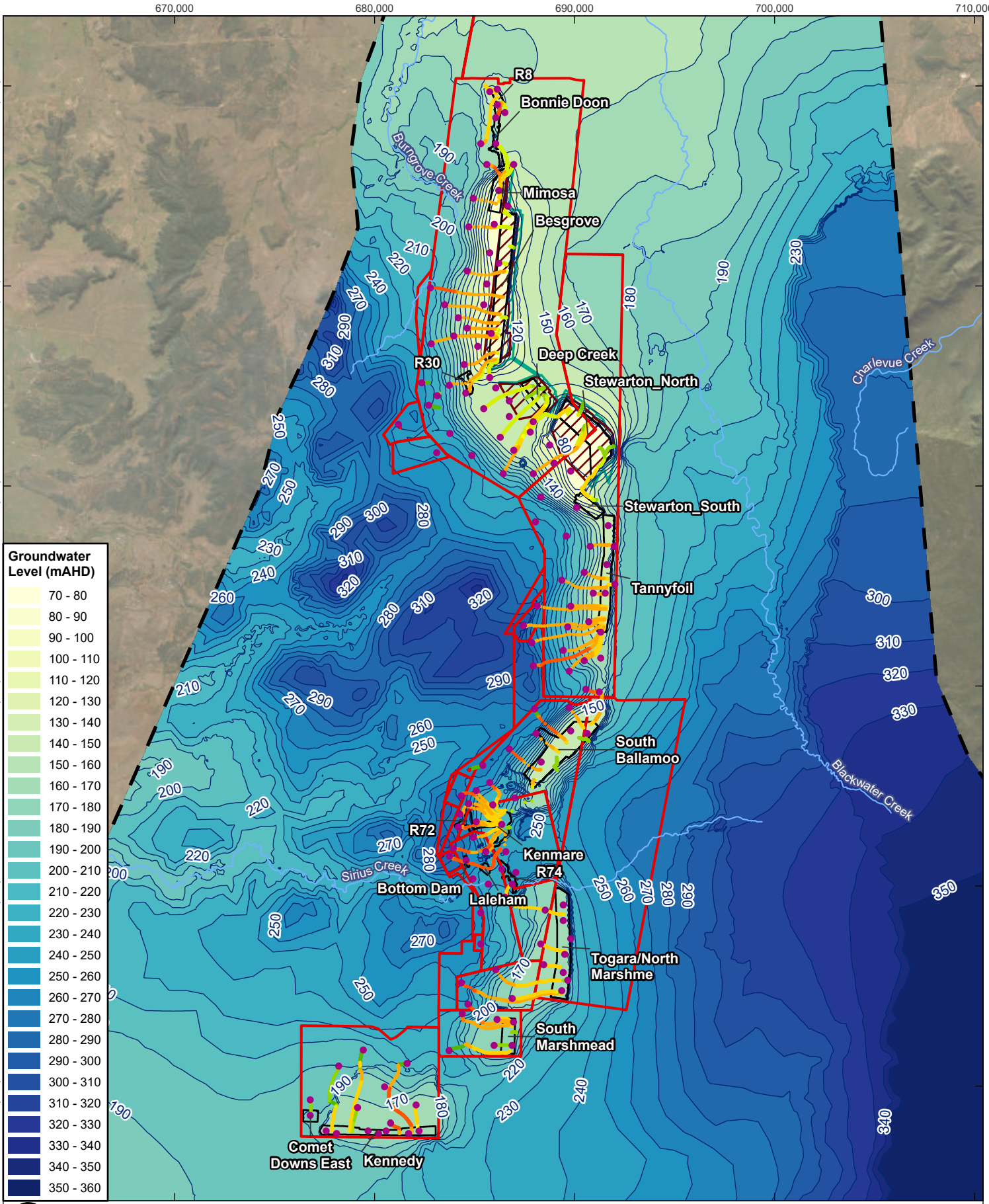
Results of the second simulation are shown on **Figure 8-45**. Differences in the flow path between particles starting at the end of mining (**Figure 8-44**) and particles starting at post mining equilibrium (**Figure 8-45**) are minimal. A comparison of the two results indicates some particles traveling a slightly different path, but destinations do not change. For particles still traveling at the end of the simulation (i.e. not captured by evapotranspiration or final void lakes), particles released at the end of mining travel a slightly longer distance (due to the longer simulation period).

Flow path descriptions and conclusions as presented for the post mining particle release time (**Section 8.2.6.2**) apply to the post mining equilibrium particle release time. No particles are predicted to travel outside of the mine lease in the 1300-year simulation.

8.2.6.4 Conclusion

Water associated with spoil and tailings deposition, underground mine workings or open cut residual void lakes is not predicted to migrate away from the BWM Area post mining, with the residual voids acting as passive containment for groundwater which has passed through the mine workings. This includes for the four residual voids predicted to have an outwards flux, with particle tracking simulations validating the outwards flux is driven by, and captured by, the adjoining residual voids with significantly lower lake levels.





Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	21-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

PREDICTED MOVEMENT OF PARTICLES (2641 - 4040)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 8-45

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_F08_45_Predicted Movement of Particles Post Mining (2641 - 4040)

9.0 Conceptual Site Model - Post Mining

A visual representation of the post mining conceptual hydrogeological model following the groundwater modelling presented in **Figure 9-1** for the northern area of BWM and **Figure 9-2** for the southern area of BWM. It is an update to the preliminary assessment of potential impacts provided in **Section 7.2** utilising the modelling prepared for the PRC Plan.

Based on the understanding of hydrogeological mechanisms and groundwater modelling presented in this report, key features relevant to the discussion of potential groundwater impacts post-mining include:

- Residual void lake formation, with lake levels stabilising significantly below any shallow post-Permian strata, including the base of surficial weathering and shallow hydrostratigraphic units (i.e. alluvium and Tertiary strata) for most void except Comet East Downs.
- Partial groundwater system recovery outside the residual voids, primarily in the Rangal Coal Measures.
- Continued groundwater drawdown within the Rangal Coal Measures, associated with evaporative discharge from the void lakes, resulting in continued inwards hydraulic flow gradients in the coal measures and ongoing groundwater discharge to the residual voids, keeping the residual void lakes as groundwater sinks.
- Potential for ongoing salinization of the residual void lakes associated with evaporative discharge from the lakes.
- Reflooding of historical underground workings.
- No potential for groundwater quality impacts outside of the BWM Area associated with residual voids or spoil emplacements, due to the inward groundwater flow gradients towards the residual voids continuing to capture all potential seepage.
- No potential for groundwater quality impacts outside of the BWM Area associated with in-pit tailings emplacements at Bonnie Doon and Laleham, due to the inward groundwater flow gradients towards the residual voids continuing to capture all potential seepage.

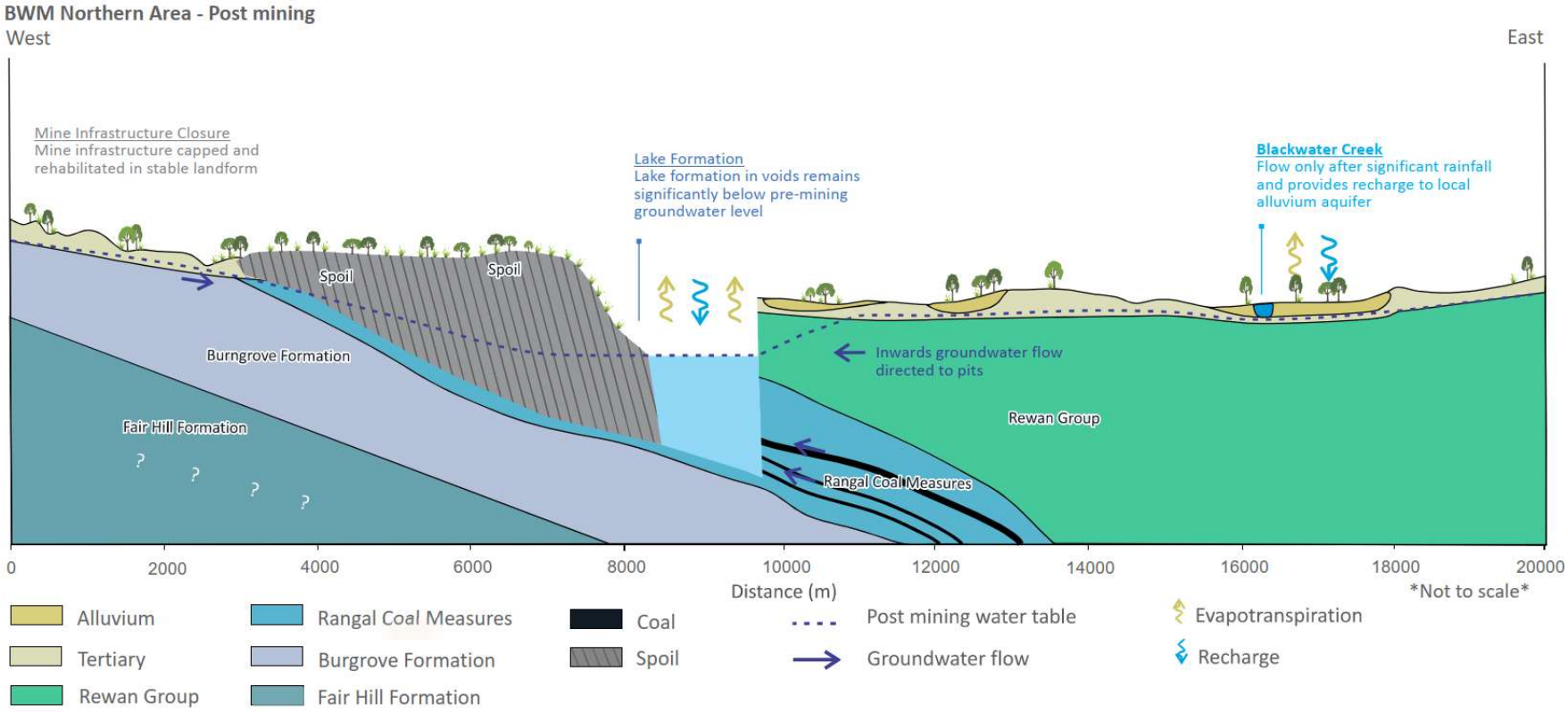


Figure 9-1 Conceptual Model of BWM Groundwater System – BWM Northern Area (Post Mining)

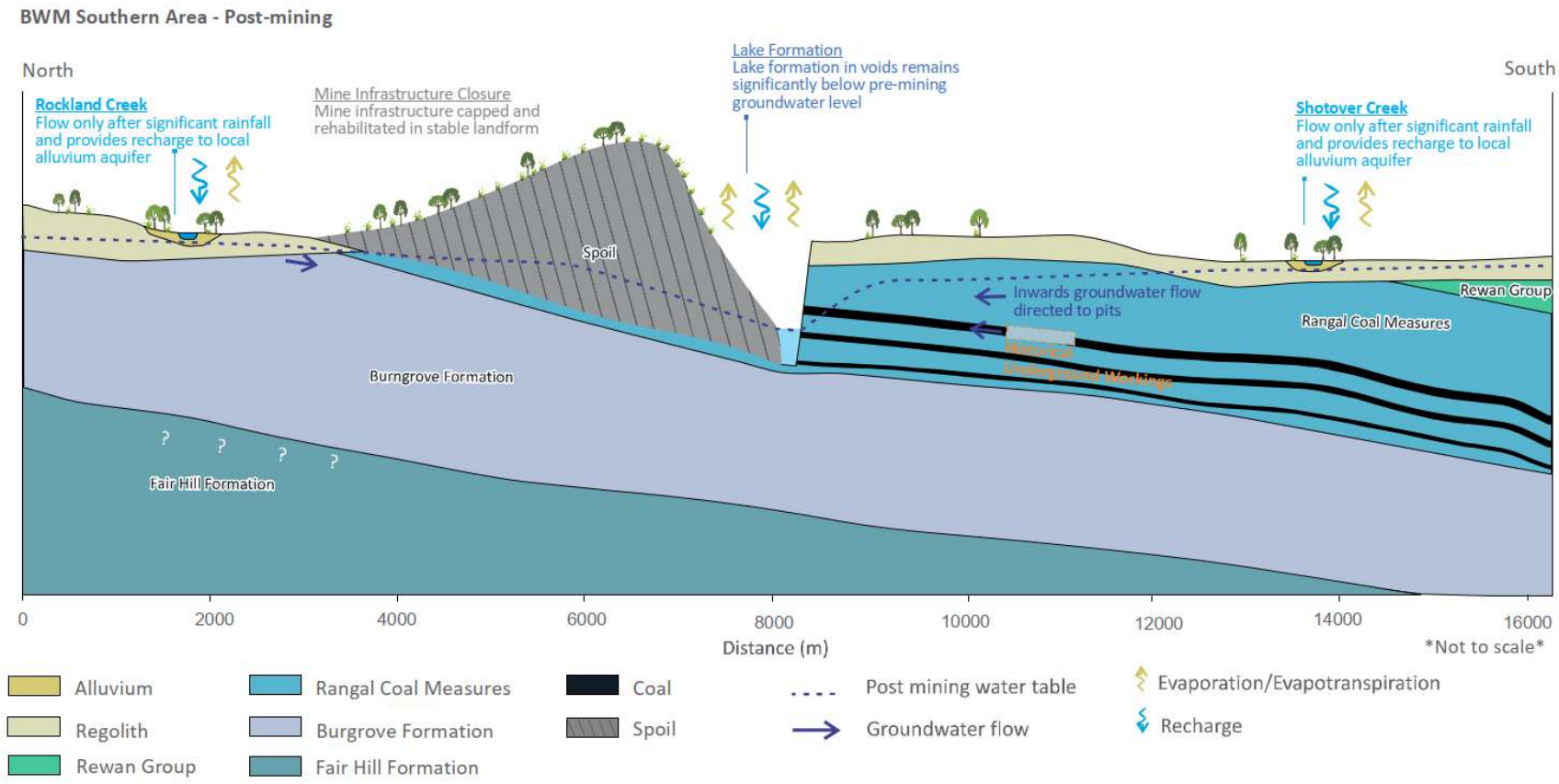


Figure 9-2 Conceptual Model of BWM Groundwater System – BWM Southern Area (Post Mining)

10.0 References

Arrow Energy. (2013). Arrow Bowen Gas Project Supplementary Report to the EIS Chapter 7 Groundwater. https://www.arrowenergy.com.au/__data/assets/pdf_file/0007/28987/07-Groundwater.pdf

Australasian Groundwater and Environmental (AGE) Consultants, 2020. Blackwater Mine Southern Leases Monitoring Bore Installation Report. Prepared for BMA. Project No. BWM5000.001

Australasian Groundwater and Environmental (AGE) Consultants, 2020. Blackwater Mine Monitoring Bore Installation Report. Northern Lease Area ML1759 and ML1762. Prepared for BMA

Australasian Groundwater and Environmental (AGE) Consultants, 2003. Report on CBM Extraction – South Blackwater Area, Prepared for Prepared for BMA. Project No. G1187

Australasian Groundwater and Environmental (AGE) Consultants, 2008. Report on Groundwater Regime and Monitoring Program – Blackwater Mine, Prepared for BMA. Project No. G1426

Australasian Groundwater and Environmental (AGE) Consultants, 2013. Minyango Project Groundwater, Project G1562, Report for Hansen Bailey, April 2013.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG), 2018. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

Barnett, B, Townley, LR, Post, V, Evans, RE, Hunt, RJ, Peeters, L, Richardson, S, Werner, AD, Knapton, A & Boronkay, A, 2012. Australian Groundwater Modelling Guidelines. Waterlines Report 82, National Water Commission, Canberra.

BHP Billiton Mitsubishi Alliance (BMA), 2014. Blackwater Mine Seam Correlation Diagram. Drawn RRM, 15-08-2014, BW-150.CDR.

Bureau of Meteorology (BoM), 2017. Groundwater Dependent Ecosystems Atlas. Available at: http://www.bom.gov.au/water/groundwater/gde/map.shtml

Byrnes Geotechnical, 2024. Geotechnical considerations for closure of underground mines at BMA Blackwater. Prepared for BMA. Report reference: BMA-10 BLACKWATER PRCP.

Clark, D., McPherson, A. and Collins, C., 2011. Australia's seismogenic neotectonic record. Geoscience Australia record 2011/11.

Coffey, 2014. Appendix E - Supplementary Groundwater Assessment, Arrow Energy Bowen Gas Project. Supplementary Report to the EIS.

Department of Environment and Heritage Protection (DEHP), 2011a. Environmental Protection (Water) Policy 2009 Comet River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Comet River Sub-basin

Department of Environment and Heritage Protection (DEHP), 2011b. Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin

Department of Regional Development, Manufacturing and Water (DRDMW). (2023). Groundwater Database – Queensland. Available at http://qldspatial.information.qld.gov.au/catalogue/custom/search.page?q=%22Groundwater Database - Queensland%22

EMM, 2023a Blackwater Mine North Extension Project – Terrestrial Ecology Matters of National Environmental Significance (MNES) Assessment. Report prepared for BMA.

EMM, 2023b Aquatic Ecology Baseline Assessment Blackwater Mine – North Extension Project. Report prepared for BMA.

EMM, 2021. Hydrogeological Conceptual Site Model and Data Gap Analysis – Blackwater Mine. Prepared for BHP Billiton Mitsubishi Alliance. Report Number B200604 PR#2 (draft).

EMM, 2019 Blackwater Mine - Groundwater Gap Analysis and Monitoring Recommendations, Prepared for BHP Billiton Mitsubishi Alliance February 2019

Flodin, E.A., Aydin, A., Durlofsky, L.J. and Yeten, B., 2001. Representation of Fault Zone Permeability in Reservoir Flow Models. SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana.

Food and Agriculture Organization of the United Nations (FAO), 2013. Chapter 2 – Saline waters as resources. Available at: http://www.fao.org/3/t0667e/t0667e05.htm

Geoscience Australia, 2021. Australian Stratigraphic Unit Database. https://asud.ga.gov.au/search-stratigraphic-units

GHD , 2023. Blackwater Mine – Groundwater Contaminant Trigger Levels Report. Prepared for BHP. Report Number 4131665.

Henderson Geotech, 2024. Concept Cover Designs for Waste Storage Facilities at Blackwater Mine. Prepared for Whitehaven Coal by Henderson Geotech Pty Ltd.

HydroBalance, 2026. Blackwater North Extension Project Water Balance Assessment Report. Prepared for Whitehaven Coal. Report Reference: WHC-037-C1_DRAFT

Hydrogeologist Field Services (HydroFS), 2021. Hydrogeological Drilling Report. Blackwater mine Tailings Solution Project. Hydrogeologist Field Services, Prepared for Engeny Water Management Pty Ltd.

Jourde H, Flodin E.A., Aydin A., Durlofsky L.J., and Wen X.H., 2002. Computing permeability of fault zones in eolian sandstone from outcrop measurements. AAPG Bulletin, v. 86, no. 7, p. 1187–1200.

Mallett, C.W, Grimstone, L.R; Gorman, J.M, 1985. Structural lineaments in the Blackwater area. The GSA Coal Geology Group, Bowen Basin Coal Symposium. Abstracts, Geological Society of Aust, 17, p. 143-144.

McDonald, M.G., Harbaugh, A.W, A.W., 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model., In: Techniques of Water-Resources Investigations, Book 6, U.S. Geological Survey.

MDBC (Middlemis, H., Merrick, N., and Ross, J.), 2001. Murray-Darling Basin Commission – Groundwater Flow Modelling Guideline. Report for MDBC. January 2001.

National Health and Medical Research Council, Natural Resource Management Ministerial Council (NHMRC, NRMMC) 2011. Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

Paul P.K, Zoback M.D, and Hennings P.H. 2009. Fluid Flow in a Fractured Reservoir Using a Geomechanically Constrained Fault-Zone-Damage Model for Reservoir Simulation. SPE Reservoir Evaluation & Engineering, Volume 12, Number 4, p. 562-575

Peeters LJM and Middlemis H 2023. Information Guidelines Explanatory Note: Uncertainty analysis for groundwater modelling, A report prepared for the Independent Expert Scientific



Committee on Coal Seam Gas and Large Coal Mining Development through the Department of Climate Change, Energy, the Environment and Water, Commonwealth of Australia, 2023

Queensland Government, 2025. Scientific Land Owners (SILO) database – Australian climate data from 1889 to yesterday. https://www.longpaddock.qld.gov.au/silo/point-data/

RDM Hydro, 2023. Groundwater Dependent Ecosystem Desktop Assessment Blackwater Mine, prepared for BMA, January 2023

Richardson S, et al 2011. Australian groundwater-dependent ecosystem toolbox part 1: assessment framework, Waterlines report, National Water Commission, Canberra.

SLR, 2026a. Blackwater North Extension Project - Groundwater Impact Assessment. Prepared for Whitehaven Coal Pty Ltd. Report reference: 640.01031809.00001-R01-v4.0.

SLR, 2026b. Blackwater North Extension Project – Groundwater Modelling Technical Report. Prepared for Whitehaven Coal Pty Ltd. Report reference: 640.031809.00001-R02-v3.0

SLR, 2025a. Blackwater Mine – Transitional PRC Plan Hydrogeology Assessment – Revision 2. Prepared for Whitehaven. Report reference: 620.040199.00012-R01-v2.0, November 2025.

SLR, 2025b. Blackwater Mine 2025 Groundwater Monitoring and Management Program Review. Prepared for Whitehaven, report reference: 620.041706.00001-R02-v2.0

SLR, 2025a. Blackwater Mine – Modelling Technical Report Calibration. Prepared for BMA. Report reference: 620.040199.00001 -v1.0_11.09.2025.docx, September 2025.

SLR, 2023a. Blackwater Mine – North Extension Project Groundwater Impact Assessment. Prepared for BMA. Report reference: 620.014601.00006-R01-v2.3_14.12.2023.docx, December 2023.

SLR, 2023b. Blackwater Mine – North Extension Project Groundwater Modelling Technical Report. Prepared for BMA. Report reference: 620.014301.00006-R02-v4.0_20231211.docx, December 2023.

SLR, 2023c. Saraji East Mining Lease Project Groundwater Modelling Technical Report. Prepared for AECOM. Report reference: 620.31025.00000-R01-v4.1-20230531.docx, May 2023.

SLR, 2021. Caval Ridge Mine Horsepit Extension Project Groundwater Assessment. Prepared for BMA. Report reference: 620.13593.00005-R01, December 2021

S.S. Papadopulos & Associates, Inc., 2018. mod-PATH3DU, version 2.1.2. Rockville, Maryland.

Terrenus Earth Sciences, 2024. Blackwater Mine Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste. Prepared for Whitehaven Blackwater Pty Ltd.

Uysal, T., Golding, S. and Glikson, M., 2000. Thermal and Fluid Flow History in the Bowen Basin. Bowen Basin Symposium 2000.

Wilford, John; Searle, Ross; Thomas, Mark; Pagendam, Dan; Grundy, Mike. 2016 A Regolith depth map of the Australian continent. Geoderma. 2016; 266:1-13. https://doi.org/10.1016/j.geoderma.2015.11.033

WSP, 2024, Void Closure Plan – Blackwater Mine. Prepared for Whitehaven Coal Limited by WSP.



Appendix A 80th Percentile Summary Statistics and Comparison to Guideline Values

Blackwater Mine

PRC Plan Hydrogeology Assessment – Revision 3

Whitehaven Blackwater Pty Ltd

SLR Project No.: 620.040199.00017

28 September 2026

Appendix A - 80th Percentile Summary Statistics and Comparison to Guideline Values

WQO Zone	Monitored Unit	Bore	pH (20th)	pH (80th)	TDS	EC	Ca	Cl	Na	Mg	SO4	Hardness as CaCO3	Alkalinity as CaCO3	HCO3	Nitrate as N	SiO2	Fluoride	Al (Diss)	Be (Diss)	B (Diss)	Cd (Diss)	Cr (Diss)	Co (Diss)	Cu (Diss)	Fe (Diss)	Pb (Diss)	Li (Diss)	Mn (Diss)	Hg (Diss)	Mo (Diss)	Ni (Diss)	Se (Diss)	Ag (Diss)	As (Diss)	U (Diss)	V (Diss)	Zn (Diss)
Units			-	-	mg/L	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Australian Drinking Water Guidelines (Aesthetic) (NHMRC, NRMMC, 2011)			6.5	8.5	600	-	-	250	180	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	1	0.3	-	-	0.1	-	-	-	-	-	-	-	3
Australian Drinking Water Guidelines (Health) (NHMRC, NRMMC, 2011)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	0.06	4	0.002	0.05	-	2	-	0.01	-	0.5	0.001	0.05	0.02	0.01	0.1	0.01	0.02	-	-
Aquatic Ecosystem (95% Protection) (ANZG, 2018)			6.5	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.055	-	-	0.0002	0.001	-	0.0014	-	0.0034	-	1.9	0.0006	-	0.011	0.005	0.05	0.024	-	-	0.008
Irrigation (Fitzroy Basin WQO)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	0.1	0.5	0.01	0.1	0.05	0.2	0.2	2	2.5	0.2	0.002	0.01	0.2	0.02	-	0.1	0.01	0.1	2
Stock (Fitzroy basin WQO)			-	-	5000	-	-	-	-	-	-	-	-	-	-	-	2	5	-	5	0.01	1	1	1	-	0.1	-	-	0.002	0.15	1	0.02	-	0.5	0.2	-	20
Zone 35 Shallow Groundwater (<30m)			7.59	7.93	-	1983	81	392	256	58	25	430	556	646	9.6	72	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 35 Deep Groundwater (>30m)			7.37	8.01	-	13604	366	5368	2555	226	122	1905	311	376	0.5	76	0.5	-	-	-	-	-	-	0.01	0.047	-	-	2.495	-	-	-	-	-	-	-	0.27
Zone 36 Shallow Groundwater (<30m)			7.7	8.35	-	7410	105	2373	1511	72	120	528	843	1021	7.5	60	0.39	-	-	-	-	-	-	-	0.02	-	-	0.07	-	-	-	-	-	-	-	-
Zone 36 Deep Groundwater (<30m)			8.21	8.66	-	7255	75	1945	1748	106	210	619	1322	1549	2.9	81	1.12	-	-	-	-	-	-	-	0.047	-	-	0.047	-	-	-	-	-	-	-	-
Zone 35 shallow	Alluvium	BWM_MB01_01	6.7	7.1	11400	21280	124.2	6005	3412	341	475		828.6	828.6	0.04		0.76	0.005	0.0005	2.04	0.0001	0.0005	0.0056	0.0016		0.0005	0.08	0.534	0.00005	0.004	0.005	0.005	0.0005	0.0014	0.0468	0.005	0.0536
Zone 35 shallow	Tertiary	BWM_MB15_01	3.1	3.2	3980	6354	14	1980	816	122	8		1	1	1.12		2.90	49.120	0.12	1.8	0.0004	0.012	0.06	0.063	0.184	0.011		0.2286	0.00005	0.0005	0.148	0.005	0.005	0.004	0.0070	0.005	0.195
Zone 35 shallow	Tertiary	BWM_MB17_02	7.2	7.3	363	570	8	60.8	118	6	10		194	194	0.01		0.7	0.011	0.00005	0.50	0.00005	0.0005	0.0005	0.0005	0.286	0.0005		0.144	0.00005	0.0024	0.006	0.005	0.005	0.002	0.0005	0.005	0.003
Zone 35 shallow	Tertiary	MB21	6.4	6.9	10300	14700	520.6	4806	2258	584	1944		573.6	574	0.01		0.20	0.010	0.0005	0.6	0.00005				3.056			0.3266	0.0001	0.001	0.004	0.01	0.001	0.002			0.017
Zone 36 shallow	Rewan Group	BWM_MB03_02	7.2	7.4		39140	1960	13000	6220	145	3							0.025		0.25					1.578			6.638	0.00025	0.0025	0.0214	0.025		0.0025			0.0241
Zone 36 shallow	Rewan Group	MB19BWM02A	6.2	6.4	29000	38000	1001.2	13500	7086	1064	511	6862	454	454	0.01	12.9	0.10	0.050	0.005	0.70	0.0005	0.005	0.005	0.031	0.368	0.005	0.14	0.103	0.00025	0.005	0.014	0.05	0.005	0.005	0.0025	0.050	0.2400
Zone 36 shallow	RCM north	BWM_MB02_01	6.668	6.7	18500	25080	608.6	8896	4076	607.4	372		346	346	0.01		0.05	0.005	0.0005	0.30	0.00005	0.0005	0.0005	0.0005	2.846	0.0005		0.597	0.00005	0.0005	0.0156	0.005	0.005	0.0025	0.0005	0.005	0.0156
Zone 36 deep	RCM north	MB1	6.55	6.8	26500	35800	756.8	12940	6886	704.4	372		368	368	0.01		0.05	0.050	0.0025	0.25	0.00025	0.0025	0.0025	0.0025	3.944	0.0025		0.144	0.0001	0.005	0.014	0.05	0.005	0.005	0.0025	0.025	0.0125
Zone 36 deep	RCM north	MB19BWM01P	6.992	9.8	16600	26000.6	243	9214	5800	138.4	7	1180	657	660	0.01	22.7	0.30	0.050	0.005	0.45	0.0004	0.004	0.004	0.005	1.548	0.004	1.21	0.121	0.0001	0.0336	0.005	0.035	0.0035	0.005	0.0013	0.050	0.072
Zone 36 deep	RCM north	MB19BWM27P	6.63	6.8	9348	14700.4	119	4440	3390	54	1	529	1896	1896	0.01	23.4	0.4	0.010	0.001	1.36	0.0002	0.001	0.007	0.0058	2.28	0.001	1.70	0.275	0.0001	0.004	0.013	0.01	0.001	0.0122	0.0005	0.010	1.292
Zone 36 deep	RCM north	MB20BWM03P2	6.89	7.0	12260	19820	167	6878	4276	104	3	957	584	584	0.01	20.8	0.4	0.005	0.0005	0.42	0.00005	0.0005	0.004	0.0164	1.288	0.0005	1.71	0.0968	0.00005	0.005	0.005	0.005	0.0005	0.0025	0.0020	0.005	0.3236
Zone 36 deep	RCM north	MB18	6.68	7.2	12160	17360	645.8	6370	2970	117	3		120	120	0.02		0.20	0.010	0.0005	0.48	0.00005	0.0005	0.0005	0.0005	2.558	0.0005		2.328	0.0001	0.001	0.009	0.01	0.001	0.001	0.007	0.0005	0.005	0.026
Zone 36 deep	RCM north	MB19BWM08P	7.446	7.6	3468	5411	33	1370	1216	6	2	109	788	799	0.01	17.8	0.50	0.010	0.001	1.56	0.0001	0.001	0.001	0.001	0.202	0.001	0.68	0.048	0.0001	0.003	0.003	0.01	0.001	0.001	0.0005	0.010	0.1216
Zone 36 deep	RCM north	BWM_MB02_02	8.08	9	10000	3420	8	715.6	704.4	6	4		17					0.008		1					0.06			0.011	0.00005	0.0268	0.0005	0.005	0.0005	0.002			0.0025
Zone 35 deep	RCM north	BWM_MB12_02	8.174	9.4		1952	14	423.8	405	6	25							0.009		0.20					0.062			0.003	0.00005	0.024	0.0005	0.005		0.004			0.0025
Zone 35 shallow	RCM south	BWM_MB14_01	6.5	6.6	13100	17780	374	5344	2784	717	1892		865.6	865.6	0.01		0.05	0.012	0.0005	0.80	0.00005	0.0005	0.002	0.0005	5.61	0.0005		1.418	0.00005	0.001	0.0192	0.005	0.0005	0.0066	0.0040	0.005	0.0158
Zone 35 deep	RCM south	BWM_MB14_02	7.6	7.7	4732	7408	7	1100	1980	8	26		2730	2856	0.01		1.8	0.014	0.0005	0.30	0.00005	0.0005	0.0007	0.0005	0.36	0.0005		0.011	0.00005	0.0005	0.001	0.005	0.0005	0.004	0.0005	0.005	0.0025
Zone 36 deep	Burngrove Formation	BG No.1 AP	7.17	7.9	4060	6950	37	1930	1504	21.6	28		670	691	0.01		0.60	0.010	0.0005	0.5	0.00005	0.0005	0.0005	0.0005	0.08	0.0005		0.017	0.0001	0.001	0.0005	0.01	0.001	0.001	0.0005	0.005	0.0060
Zone 36 deep	Burngrove Formation	BG No.2 BG	6.572	7.3	11140	17200	303.8	5238	3078	472.8	1510		875	875	0.01		0.20	0.010	0.0005	0.9	0.00005	0.0005	0.0005	0.0005	0.43	0.0005		0.195	0.0001	0.001	0.0348	0.01	0.001	0.001	0.0005	0.005	0.0025

Highlight cell indicates 80th Percentile is above criteria:

- Australian Drinking Water Guidelines (Aesthetic) (NHMRC, NRMMC, 2011)
- Australian Drinking Water Guidelines (Health) (NHMRC, NRMMC, 2011)
- Aquatic Ecosystem (95% Protection) (ANZG, 2018)
- Irrigation (Fitzroy Basin WQO)
- Stock (Fitzroy basin WQO)
- Zone 35 Shallow Groundwater (<30m)
- Zone 35 Deep Groundwater (>30m)
- Zone 36 Shallow Groundwater (<30m)
- Zone 36 Deep Groundwater (<30m)
- Multiple of above

Appendix B Groundwater Modelling Technical Report

Blackwater Mine

PRC Plan Hydrogeology Assessment – Revision 3

Whitehaven Blackwater Pty Ltd

SLR Project No.: 620.040199.00017

28 September 2026

Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

Level 31, 12 Creek Street
Brisbane QLD 4000 Australia

Prepared by:

SLR Consulting Australia

Level 16, 175 Eagle Street, Brisbane QLD 4000,
Australia

SLR Project No.: 640.031809.00001

7 October 2026

Revision: V4.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	13 February 2026	Haili Jia	Louis Bouchet	Brian Rask
2.0	27 March 2026	Haili Jia	Louis Bouchet	Brian Rask
3.0	09 April 2026	Haili Jia	Brian Rask	Brian Rask
4.0	7 October 2026	Haili Jia	Brian Rask	Brian Rask

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Whitehaven Blackwater Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.



Table of Contents

Basis of Report i
1.0 Introduction 1
1.1 Background 1
1.2 This Report 1
1.3 Model Objectives 1
2.0 Model Construction 2
2.1 Model Code 2
2.2 Model Extent and Mesh Design 2
2.3 Model Layers 4
2.3.1 Geological Structures 6
2.4 Timing 8
2.5 Parameterisation 8
2.6 Model Stresses and Boundary Conditions 11
2.6.1 Regional Groundwater Flow 11
2.6.2 Watercourses 11
2.6.3 Rainfall Recharge 14
2.6.4 Evapotranspiration 16
2.6.5 Mining 18
3.0 Calibration 21
3.1 Calibration Method 21
3.2 Calibration Dataset 21
3.2.1 Groundwater Levels 22
3.2.2 Drawdown 22
3.2.3 Calibration Weighting 23
3.3 Calibration Performance 23
3.3.1 Calibration Statistics 23
3.3.2 Calibration Hydrographs 29
3.4 Calibration Results 35
3.4.1 Calibrated Fluxes 35
3.4.2 Calibrated Hydraulic Parameters 37
3.4.3 Calibrated Boundary Conditions 40
3.4.4 Calibrated Water Table Elevation 42
4.0 Predictive Modelling – Mining Period 45
4.1 Timing and Mining 45
4.2 Water Balance 47

4.3 Predicted Groundwater Levels 50
4.4 Maximum Predicted Drawdowns 55
4.4.1 Maximum Incremental Drawdowns 55
4.4.2 Maximum Cumulative Drawdowns 55
4.5 Predicted Groundwater Interception 65
4.6 Incidental Water Impacts 66
4.6.1 Alluvium Take 66
4.6.2 Groundwater – Surface Water Interaction 66
4.6.3 Drawdown at Landholder Bores 67
5.0 Predictive Modelling – Post Mining 70
5.1 Timing 70
5.2 Final Voids Inflows 70
5.2.1 Methodology 70
5.2.2 Results 73
5.3 Particle tracking 79
6.0 Sensitivity Analysis 82
6.1 Purpose 82
6.2 Methodology 82
6.2.1 Data Aggregation and Standardisation 82
6.2.2 Spearman Rank Correlation Coefficient 83
6.2.3 Linear Regression Sensitivity Coefficient 83
6.2.4 Interpretation 83
6.3 Results 84
6.3.1 Calibration Sensitivity (Parameter Conditioning) 84
6.3.2 Predictive Sensitivity 84
6.3.3 Type I-IV Analysis 85
6.3.4 Conclusion 89
6.4 Mine Inflows 90
7.0 Uncertainty Analysis 91
7.1 Uncertainty Convergence 92
7.2 Uncertainty Results 94
7.2.1 Uncertainty in Mine Inflows 94
7.2.2 Uncertainty in Alluvium Take 95
7.2.3 Uncertainty on Surface Water Flow 97
7.2.4 Uncertainty in Drawdown 97
8.0 Model Confidence and Limitations 98
8.1 Conclusions 102

9.0 References 103

Tables

Table 2-1 Model Layers and Thicknesses 5
Table 2-2 Model Timing 8
Table 2-3 Hydraulic Property Zones 9
Table 2-4 River and Surface Water Features in the Model 12
Table 2-5 Mining Infrastructure in the Model 12
Table 2-6 Fracture Zone Multipliers 20
Table 3-1 Summary of Initial Groundwater Levels used for Calibration Targets 22
Table 3-2 Summary of Drawdowns Used for Calibration Targets 23
Table 3-3 Calibration Statistics 24
Table 3-4 Average Residual by Model Layer 27
Table 3-5 Steady-State Model Water Balance 35
Table 3-6 Transient Model Water Balance 36
Table 3-7 Calibrated Hydraulic Conductivity 38
Table 3-8 Calibrated Storage Parameters 39
Table 3-9 Calibrated Rainfall Recharge 40
Table 3-10 Calibrated Evapotranspiration Rate and Extinction Depth Bounds 41
Table 3-11 Calibrated River Vertical Conductivity 42
Table 3-12 Calibrated Tailing Deposition Vertical Conductivity 42
Table 4-1 Average Simulated Water Balance over the Predictive Period - Cumulative 47
Table 4-2 Average Simulated Water Balance over the Predictive Period – Approved 48
Table 4-3 Average Simulated Water Balance over the Predictive Period - Null Run 48
Table 4-4 Drawdown Impact on Landholder Bores 68
Table 5-1 Stress Period Set-up for Post Mining Model 70
Table 5-2 Final Voids – Equilibrium Water Levels and Groundwater Levels (From North to South) 74
Table 6-1 Comparison of Spearman and Regression in Sensitivity Analysis 84
Table 6-2 Type IV Parameters 88
Table 8-1 Groundwater Model and Data Limitations 99

Figures

Figure 2-1 Model Mesh and Boundary Conditions 3
Figure 2-2 Faults in the Model 7
Figure 2-3 Pilot Points Locations 10

Figure 2-4 River Cells 13
Figure 2-5 Recharge Zones 15
Figure 2-6 Evapotranspiration Zones 17
Figure 2-7 Mining Progression 19
Figure 3-1 Calibration Scattergram 25
Figure 3-2 Calibration Residual Histogram 26
Figure 3-3 Transient Calibration Average Head Residuals (m) 28
Figure 3-4 Calibration Fit - Alluvium and Regolith Bores 30
Figure 3-5 Calibration Fit - Interburden Bores 32
Figure 3-6 Calibration Fit – Coal Seams Bores (Aries and Castor) 33
Figure 3-7 Calibration Fit – Coal Seams Bores (Pollux and Orion) 34
Figure 3-8 Transient Water Balance 37
Figure 3-9 Calibrated Water Table Elevation, Steady State 43
Figure 3-10 Calibrated Water Table Elevation, End of Calibration 44
Figure 4-1 Project Indicative Mine Progression 46
Figure 4-2 Transient Water Balance Over the Prediction Period – Cumulative 49
Figure 4-3 Transient Water Balance Over the Prediction Period - Approved 49
Figure 4-4 Transient Water Balance Over the Prediction Period – Null Run 50
Figure 4-5 Predicted Water Level within the Alluvium and Tertiary (Layer 1) at the End of Mining 51
Figure 4-6 Predicted Water Level within the Alluvium and Weathered Zone (Layer 2) at the End of Mining 52
Figure 4-7 Predicted Water Level within the Clematis Sandstone (Layer 3) at the End of Mining 53
Figure 4-8 Predicted Water Level within the Permian Coal Measures (Layer 12) at the End of Mining 54
Figure 4-9 Maximum Incremental (a) and Cumulative (b) Drawdown in the Alluvium and Tertiary (Layer 1) 57
Figure 4-10 Maximum Incremental (a) and Cumulative (b) Drawdown in the Alluvium and Weathered Zone (Layer 2) 58
Figure 4-11 Maximum Incremental (a) and Cumulative (b) Drawdown in the Upper Rewan Formation (Layer 4) 59
Figure 4-12 Maximum Incremental (a) and Cumulative (b) Drawdown in the Middle Rewan Formation (Layer 5) 60
Figure 4-13 Maximum Incremental (a) and Cumulative (b) Drawdown in the Lower Rewan Formation (Layer 6) 61
Figure 4-14 Maximum Incremental (a) and Cumulative (b) Drawdown in the Aries Seam (Layer 8) 62
Figure 4-15 Maximum Incremental (a) and Cumulative (b) Drawdown in the Pollux Seam (Layer 12) 63

Figure 4-16 Maximum Incremental (a) and Cumulative (b) Drawdown in the Burngrove Formation (Layer 16) 64
Figure 4-17 Predicted Cumulative and Incremental Project Mine Inflows 65
Figure 4-18 Predicted Alluvium Incremental Take 66
Figure 4-19 Predicted Incremental Loss in River Baseflow (Blackwater Creek) 67
Figure 5-1 Final Void Locations 72
Figure 5-2 Final Void Recovery Curves 73
Figure 5-3 Post-mining Groundwater Inflows to Stewarton South 74
Figure 5-4 Post-mining Groundwater Inflows to Stewarton North 75
Figure 5-5 Post-mining Groundwater Inflows to Deep Creek 75
Figure 5-6 Post-mining Groundwater Inflows to R30 76
Figure 5-7 Post-mining Groundwater Inflows to Mimosa Besgrove 76
Figure 5-8 Groundwater Table Recovery (Post-mining Equilibrium) 77
Figure 5-9 Groundwater Table Recovery (Post-mining Equilibrium), BWM North 78
Figure 5-10 Starting Location of Particles 80
Figure 5-11 Predicted Movement of Particles – Post-mining (2093 – 4040) 81
Figure 6-1 Predictive Sensitivity (Alluvium Take) Versus Calibration Sensitivity 86
Figure 6-2 Predictive Sensitivity (Drawdown) Versus Calibration Sensitivity 87
Figure 6-3 Predictive Sensitivity (Mine Inflow) Versus Calibration Sensitivity 87
Figure 6-4 Predictive Sensitivity (River Take) Versus Calibration Sensitivity 88
Figure 6-5 TVM Sensitivity Analysis – Predicted Cumulative Mine Inflows 91
Figure 7-1 Predictive Uncertainty Convergence – Alluvium Take 93
Figure 7-2 Predictive Uncertainty Convergence – Dewatering Rate 93
Figure 7-3 Predicted Open Cut Inflow Uncertainty - Cumulative Scenario 94
Figure 7-4 Uncertainty in Incremental Alluvium Take 95
Figure 7-5 Uncertainty in Cumulative Alluvium Take 96
Figure 7-6 Uncertainty in Incremental River Baseflow Loss 97

Appendices

Appendix A Calibration Residuals
Appendix B Calibration Hydrographs
Appendix C Predictive Period Timing
Appendix D Post-mining predicted water levels
Appendix E Parameter Distribution Plots for Sampled Prior and Calibrated Ensemble
Appendix F Sensitivity Analysis Plots
Appendix G Uncertainty in 1 m Drawdown Contours

1.0 Introduction

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) was engaged by Whitehaven Blackwater Pty Ltd, a wholly owned subsidiary of Whitehaven Coal Limited to undertake a Groundwater Impact Assessment for the Blackwater North Extension Project (the Project), for incorporation into an application for an Environmental Authority (EA) Amendment and an application for an *Environment Protection and Biodiversity Conservation Act 1999* Approval.

The Project is an extension of mining into Surface Area (SA) 10 on Mining Lease (ML) 1759 and SA 7 on ML 1762 utilising existing Blackwater Mine (BWM) mining methods, mining fleet, mine infrastructure and facilities.

As part of the Groundwater Impact Assessment, a numerical groundwater model for the BWM has been developed to predict impacts of the Project on the local groundwater regime.

1.2 This Report

This report outlines the technical details of the BWM numerical groundwater model development to support the BWM groundwater assessment.

The conceptualisation provides a simplified overview of the groundwater regime (i.e., the distribution and flow of groundwater) based on available data and expert knowledge. Maintaining consistency between the numerical model results and the conceptual understanding of the groundwater regime enhances the credibility of the model's predictions. The numerical model presented in this report was developed in line with the conceptual framework described in the BWM Groundwater Assessment report (SLR, 2026).

1.3 Model Objectives

Numerical modelling was undertaken in support of the hydrogeological assessment to evaluate the potential impacts of the Project on the groundwater regime. The overall objectives of this modelling are to:

- Assess the groundwater inflow to the mine workings as a function of mine position and timing.
- Simulate the extent of maximum groundwater drawdown/depressurisation due to the Project and also with respect to cumulative impacts.
- Simulate and predict the change in groundwater levels at identified groundwater users (i.e. registered bores, landholder bores and groundwater dependent ecosystems [GDEs]) due to the Project and also with respect to cumulative impacts.
- Simulate the direct and indirect take of groundwater and surface water (baseflow) due to the Project.
- Simulate the long-term impacts in the post-mining environment utilising the proposed final landform and void lakes.



2.0 Model Construction

2.1 Model Code

MODFLOW-USG Transport was used as the model code (Panday et al. 2013). MODFLOW-USG is a recent version of industry standard MODFLOW code and was determined to be the most suitable modelling code for accomplishing the model objectives. MODFLOW-USG optimises the model grid and increases numerical stability by using unstructured, variably sized cells. These cells take any polygonal shape, with variable size constraints allowing for refinement in areas of interest.

Where previous MODFLOW versions restricted interlayer flow to vertical connectivity, MODFLOW-USG offers lateral connectivity between model layers. Lateral connectivity enables more accurate representations of hydrostratigraphic units, particularly those that pinch out, outcrop or cross geological faults.

MODFLOW-USG is also able to simulate unsaturated conditions, allowing progressive mine dewatering and post mining rewetting to be represented by the model. For the BWM model, vadose zone properties have been excluded, and the unsaturated zone was simulated using the upstream-weighting method.

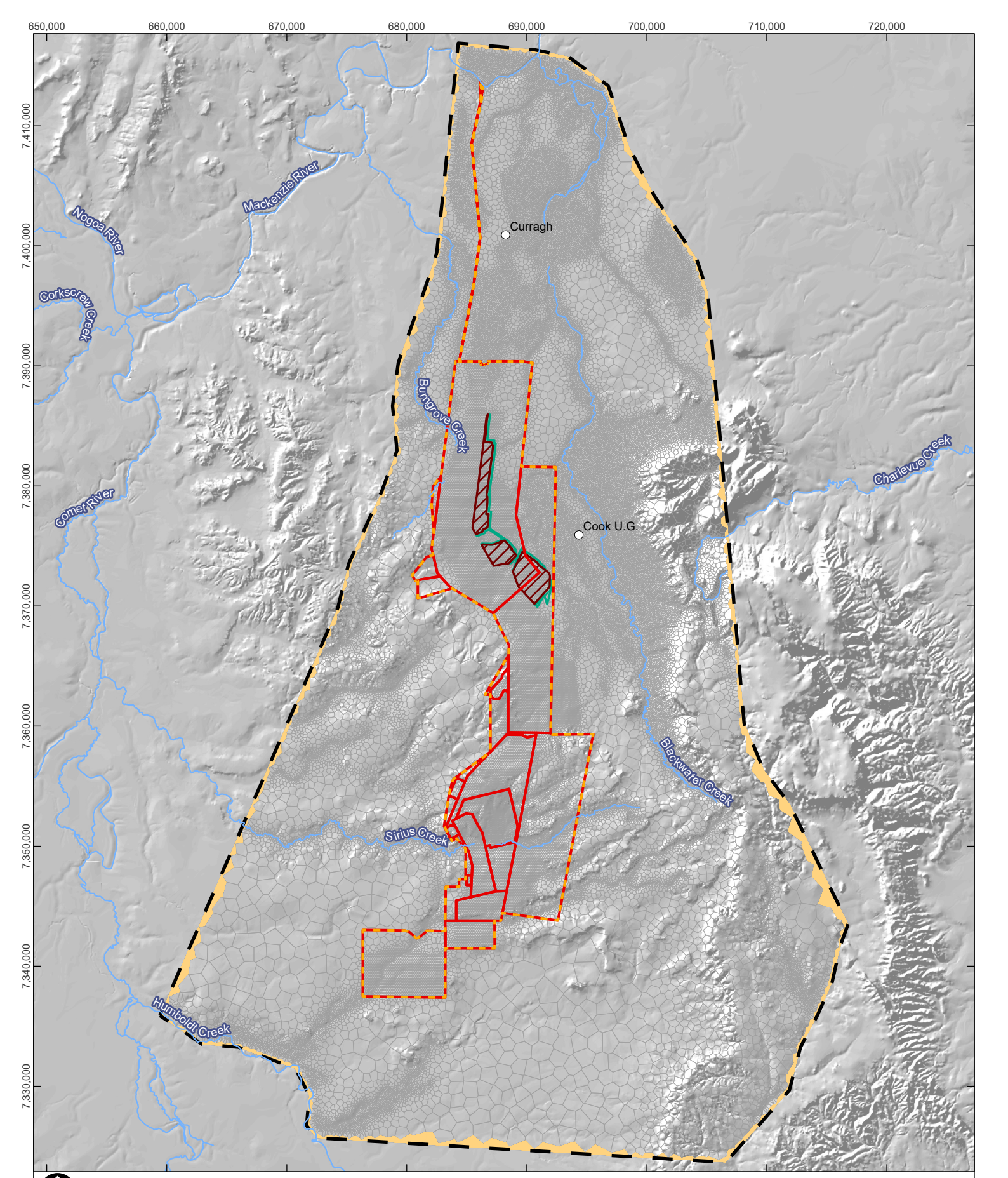
In-house Python codes and a MODFLOW-USG edition of the Groundwater Data Utilities (Watermark Numerical Computing) were used to construct the MODFLOW-USG input files.

2.2 Model Extent and Mesh Design

The model domain and mesh are presented on **Figure 2-1**. Both the northern and southern BWM geological models were adopted to set up the groundwater model layers. The model incorporates regional influences that have interacted with the local groundwater system in the past (during the calibration period) and may continue to interact with it in the future, including during the predictive mining and post-mining periods. These regional influences include operations at the Curragh Mine to the north (open cut) and underground mining at Cook Colliery to the east of BWM, both of which are considered to have a potential to interact with groundwater in the BWM area due to their proximity.

The model domain is intended to place boundary conditions sufficiently distant from the BWM site to allow the extent of potential impacts from mining activities on the groundwater system to be assessed. At its widest extents, the model is approximately 57 kilometres (km) west-east by 93 km north-south. The model domain was selected based on the following considerations:

- The western boundary is represented by the outcrop boundary of the Burngrove Formation, which underlies the Rangal Coal Measures (RCM) and is considered the basement formation for the purpose of this modelling.
- The northern boundary extends to include the open cut Curragh Mine and is 25 km north of the Project area.
- The southern boundary is set approximately 12 km south of the BWM site and is expected to be far outside the range of predicted BWM related drawdown.
- The eastern boundary is set along the Shotover fault which is located approximately 20 km to the east of the Project area. This boundary is expected to be far outside the range of predicted Project related drawdown.



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Coal Mine
- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- Model Grid
- General Head Boundary
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

MODEL MESH AND BOUNDARY CONDITIONS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_01_Model Mesh and Boundary Conditions

To allow stable numerical modelling of the large spatial area of the model domain, an unstructured grid with varying Voronoi cell sizes was designed using Algomesh (HydroAlgorithmics Pty Ltd, 2014). Varying Voronoi cell sizes allowed refinement around areas of interest, while a coarser resolution elsewhere reduces the total cell count to a manageable size. Compared with the previous model, the current mesh includes additional refinements around the bottom dam and underground mines. The refinement scale was also adjusted to ensure a reasonable total cell count.

Vertically, the model domain was vertically discretised into 17 layers, each layer comprising a cell count of up to 64,880. The total number of cells in the model is 815,467. This is after pinching out areas in layers 3 to 15 where layers are not always present based on the mapped geology. The current model also incorporates updated geological elevation data in South Blackwater, which were largely assumed in the previous model.

The following features have been included in the grid design:

- Open cut mining for the BWM including the historical mine and proposed extension is represented with a 150 metres (m) cell size constraint.
- Open cut mining for the historical Curragh mine is represented with a 200 m cell size constraint.
- Underground mining at Cook Colliery and Laleham projects has an oriented regular grid of 100 m width squares to represent longwalls.
- Underground mining at Sirius Creek No. 1 and 2 (ML 1771) are represented with a 50 m cell size constraint.
- Bottom dam area is represented with a 50 m cell size constraint.
- Alluvium areas are represented with a 200 m cell size constraint.
- Rivers, including major rivers and minor creeks and drains, are represented with a 100 m cell size constraint.
- The northwest-southeast striking faults within the model domain are represented with a 200 m cell size constraint.

2.3 Model Layers

The topography within the model domain has been defined using high-resolution (1 m) Digital Elevation Model data for pre-mining surface of the BWM area. Public domain 1-second Shuttle Radar Topography Mission data was used to define the topography in the remainder of the model domain.

The model domain is discretised into 17 layers, as listed in **Table 2-1**. Model layer extents (lateral and vertical) have been defined using data from the following sources:

- BWM site geological model.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) Regolith depth survey (Wilford et al, 2016).
- Queensland Globe bore hole logs.
- Queensland surface geology and basement geological maps.
- Office of Groundwater Impact Assessment (2019) model layers.

Layer 17 was designed as a basement layer to mitigate the risk of abnormal model behavior caused by the thin thickness of the Burngrove Formation in the western part of the model.



Table 2-1 presents the average thickness across the model domain for each layer.

Table 2-1 Model Layers and Thicknesses

Model Layer	Formation	Unit	Average Thickness (m)
1	Alluvium/Tertiary	Surface cover and Tertiary	8.5
2	Alluvium/Weathered zone	Weathered zone/Regolith	13.1
3	Clematis Group	Triassic	372.9
4	Rewan Group (Upper)	Triassic	309.4
5	Rewan Group (Middle)	Triassic	180.9
6	Rewan Group (Lower)	Triassic	114.9
7	RCM	Overburden	51.5
8		Aries seam	1.7
9		Interburden	15.2
10		Castor seam	1.7
11		Interburden	16.3
12		Pollux seam	4.2
13		Interburden	16.2
14		Orion seam	0.8
15		Underburden	17.9
16	Burngrove Formation	Permian	159.4
17	Basement	Permian and/or below	100.0

The regional site geology model (BM Alliance Coal Operations Pty Ltd, 25 m grid) provides the surfaces for tertiary and weathering zone within the BWM area. These surfaces were used to assign the bottom of layers 1 (i.e. Tertiary) and 2 (i.e. weathering) in the model. Outside the geology model extent, CSIRO Regolith survey depths (i.e. weathering depth) was used to define the base of layers 1 and 2. In doing so, the CSIRO Regolith depth was divided into two with each layer covering 50 percent (%) of total depth. Both Layers 1 and 2 are fully extensive across the model. The depth of alluvium was calculated from the site monitoring bores, drill holes, and available public Queensland Globe bore logs. Similar to weathering zone, layers 1 and 2 each cover 50% of total alluvium thickness, where present.

The underlying Rewan and Permian layers are present only to their outcrop extents, with some inference made for the presence of older units beneath the surface outcrop due to folding and faulting. The bottom of layers 3 to 16 was constructed based on the BWM geology model. Outside of the geology model extent, the surface geology map was used to define the location of outcrops of each unit. The average thicknesses were then extrapolated out into the extended model area to cover the layer outside the geology model.

As it is not practical to represent every individual coal seam in a regional groundwater model, a “combined thickness” totalling the individual seam thicknesses for each relevant seam has been simulated. The coal seams of the RCM were combined into four major coal seams: the Aries, Castor, Pollux and Orion seams.

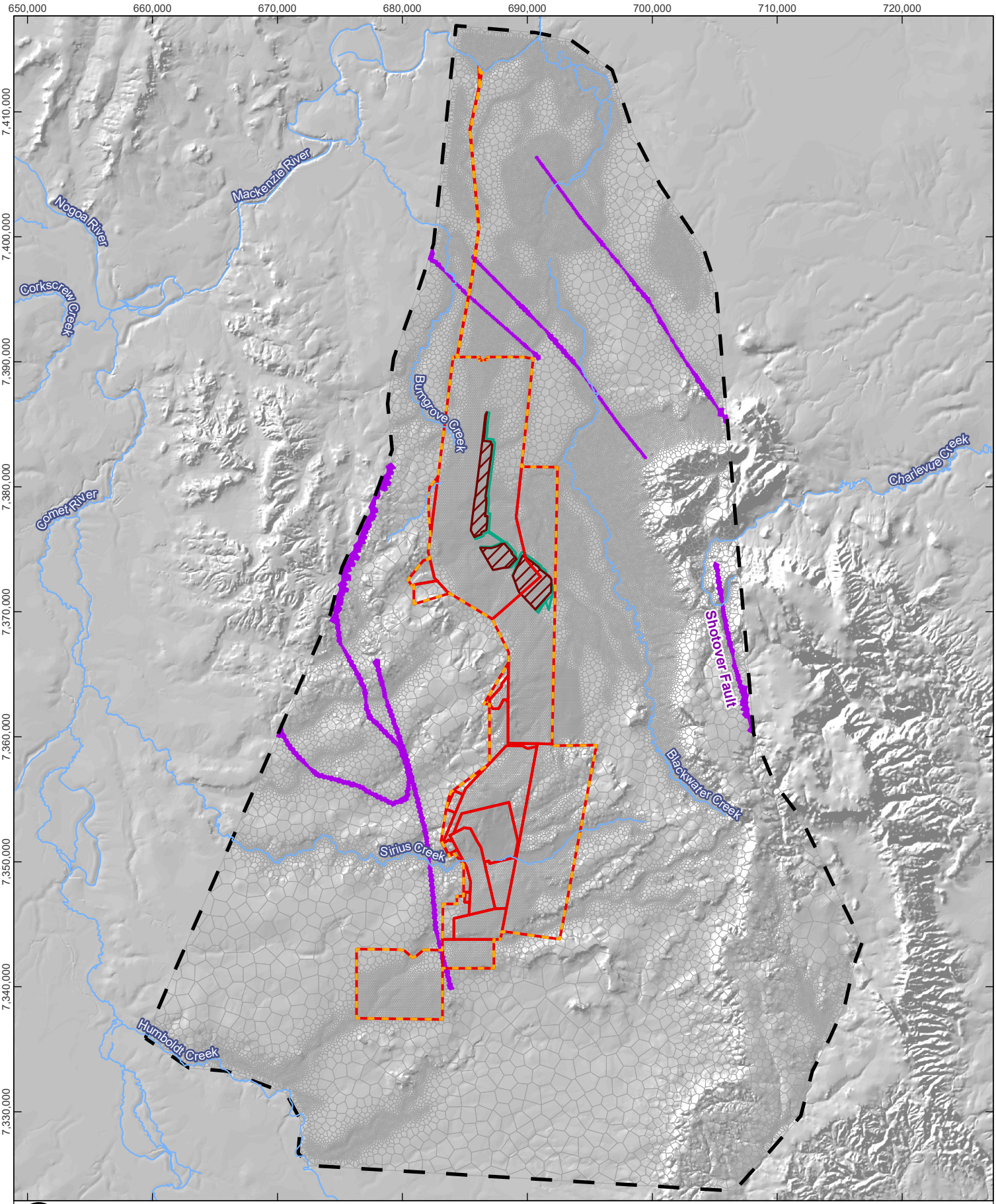
The Burngrove Formation is considered the regional low-permeability basement for the purpose of this modelling. However, due to its thin thickness in the western part of the model

and to prevent abnormal model behaviour, an extra layer, Layer 17, with a uniform thickness of 100 m, was added to define the base of the model and the western and eastern model boundaries.

2.3.1 Geological Structures

Mapped faults and geological structures in the vicinity of the Project area are shown in **Figure 2-2**. The most significant feature is the Shotover Fault, an east-dipping thrust fault with a displacement of up to 3,000 m (Mallet et al., 1988), located approximately 20 km east of the Project area and incorporated along the model's eastern boundary. Numerous smaller local faults are also mapped within the extent of the BWM and its proposed extension, with throws typically less than (<) 5 m, but reaching up to 20 m in some areas (Jeuken, 2011). These faults can fully offset coal seams and potentially act as barriers to groundwater flow, however, their hydraulic impacts are currently not well understood.

To reflect the structural complexity shown in **Figure 2-2**, the model grid was refined in areas where faults are present. While the faults were not assigned distinct hydraulic properties (e.g., reduced permeability or barrier features) due to the lack of site-specific hydrogeological data, their influence is implicitly incorporated through the layering and geometry in the refined grid. Should further data become available, the model could be updated to include fault-specific hydraulic characteristics.



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- Model Grid
- Fault Cell
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

LOCAL AND REGIONAL FAULTS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-2

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_02_Faults in the Model

2.4 Timing

The model timing includes a combined transient warm up, steady state and transient calibration periods (**Table 2-2**).

To help with convergence in the steady state, a warmup transient stress period of 5 years from January 1966 to December 1969 was added to the timing as stress period 1. The calibration period includes a combined steady state (pre-mining) period and a transient historical period from January 1970 to January 2005. The transient calibration period runs from January 2005 to December 2024 with quarterly time intervals to replicate influence of historical mining.

To assist the model in overcoming numerical difficulties, MODFLOW-USG Adaptive Time-Stepping (ATS) option was used. The ATS option of MODFLOW automatically decreases time-step size when the run fails to converge. Once the run converged with a reduced time-step size, it increases the time-step size for the next time step to speed up the model run time. The minimum time step size used in the simulations was one day.

Table 2-2 Model Timing

Stress Period	Date Start	Date End	Mining Period	Max Stress Period Length (days)	Max Time Step Length (days)
1	01-01-1966	31-12-1969	Transient Warmup	1,460	1,460
2	-	-	Steady State	1	1
3 - 5	01-01-1970	31-12-2004	Historical	12,784	5,479
6 - 85	01-01-2005	31-12-2024	Calibration	7,305	92

2.5 Parameterisation

The modelled hydraulic zones are reflective of the conceptual (and geological) model. The site conceptualisation, as presented in SLR (2024), describes the hydraulic conductivity (K) data sources and the horizontal (Kx) and vertical (Kz) hydraulic conductivity parameter ranges for each stratigraphic unit as derived from field data. Overall, a broadly declining K with depth is noted for most of the solid geology stratigraphic units.

In the model, the decrease in hydraulic conductivity of the RCM, Rewan Group and Burngrove Formation is simulated to decrease exponentially with depth according to the following equation:

$$HC = HC_0 \times e^{(Slope \times dept\ )}$$

where: HC = horizontal hydraulic conductivity at the specific depth

HC_0 = horizontal hydraulic conductivity at depth of 0 m

Slope = term representing slope of the formula (steepness of the curve)

Depth = depth of the floor of the layer (thickness of the cover material)

Note: The hydraulic conductivity at zero depth (HC_0) is estimated in the calibration.

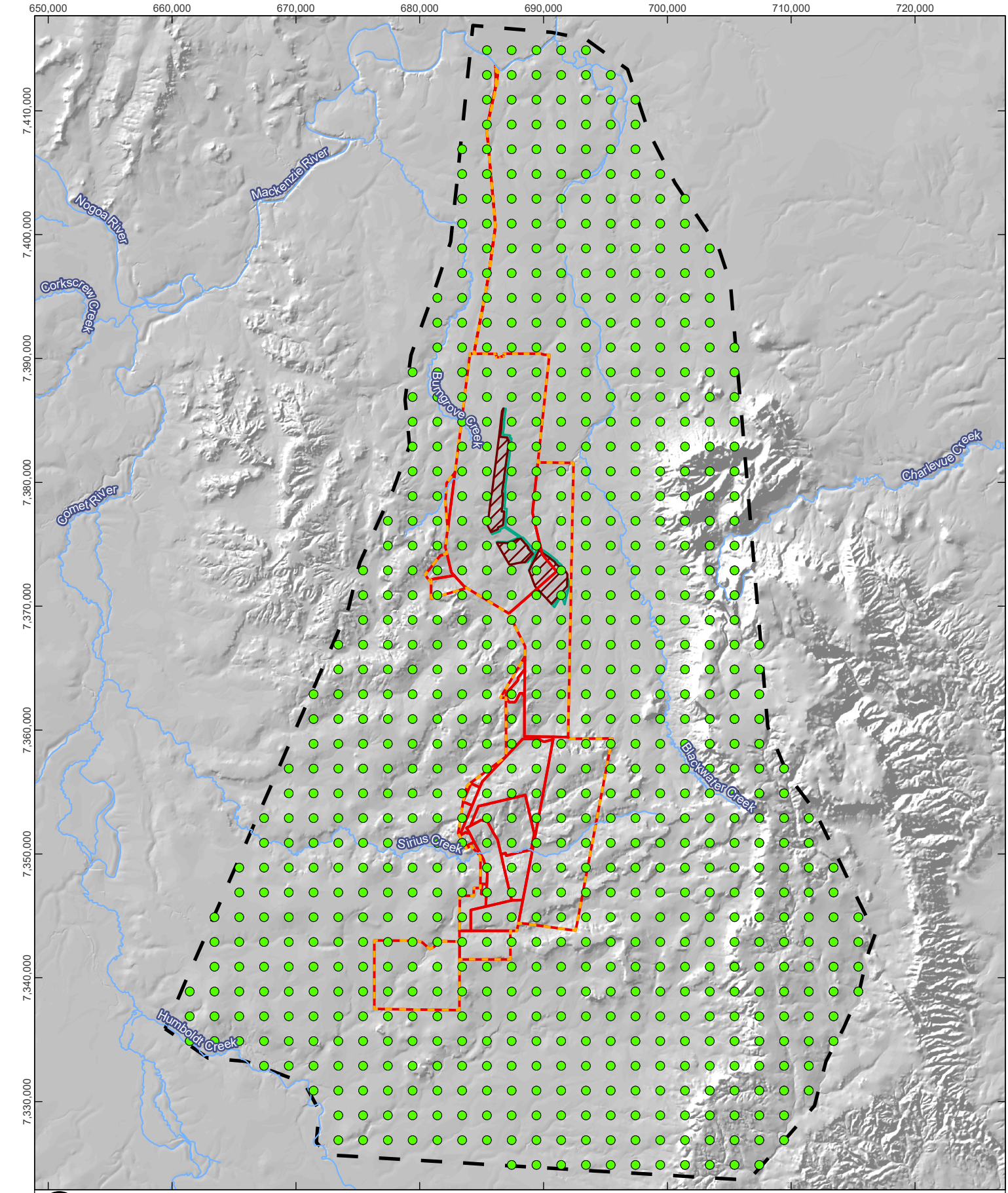
To allow spatial variability in unconsolidated units and the Clematis Group, pilot points were used from layer 1 to layer 3 (**Figure 2-3**). Pilot points were spaced uniformly. PEST++ use its PLPROC utility to interpolate between the pilot point values and creates a surface across the model domain for a targeted model parameter. This surface of model parameter values is then interrogated to provide a value at each model cell.

Hydraulic parameter zones and spatial variation options (e.g. pilot points, depth dependent equation or factor) are summarised on **Table 2-3**.

Table 2-3 Hydraulic Property Zones

Hydraulic Zone	Model Layer	Formation	Unit	Spatial Variation Options			
				Kx	Kz	Sy[1]	Ss[2]
1	1	Alluvium/Tertiary	Surface cover	Pilot Point	Pilot Point	Pilot Point	Constant
2	1	Regolith	Surface cover	Pilot Point	Pilot Point	Pilot Point	Constant
3	2	Alluvium/ Weathered zone	Surface cover	Pilot Point	Pilot Point	Pilot Point	Constant
4	2	Regolith	Surface cover	Pilot Point	Pilot Point	Pilot Point	Constant
5	3	Clematis Group	Triassic	Pilot Point	Pilot Point	Pilot Point	Constant
6	4	Rewan Group (Upper)	Triassic	Eq.1	Factor Kx	Constant	Constant
7	5	Rewan Group (Middle)	Triassic	Eq.1	Factor Kx	Constant	Constant
8	6	Rewan Group (Lower)	Triassic	Eq.1	Factor Kx	Constant	Constant
9	7	RCM	Overburden	Eq.1	Factor Kx	Constant	Constant
10	8	RCM	Aries seam	Eq.1	Factor Kx	Constant	Constant
11	9	RCM	Interburden	Eq.1	Factor Kx	Constant	Constant
12	10	RCM	Castor seam	Eq.1	Factor Kx	Constant	Constant
13	11	RCM	Interburden	Eq.1	Factor Kx	Constant	Constant
14	12	RCM	Pollux seam	Eq.1	Factor Kx	Constant	Constant
15	13	RCM	Interburden	Eq.1	Factor Kx	Constant	Constant
16	14	RCM	Orion seam	Eq.1	Factor Kx	Constant	Constant
17	15	RCM	Underburden	Eq.1	Factor Kx	Constant	Constant
18	16	Burngrove Formation	Permian	Eq.1	Factor Kx	Constant	Constant
19	17	Burngrove Formation	Permian	Eq.1	Factor Kx	Constant	Constant

1 Sy = Specific yield
2 Ss = Specific storage



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Pilot Point
- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PILOT POINTS LOCATIONS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-3

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_03_Pilot Points Used in the Model

2.6 Model Stresses and Boundary Conditions

2.6.1 Regional Groundwater Flow

General Head Boundaries (GHB) have been specified along the perimeter of the model domain, as represented in **Figure 2-1**.

The GHB boundary condition was used to represent regional groundwater inflow and outflow across the model domain. GHB cells were assigned along the perimeter of the model area in all layers except where river cells are present. For each GHB cell, the head was estimated during the steady state calibration.

Groundwater enters the model where the GHB head exceeds the modelled head in the adjacent cell and leaves the model when the water level is lower in the GHB. GHB conductance is calculated using the hydraulic conductivity and the dimensions of each GHB cell and is therefore variable in this model due to variable cell size.

2.6.2 Watercourses

2.6.2.1 Natural Watercourses

The largest local creek (Blackwater Creek), along with selected higher-order tributaries, was incorporated into the model using the MODFLOW-USG River (RIV) package. The rivers within the model that were included in the RIV package are presented in **Figure 2-4,** and were categorized into 10 zones based on their scales and spatial distribution within the model domain. Only higher-order streams were included in the RIV package to represent the primary surface water–groundwater interactions. Lower-order stream segments were not incorporated. As a result, some streams (e.g., Rockland Creek) appear to terminate at or near the mine lease boundary in the model representation.

River boundaries were also applied to the southwestern and southeastern parts of the model where the boundary cells intersect with Humboldt Creek and Planet Creek, both of which are tributaries of the Fitzroy River.

After reviewing water stage data from several stations via the Water Monitoring Information Portal, it was determined that all rivers within the model domain are ephemeral. Consequently, the stage level was set to 0 for all river cells, effectively replicating the behaviour of the DRN package. River widths were assumed to be fixed for each river in the model. The river conductance was calculated using river width, river length, riverbed thickness, and the vertical hydraulic conductivity of riverbed material (**Table 2-4**).

2.6.2.2 Mining Infrastructure

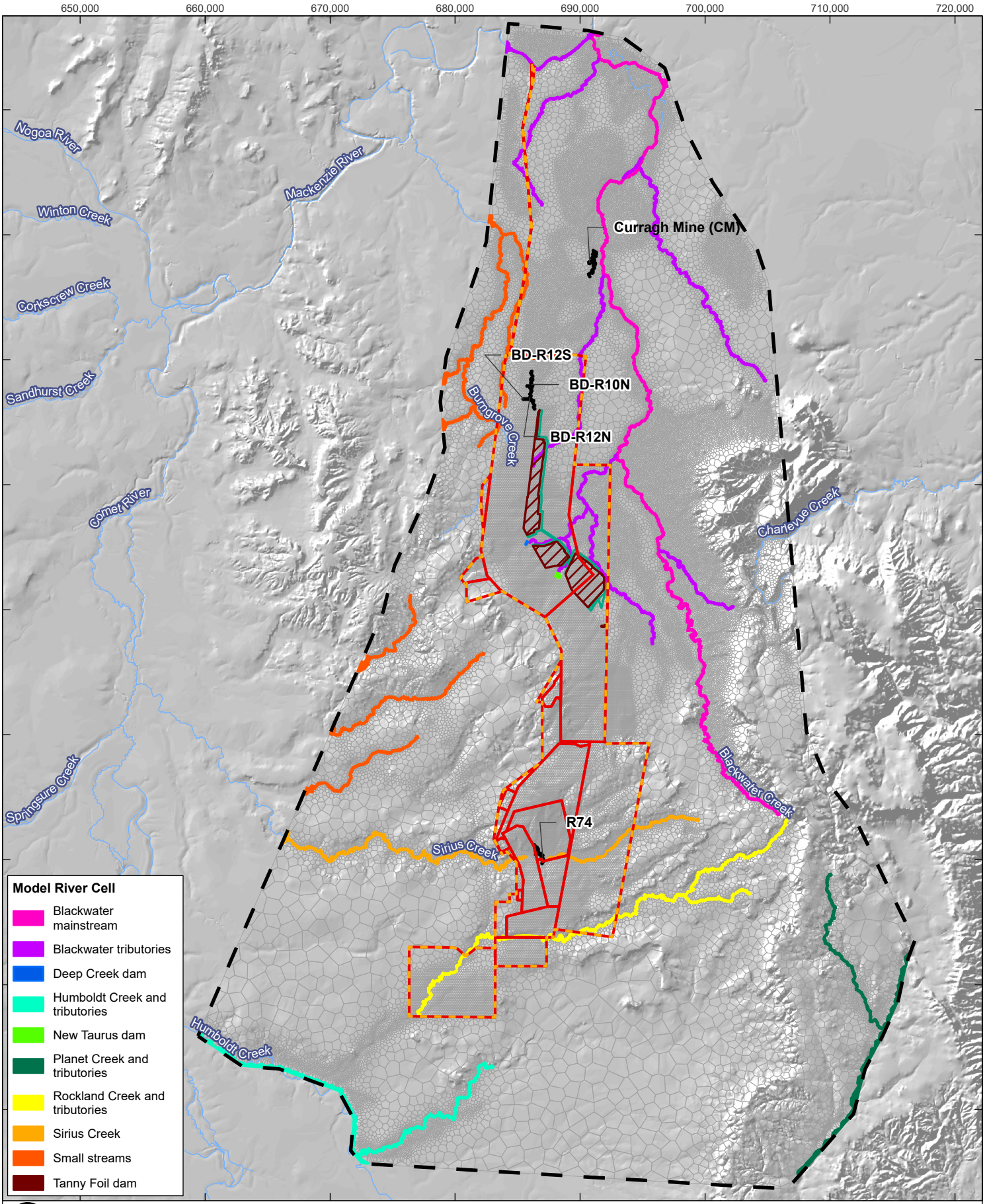
The RIV package was also used to represent dams and tailing storage facilities within the area, with dams presented in **Table 2-4.** Tailings dams are listed **Table 2-5** and their location is presented on **Figure 2-4**.

Table 2-4 River and Surface Water Features in the Model

Zone	Vertical K (meters per day [m/day])	River Width (m)	River Bed Thickness (m)	Name
1	0.05	5	1	Blackwater mainstream
2	0.05	1	1	Blackwater tributaries
3	0.05	2	1	Sirius Creek
4	0.05	1	1	Rockland Creek and tributaries
5	0.05	1	1	Humboldt Creek and tributaries
6	0.05	1	1	Planet Creek and tributaries
7	0.05	1	1	Small streams
8	0.001	1	1	Deep Creek dam
9	0.001	1	1	New Taurus dam
10	0.001	1	1	Tannyfoil dam

Table 2-5 Mining Infrastructure in the Model

Tailing Dams	Kz (m/day)	Stage
BD-R10N	5.0×10^{-1}	Deposited from July 2023 until 2040
BD-R12N	5.0×10^{-1}	Deposited from July 2023 until 2040
BD-R12S	5.0×10^{-1}	Deposited from July 2023 until 2040
R74	5.0×10^{-1}	Deposited from Jan 2025 until 2040
Curragh Mine (CM)	5.0×10^{-1}	Deposited from Jan 2007 until 2023



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- Model Grid
- TSF Cell
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

RIVER CELLS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-4

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_04_River Cells

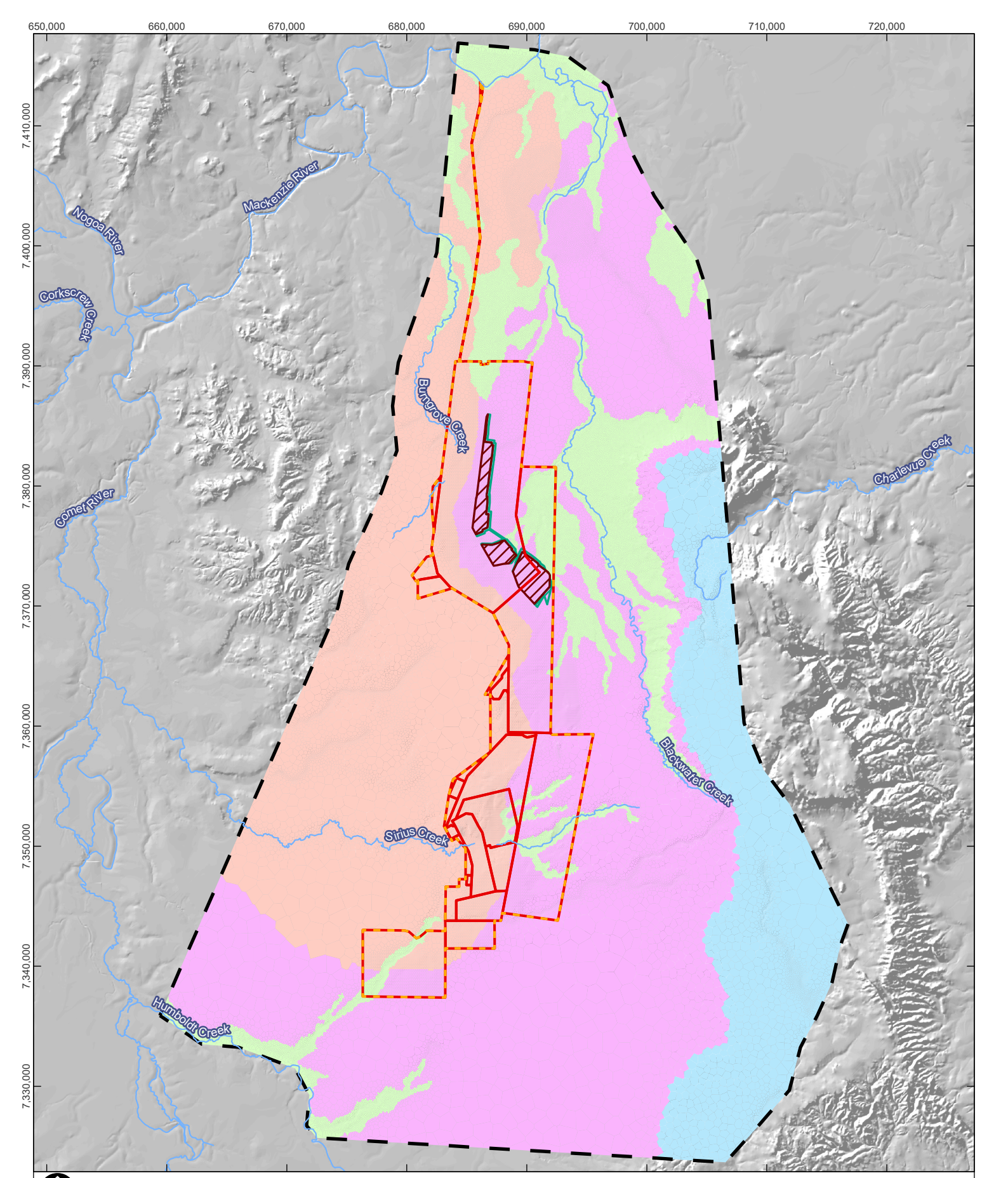
2.6.3 Rainfall Recharge

Diffuse infiltration of rainfall through the soil profile and subsequent deep drainage to underlying groundwater systems were represented using the MODFLOW-USG Recharge package (RCH). For the period from January 1970 to December 2024, recharge rate data was sourced from the Bureau of Meteorology's Australian Water Resources Assessment Landscape model, which simulates deep drainage, and introduces seasonality to the modelled recharge rates for the quarterly stress periods used during calibration. The recharge rate for the steady state condition was calculated using the long-term average daily recharge rate from January 1911 to December 1967. For the subsequent stress periods, daily recharge rates were calculated based on the average daily recharge rate over the corresponding date range within each stress period.

Multipliers were then utilised during the calibration process. Separate multipliers are used for each recharge zone. Rainfall recharge was imposed as a percentage of actual rainfall from the Scientific Information for Land Owners (SILO) Grid Point observations. Long-term average rainfall was used for the steady-state model. The historical rainfall data were averaged on an annual basis (2000 to 2004) and on a quarterly basis (2004 to 2024) for the transient calibration model. Also, the averages of the historical rainfall data from 1980 to 1990 and from 1990 to 2000 were used for these periods. For the predictive model, long-term average rainfall was used.

The model includes 4 recharge zones, as presented in **Figure 2-5**:

- Zone 1 - Quaternary Alluvium.
- Zone 2 - Regolith.
- Zone 3 - Weathered Clematis.
- Zone 4 - Weathered Permian.



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

Recharge Zone

- Zone 1 - Quaternary Alluvium
- Zone 2 - Regolith
- Zone 3 - Weathered Clematis
- Zone 4 - Weathered Permian

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MODELLED RECHARGE ZONES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-5

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_05_Recharge Zones

2.6.3.1 Mining Induced Recharge

Enhanced recharge via spoil was simulated by progressively introducing a fifth recharge zone for the spoil. That zone expands as mining progresses and spoil is deposited in the open cut pits.

The calibrated recharge rates for all zones are discussed in **Section 3.4.3.1**.

2.6.4 Evapotranspiration

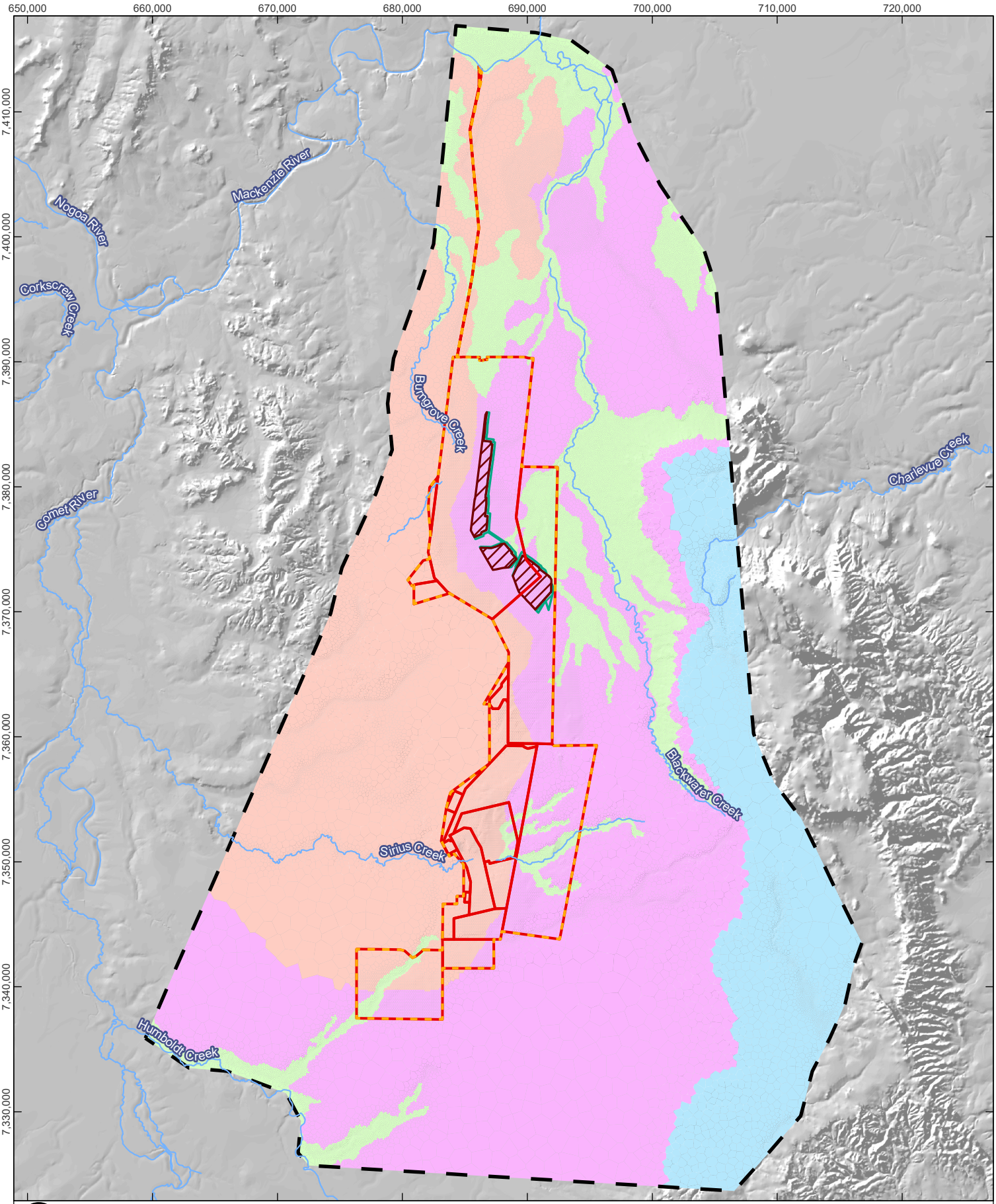
Evapotranspiration (ET) from the shallow water table was simulated using the Evapotranspiration package (EVT). ET was represented in the upper most cells of the model domain, with the extinction depth varied spatially based on the estimated rooting depths of regionally vegetation type.

In this model, EVT is excluded from cells that also contain RIV or GHB conditions. This approach is taken to avoid double-counting groundwater discharge in locations where other boundary conditions already represent flow out of the aquifer. Applying EVT in the same cells could result in non-physical water losses and distort the water balance by allowing multiple boundary conditions to compete for the same volume of groundwater. Excluding these cells from the EVT zone ensures that each type of boundary condition represents a distinct and non-overlapping physical process.

Same zones as recharge were assigned as EVT zones (refer to **Figure 2-6**):

- Zone 1 - Quaternary Alluvium.
- Zone 2 - Regolith.
- Zone 3 - Weathered Clematis.
- Zone 4 - Weathered Permian.

The maximum ET rate was derived from the SILO Grid Point series (Queensland Government, 2023). A single value of 0.0045 m/day was applied in the model for the steady-state and initial stress periods preceding the calibration period, and also the predictive period. Varied rates were applied to the calibration periods, while a single value was used for the first two stress periods, as well as the predictive period. An ET rate of zero was assigned to model cells representing rivers.



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

Recharge Zone

- Zone 1 - Quaternary Alluvium
- Zone 2 - Regolith
- Zone 3 - Weathered Clematis
- Zone 4 - Weathered Permian

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

EVAPOTRANSPIRTION ZONES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-6

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_05_Recharge Zones

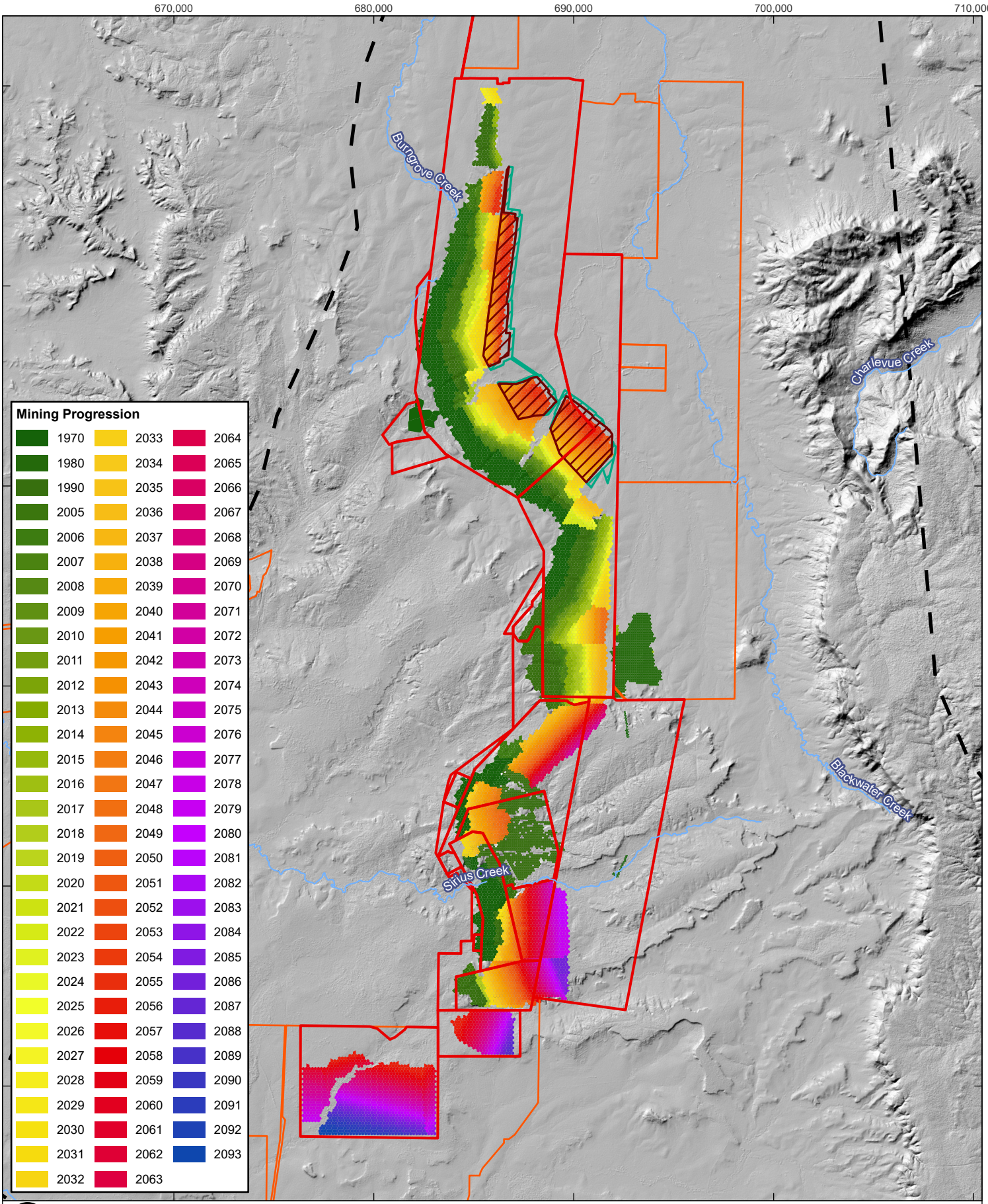
2.6.5 Mining

All mines included in this assessment, namely BWM, BWM South (Kenmare and Laleham), Cook Collieries, and Curragh Mines are targeting the RCMs, hence a cumulative assessment of impacts is carried out. The location of both the open pit and underground mines is shown in **Figure 2-7**.

2.6.5.1 Dewatering

The MODFLOW Drain (DRN) package is used to simulate mine dewatering in the model for the Project and surrounding mines. Boundary conditions for drain cells allow one-way flow of water out of the model. When the computed head drops below the pre-defined stage elevation of the drain, the drain cells become inactive. This is an effective way of theoretically representing removal of water seeping into a mine over time, with the actual removal of water being via pumping and evaporation.

To simulate BWM open cut pits in the model, drain cells are applied to all active layers from the surface to the base of the lowermost mined seam, which is the Pollux seam (Layer 12). The drain cells representing the surrounding open cut mines were interpolated from previous reports, publicly available Environmental Impact Statement documentation and aerial photography.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area
- Study Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MINING PROGRESSION

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 2-7

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F02_07_Mining Progression

2.6.5.2 Variation in Hydraulic Properties due to Mining

Two types of mining have been considered; open cut and underground.

For open cut mining, Hawkins (1998) and Mackie (2009) indicate that spoil and waste rock are more permeable than the undisturbed strata. Completed open cut mining areas will be backfilled with waste overburden as the extraction proceeds. Backfilling of open cut mine areas with spoil was modelled using the MODFLOW-USG Time-Variant Material (TVM) package. The model cell properties were updated to spoil properties guided by operational mine plans. Horizontal hydraulic conductivity, vertical hydraulic conductivity, specific yield and specific storage of the spoil were adjusted during the calibration process. Hydraulic conductivity (Kx and Kz) change within the stress period when mining (DRN) is activated, and storage properties are activated in the stress period when DRNs become inactive

Several tailings storage areas were defined by the proponent, with tailing hydraulic properties applied in the model and adjusted during the calibration process.

For the underground mines, the hydraulic properties were changed with time in the goaf and overlying fractured zone directly above each longwall panel. The TVM package was used to simulate changes to aquifer properties in response to mining within the overlying strata and fracture zone. Calculated multipliers were used to enhance hydraulic conductivities within the fracture zone overlying coal extraction areas, with multipliers generally following a ramp function, so that the multipliers with highest values are applied to the units closest to the mined seam and then gradually decrease as the units become close to the maximum height of connective cracking. The fracture zone multipliers are listed in **Table 2-6**.

The maximum height of connective cracking was derived using the Ditton/Merrick equation (Ditton and Merrick, 2014). The fracture heights over the Pollux seam in the underground mines ranged from 57 m to 154 m, with an average fracture height of 119 m and no fracturing of the surface is expected.

Table 2-6 Fracture Zone Multipliers

Layer	Unit	Average Kx Multipliers	Average Kz Multipliers
1	Alluvium/Tertiary	1	1
2	Alluvium/Weathered zone	1	1
6	Rewan Group (Lower)	1	1
7	RCM - Overburden	44	51
8	RCM - Aries seam	6	30
9	RCM - Interburden	1	2
10	RCM - Castor seam	1	1.3
11	RCM - Interburden	12	295

3.0 Calibration

3.1 Calibration Method

Automated calibration utility PESTPP-IES (White et al, 2020) was used to match the available water level data. The numerical algorithm that is implemented by PESTPP-IES is referred to as an “iterative ensemble smoother”. The job of an ensemble smoother is to assimilate data in a “batch” sense. To accomplish this, PESTPP-IES begins the model parameterisation process with a collection of random parameter fields drawn from the prior parameter probability distribution. Through a series of iterative adjustments, PESTPP-IES modifies the parameter realisations that make up the ensemble to satisfy calibration constraints. The results presented in this section are from the realisation that yielded the lowest simulated error (sum of squares). However, where possible, results have been provided for all realisations within the ensemble. The model variables included in the calibration were:

- Aquifer parameters, including horizontal and vertical hydraulic conductivity, specific storage and specific yield by zone.
- Pilot point multiplications for horizontal and vertical hydraulic conductivity, and specific yield.
- RCH rate factors by zone.
- EVT rate factors and extinction depths by zone.
- Vertical conductivity of RIV cells. Additionally, tailing dams were modelled using the RIV package, with their vertical hydraulic conductivities also parameterized.
- Hydraulic properties of spoils and tailings, including horizontal and vertical hydraulic conductivity, specific storage, and specific yield, with vertical conductivity linked to horizontal conductivity.

The calibration methodology for the BWM model involved running the model numerous times with different parameter sets to identify those that yielded the best calibration statistics. The process began with 500 initial realisations, sampled within the defined parameter ranges by PESTPP-IES. After 10 iterations, 75 realisations were optimized to achieve satisfactory calibration performance. The ensemble size was deemed sufficient based on a review of uncertainty convergence on predicted fluxes (**Section 7.1**)

The calibration statistics were calculated for each realisation and the realisation that produced the lowest Scaled Root Mean Square (SRMS) error was considered to be the best-calibrated model for the purposes of the BWM. This model is referred to as “Best Calibrated Model” (BCM) and calibration results are presented for the BCM herein.

3.2 Calibration Dataset

The groundwater levels recorded between Aug 2009 to Dec 2024 were used as calibration targets. They were processed into two groups – initial water level and drawdowns from the initial water levels for each bore. In all, 1,789 observation targets, including 108 initial heads and 1,681 drawdowns, were established for 108 bores from the BWM area.

Groundwater targets were selected where valid information on bore construction or geology information was available for the site. Targets were manually reviewed to ensure the measurements were realistic.

Details on each of the observation points are presented in **Appendix A** of this report.



3.2.1 Groundwater Levels

Table 3-1 summarizes the initial groundwater levels measured from 108 observation points, which have been used as the first group of calibration targets for the groundwater model. The groundwater levels from various geological formations, including the weathered zone, Rewan Group, RCM overburden/interburdens and RCM coal seams.

Table 3-1 Summary of Initial Groundwater Levels used for Calibration Targets

Model Layer	Target Unit	Number of Bores
2	Weathered zone/Regolith	18
5	Rewan Group (Middle)	1
6	Rewan Group (Lower)	6
7	RCM Overburden	14
8	Aries seam	13
9	RCM Interburden	3
10	Castor seam	9
11	RCM Interburden	3
12	Pollux seam	18
13	RCM Interburden	1
14	Orion seam	2
16	Burngrove Formation	20
	Total	**108**

3.2.2 Drawdown

Table 3-2 summarizes the drawdowns used as calibration targets for the groundwater model. These values are derived by subtracting the initial groundwater level from the subsequent measurements taken from the same observation bores. A total of 1,681 drawdowns across 107 bores were converted from the measured water levels. The data spans multiple geological layers, including the weathered zone, Rewan Group, RCM overburden/interburdens, RCM coal seams and Burngrove Formation, offering a comprehensive view of the groundwater system's response.



Table 3-2 Summary of Drawdowns Used for Calibration Targets

Model Layer	Target Unit	Number of Bores	Number of Observations
2	Weathered zone/Regolith	18	167
5	Rewan Group (Middle)	1	7
6	Rewan Group (Lower)	6	137
7	RCM Overburden	14	433
8	Aries seam	13	354
9	RCM Interburden	3	74
10	Castor seam	9	95
11	RCM Interburden	3	38
12	Pollux seam	18	190
14	Orion seam	2	21
16	Burngrove Formation	20	165
	Total	**107**	**1681**

3.2.3 Calibration Weighting

During calibration, each groundwater bore in each group (initial water level or head difference) was assigned a base weight of 1, and the weight for each observed target was calculated as $1/\sqrt{n}$, where n is the total number of observations recorded at that bore.

3.3 Calibration Performance

3.3.1 Calibration Statistics

An industry-standard approach for assessing the calibration of a model is to analyse statistics related to the calibration. One way of doing this is by comparing the simulated differential (i.e. error) between the simulated and observed (measured) water levels, which is often expressed as the root mean square (RMS). The RMS value is calculated by taking the square root of the mean of the squared differences between the simulated and observed water levels. RMS is expressed as:

$$\mathrm{RMS} = \left[\frac{1}{\mathrm{n}}\sum(\mathrm{h_o} - \mathrm{h_m})_\mathrm{i}^{\,2}\right]^{0.5}$$

where: n = number of observations

h_o = observed water level

hm = simulated water level

Another option for measuring the goodness of fit is the SRMS error. SRMS is computed by dividing the RMS by the range of measured heads and expressing it as a percentage. When the goal is to fit historical measurements of water levels, SRMS provides a valuable indicator of the goodness of fit (Barnett et al., 2012). This is primarily due to its ability to compare errors in the simulated values against the total head changes in the system. If the errors are small relative to the total head change, they can be considered negligible.

The PESTPP-IES ensemble calibration process was initiated with 500 randomly generated realisation and 75 calibrated realisations from the final iteration were retained as sufficient for assessing uncertainty in the quantities of interest (QOIs). A summary of statistical analyses of the error residual between simulated and observed water level elevation for all calibrated realisations is provided in **Table 3-3.**

Although there is no universal recommendation for an acceptable SRMS error, Barnett et al. (2012) suggest that establishing SRMS targets, such as 5% or 10%, may be appropriate in certain circumstances. In this study, RMS error calculated for the Best Calibrated Realisation within the ensemble is 11.6 m. The total measured head change across the model domain is 177.3 m, leading to a SRMS value of 6.6%. For the ensemble, the maximum SRMS is 7.4% (**Table 3-3**).

Figure 3-1 presents the observed and simulated groundwater levels graphically as a scattergram for the historic transient calibration (1990 to 2024), for the BCM. As can be seen in **Figure 3-1**, hydraulic gradients are well reproduced across the calibration dataset.

Table 3-3 Calibration Statistics

Statistic	Minimum	Median	Maximum	Best Calibrated Realisation
Mean Residual (m)	1.3	3.7	5.5	3.8
Mean Absolute Residual (m)	8.8	9.3	10.2	9.1
Standard Deviation (m)	10.9	11.5	12.6	11.0
Sum of Squares (square metres [m^2])	242581.2	259575.5	308003.7	242581.2
RMS error (m)	11.6	12.1	13.1	11.6
Minimum Residual (m)	-51.6	-33.3	-26.5	-30.2
Maximum Residual (m)	29.0	33.1	39.4	34.2
Number of Observations	1789	1789	1789	1789
Range in Observations (m)	177.3	177.3	177.3	177.3
Scaled Standard Deviation (%)	6.2	6.5	7.1	6.2
Scaled Absolute Mean (%)	5.0	5.3	5.8	5.1
SRMS (%)	6.6	6.8	7.4	6.6

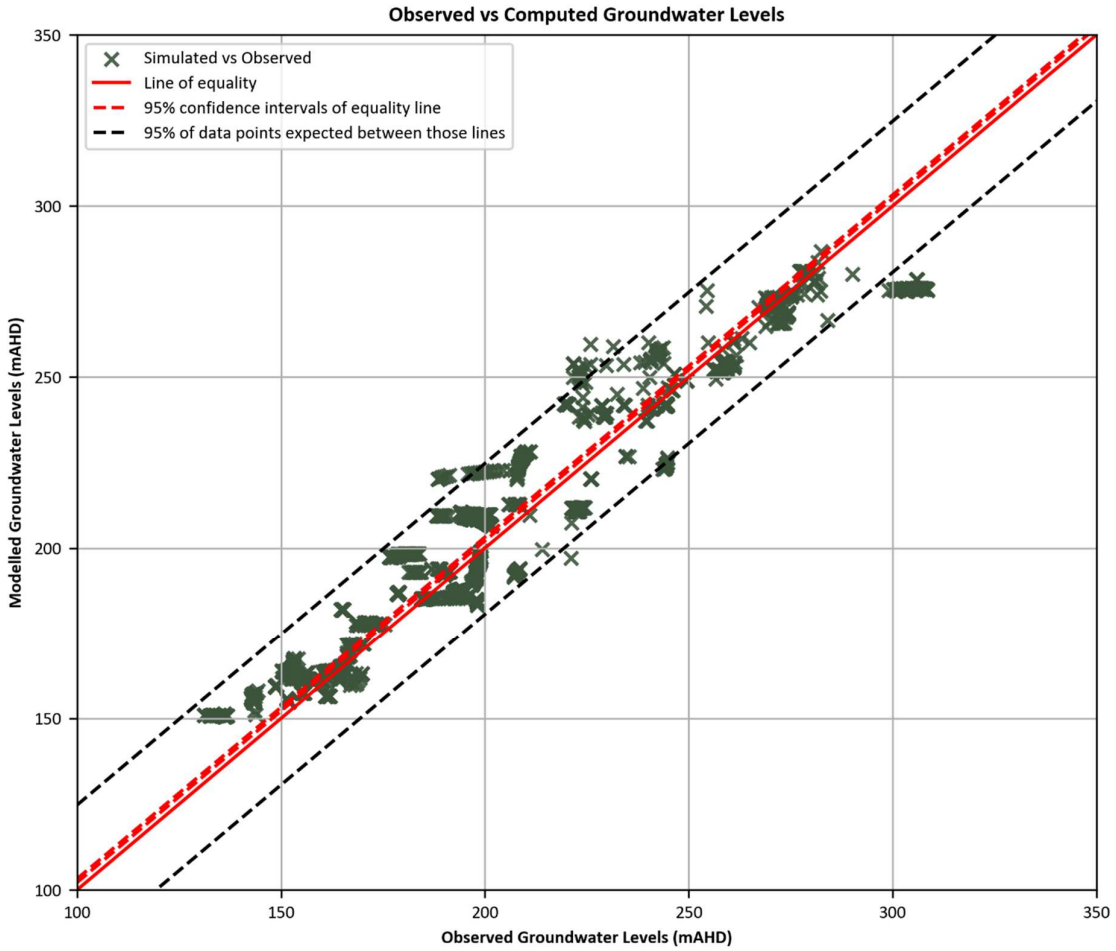


Figure 3-1 Calibration Scattergram

Figure 3-2 shows the distribution of calibration residuals for the BCM. As shown in the figure the calibration residuals in majority of the calibration data points are within ± 10 m. **Figure** 3-2 indicates that in general, the model tends to slightly overpredict groundwater levels.

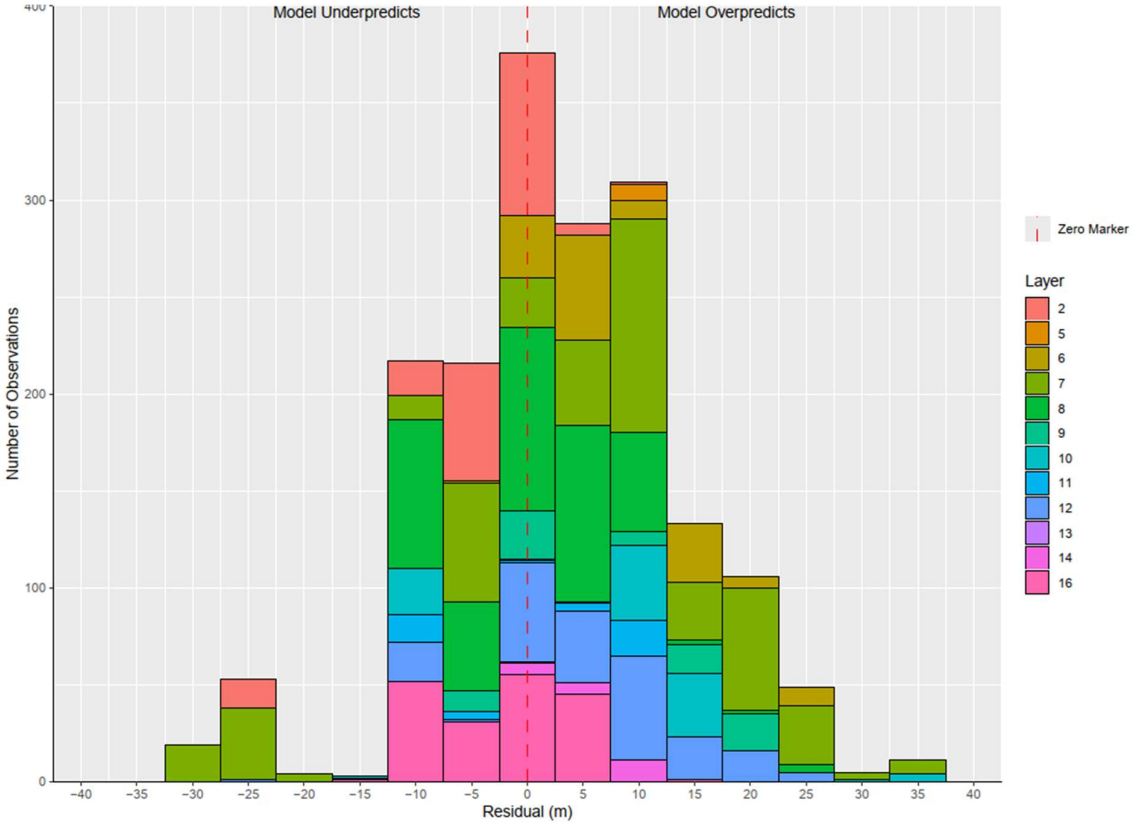


Figure 3-2 Calibration Residual Histogram

Table 3-4 shows the average calibration residual and absolute average residual per model layer, for the BCM. The residual is the difference between the measured and the modelled water level at each bore. A negative residual represents an over estimation of water levels, while a positive residual represents an underestimate.

Table 3-4 shows a general overestimation of water level in the model layers except for the Alluvium/weathered zone, some interburden and the Burngrove formation. The overestimation is greater for the Rewan Group (9.5 m on average).

Table 3-4 Average Residual by Model Layer

Model Layer*	Formation	Unit	Average Residual (m)	Average Absolute Residual (m)	Number of Observation Targets	Number of bores
2	Alluvium/ Weathered zone	Surface cover	-3.6	4.6	185	18
5	Rewan Group (Middle)	Triassic	9.8	9.8	8	1
6	Rewan Group (Lower)	Triassic	8.9	9.0	143	6
7	RCM	Overburden	5.6	13.8	447	14
8		Aries seam	1.0	6.4	367	13
9		Interburden	7.7	9.8	77	3
10		Castor seam	10.7	13.1	104	9
11		Interburden	1.9	9.1	41	3
12		Pollux seam	7.5	9.5	208	18
13		Interburden	-2.4	2.4	1	1
14		Orion seam	7.1	7.1	23	2
16	Burngrove Formation	Permian	-1.5	5.1	185	20

*There are no observation bores in Layers 1, 3, 4, 15 and 17.

The spatial distribution of average residuals for each bore from the transient calibrated model is shown in **Figure 3-3**. The size of the bore symbol in **Figure 3-3** is proportional to the residual (i.e. larger residual has a larger symbol size). **Figure 3-3** shows regionally there is a good match between the observed and simulated groundwater levels.

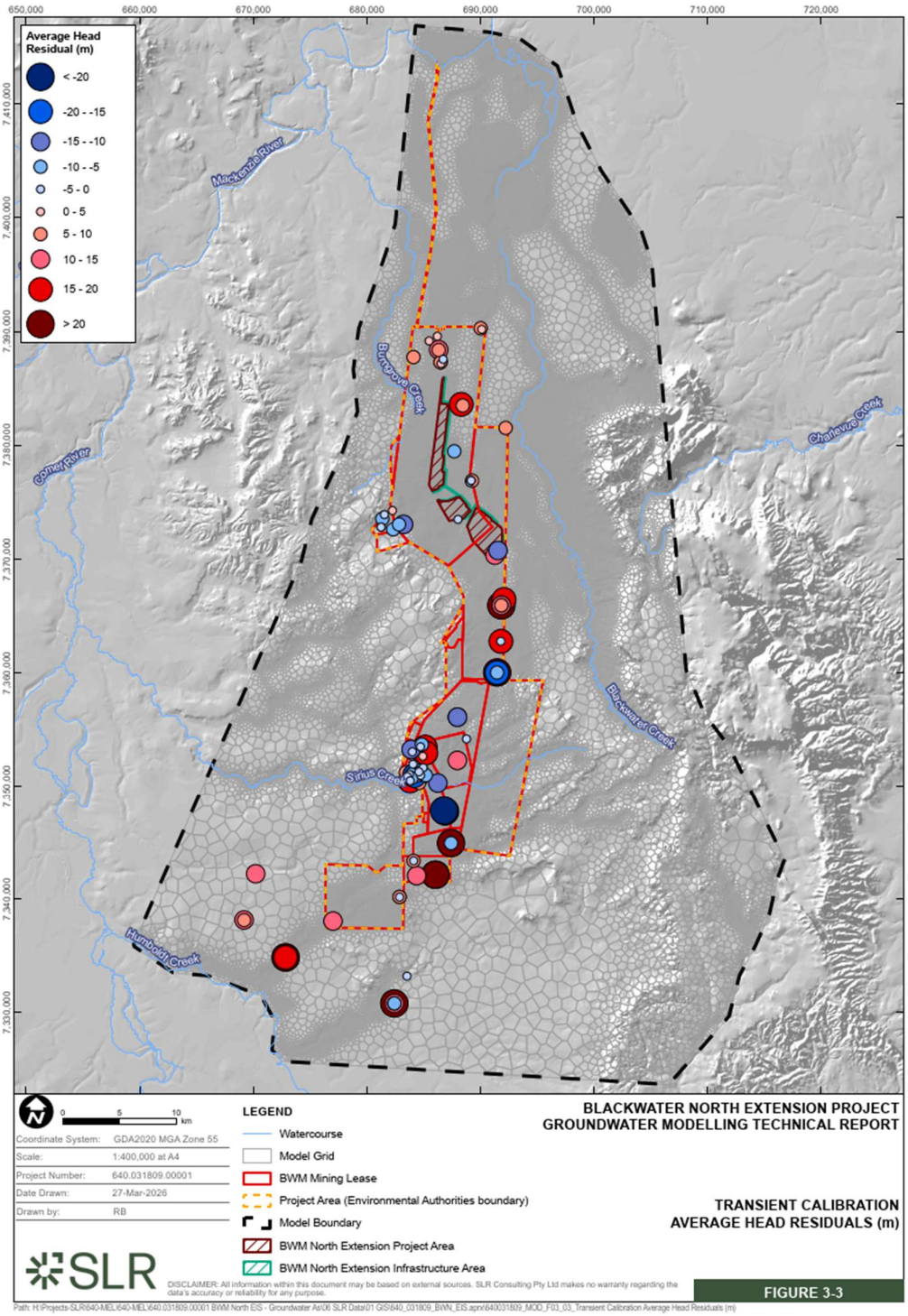


Figure 3-3 Transient Calibration Average Head Residuals (m)

3.3.2 Calibration Hydrographs

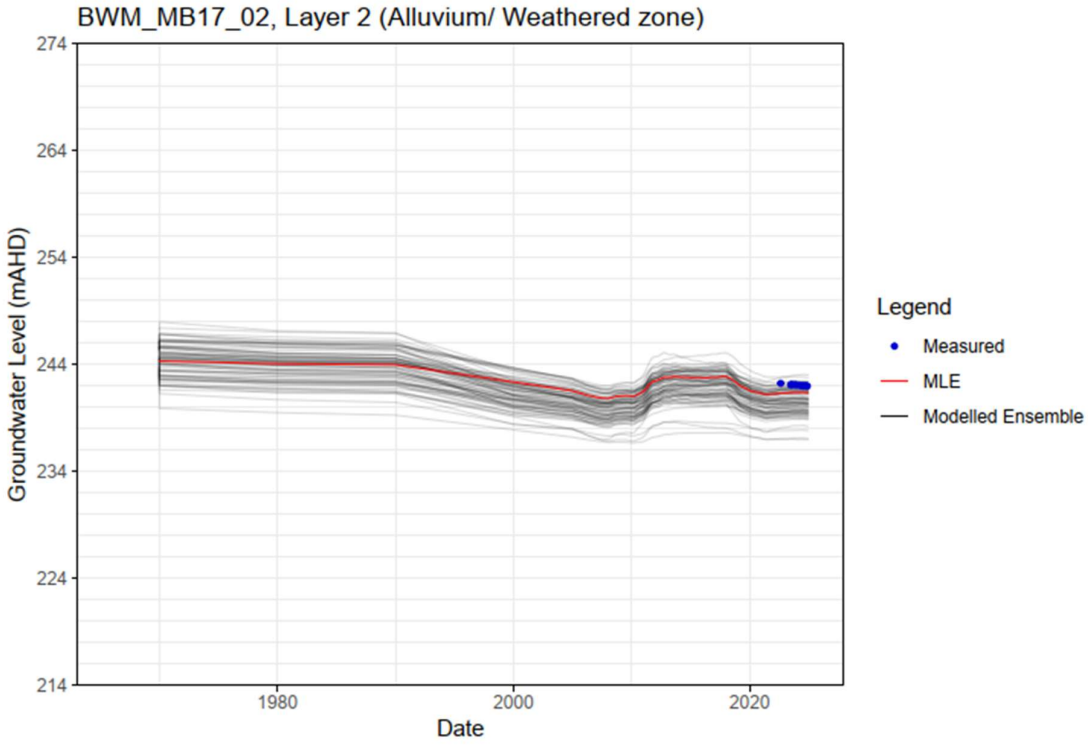
This section provides discussion on the modelled to observed groundwater level trends (calibration hydrographs) for key bores across the BWM site. Calibration hydrographs for the full calibration dataset are presented in **Appendix B**.

3.3.2.1 Alluvium and Regolith

There are no bores with valid observation data in the Alluvium and Regolith (Layer 1) in the model area.

Figure 3-4 presents the fit between simulated and observed heads in BWM_MB17_02, BWM_P4, BWM_P7 within the Alluvium and Weathered zone (Layer 2). BWM_MB17_02 is located at the edge of the South Marshmead Pit, whereas BWM_P4 and BWM_P7 are located along the western edge of the Kenmare Pit. The hydrographs for these bores generally show a close match between the simulated and measured groundwater levels.

However, as shown in the hydrographs in **Appendix B**, regionally there is a relatively good match between the simulated and measured groundwater levels in regolith bores.



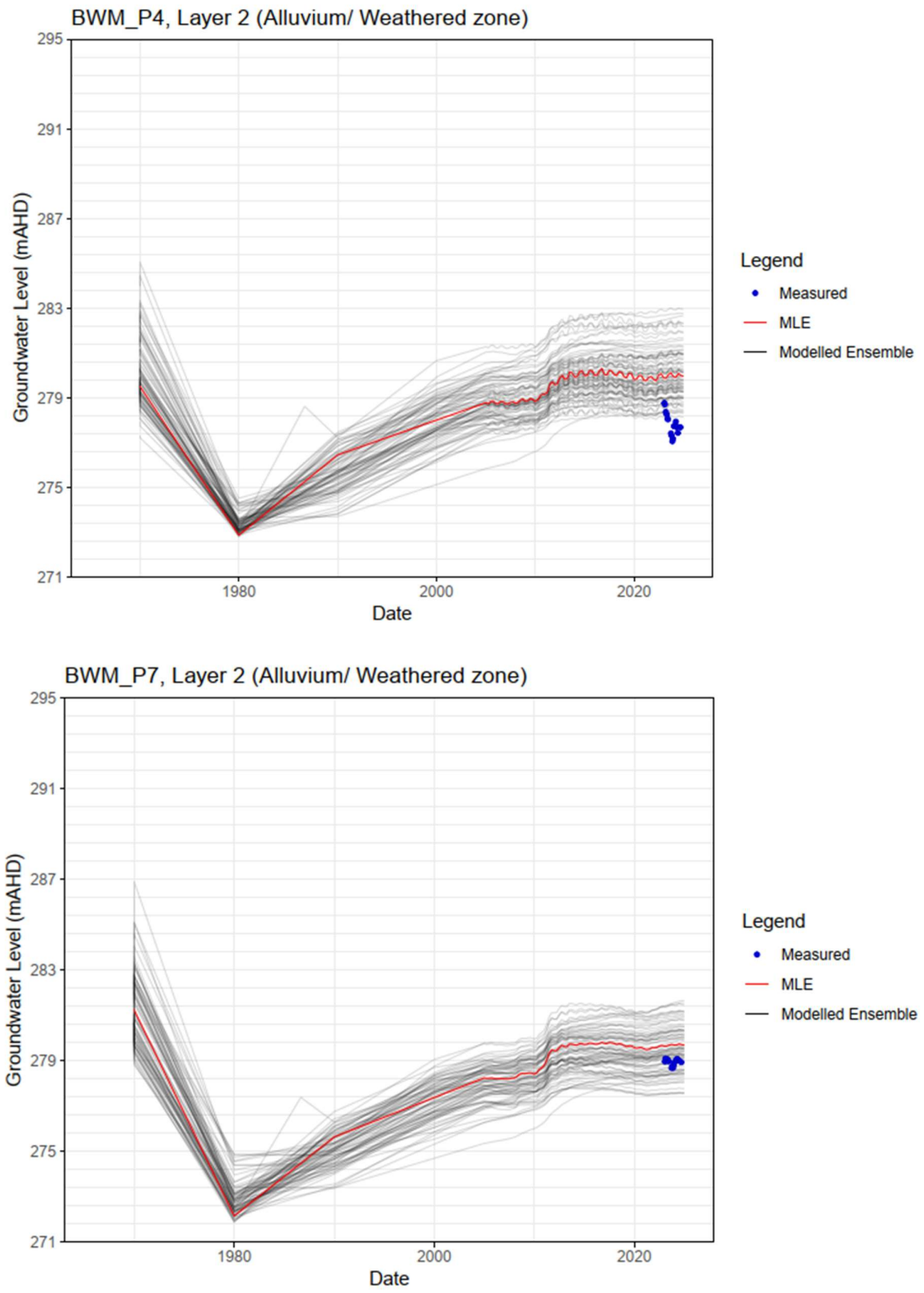
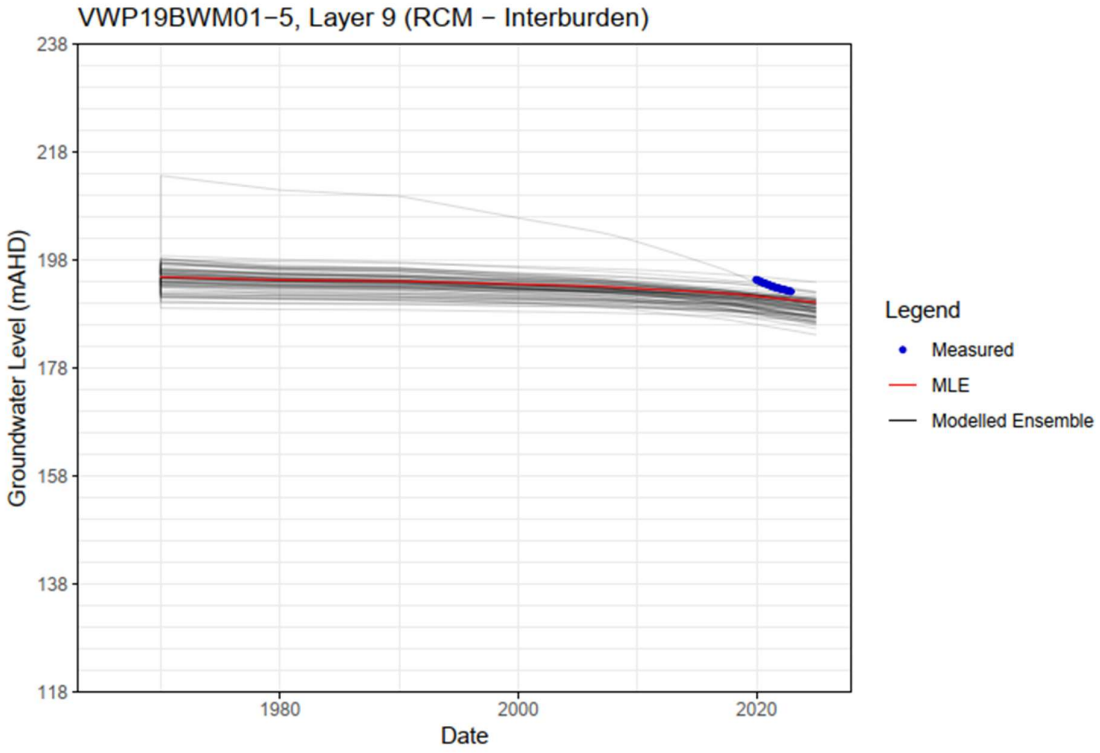


Figure 3-4 Calibration Fit - Alluvium and Regolith Bores

3.3.2.2 Interburden

The hydrographs for some of the Interburden bores are shown in **Figure 3-5** for bores VWP19BWM01-5 and VWP19BWM02-3 in the Interburden layers, located to the east of the Besgrove Pit and in the Tannyfoil Pit respectively, show that the model results in a reasonable (± 3 m) fit between modelled and observed groundwater. Trends are also relatively well reproduced.



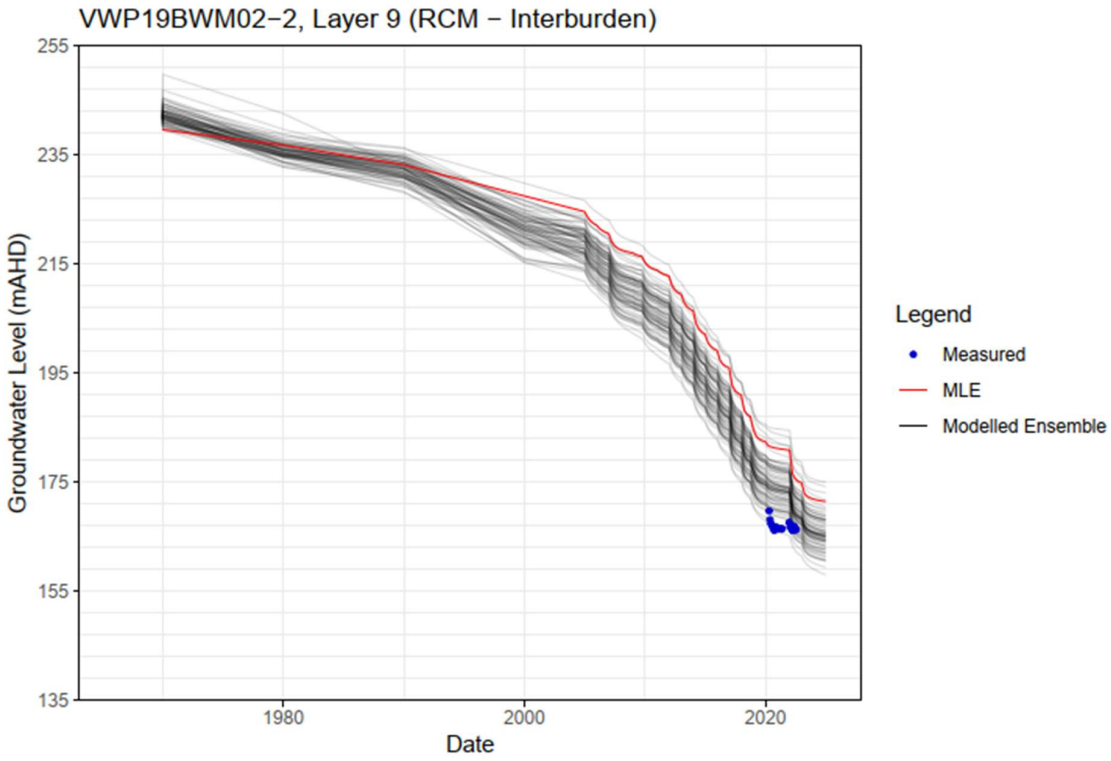


Figure 3-5 Calibration Fit - Interburden Bores

3.3.2.3 Coal Seams

The hydrographs for bores MB3, MB20BWM03P1, FY16_PZ_2 and VWP19BWM02_5 located in the Aries, Castor, Pollux and Orion seams respectively are shown in **Figure 3-6** and **Figure 3-7**. The hydrographs show that the model results in a reasonable (± 3 m) fit between modelled and observed groundwater levels for these bores. Trends are also relatively well reproduced.

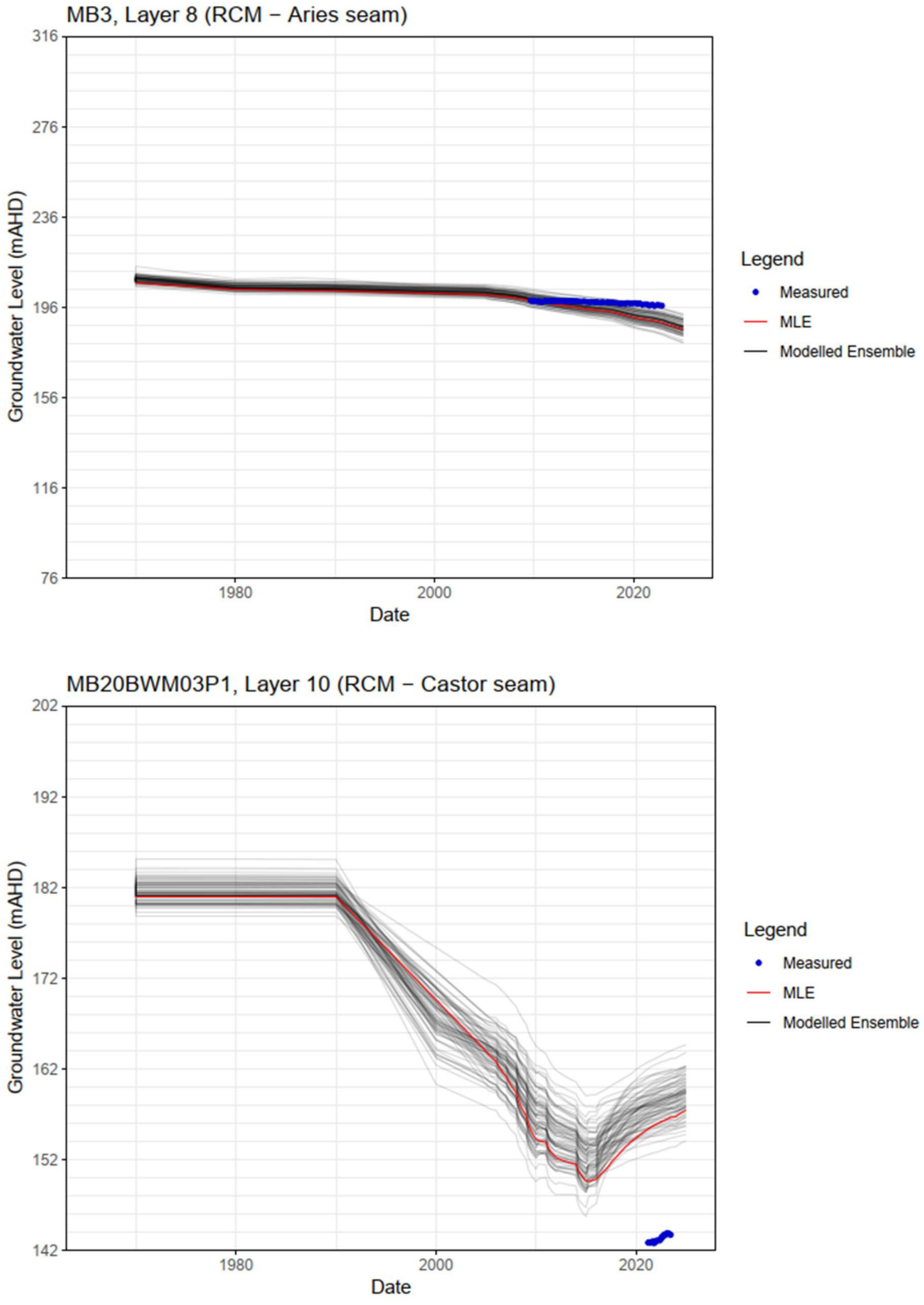


Figure 3-6 Calibration Fit – Coal Seams Bores (Aries and Castor)

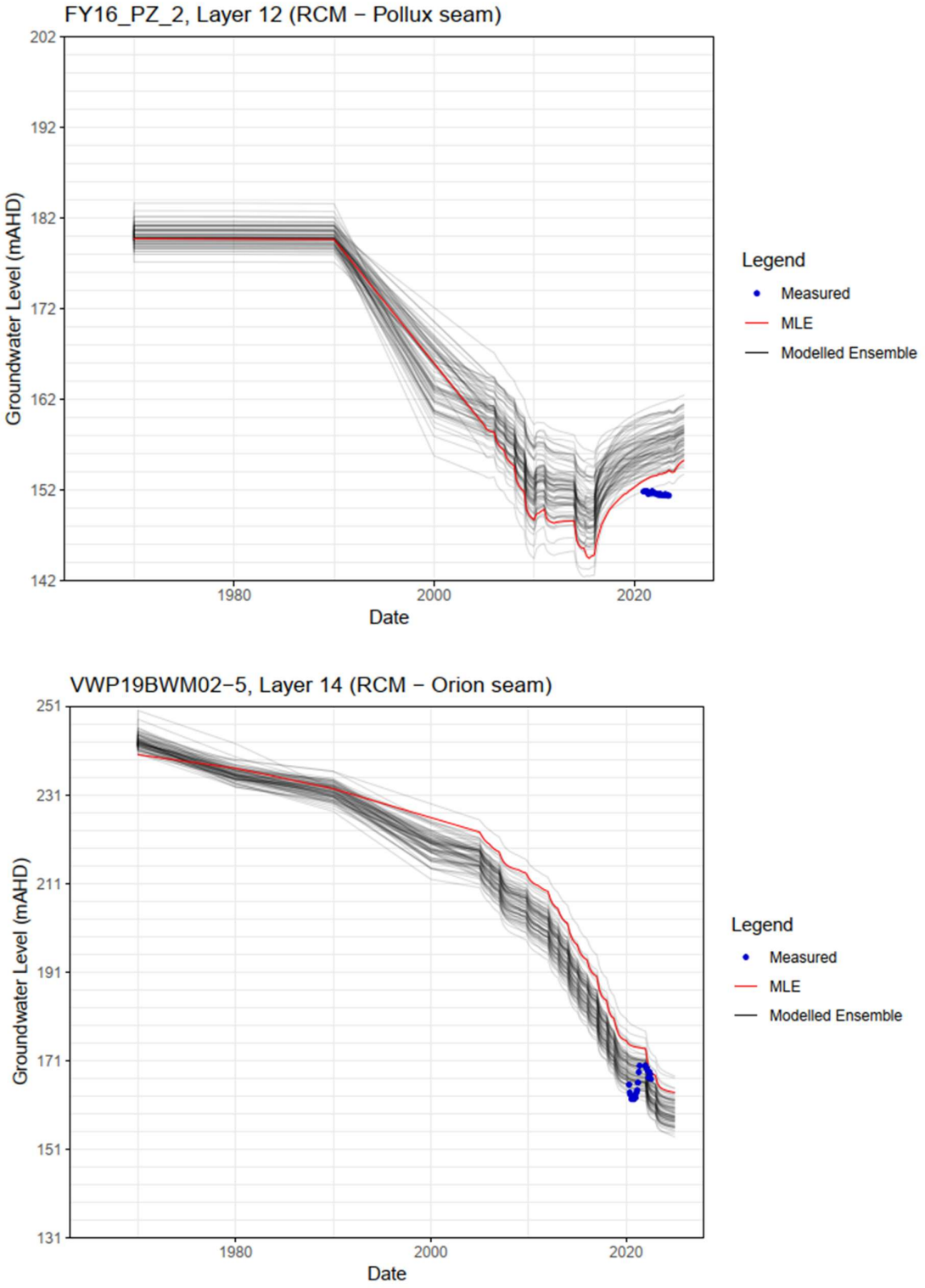


Figure 3-7 Calibration Fit – Coal Seams Bores (Pollux and Orion)

3.4 Calibration Results

3.4.1 Calibrated Fluxes

3.4.1.1 Steady State Water Balance

The water balance for the steady state model calibration is shown in **Table 3-5**. The results indicate that recharge is the dominant inflow contributor (61.8 Megalitres per day [ML/day]). ET is the highest groundwater outflow (61.6 ML/day), indicating that groundwater primarily leaves the model domain through ET. Other outflow components, such as river and GHBs, contributed only minimally. The mass balance error for the steady state calibration is 0.03%, within the error threshold recommended by the Australian Groundwater Modelling Guidelines (Barnett et al., 2012).

Table 3-5 Steady-State Model Water Balance

Component	Inflow (ML/d)	Percent of Total Inflow (%)	Outflow (ML/day)	Percent of Total Outflow (%)
Recharge (RCH)	61.8	100.0	0.0	0.0
ET (from GW) (EVT)	0.0	0.0	61.6	99.8
River (RIV)	0.0	0.0	0.0	0.0
Regional Groundwater Flow (GHB)	0.0	0.0	0.1	0.2
Mines (DRN)	0.0	0.0	0.0	0.0
Storage	0.0	0.0	0.0	0.0
Total	**61.8**	**100.0**	**61.8***	**100.0**

* Total values may not exactly equal the sum of individual components due to rounding.

3.4.1.2 Transient Water Balance

The model water balance for the transient simulation averaged over the duration of the calibration period is presented in **Table 3-6** and **Figure 3-8**.

The water balance for the transient calibration period indicates that recharge to the groundwater system within the model averages 63.8 ML/day. Approximately 56.6 ML/day is lost to ET in areas where the water table is within a few metres of the land surface.

The net flux from the GHB component is -0.4 ML/day indicating that groundwater leaves the model domain through this boundary. 10 ML/day is removed from the model by the Drain boundary condition that represents mining in the model.

The mass balance error recorded for each stress period of the transient calibration is between -0.45% and 0.08%, within the error threshold recommended by the Australian Groundwater Modelling Guidelines (Barnett et al., 2012).

Table 3-6 Transient Model Water Balance

Component	Inflow (ML/day)	Percent of Total Inflow (%)	Outflow (ML/day)	Percent of Total Outflow (%)
Recharge (RCH)	63.8	88.0	0.0	0.0
ET (from GW) (EVT)	0.0	0.0	56.6	78.1
River (RIV)	0.0	0.0	0.0	0.0
Regional Groundwater Flow (GHB)	0.2	0.3	0.6	0.8
Mines (DRN)	0.0	0.0	10.0	13.8
Storage	8.5	11.7	5.3	7.3
Total	**72.5**	**100.0**	**72.5**	**100.0**

The ET response (ET Out) to increases in recharge (Recharge In) are the largest components of outflow and inflow respectively.

Water coming out of storage (Storage In) shows peaks are associated with mine dewatering (Drains Out) peaks. Water going into storage (Storage Out) shows peaks associated with large rainfall events.

Contributions from regional boundary flow (GHB In and Out) and rivers (Riv In and Out) are small overall (**Figure 3-8**).

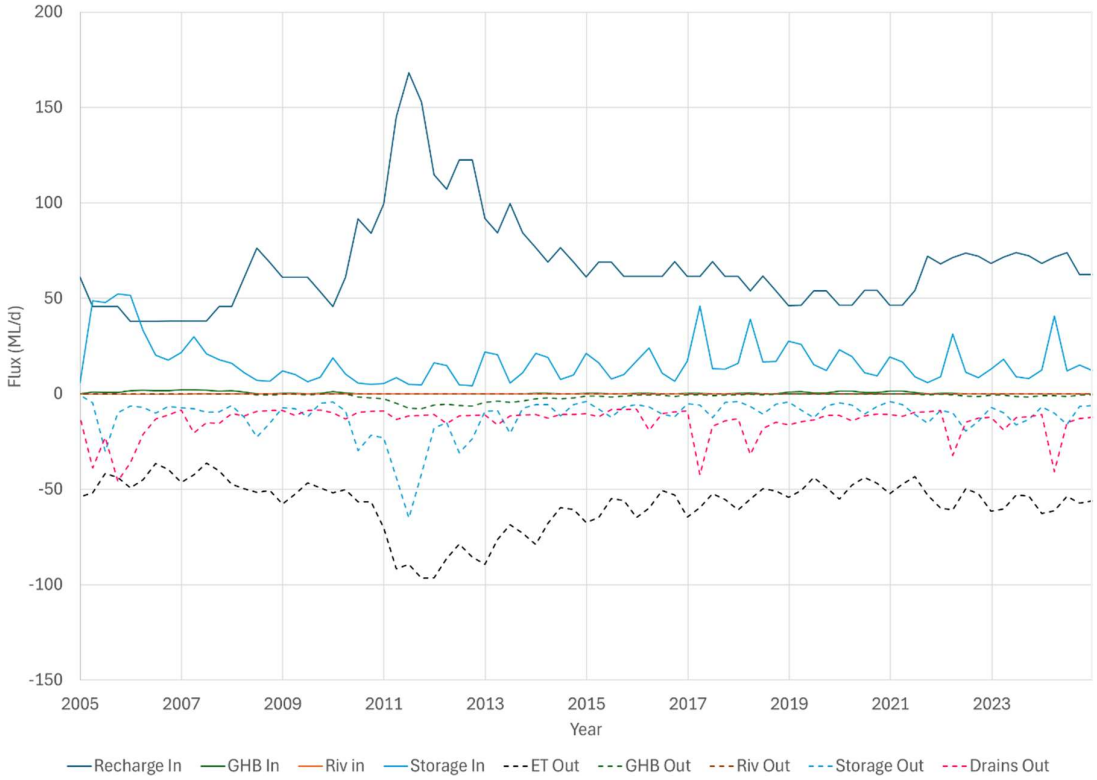


Figure 3-8 Transient Water Balance

3.4.2 Calibrated Hydraulic Parameters

3.4.2.1 Calibrated Hydraulic Conductivities

Table 3-7 provides a summary of the model layer parameter values for horizontal and vertical hydraulic conductivity.

3.4.2.1 Calibrated Storage Properties

Table 3-8 summarises the calibrated values of specific storage and specific yield for the hydrostratigraphic units.

Table 3-7 Calibrated Hydraulic Conductivity

Model Layer	Formation	Unit	Kx min (m/day)	Kx max (m/day)	Kx mean (m/day)	Kx BCM (m/day)	Kz min (m/day)	Kz max (m/day)	Kz mean (m/day)	Kz BCM (m/day)
1	Alluvium/Tertiary	Surface cover	8.7E-02	6.4E+00	1.3E+00	8.7E-02	2.2E-03	1.9E-01	3.8E-02	2.2E-03
1	Alluvium/Tertiary	Tertiary	2.1E-01	1.8E+00	8.6E-01	1.1E+00	6.7E-03	6.9E-02	2.8E-02	3.6E-02
2	Alluvium/Weathered zone	Weathered zone	9.9E-01	2.2E+01	5.6E+00	4.7E+00	1.8E-02	7.5E-01	1.6E-01	7.9E-02
2	Alluvium/Weathered zone	Regolith	3.7E-01	2.1E+00	1.3E+00	8.8E-01	9.0E-03	6.7E-02	3.5E-02	2.5E-02
3	Clematis Group	Triassic	4.2E-02	1.7E+00	6.2E-01	1.4E+00	3.5E-03	2.0E-01	3.9E-02	1.0E-01
4	Rewan Group (Upper)	Triassic	9.0E-04	1.3E+00	1.7E-01	4.7E-02	2.4E-05	6.2E-01	2.2E-02	3.8E-04
5	Rewan Group (Middle)	Triassic	2.5E-05	4.4E-02	9.2E-03	1.4E-03	6.6E-07	1.3E-02	1.2E-03	3.9E-05
6	Rewan Group (Lower)	Triassic	2.1E-05	1.1E-01	1.3E-02	1.2E-02	6.0E-07	1.2E-02	2.0E-03	8.3E-04
7	RCM	Overburden	1.3E-04	1.3E-02	2.0E-03	1.6E-03	1.0E-05	1.8E-03	1.1E-04	1.3E-04
8		Aries seam	2.3E-05	3.4E-04	6.1E-05	2.3E-05	1.7E-07	1.3E-06	4.0E-07	6.6E-07
9		Interburden	9.6E-04	1.5E-02	6.0E-03	1.4E-02	5.5E-05	1.2E-02	5.9E-04	1.5E-04
10		Castor seam	7.5E-05	8.6E-02	7.9E-03	2.2E-02	9.5E-07	5.0E-03	5.0E-04	4.0E-04
11		Interburden	4.2E-04	3.6E-02	6.6E-03	3.8E-03	5.0E-06	1.6E-04	3.4E-05	1.4E-05
12		Pollux seam	5.0E-05	2.6E-02	3.8E-03	7.7E-04	3.5E-06	6.0E-03	5.4E-04	2.2E-04
13		Interburden	1.6E-04	2.4E-02	5.0E-03	1.1E-03	1.5E-05	4.5E-03	6.0E-04	1.7E-04
14		Orion seam	3.1E-05	2.8E-01	2.3E-02	2.8E-01	2.7E-06	2.0E-01	1.0E-02	2.0E-01
15		Underburden	1.6E-05	1.1E-02	1.0E-03	4.0E-04	4.3E-08	1.6E-03	1.3E-04	1.1E-04
16	Burngrove Formation	Permian	2.4E-05	6.8E-03	8.8E-04	5.0E-05	2.4E-05	1.3E-03	1.6E-04	4.1E-05
17	Basement	Permian and/or below	1.2E-05	1.9E-03	5.0E-04	3.1E-04	3.6E-07	1.2E-03	5.2E-05	4.3E-06



Table 3-8 Calibrated Storage Parameters

Model Layer	Formation	Unit	Sy min (-)	Sy max (-)	Sy mean (-)	Sy BCM (m/day)	Ss min (m^{-1})	Ss max (m^{-1}))	Ss mean (m^{-1})	Ss BCM (m^{-1})
1	Alluvium/Tertiary	Surface cover	3.5E-02	7.2E-02	4.9E-02	5.0E-02	5.0E-07	2.7E-05	4.7E-06	5.8E-06
1	Alluvium/Tertiary	Tertiary	2.5E-02	4.0E-02	3.2E-02	2.8E-02	5.9E-07	3.7E-05	8.4E-06	3.0E-06
2	Alluvium/Weathered zone	Weathered zone Regolith	2.8E-02	6.7E-02	4.8E-02	4.0E-02	8.0E-07	4.6E-05	1.3E-05	5.5E-06
2	Alluvium/Weathered zone	Regolith	2.8E-02	4.2E-02	3.5E-02	3.6E-02	5.0E-07	1.4E-05	3.4E-06	1.7E-06
3	Clematis Group	Triassic	2.7E-03	5.3E-03	3.9E-03	3.4E-03	1.0E-07	2.1E-06	4.9E-07	8.4E-07
4	Rewan Group (Upper)	Triassic	1.4E-03	2.6E-02	8.5E-03	8.9E-03	1.3E-07	3.6E-06	1.0E-06	2.8E-07
5	Rewan Group (Middle)	Triassic	1.7E-03	2.4E-02	8.1E-03	3.9E-03	1.0E-07	2.5E-06	6.9E-07	4.6E-07
6	Rewan Group (Lower)	Triassic	3.0E-03	3.0E-02	1.4E-02	2.7E-02	1.3E-07	3.9E-06	9.4E-07	6.1E-07
7	RCM	Overburden	1.3E-03	1.5E-02	5.2E-03	2.9E-03	1.9E-07	4.5E-06	1.4E-06	1.7E-06
8		Aries seam	1.1E-03	2.4E-02	7.6E-03	4.2E-03	1.0E-07	3.2E-06	6.8E-07	2.1E-07
9		Interburden	2.1E-03	3.0E-02	1.1E-02	6.9E-03	2.2E-07	5.0E-06	2.1E-06	2.8E-06
10		Castor seam	1.1E-03	2.7E-02	5.8E-03	2.2E-03	2.3E-07	5.0E-06	1.5E-06	2.0E-06
11		Interburden	2.6E-03	3.0E-02	1.1E-02	4.7E-03	1.2E-07	3.1E-06	6.3E-07	1.4E-07
12		Pollux seam	1.1E-03	1.6E-02	5.9E-03	8.2E-03	1.5E-07	4.5E-06	8.0E-07	5.2E-07
13		Interburden	1.1E-03	2.3E-02	5.6E-03	2.9E-03	1.9E-07	5.0E-06	1.1E-06	5.7E-07
14		Orion seam	1.3E-03	2.3E-02	7.1E-03	2.7E-03	1.2E-07	4.5E-06	9.5E-07	1.1E-06
15		Underburden	1.1E-03	1.7E-02	6.0E-03	1.7E-02	1.1E-07	3.1E-06	8.2E-07	1.3E-06
16	Burngrove Formation	Permian	1.1E-03	2.2E-02	6.7E-03	8.0E-03	1.0E-07	2.2E-06	4.4E-07	2.7E-07
17	Basement	Permian and/or below	1.7E-03	2.8E-02	9.9E-03	1.4E-02	1.0E-07	1.2E-06	3.9E-07	3.6E-07



3.4.3 Calibrated Boundary Conditions

3.4.3.1 Calibrated Recharge

Table 3-9 presents the calibrated recharge rates for each zone in the model. The mean annual rainfall was assumed to be 546 millimetres per year (mm/year), based on SILO gridded data. This value was used to convert deep drainage to an equivalent annual rainfall.

Table 3-9 Calibrated Rainfall Recharge

Model Recharge Zone	Percentage of Rainfall (%)				Long-term Average Rainfall Recharge (mm/year)			
	Min	Max	Mean	BCM	Min	Max	Mean	BCM
Alluvium Quaternary	0.1	0.9	0.3	0.2	0.6	5.2	1.8	1.1
Regolith	0.0	0.3	0.1	0.1	0.1	1.7	0.4	0.4
Weathered Clematis	0.2	4.2	1.3	1.1	1.0	23.1	7.1	6.0
Weathered Permian	1.5	5.1	3.8	4.0	8.1	28.1	20.7	21.9
Spoil	1.0	5.4	2.8	3.0	5.6	29.7	15.3	16.1
Tailing	0.0	2.5	0.4	0.2	0.1	13.8	2.0	1.1

3.4.3.2 Calibrated Evapotranspiration

Table 3-10 presents the calibrated EVT rates and extinction depth. The mean annual potential ET was assumed to be 1,644 mm/year, based on SILO gridded data. This value was applied to the steady-state and predictive periods, while a time-varying series was applied during the transient calibration period.



Table 3-10 Calibrated Evapotranspiration Rate and Extinction Depth Bounds

Model EVT Zone	EVT factor of PAN				EVT Depth (m)				Long-term Potential EVT (mm/year)	Long-term Average EVT (mm/year)			
	Min	Max	Mean	BCM	Min	Max	Mean	BCM		Min	Max	Mean	BCM
Alluvium Quaternary	0.5	0.9	0.7	0.6	1.7	13.7	6.6	5.0	1644.0	845.6	1543.9	1105.2	1041.6
Regolith	0.5	0.9	0.7	0.8	0.7	11.2	3.3	4.5		897.6	1557.7	1198.5	1361.8
Weathered Clematis	0.5	0.8	0.7	0.6	0.6	12.5	3.6	4.3		822.7	1372.4	1077.7	1044.1
Weathered Permian	0.5	0.8	0.6	0.6	6.6	14.9	11.5	12.7		821.3	1350.1	1028.7	1025.5
Spoil	0.5	0.9	0.6	0.5	0.5	2.5	1.2	1.3		821.3	1404.9	1056.4	821.3
Tailing	0.5	0.9	0.7	0.6	0.5	2.9	1.2	1.2		838.2	1471.0	1102.5	903.4



3.4.3.3 Calibrated River Boundary

Calibrated river vertical conductivity are presented in **Table 3-11** and calibrated tailing deposition vertical conductivity are presented in **Table 3-12**.

Table 3-11 Calibrated River Vertical Conductivity

Zone	Vertical K (m/day)				River Name
	Min	Max	Mean	BCM	
1	1.2E-05	1.6E-01	1.5E-02	8.9E-03	Blackwater mainstream
2	8.5E-04	1.0E+00	3.6E-01	2.1E-01	Blackwater tributaries
3	1.0E-05	1.9E-01	7.7E-03	3.7E-03	Sirius Creek
4	5.3E-05	5.6E-01	3.2E-02	2.7E-03	Rockland Creek and tributaries
5	2.1E-05	7.9E-01	3.8E-02	1.5E-02	Humboldt Creek and tributaries
6	9.0E-05	7.4E-01	8.3E-02	2.5E-02	Planet Creek and tributaries
7	1.0E-05	2.8E-01	1.5E-02	3.8E-05	Small streams
8	1.1E-05	1.5E-01	7.3E-03	7.4E-05	Deep Creek dam
9	1.0E-05	6.7E-02	4.2E-03	8.8E-04	New Taurus dam
10	3.7E-05	6.2E-01	3.8E-02	1.7E-04	Tannyfoil dam

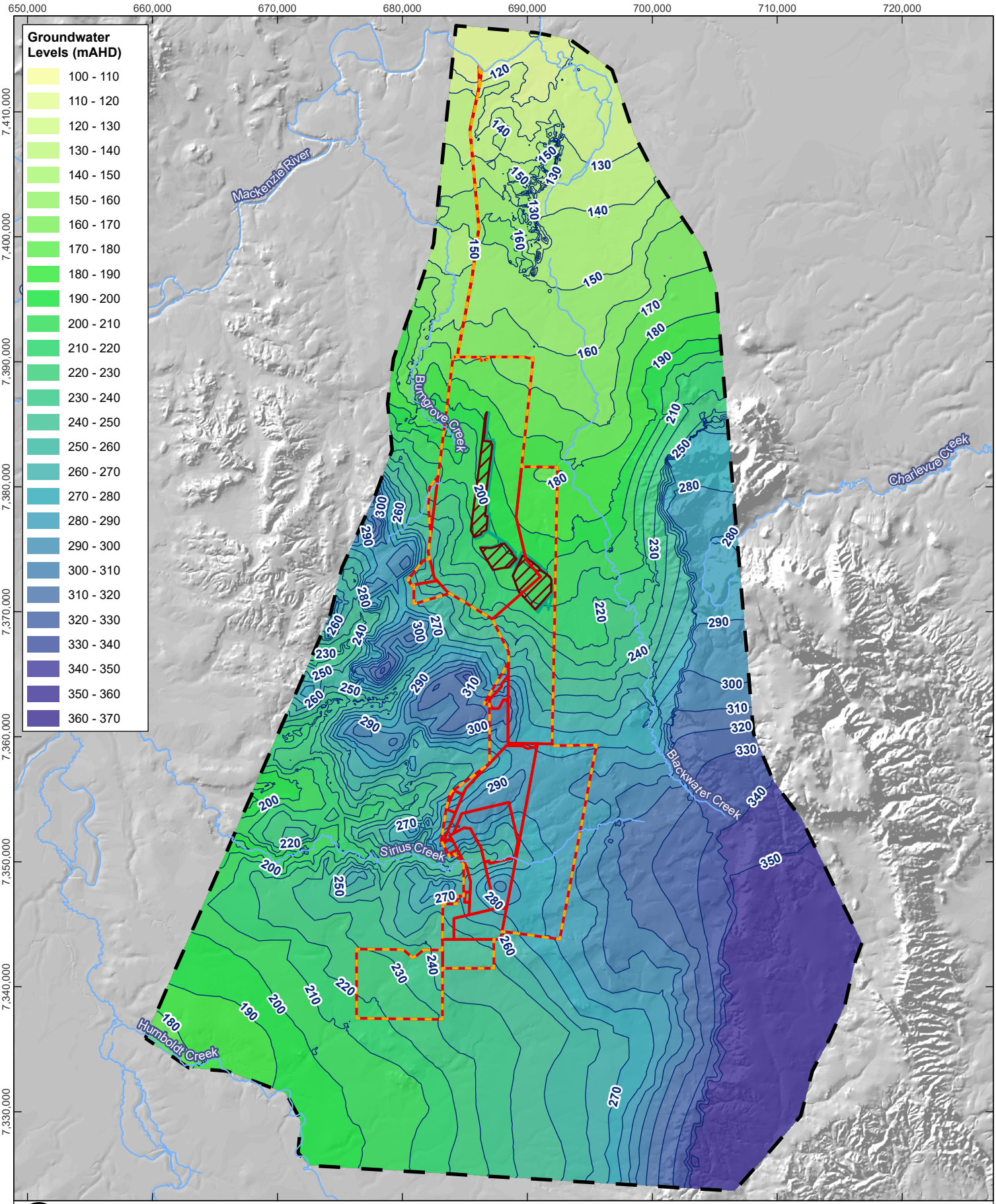
Table 3-12 Calibrated Tailing Deposition Vertical Conductivity

Tailings	Kz (m/day)				Stage
	Min	Max	Mean	BCM	
BD-R10N	2.7E-06	9.5E-05	2.5E-05	4.9E-05	Deposited from July 2023 until 2040
BD-R12N	2.7E-06	9.5E-05	2.5E-05	4.9E-05	Deposited from July 2023 until 2040
BD-R12S	2.7E-06	9.5E-05	2.5E-05	4.9E-05	Deposited from July 2023 until 2040
R74	2.7E-06	9.5E-05	2.5E-05	4.9E-05	Deposited from Oct 2015 until 2023
Curragh Mine	2.7E-06	9.5E-05	2.5E-05	4.9E-05	Deposited from Jan 2007 until 2023

3.4.4 Calibrated Water Table Elevation

The calibrated water table elevation is presented for steady state period (**Figure 3-9**) and the end of the calibration period (**Figure 3-10**).





0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- Groundwater Level Contour (10mAHD)
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

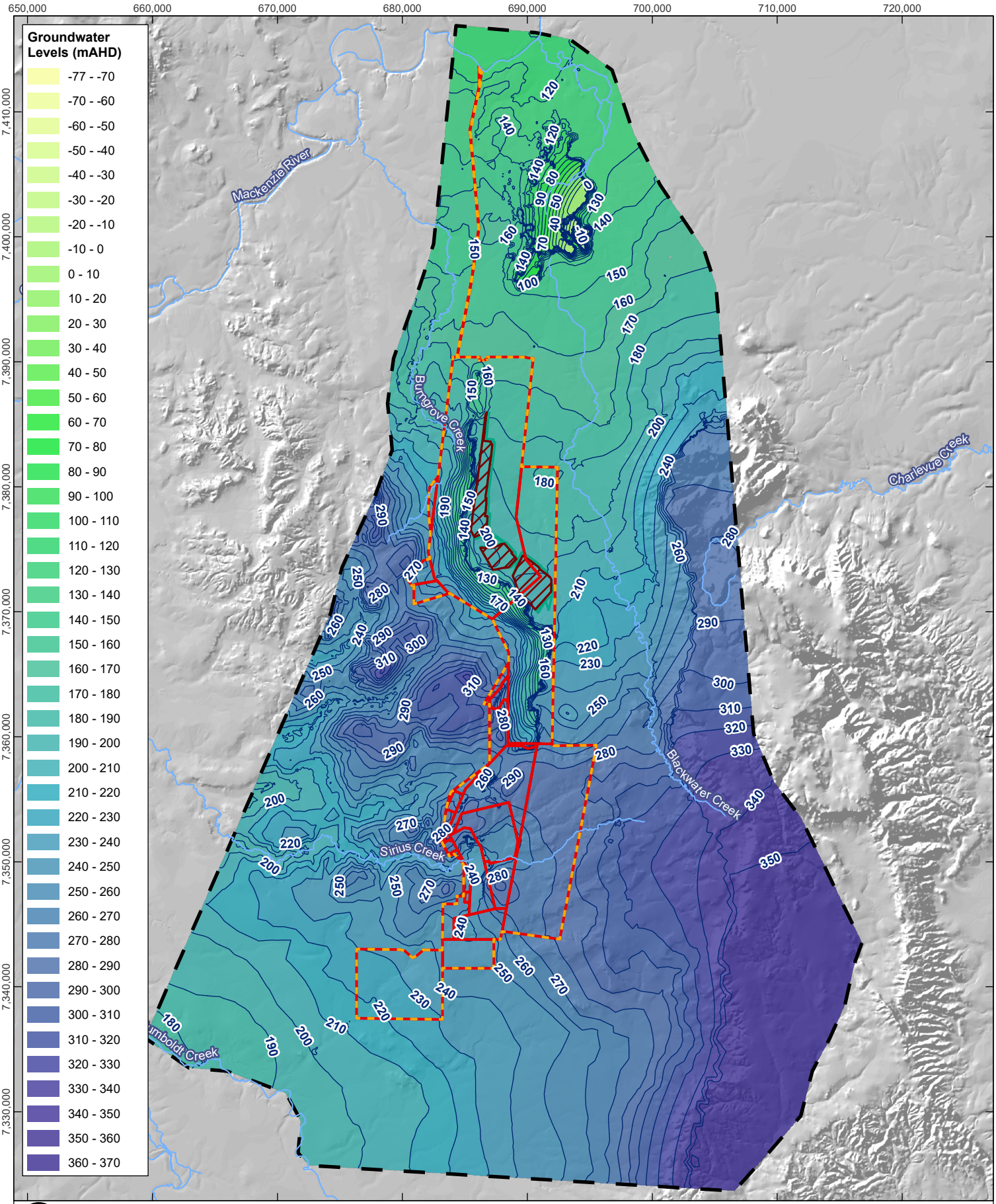
CALIBRATED WATER TABLE ELEVATION, STEADY STATE

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 3-9

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F03_09_Calibrated Water Table Elevation - Steady State Period



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- Groundwater Level Contour (10mAHD)
- BWM Mining Lease
- Project Area (Environmental Authorities boundary)
- Model Boundary
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

CALIBRATED WATER TABLE ELEVATION - END OF CALIBRATION

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 3-10

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F03_10_Calibrated Water Table Elevation - End of Calibration

4.0 Predictive Modelling – Mining Period

4.1 Timing and Mining

Transient predictive modelling was used to simulate the proposed mining at the Project as well as mining at other approved and foreseeable mines within the model domain. The cumulative assessment was undertaken for BWM (northern portion), the Project (SA 7 and SA 10), BWM (southern portion), Curragh Mine (operating mine), and Cook Collieries. The simulated predictive mine progression for BWM, including the Project, is presented in **Figure 4-1**.

The predictive part of the model comprises annual stress periods, commencing January 2025 through until December 2093. The predictive model stress period setup is detailed in **Appendix C** alongside simulated mine timings.

Transient predictive models have been developed for three scenarios:

- Cumulative Scenario– all approved and foreseeable mining in the model area and at BWM plus the Project.
- Approved Scenario– all approved and foreseeable mining in in the model area and at BWM without the Project.
- Null Run – no mining within the model area.

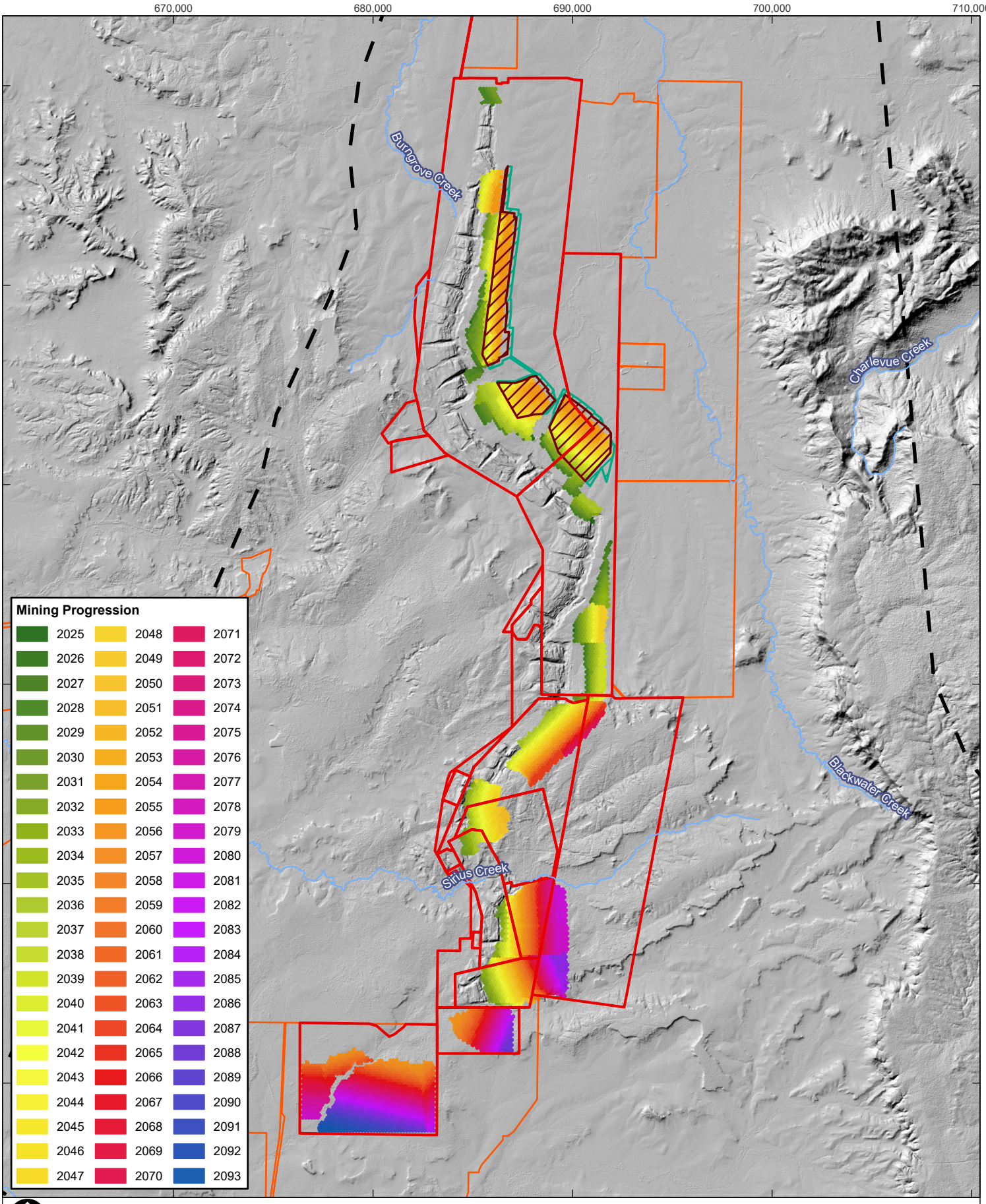
The Project effects (i.e. the incremental changes) are estimated by the difference between the Cumulative and Approved scenarios. Mining cells progressed annually and drain cells simulating the mining were projected down to the base of the lowermost target coal seam (i.e. the Pollux seam).

To define the active drainage period for the mining cells at the project, rather than assuming a fixed period of 1 or 2 years, an in-house script that dynamically calculates this period by referencing adjacent mining cells was utilised. For each cell, the script identifies the nearest mined neighbour in the same pit and compares their mining time. The difference determines how long the cell should be draining, providing a more realistic and spatially responsive representation of pit dewatering. After the drains were removed the TVM package was used to assign spoil/void/tailing properties to the cells depending on their spatial location.

Appendix C presents the simulated mine timings for the Project and surrounding mines used in the predictive model. BWM (including the Project) was included for the predictive run, as all other mines have either been in closure or care and maintenance or the future mining sequence was not available. The cumulative impact assessment however will consider those mines as they were included in the calibration period up to end of 2024. The following applies:

- Cook Colliery underground mining: in closure, active during calibration period and included as such.
- Curragh mine: Coronado currently operates the Curragh coal mine complex, which is located adjacent to the Project and approximately 8 km north of Blackwater Township. The complex comprises two open cut mines (Curragh North and Curragh South) and an underground mine (Mammoth Underground). The open cut operations began in 1983, extracting coal from the Aries, Pisces, Castor and Pollux coal seams of the RCM, while the underground mine started in 2024.

All mines included in the model were simulated using the DRN package. A nominally high drain conductance of 100 square metres per day (m²/day) was applied to drain cells to simulate rapid removal of water from the system.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	AS

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PROJECT INDICATIVE MINE PROGRESSION

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 4-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_01_Project Indicative Mine Progression

4.2 Water Balance

Table 4-1 to **Table 4-3** provide average flow rates (January 2025 until December 2093) for water transfer into and out of the groundwater model domain for the three predictive scenarios; the Cumulative, Approved and Null Run. The cumulative mass balance error over the entire simulation period is < 0.1% for all three scenarios.

The tables show that simulated recharge increased from 61.8 ML/day in the Null scenario to 64.5 ML/day and 62.7 ML/day in the Cumulative scenario and the Approved scenario respectively. The increase in recharge is due to the presence of open cut mining and enhanced recharge through the spoil to the groundwater system in the Approved and Cumulative scenarios.

Table 4-1 to **Table 4-3** and **Figure 4-2** to **Figure 4-4** show that in all three predictive scenarios, groundwater leaves the model through regional groundwater flow (GHB). The GHB inflow and outflow are < 0.4% of the total inflow and outflow in water balance for all the scenarios indicating the model boundary conditions do not have a significant influence on the model predictions.

ET decreased from 56.6 ML/day in the Null Scenario to 51.4 ML/day and 51.7 ML/day in the Project and Approved scenarios. The ET decline is primarily due to the mining activities and decline of water levels within the saturated shallow areas such as voids, pits or outcropping areas.

The net groundwater flow to Blackwater Creek is 0.02 ML/day in all three scenarios. All scenarios indicate the flow is generally from groundwater to the Creek, however this flow is very minor (and shows that Blackwater Creek does not receive continuous amounts of baseflow).

Groundwater outflow from the model occurs predominantly via drain cells, used to simulate open cut and underground mining activity in the model. **Table 4-1** and **Table 4-2** show that the Cumulative scenario resulted in an increase in the average drain outflow (to 14.5 ML/day from 11.8 ML/day predicted for the Approved scenario). The storage component in the table refers to changes in the water level over the transient simulation timeframe. Changes in the storage between the Approved and Cumulative Scenarios relate to the change in mine footprint and added recharge through spoil.

Table 4-1 Average Simulated Water Balance over the Predictive Period - Cumulative

Component	Inflow (ML/day)	Percent of Total Inflow (%)	Outflow (ML/day)	Percent of Total outflow (%)
Recharge (RCH)	64.5	75.4	0.0	0.0
ET (from GW) (EVT)	0.0	0.0	51.4	60.0
Surface Drainages (RIV)	0.0	0.0	0.0	0.0
Pit Lakes and dams (CHD)	6.9	8.1	5.2	6.1
Regional Groundwater Flow (GHB)	0.3	0.4	0.1	0.2
Mines (DRN)	0.0	0.0	14.5	16.9
Storage	13.8	16.1	14.3	16.8
Total	**85.5**	**100.0**	**85.6**	**100.0**

Table 4-2 Average Simulated Water Balance over the Predictive Period – Approved

Component	Inflow (ML/day)	Percent of Total Inflow (%)	Outflow (ML/day)	Percent of Total outflow (%)
Recharge (RCH)	62.7	77.2	0.0	0.0
ET (from GW) (EVT)	0.0	0.0	51.7	63.6
Surface Drainages (RIV)	0.0	0.0	0.0	0.0
Pit Lakes and dams (CHD)	6.0	7.5	7.9	9.8
Regional Groundwater Flow (GHB)	0.3	0.4	0.1	0.2
Mines (DRN)	0.0	0.0	11.8	14.5
Storage	12.2	15.0	9.6	11.9
Total	**81.2**	**100.0**	**81.2**	**100.0**

Table 4-3 Average Simulated Water Balance over the Predictive Period - Null Run

Component	Inflow (ML/day)	Percent of Total Inflow (%)	Outflow (ML/day)	Percent of Total outflow (%)
Recharge (RCH)	61.8	99.6	0.0	0.0
ET (from GW) (EVT)	0.0	0.0	61.8	99.7
Surface Drainages (RIV)	0.0	0.0	0.0	0.0
Pit Lakes and dams (CHD)	0.0	0.0	0.0	0.0
Regional Groundwater Flow (GHB)	0.0	0.0	0.2	0.2
Mines (DRN)	0.0	0.0	0.0	0.0
Storage	0.2	0.4	0.0	0.0
Total	**62.0**	**100.0**	**62.0**	**100.0**



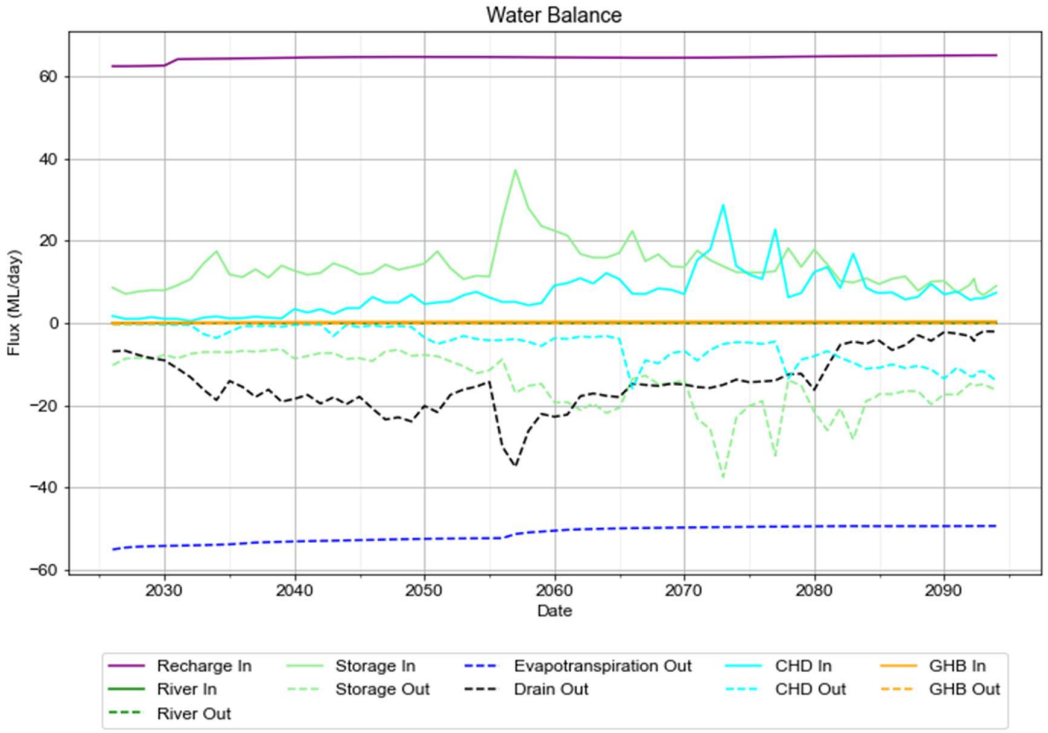


Figure 4-2 Transient Water Balance Over the Prediction Period – Cumulative

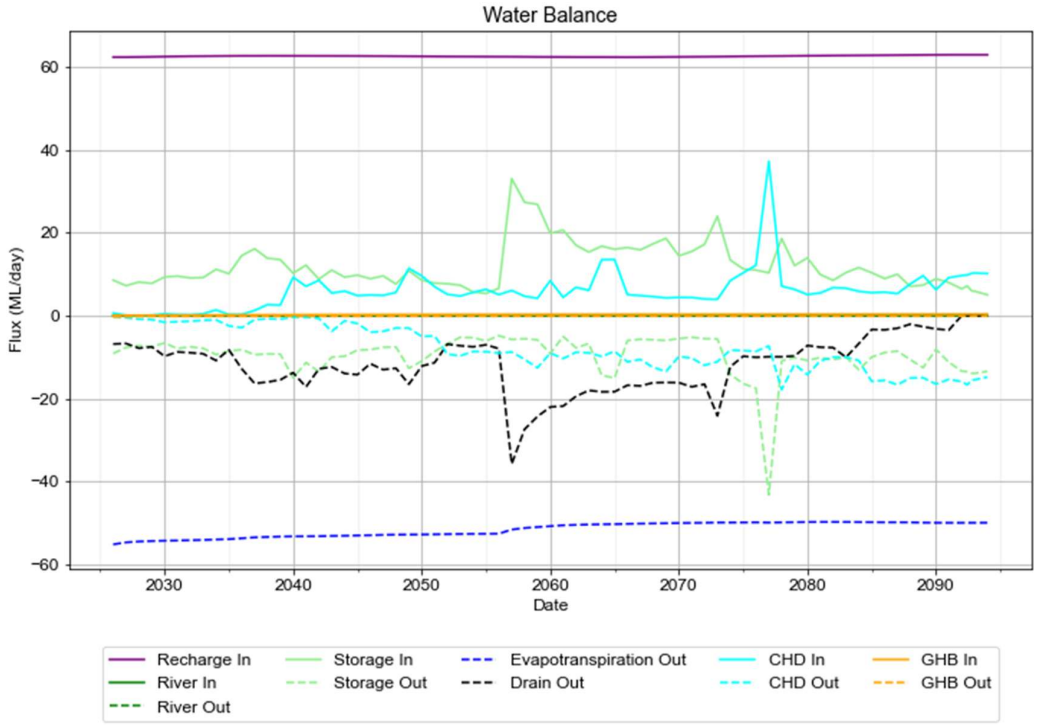


Figure 4-3 Transient Water Balance Over the Prediction Period - Approved

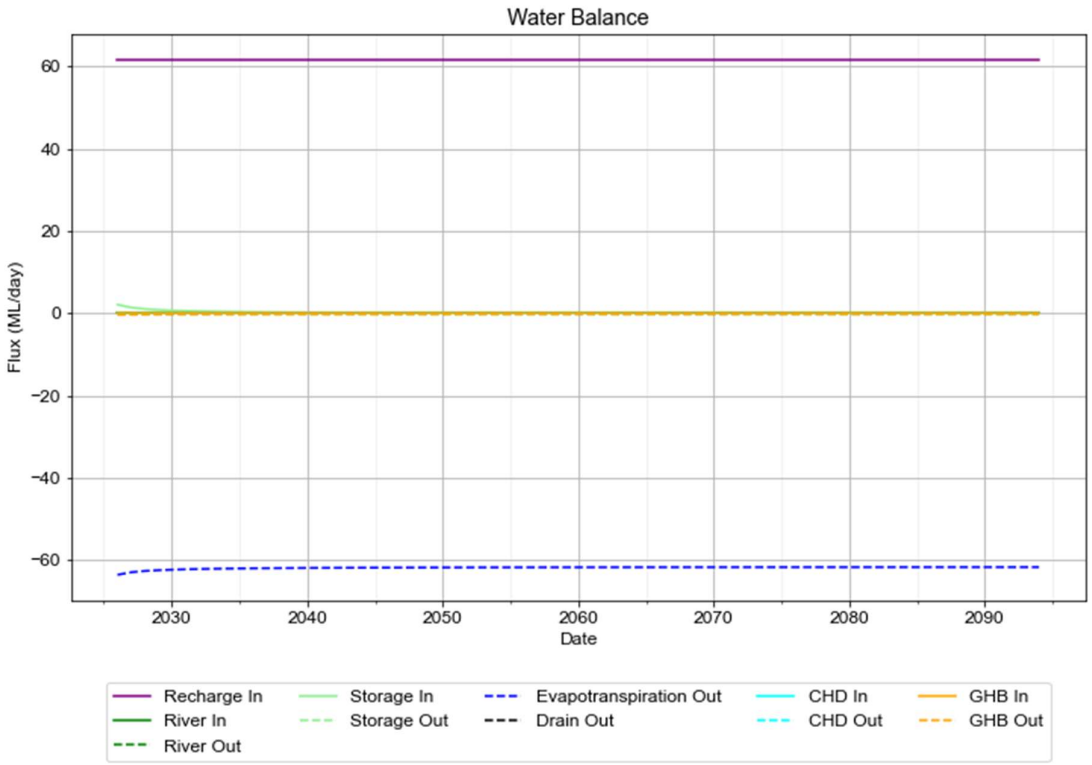


Figure 4-4 Transient Water Balance Over the Prediction Period – Null Run

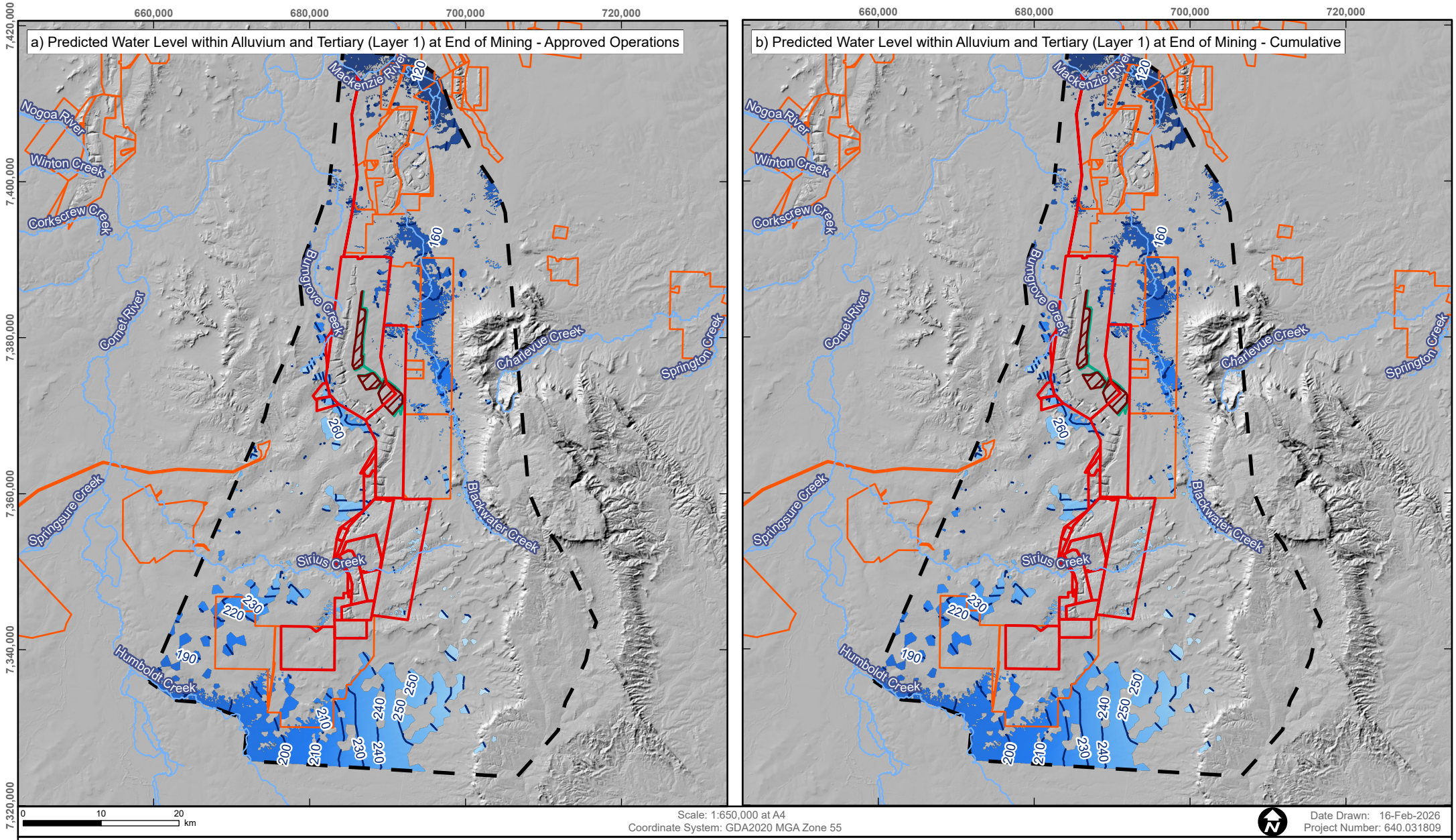
4.3 Predicted Groundwater Levels

Predicted groundwater levels at the end of the modelling timeframe for the Approved and Cumulative scenarios are provided in **Figure 4-5** to **Figure 4-8**. In these four figures, the Approved scenario is presented on the left side, and the Cumulative scenario is presented on the right side. The grey cells in the water level grids represent unsaturated areas (i.e., where the simulated water level elevation is below the base of cell) or an area where the layer is not present.

Minimal changes to alluvium/tertiary (Layer 1) groundwater levels are observed between the Approved and Cumulative mining scenarios (**Figure 4-5**). **Figure 4-6** shows that the dewatering of the weathered zone (Layer 2) caused by the Project occurs particularly within the area immediately to the east of the Project area. **Figure 4-6** also shows that there are no significant changes to the water levels along Blackwater Creek between the Approved and Cumulative Scenarios.

Figure 4-7 shows the predicted groundwater levels in the Clematis sandstone (Layer 3). The Clematis Sandstone is presenting as an outcrop at the eastern side of the model and is disconnected from the Permian coal measures by the Rewan formation. **Figure 4-7** also shows that there are no significant changes to the water levels between the Approved and Cumulative scenarios, indicating that the Clematis sandstone would not be impacted by the Project.

Figure 4-8 show the predicted water levels in the Permian coal measures (Layer 12) at the end of mining for the Approved and Cumulative mining scenarios. **Figure 4-8** shows that the groundwater flow is generally from southeast and south towards Blackwater Creek in the centre and north of the model. Zones of depressurisation at the Project and surrounding mines are shown to cause localised interruptions to the regional flow gradient.



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area
- Groundwater Contour (mAHD)

Groundwater Level (mAHD)

332

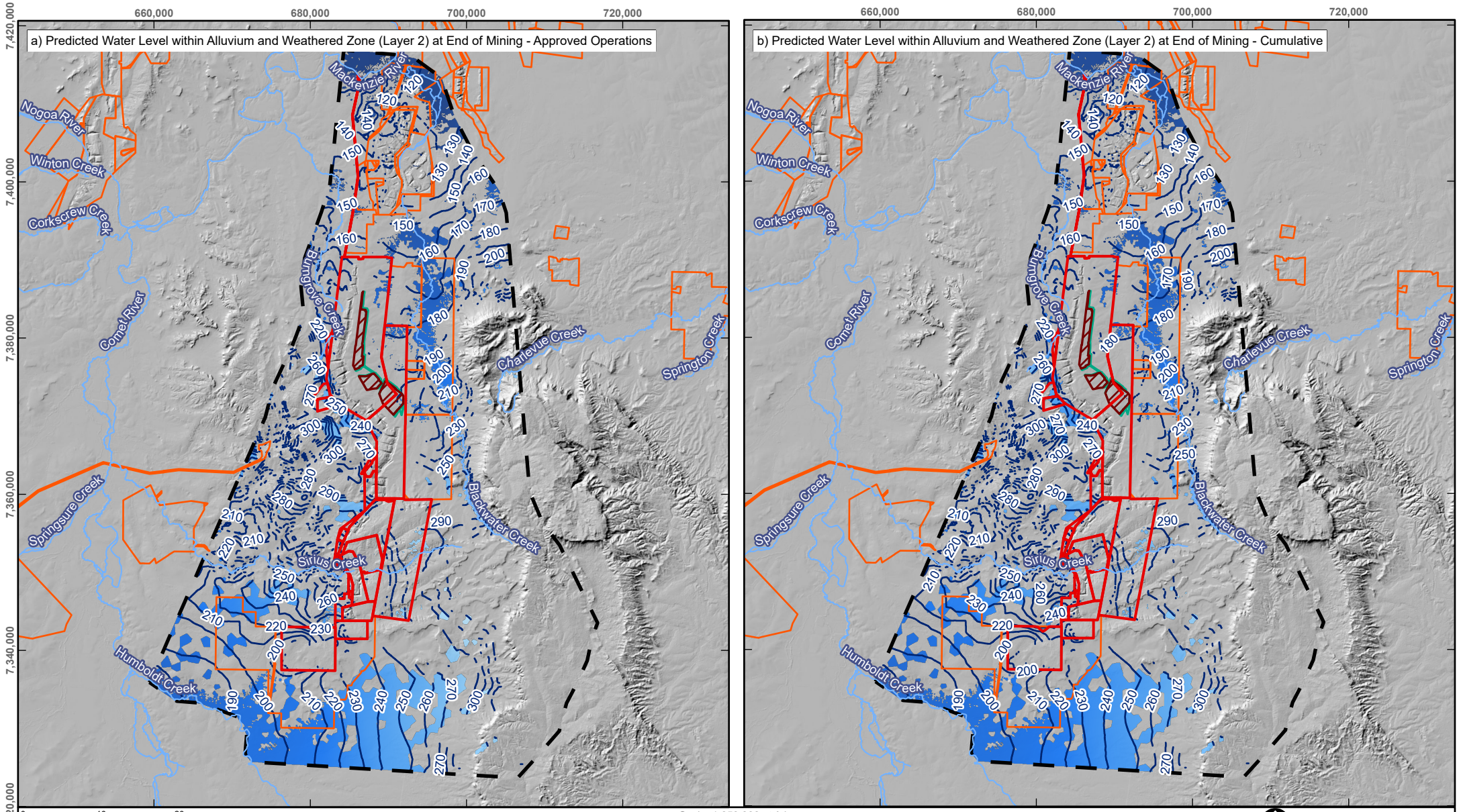
90

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED WATER LEVEL WITHIN THE ALLUVIUM AND TERTIARY (LAYER 1) AT THE END OF MINING

FIGURE 4-5

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_05_Predicted Water Level within the Alluvium and Tertiary (Layer 1) at the EOM



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Groundwater Contour (mAHD)

Groundwater Level (mAHD)

334

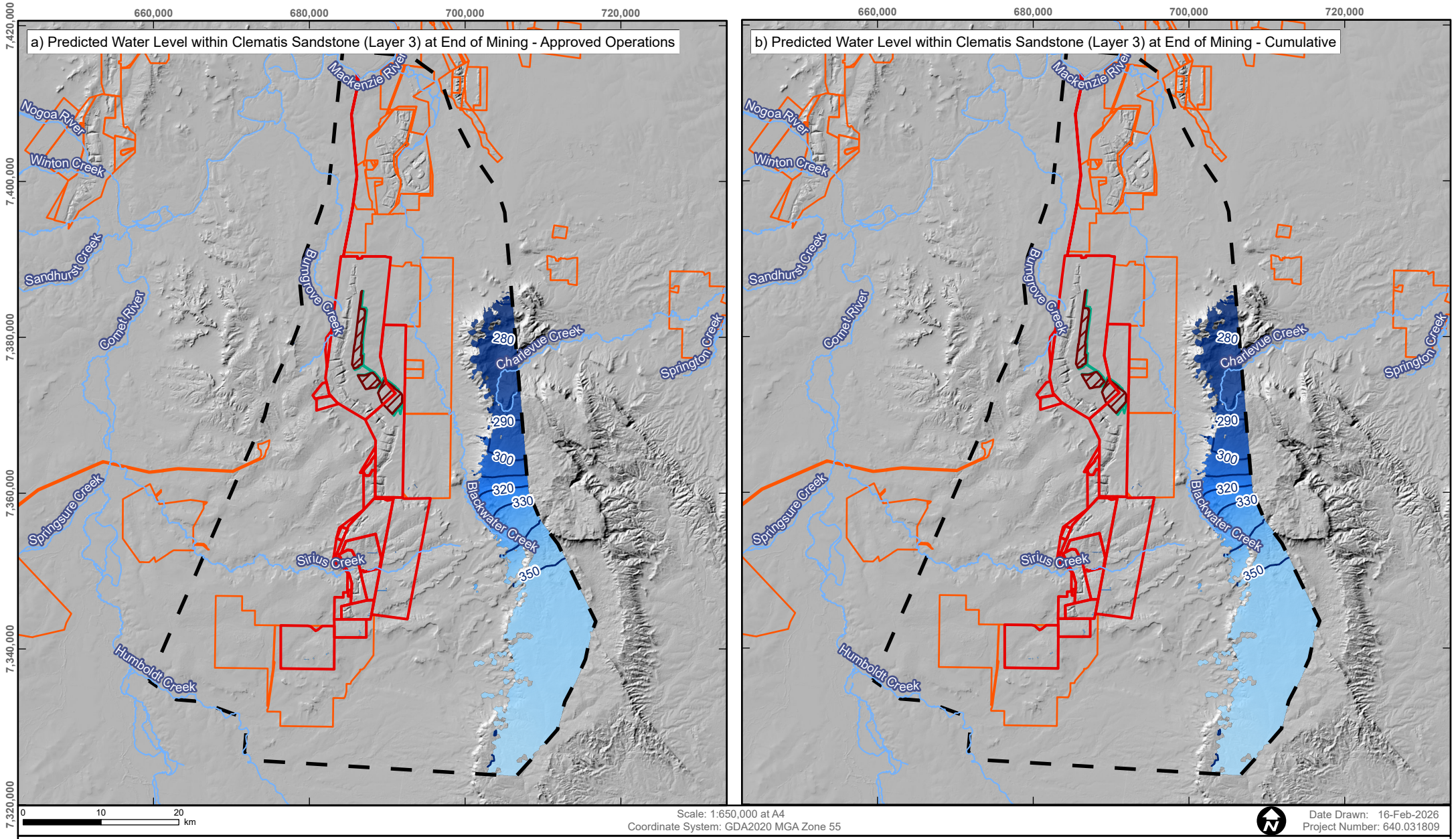
90

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED WATER LEVEL WITHIN THE ALLUVIUM AND WEATHERED ZONE (LAYER 2) AT THE END OF MINING

FIGURE 4-6

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_06_Predicted Water Level within the Alluvium and Weathered Zone (Layer 2) at the EOM



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Groundwater Contour (mAHD)

Groundwater Level (mAHD)

363

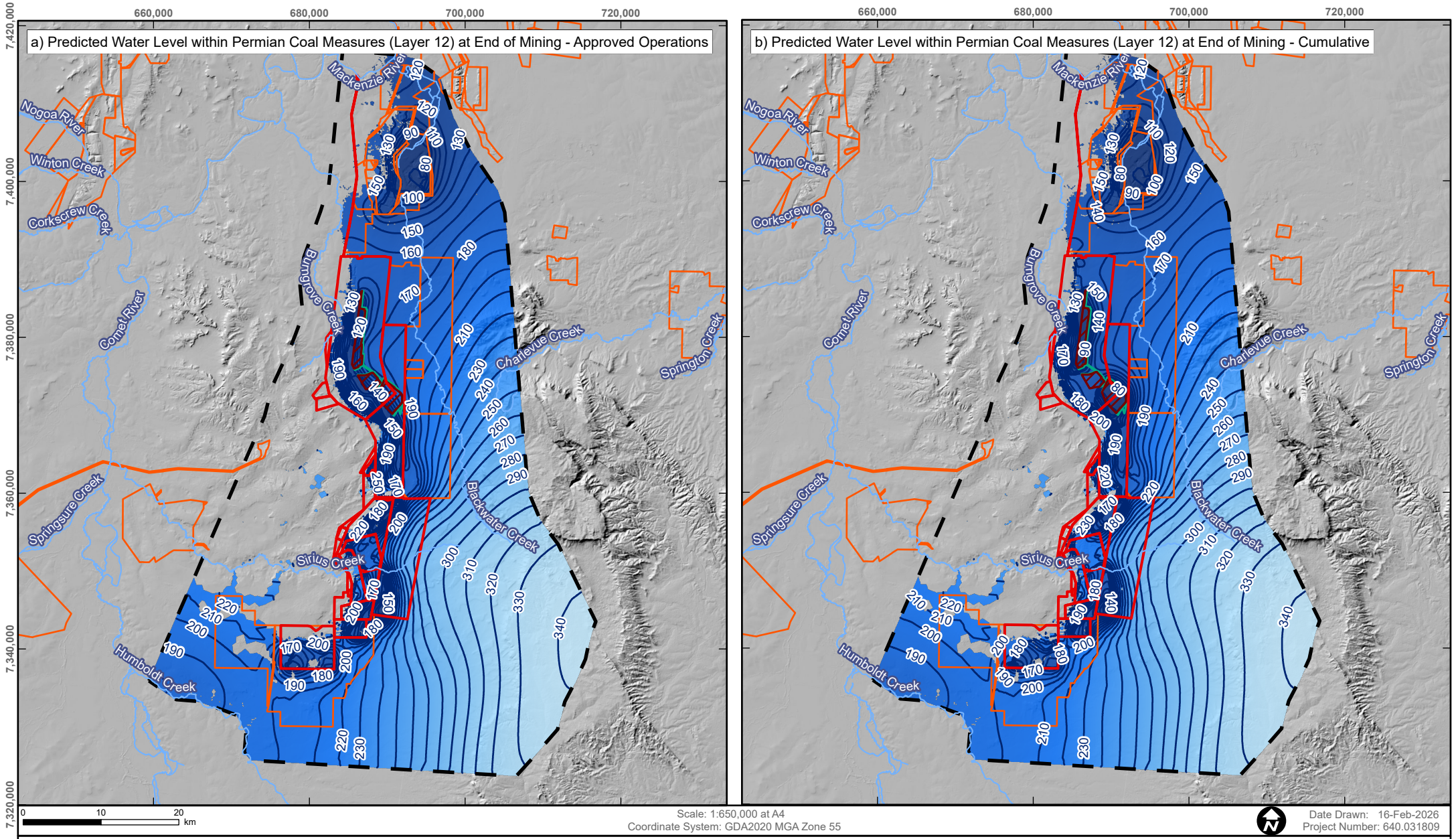
256

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED WATER LEVEL WITHIN THE CLEMATIS SANDSTONE (LAYER 3) AT THE END OF MINING

FIGURE 4-7

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_07_Predicted Water Level within the Clematis Sandstone (Layer 3) at the EOM



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Groundwater Contour (mAHD)

Groundwater Level (mAHD)

342

68

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED WATER LEVEL WITHIN THE PERMIAN COAL MEASURES (LAYER 12) AT THE END OF MINING

FIGURE 4-8

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_08_Predicted Water Level within the Permian Coal Measures (Layer 12) at the EOM

4.4 Maximum Predicted Drawdowns

The process of mining directly removes water from the groundwater system and reduces water levels in surrounding groundwater units. The extent of the zone affected is dependent on the properties of the aquifers/aquitards and is referred to as the zone of drawdown. Aquifer drawdown is greatest at the working coalface and decreases with distance from the mine.

4.4.1 Maximum Incremental Drawdowns

Maximum incremental drawdown refers to the drawdown impact associated with the Project and is obtained by subtracting the predicted maximum aquifer groundwater drawdown for the Approved model scenario (Null – Approved) over the model duration from the predicted maximum aquifer groundwater drawdown for the Cumulative model scenario (Null – Project) over the model duration. The maximum drawdown represents the maximum drawdown values recorded at each model cell. Predicted incremental drawdown figures are presented in **Figure 4-9** to **Figure 4-16**, on the left side.

Figure 4-9 (a) shows that no incremental drawdown greater than (>) 1 m are predicted for the alluvium as a result of mining at the Project. For a discussion on the potential incidental water impacts on the alluvium, see **Section 4.6.1**. The maximum predicted incremental drawdowns associated with the Project within the weathered zone is shown in **Figure 4-10** (a). The incremental drawdown extent within the weathered zone (Layer 2) is largely confined to near the pit and is influenced by the distribution of predicted saturated zones in the weathered zone.

Figure 4-11 (a), **Figure 4-12** (a), and **Figure 4-13** (a) show the maximum predicted incremental drawdown in the Upper, Middle and Lower Rewan Formation, respectively. Drawdown increases with depth across the Rewan Formation, with Layer 6 showing incremental drawdown associated with the Project. The incremental drawdown extent is largely confined to near the pit, and in the lower Rewan. The lower Rewan is expected to be primarily disconnected from shallow receptors, and the drawdown does not propagate into the upper Rewan.

The Permian coal seams are the primary aquifers targeted by the Project and will experience drawdowns as a direct result of mining at the Project. Groundwater level drawdown within the mined coal seams is influenced by unit structure and is confined to unit extents. **Figure 4-14** (a) and **Figure 4-15** (a) show the maximum predicted incremental drawdown for the Aries and Pollux Seams in the RCM, respectively. The figures show that to the west, the extent of maximum predicted incremental drawdown of the Permian coal measures is limited to near the pit due to the structural geology (i.e., coal seams subcrop). The extent of maximum predicted incremental drawdown in the coal seams towards the east extends laterally to Blackwater Creek, however at depth, not vertically into the shallow formations, such as alluvium or Tertiary.

Maximum predicted incremental drawdown for the Burngrove Formation is shown in **Figure 4-16** (a). The figure shows that maximum predicted incremental drawdown is similar to the drawdown in the coal seams and is limited to the coal seam outcrop.

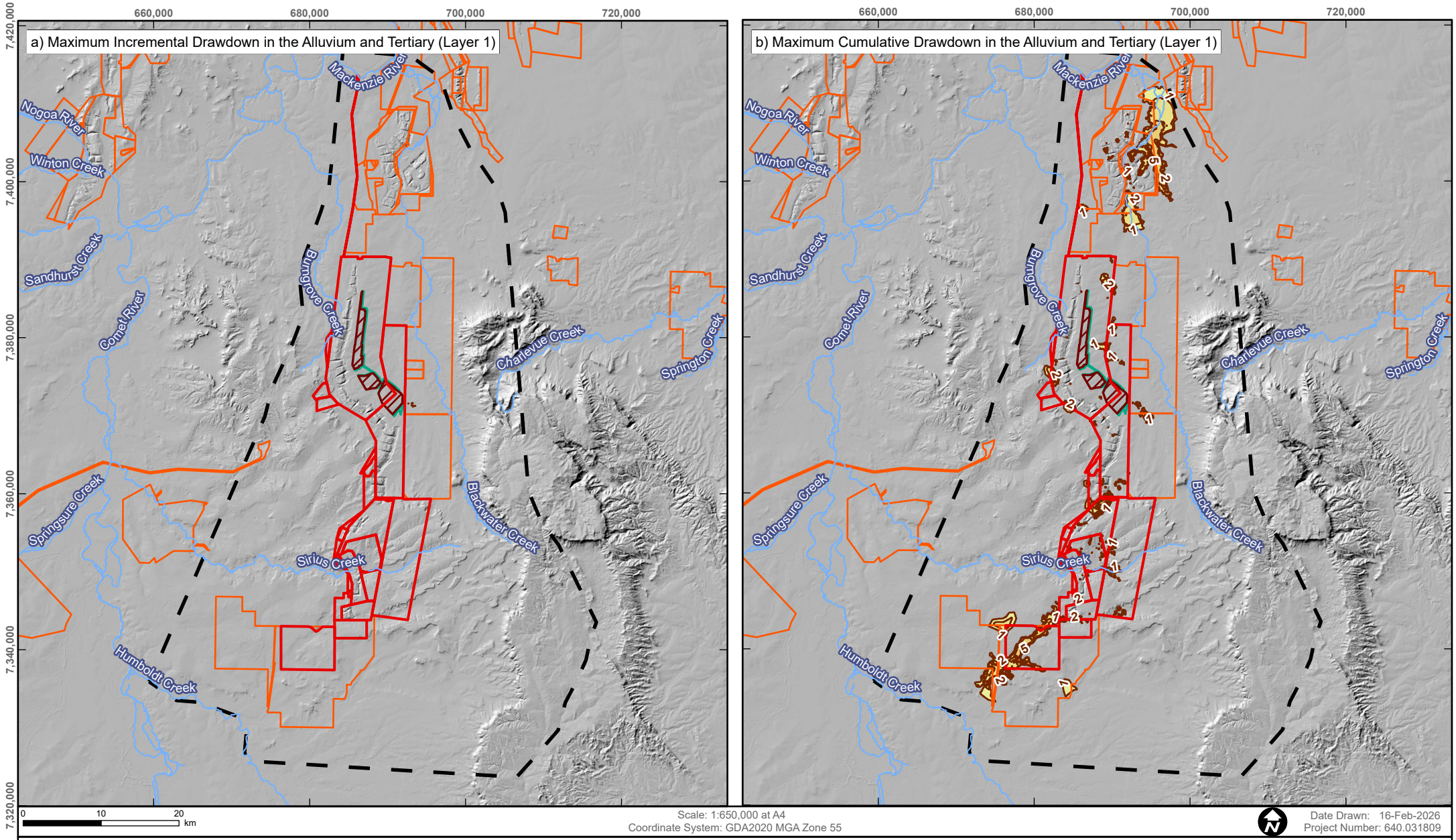
4.4.2 Maximum Cumulative Drawdowns

Maximum cumulative drawdown predicted impacts are shown in **Figure 4-9** to **Figure 4-16**, on the right side. These drawdowns represent the total impact of mining by all current mining and foreseeable mining, including the Project. The cumulative drawdown is derived by calculating the maximum difference in the groundwater levels for the Cumulative scenario with those in a theoretical “No Mining” or Null Run scenario, for all times during the predictive model period.

Cumulative drawdown impacts for the Alluvium and Tertiary (**Figure 4-9**, [b]) show that maximum predicted cumulative drawdown impacts are in the north near Blackwater Creek. Cumulative impacts within the weathered zone (**Figure 4-10**, [b]) can be seen connecting to the drawdown in the Tertiary.

Figure 4-14 (b) and **Figure 4-15** (b) show the maximum predicted cumulative drawdown in the Aries and Pollux seams in the RCM. As shown in the figures the maximum cumulative drawdown is bounded on the western side by the coal seam outcrop and predicted to extend generally a distance of 5-7 km east of the mining areas. The cumulative drawdown reached the model boundary in the northeast, which coincides with a major fault. An extension of the model in that area would still result in the same drawdown, as the fault is expected to act as a barrier to flow.

Figure 4-16 (b) shows the maximum predicted cumulative drawdown in the Burngrove Formation. The maximum cumulative drawdown for Burngrove is similar to the drawdowns expected in the Permian coal measures and predicted to extend approximately 5-7 km east of the mining areas.



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area
- Drawdown Contour (m)

Drawdown (m)

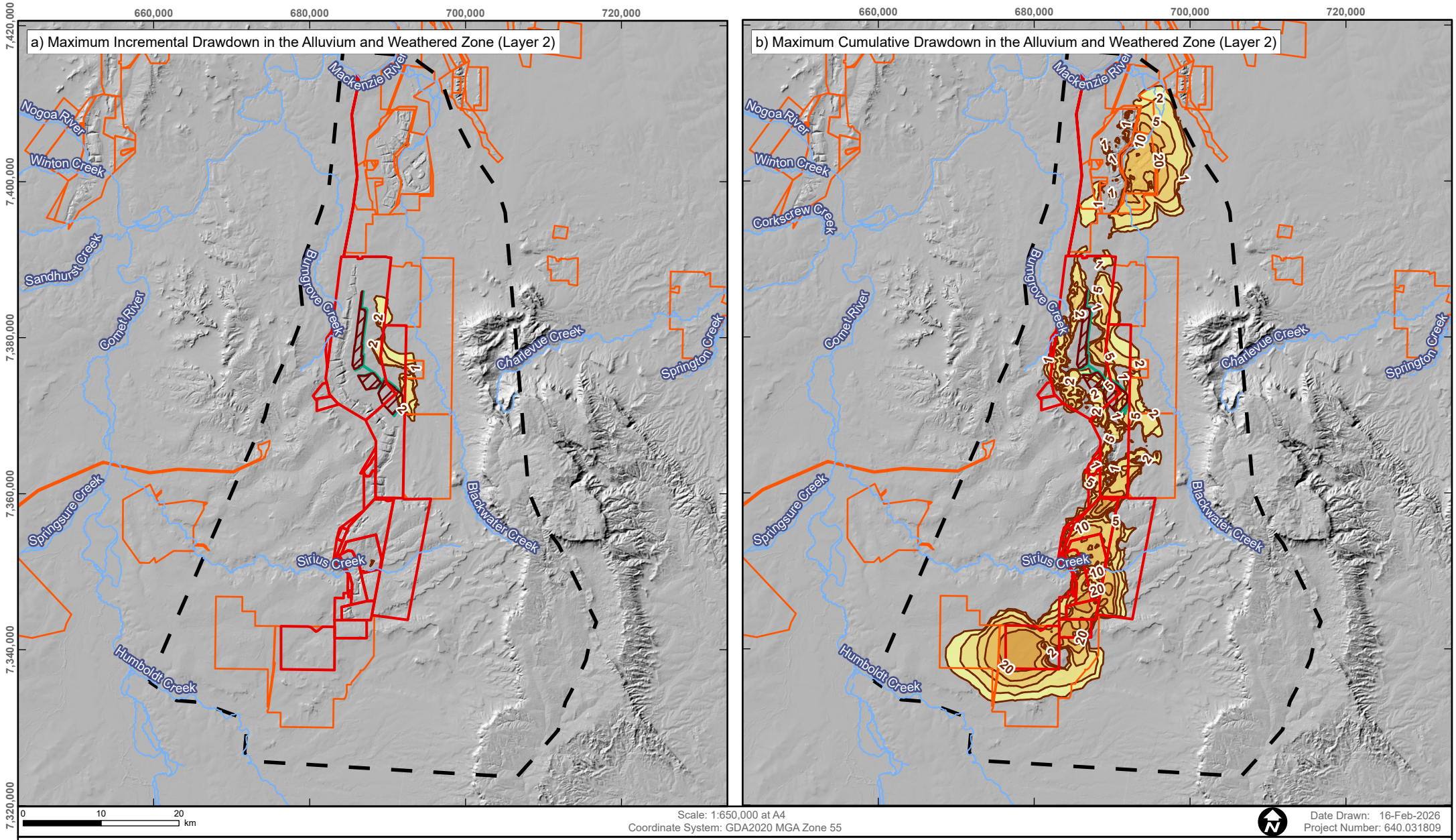
1 - 2	20 - 50
2 - 5	50 - 100
5 - 10	100 - 200
10 - 20	200 - 300

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ALLUVIUM AND TERTIARY (LAYER 1)

FIGURE 4-9

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_09_Maximum Incremental (a) and Cumulative (b) Drawdown in the Alluvium and Tertiary (Layer 1)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- BWM Mining Lease
- Model Boundary
- Mining Lease
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Drawdown Contour (m)

Drawdown (m)

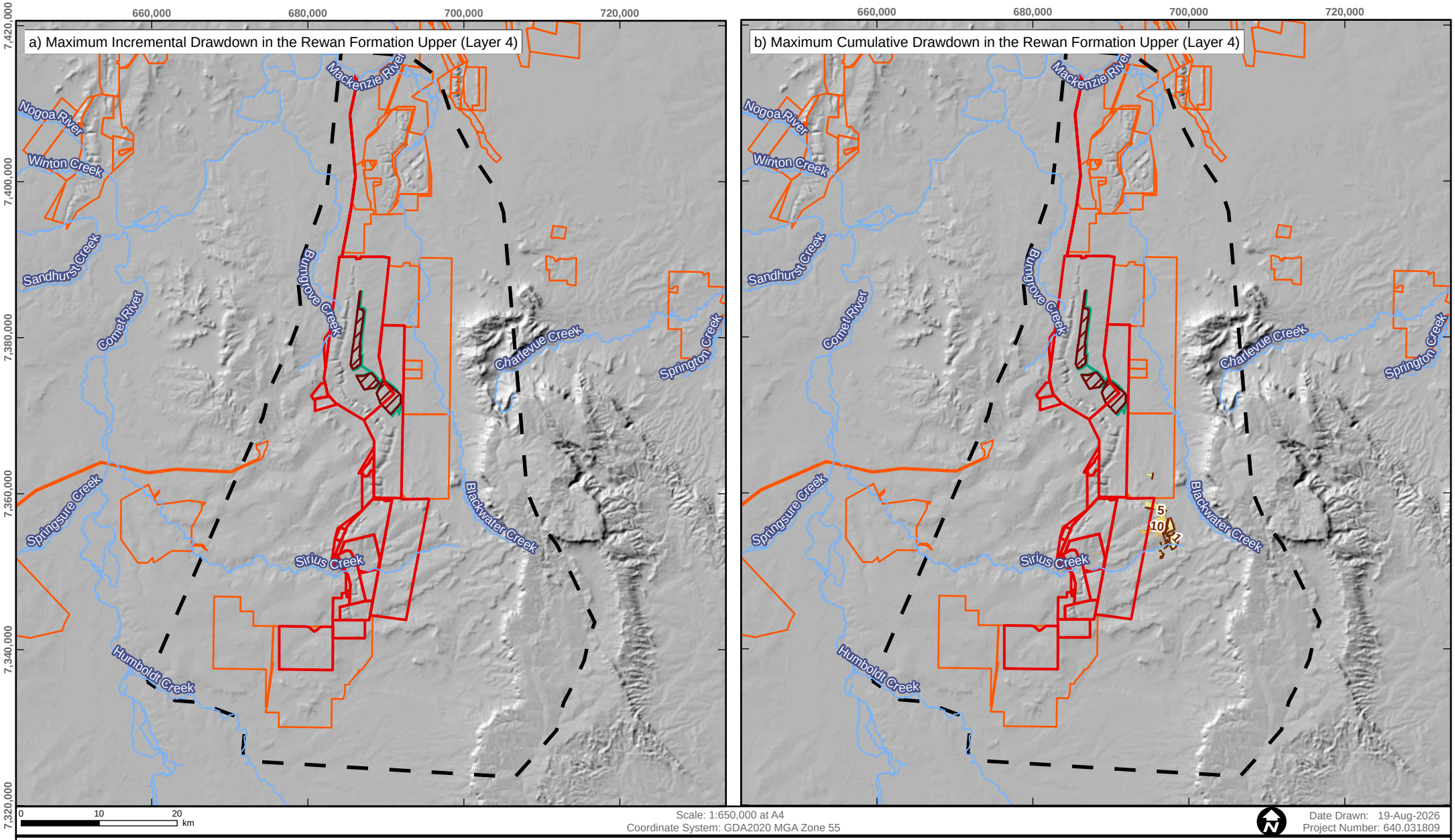
1 - 2	20 - 50
2 - 5	50 - 100
5 - 10	100 - 200
10 - 20	200 - 300

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ALLUVIUM AND WEATHERED ZONE (LAYER 2)

FIGURE 4-10

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_10_Maximum Incremental (a) and Cumulative (b) Drawdown in the Alluvium and Weathered Zone (Layer 2)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 19-Aug-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- Drawdown Contour (m)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Drawdown (m)

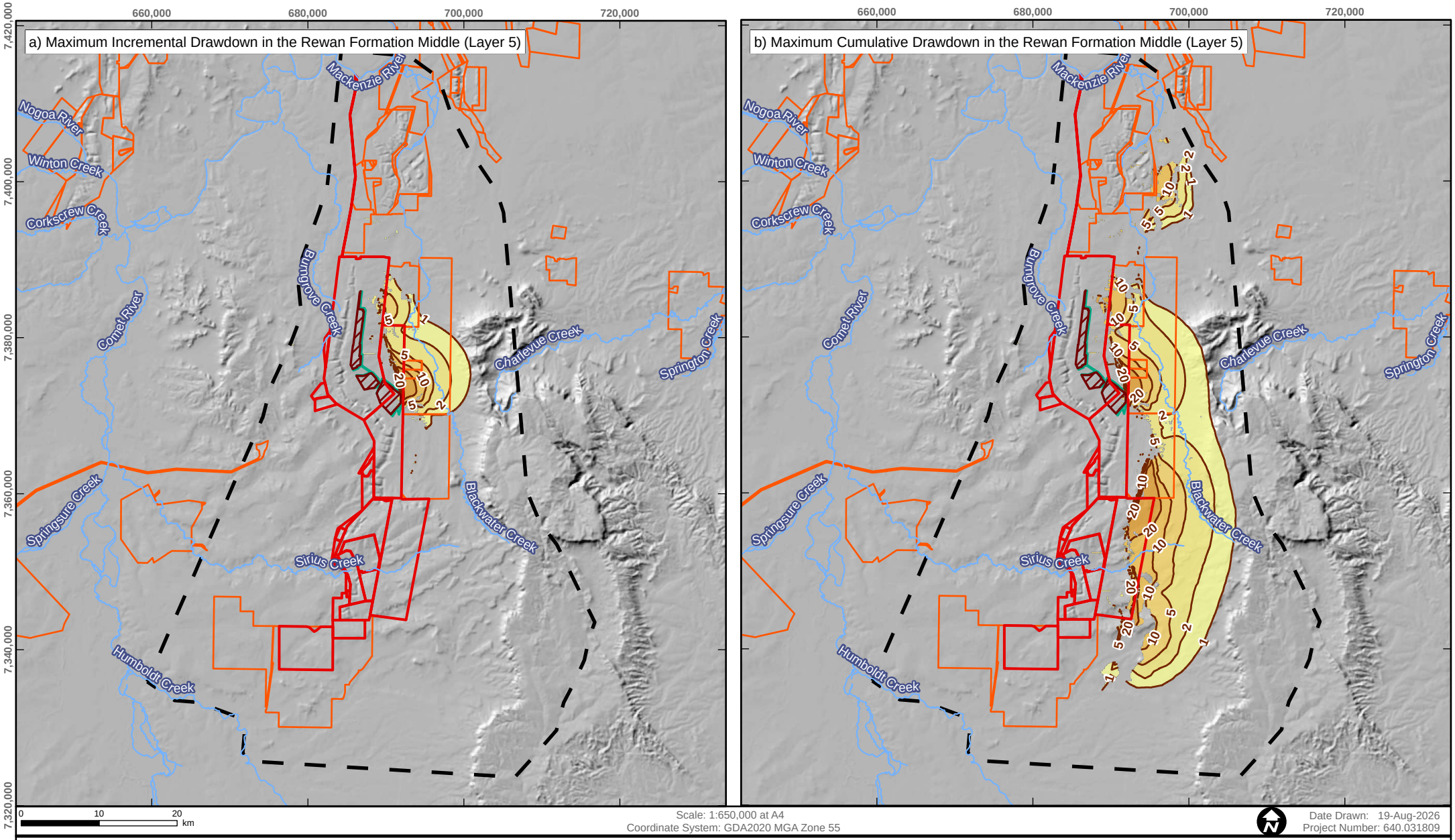
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 300

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE REWAN FORMATION UPPER (LAYER 4)

FIGURE 4-11

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Maximum Incremental (a) and Cumulative (b) Drawdown in the Rewan Formation Upper (Layer 4)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 19-Aug-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- Drawdown Contour (m)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Drawdown (m)

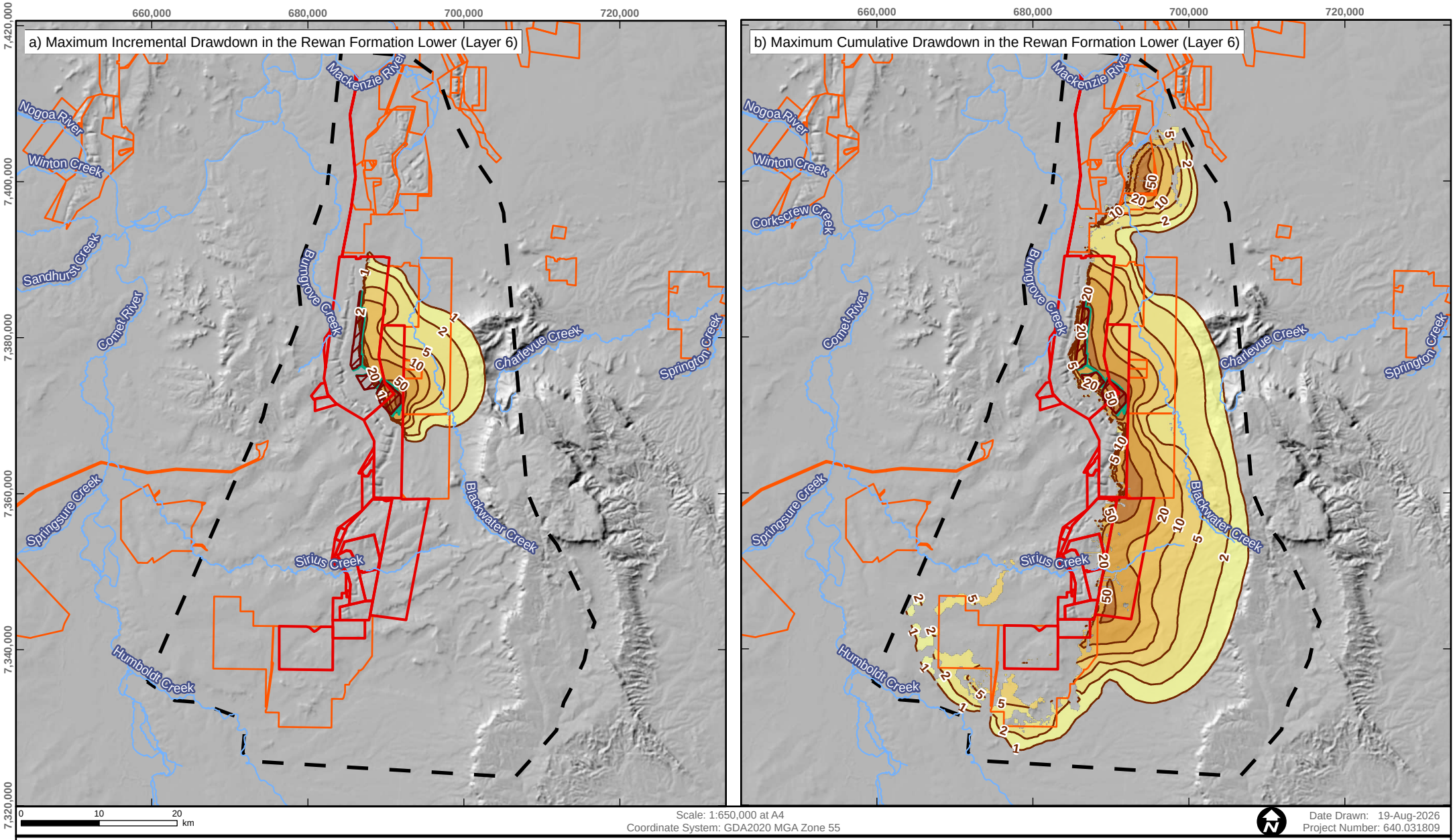
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 300

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE REWAN FORMATION MIDDLE (LAYER 5)

FIGURE4-12

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Maximum Incremental (a) and Cumulative (b) Drawdown in the Rewan Formation Middle (Layer 5)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 19-Aug-2026
Project Number: 640.031809

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

LEGEND

- Watercourse
- Drawdown Contour (m)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Drawdown (m)

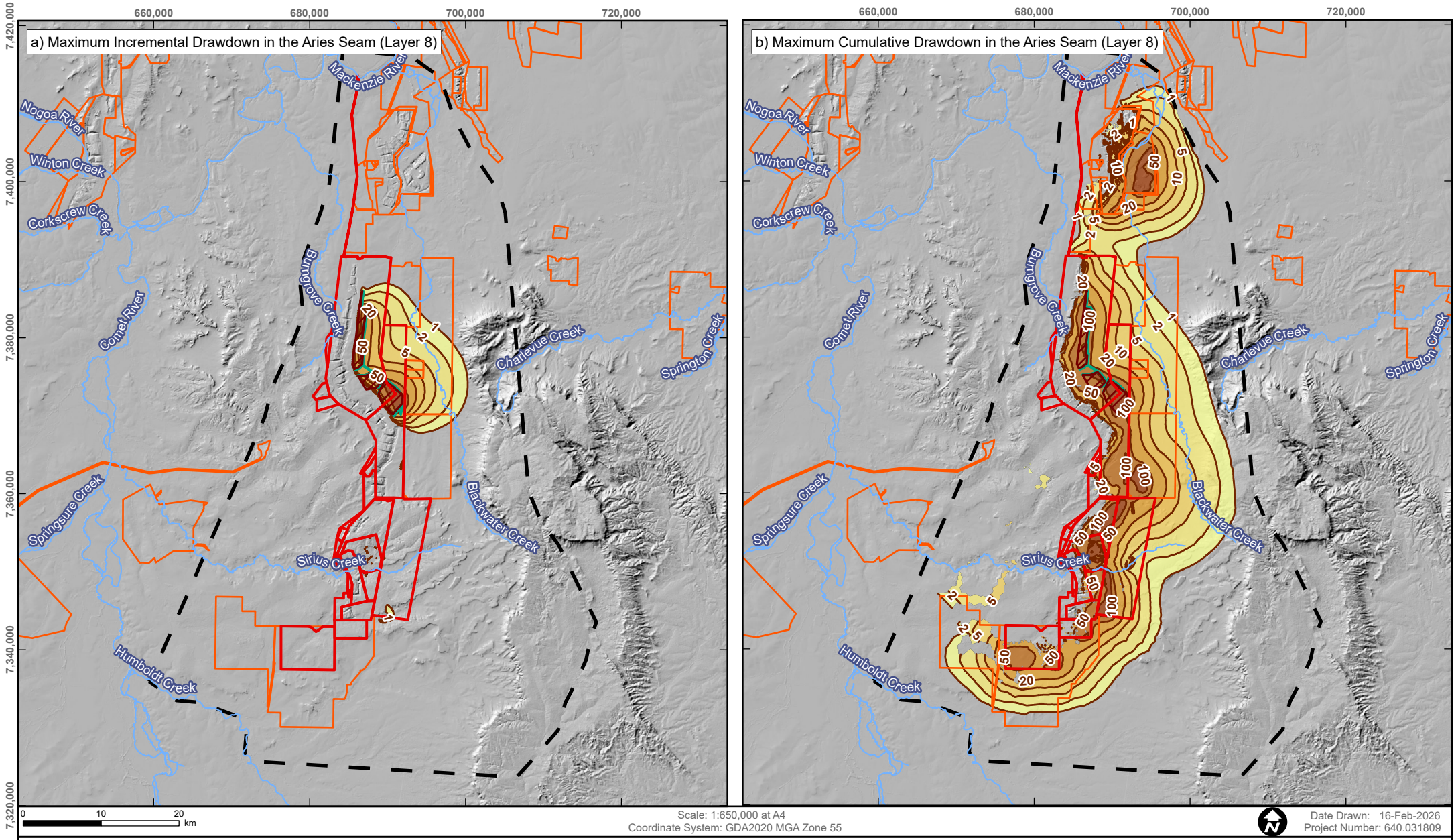
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 300

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE REWAN FORMATION LOWER (LAYER 6)

FIGURE 4-13

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Maximum Incremental (a) and Cumulative (b) Drawdown in the Rewan Formation Lower (Layer 6)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area
- Drawdown Contour (m)

Drawdown (m)

1 - 2	20 - 50
2 - 5	50 - 100
5 - 10	100 - 200
10 - 20	200 - 300

SLR

Service Layer Credits:

Credits:

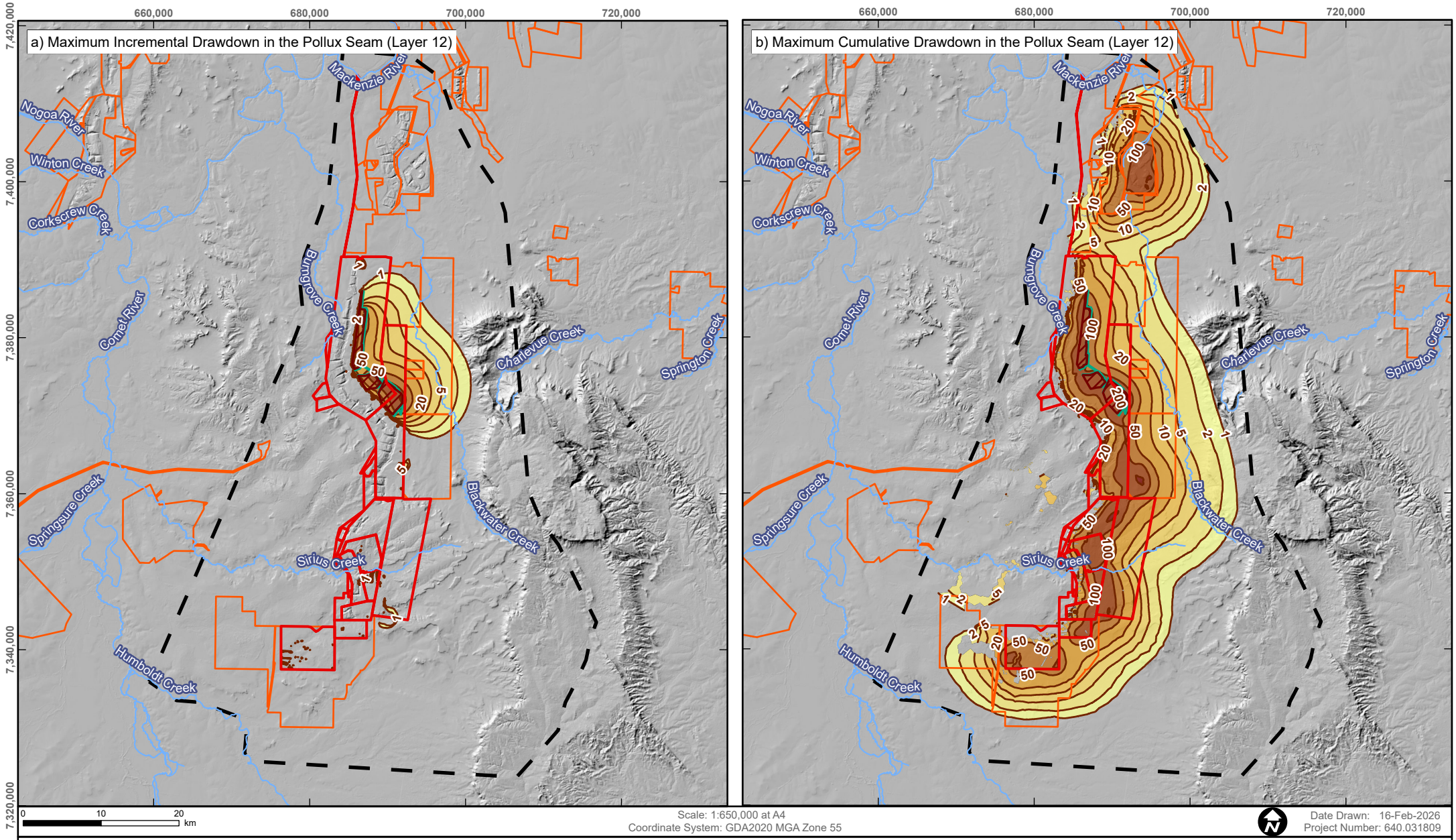
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting (N) Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ARIES SEAM (LAYER 8)

FIGURE 4-14

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_11_Maximum Incremental (a) and Cumulative (b) Drawdown in theAries Seam (Layer 8)



Scale: 1:650,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 16-Feb-2026
Project Number: 640.031809

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area
- Drawdown Contour (m)

Drawdown (m)

1 - 2	20 - 50
2 - 5	50 - 100
5 - 10	100 - 200
10 - 20	200 - 300

SLR

Service Layer Credits:

Credits:

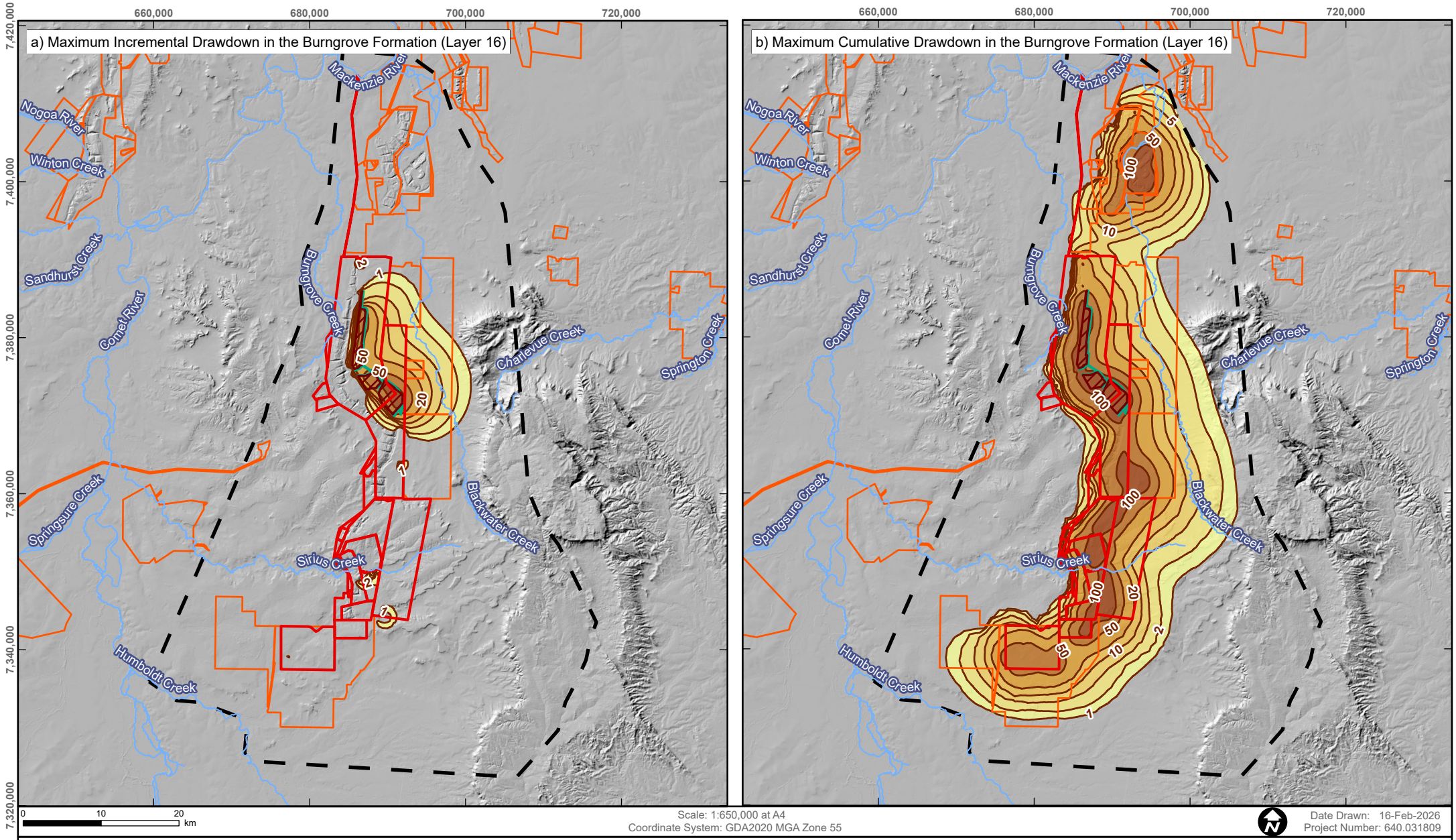
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE POLLUX SEAM (LAYER 12)

FIGURE 4-15

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_12_Maximum Incremental (a) and Cumulative (b) Drawdown in the Pollux Seam (Layer 12)



LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Drawdown Contour (m)

Drawdown (m)

1 - 2	20 - 50
2 - 5	50 - 100
5 - 10	100 - 200
10 - 20	200 - 300

SLR

Service Layer Credits:

Credits:

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE BURNGROVE FORMATION (LAYER 16)

FIGURE 4-16

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F04_13_Maximum Incremental (a) and Cumulative (b) Drawdown in the Burngrove Formation (Layer 16)

4.5 Predicted Groundwater Interception

The mine inflow volumes have been calculated as time weighted averages of the outflow reported by Zone Budget software for the relevant drain cells. The predicted inflows for the Cumulative inflows (Approved mining and the Project) and the Incremental inflows (the Project only) are presented in **Figure 4-17**.

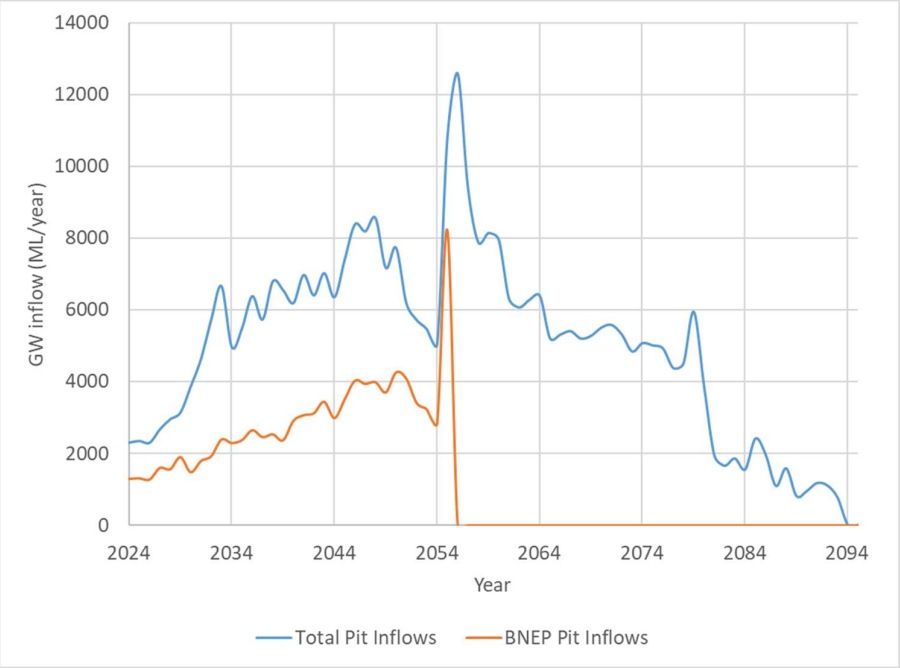


Figure 4-17 Predicted Cumulative and Incremental Project Mine Inflows

Cumulative inflows are predicted to range between 2,290 ML/year and 12,585 ML/year from year 2025 and 2056, peaking in 2056, then decrease until end of mining. The average predicted cumulative mine inflow rate (2025 to 2093) is 5,139 ML/year (14.1 ML/day). The spike in cumulative inflows in 2056 is due to the commencement of the southern mining operations, which are not part of the BNEP and thus the incremental is 0 ML/year.

The incremental inflows into the mine pits on SA 7 and SA 10 are predicted to reach a maximum in year 2055, with a peak just above 8,200 ML/year (22.5 ML/day). The average project mine inflow rate for the Project (2025 to 2055) is 2,272 ML/year (6.2 ML/day).

The Water Plan (Fitzroy Basin) 2011 groundwater area consists of the following:

- Groundwater Unit 1 (containing aquifers of the Quaternary alluvium).
- Groundwater Unit 2 (sub-artesian aquifers).

Planned mining operations at the Project will not intercept Quaternary alluvium at any of the proposed pits. As such, all direct groundwater take predicted by the model is from Groundwater Unit 2.

4.6 Incidental Water Impacts

4.6.1 Alluvium Take

The change in alluvial water resources was estimated by comparing water budgets for alluvial zones using the Approved and Cumulative scenarios of the predictive model. Interference of the alluvial groundwater can occur due to reduced upward leakage from Permian coal measures that are depressurised because of mining activities. Over the extent of Quaternary alluvium along Blackwater Creek, there is a maximum flow reduction of 0.5 ML/day (500 kilolitres per day [KL/day]) from underlying formation to alluvium as a result of the Project (**Figure 4-18**). This reduction represents a regional-scale response, as no specific areas of alluvium are predicted to experience drawdown > 1 m Layer 1 - Alluvium and Tertiary.

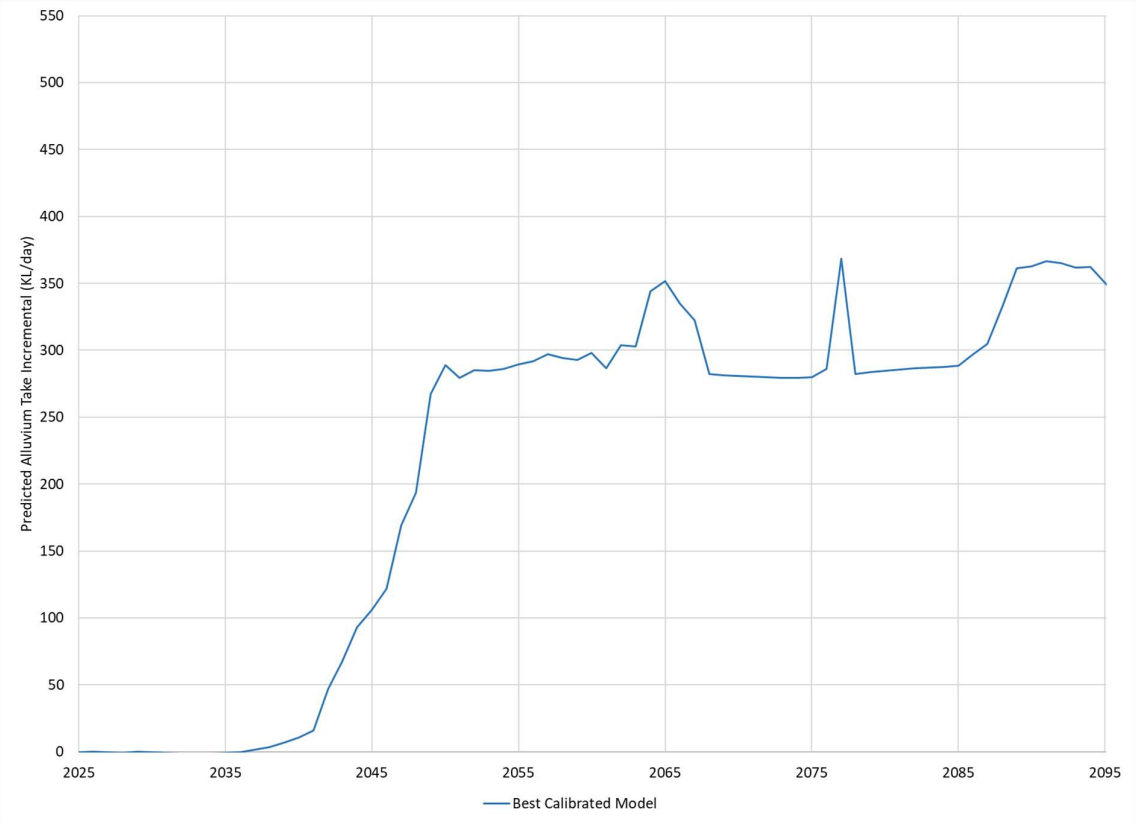


Figure 4-18 Predicted Alluvium Incremental Take

4.6.2 Groundwater – Surface Water Interaction

The change in groundwater flow to Blackwater Creek due to the Project was calculated by comparing the river flow budgets for Blackwater Creek in the Cumulative scenario against the Approved scenario (**Figure 4-19**). This calculation showed that over the life of mine, the maximum change of groundwater flow to Blackwater Creek is negligible (0.001 KL/day).

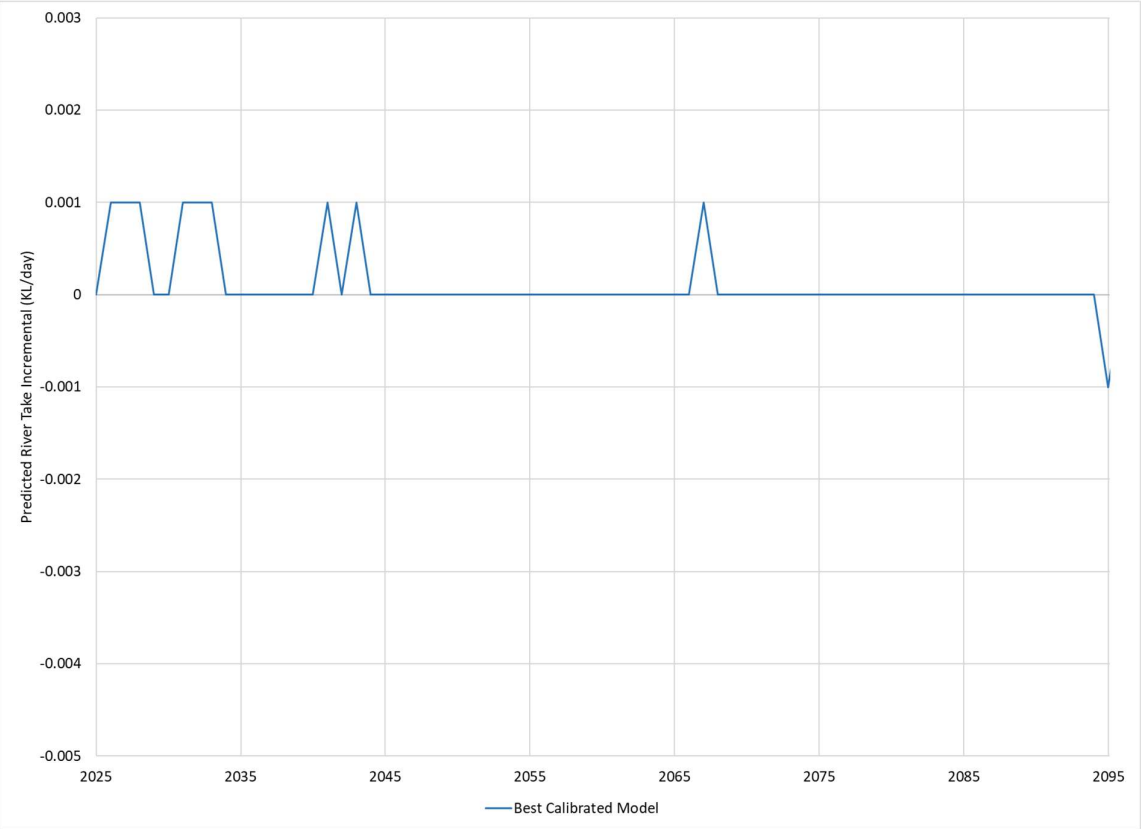


Figure 4-19 Predicted Incremental Loss in River Baseflow (Blackwater Creek)

4.6.3 Drawdown at Landholder Bores

Drawdown was assessed for landholder bores identified in a 5 km radius of the mining lease. **Table 4-4** lists the bores with their name, location, screened formation and use. The last two columns present the maximum incremental and cumulative drawdown predicted to occur at each location. Incremental drawdown from the Project is not predicted to be > 0.5 m at any bore. Only bores with casing depth information, and therefore, able to be assigned to a model layer, were assessed.

Table 4-4 Drawdown Impact on Landholder Bores

Registered RN (ID)	Bore name	Easting (GDA94 z55)	Northing (GDA94 z55)	Assumed Model Layer	Bore Depth (m)	Use	Maximum Incremental Drawdown (m)	Maximum Cumulative Drawdown (m)
38998	-	681119	7391492	Permian	36.6	Unknown	0	0
43097	-	681800	7392230	Permian	22.8	Water Supply	0	0
43459	Top Bore	683719	7395787	Permian	54.9	Unknown	0	0
57410	House well	674936	7345038	Weathered zone/Regolith	24.4	Unknown	0	0.2
57421	Home well	675898	7343916	Weathered zone/Regolith	30.5	Water Supply	0	4.7
57423	Mikes Bore	677244	7341916	Weathered zone/Regolith	38	Water Supply	0	23.2
57424	Plain Bore (OLD)	675422	7336214	Weathered zone/Regolith	39.6	Water Supply	0.5	13.7
57425	Plain Bore (NEW)	675596	7336268	Weathered zone/Regolith	39.6	Water Supply	0.5	14.6
57461	House Bore	692896	7340485	Triassic	28.9	Unknown	0	14.6
57462	Kulla well (1)	694367	7340239	Surface cover and Tertiary	4.9	Unknown	0	0
57463	Kulla well (2)	694678	7340159	Surface cover and Tertiary	7.6	Unknown	0	0
62660	Thomas Bore	672542	7339045	Interburden	100	Unknown	0.1	9.4
62663	Kevanaghs Bore	675228	7346704	Permian	43	Unknown	0	0
84221	-	683596	7390708	Permian	24	Unknown	0	0



Registered RN (ID)	Bore name	Easting (GDA94 z55)	Northing (GDA94 z55)	Assumed Model Layer	Bore Depth (m)	Use	Maximum Incremental Drawdown (m)	Maximum Cumulative Drawdown (m)
90446	-	686300	7340827	Permian	220	Water Supply	0	62.6
90447	-	685251	7340020	Permian	200	Water Supply	0	41.4
103345	-	684091	7363016	Permian	47	Water Supply	0	0.1
103347	-	678897	7350341	Permian	35	Water Supply	0	0
103348	-	678064	7347791	Permian	38	Water Supply	0	0
103349	-	679152	7345733	Permian	43	Water Supply	0	0.3
103388	-	687575	7340715	Triassic	32	Water Supply	0	21.3
103469	Walro Bore	673410	7335977	Interburden	171.13	Water Supply	0.3	9.5
111709	-	680013	7390877	Permian	72	Water Supply	0	0
132075	-	692910	7340474	Weathered zone/Regolith	9	Water Supply	0	0
158911	-	695505	7341762	Triassic	90	Unknown	0	10.3
165937	-	694749	7341252	Triassic	52	Water Supply	0	12
207590	-	683925	7368395	Surface cover and Tertiary	30	Domestic	0	0
207592	-	685877	7368329	Permian	36	Stock	0	1
208967	-	694466	7340032	Triassic	18	Stock	0	9.9
Unregistered 1	-	671980	7343932	Weathered zone / Regolith	33	Stock	0	0.1
Unregistered 10	-	681315	7380737	Permian	49	Not in use	0	0

5.0 Predictive Modelling – Post Mining

5.1 Timing

The potential post mining impacts of the Project were investigated through a post mining period, commencing at the end of mining at the Project and extending for 1,947 years until the model reached equilibrium. The stress period lengths for the post mining periods are shown in **Table 5-1**. In total, there are 38 stress periods of varying lengths.

Table 5-1 Stress Period Set-up for Post Mining Model

Stress Period	Date Range	Time Interval
155 - 167	01/01/2094 – 31/12/2110	Annual
168	01/01/2111 – 31/12/2120	10 years
169	01/01/2121 – 31/12/2140	20 years
170 - 189	01/01/2141 – 31/12/4040	50 years and greater

The above post mining stress periods were added to the predictive model to ascertain post-mining inflows, with all drain cells removed.

5.2 Final Voids Inflows

The indicative location of the 15 final voids (with three voids in the Project area and two voids in the immediate vicinity of the Project area) at the Project is provided in **Figure 5-1**. The cells were assigned high horizontal and vertical hydraulic conductivities (1000 m/day) and storage parameters based on the compressibility of water (specific yield of 1.0, storage coefficient of 5.0×10^{-6} m^{-1}), to simulate free water movement within the final voids. This approach is often referred to as a 'high-K' lake. There are 10 other final voids, not located in the immediate vicinity of the Project area (but within the BWM site), which have also been modelled.

5.2.1 Methodology

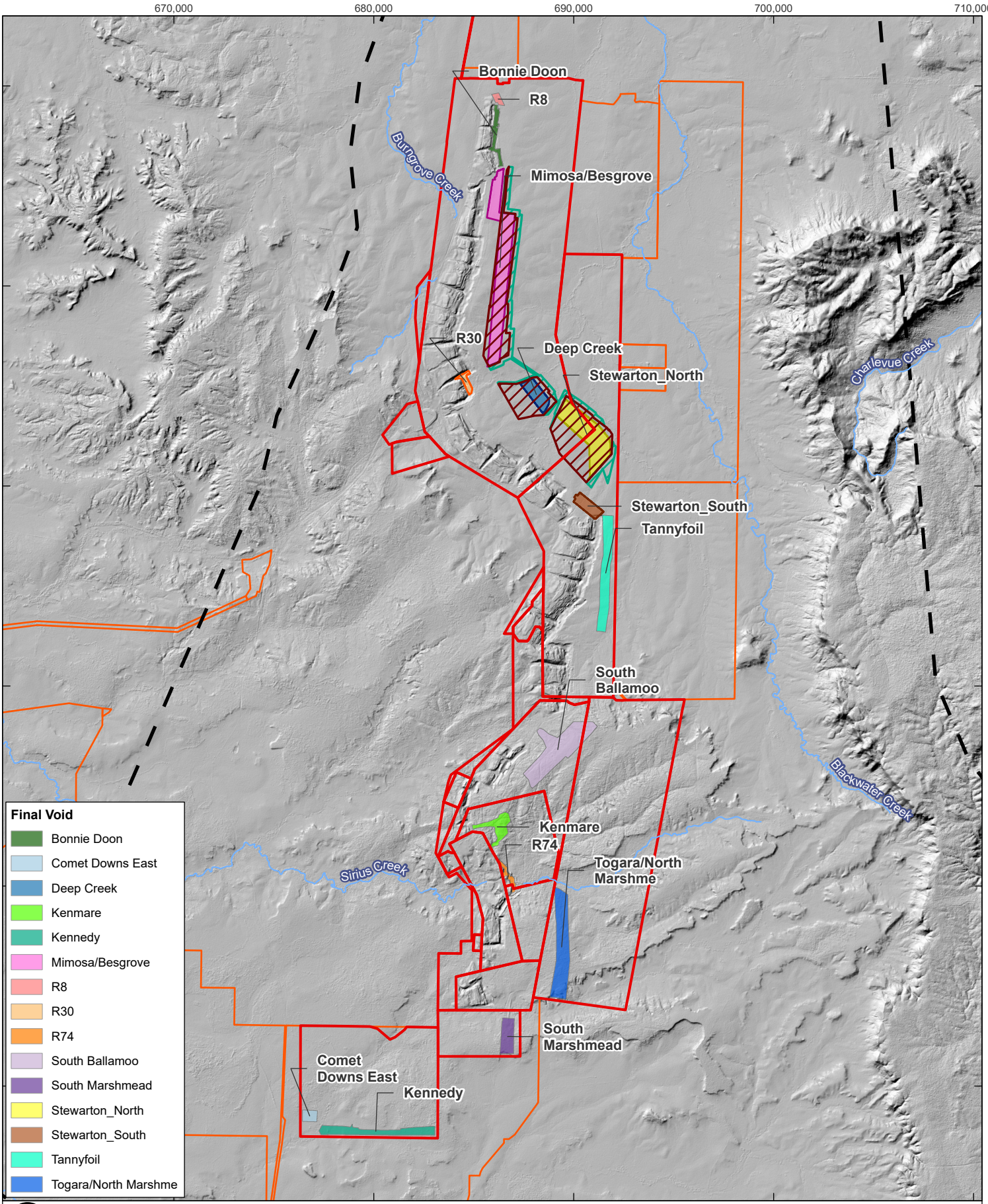
The following methodology was used to allow convergence between the groundwater and water balance models with respect to void lakes. The groundwater modelling methodology involves a stepwise iterative process with the water balance model:

1. Initial predicted groundwater inflows with time to the voids from the groundwater model were incorporated in the initial water balance model.
2. The pit lake recovery levels and timings were then predicted by the water balance model, incorporating both groundwater and surface water fluxes and processes.
3. The void water elevations and recovery timings derived from the water balance modelling were then replicated within the numerical groundwater recovery model using the time variant constant head boundary (CHD) condition, to refine the groundwater model prediction of void groundwater inflows and lake recovery.
4. Assessment was made to check that the refined groundwater model predictions for fluxes to the voids agree with what was used as input to the water balance modelling.

To avoid iterating many times between the groundwater model and the water balance model before reaching agreement, SLR used an automated process (using python code) that iterates between the groundwater model and the water balance model until a predefined convergence criteria is reached (Xiao et al., 2025). Not only does this automated process



save time, it also allows reaching full convergence between the groundwater and the water balance model, increasing confidence in the modelling process.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

FINAL VOID LOCATIONS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F05_01_Indicative Final Void Locations

5.2.2 Results

Once the convergence was achieved, the resulting pit lake recovery curves (HydroBalance, 2026) for the five voids (**Figure 5-2**) were applied within the numerical groundwater model using time-variant constant head boundary conditions (CHD) to represent long-term equilibrium conditions. The groundwater model was subsequently run for 1,947 years.

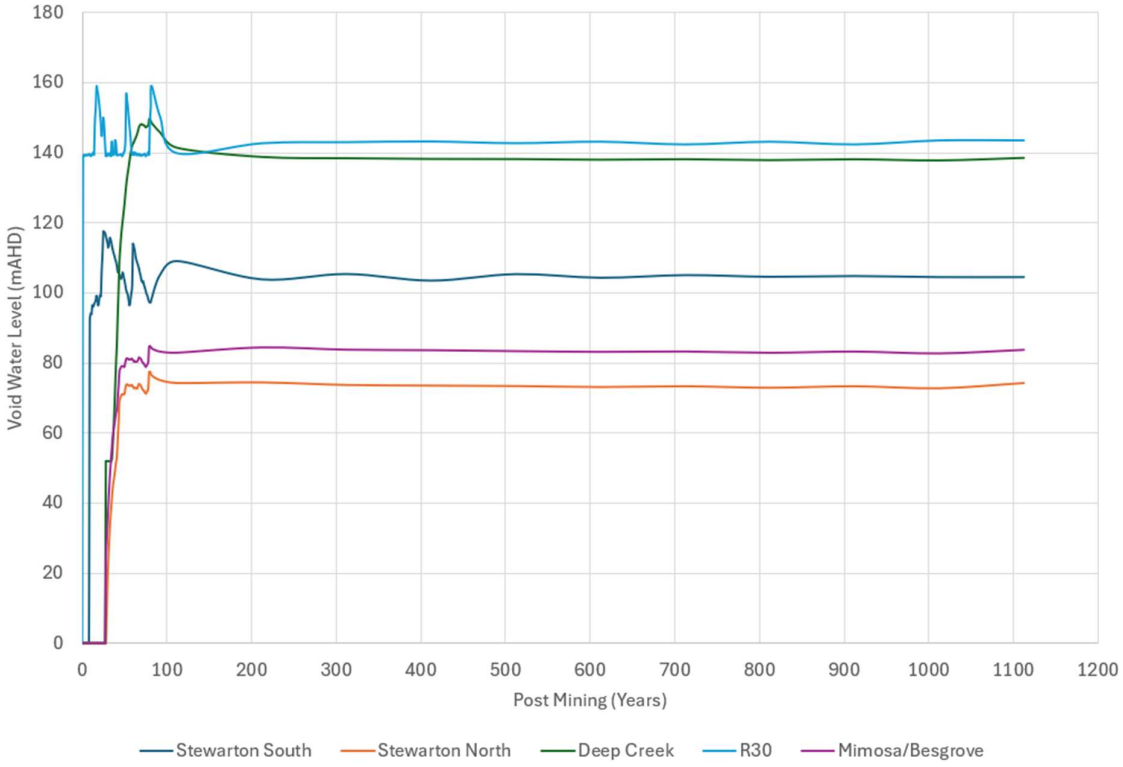


Figure 5-2 Final Void Recovery Curves

The equilibrated final void water levels are listed in **Table 5-2**. **Table 5-2** also lists the recovered water table to the east of the pits, at a distance of approximately 250 m. The head difference between the groundwater and the pit lake ranges between -21.88 m and 55.89 m for all pits.

Final void inflows are shown for all five voids from **Figure 5-3** to **Figure 5-7**. A positive flow value indicates a net inflow to the void while a negative value indicates a net outflow, from the void toward the local groundwater system. For each void, the net flux to the void is categorised based on its origin: Fluxes from spoil material to the void is shown as “Spoil to void”, while fluxes from the in-situ native rock to the void is show as “native rock to void”.

Final void Stewarton South and R30 show a constant negative net flux, indicating that water in the void primarily flow toward the local groundwater. The fate of these water fluxes is further discussed in **Section 5.3**.

Table 5-2 Final Voids – Equilibrium Water Levels and Groundwater Levels (From North to South)

Component	Equilibrium Void Water Level (mAHD)	Groundwater Level (mAHD)[1]	Head Difference (m)[2]
R8	144.98	150.56	5.58
Bonnie Doon	159.11	156.79	-2.32
Mimosa/Besgrove	83.8	131.1	47.3
R30	143.46	123.83	-19.63
Deep Creek	138.67	138.84	0.17
Stewarton_North	74.31	108.19	33.88
Stewarton_South	104.63	143.08	38.45
Tannyfoil	143.17	176.17	33
South Ballamoo	140.27	158.59	18.32
Kenmare	215.48	193.6	-21.88
R74	234.19	244.34	10.15
Togara/North Marshmead	163.86	219.75	55.89
South Marshmead	170.09	181.13	11.04
Comet Downs East	189.24	188.68	-0.56
Kennedy	160.8	173.06	12.26

1 Groundwater level extracted from the recovered water level map, read out approximately 250 m away from each pit to the east.
2 A positive number indicates gradient towards the void, a negative number would indicate a gradient away from void.

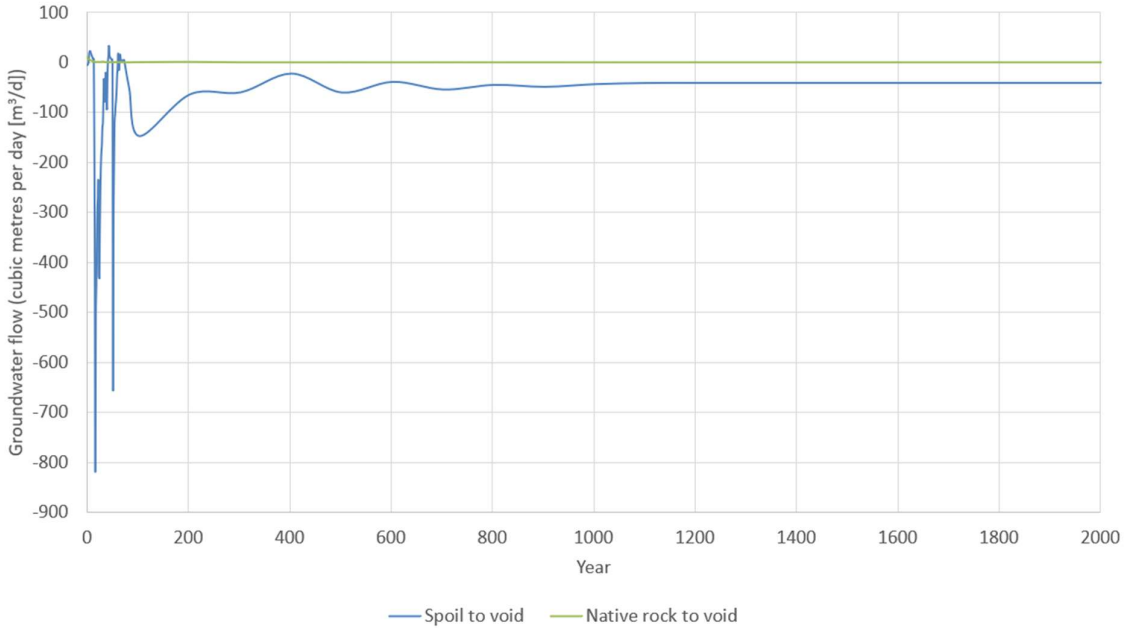


Figure 5-3 Post-mining Groundwater Inflows to Stewarton South

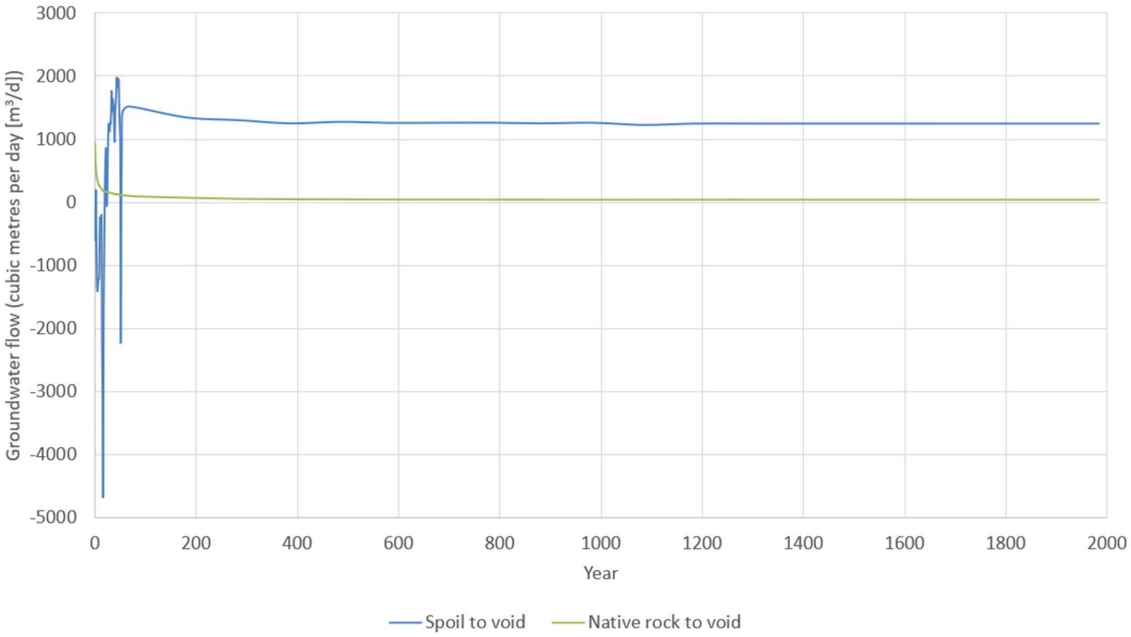


Figure 5-4 Post-mining Groundwater Inflows to Stewarton North

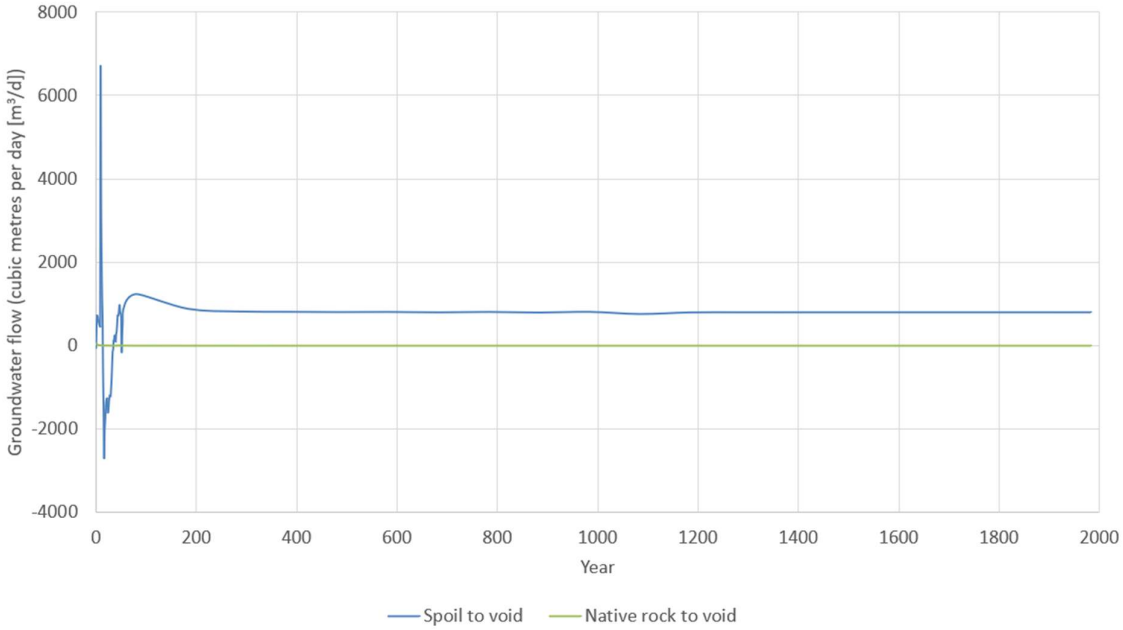


Figure 5-5 Post-mining Groundwater Inflows to Deep Creek

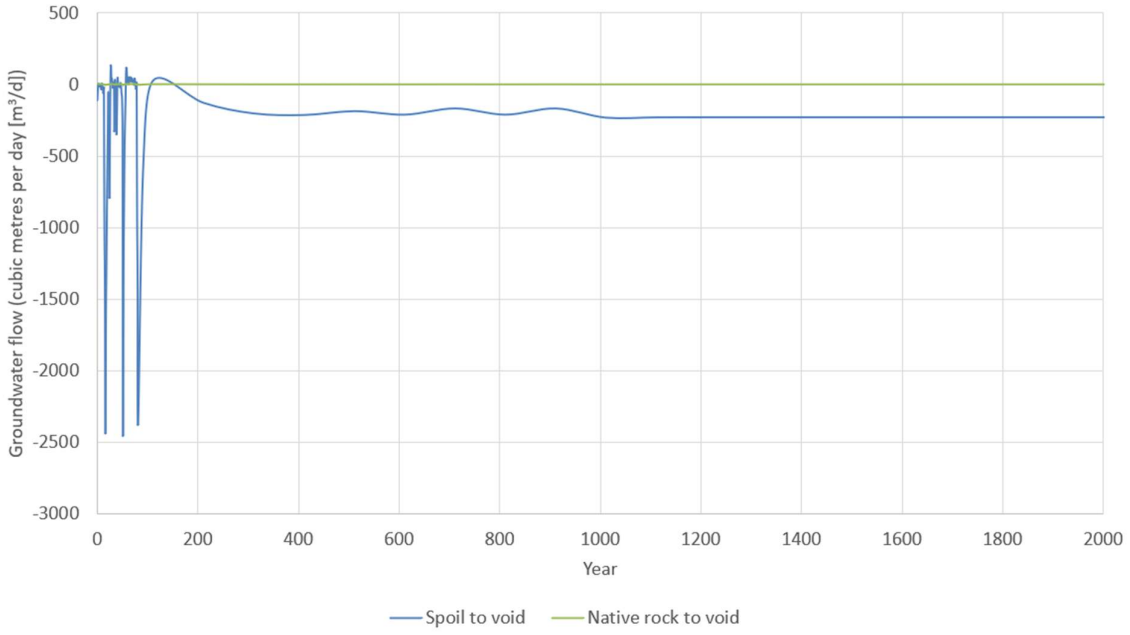


Figure 5-6 Post-mining Groundwater Inflows to R30

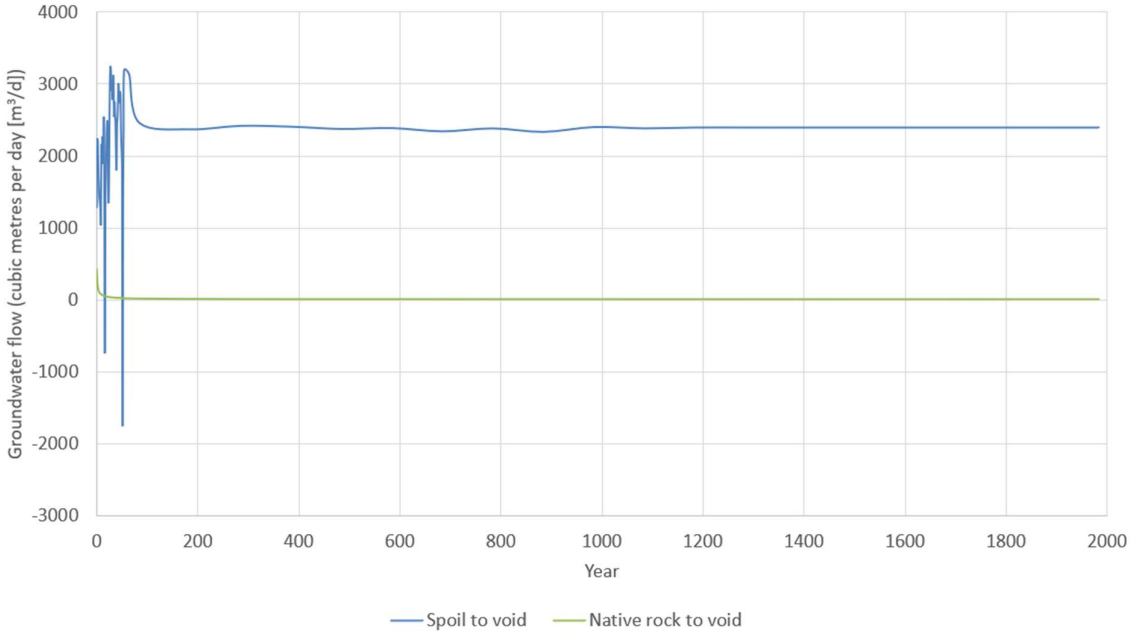
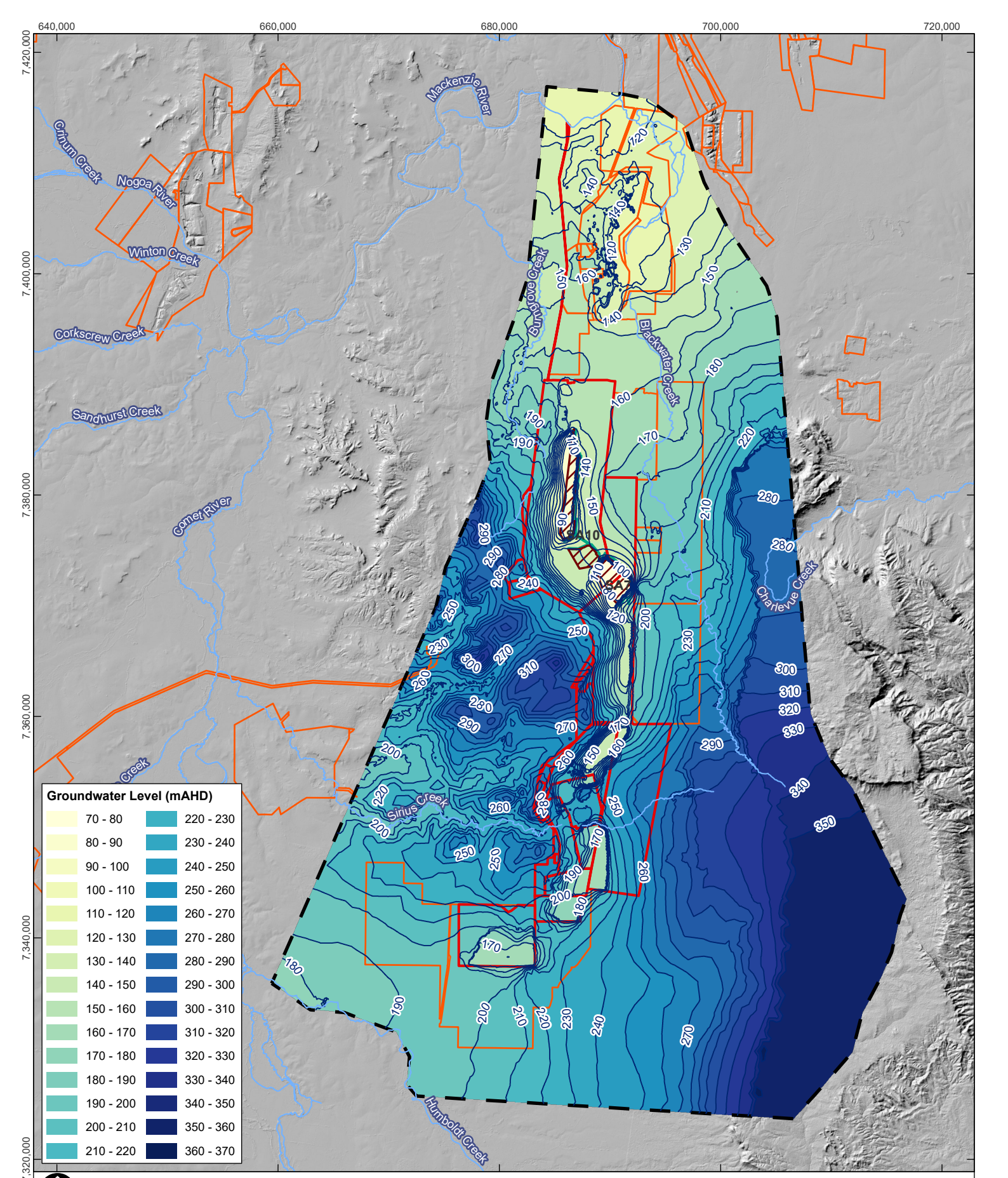


Figure 5-7 Post-mining Groundwater Inflows to Mimosa Besgrove

The predicted final groundwater water levels are presented in **Figure 5-8** and **Figure 5-9**. Predicted final groundwater levels for the Tertiary Sediments, Rewan Formation, Rangal Coal Measures and the Burngrove Formation are provided in **Appendix D.**



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:433,846 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

LEGEND

- Groundwater Level Contour (m)
- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

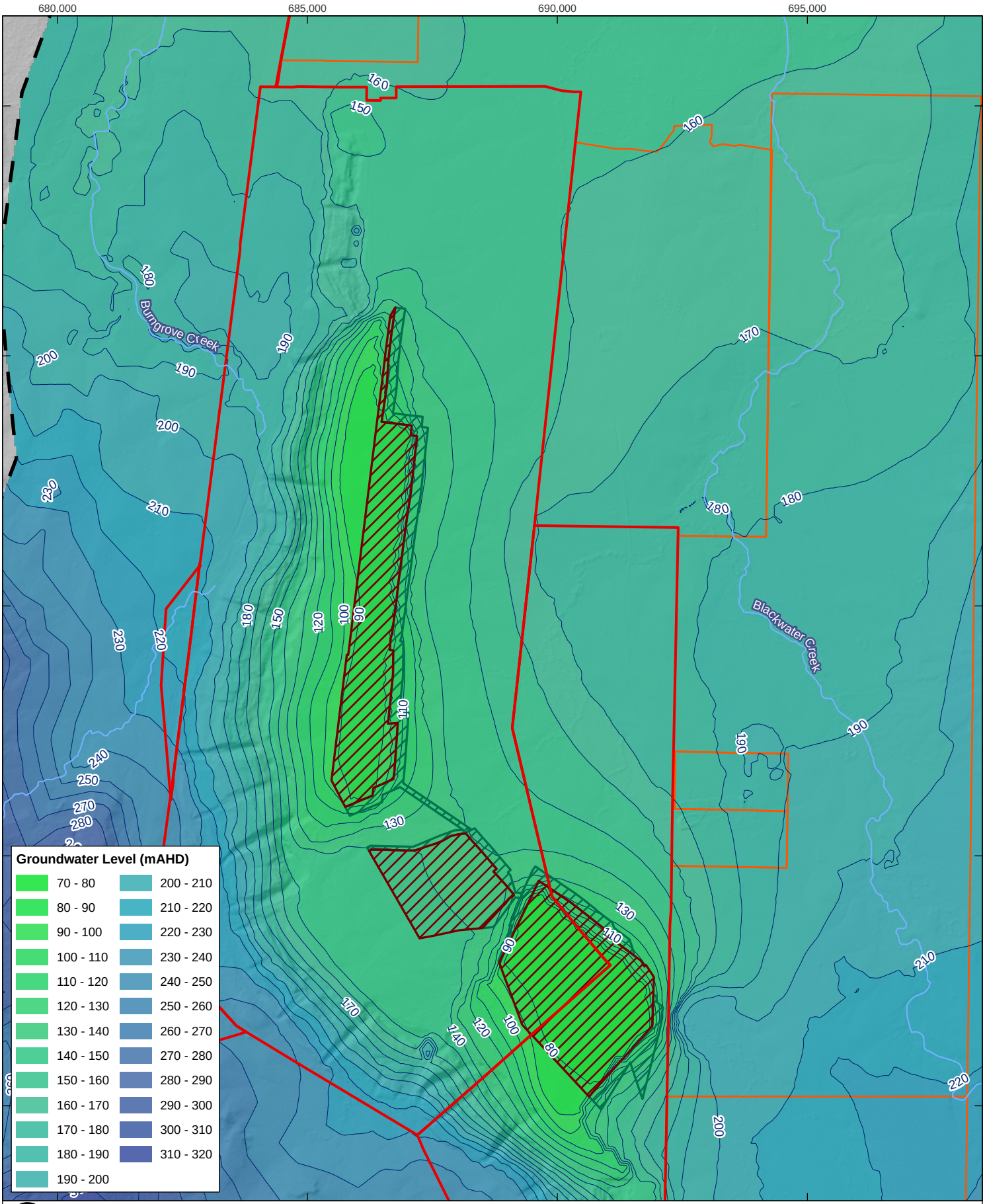
GROUNDWATER TABLE RECOVERY (POST-MINING)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-8

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F05_08_Groundwater Table Recovery (post-mining)



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	RB

LEGEND

- Groundwater Level Contour (m)
- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

GROUNDWATER TABLE RECOVERY (POST-MINING) - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-9

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Groundwater Table Recovery (post-mining)

5.3 Particle tracking

The mod-PATH3DU code (S.S. Papadopulos & Associates, Inc., 2020) was used to simulate particle pathways along the groundwater flow field post mining. To run the mod-PATH3DU code the transient head outputs from the groundwater flow model were used by mod-PATH3DU to simulate particle flow path lines.

The particles were placed on the final landform (landform 4.1) and within the residual voids (**Figure 5-10**), at the surface of the model (with the exception of particles placed within the underground mine workings adjacent to Laleham). Particle placed at the surface of the model are automatically moved to the shallowest saturated layer at the commencement of the simulation. Mod-PATH3DU was configured to release the particles at the midpoint between the base of the first saturated layer and the water table. As shown on **Figure 5-10** for many of the particles this represents the Permian layers (including areas of spoil backfill in model layers that represent Permian units pre-mining) as the shallow layers (Layers 1 and 2) are unsaturated across much of the BWM Area at the commencement of the post-mining simulation. The particles placed in the underground mines were configured to begin their simulation in the Pollux seam (Layer 12) to simulate the fate of water beginning in the flooded underground workings after mine closure.

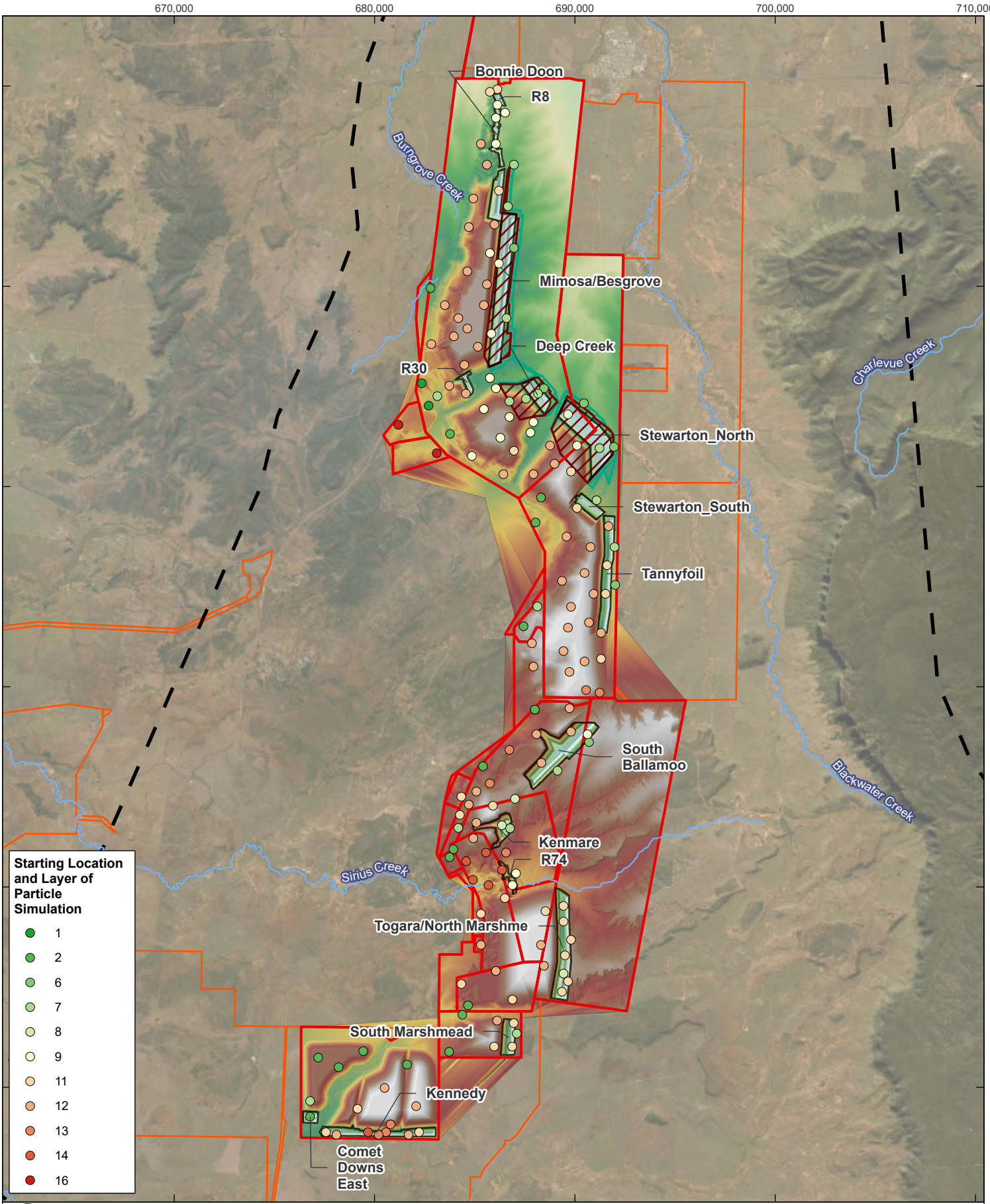
To estimate flow paths from the end of mining until post mining equilibrium, particles were released at the start of the post mining period (year 2093) and tracked until the end of the post mining simulation period (year 4040). **Figure 5-11** shows the predicted movement of water particles in the 1,947-year post mining simulation. The colours along the predicted particle flow paths provide the model layer the particle was simulated to be moving through, with the green to red scale classification representing particles moving from shallower to deeper model layers.

The colour changes along the paths on **Figure 5-11** indicate that particles situated within the shallower saturated layers at the beginning of the post-mining simulation generally move progressively toward deeper layers representing the Permian coal measures (or backfilled spoil where the coal measures has been mined out) over the post-mining period. However, particles that begin in the Pollux seam (Layer 12) and other deeper layers often are observed to move upwards to shallower layers over the course of the recovery simulation, as the saturated water levels in the spoil and aquifers adjacent to the residual voids recover to their long-term post-mining equilibrium state. The flow path analysis indicates the particles generally move toward the void lakes, with the majority of the particles captured in the voids.

As discussed in **Section 5.2,** both Stewarton South and Ramp 30 are showing a negative net inflow; However, particle tracking indicates that fluxes from these voids do not flow to the regional groundwater and instead flow toward neighbouring voids. As shown on **Figure 5-11**:

- particles released into Stewarton South are captured by Stewarton North; and
- particles released into Ramp 30 are captured by Mimosa/Besgrove.

No particles are predicted to travel outside of the mine lease in the post-mining simulation.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	17-Feb-2026
Drawn by:	AS

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Study Area
- Void Extent
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

Final Landform Elevation (mAHD)

450

-5

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

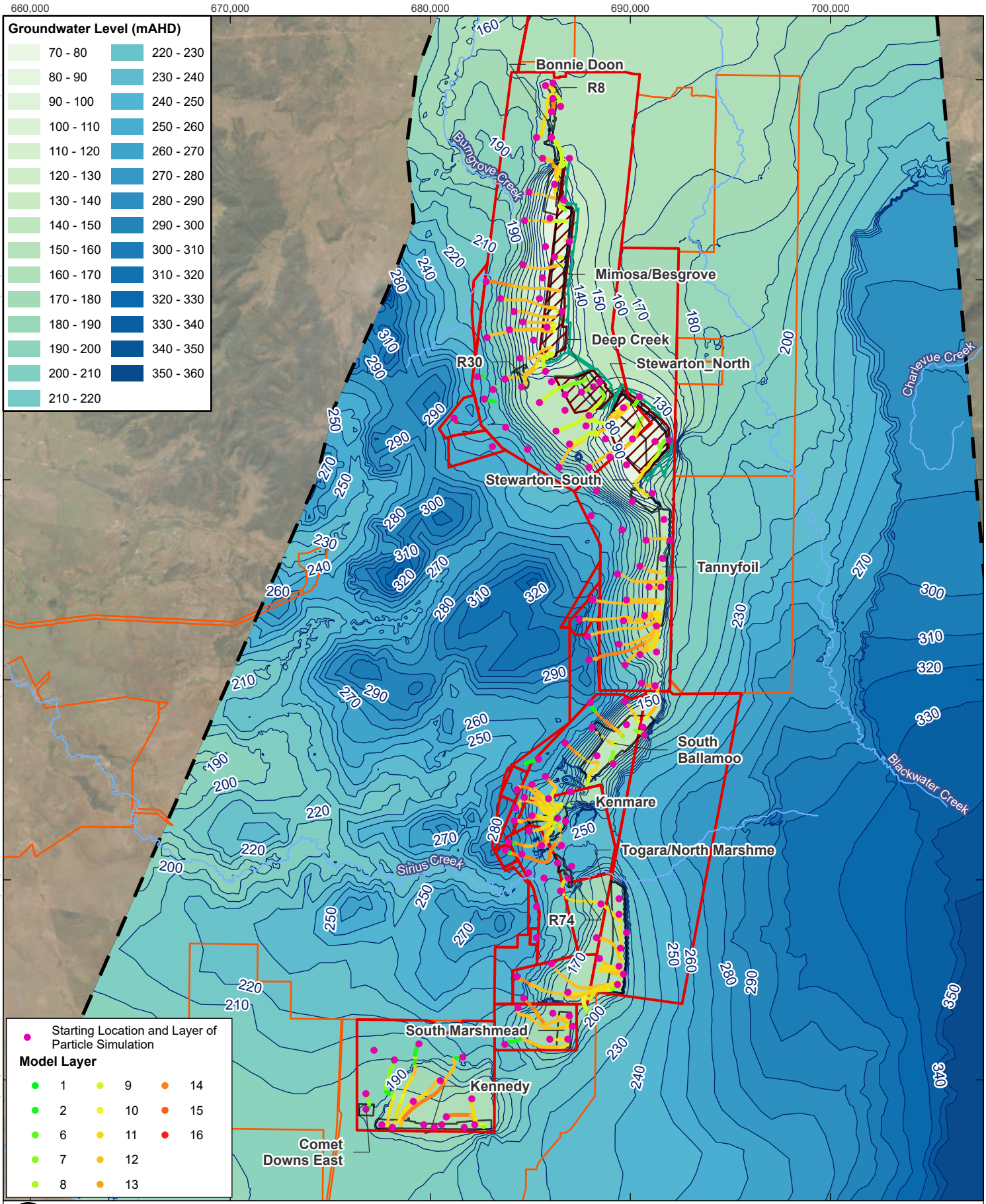
STARTING LOCATION OF PARTICLES

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-10

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F05_09_Particle Starting Location



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	17-Feb-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Level (mAHD)
- BWM Mining Lease
- Mining Lease
- Study Area
- Void Extent
- BWM North Extension Project Area
- BWM North Extension Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED MOVEMENT OF PARTICLES – POST MINING (2093 – 4040)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-11

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F05_10_Predicted Movement of Particles

6.0 Sensitivity Analysis

6.1 Purpose

Quantifying the sensitivity of both calibration performance and model predictions to input parameters provides critical insight into model behaviour and uncertainty. The combined sensitivity analysis presented in this section supports two primary objectives:

1 **Assessing parameter conditioning through calibration sensitivity**: Parameters that have a strong influence on calibration performance metrics are more likely to be conditioned by the calibration process. In contrast, parameters with low sensitivity to calibration performance are less likely to be conditioned by the calibration process, meaning that their posterior distributions will likely remain broad regardless of the amount or quality of calibration data.

2 **Understanding prediction sensitivity to parameter uncertainty**: When model predictions are highly sensitive to specific parameters, it indicates that uncertainties in those parameters have a strong influence on predictive outcomes. Conversely, if predictions are insensitive to a given parameter, then uncertainty in that parameter has limited influence on the modelled forecast.

Comparing calibration and predictive sensitivity allows for distinguishing between parameters that are constrained during calibration, and parameters that drive predictive uncertainty, which may or may not overlap. Such insights support decision-making in model refinement, data collection prioritisation and risk-based scenario analysis.

6.2 Methodology

To evaluate how variations in model parameters affect calibration and prediction outcomes, SLR employed two complementary global sensitivity analysis methods:

- Spearman rank correlation; and
- standardised linear regression coefficients.

These two methods assess different aspects of the input-output relationship and are well-suited to the often non-linear and complex behaviour of hydrogeological systems. They are commonly used in hydrological and environmental modelling due to their simplicity, interpretability and relatively low computational demand (Saltelli et al., 2008; Pianosi et al., 2016).

6.2.1 Data Aggregation and Standardisation

Pilot points were excluded from the sensitivity analysis to reduce parameter dimensionality since they are highly spatially correlated parameters, which can obscure the identification of key model controls and violate assumptions of parameter independence. The analysis therefore focused on primary hydrogeological parameters to better represent conceptual model behaviour rather than calibration-specific detail.

Parameter and observation data were pre-processed and standardised. Parameters using a log normal distribution were converted to $\log_{10}$ values.

Calibration performance was assessed using Mean Residual for this analysis because it aligns more closely with linear regression interpretation than other statistics that use squaring or absolute functions that change the linear relationship of parameter changes and calibration metrics.

For predictive sensitivity, predictive data included four groups: total alluvium take, total area with drawdown > 1 m, mine groundwater inflow (active mining) and total river take.



Parameter values (one group), calibration data (two groups) and prediction data (four groups) were standardised (zero mean, unit variance) independently (i.e. per group) to enable consistent comparison across variables and groups.

6.2.2 Spearman Rank Correlation Coefficient

Spearman rank correlation measures the monotonic relationship between input parameters and model outputs. It identifies whether changes in a parameter consistently increase or decrease a model output, regardless of the exact functional form of the relationship. This is especially useful in groundwater models where non-linearities are common due to boundary conditions, storage terms or non-linear recharge responses (van Griensven et al., 2006).

Given a parameter vector X and a model response vector Y, Spearman's rank correlation coefficient ρ is calculated as:

$$\rho = 1 - \frac{6\sum_{i=1}^{n}(R_i - S_i)^2}{n(n^2-1)}$$

where: R_i = rank of parameter X for sample *i*

S_i = rank of the corresponding model output Y

N = number of realisations

6.2.3 Linear Regression Sensitivity Coefficient

Linear regression sensitivity quantifies how much the output changes *on average* with a unit change in a parameter, assuming a linear relationship. It describes the *magnitude* of influence a parameter has on model outputs under the assumption of a linear relationship.

The relationship is represented as:

$$Y = X\beta + \epsilon$$

where: Y = model output

X = a matrix of standardized parameter values

β = vector of estimated sensitivity coefficients

ϵ = model error

The coefficient β represents the average change in model output (Y) for a one standard deviation change in model parameter (X) and is interpreted as a direct measure of sensitivity magnitude, specifically how the variance of the parameter uncertainty contributes to the variance of the predictive or calibration uncertainty. This method assumes linearity and additivity but remains useful as a first-order sensitivity metric (Helton et al., 2006).

6.2.4 Interpretation

There is no single universally accepted threshold for Spearman or regression coefficients in sensitivity analysis. However, some thresholds are often used as pragmatic benchmarks based on the practical significance of parameter influence rather than strict statistical cutoffs. For this analysis, moderate sensitivity was selected for an absolute ρ score > 0.2 and for an absolute β value > 0.1.

This dual-method framework supports robust sensitivity diagnostics by capturing both the consistency and strength of parameter influence. The combined use of both metrics enables us to distinguish between parameters that:

- have a strong and consistent effect;
- have an effect only in a narrow range (local sensitivity); and/or



- behave non-monotonically and inconsistently.

A comparison of the interpretive value of each method is provided in **Table 6-1**.

Table 6-1 Comparison of Spearman and Regression in Sensitivity Analysis

Sensitivity Scenario (S)	Impact of Parameter Changes on Model Outcome	Spearman	Regression	Interpretation
S1	Strong, consistent linear effect	> 0.2	> 0.1	Parameter is influential and predictable
S2	Consistent but nonlinear effect	> 0.2	< 0.1	Parameter is influential but not well described by linear models
S3	Local or inconsistent effect	< 0.2	> 0.1	Large effect in a narrow range
S4	Non-influential	< 0.2	< 0.1	Parameter has minimal influence

6.3 Results

The results are presented as bar charts in **Appendix E** and discussed in **Section 6.3.1** and **Section 6.3.2** for both Spearman rank correlation coefficient and Linear regression sensitivity coefficient.

6.3.1 Calibration Sensitivity (Parameter Conditioning)

Parameter with a ρ score > 0.2 and/or a β value > 0.1 (scenarios S1, S2 or S3 in **Table 6-1**) are likely to be conditioned through the calibration process.

As presented on **Appendix E** the calibration process is likely to be conditioning:

- Horizontal hydraulic conductivity (Kx) of the Clematis Group, Rewan formation (upper and middle), interburden, Pollux seam (lower) and tailings; as well as spatial locations associated with pilot points.
- Vertical hydraulic conductivity (Kz) of the interburden and tailings; as well as spatial locations associated with pilot points.
- Specific yield (Sy) of the Rewan Formation (upper); as well as spatial locations associated with pilot points.
- Riverbed Kz (Riv_vk) of the Humboldt Creek and tributaries.
- ET coefficient (evt) for the spoil and depth (exdp) for the alluvium.

The calibration process in unlikely to be conditioning the majority of:

- Recharge coefficients (rch).
- ET coefficient and depth (evt and exdp).
- Spoil hydraulic properties (spl_kx, spl_kz, spl_ss and spl_sy).

6.3.2 Predictive Sensitivity

Parameters with a ρ score > 0.2 and/or a β value > 0.1 (scenarios S1, S2 or S3 in **Table 6-1**) are likely to influence model predictions.



As presented in **Appendix E,** these parameters are:

- **For Mine associated drawdown:** Horizontal hydraulic conductivity of the regolith, Rewan formation (lower, middle and upper) and interburden; vertical hydraulic conductivity of the coal seams (lower); storage of the Rewan Formation (upper), interburden, coal seams, and spoil; recharge over the alluvium, regolith and weathered Clematis zones and spoil; ET rate and depth for the alluvium and regolith.
- **For Mine groundwater inflow (active mining):** Horizontal hydraulic conductivity of the regolith and Burngrove formation; vertical hydraulic conductivity of the coal seams, Burngrove formation and spoil; storage of regolith, Rewan formation, underburden and spoil; recharge over the weathered Clematis and weathered Permian zone, riverbed conductance of the Rockland Creek and tributaries.
- **For alluvium take:** Horizontal hydraulic conductivity of the alluvium, regolith, Clematis, Rewan formation (upper), overburden, interburden, underburden, Burngrove formation and spoil; vertical hydraulic conductivity of interburden, interburden, and Burngrove formation; storage of regolith, Clematis, overburden, interburden, coal seams, Burngrove formation, and spoil; recharge over the alluvium, regolith, and weathered Permian zones; ET depth for the alluvium, regolith, weathered Clematis and weathered Permian zones.
- **For River take:** Horizontal hydraulic conductivity of the alluvium, regolith, Rewan formation (upper and lower), overburden, interburden, Castor coal seam, and Burngrove formation; vertical hydraulic conductivity of the Rewan formation (middle and lower), interburden, coal seams, underburden and Burngrove formation; storage of regolith, Rewan formation, overburden, coal seams, underburden and spoil; recharge over the regolith and weathered Permian zones; ET depth for the alluvium; riverbed conductance of the Blackwater main stream and small streams.

6.3.3 Type I-IV Analysis

The Murray Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline (MDBC, 2001) recommends classifying sensitivity by the resultant changes (or contribution) to the model calibration and predictions. According to this process models can be classified as one of the four main types:

- Type I: Insignificant changes to calibration (low calibration sensitivity) and prediction (low predictive sensitivity).
- Type II: Significant changes to calibration (high calibration sensitivity) – insignificant changes to predictions (low predictive sensitivity).
- Type III: Significant changes to calibration (high calibration sensitivity) – significant changes to predictions (high predictive sensitivity).
- Type IV: Insignificant changes to calibration (low calibration sensitivity) – significant changes to predictions (high predictive sensitivity).

Types I-III are of less concern, as these Types have an insignificant impact on model predictions or conditioned by calibration. Type IV is classed as ‘a cause for concern’ as non-uniqueness in a model input might allow a range of valid calibrations but the choice of value impacts significantly on a prediction (MDBC, 2001).

To classify the sensitivity contribution to the model calibration and predictions for each model parameter, the calibration and prediction sensitivities were compared against each other for each parameter.



To allow comparing calibration and prediction sensitivity in one graph, a combined sensitivity value was calculated for each sensitivity group as:

$$Combined_{(i,g)} = 0.5 * | \beta_{(i,g)} | + 0.5 * | \rho_{(i,g)} |$$

where: $\beta_{(i,g)}$ = standardised regression coefficient for parameter *i* and group *g*.

$\rho_{(i,g)}$ = Spearman rank correlation coefficient between parameter and group *g*.

For this analysis, the threshold value for a sensitive parameter was set at 0.15, as the average of the threshold for *β and ρ* (see **Section 6.2.4**).

Comparison plots are presented for the alluvium take (**Figure 6-1**), drawdown (**Figure 6-2**) and mine groundwater inflow (active mining) (**Figure 6-3**), and Isaac River take (**Figure 6-4**). Type IV parameters are summarised in **Table 6-2.**

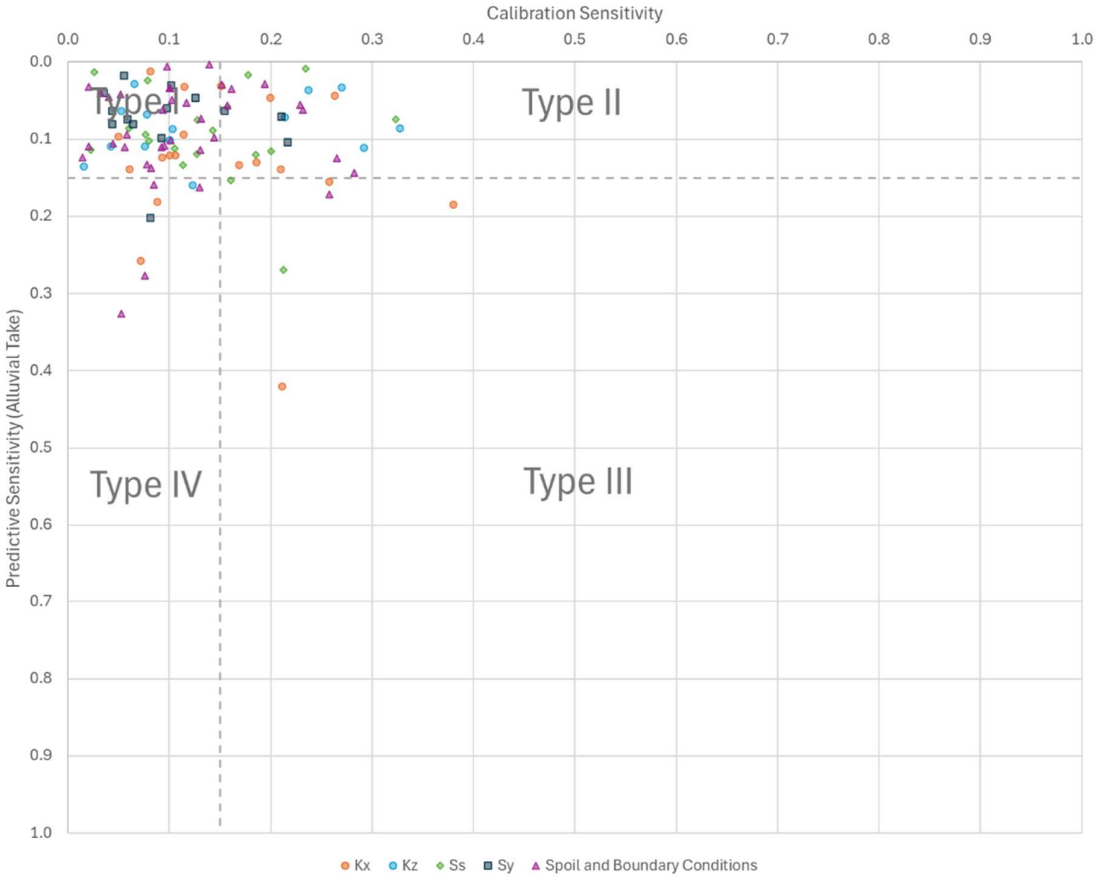


Figure 6-1 Predictive Sensitivity (Alluvium Take) Versus Calibration Sensitivity

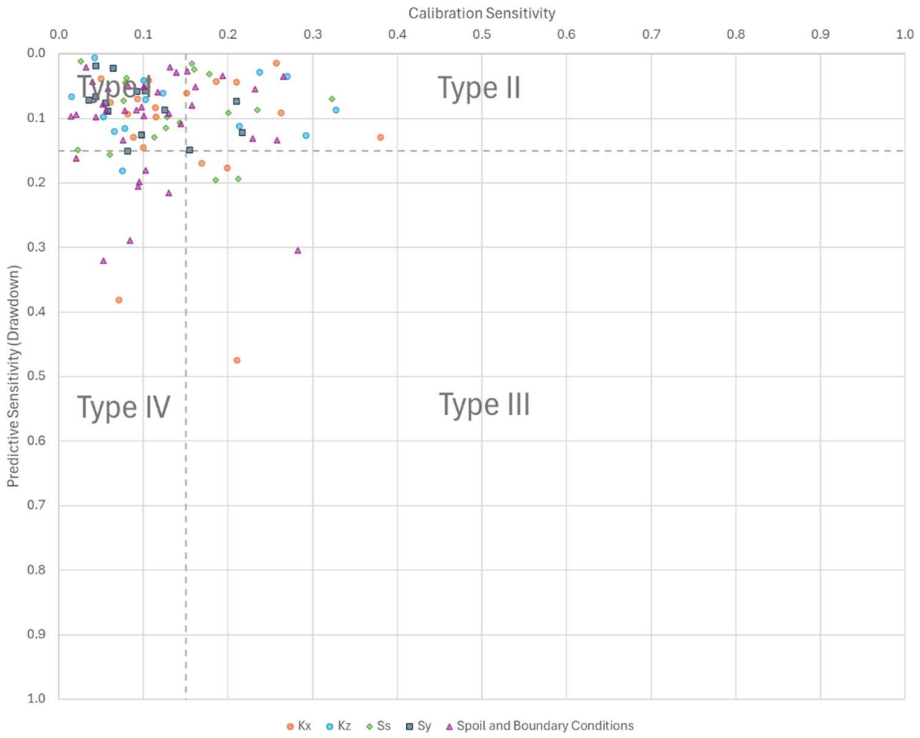


Figure 6-2 Predictive Sensitivity (Drawdown) Versus Calibration Sensitivity

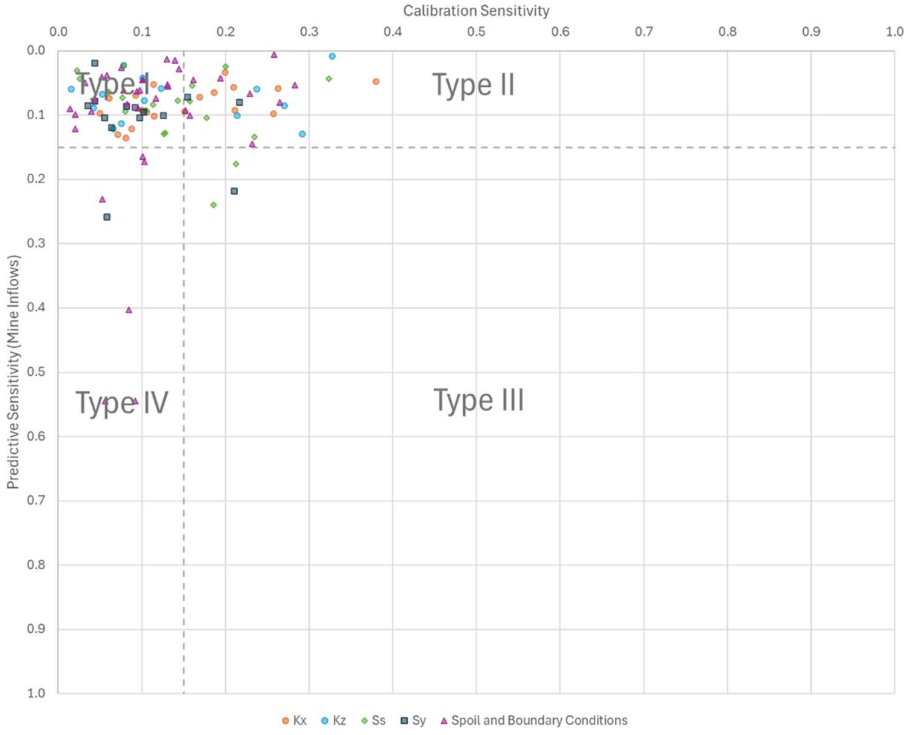


Figure 6-3 Predictive Sensitivity (Mine Inflow) Versus Calibration Sensitivity

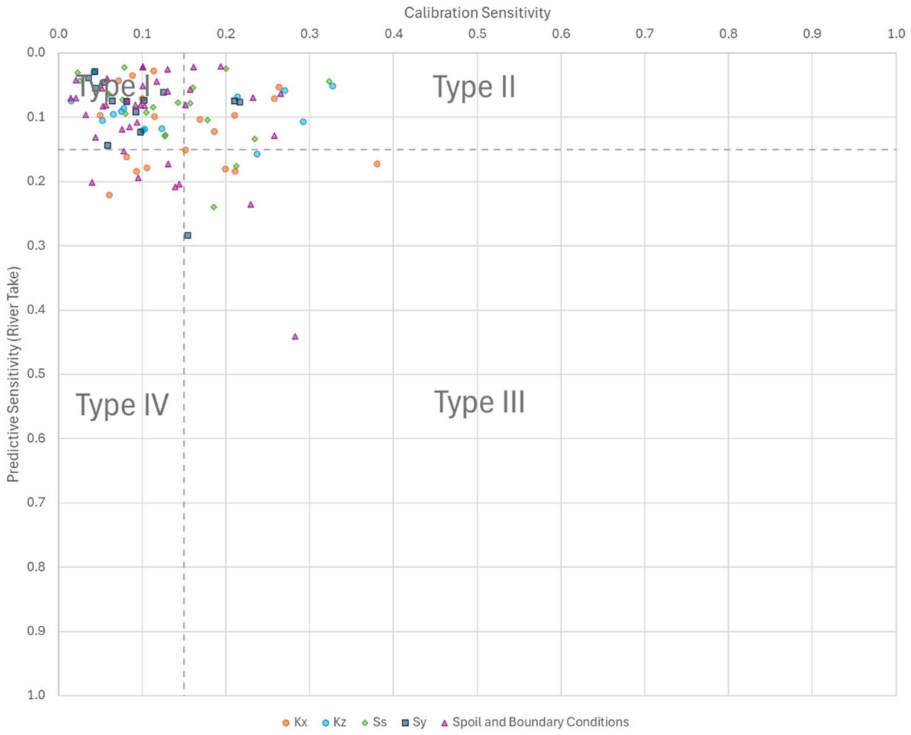


Figure 6-4 Predictive Sensitivity (River Take) Versus Calibration Sensitivity

Table 6-2 Type IV Parameters

Parameter	Description	Associated Prediction
kx_z04	Weathered zone	Alluvium Take, Drawdown
kzf_z18	Burngrove formation	Drawdown
rchf_z03	Weathered Clematis	Drawdown, Mine Inflow
rchf_z04	Weathered Permian	Alluvium Take, Drawdown, Mine Inflow
rivk_z02	Blackwater tributaries	Drawdown
rivk_z10	Tanny Foil dam	Drawdown
spl_rchf_z01	Spoil	Alluvium Take, Drawdown
spl_sy_z01	Spoil	Alluvium Take, Drawdown, Mine Inflow
ss_z02	Tertiary	Drawdown
sy_z13	Interburden	Alluvium Take, Drawdown
tl_rchf_z01	Tailing	Drawdown, River Take
exdp_z02	Regolith	Alluvium Take
kx_z18	Burngrove formation	Alluvium Take
kzf_z15	Interburden	Alluvium Take
rivk_z04	Rockland Creek and tributories	Mine Inflow
spl_kx_z01	Spoil	Mine Inflow
spl_kz_z01	Spoil	Mine Inflow
evtf_z02	Regolith	River Take
kx_z02	Tertiary	River Take
kx_z03	Alluvium	River Take

Parameter	Description	Associated Prediction
kx_z11	Interburden	River Take
kx_z19	Fair Hill formation	River Take
rchf_z02	Regolith	River Take
rivk_z01	Blackwater mainstream	River Take
rivk_z07	Small streams	River Take
spl_ss_z01	Spoil	River Take
ss_z04	Weathered zone	River Take
ss_z08	Rewan lower	River Take
ss_z10	Aries seam	River Take
sy_z09	Overburden	River Take

6.3.4 Conclusion

The sensitivity analysis suggests that most parameters in the model are adequately constrained by the calibration process. It also highlighted several parameters that contribute to predictive uncertainty and that are less conditioned by the calibration process (Type IV parameters).



6.4 Mine Inflows

Following peer review, it was noted that the modelled inflows (**Section 4.5**) were higher than observed pit inflows. These observations were typically 2.25 ML/day (Engeny Australia Pty Ltd, 2025), which are lower than the average cumulative mine inflow rate (2025 to 2093) of 5,139 ML/year (14.1 ML/day) (**Section 4.5**).

The peer reviewer requested that a couple of sensitivity simulations be conducted to test the sensitivity of the predicted mine inflows to the timing setup of when TVM activates the changes in parameters from host material properties to post-mining properties (i.e. spoil or void).

The model results presented outside this section use what will be referred to herein in the sensitivity assessment as the TVM3 setup. The TVM3 setup has hydraulic conductivity (Kx and Kz) change within the stress period when mining (DRN) is activated, and storage properties are activated in the stress period when DRNs become inactive.

MODFLOW USG does not instantaneously change parameter values at the beginning of the activated stress period. Instead, it either linearly or on a log transform basis changes the parameters over the stress period length such that only at the end of the stress period is the full change implemented. An example for how TVM3 is implemented would be:

- Assume a mining DRN cell becomes active in stress period 50 and is active for 1 stress period (i.e. is inactive in stress period 51).
- Hydraulic conductivity values would be transformed (SLR uses the log transform option) over the duration of stress period 50 such that by the end of mining the hydraulic properties would be equal to the spoil properties and therefore full spoil properties for the beginning of stress period 51 when DRNs are inactive.
- Storage properties would not begin to change until stress period 51 and would be fully transformed by the end of stress period 51, one year after mining was completed.

The peer reviewer requested two sensitivity simulations that vary the start timing of the TVM operations.

- TVM2 – this option has all parameters begin to change in the stress period following the mining. In the above example, this would mean no change to how storage was handled but would push the change of hydraulic conductivity values to begin the stress period after mining has ceased (stress period 51) with full implementation of the changes by the end of stress period 51.
- TVM1 - this option has all parameters begin to change in the stress period when the mining is activated. In the above example, this would mean no change to how hydraulic conductivities were handled but would push the change of storage values to begin the stress period when mining commences (stress period 50) with full implementation of the changes by the end of stress period 50.

The results for estimated total pit inflows are provided for TVM2 and TVM3 in **Figure 6-5**. The results for TVM1 were exactly the same as those for TVM3 and therefore are not explicitly represented in **Figure 6-5**.

The predicted mine inflows are insensitive to the timing of when storage properties are changed.

The predicted mine inflows are sensitive to the timing of when hydraulic conductivity properties are changed. By delaying when the hydraulic properties are changed to the year after mining was completed reduces predicted pit inflows. The reduction in inflows is closer to the observed values; however, it is noted that neither model result has been corrected for



evaporation that would occur on the highwalls and pit floors, and as such would be expected to be greater than observed ingress and or values estimated from operational site water balance models.

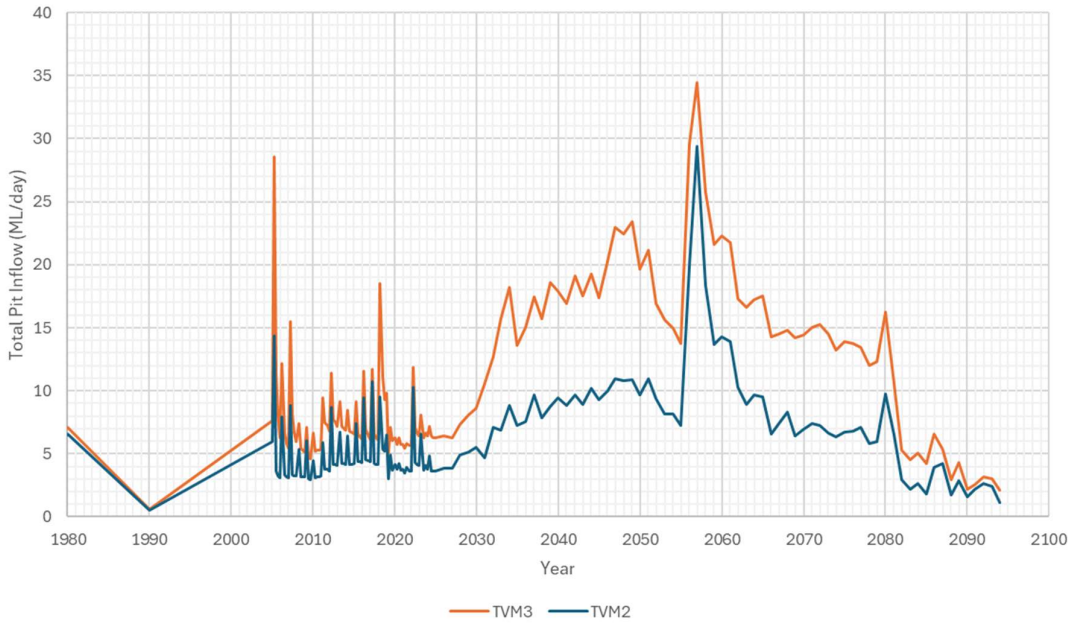


Figure 6-5 TVM Sensitivity Analysis – Predicted Cumulative Mine Inflows

7.0 Uncertainty Analysis

A Type 3 Monte Carlo uncertainty analysis was undertaken to estimate the uncertainty in the future impacts predicted by the model. This method operates by generating numerous alternative sets of input parameters to the deterministic groundwater flow model (realisations), executing the model independently for each realisation, and then aggregating the results for statistical analysis. This approach is consistent with guidance provided by the Independent Expert Scientific Committee (IESC) (2018) for uncertainty analysis within a groundwater modelling risk management framework.

The first step in Monte Carlo analysis is to define the parameter distribution and range. For this project, the software PESTPP-IES (part of the PEST suite) was used to generate parameter ensembles based on a provided range of plausible value. The parameter distributions for the sampled prior and the calibrated ensemble are shown in **Appendix F**.

PESTPP-IES uses an “ensemble smoother” method that enable optimising each realisation in order to obtain an ensemble (suite of realisations) that:

- covers the range of plausible parameters distribution; and
- is calibrated to historical water level data.

As discussed in **Section 3.1**, a total of 75 calibrated realisations were selected from the last iteration and regarded as sufficient.

The predictions included in the uncertainty analysis were:

- maximum drawdown;
- predicted open cut mine inflow;
- alluvium water take; and
- change in river baseflow.

7.1 Uncertainty Convergence

SLR conducted statistical analyses of predictive results to assess if additional realisations were likely to provide results that would significantly change reported results. SLR calculated the 95% confidence interval for the predictive results.

The confidence intervals are presented sequentially as more realisations are added. For example, the confidence interval of the predicted alluvium take and total dewatering rates was calculated using the results from two realisations, three realisations, sequentially up to the total number of realisations.

Figure 7-1 and **Figure 7-2** show the median and maximum confidence intervals of alluvium take and total dewatering rates respectively, as well as the variance of the confidence intervals as more realisations are added. To calculate the statistics shown, the following steps are taken:

1 The model results of interest, total dewatering rates for this example, are first processed for all realisations.

2 The 95% confidence interval is then calculated sequentially as more realisations (i.e. results) are added, creating a sequential progression of confidence intervals as new realisations are added.

3 Median and maximum values of confidence intervals are then calculated at each interval of realisations being added.

4 Variance is calculated from the confidence intervals at each interval of realisations being added.

As indicated in **Figure 7-1** and **Figure 7-2**, additional realisations are unlikely to significantly increase or decrease the confidence intervals of predictions. This conclusion is drawn based upon the combination of two factors:

1 The rate of change per additional realisation is small.

2 The magnitudes of the confidence interval are small and well below reasonable expectation of the predictive ability of a numerical model.



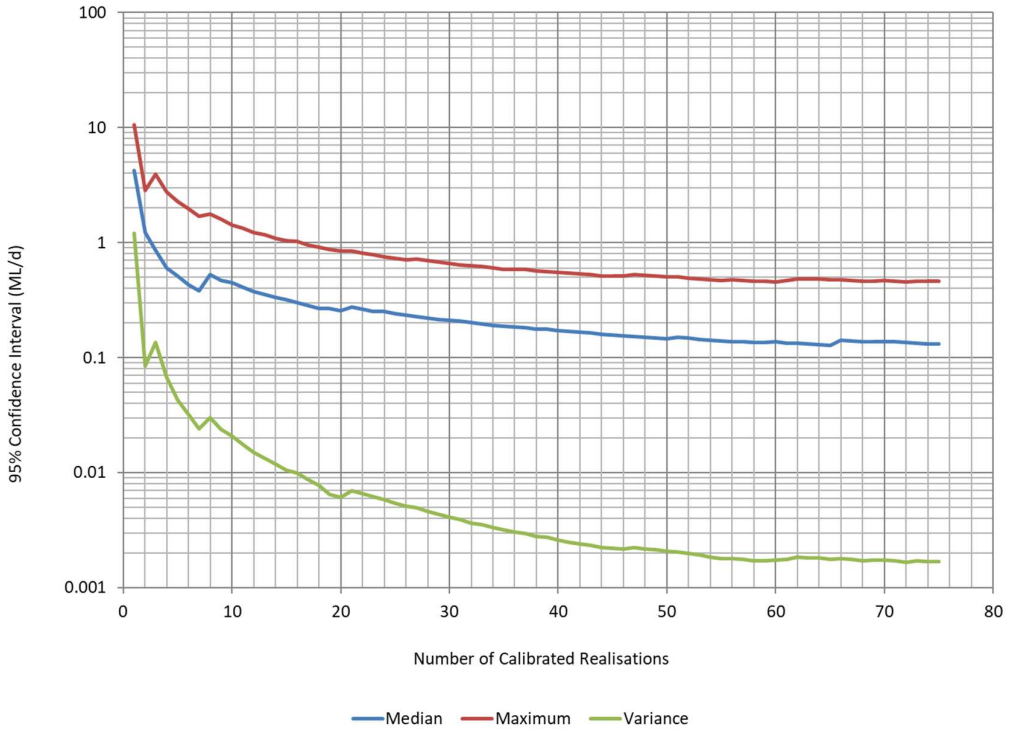


Figure 7-1 Predictive Uncertainty Convergence – Alluvium Take

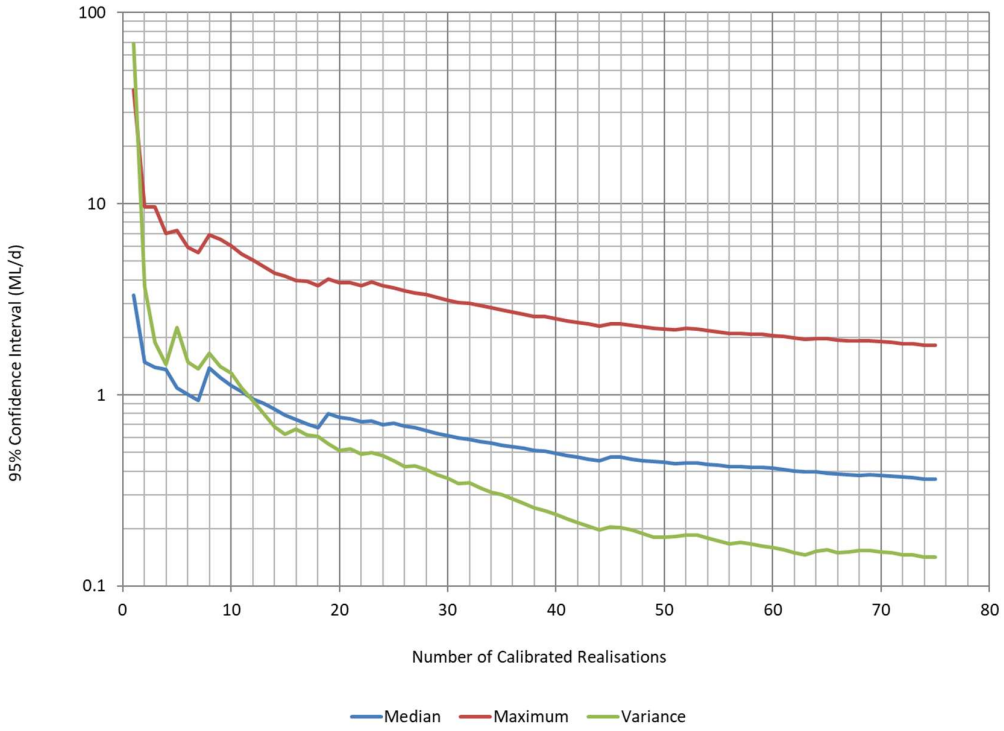


Figure 7-2 Predictive Uncertainty Convergence – Dewatering Rate

The “converged” values shown in **Figure 7-1** to **Figure 7-2** for alluvium take and total dewatering rate do not represent physical dewatering or water take rates at a specific point in time. Instead, they reflect the reduction in predictive uncertainty as more realizations are included. In other words, convergence indicates that additional realizations do not significantly change the spread of model predictions. Therefore, this value is a statistical measure of prediction stability rather than an actual pumping rate.

7.2 Uncertainty Results

7.2.1 Uncertainty in Mine Inflows

The uncertainty in groundwater inflow into the open cut mine (active take) from the start of the predictive model (2025) to the end of mining (2093), is shown for the cumulative Scenario (**Figure 7-3**). The predicted inflows are shown for the BCM and different percentiles prediction ranges. These represent the:

- Minimum to 5th percentile indicates it is very likely the outcome is larger than this range.
- 5th – 33th indicates it is likely that the outcome is larger than this range.
- Median indicate it is as likely as not that the outcome is larger or smaller than this value.
- 33th - 67th indicates it is likely that the outcome is within that range.
- 67th – 95th indicates it is unlikely that the outcome is larger than this range.
- 95th percentile indicates it is very unlikely the outcome is larger than this value.

Overall, the results indicate that the BCM is representative of the median estimated mine inflows. From 2056, the BCM is more representative of the 67th to 95th percentile band.

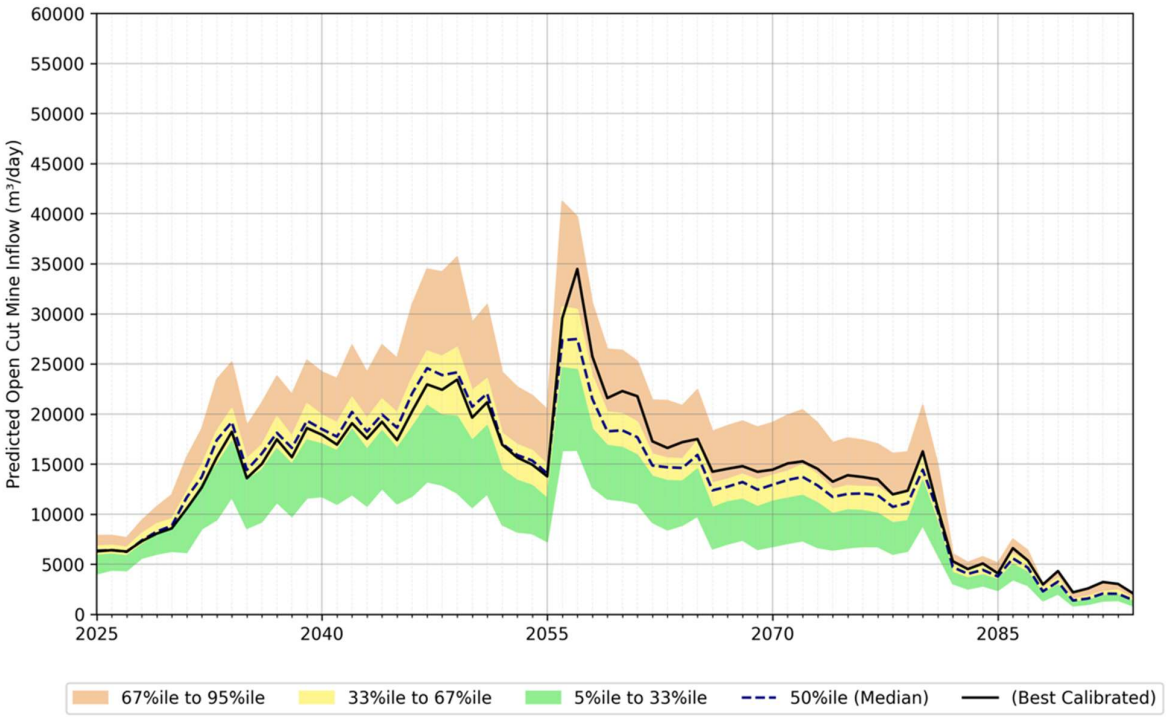


Figure 7-3 Predicted Open Cut Inflow Uncertainty - Cumulative Scenario

7.2.2 Uncertainty in Alluvium Take

The uncertainty in alluvium take for the alluvium associated with the Blackwater Creek is shown for the incremental scenario (**Figure 7-4**) and the cumulative scenario (**Figure 7-5**). Negative values indicate a reduction in alluvium take while positive values indicate an increase in alluvium take.

The BCM is representative of the median for the incremental alluvium take and the 5th to 33th percentile for the cumulative alluvium take.

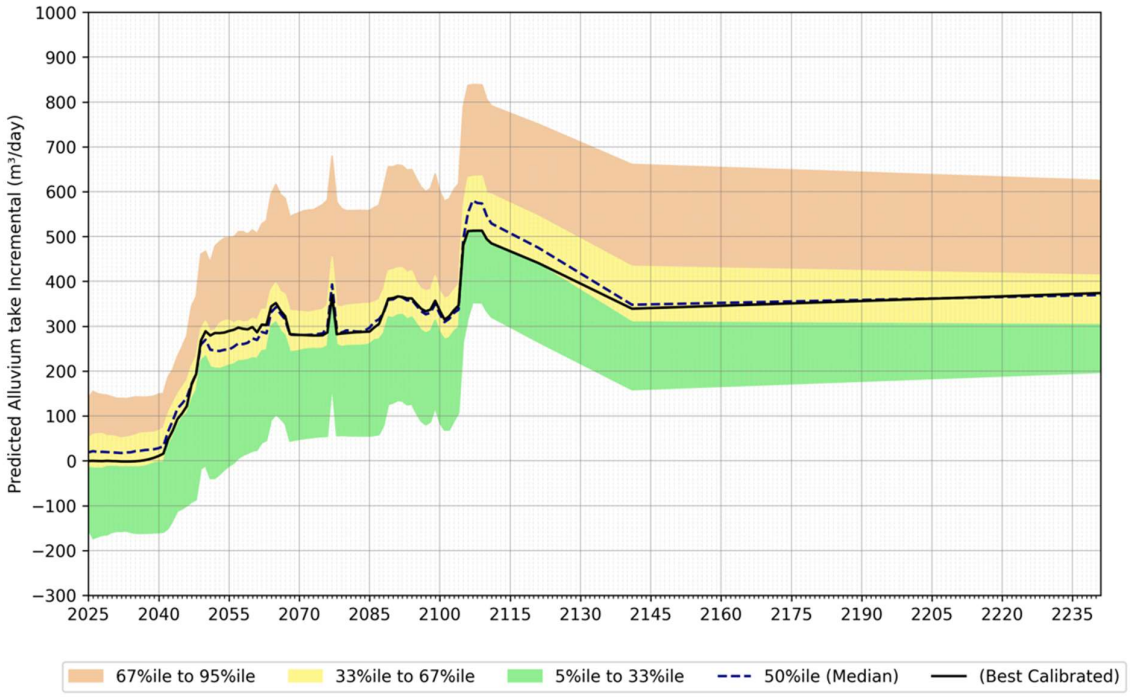


Figure 7-4 Uncertainty in Incremental Alluvium Take

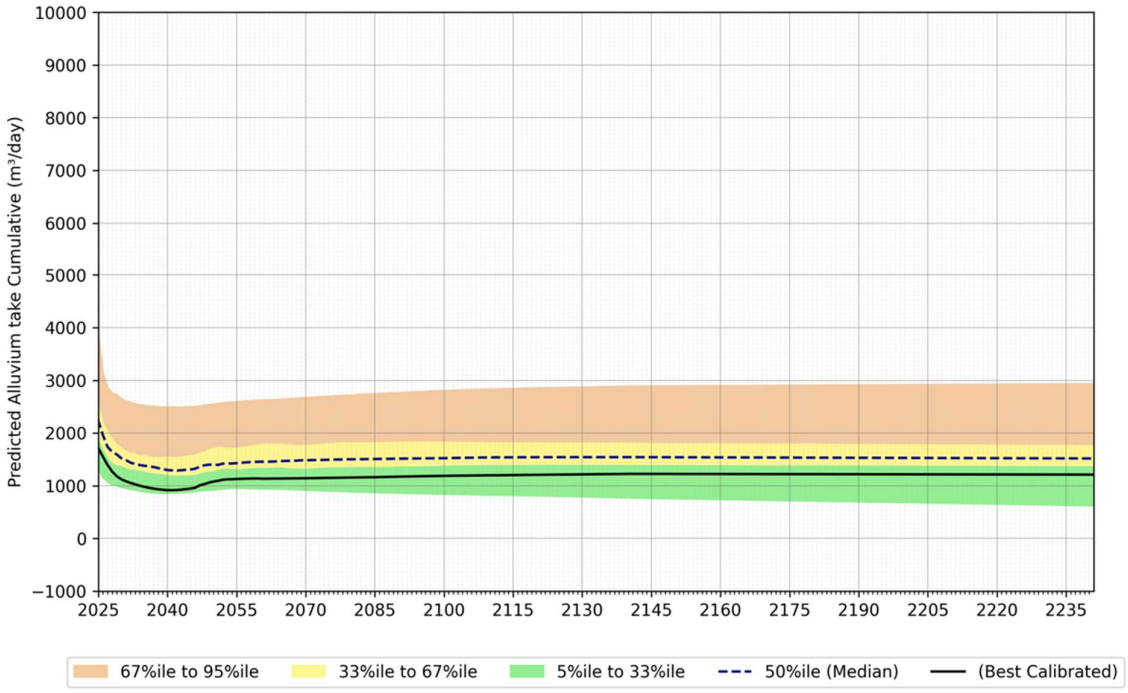


Figure 7-5 Uncertainty in Cumulative Alluvium Take

7.2.3 Uncertainty on Surface Water Flow

The change in groundwater flow to Blackwater Creek due to the Project was calculated by comparing the river flow budgets for Blackwater Creek in the Cumulative scenario against the Approved scenario.

The uncertainty in change in groundwater flow to Blackwater Creek is shown for the incremental scenario on **Figure 7-6**. Negative values indicate an increase in groundwater fluxes to Blackwater Creek while positive values indicate a decrease in groundwater fluxes to Blackwater Creek. The BCM is representative of the median.

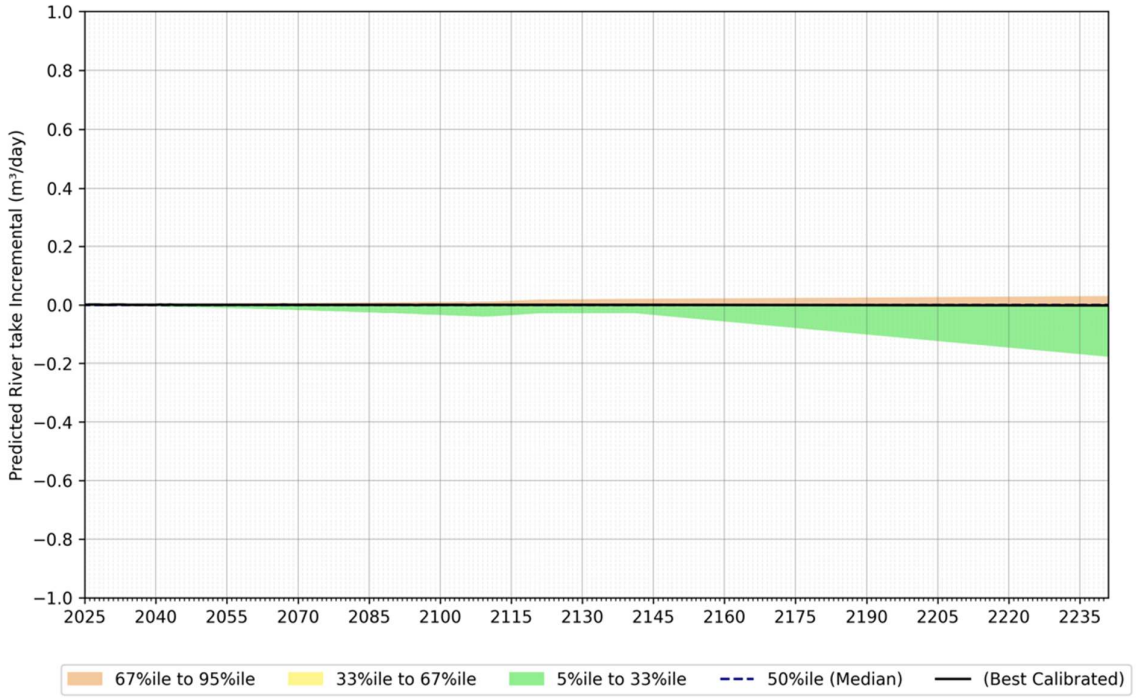


Figure 7-6 Uncertainty in Incremental River Baseflow Loss

7.2.4 Uncertainty in Drawdown

To illustrate the level of uncertainty in the extent of predicted mine induced drawdown (1 m contours), the 50th percentile maximum drawdown extent were compared to the maximum drawdown extent for the 5th and 95th percentiles (**Appendix G**). Both cumulative and incremental drawdown were calculated to demonstrate the impacts of mining on groundwater levels across different model layers. Incremental drawdown is generally limited in extent within model layers 1 and 2; however, the 95th percentile drawdown extent expands to the model boundary in the deeper layers.

8.0 Model Confidence and Limitations

The groundwater modelling was conducted in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012), the MDBC Groundwater Flow Modelling Guideline (MDBC, 2001) and the IESC Explanatory Note for Uncertainty Analysis (Peeters and Middlemis, 2023).

The model confidence level (Class 1, Class 2 or Class 3 in order of increasing confidence) based on the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) was previously widely used in the industry. The latest version of the IESC Explanatory Note for Uncertainty Analysis (Peeters and Middlemis, 2023) introduces a new concept on how model confidence can be assessed. The document also indicates that this change will follow in the next iteration of the Australian Modelling Guidelines and the new concept for assessing model confidence is hence applied for this model.

The latest version of the IESC Explanatory Note for Uncertainty Analysis defines a model fit for purpose when model results are:

- **Usable:** Relevant to the decision-making process, providing information about the uncertainty in conceptualisations and modelling simulations in a way that allows decision-makers to understand the effects of uncertainty on project objectives and the effects of potential bias. The relevant QoIs in this context are the groundwater inflows (active mining and final voids), drawdown due to mining and fluxes changes due to mining.
- **Reliable:** Demonstrate that the range of model outcomes is consistent with the system knowledge and honours historical observations, and provides objective evidence that uncertainties affecting decision-critical predictions of impacts on aquifer resources and dependent systems are not underestimated. The calibration performance was deemed acceptable, and a rigorous uncertainty analysis was undertaken to further improve confidence in the modelling outputs.
- **Feasible:** Trade-offs due to budget, time and technical constraints are reasonable and justifiable within the risk context of the project. This study is an update of a 2021 model variation, which shows that there are several model revisions and the latest data has been included. The model has been peer reviewed for each revision. This model build and associated review process is deemed commensurate with the Project related risk to the groundwater environment.

In order to assess these three points above, the four sources of scientific uncertainty (structural, parametrisation, measurement error, predictions) have been qualitatively assessed with regards key aspects of the BWM groundwater model, as presented in **Table 8-1**.

Overall, the model captures depressurisation due to active mining. The model is numerically stable with an acceptable mass balance error. The model shows a good fit between observed and modelled groundwater levels. A depth dependence function was used for hydraulic conductivity. Overall, the model is considered fit for purpose to achieve the objectives outlined in **Section 1** based on the data provided and the Project timeframe. Updates could be conducted in future to further refine the model, but this would be dependent on the purpose of the modelling and availability of data to inform future changes.

The model sensitivity was explored for an array of parameters. This showed that these parameters were generally well constrained by the calibration. Parameters are likely to contribute the most to predictive uncertainty (Type IV) were also identified.

The uncertainty analysis was undertaken to add a likelihood estimate to the prediction for the quantities of interest.



Table 8-1 Groundwater Model and Data Limitations

Type	Part	Status	Comment
Structural/ Conceptual	Grid and Model Extent	Fit for purpose	The model has an unstructured Voronoi grid that includes detailed cell refinement around site, neighbouring mines and along drainage features.
	Layers	Fit for purpose	Top of layer 1 incorporates site Light Detection and Ranging data.
		Fit for purpose	Representation of alluvium based on the CSIRO Regolith mapping Wilford et al (2016) and refined based on site drill data.
	Conceptualisation – Geological Structure	Fit for purpose, future improvements possible where new data collected	The local structure of the geology is based on detailed data at site (BWM geology model), and regional model geometry (outside of site) interpolated based on publicly available data, such as geological mapping and the CSIRO Regolith data set. Geophysical surveys across the Project area have identified minor faulting in the BWM area. Faulting is typically confined to the coal seams of the RCM. The minor faults show a displacement of up to 5 m. Hence, no geological structures (i.e. faults) have been included within the Project area in the model other than through layer displacements from the site geological model. The main regional fault (shot over fault) was included as the eastern model boundary. Displacements of up to 3,000 m are reported at this fault. The Permian coal measures outcrop along the western edge of the site. Therefore, how this is captured within the model influences the model predictions. The structure of the coal seams was checked to ensure it matches observed and mapped geology. The predictions of drawdown adjacent to mining was checked and the model shows a good fit between modelled and observed trends.
	Conceptualisation – GDEs	Fit for purpose, future improvements possible	A GDE conceptualisation is provided in SLR (2026).
	Conceptualisation – Surface Water Groundwater Interactions	Fit for purpose	The groundwater - surface water interactions are conceptualised as limited. Due to the gauged creeks to be classified as ephemeral (SLR, 2026), no long-term baseflow contribution from the groundwater is expected. Rather, surface water is expected to recharge the groundwater and after such recharge events, some minor baseflow contributions back into the creeks is possible.



Type	Part	Status	Comment
	Conceptualisation – Saturated Extent of Alluvium and Regolith	Fit for purpose future improvements possible	Site monitoring network includes one bore mapped within alluvium that was used to inform saturated extent of alluvium locally at site and for calibration targets. However, the alluvium in the area was found dry at this location. Other attempts to drill into the alluvium were abandoned, as either no alluvium was found or the alluvium was dry, or the bores were installed into the Rewan instead. The modelled groundwater levels in alluvium have hence no comparison available.
Parameterisation	Hydraulic Conductivity – Shallow layers	Fit for purpose	Spatial variability of hydraulic parameters in the Alluvium and Regolith have been incorporated in this model version by adding pilot points in both layer 1 and 2. This enhancement has allowed representing the heterogeneity in the alluvial system, improving the model's ability to replicate water level measurements in these units.
	Hydraulic Conductivity – Depth Dependence	Fit for purpose	Field testing of hydraulic conductivity (horizontal and to a lesser extent vertical) has been conducted in the area. Hydraulic conductivity test results from the other sites within the model domain were also considered. The data shows a general decline in hydraulic conductivity with depth that is replicated in the model.
	Spoil Properties	Fit for purpose, future improvements possible	Limited site-specific data is available for the spoil. Spoil properties were adopted using the previous studies.
	Rivers	Fit for purpose, future improvements possible	Blackwater Creek stage height is changed temporally in the historical calibration model based on observed levels from site stream gauges, and long term annual average level assumed in the predictive model. Blackwater Creek records flow only for a few days per year. The simulation of river stage height involves representing it as the average stage over the entire model stress period. However, since the stress periods (i.e., time slices) in the model are quarterly or annual, the stage height for Blackwater Creek persists in the model for a much longer period than it does in reality. This conservative design approach results in the simulation of what is naturally an ephemeral river reach as a perennial river in the model. Consequently, this leads to an overprediction of water levels in the alluvium along Blackwater Creek. All other watercourses within and in the vicinity of the Project area are ephemeral and only flow briefly after rainfall. Therefore, river stage height of zero was assigned to these watercourses in the model.



Type	Part	Status	Comment
	Recharge	Fit for purpose	Recharge zonation is based on mapped surface geology and calibrated recharge rates.
Measurement Error	Observation Data Quality	Fit for purpose	Bore logs and construction details available for most site bores, and long-term site water level data available for various units.
	Landholder Bore Data Quality	Fit for purpose, future improvements possible	Impacts on registered landholder bores are influenced by the assumptions of the bore design, target geology and use. Verification of landholder bore details may be required in future.
	Temporal spread	Fit for purpose	Timeseries water level data from the site as well as for the tertiary and Permian coal measures.
Scenario Uncertainties Future stresses/ conditions	Calibration	Fit for purpose	Transient warm-up (1970-2005) and transient (2005 to 2024) calibration model set up and a depth dependence function used and calibration to water levels conducted using automated (PEST) and manual methods.
	Predictive	Fit for purpose	Model captures approved and proposed open cut mining at BWM. The model also includes future mining at BWM South and Curragh mines, mainly based on publicly available data. The actual future mine progression for these sites may vary.
	Sensitivity and uncertainty	Fit for purpose	Uncertainty analysis has been conducted using PESTPP-IES. The uncertainty analysis quantified the variability in predictions with changes in maximum predicted drawdowns, mine inflows, impact on alluvium flow and impacts on surface water flow.



8.1 Conclusions

The numerical groundwater model developed for the Project successfully achieved the modelling objectives, as outlined in **Section 1**. Model calibration statistics are within suggested guidelines (Barnett et al., 2012) and mass balance errors remain low, through the model calibration and predictive modelling. Model construction considers all available data, including the current site mine plan and site geological model for the Project area. The uncertainty analysis has demonstrated a low likelihood for the Project to impact on alluvial water levels, with Project related drawdown primarily contained within the Project area. The model serves as a suitable representation of possible transient groundwater conditions within the Study Area, over the life of the Project, however, the uncertainty in predictions should be acknowledged.

Limited site-specific information on hydraulic conductivities and storage parameters were available during calibration. As more site-specific hydraulic data becomes available, new data should be compared with the calibrated parameters achieved and the validity of the model calibration should be assessed. Additional site-specific data is expected to “tighten” uncertainty bounds for model prediction results.

Predictive sensitivity indicates that mine inflows are sensitive to spoil hydraulic parameters. However, calibration sensitivity to these parameters is relatively low. Future work should consider opportunities to further constrain values of these parameters.



9.0 References

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A., 2012. Australian Groundwater Modelling Guidelines. Waterlines Report Series No. 82, June 2012.

Ditton, S. and Merrick, N.P, 2014. A new sub-surface fracture height prediction model for longwall mines in the NSW coalfields. Paper presented at the Australian Earth Science Convention, Newcastle NSW.

Engeny Australia Pty Ltd, 2025. Summary of 2025 AWT Methods.

Hawkins, J.W., 1998. Hydrogeologic characteristics of surface-mine spoil. In Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania, ed. Brady, Smithy and Schueck. Harrisburg, Pennsylvania. https://files.dep.state.pa.us/mining/BureauOfMiningPrograms/BMPPortalFiles/Coal_Mine_Drainage_Prediction_and_Pollution_Prevention_in_Pennsylvania.pdf.

Helton, J. C., Johnson, J. D., Sallaberry, C. J. and Storlie, C. B., 2006. Survey of sampling-based methods for uncertainty and sensitivity analysis. Reliability Engineering & System Safety, 91(10–11), 1175–1209. https://doi.org/10.1016/j.ress.2005.11.017

HydroAlgoritmics Pty Ltd, 2014. AlgoMesh User Manual.

HydroBalance, 2026. Blackwater North Extension Project Water Balance Assessment Report. Prepared for Whitehaven Coal. Report Reference: WHC-037-C1_DRAFT.

IESC, 2018. Uncertainty analysis – Guidance for groundwater modelling within a risk management framework.

Jeuken, R., 2011. Blackwater Mine – Pit by Pit Geology, January 2011.

Mackie, C.D., 2009. Hydrogeological characterisation of Coal Measures and overview of impacts of coal mining on groundwater systems in the upper Hunter Valley of NSW. PhD thesis at University of Technology, Sydney.

Mallet, C.W., 1988. Bowen Basin – Street structure and Mining conditions – Assessment of Mine Planning. Commonwealth Scientific and Industrial Research Organisation Division of Geomechanics, National Energy Research, Development and Demonstration Council (NERDDC) final report, Project 901.

MDBC (Middlemis, H., Merrick, N. and Ross, J.), 2001. Murray-Darling Basin Commission – Groundwater Flow Modelling Guideline. Report for MDBC. January 2001.

Office of Groundwater Impact Assessment, 2019. Groundwater Modelling Report – Surat Cumulative Management Area. Office of Groundwater Impact Assessment, Brisbane.

Panday, S., Langevin, C.D., Niswonger, R.G., Ibaraki, M., and Hughes, J.D., 2013. MODFLOW–USG version 1: An unstructured grid version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation: USGS Techniques and Methods 6-A45.

Peeters, L.J.M. and Middlemis, H., 2023. Information Guidelines Explanatory Note: Uncertainty analysis for groundwater modelling, A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of Climate Change, Energy, the Environment and Water, Commonwealth of Australia, 2023.

Pianosi, F., Beven, K., Freer, J., Hall, J. W., Rougier, J., Stephenson, D. B. and Wagener, T., 2016. Sensitivity analysis of environmental models: A systematic review with



practical workflow. Environmental Modelling & Software, 79, 214–232. https://doi.org/10.1016/j.envsoft.2016.02.008.

Queensland Government, 2023. Scientific Land Owners (SILO) database – Australian climate data from 1889 to 2024. https://www.longpaddock.qld.gov.au/silo/point-data/.

Saltelli, A., Ratto, M., Andres, T., Campolongo, F., Cariboni, J., Gatelli, D., Saisana, M. and Tarantola, S., 2008. Global Sensitivity Analysis: The Primer. John Wiley & Sons. ISBN: 978-0470725177.

S.S. Papadopulous and Associates Inc., 2020. Users Guide for mod-PATH3DU, a Groundwater Path and Travel-Time Simulator. https://mp3du.sspa.com/man/

SLR Consulting Australia Pty Ltd, 2024. Blackwater Mine – Transitional PRC Plan Hydrogeology Assessment. Prepared for Whitehaven. Report reference: 620.040199.00001-R01-v3.1.

SLR Consulting Australia Pty Ltd, 2026. Blackwater Mine - North Extension Project Groundwater Impact Assessment. Prepared for Whitehaven. Report reference: 640.01031809.00001-R01-v3.0.

White, J.T., Hunt, R.J., Fienen, M.N. and Doherty, J.E., 2020. Approaches to Highly Parameterized Inversion: PEST++ Version 5, a Software Suite for Parameter Estimation, Uncertainty Analysis, Management Optimization and Sensitivity Analysis: U.S. Geological Survey Techniques and Methods 7C26, 52 p., https://doi.org/10.3133/tm7C26.

Wilford, J., Searle, R., Thomas, M., Pagendam, D. and Grundy, M., 2016. A regolith depth map of the Australian continent. Geoderma. 2016; 266:1-13. https://doi.org/10.1016/j.geoderma.2015.11.033.

Xiao, M., Bouchet, L., Sharp, C., Sam, S., Weeks, S. and Rask, B., 2025. Getting Coupled – How a groundwater model and a water balance model get together for final void pit lake predictions. The 52nd Congress of the International Association of Hydrogeologists, Melbourne, September 2025.

Appendix A Calibration Residuals

Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

SLR Project No.: 640.031809.00001

7 October 2026

ID	Easting	Northing	Layer	Average Residual	Min	Max
BG No.1 AP	684107	7387742	16	-6.37	-6.64	-6.21
BG No.2 BG	684414	7384622	16	0.77	-1.79	3.86
BWM_MB01_02	687411	7344932	10	-32.48	-33.38	-29.14
BWM_MB02_01	691791	7362760	7	4.28	3.43	4.73
BWM_MB02_02	691803	7362756	10	-19.82	-20.36	-19.34
BWM_MB03_02	692220	7381519	5	-9.80	-9.83	-9.74
BWM_MB04_01	686247	7350296	10	15.26	13.07	16.69
BWM_MB100_01	683897	7353255	2	10.95	10.95	10.95
BWM_MB106_01	684923	7352654	2	-3.17	-3.17	-3.17
BWM_MB107_04	685192	7352941	12	-17.47	-17.47	-17.47
BWM_MB108_04	685132	7353470	12	-21.74	-21.74	-21.74
BWM_MB109_02	684843	7353684	12	0.69	0.69	0.69
BWM_MB110_01	684722	7353488	11	-2.59	-2.59	-2.59
BWM_MB113_01	684003	7353042	2	1.37	1.37	1.37
BWM_MB114_01	683973	7352659	2	-2.47	-2.47	-2.47
BWM_MB116_02	683430	7351232	16	-7.23	-7.23	-7.23
BWM_MB117_01	683622	7350774	16	-4.44	-4.44	-4.44
BWM_MB117_02	683557	7350857	2	3.63	3.63	3.63
BWM_MB118_02	683708	7350621	16	-2.75	-2.75	-2.75
BWM_MB11_01_R01	691468	7360018	7	-27.53	-30.77	-24.28
BWM_MB11_02	691462	7360012	10	3.78	-2.49	10.05
BWM_MB11_03	691458	7360008	12	16.79	11.89	21.69
BWM_MB121_02	684196	7350960	16	16.79	16.79	16.79
BWM_MB122_01	684453	7351176	7	10.01	10.01	10.01
BWM_MB123_02	683946	7351056	16	6.89	6.89	6.89
BWM_MB126_02	684063	7351953	16	1.90	1.90	1.90
BWM_MB12_02	687969	7356097	10	-1.03	-1.81	-0.44
BWM_MB12_03	687977	7356091	12	-3.34	-3.38	-3.30
BWM_MB130_01	684963	7351640	7	-2.90	-2.90	-2.90
BWM_MB130_02	684959	7351646	12	1.77	1.77	1.77
BWM_MB131_02	684803	7351242	16	6.65	6.65	6.65
BWM_MB132_02	684591	7351283	16	4.75	4.75	4.75
BWM_MB134_02	684943	7351085	16	7.27	7.27	7.27
BWM_MB135_02	684899	7350805	14	-7.49	-7.49	-7.49
BWM_MB136_02	684603	7350311	16	-5.65	-5.65	-5.65



ID	Easting	Northing	Layer	Average Residual	Min	Max
BWM_MB137_02	685185	7350987	16	9.19	9.19	9.19
BWM_MB138_02	684736	7350972	13	2.42	2.42	2.42
BWM_MB15_01	686794	7347807	2	25.82	25.78	25.90
BWM_MB15_02	686779	7347804	12	-11.83	-17.56	-6.11
BWM_MB15_03	686768	7347802	10	-15.47	-19.04	-11.90
BWM_MB164_01	683816	7350493	2	4.01	4.01	4.01
BWM_MB16_01	682882	7340174	2	0.79	-0.11	1.25
BWM_MB16_02	682883	7340184	10	-9.65	-9.85	-9.31
BWM_MB16_03	682875	7340188	12	-8.73	-8.93	-8.35
BWM_MB17_02	684119	7343373	2	0.56	-1.34	0.92
BWM_MB17_03	684111	7343371	2	-7.25	-7.43	-6.95
BWM_MB19_01	683803	7350482	16	-17.23	-17.23	-17.23
BWM_MB21_02	686043	7342140	8	-22.34	-22.79	-21.89
BWM_MB21_03	686041	7342148	12	-22.97	-23.38	-22.60
BWM_MB22_01	687412	7344924	2	5.12	5.02	5.18
BWM_P4	684098	7352908	2	-2.13	-2.95	-1.12
BWM_P7	684002	7352973	2	-0.75	-1.03	-0.55
FY16_PZ_2	686714	7387555	12	-2.03	-2.78	-1.18
FY16_PZ_3	686322	7388372	12	-11.22	-12.19	-6.15
FY16_PZ_4	686206	7389577	12	-7.77	-8.13	-7.47
FY16_PZ_5	685482	7389168	12	-2.78	-3.12	-2.52
MB1	686528	7387172	8	-6.22	-10.85	-1.07
MB15	688772	7354180	7	0.31	-4.92	4.89
MB16	687966	7352289	7	-13.18	-25.78	4.22
MB17	691280	7370333	7	-11.70	-14.22	-10.07
MB18	691528	7370782	7	-7.71	-12.53	-3.55
MB19BWM01P	690024	7390277	8	-6.82	-7.22	-6.32
MB19BWM02A	690112	7390183	6	-0.60	-1.13	0.02
MB19BWM03P	688442	7383483	8	-7.40	-10.97	-3.31
MB19BWM04R	688307	7383595	6	-16.58	-17.11	-16.27
MB19BWM06P	687694	7379464	8	9.68	8.96	10.74
MB19BWM08P	691544	7370740	8	8.63	8.45	9.15
MB19BWM25P	689262	7376881	6	-5.66	-6.01	-5.16
MB19BWM27P	689070	7376739	8	1.30	0.98	1.71
MB19BWM_10P	684383	7342058	12	-13.09	-13.22	-12.97



ID	Easting	Northing	Layer	Average Residual	Min	Max
MB19BWM_15P	669194	7338140	8	-5.94	-7.40	-5.09
MB19BWM_16R	669188	7338156	6	-10.61	-12.19	-9.15
MB19BWM_18P	677019	7338061	8	-11.22	-13.01	-10.33
MB19BWM_24P	670211	7342228	8	-11.82	-11.95	-11.69
MB19BWM_25P_B	683532	7333206	8	3.15	3.04	3.34
MB20BWM02P2	686321	7388395	10	-15.11	-17.87	-5.71
MB20BWM03P1	686489	7387296	10	-12.75	-13.20	-12.53
MB20BWM03P2	686490	7387289	12	-10.62	-12.21	-9.73
MB23	683792	7350850	16	-0.59	-0.77	-0.36
MB3	688026	7373479	8	3.12	0.11	7.54
MB4	692072	7366435	7	-19.36	-20.81	-12.30
MB6	686881	7347723	7	25.74	20.88	30.20
MB8	681544	7373895	2	1.56	-0.75	4.19
MB9	682318	7372602	16	7.38	6.97	7.67
RGS_PZ2-3	683745	7351052	2	3.20	3.00	3.41
RGS_PZ6-2	683925	7350731	2	8.53	7.91	9.78
TMB1-D	681252	7372802	16	-0.02	-0.12	0.07
TMB1-S	681249	7372800	2	3.95	3.82	4.05
TMB5-S	683230	7373039	2	11.23	10.85	11.80
TMB6-S	682831	7373037	16	1.31	1.08	1.51
TMB7-S	681358	7373521	16	4.09	4.09	4.09
TMB8-S	682254	7374255	16	-5.18	-5.27	-5.06
VWP19BWM01-2	689179	7376894	6	-3.66	-5.83	2.95
VWP19BWM01-4	689179	7376894	7	4.08	-0.20	5.27
VWP19BWM01-5	689179	7376894	9	2.18	1.51	3.09
VWP19BWM02-1	691840	7365921	7	-27.96	-34.15	-19.66
VWP19BWM02-2	691840	7365921	9	-13.04	-15.10	-9.05
VWP19BWM02-3	691840	7365921	11	-10.18	-12.01	-6.05
VWP19BWM02-4	691840	7365921	12	-11.87	-14.27	-8.33
VWP19BWM02-5	691840	7365921	14	-7.06	-12.05	-0.77
VWP19BWM03-2	672843	7334855	7	-23.30	-23.97	-21.56
VWP19BWM03-4	672843	7334855	9	-20.39	-22.05	-18.40
VWP19BWM03-5	672843	7334855	12	-18.64	-20.24	-16.54
VWP19BWM04-1	682417	7330805	6	-22.83	-24.10	-20.93
VWP19BWM04-2	682417	7330805	7	-12.17	-13.11	-11.01



ID	Easting	Northing	Layer	Average Residual	Min	Max
VWP19BWM04-3	682417	7330805	8	9.38	8.91	9.94
VWP19BWM04-4	682417	7330805	11	8.25	7.18	9.59
VWP19BWM04-5	682417	7330805	12	9.52	9.11	10.32

Appendix B Calibration Hydrographs

Blackwater North Extension Project

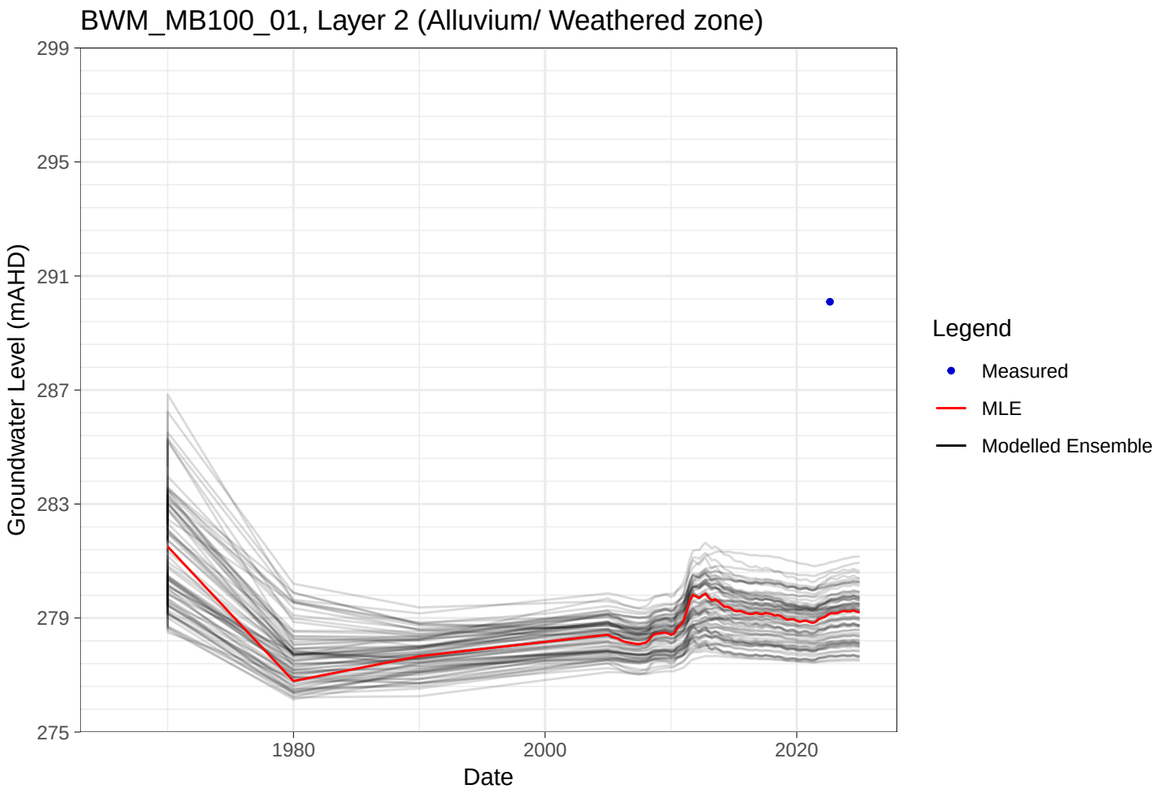
Groundwater Modelling Technical Report

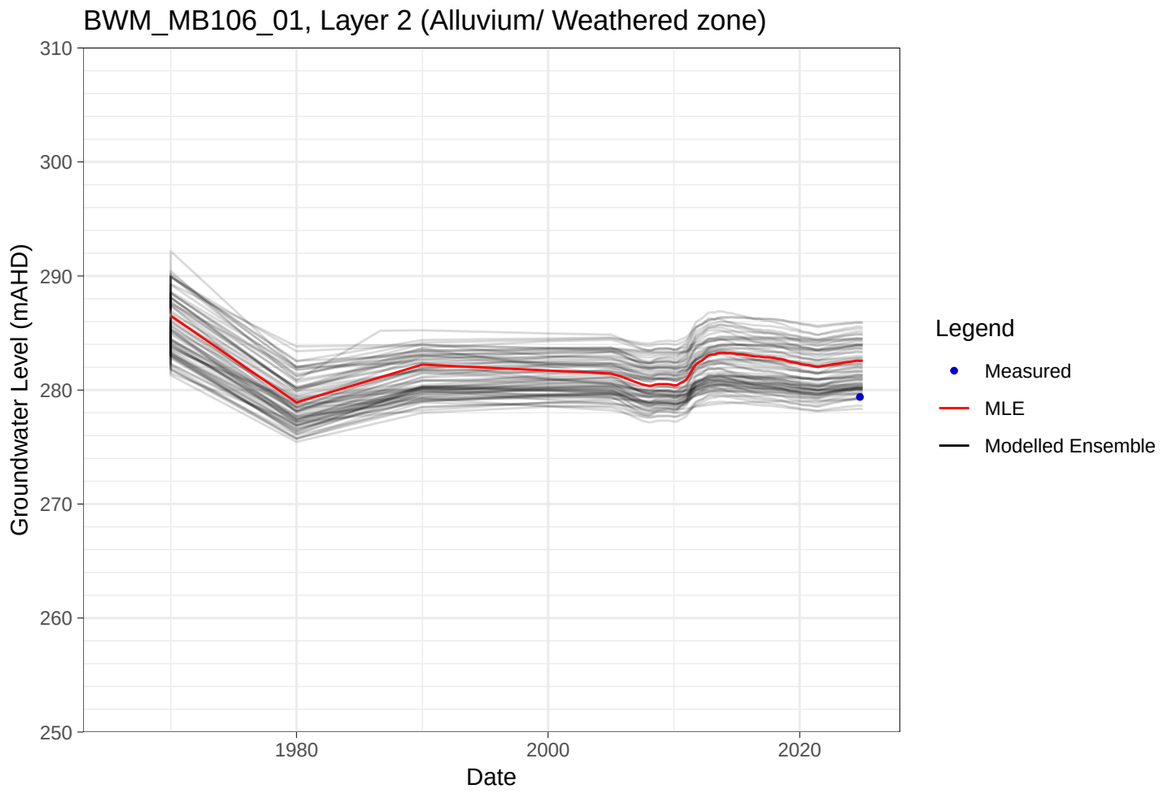
Whitehaven Blackwater Pty Ltd

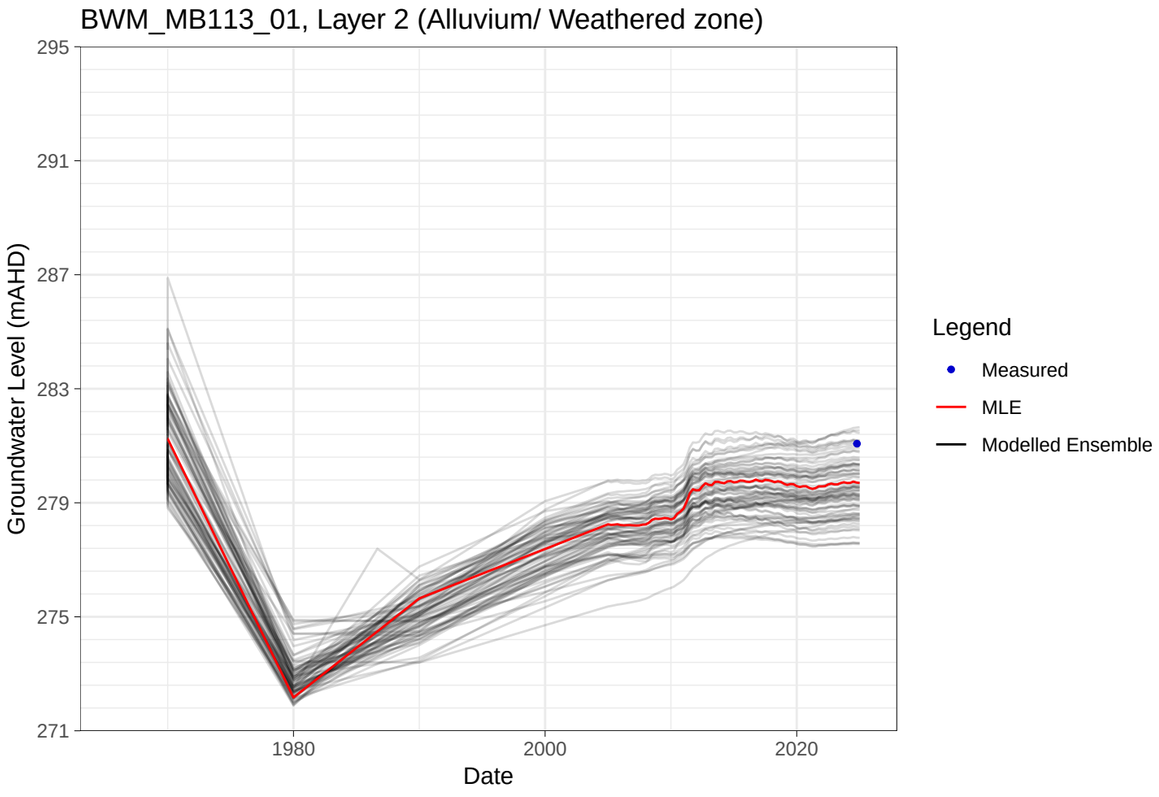
SLR Project No.: 640.031809.00001

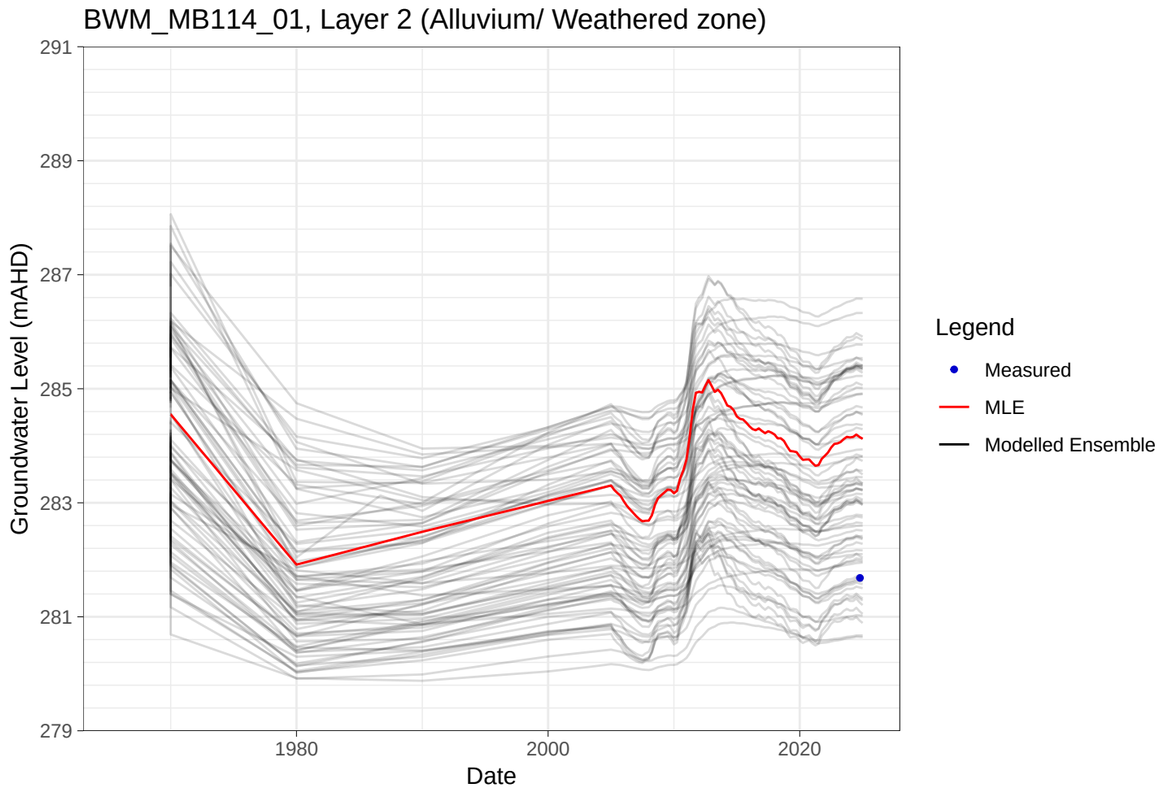
7 October 2026

,

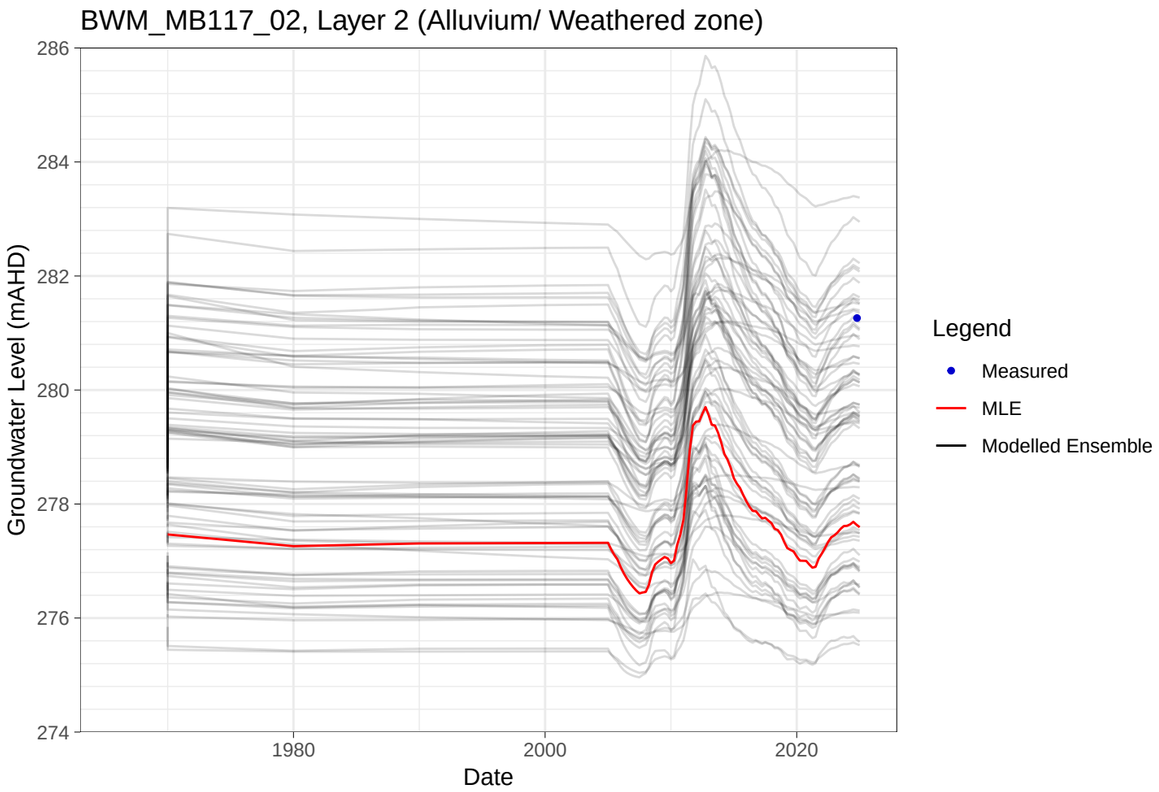

BWM_MB100_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
299
295
291
287
283
279
275
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

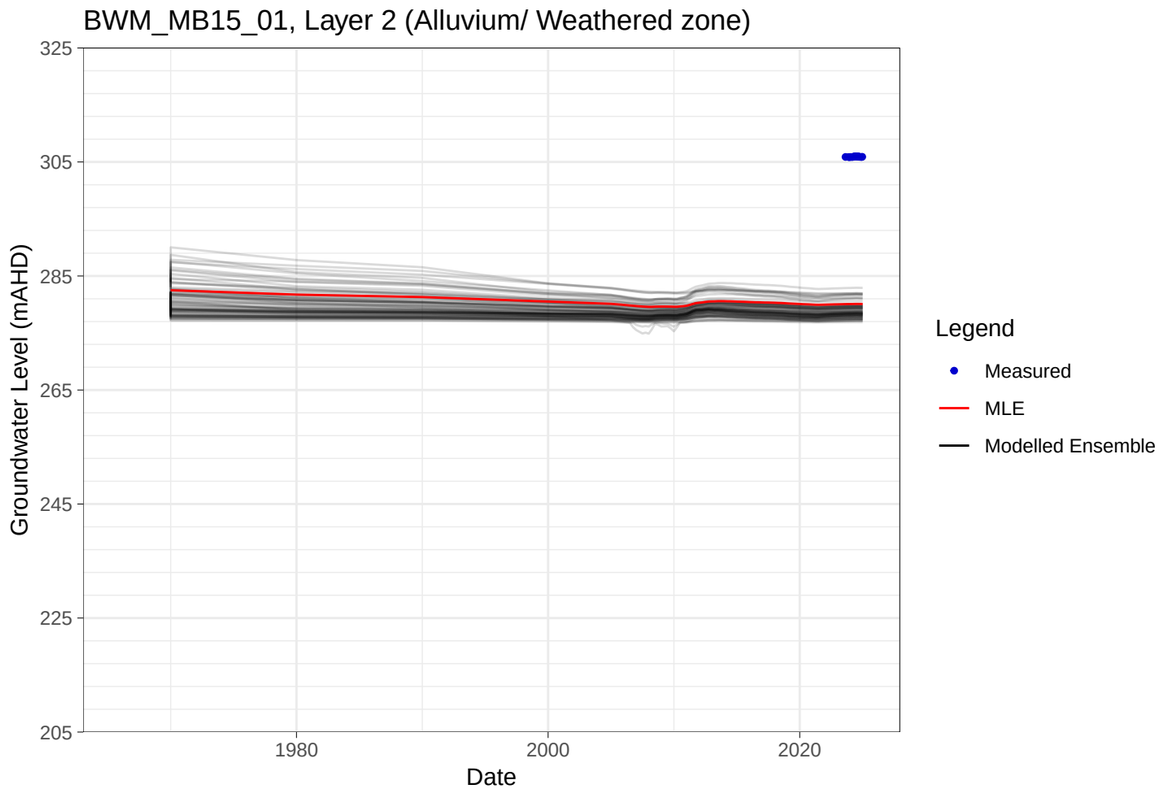

BWM_MB106_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
310
300
290
280
270
260
250
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

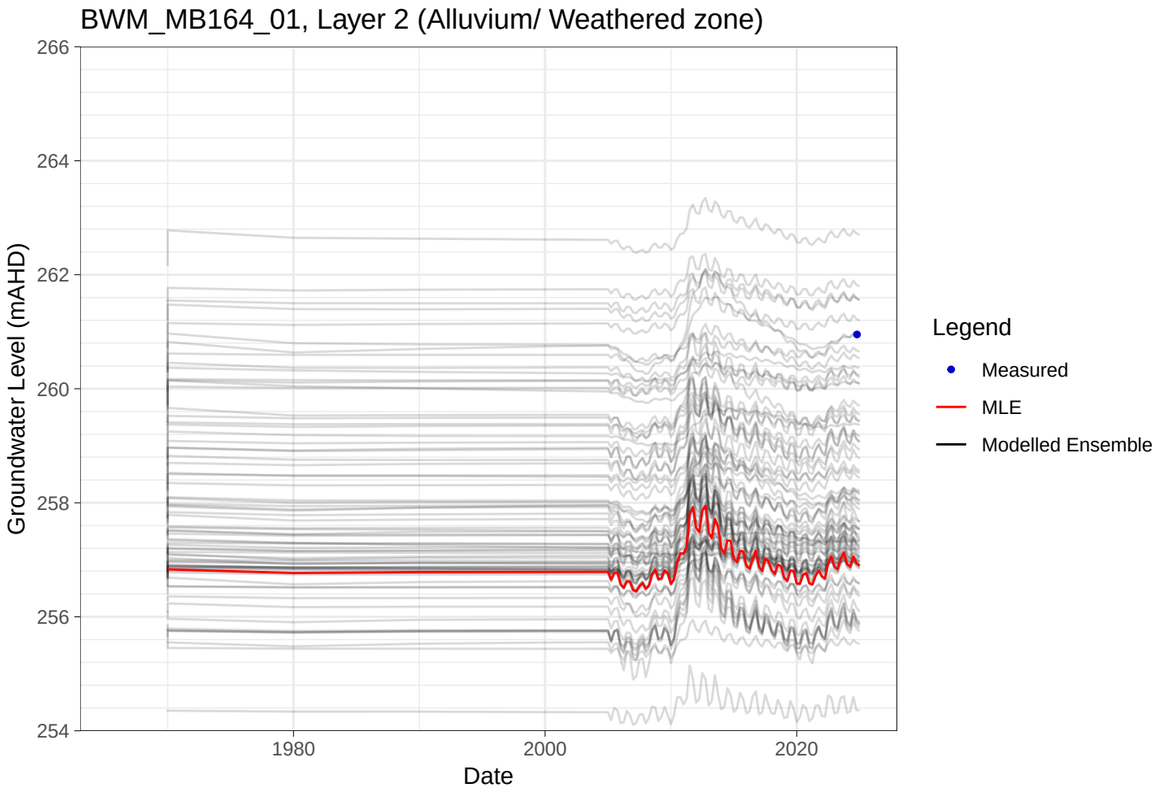

BWM_MB113_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
295
291
287
283
279
275
271
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

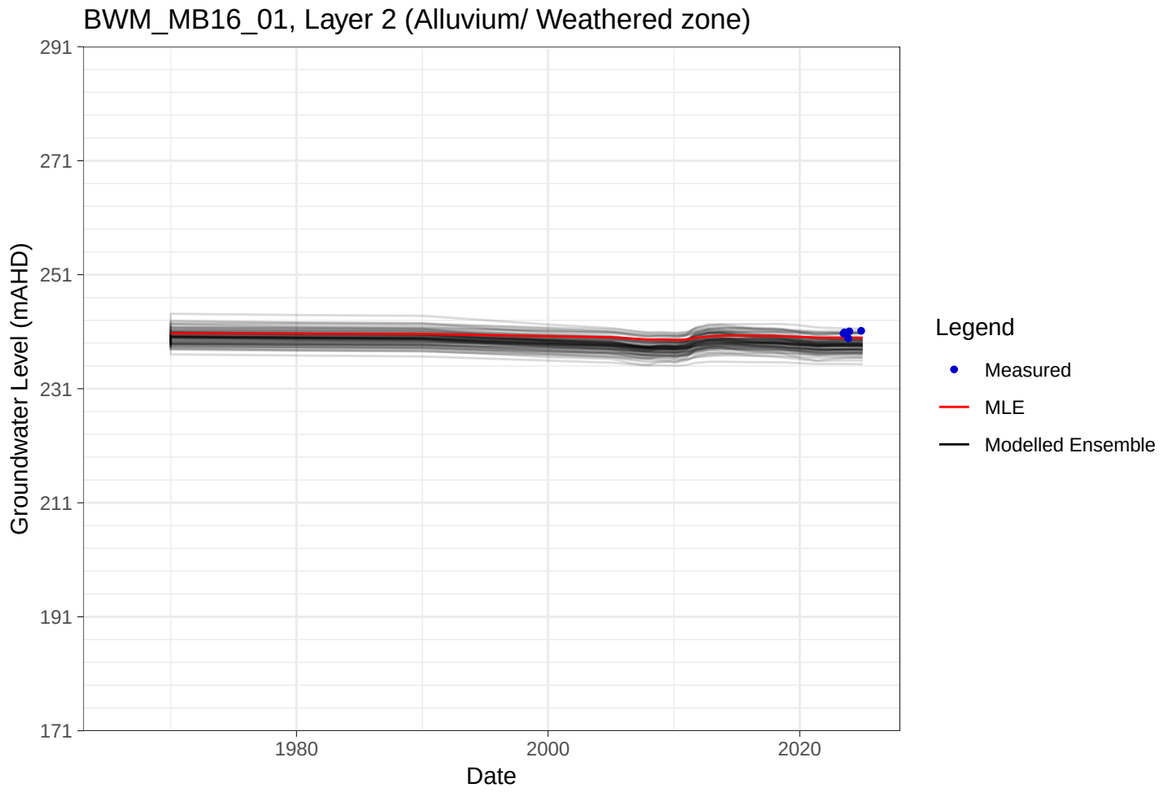

BWM_MB114_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
291
289
287
285
283
281
279
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

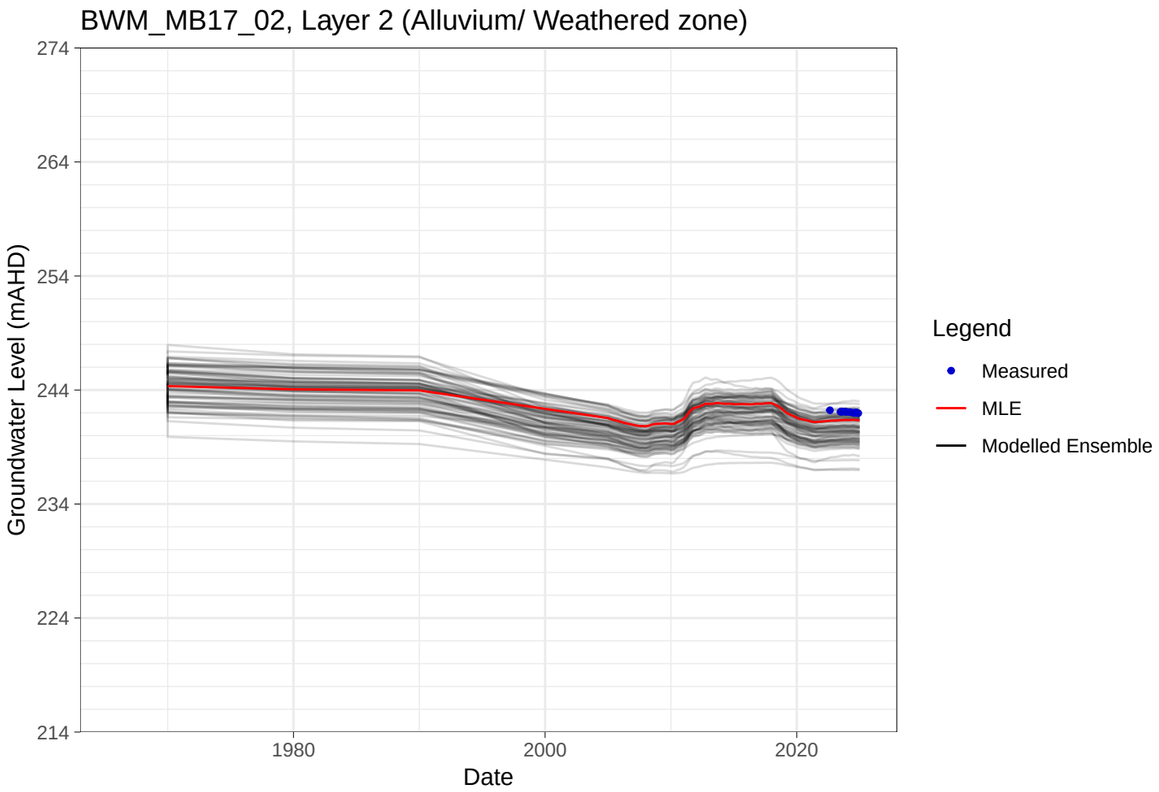

BWM_MB117_02, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
286
284
282
280
278
276
274
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

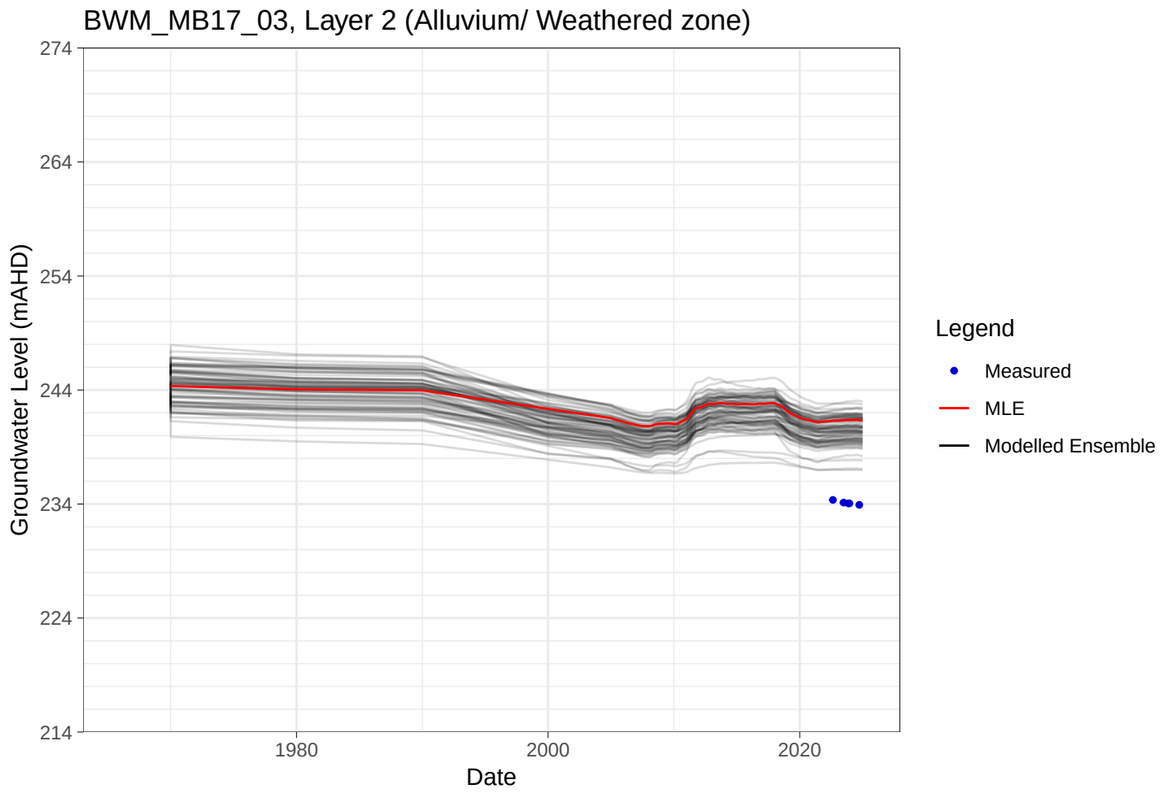

BWM_MB15_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
325
305
285
265
245
225
205
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

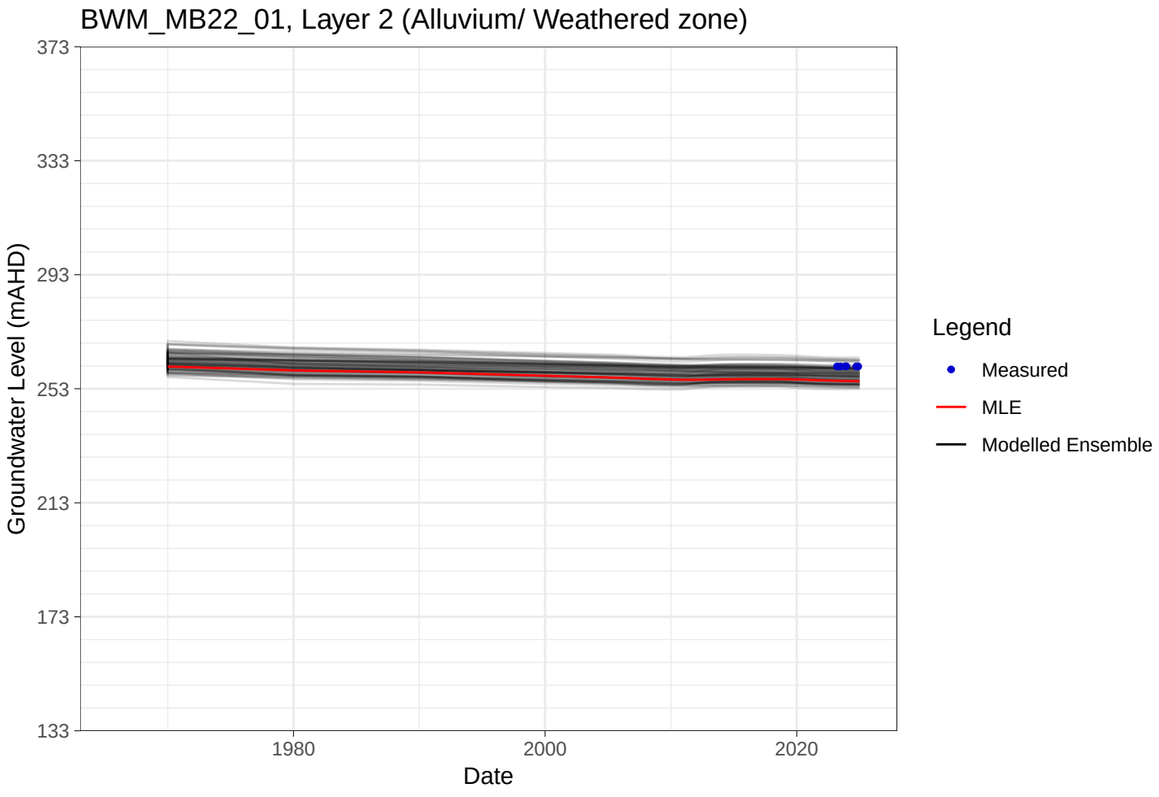

BWM_MB164_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
266
264
262
260
258
256
254
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

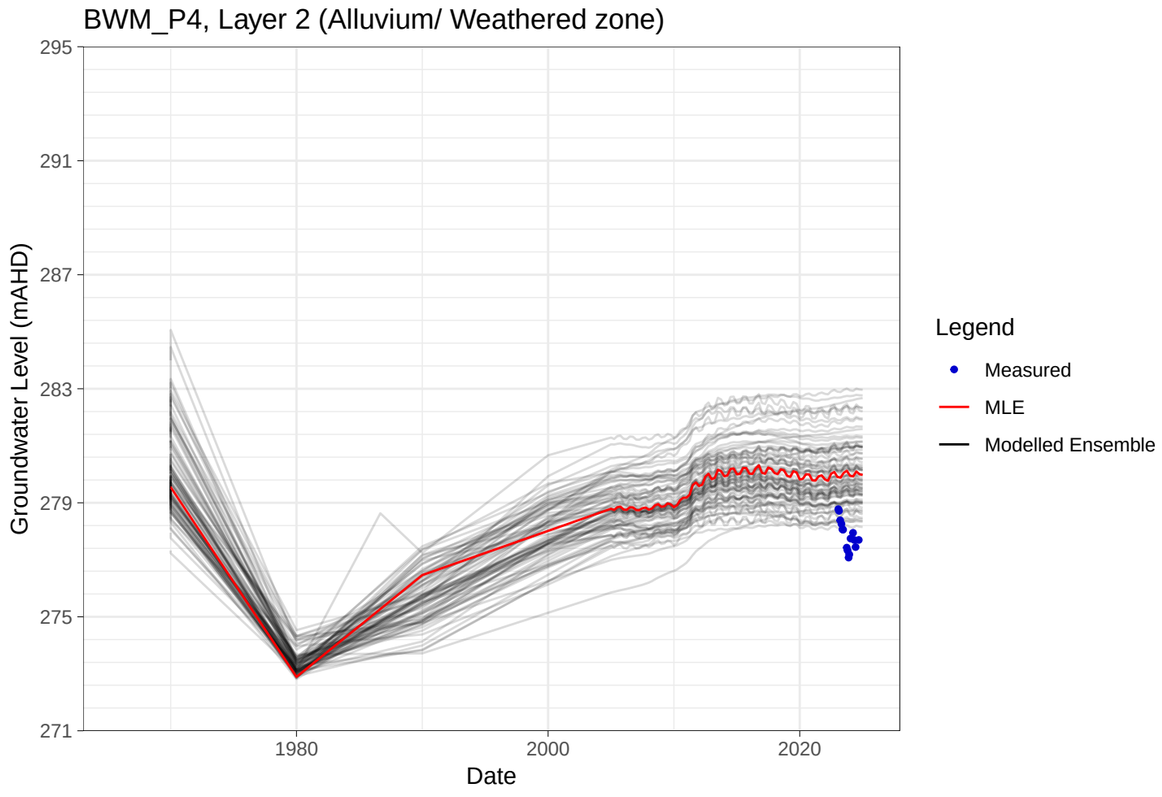

BWM_MB16_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
291
271
251
231
211
191
171
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

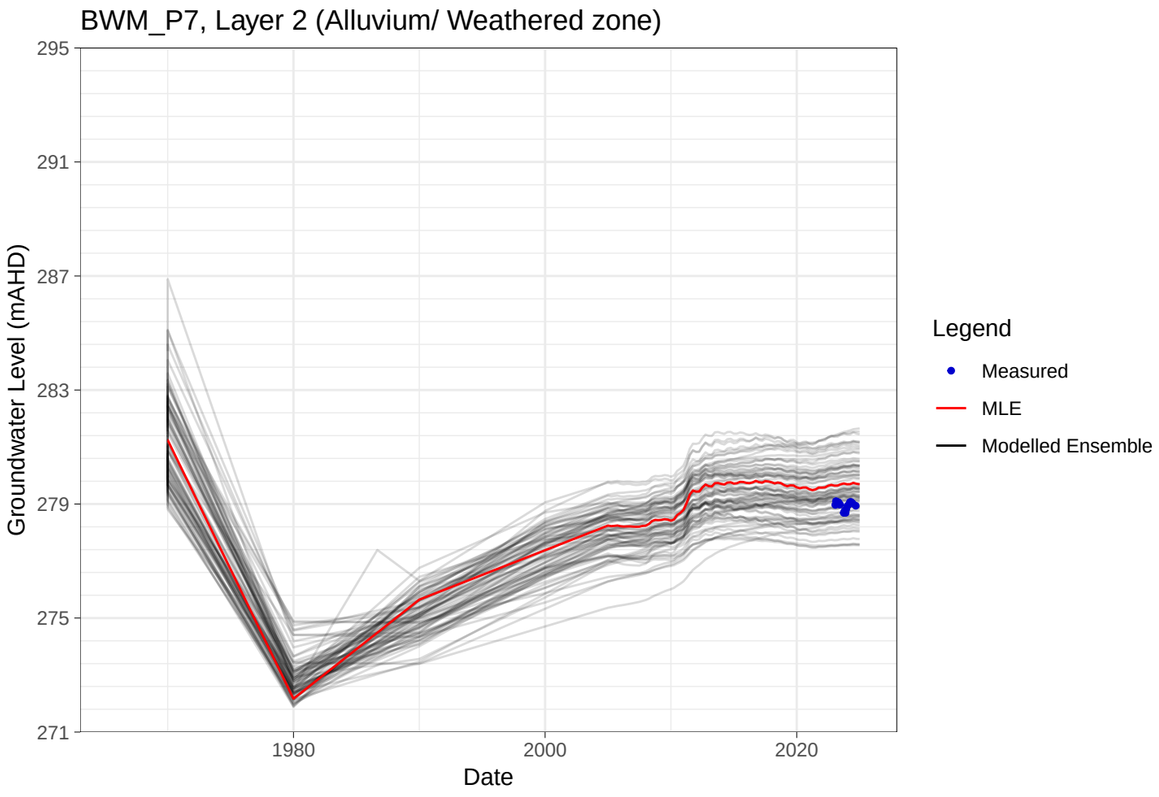

BWM_MB17_02, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
274
264
254
244
234
224
214
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

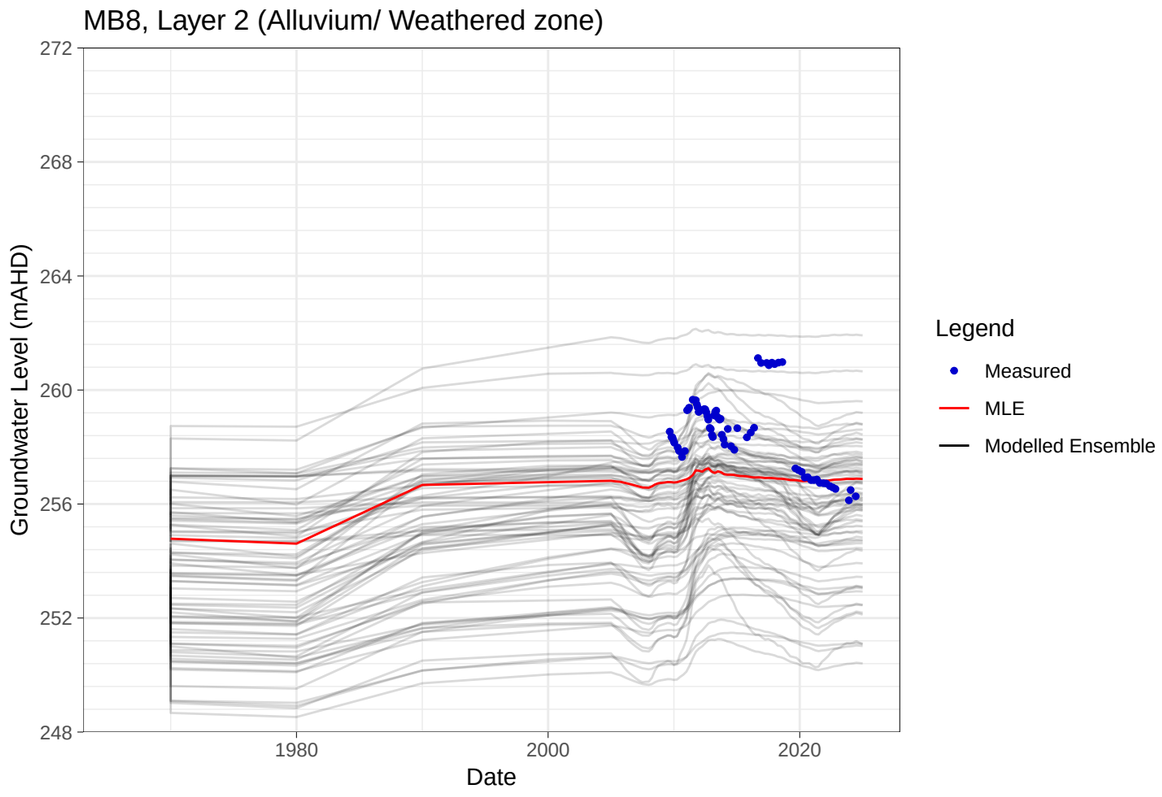

BWM_MB17_03, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
274
264
254
244
234
224
214
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

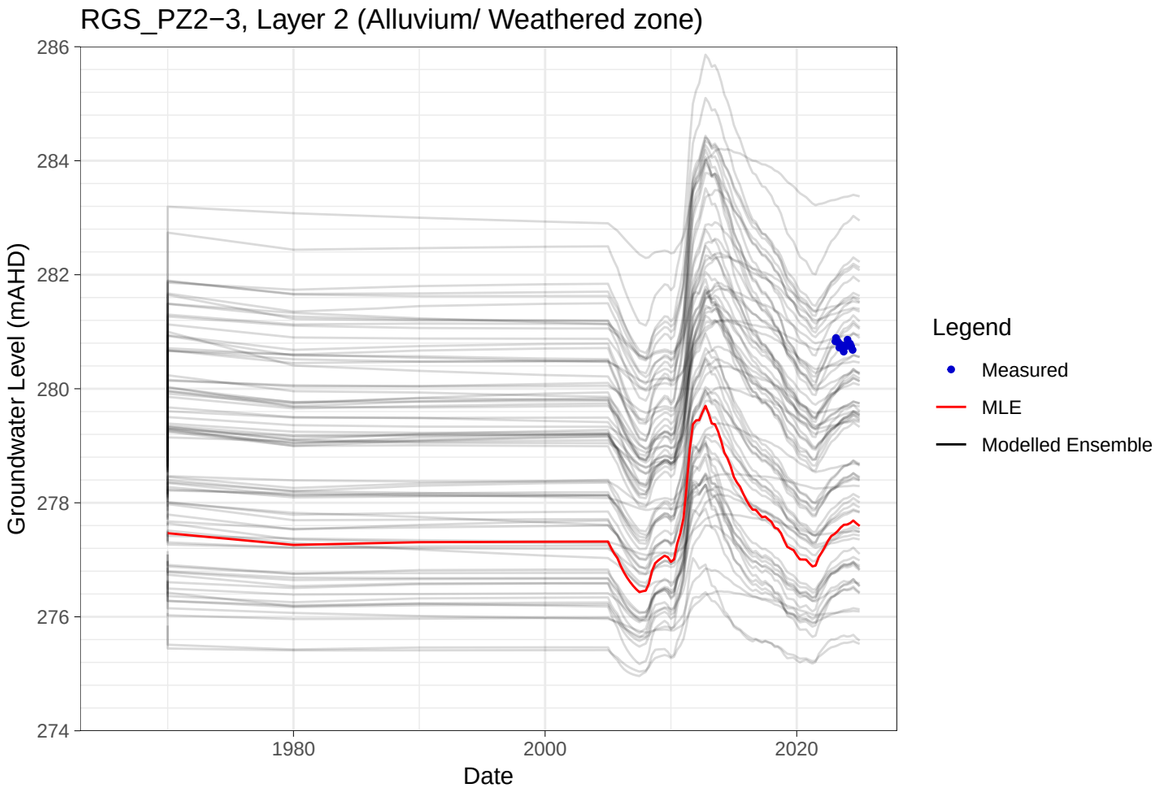

BWM_MB22_01, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
373
333
293
253
213
173
133
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

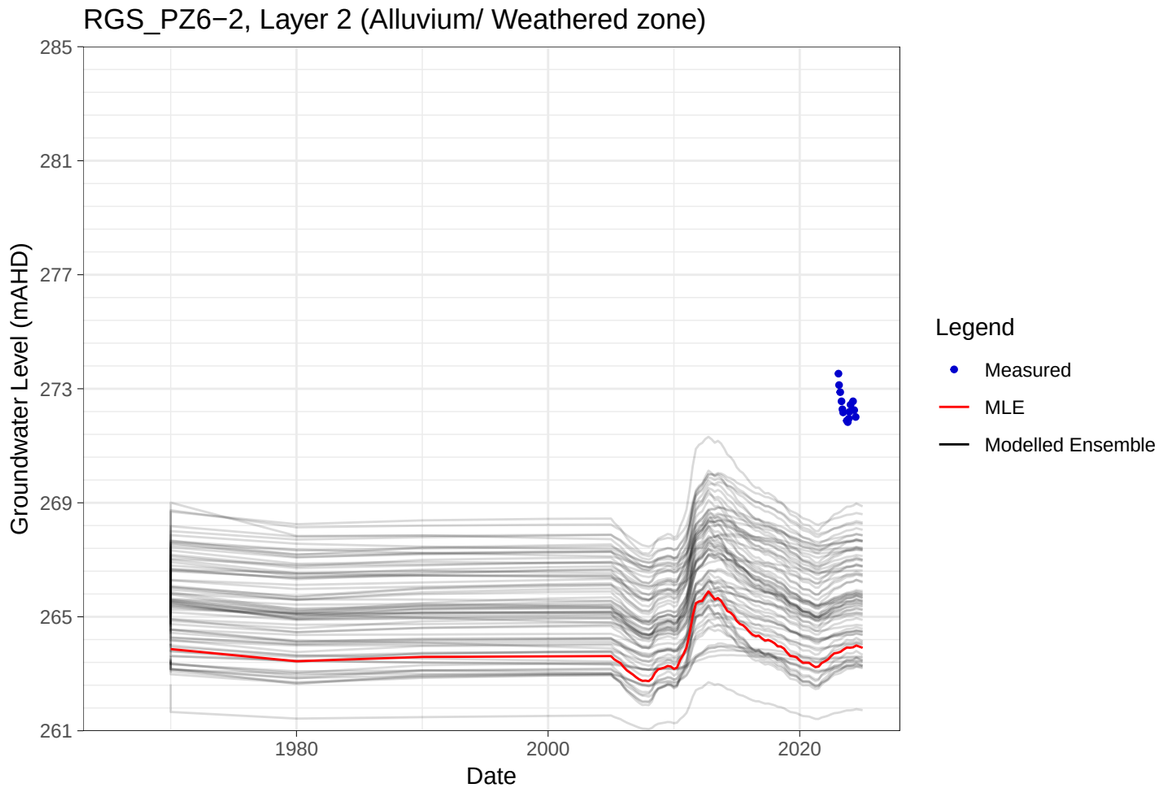

BWM_P4, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
295
291
287
283
279
275
271
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

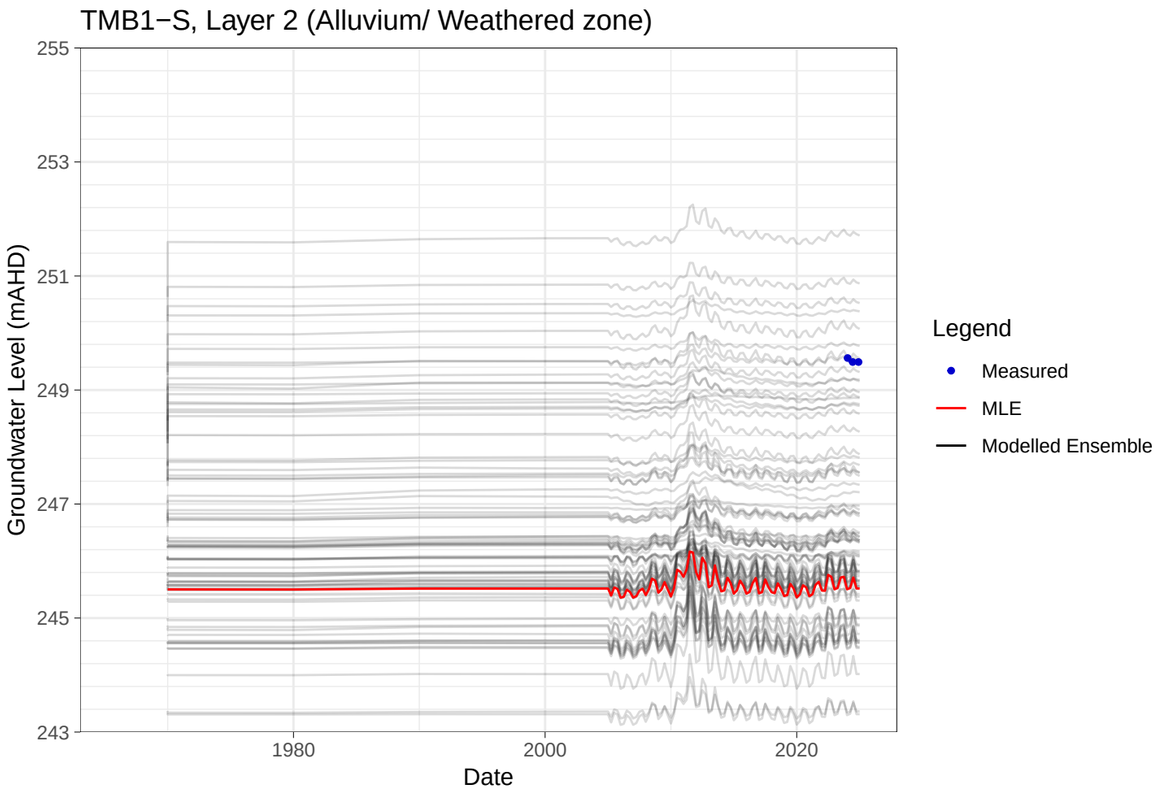

BWM_P7, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
295
291
287
283
279
275
271
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

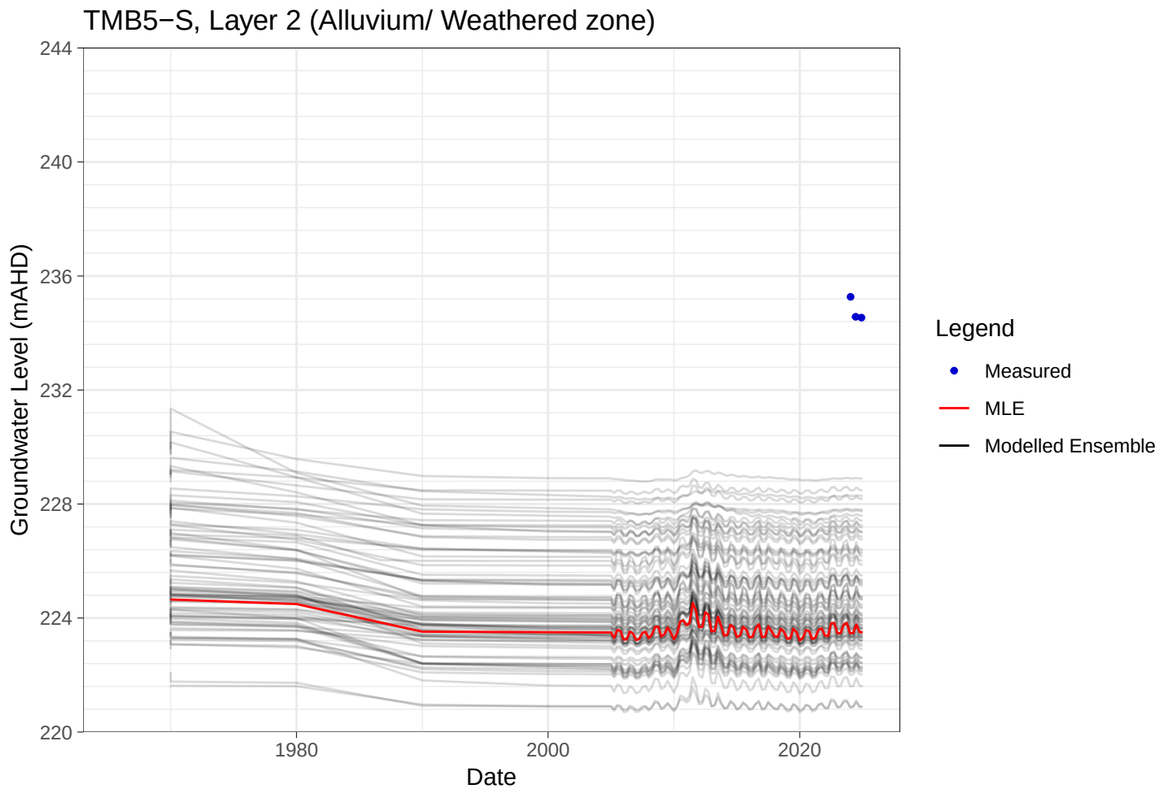

MB8, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
272
268
264
260
256
252
248
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

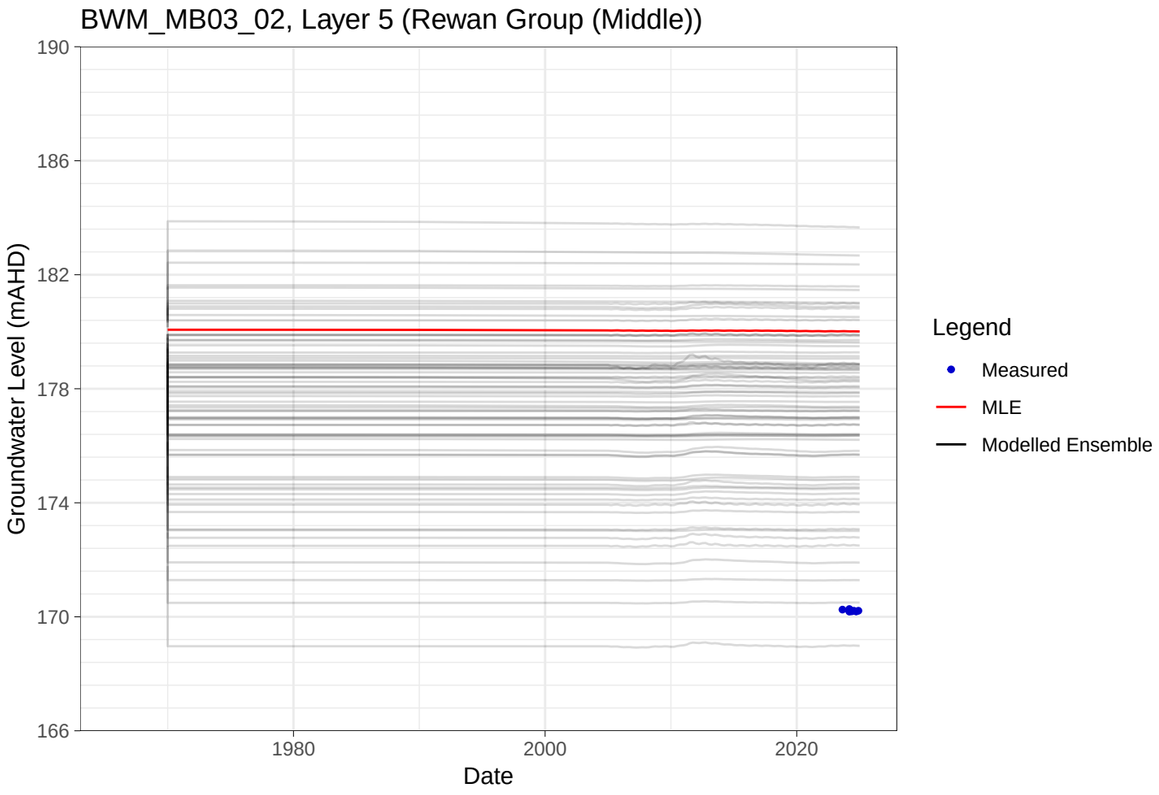

RGS_PZ2−3, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
286
284
282
280
278
276
274
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

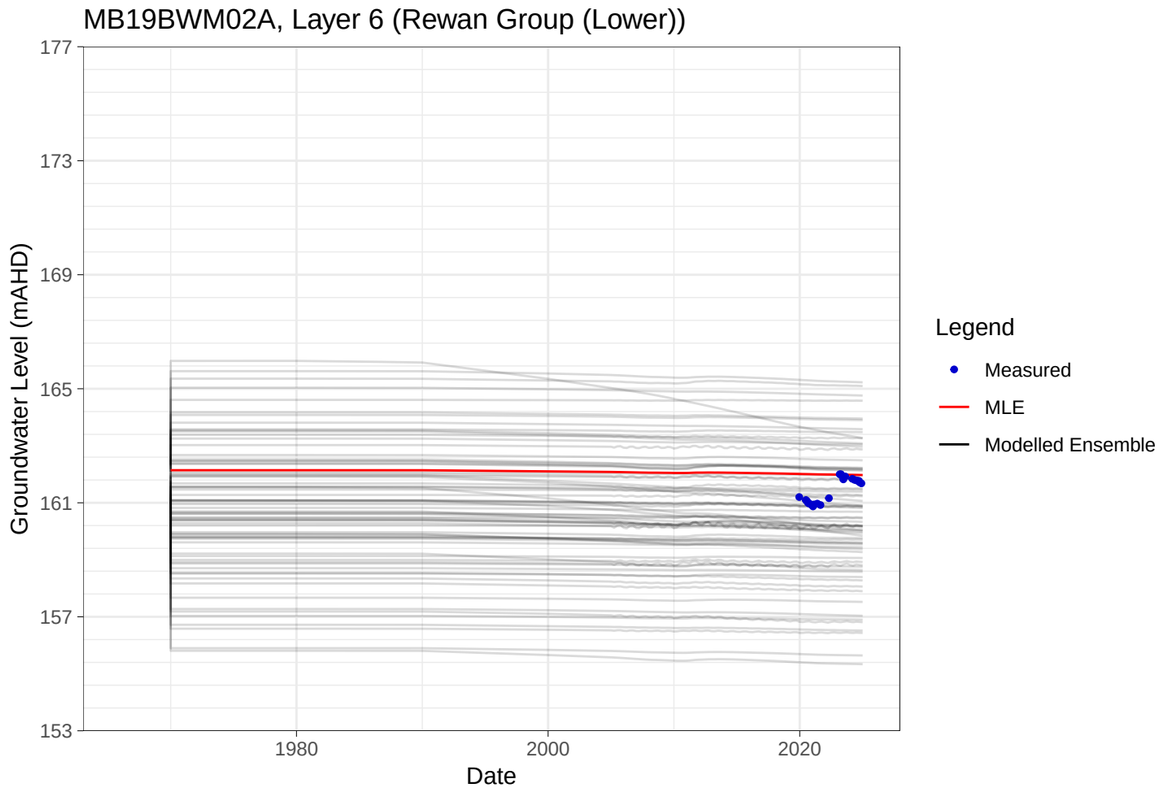

RGS_PZ6−2, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
285
281
277
273
269
265
261
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

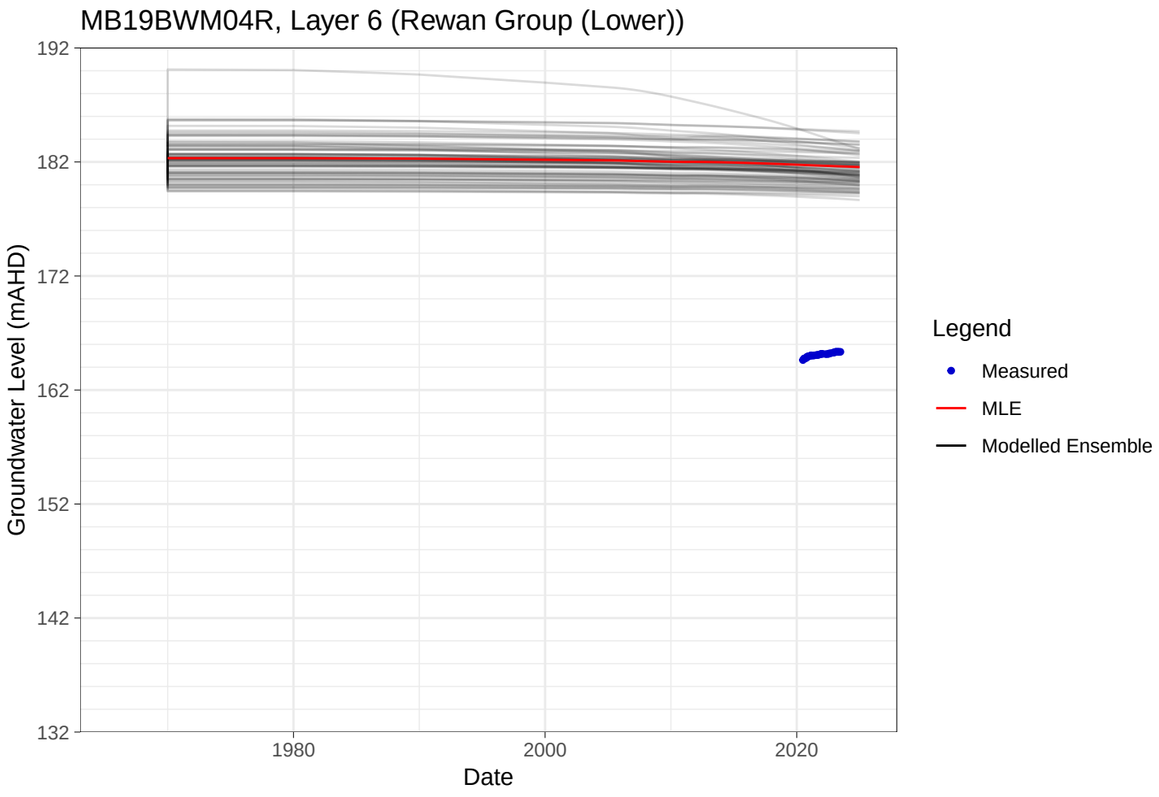

TMB1−S, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
255
253
251
249
247
245
243
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

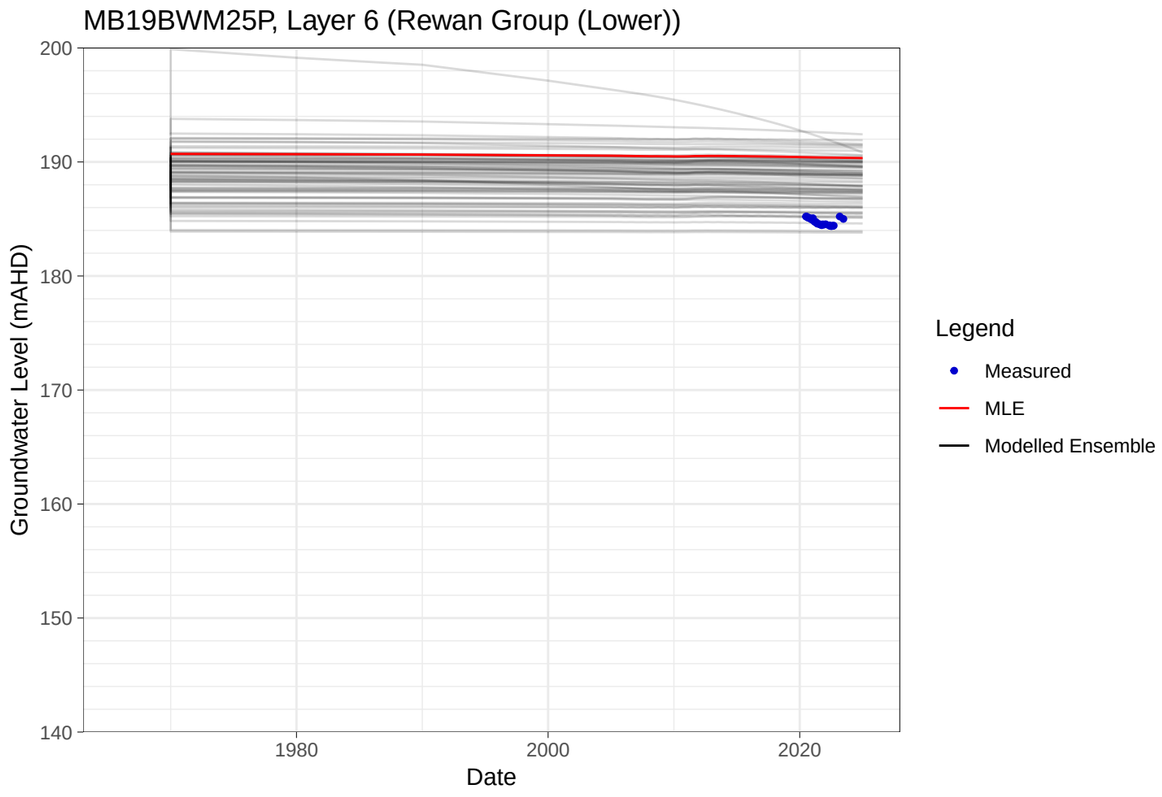

TMB5−S, Layer 2 (Alluvium/ Weathered zone)
Groundwater Level (mAHD)
244
240
236
232
228
224
220
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

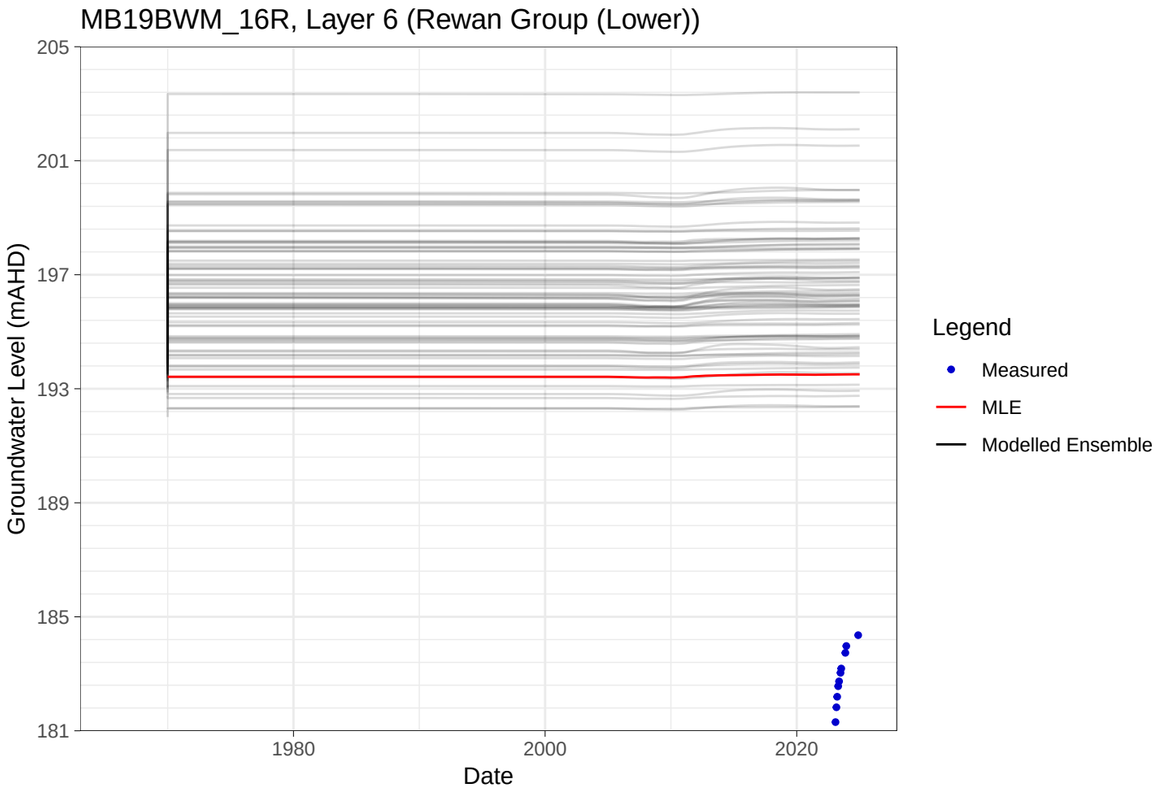

BWM_MB03_02, Layer 5 (Rewan Group (Middle))
Groundwater Level (mAHD)
190
186
182
178
174
170
166
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

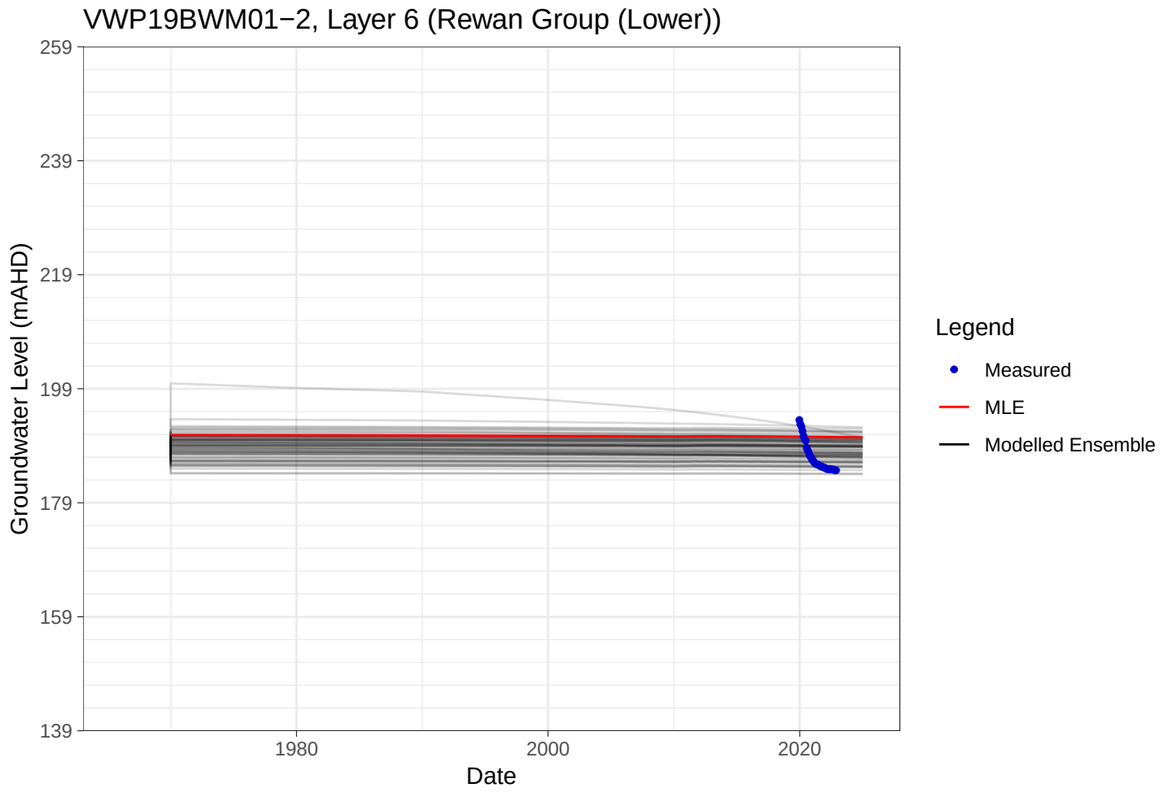

MB19BWM02A, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
177
173
169
165
161
157
153
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

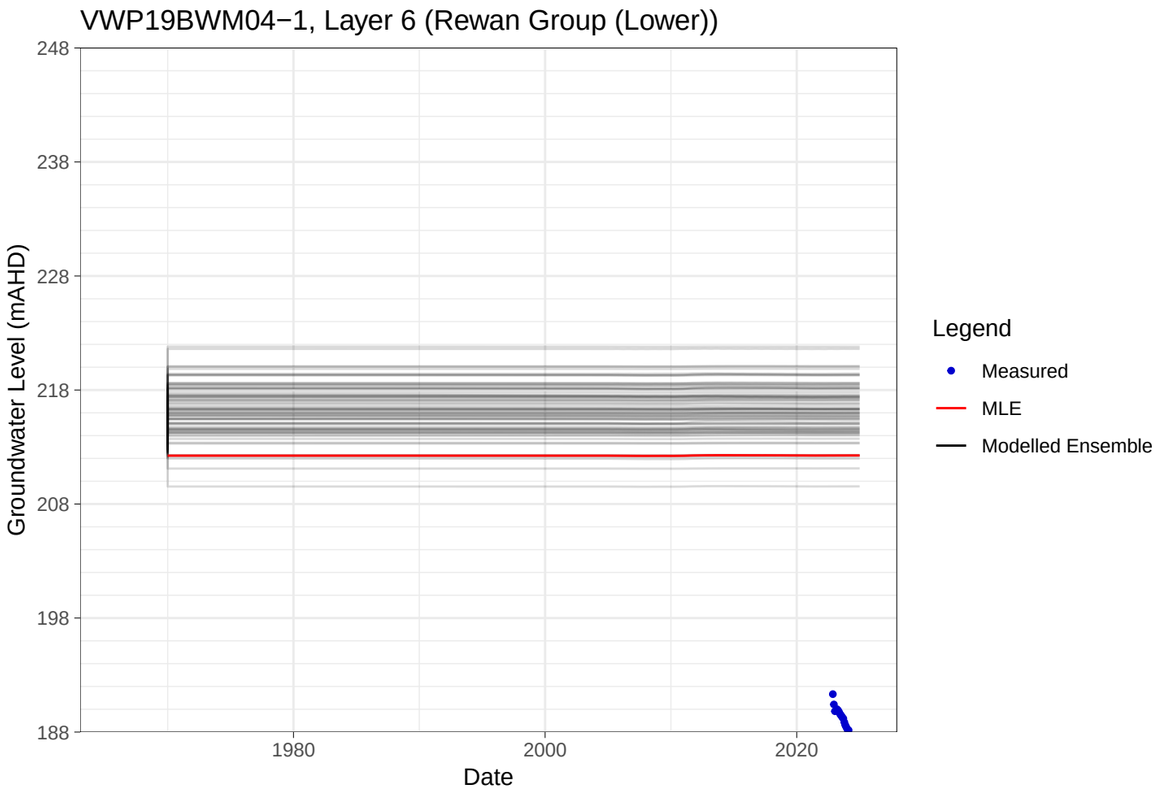

MB19BWM04R, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
192
182
172
162
152
142
132
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

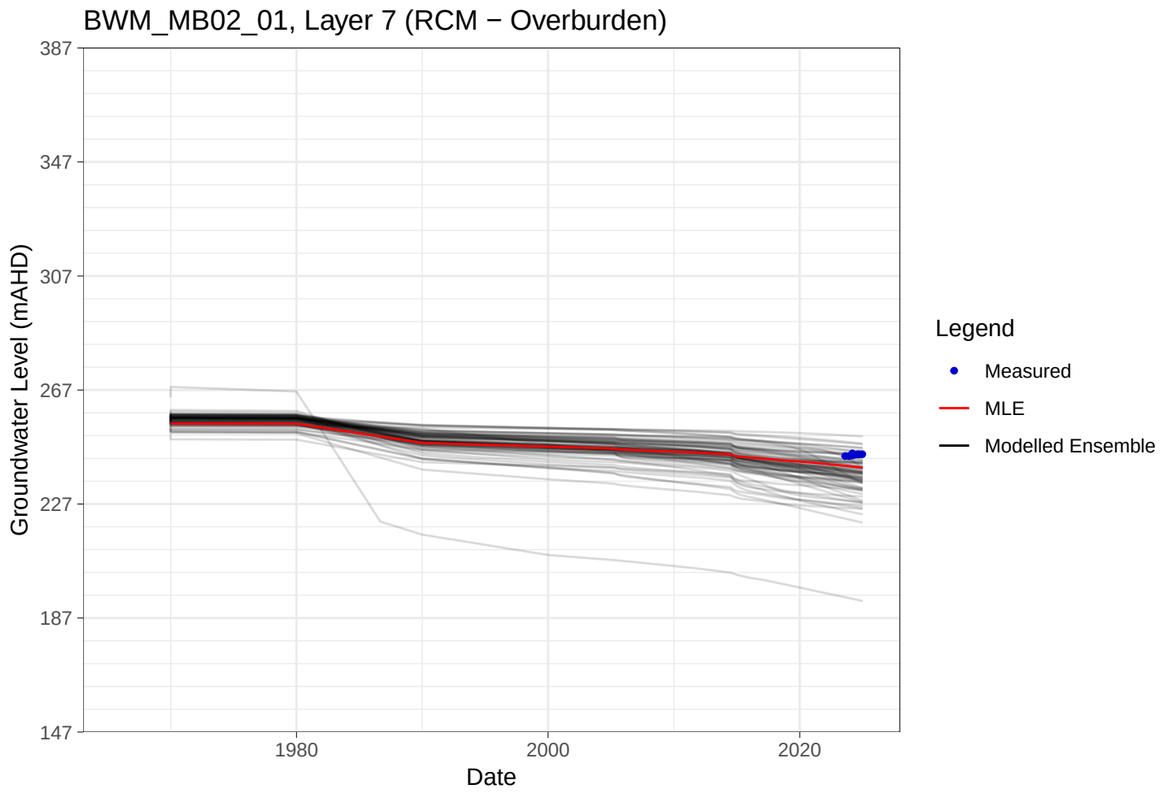

MB19BWM25P, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
200
190
180
170
160
150
140
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

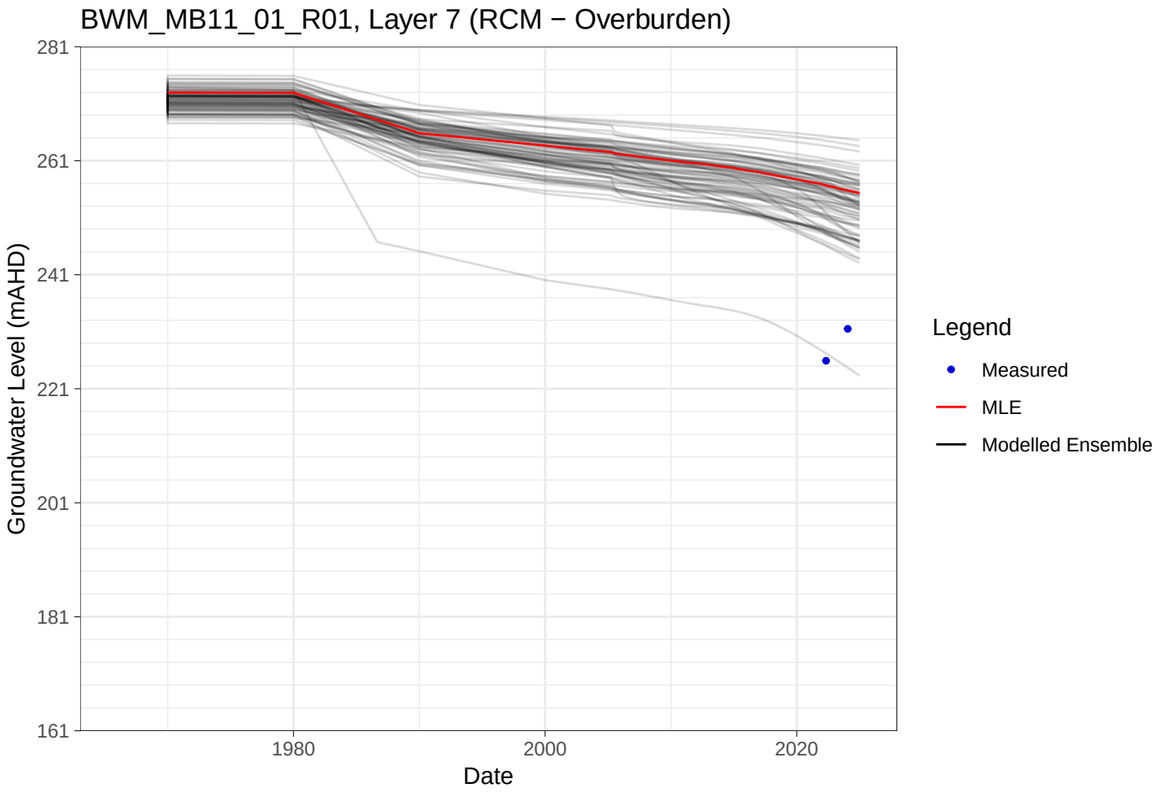

MB19BWM_16R, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
205
201
197
193
189
185
181
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

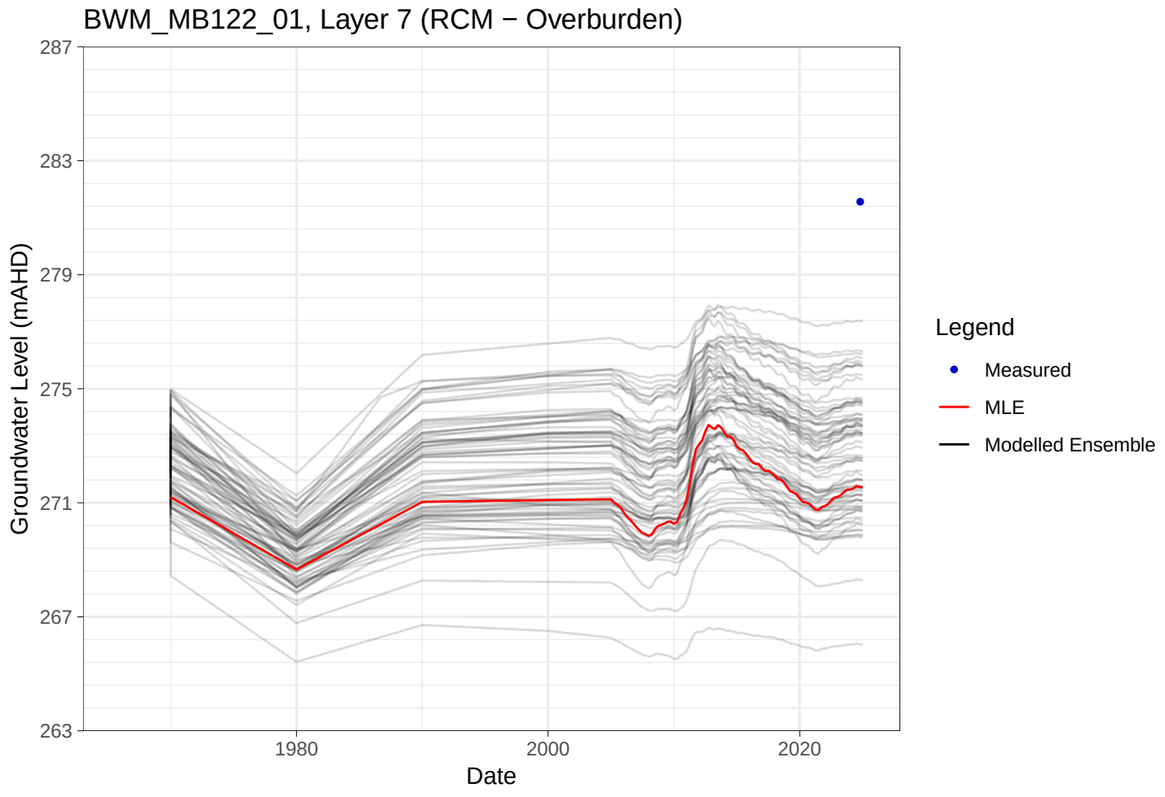

VWP19BWM01−2, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
259
239
219
199
179
159
139
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

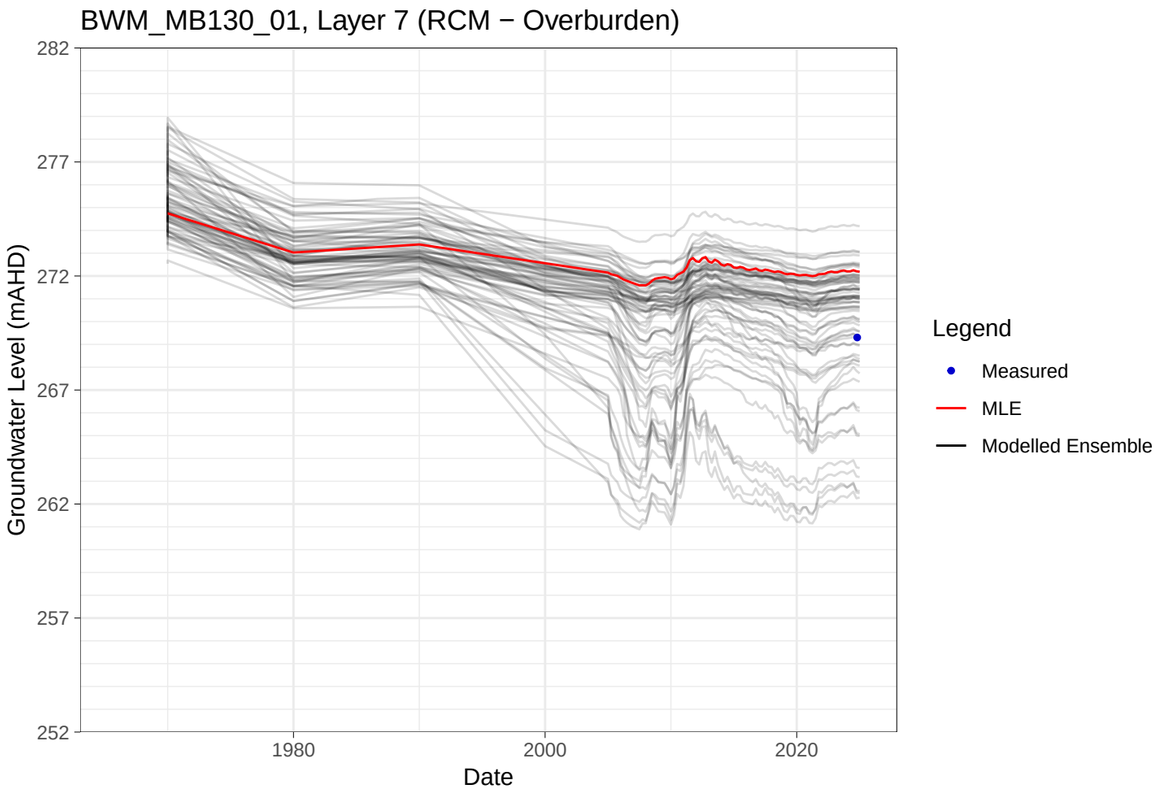

VWP19BWM04−1, Layer 6 (Rewan Group (Lower))
Groundwater Level (mAHD)
248
238
228
218
208
198
188
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

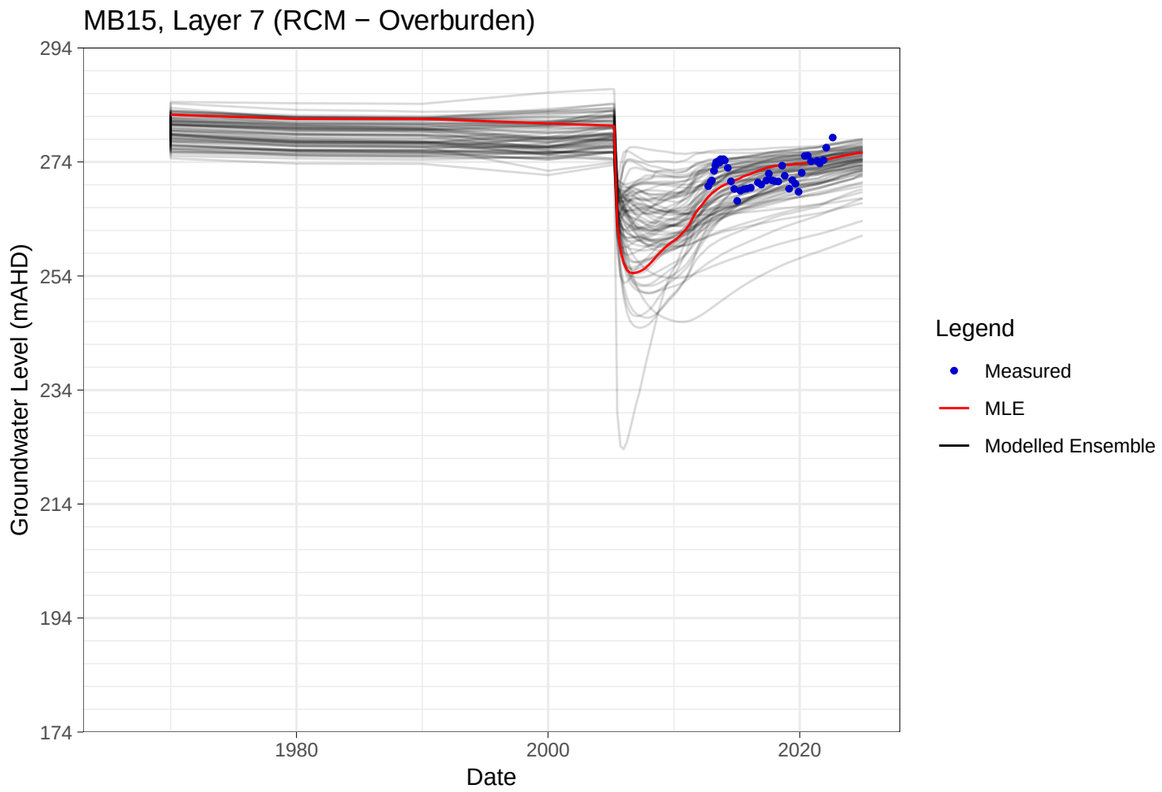

BWM_MB02_01, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
387
347
307
267
227
187
147
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

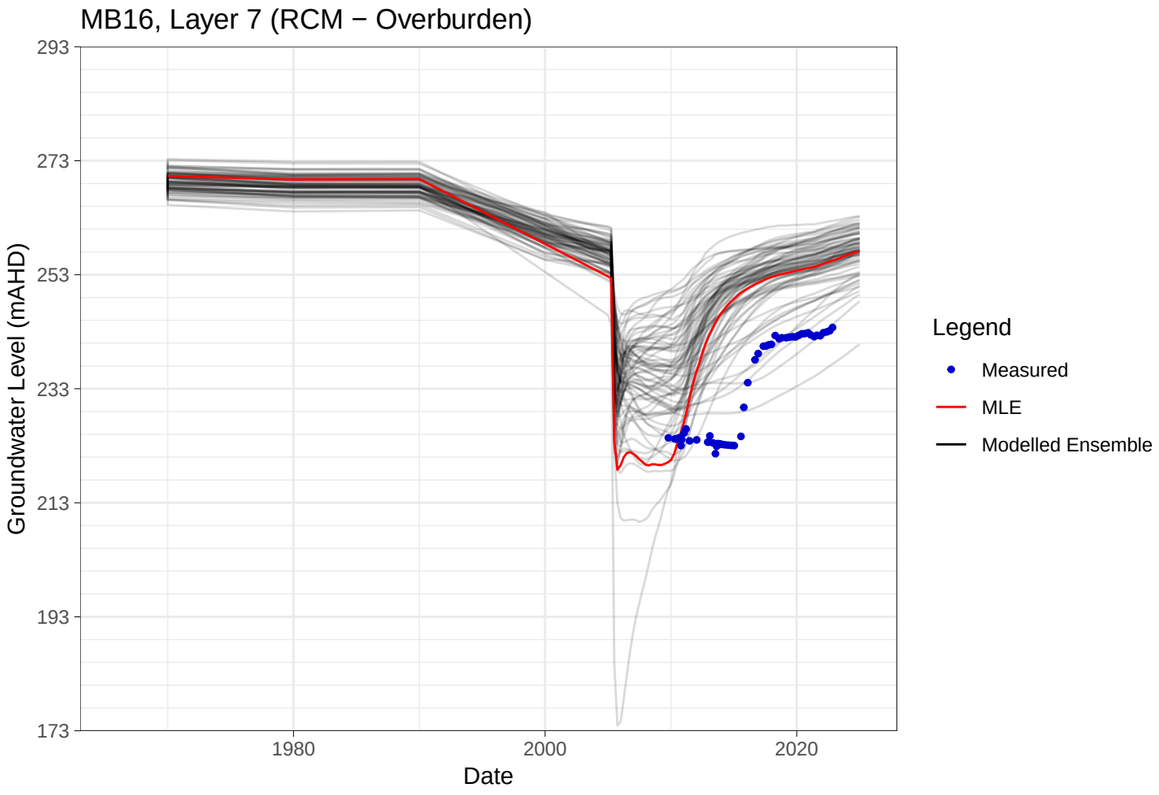

BWM_MB11_01_R01, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
281
261
241
221
201
181
161
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

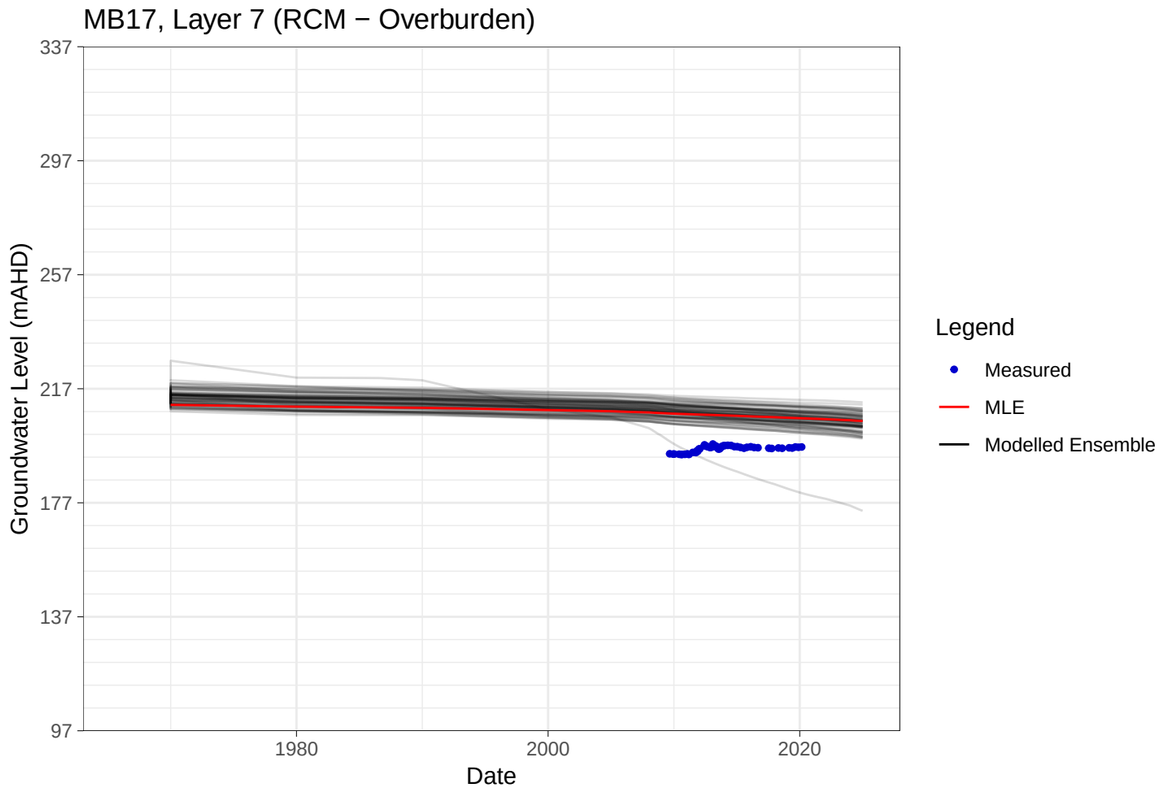

BWM_MB122_01, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
287
283
279
275
271
267
263
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

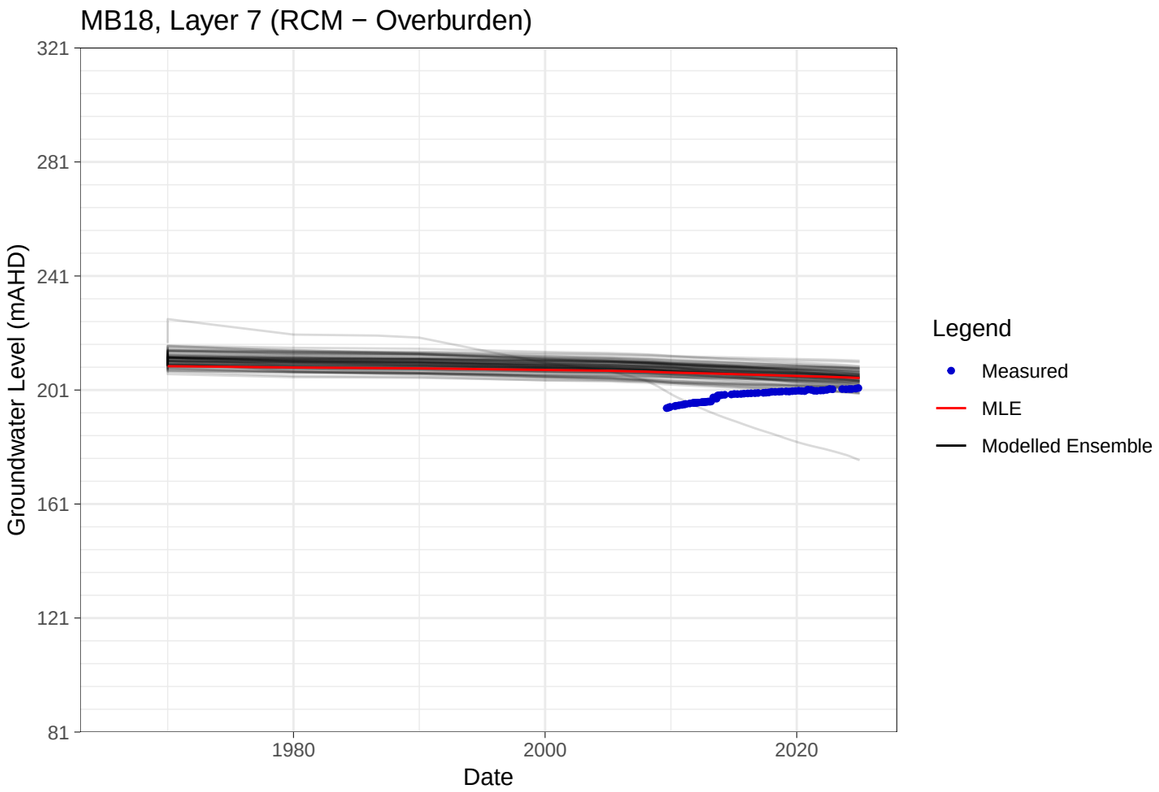

BWM_MB130_01, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
282
277
272
267
262
257
252
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

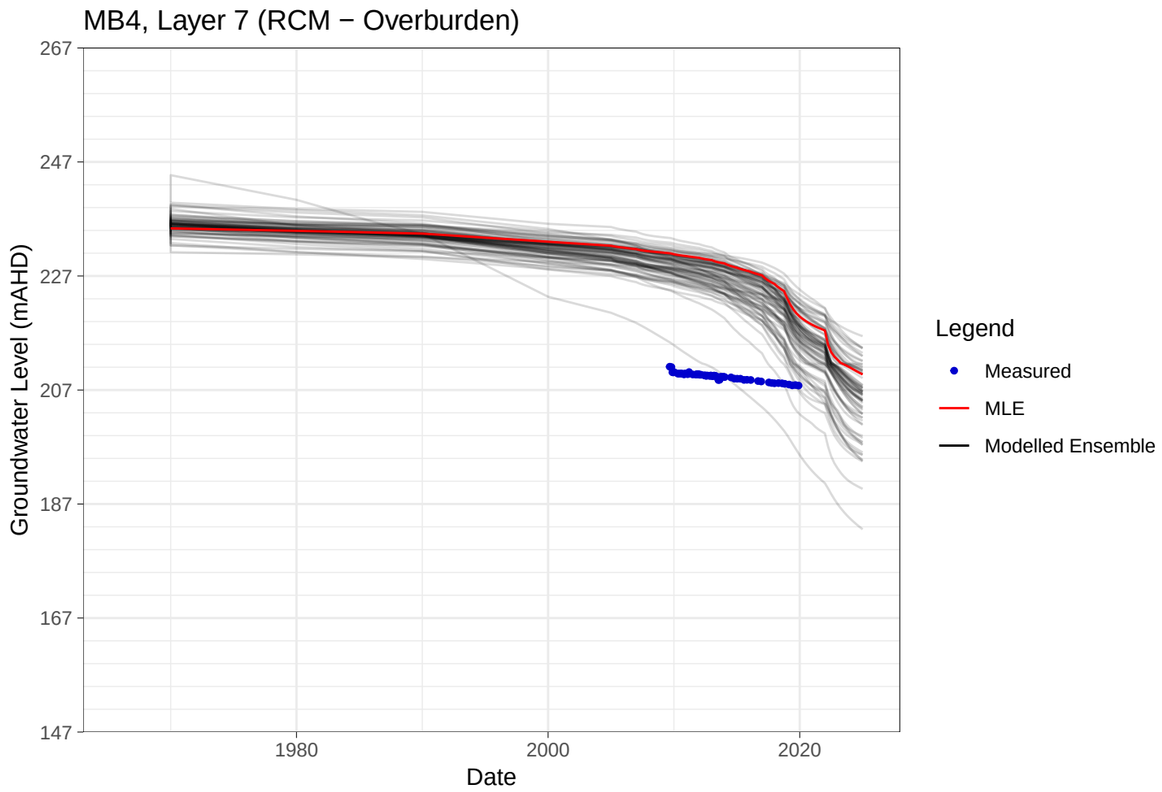

MB15, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
294
274
254
234
214
194
174
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

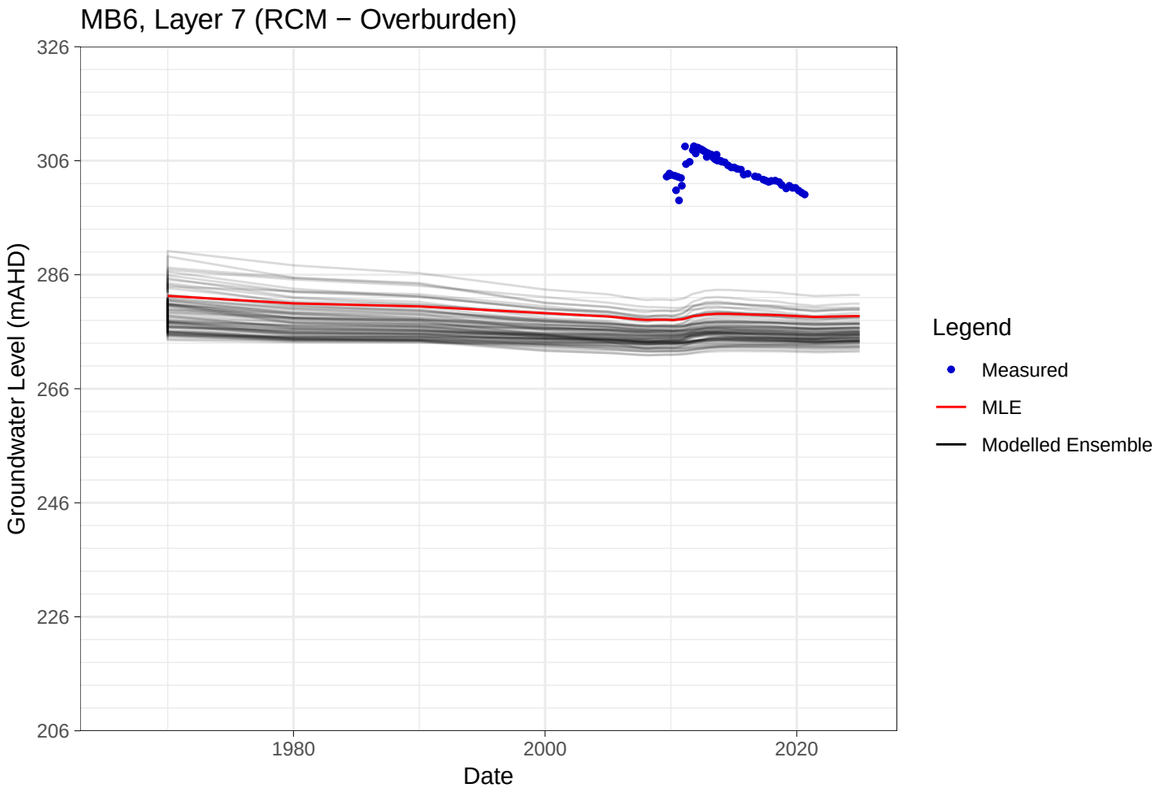

MB16, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
293
273
253
233
213
193
173
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

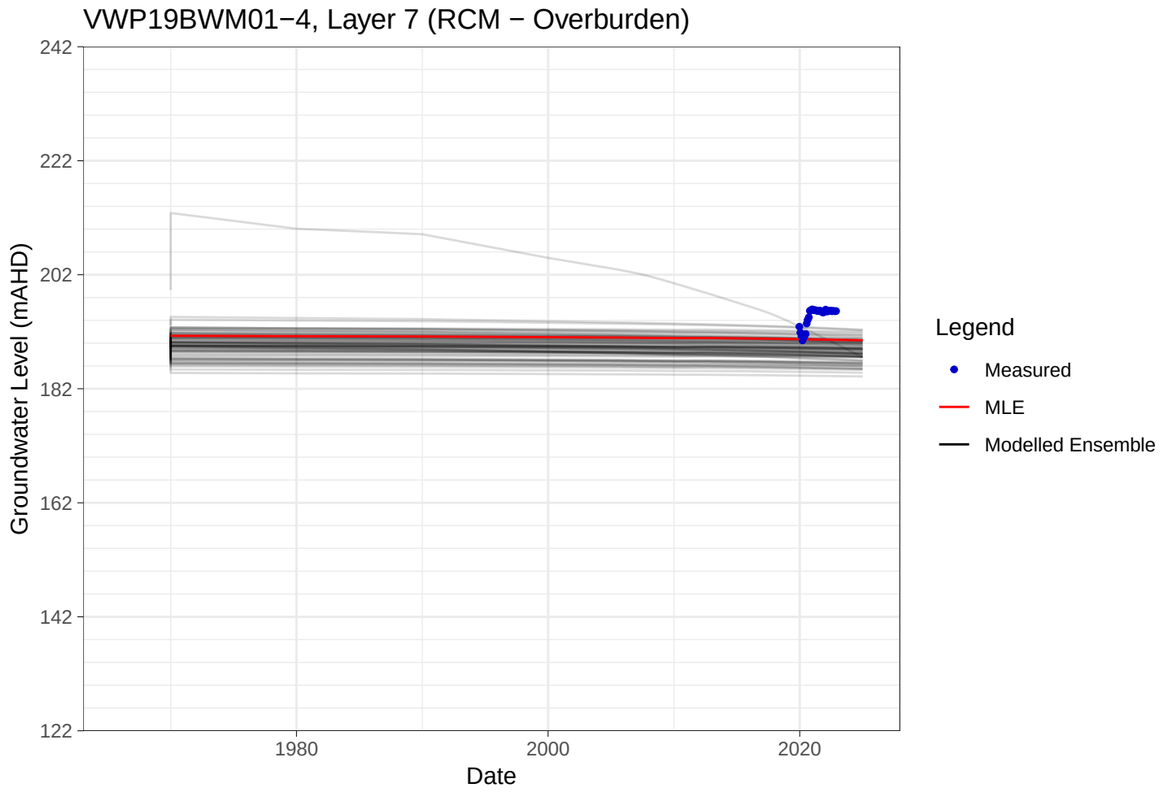

MB17, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
337
297
257
217
177
137
97
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

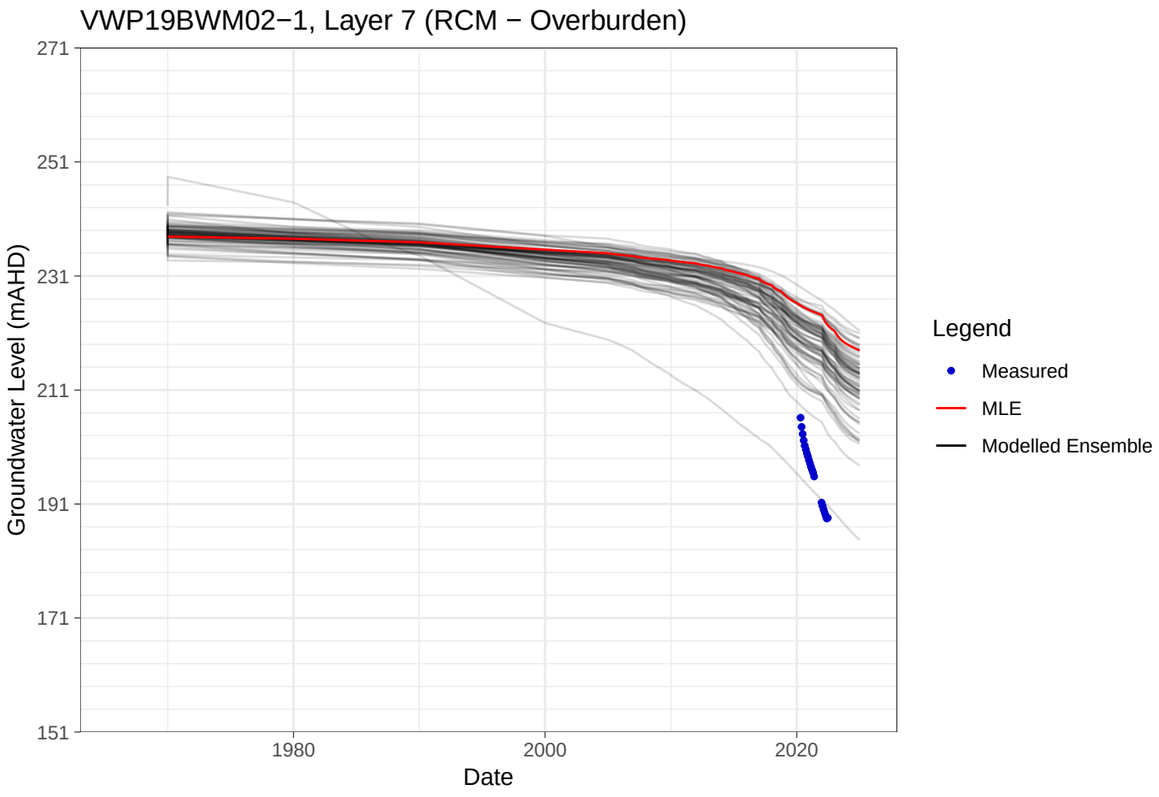

MB18, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
321
281
241
201
161
121
81
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

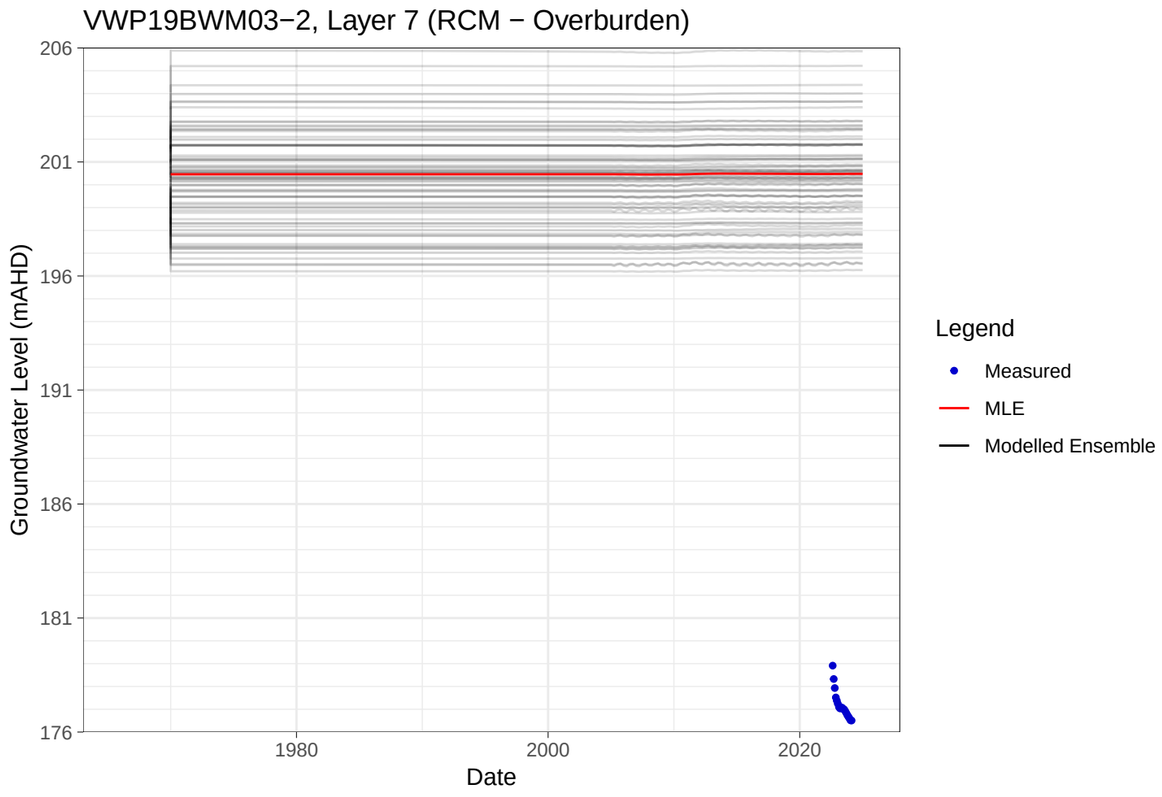

MB4, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
267
247
227
207
187
167
147
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

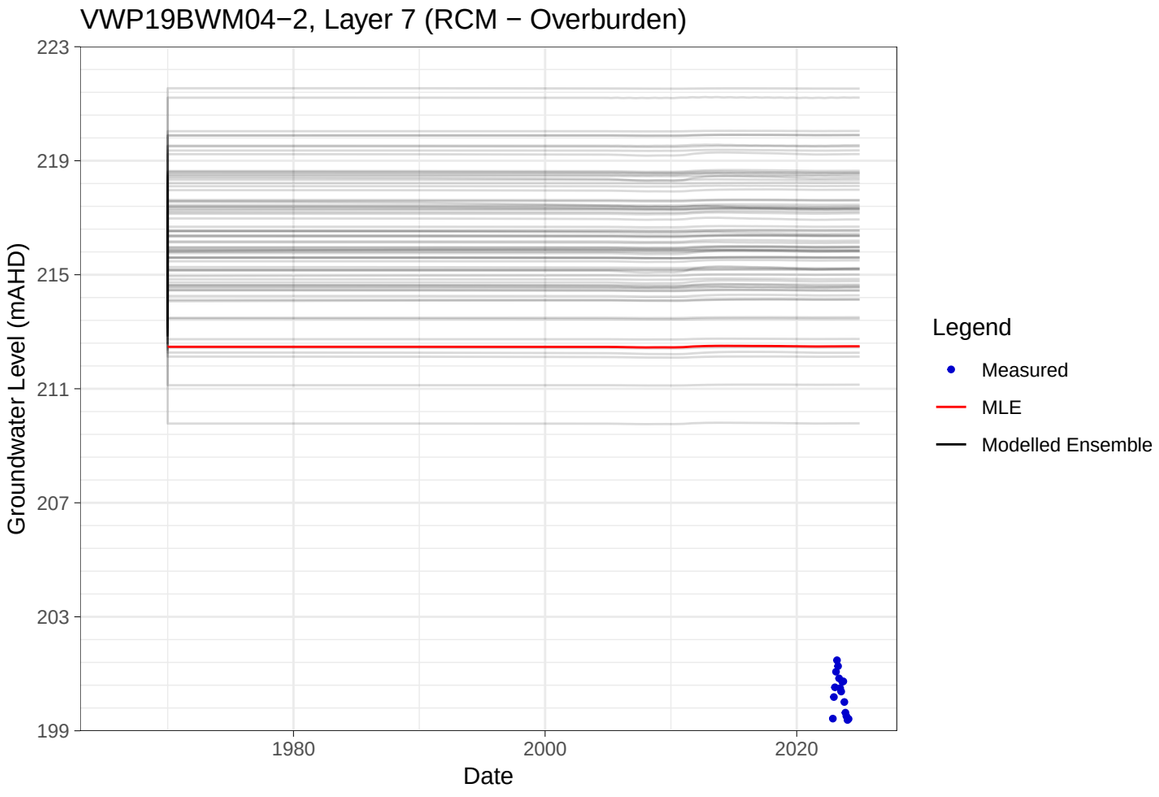

MB6, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
326
306
286
266
246
226
206
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

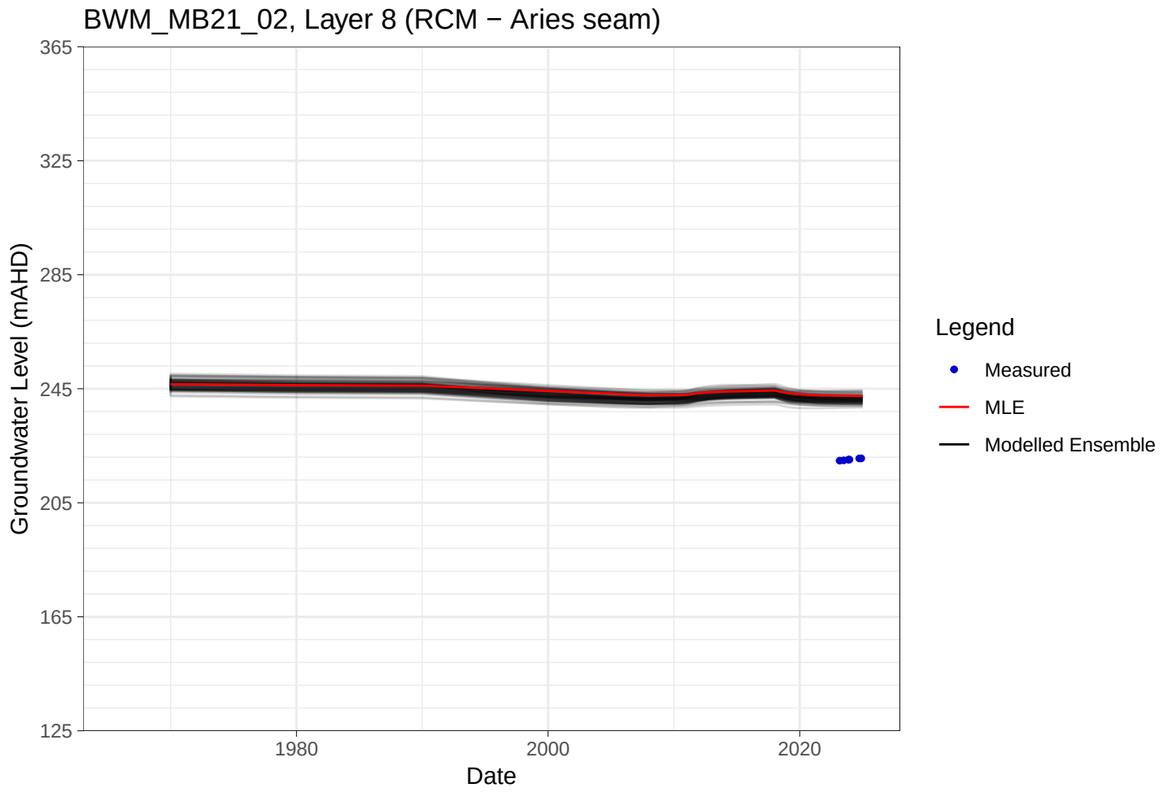

VWP19BWM01−4, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
242
222
202
182
162
142
122
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

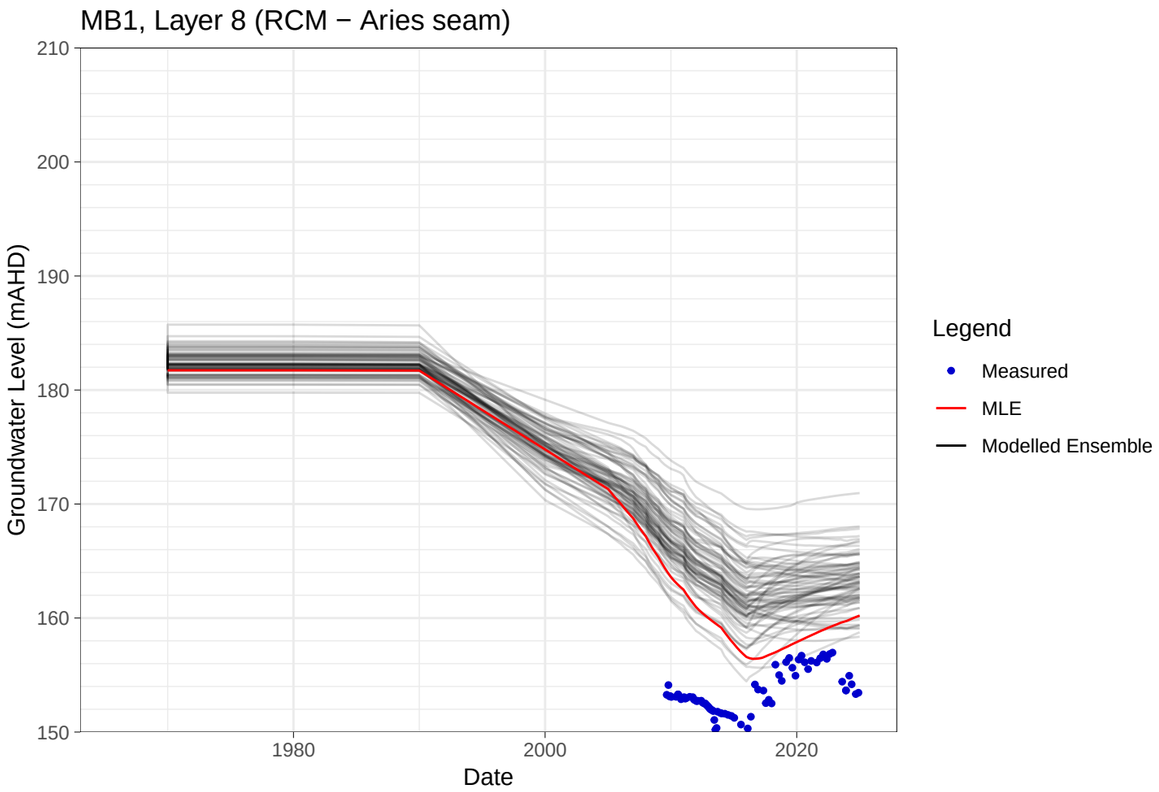

VWP19BWM02−1, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
271
251
231
211
191
171
151
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

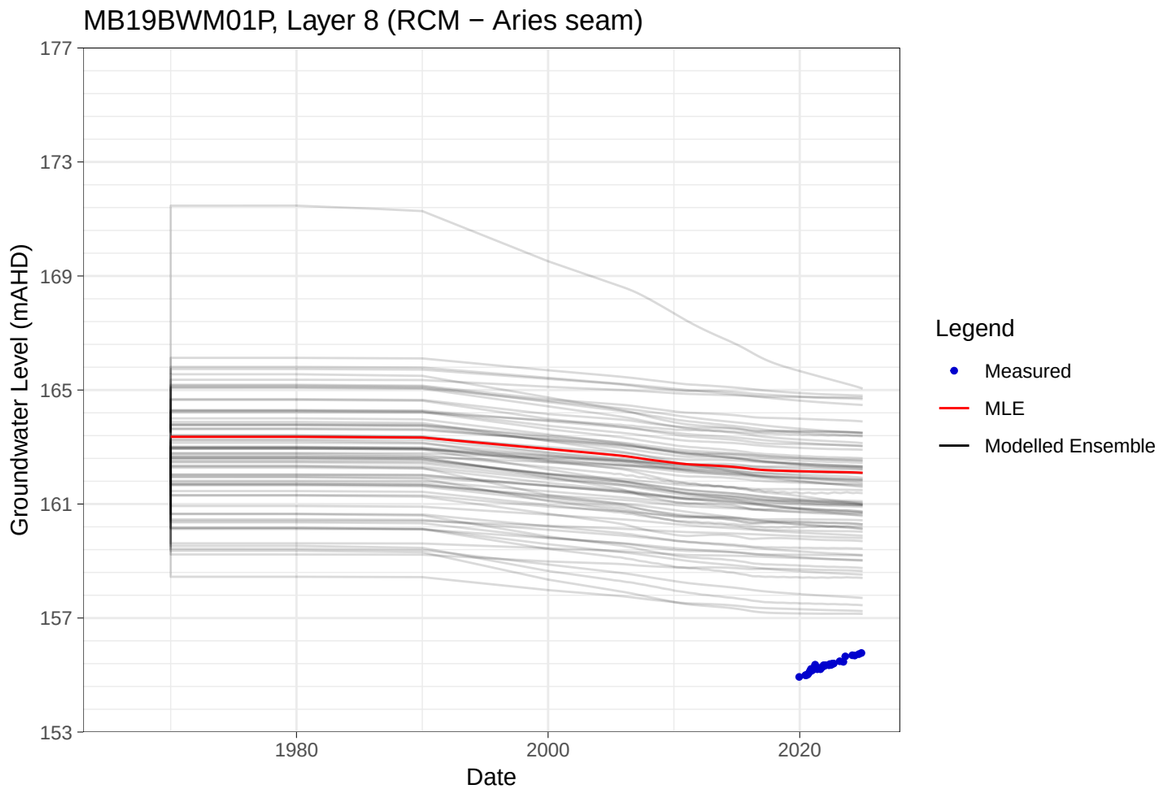

VWP19BWM03−2, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
206
201
196
191
186
181
176
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

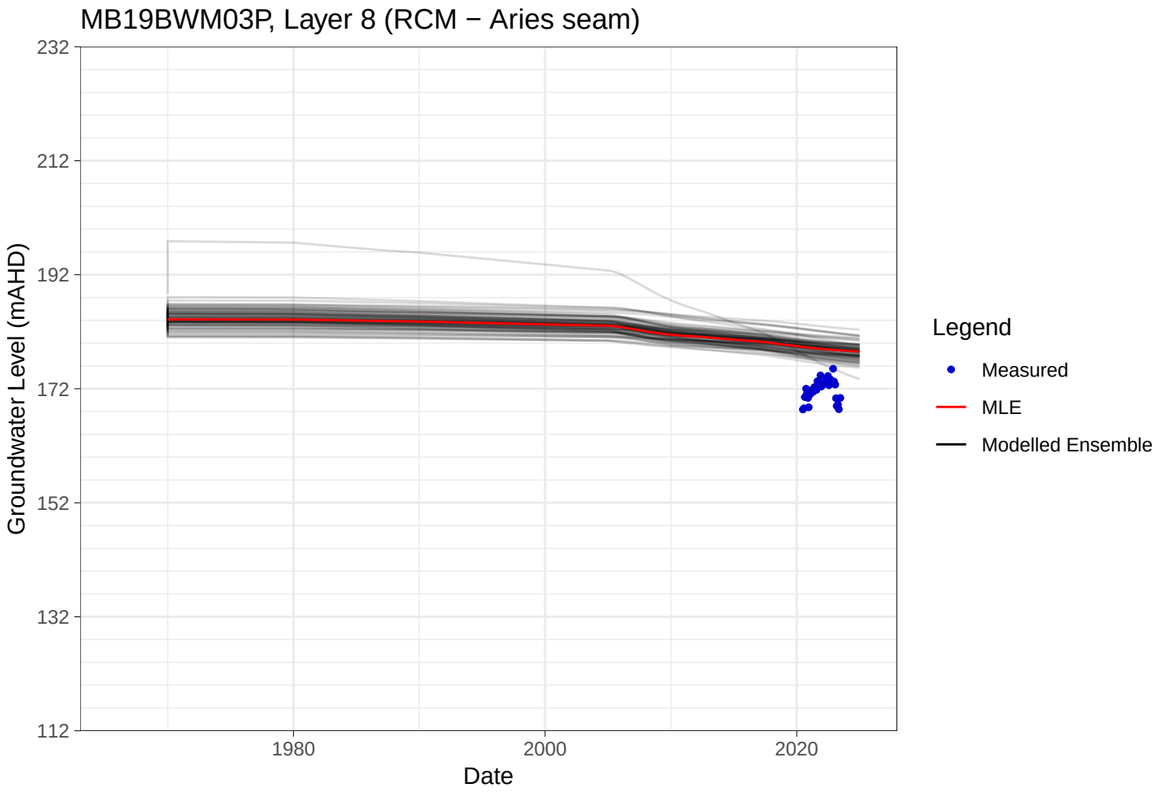

VWP19BWM04−2, Layer 7 (RCM − Overburden)
Groundwater Level (mAHD)
223
219
215
211
207
203
199
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

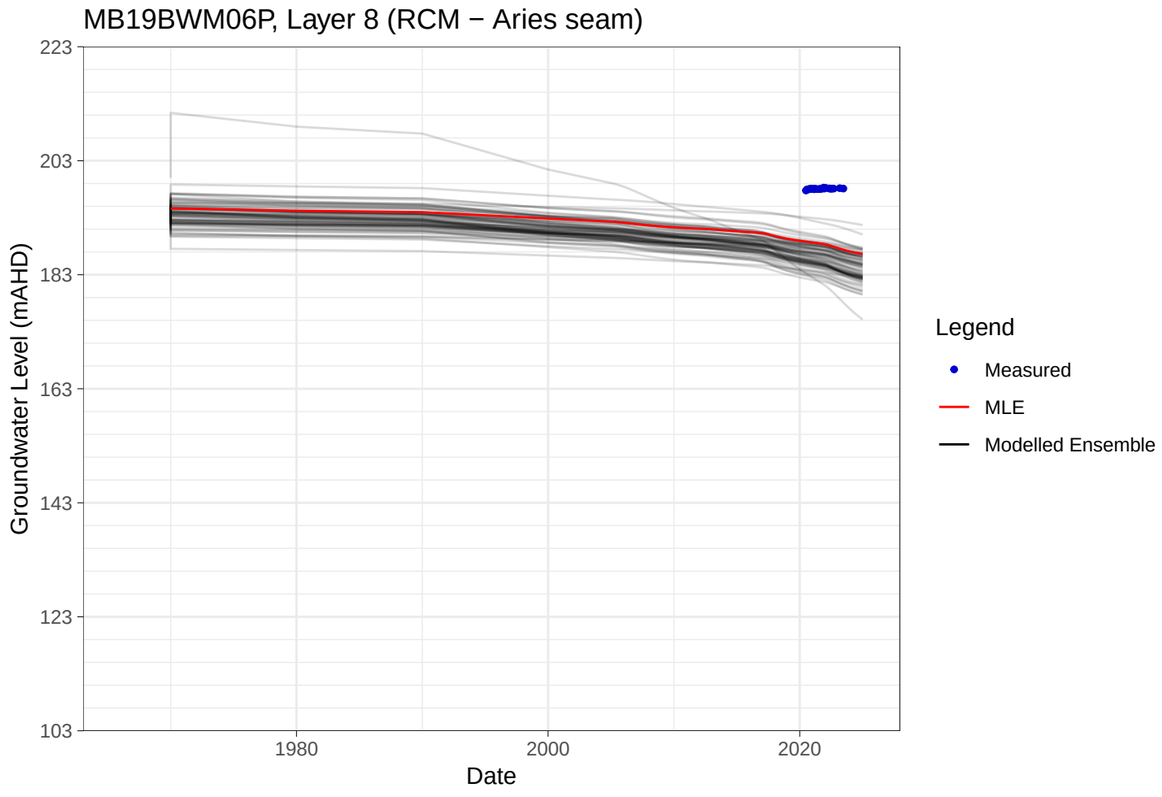

BWM_MB21_02, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
365
325
285
245
205
165
125
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

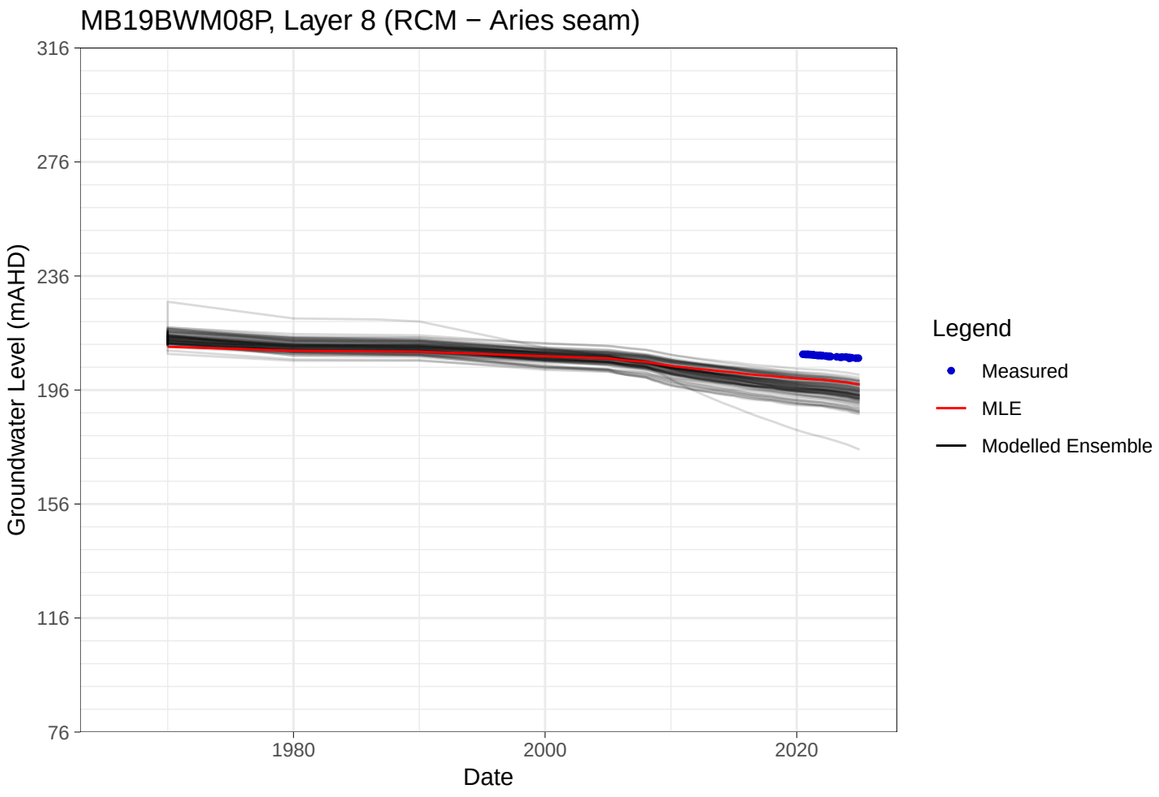

MB1, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
210
200
190
180
170
160
150
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

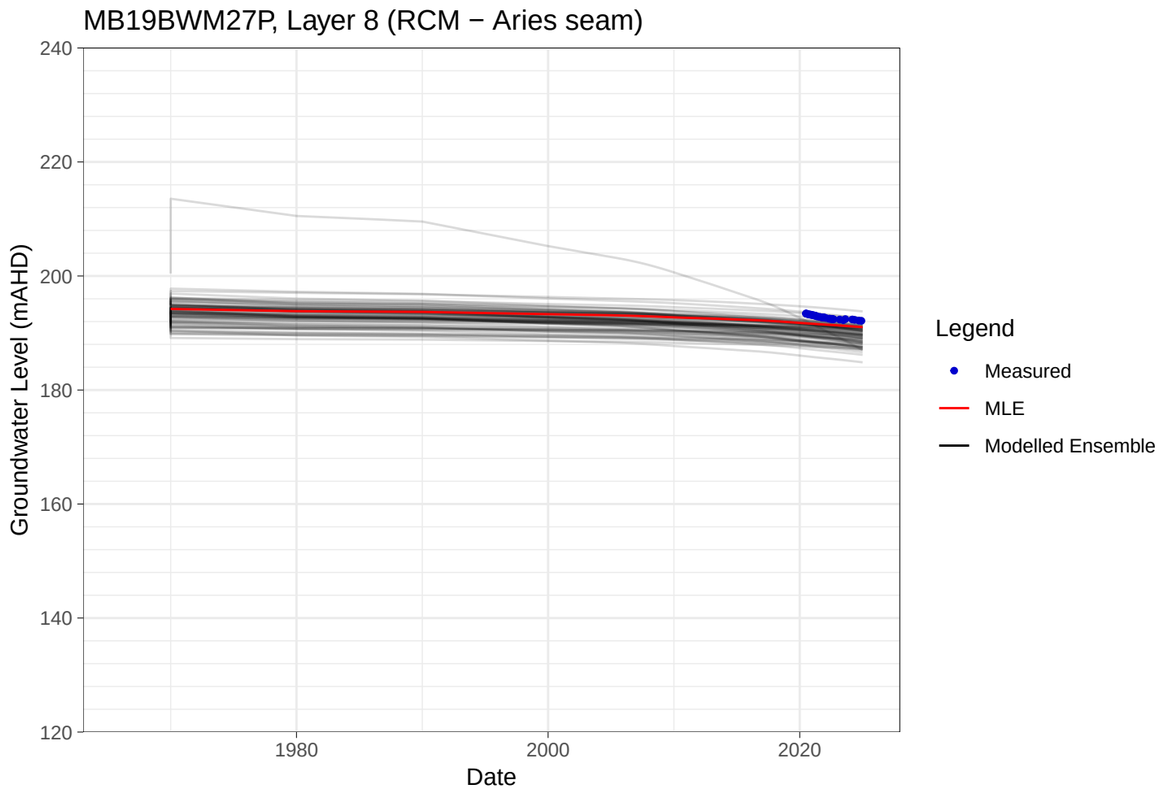

MB19BWM01P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
177
173
169
165
161
157
153
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

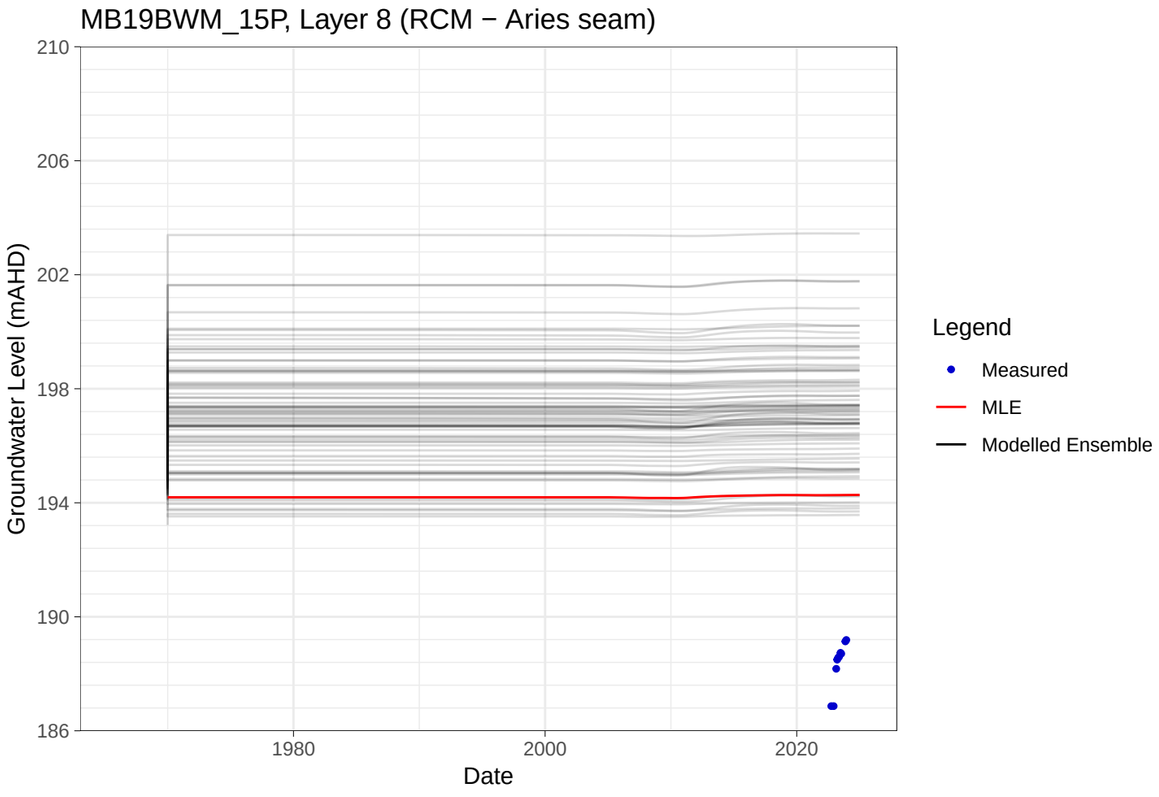

MB19BWM03P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
232
212
192
172
152
132
112
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

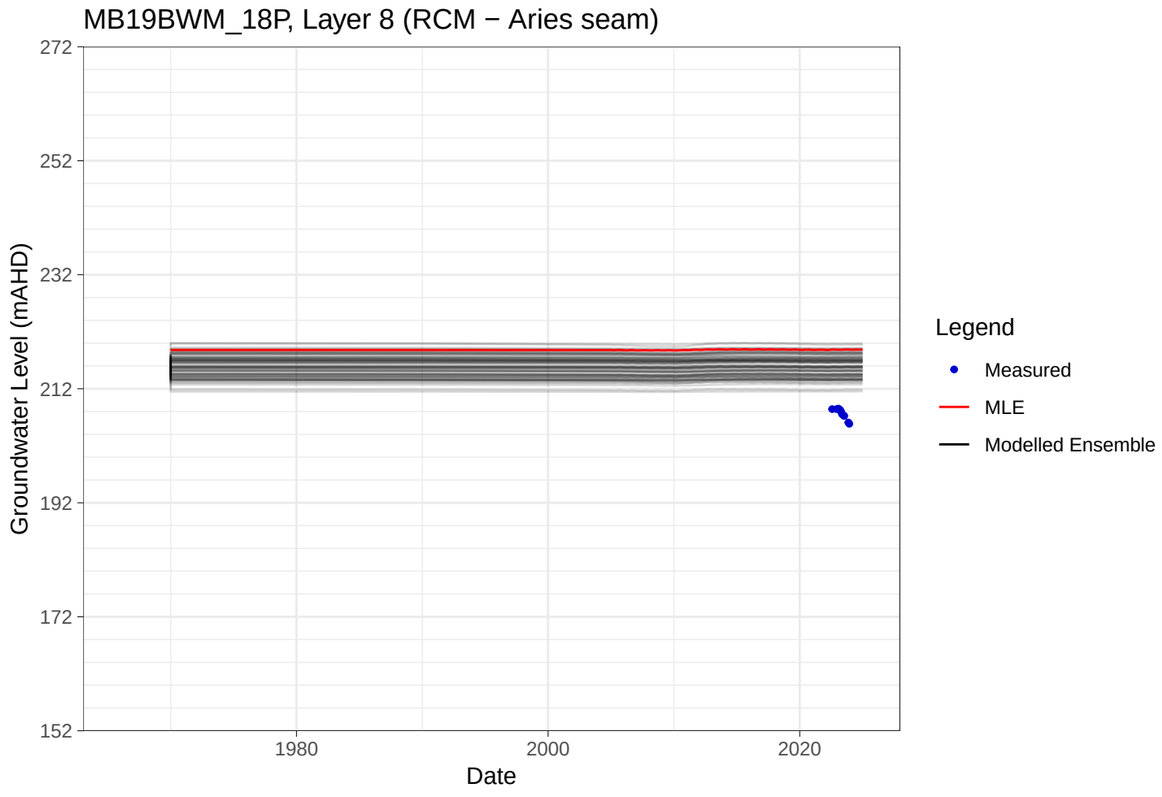

MB19BWM06P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
223
203
183
163
143
123
103
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

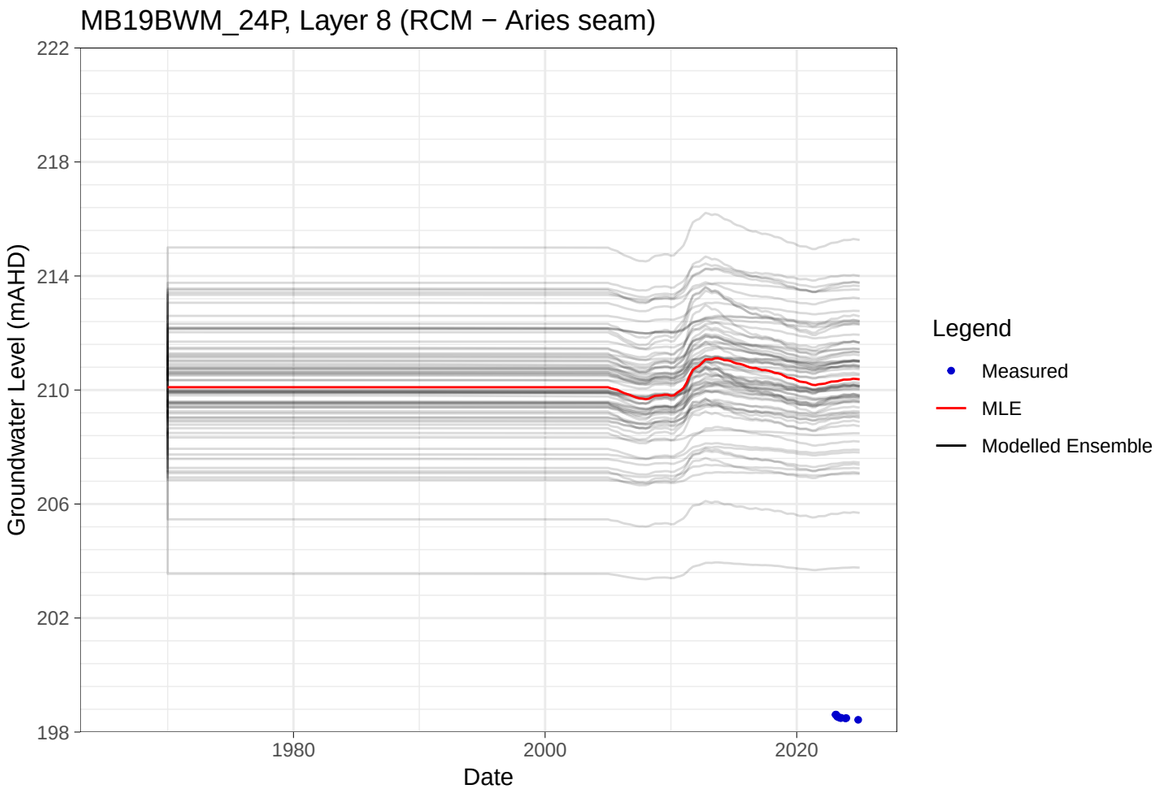

MB19BWM08P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
316
276
236
196
156
116
76
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

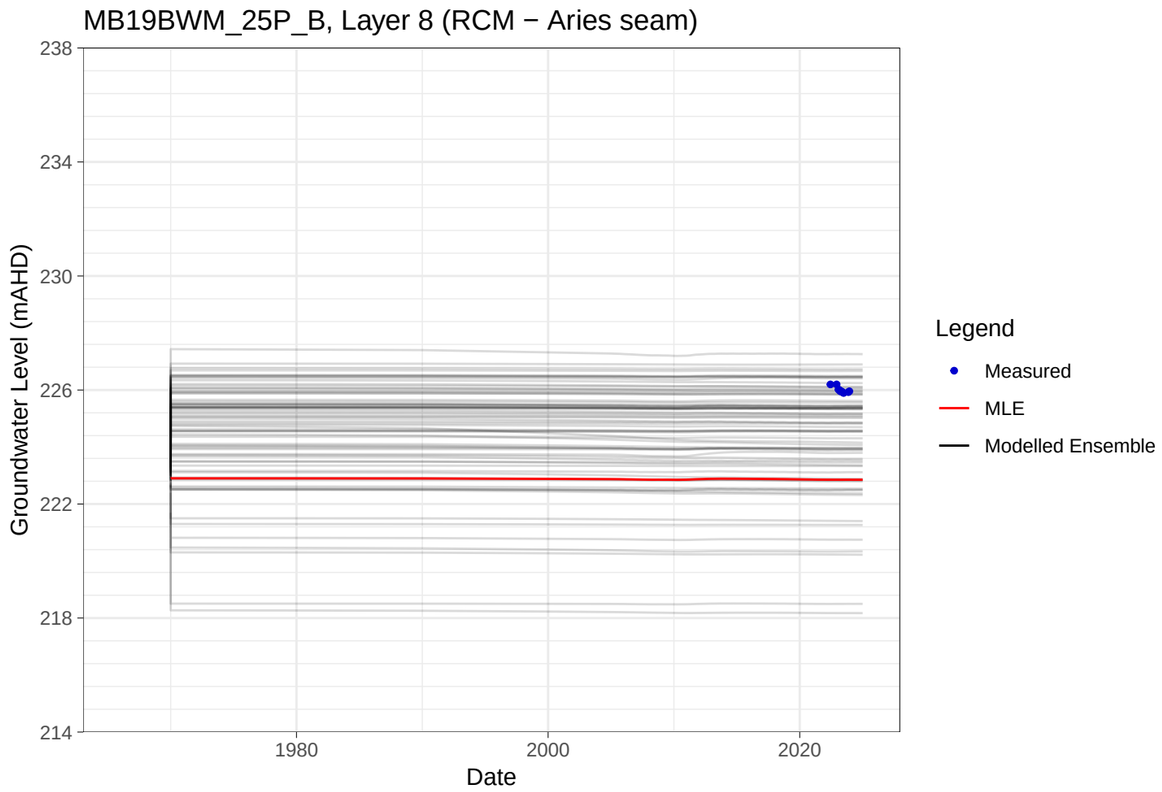

MB19BWM27P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
240
220
200
180
160
140
120
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

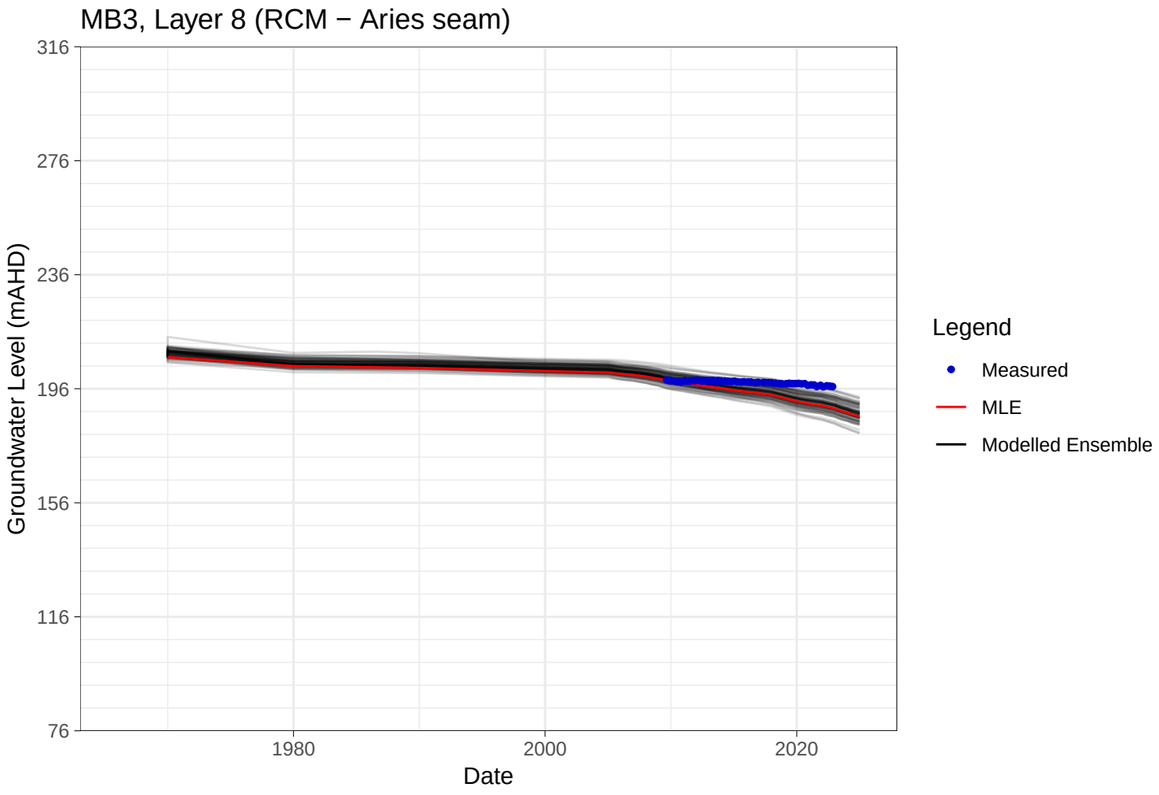

MB19BWM_15P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
210
206
202
198
194
190
186
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

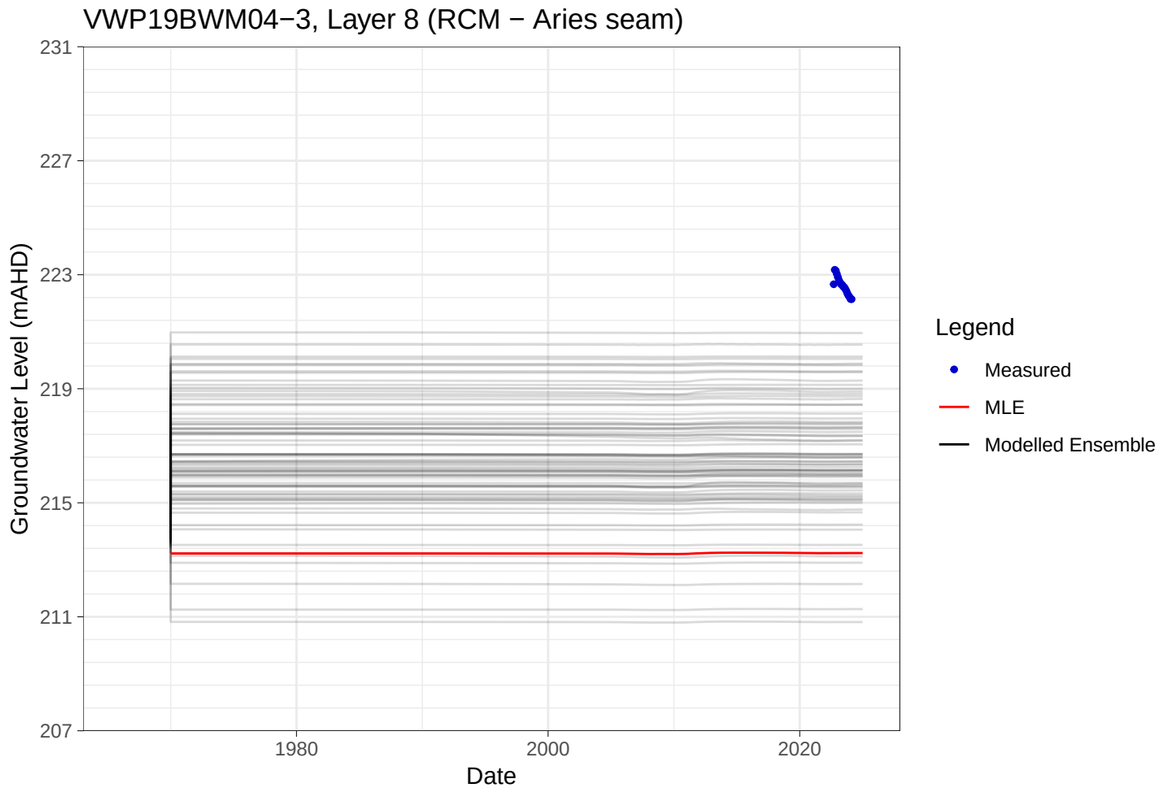

MB19BWM_18P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
272
252
232
212
192
172
152
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

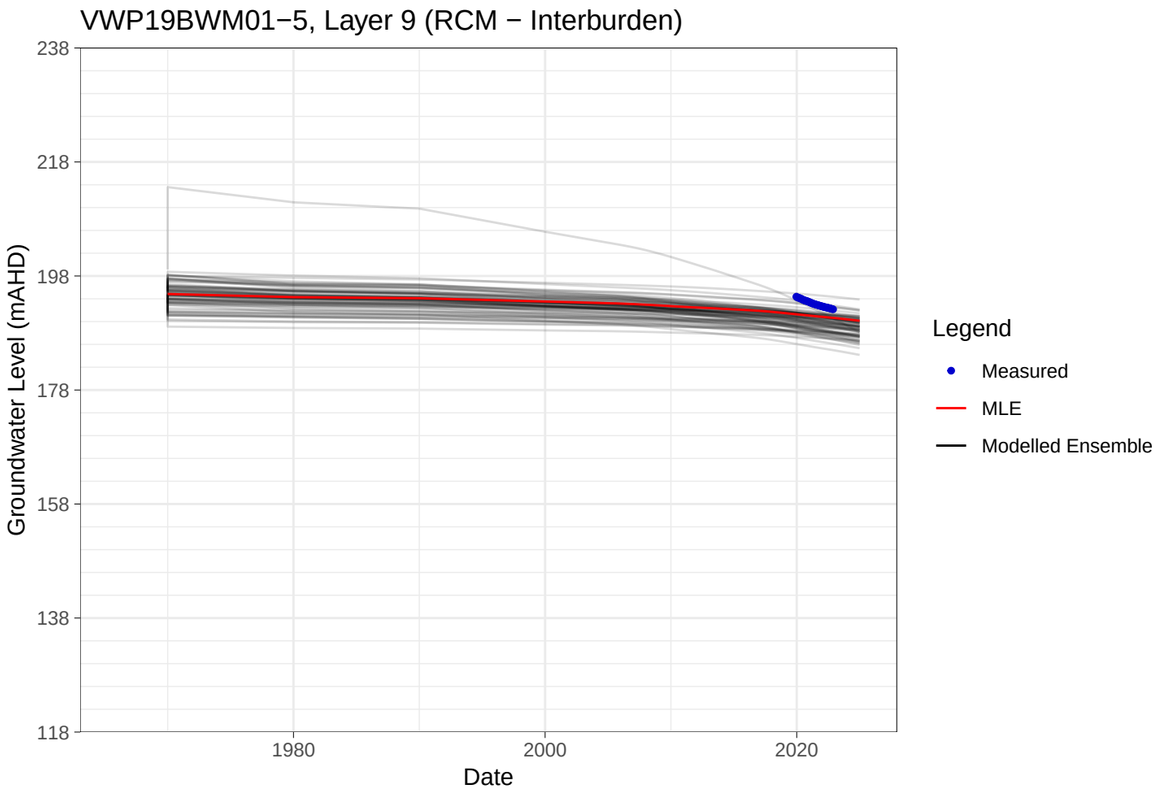

MB19BWM_24P, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
222
218
214
210
206
202
198
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

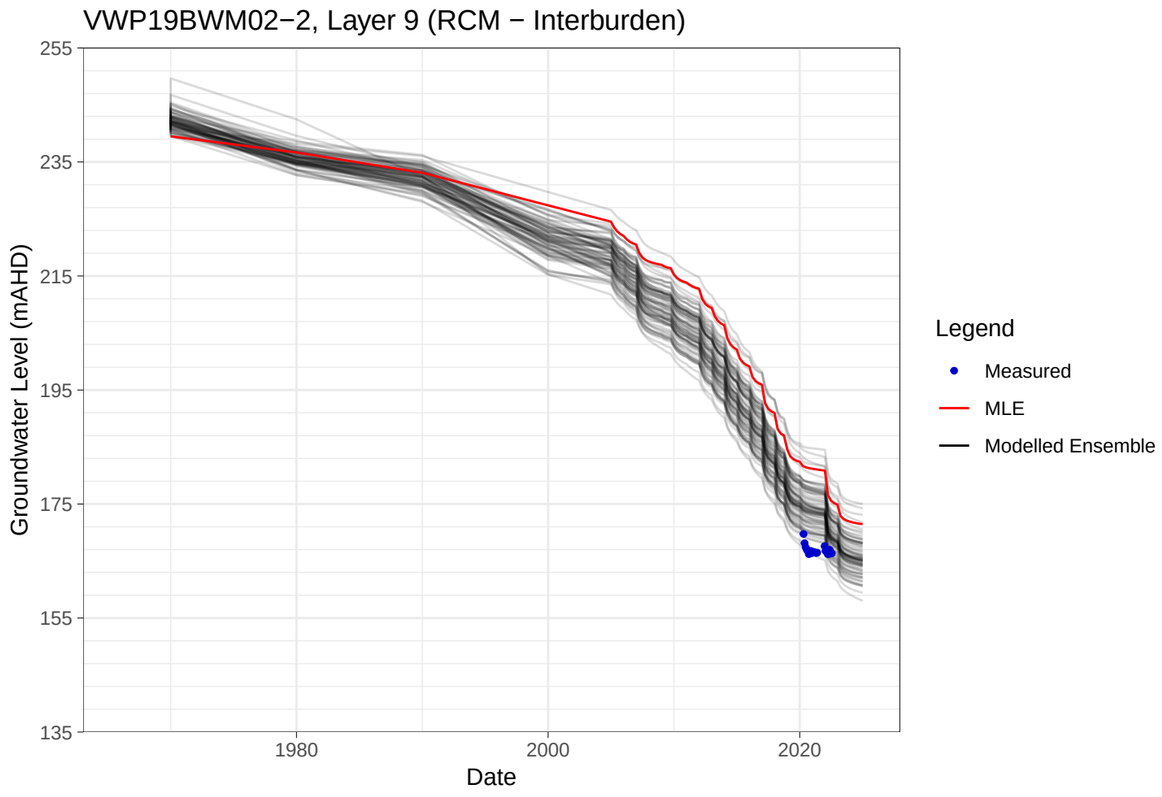

MB19BWM_25P_B, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
238
234
230
226
222
218
214
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

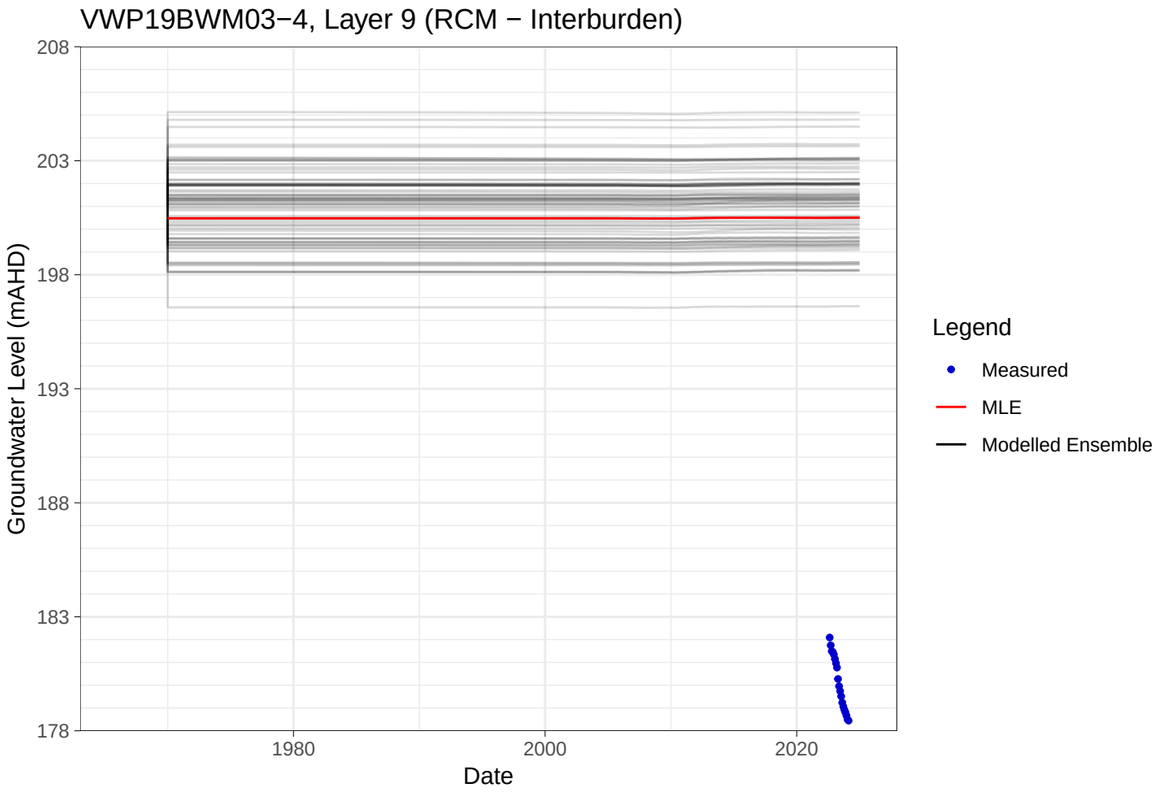

MB3, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
316
276
236
196
156
116
76
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

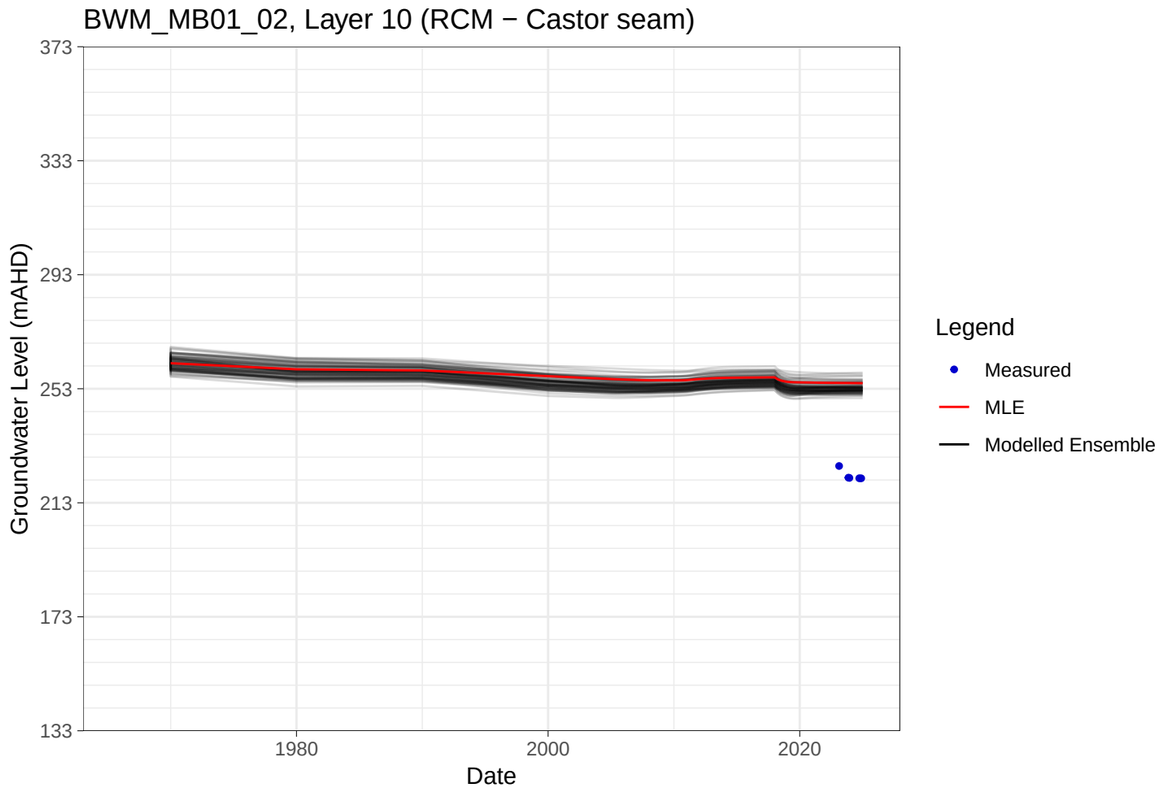

VWP19BWM04−3, Layer 8 (RCM − Aries seam)
Groundwater Level (mAHD)
231
227
223
219
215
211
207
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

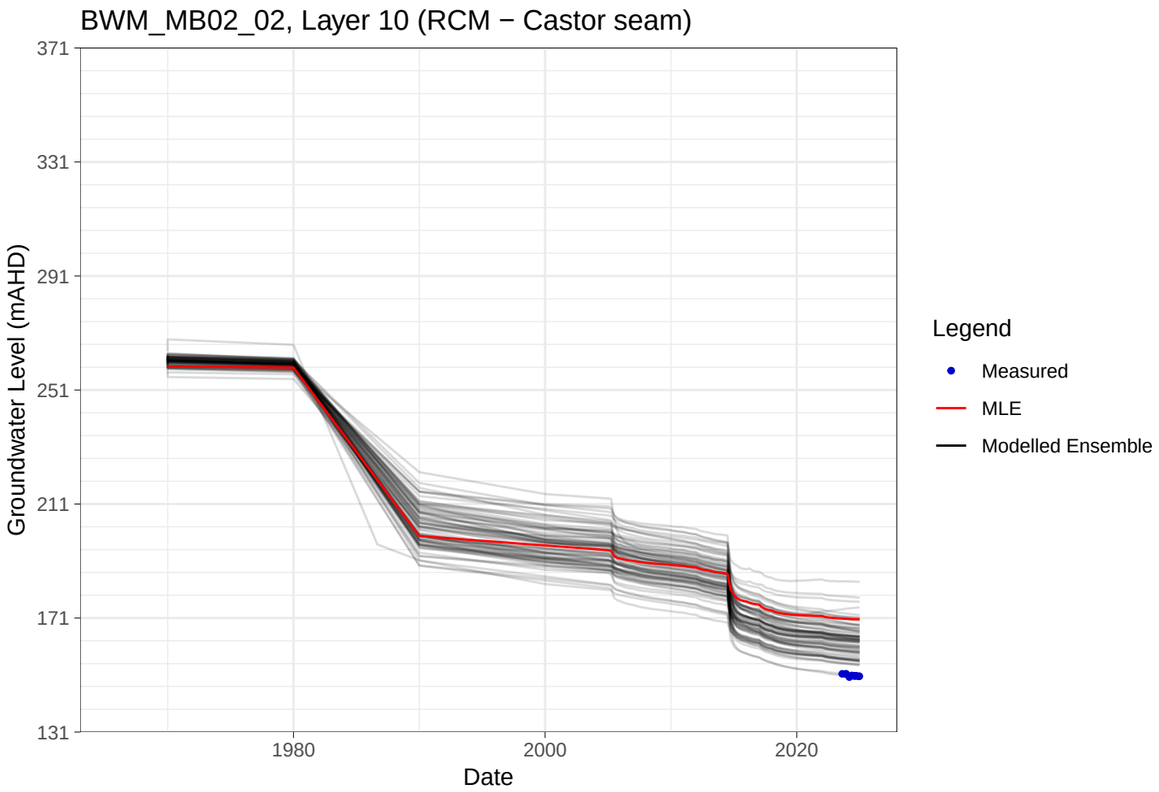

VWP19BWM01−5, Layer 9 (RCM − Interburden)
Groundwater Level (mAHD)
238
218
198
178
158
138
118
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

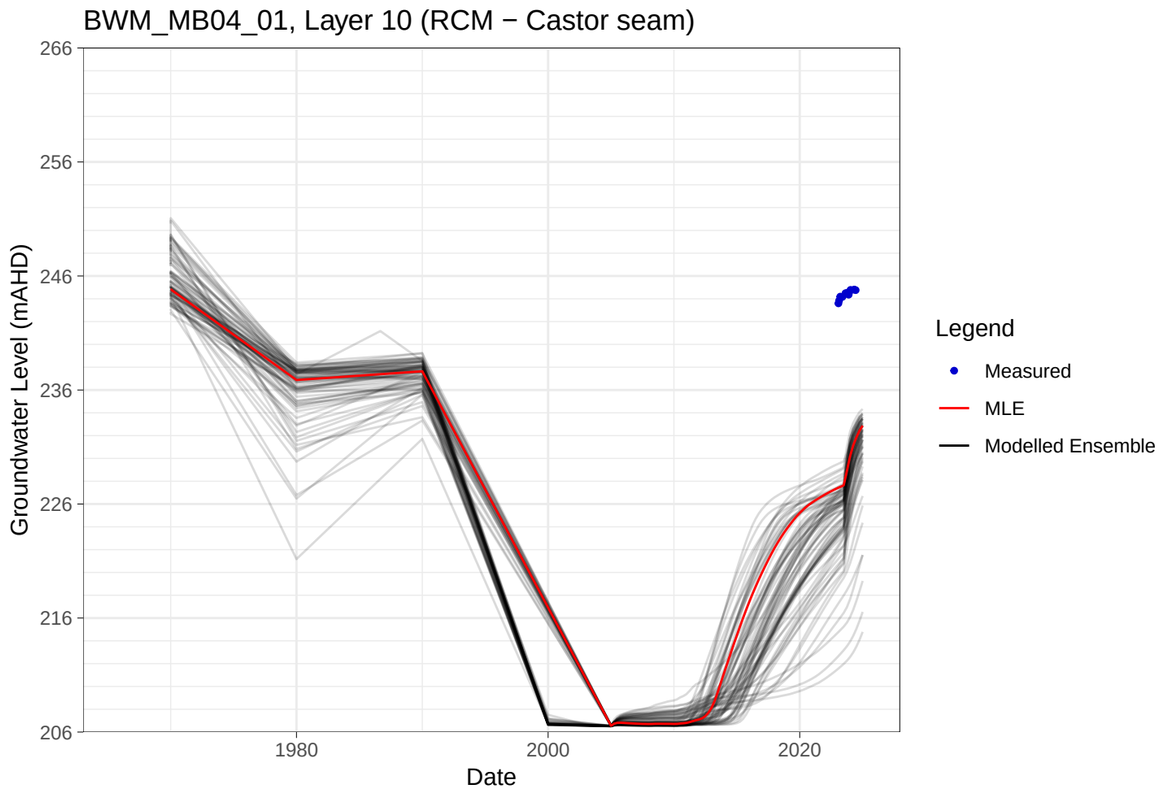

VWP19BWM02−2, Layer 9 (RCM − Interburden)
Groundwater Level (mAHD)
255
235
215
195
175
155
135
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

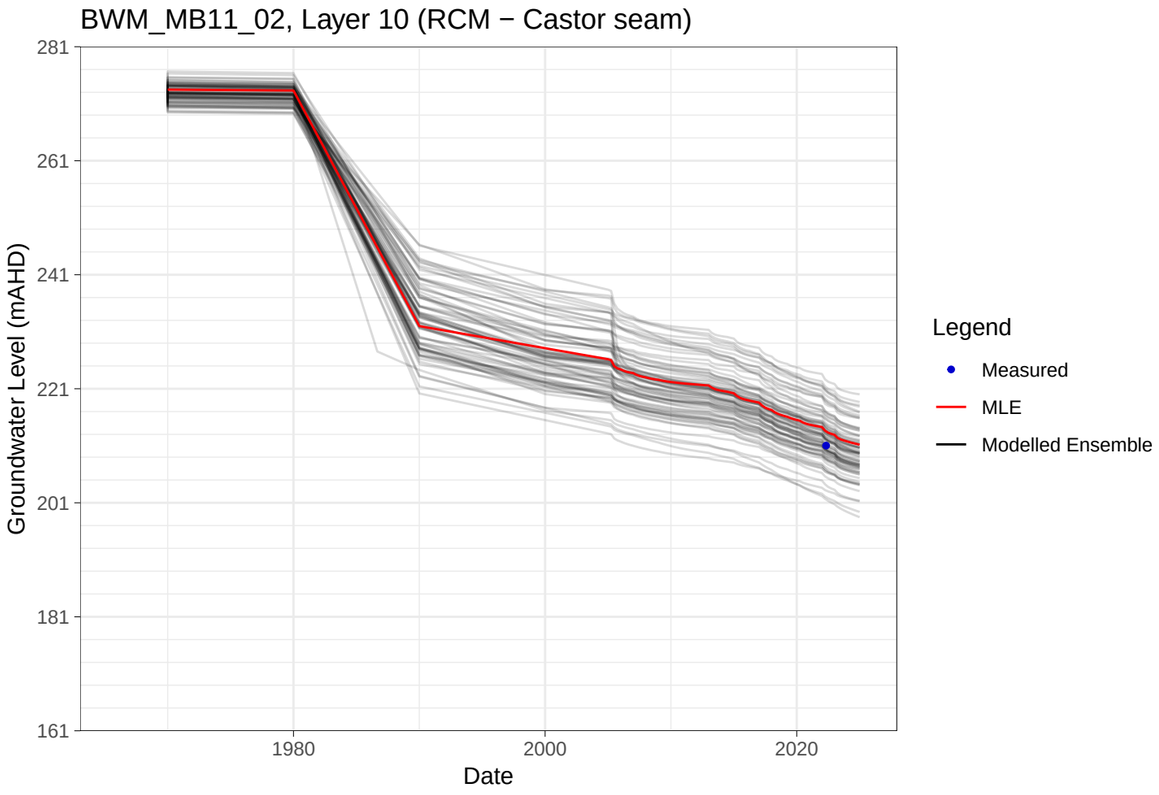

VWP19BWM03−4, Layer 9 (RCM − Interburden)
Groundwater Level (mAHD)
208
203
198
193
188
183
178
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

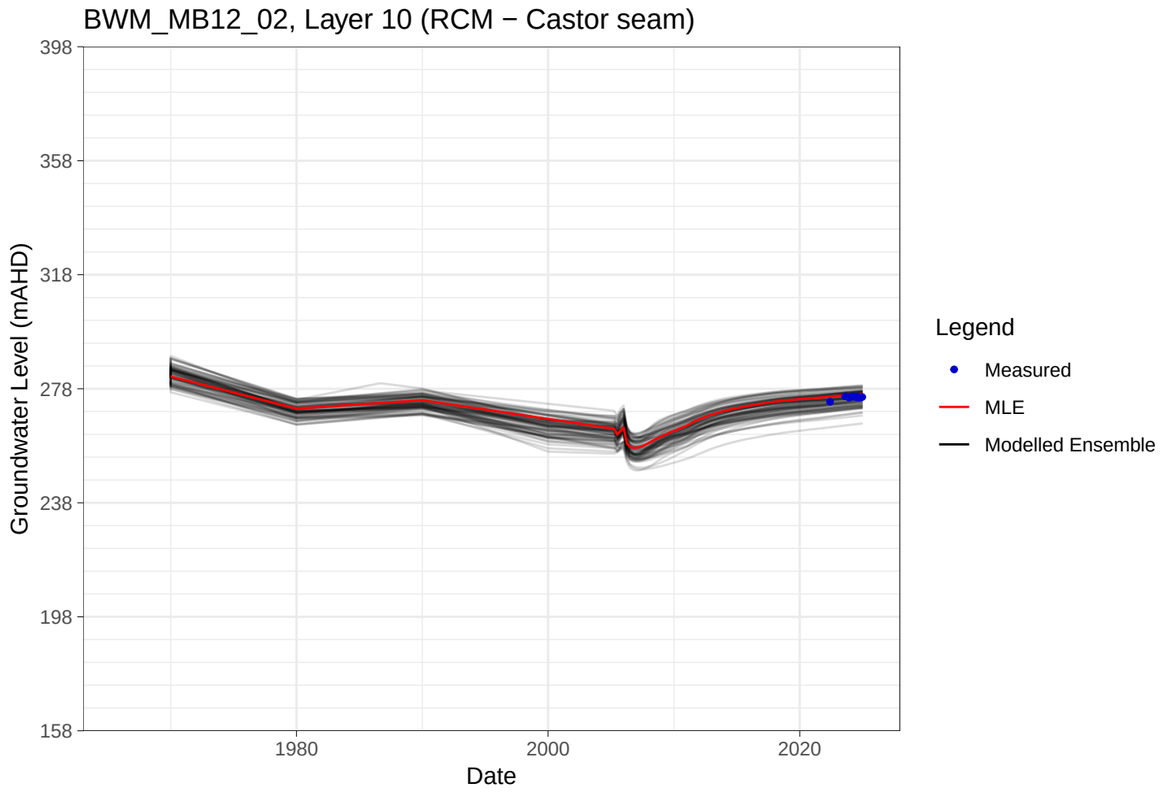

BWM_MB01_02, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
373
333
293
253
213
173
133
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

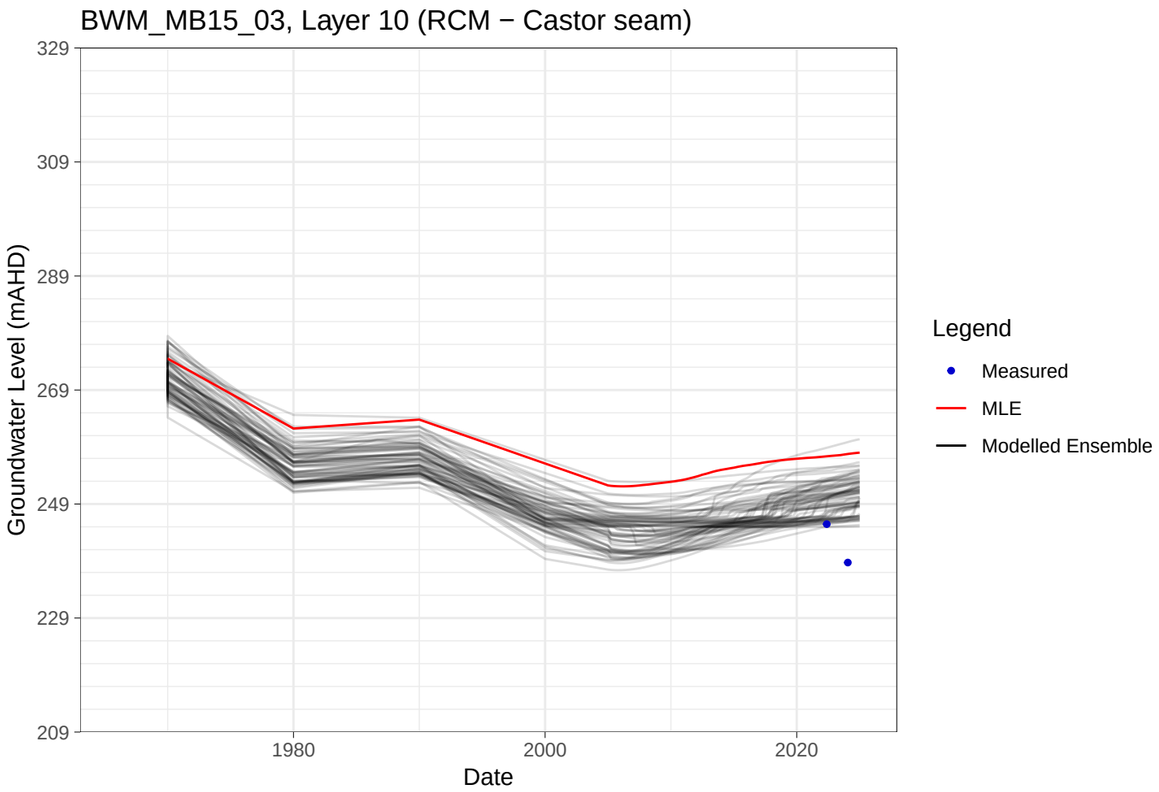

BWM_MB02_02, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
371
331
291
251
211
171
131
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

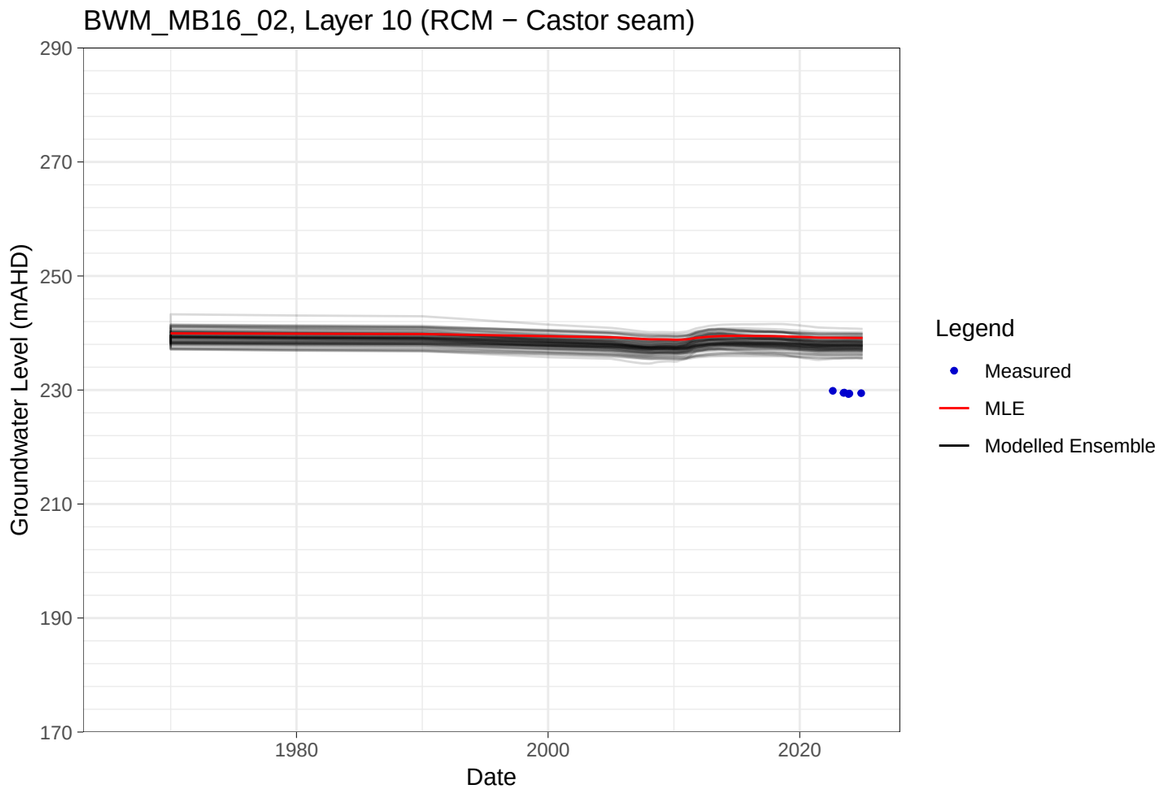

BWM_MB04_01, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
266
256
246
236
226
216
206
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

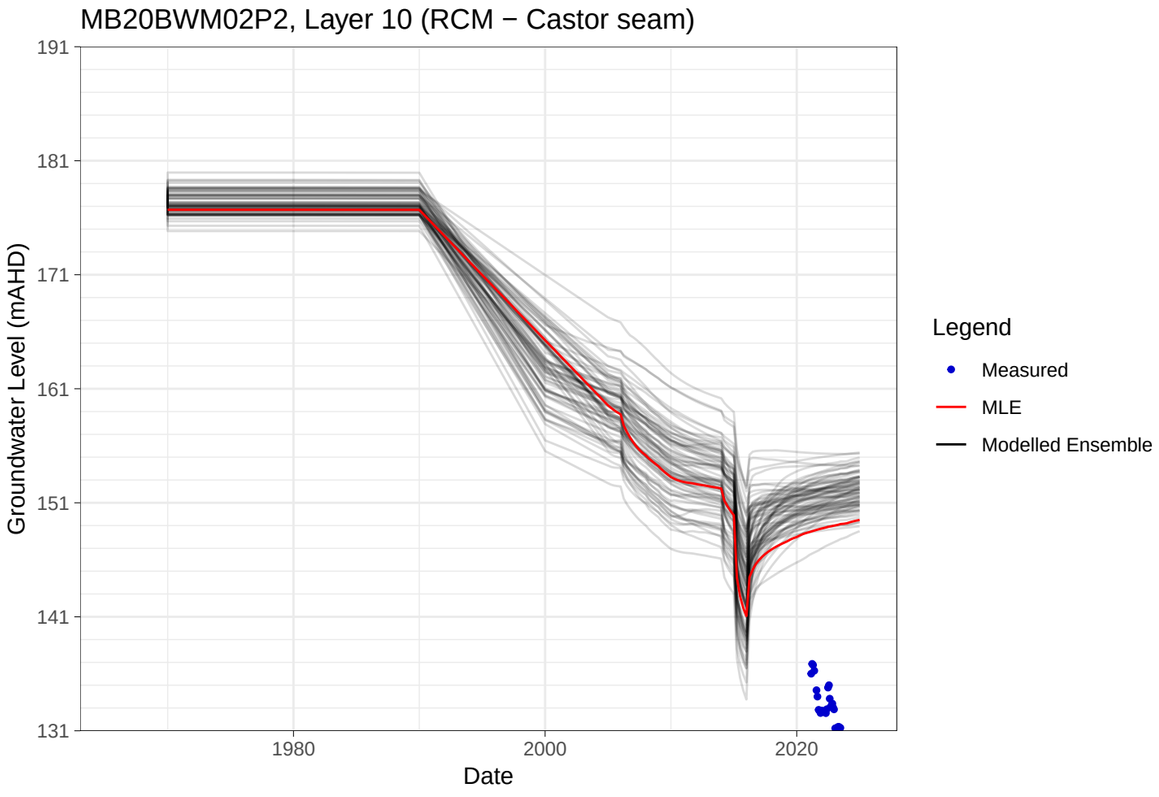

BWM_MB11_02, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
281
261
241
221
201
181
161
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

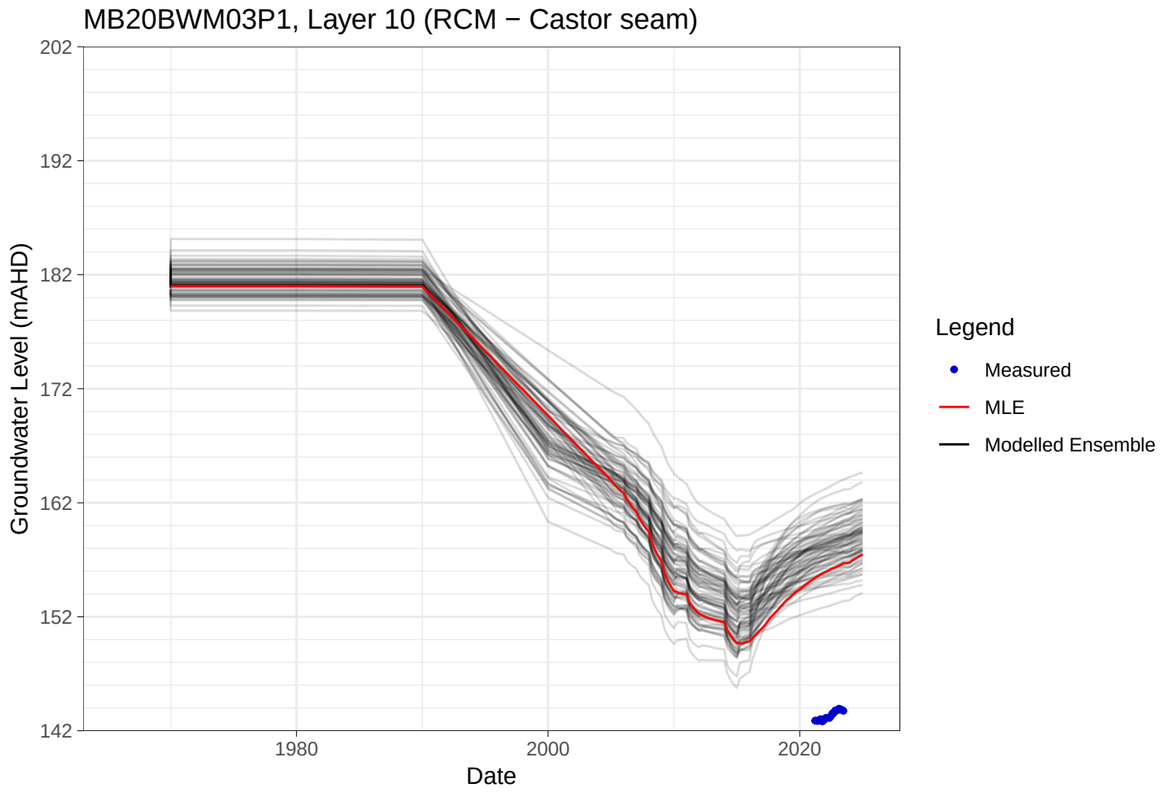

BWM_MB12_02, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
398
358
318
278
238
198
158
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

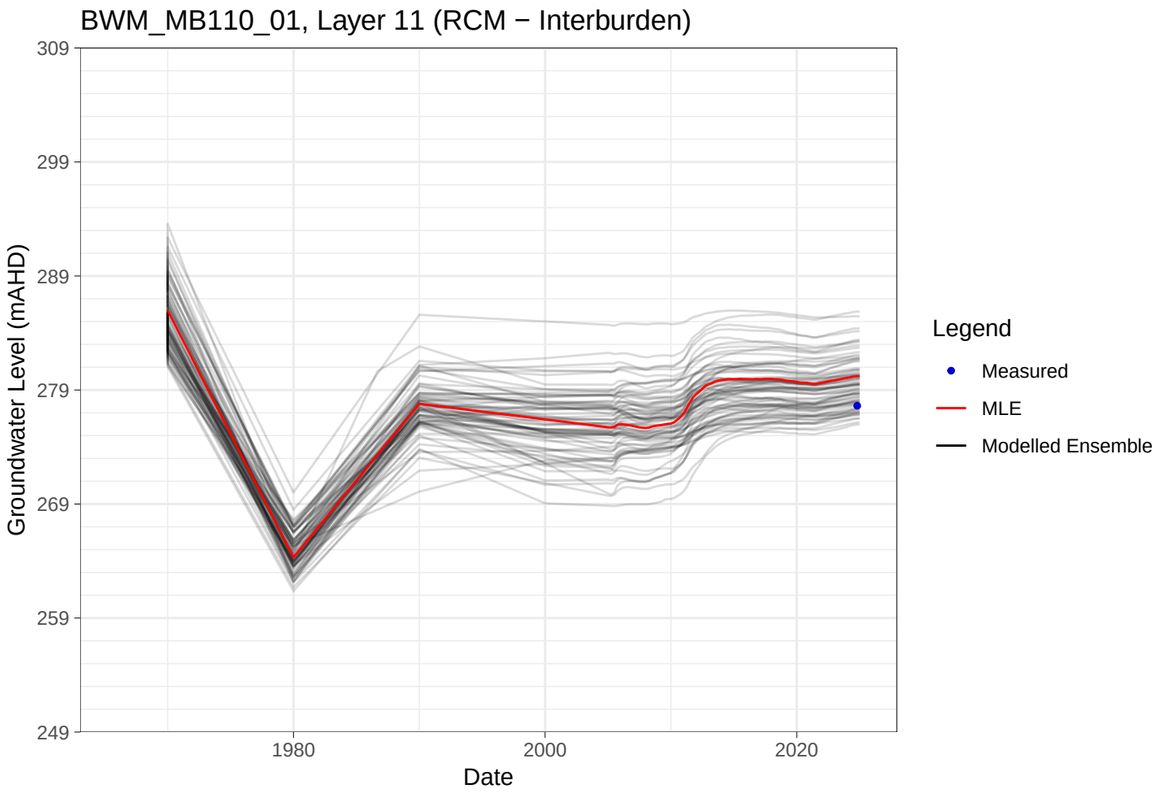

BWM_MB15_03, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
329
309
289
269
249
229
209
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

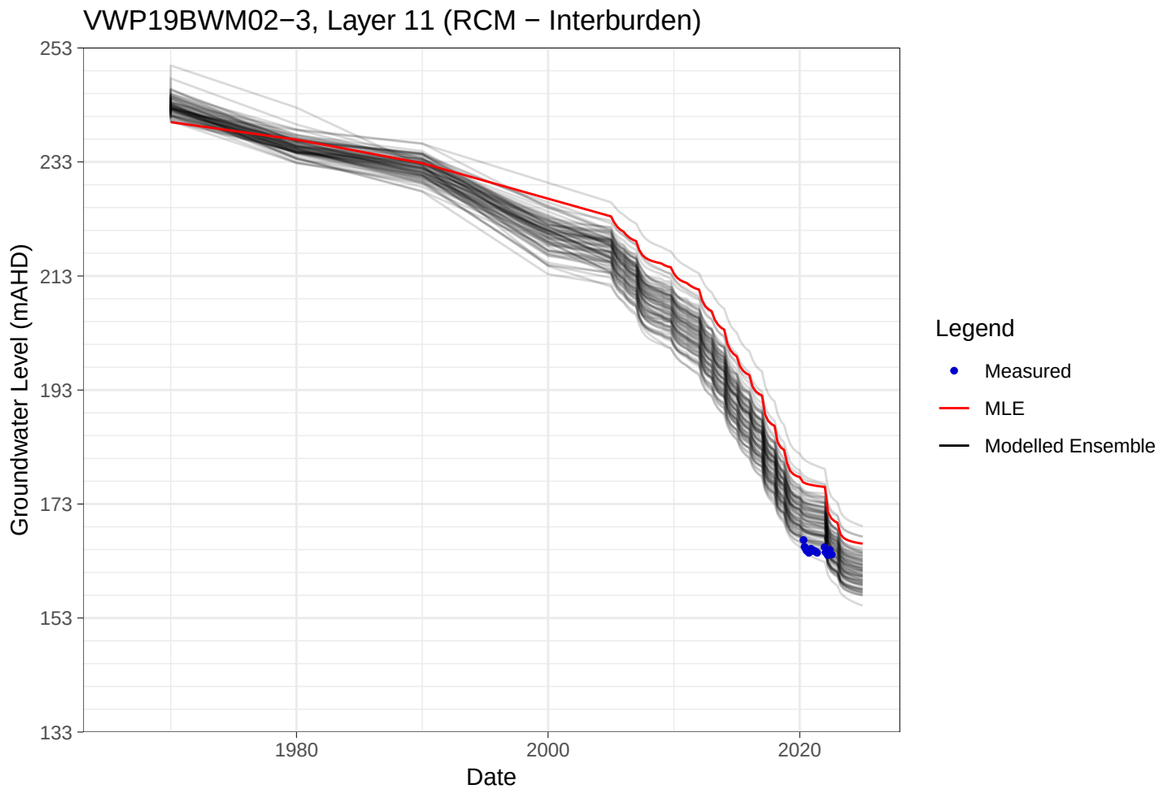

BWM_MB16_02, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
290
270
250
230
210
190
170
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

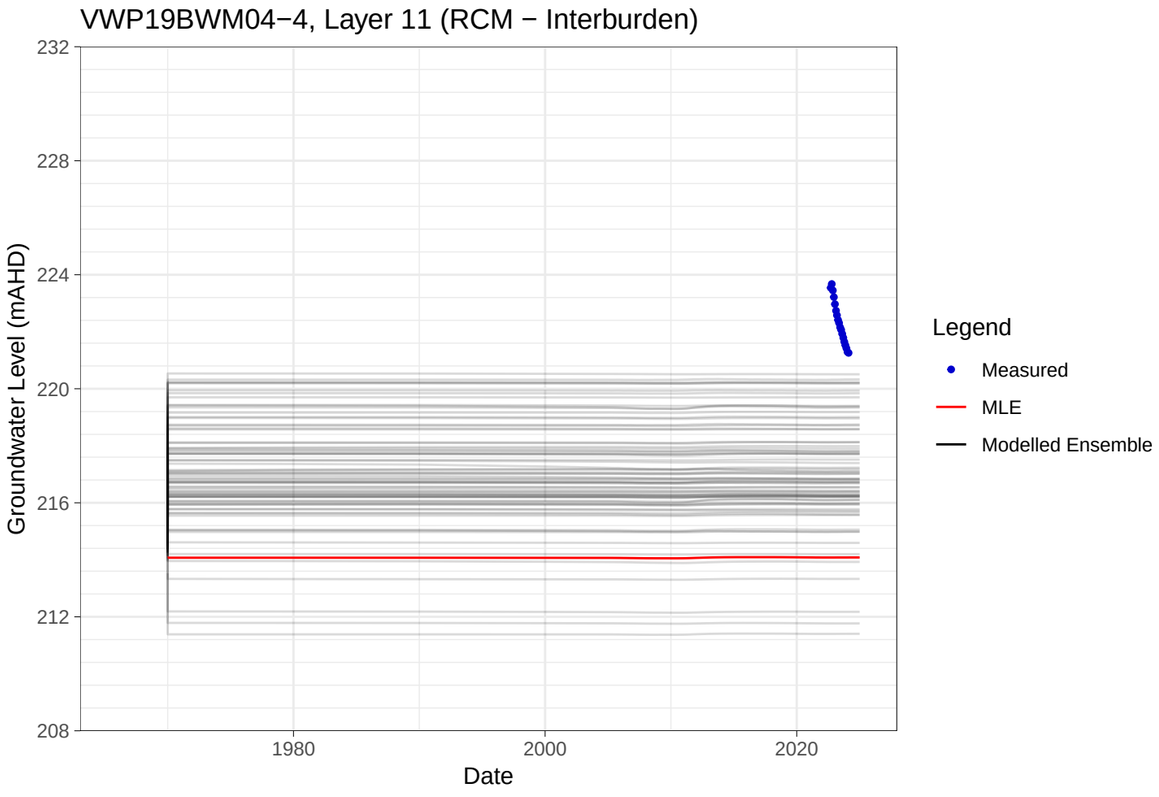

MB20BWM02P2, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
191
181
171
161
151
141
131
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

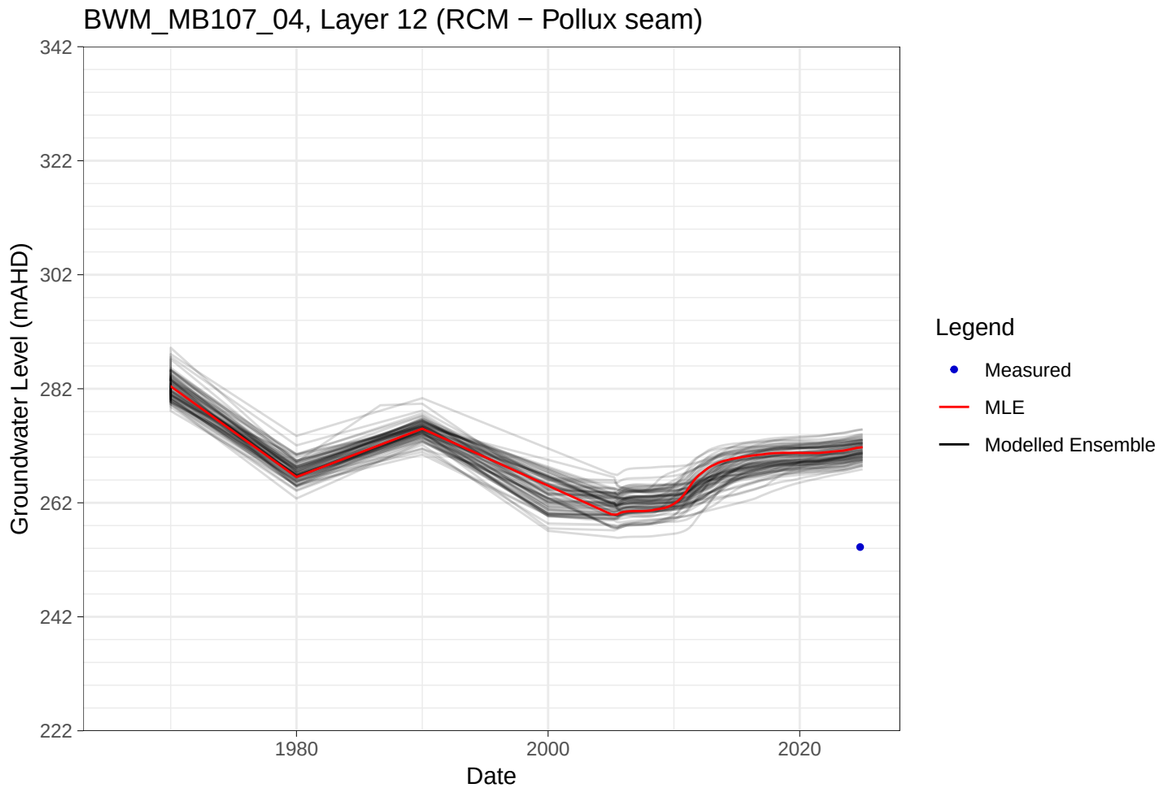

MB20BWM03P1, Layer 10 (RCM − Castor seam)
Groundwater Level (mAHD)
202
192
182
172
162
152
142
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

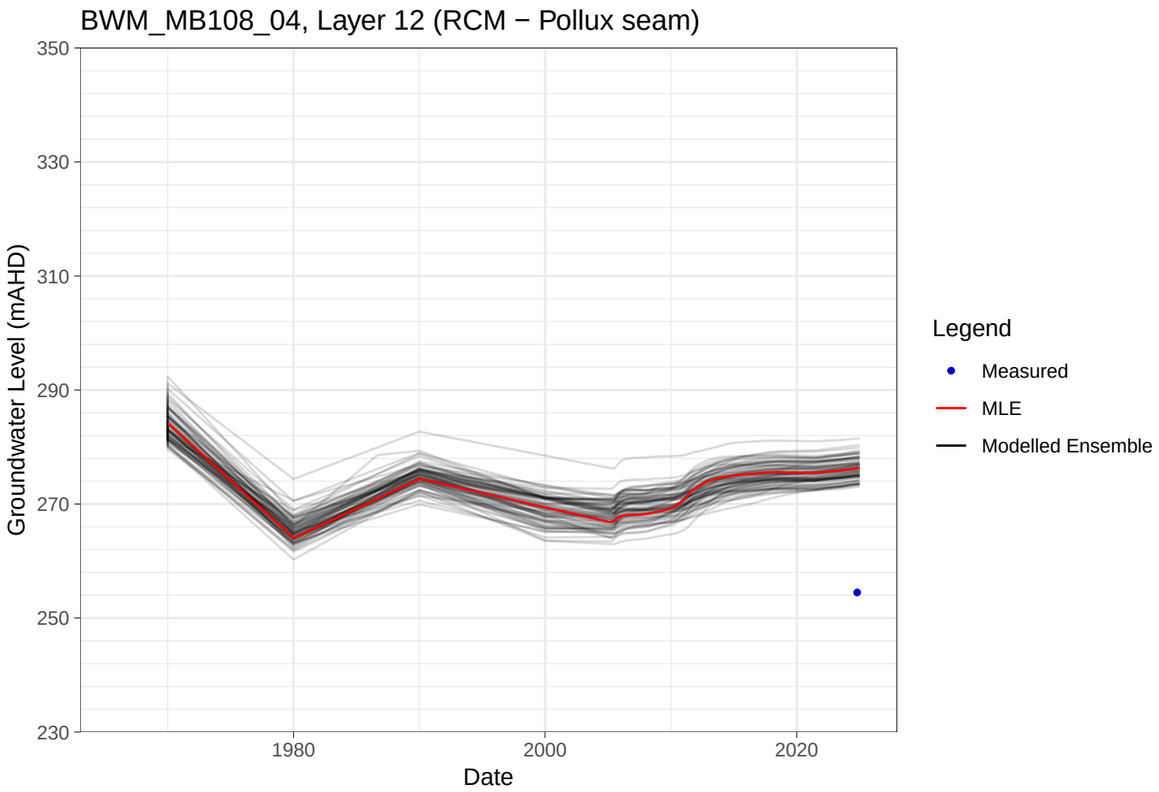

BWM_MB110_01, Layer 11 (RCM − Interburden)
Groundwater Level (mAHD)
309
299
289
279
269
259
249
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

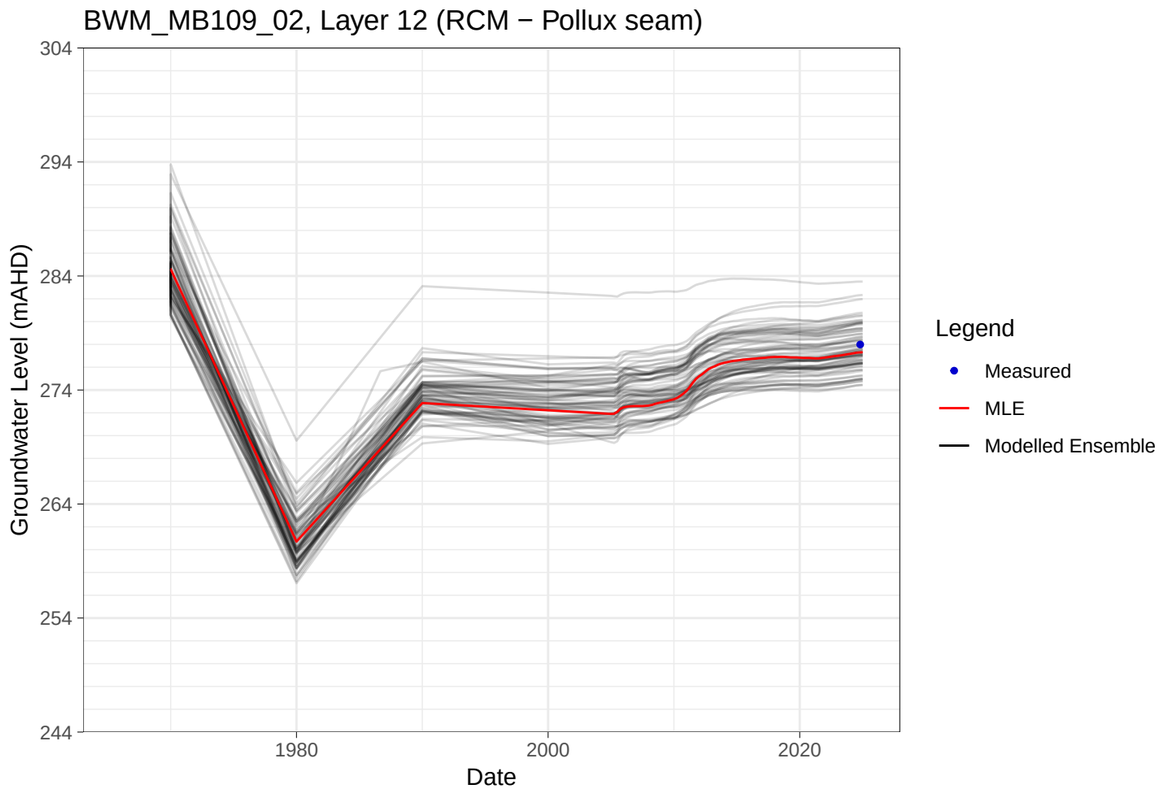

VWP19BWM02−3, Layer 11 (RCM − Interburden)
Groundwater Level (mAHD)
253
233
213
193
173
153
133
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

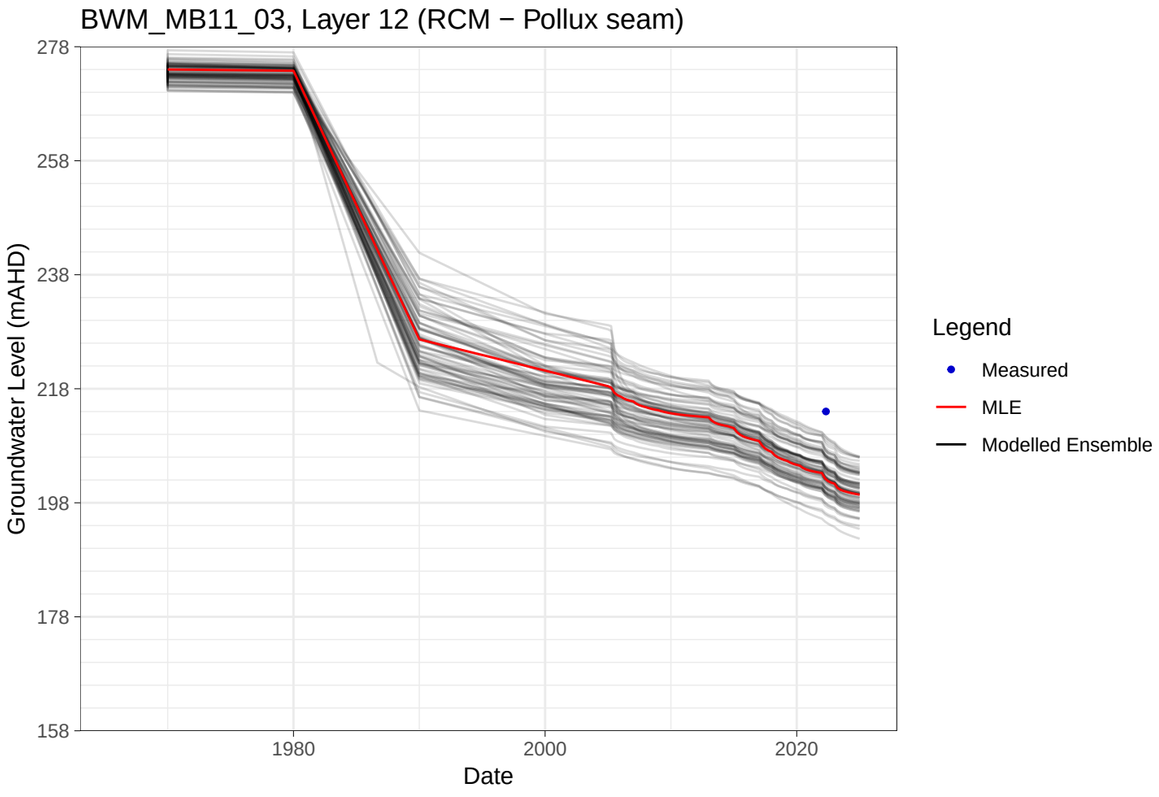

VWP19BWM04−4, Layer 11 (RCM − Interburden)
Groundwater Level (mAHD)
232
228
224
220
216
212
208
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

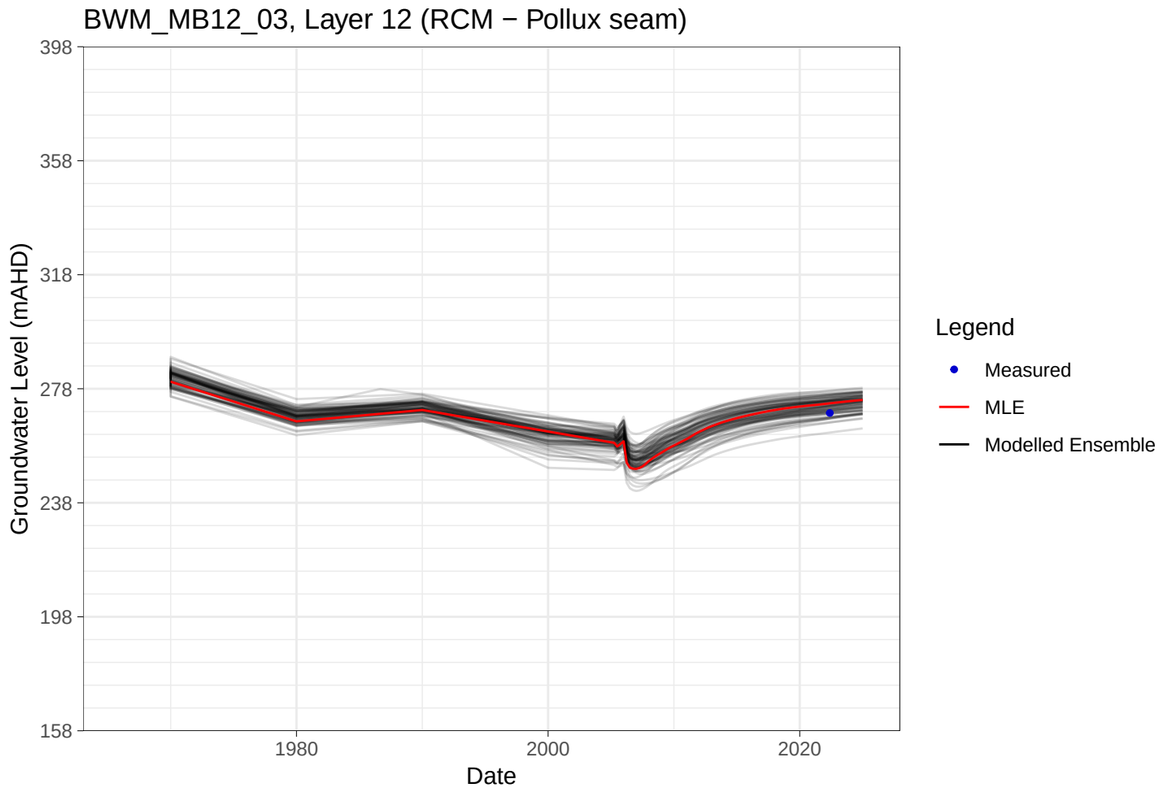

BWM_MB107_04, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
342
322
302
282
262
242
222
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

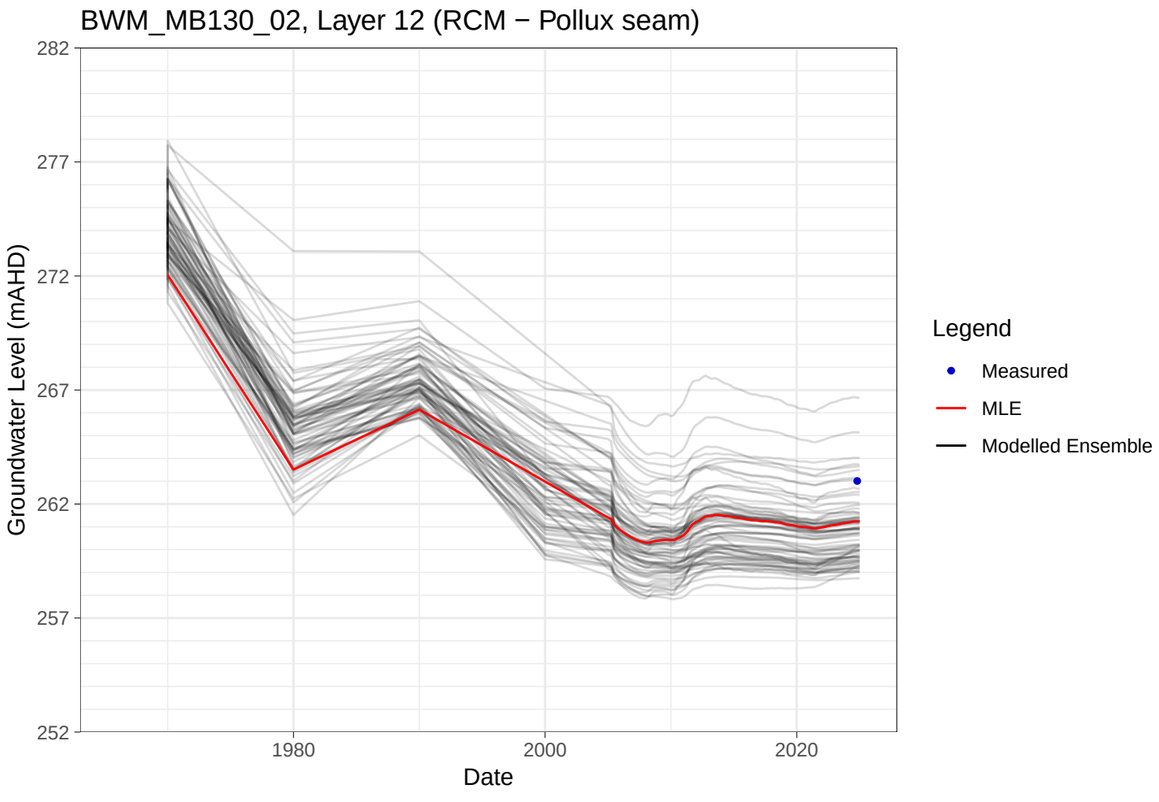

BWM_MB108_04, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
350
330
310
290
270
250
230
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

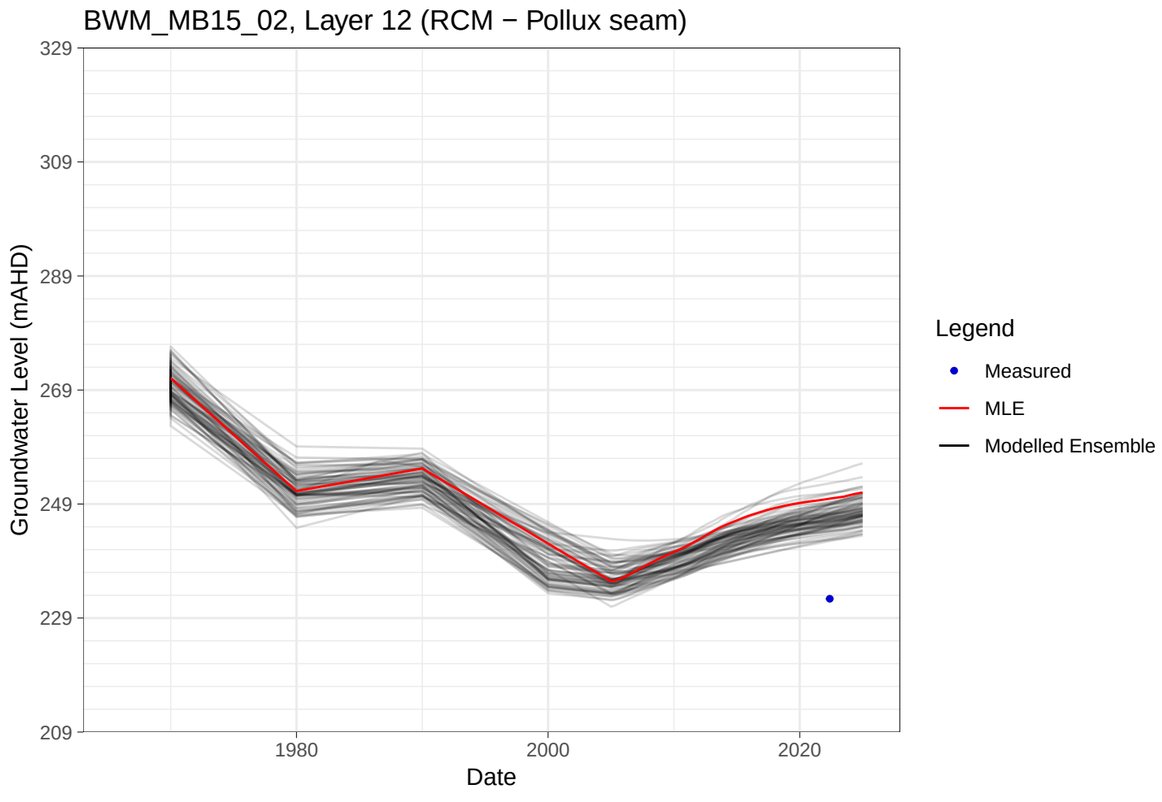

BWM_MB109_02, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
304
294
284
274
264
254
244
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

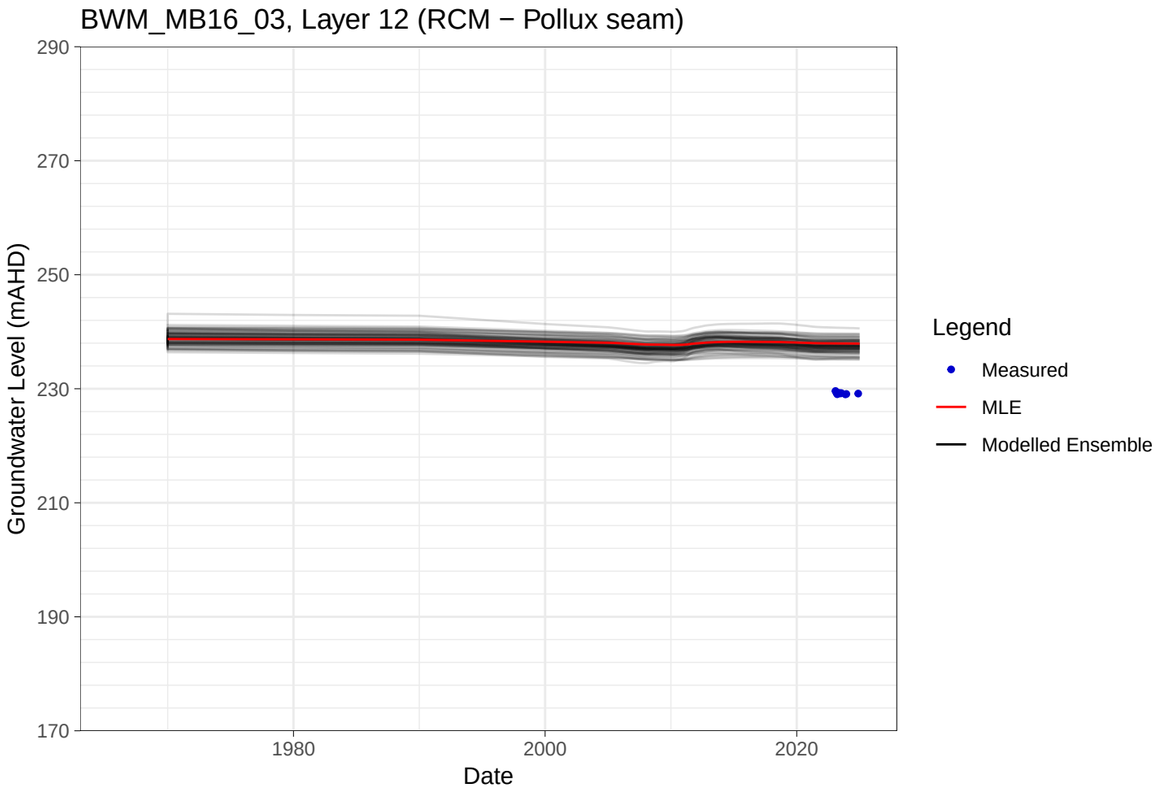

BWM_MB11_03, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
278
258
238
218
198
178
158
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

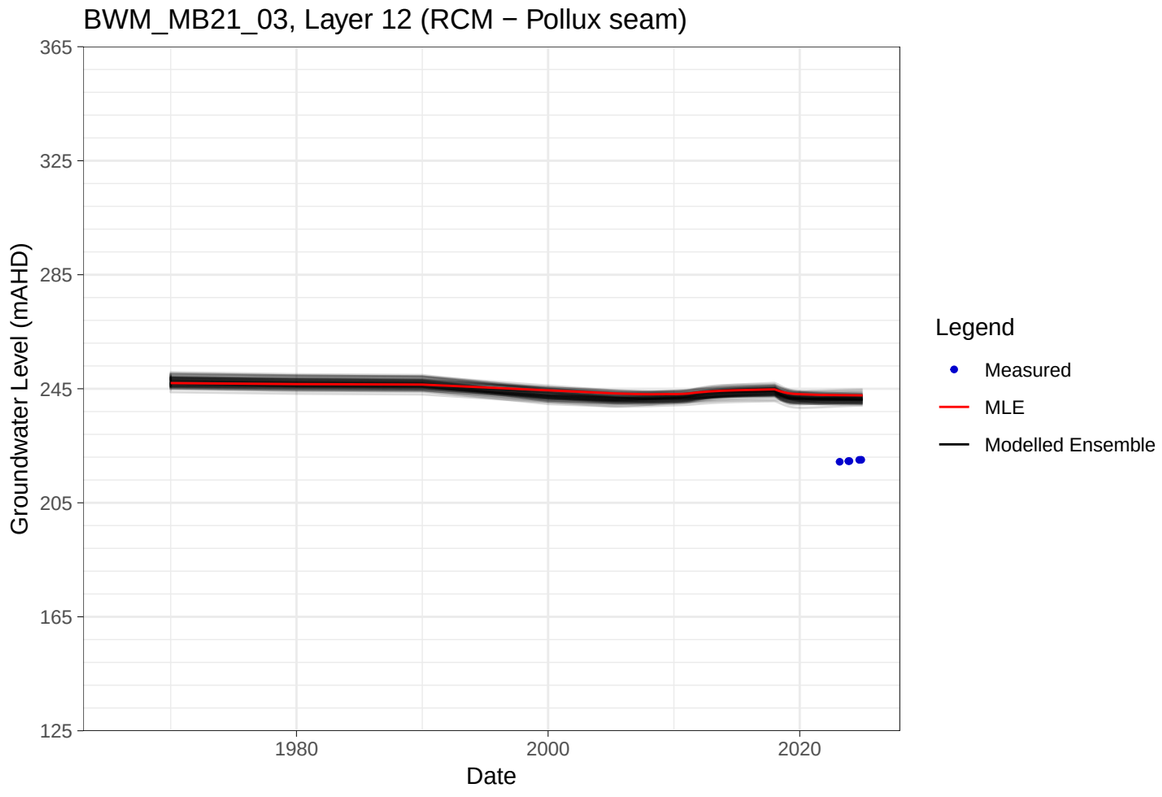

BWM_MB12_03, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
398
358
318
278
238
198
158
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

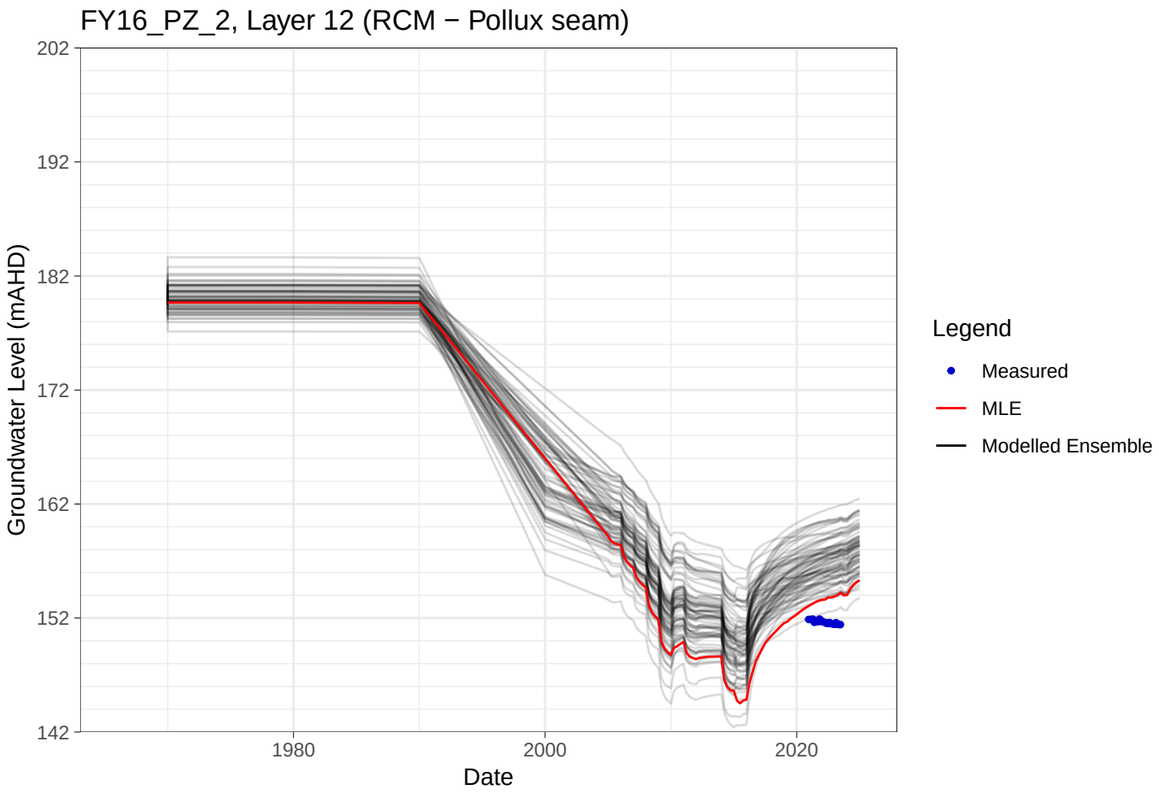

BWM_MB130_02, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
282
277
272
267
262
257
252
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

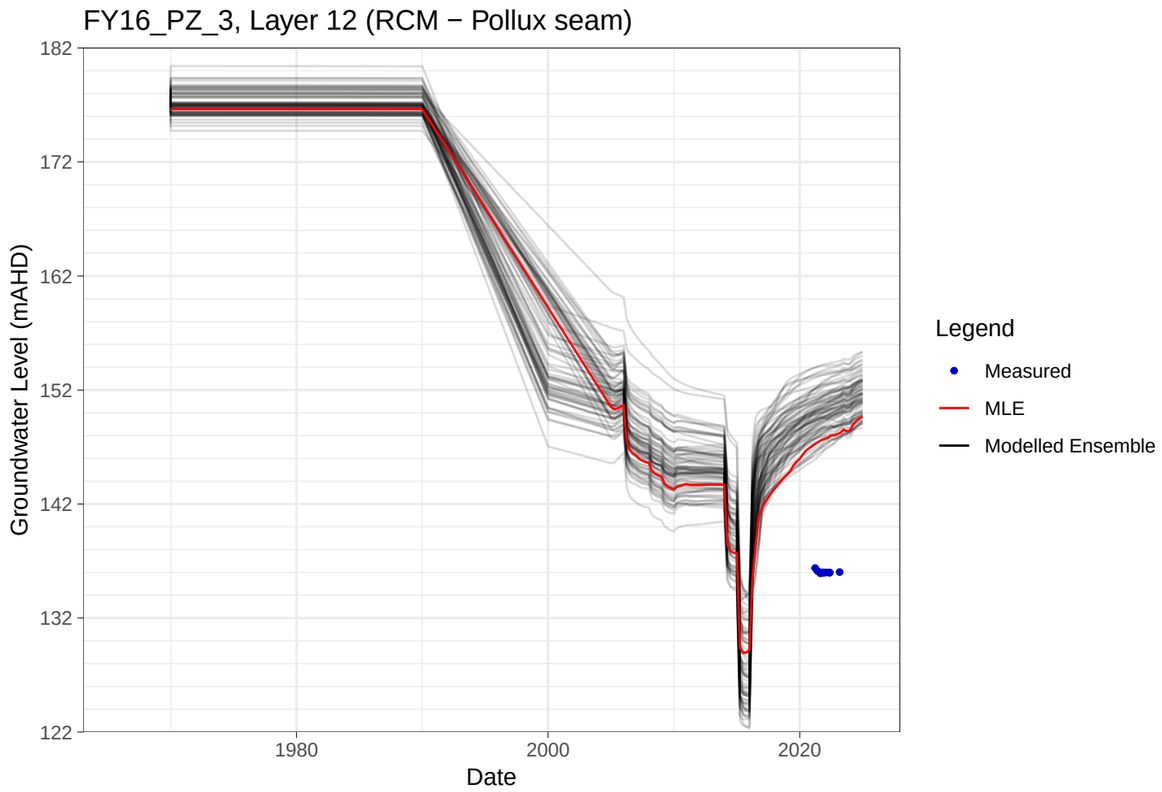

BWM_MB15_02, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
329
309
289
269
249
229
209
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

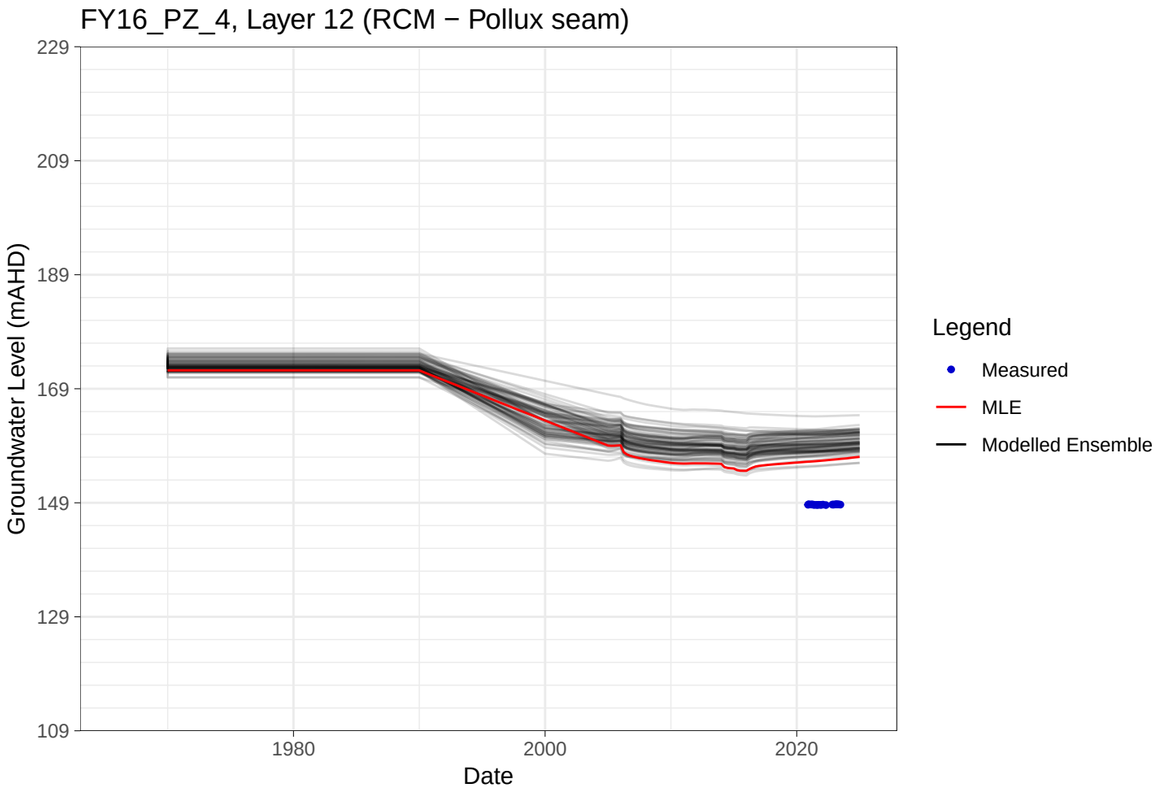

BWM_MB16_03, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
290
270
250
230
210
190
170
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

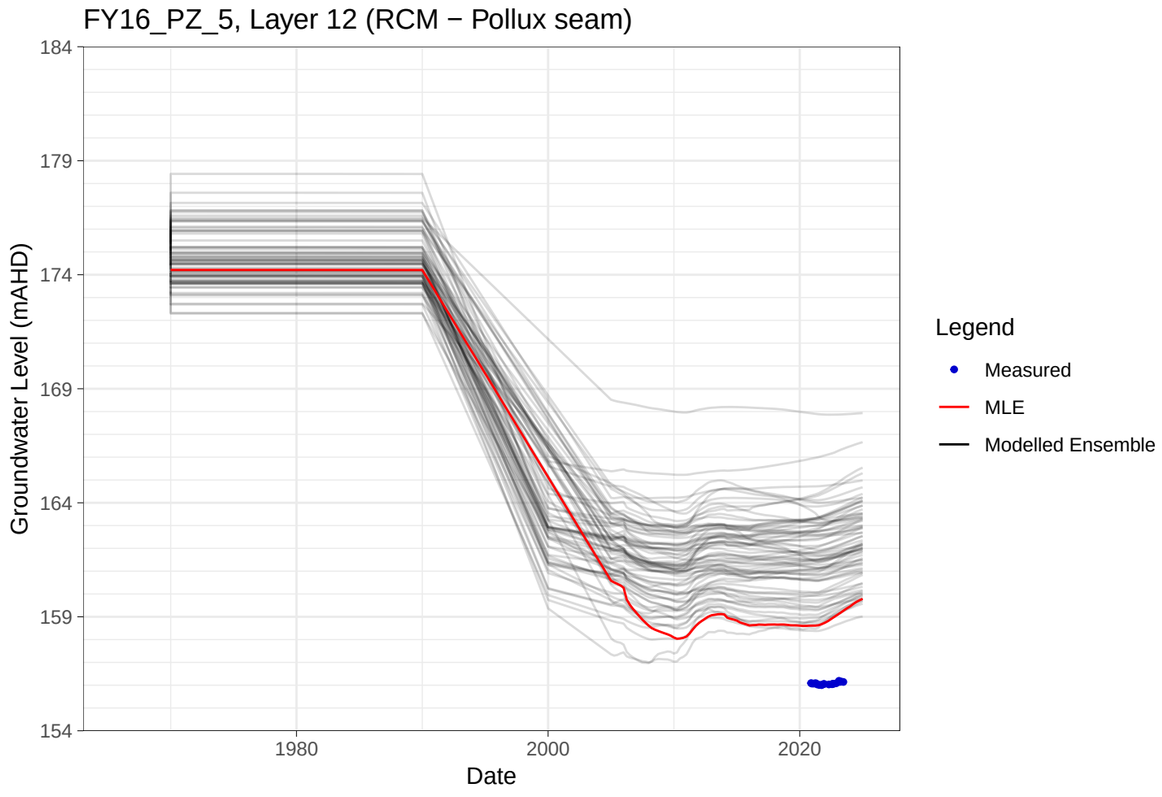

BWM_MB21_03, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
365
325
285
245
205
165
125
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

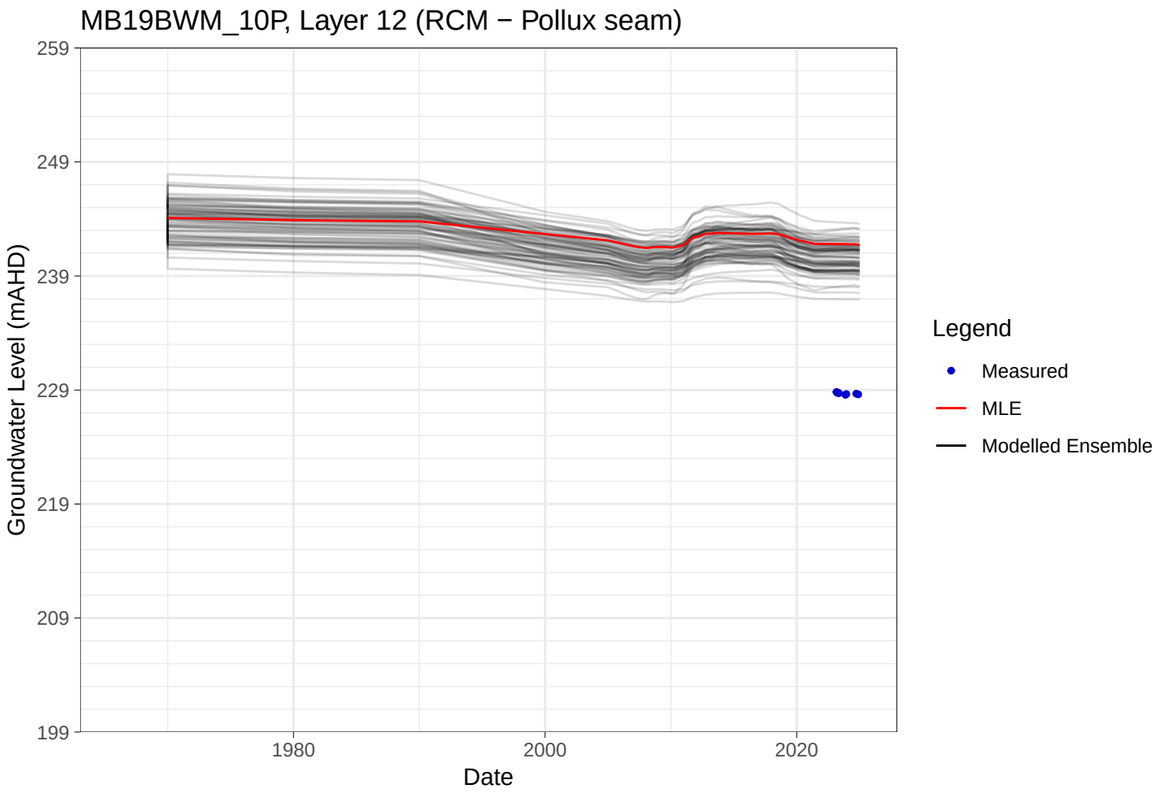

FY16_PZ_2, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
202
192
182
172
162
152
142
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

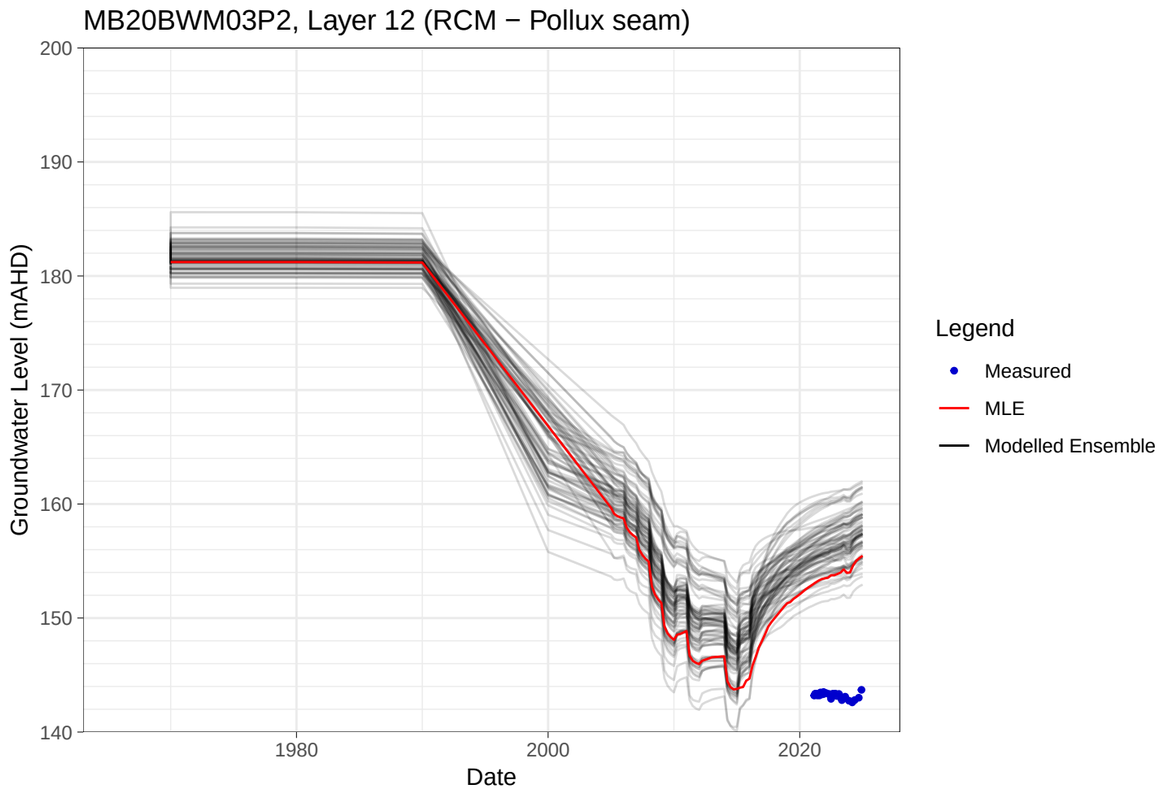

FY16_PZ_3, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
182
172
162
152
142
132
122
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

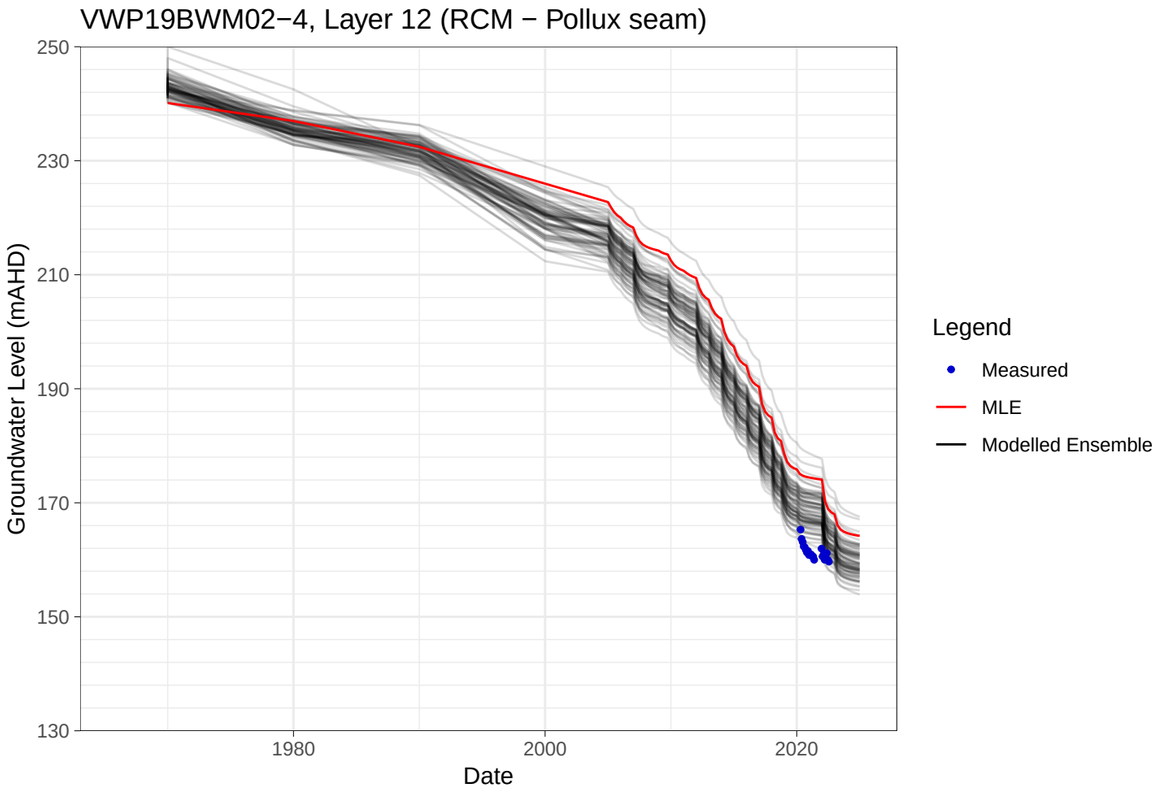

FY16_PZ_4, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
229
209
189
169
149
129
109
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

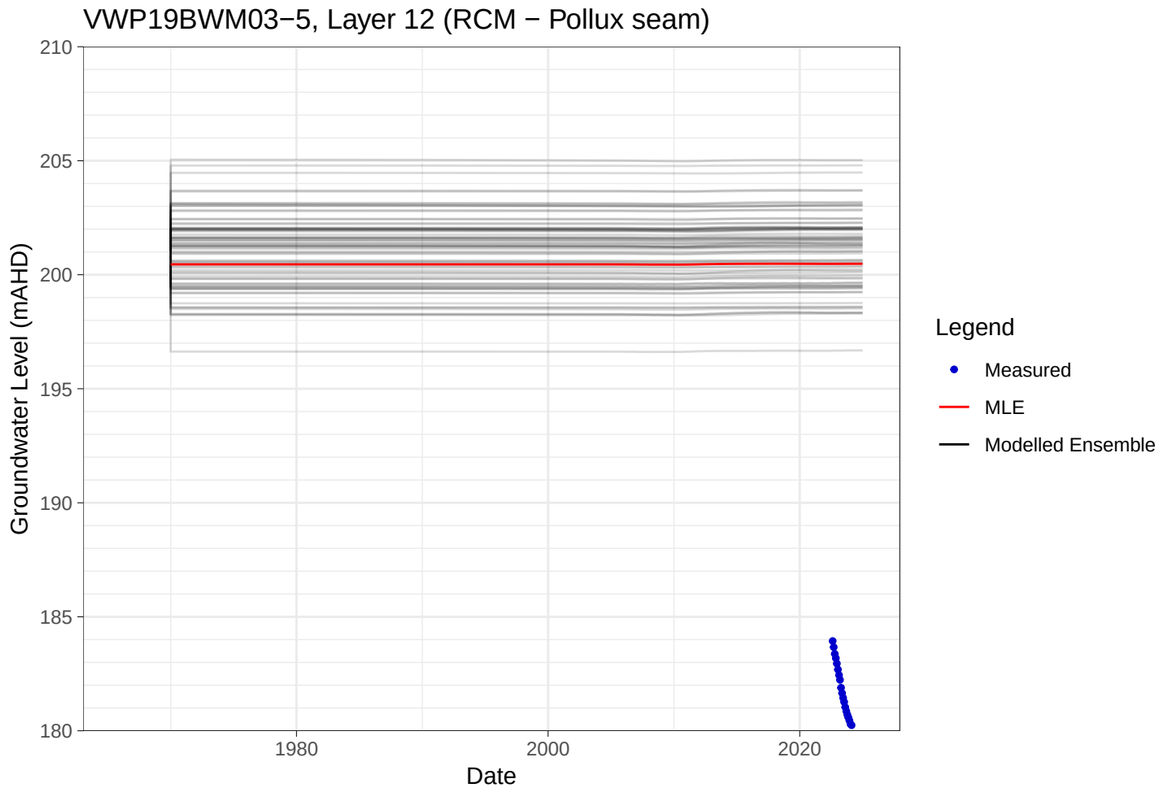

FY16_PZ_5, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
184
179
174
169
164
159
154
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

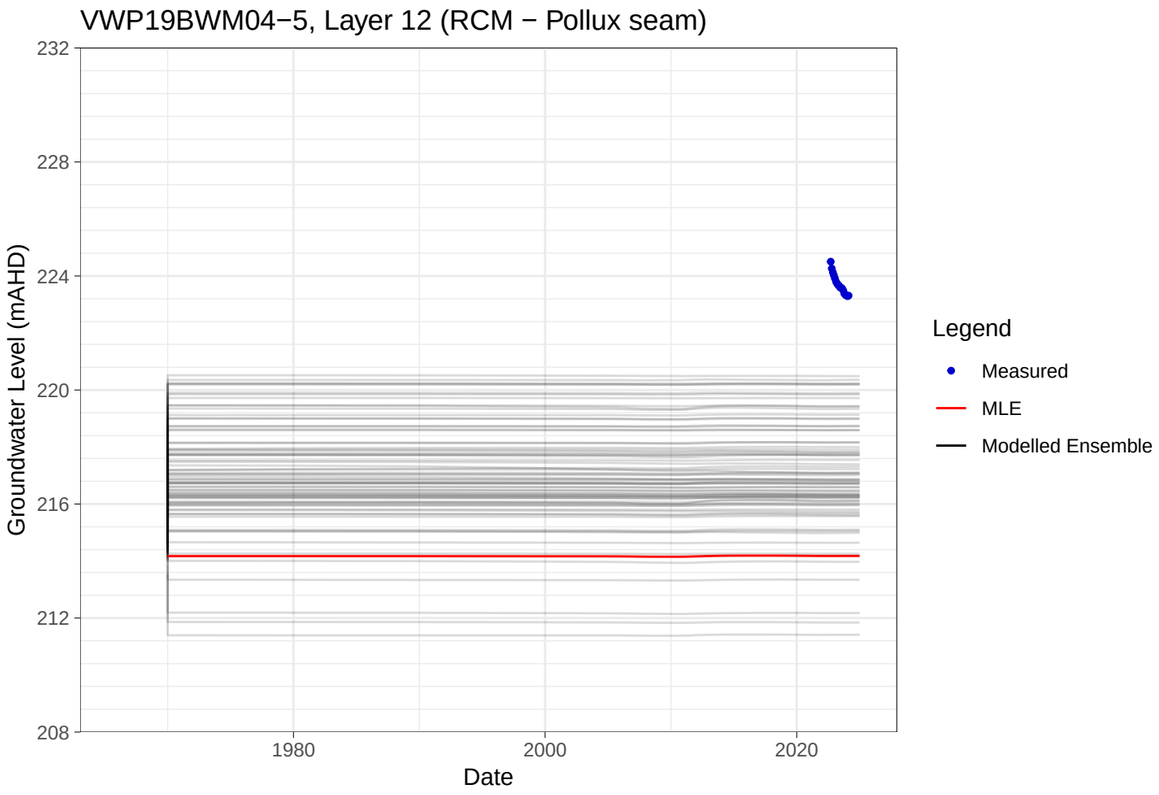

MB19BWM_10P, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
259
249
239
229
219
209
199
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

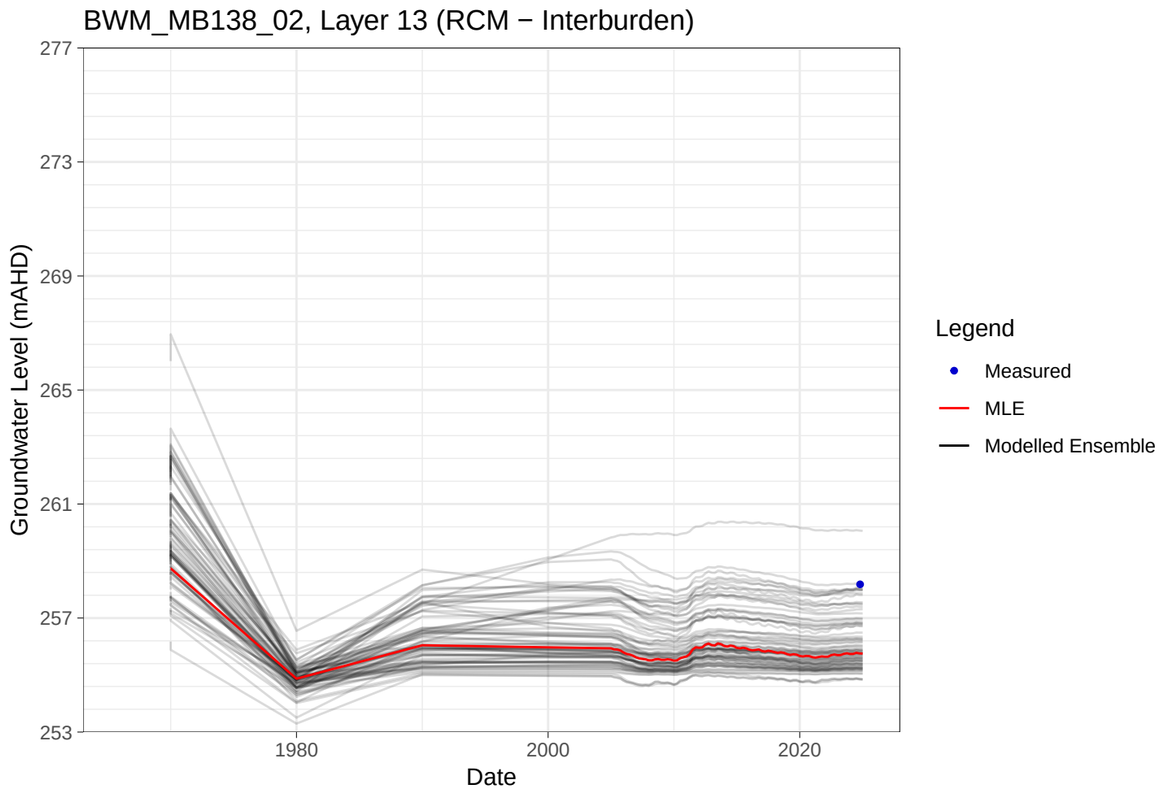

MB20BWM03P2, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
200
190
180
170
160
150
140
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

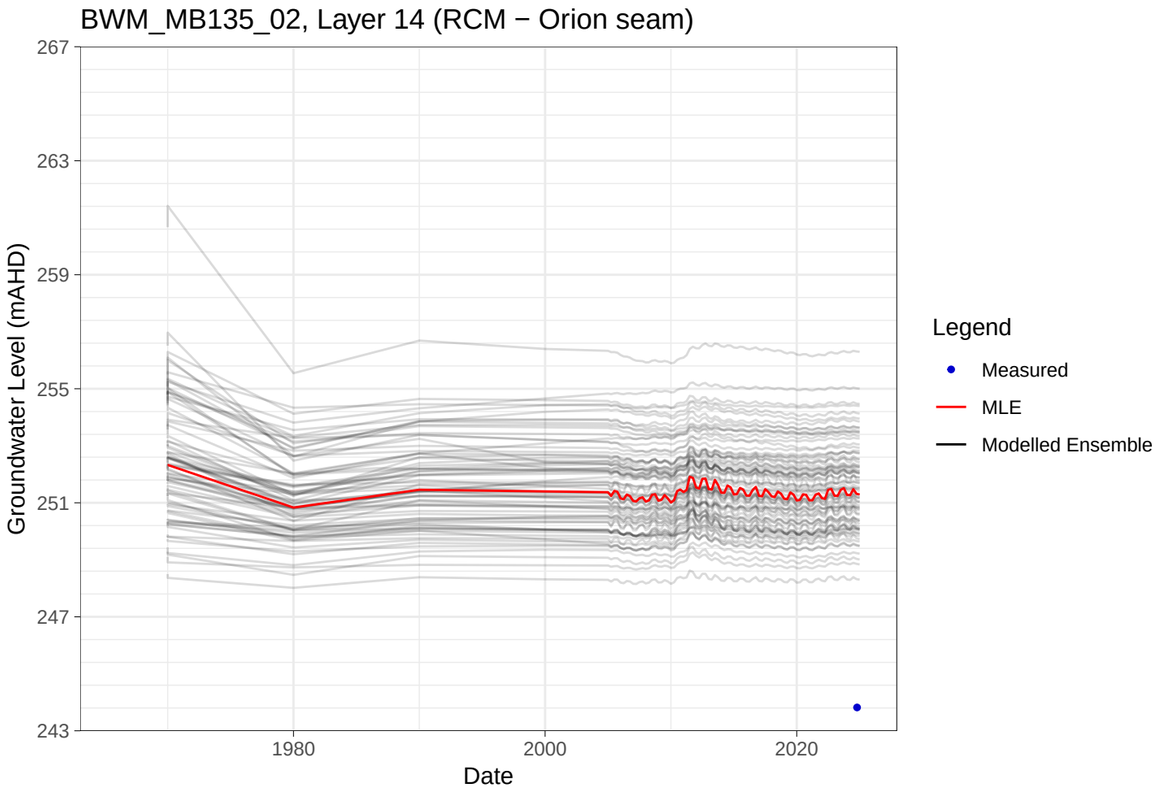

VWP19BWM02−4, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
250
230
210
190
170
150
130
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

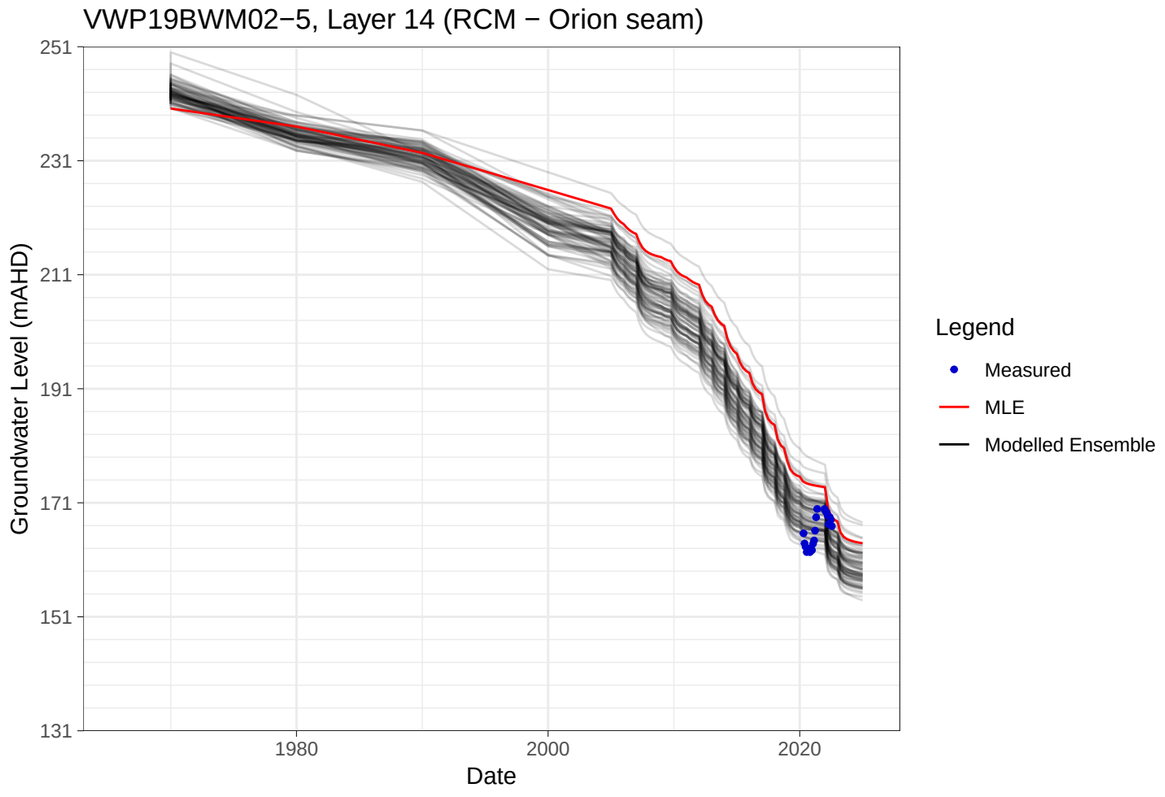

VWP19BWM03−5, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
210
205
200
195
190
185
180
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

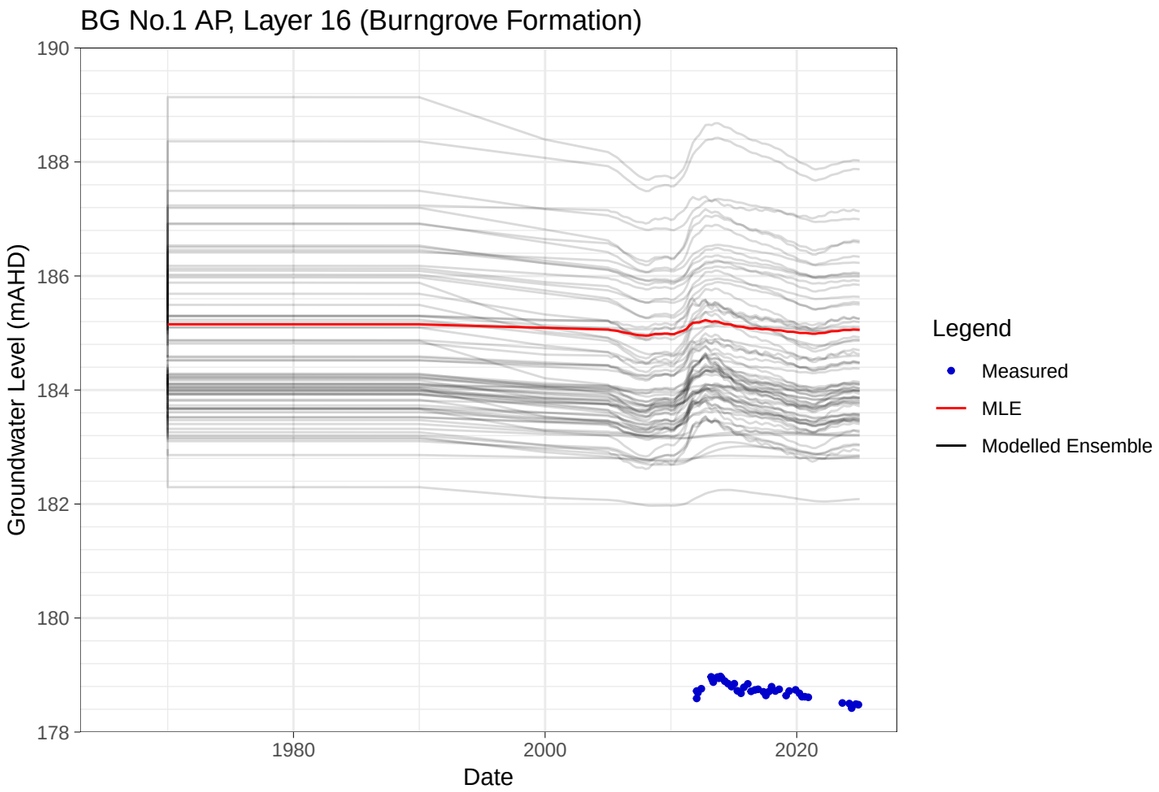

VWP19BWM04−5, Layer 12 (RCM − Pollux seam)
Groundwater Level (mAHD)
232
228
224
220
216
212
208
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

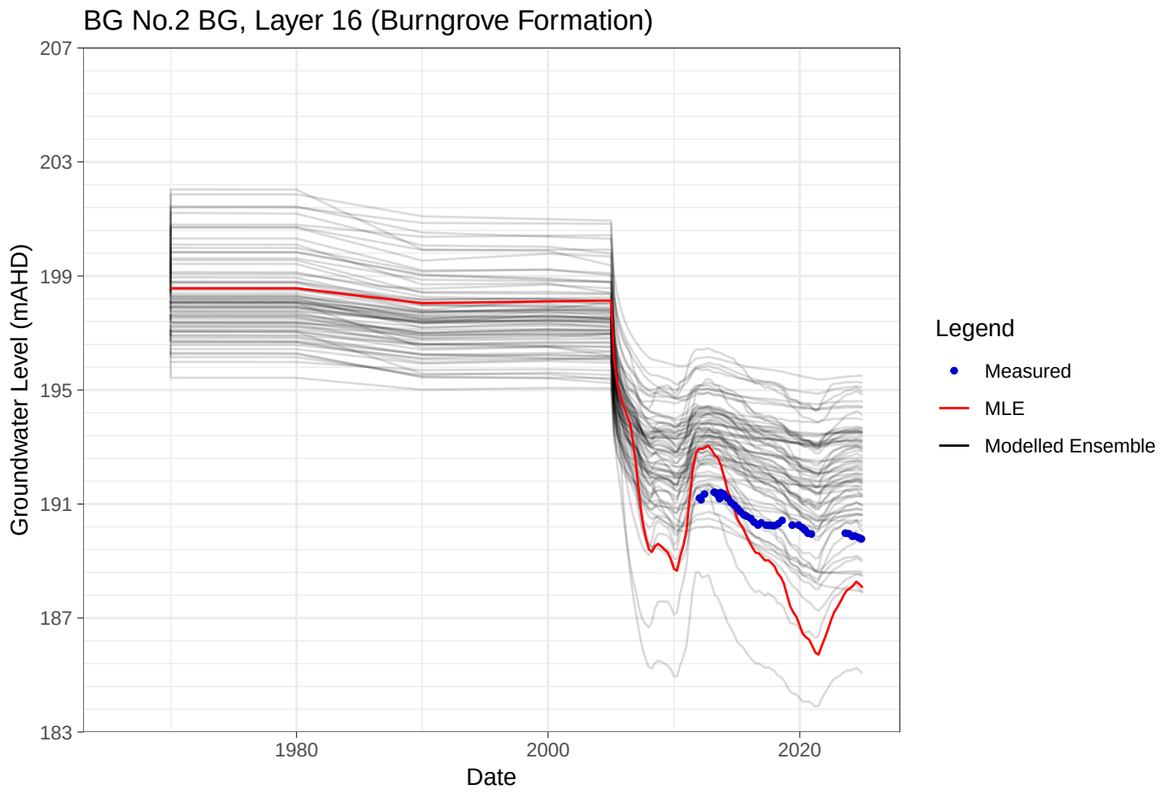

BWM_MB138_02, Layer 13 (RCM − Interburden)
Groundwater Level (mAHD)
277
273
269
265
261
257
253
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

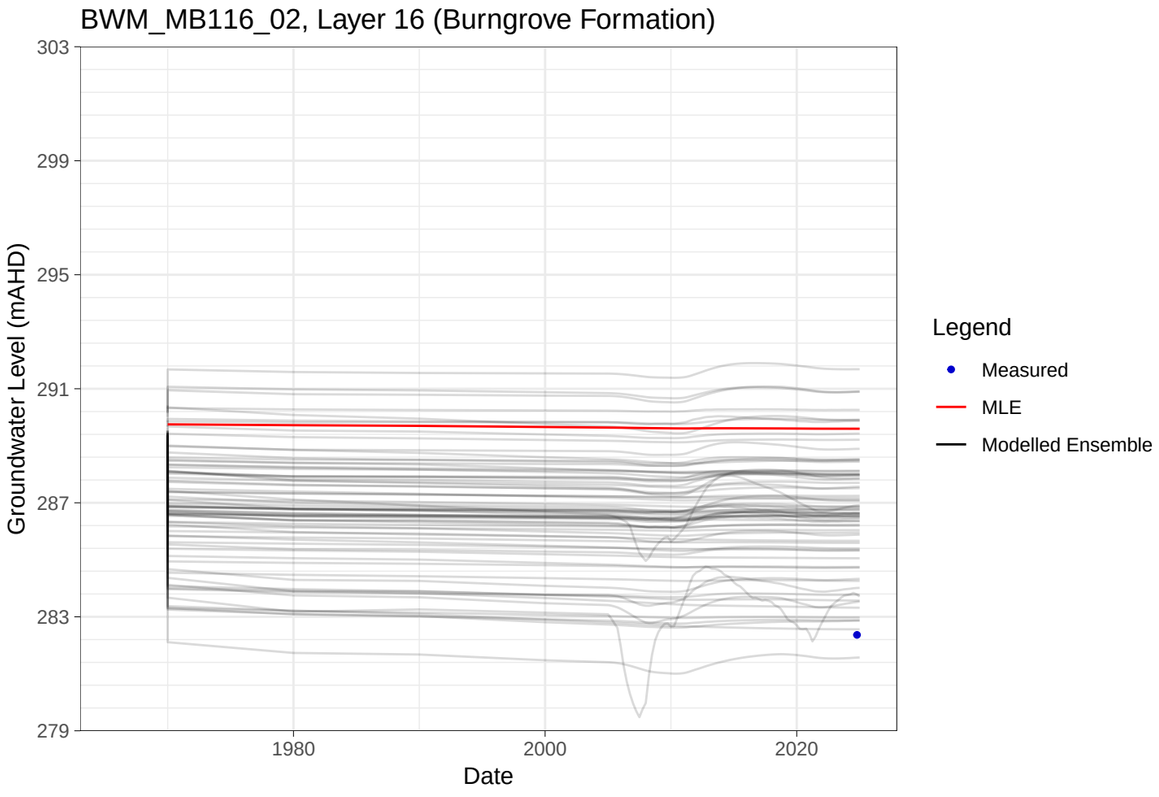

BWM_MB135_02, Layer 14 (RCM − Orion seam)
Groundwater Level (mAHD)
267
263
259
255
251
247
243
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

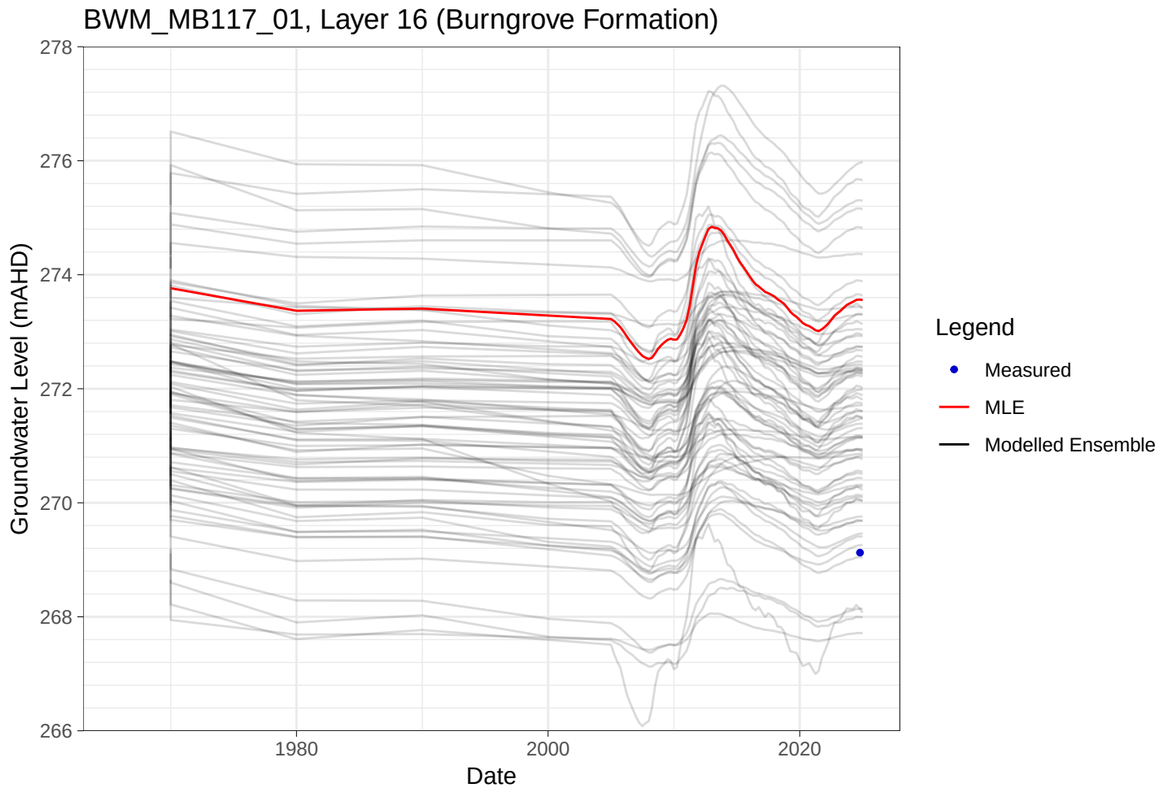

VWP19BWM02−5, Layer 14 (RCM − Orion seam)
Groundwater Level (mAHD)
251
231
211
191
171
151
131
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

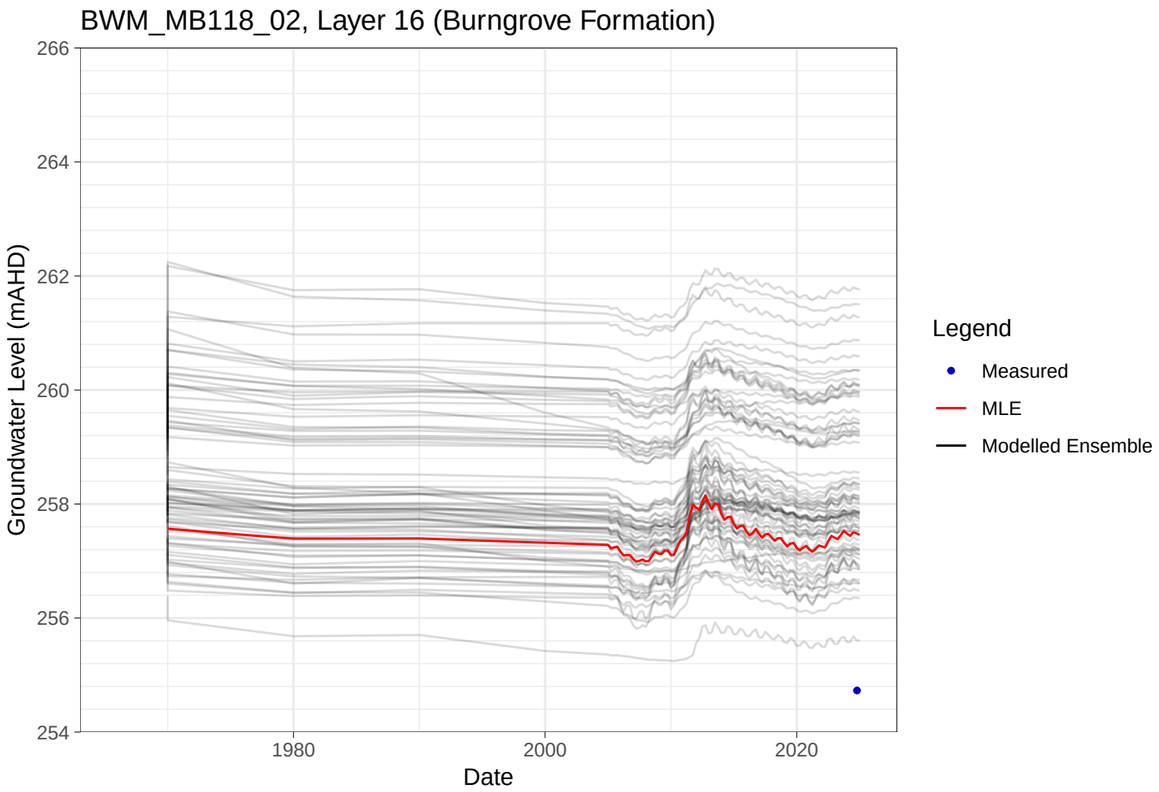

BG No.1 AP, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
190
188
186
184
182
180
178
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

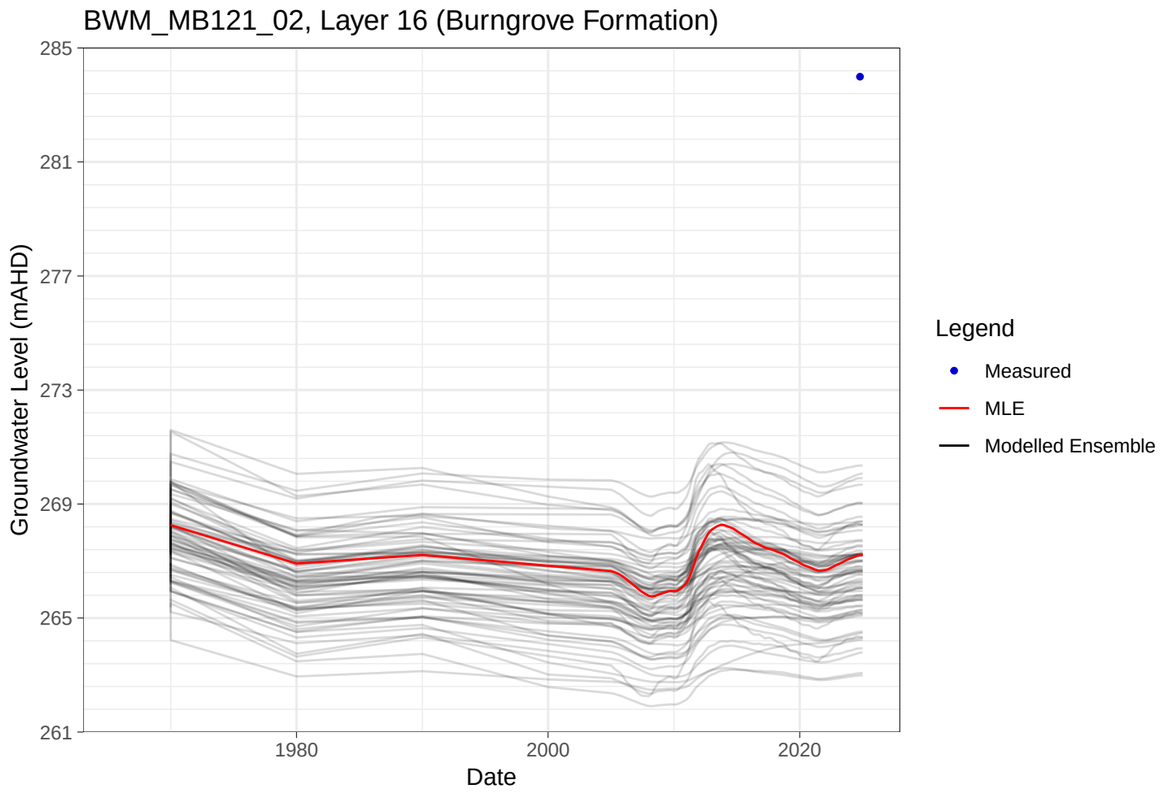

BG No.2 BG, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
207
203
199
195
191
187
183
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

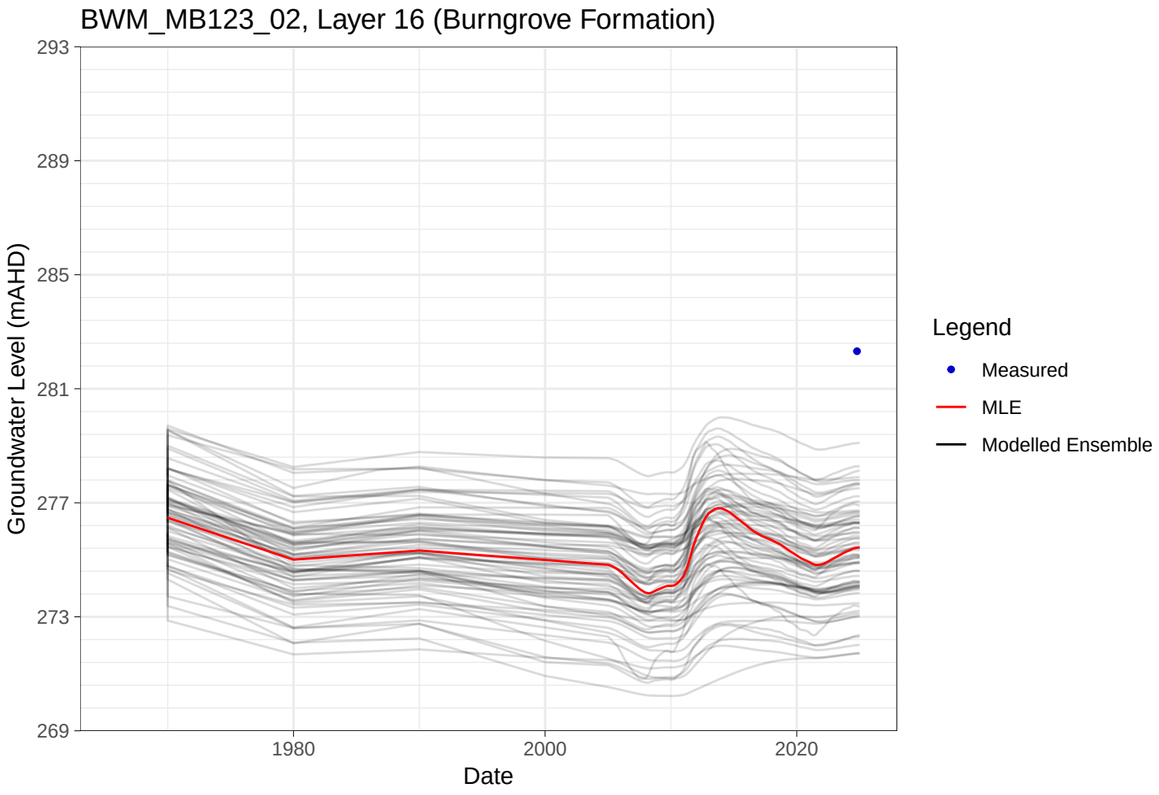

BWM_MB116_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
303
299
295
291
287
283
279
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

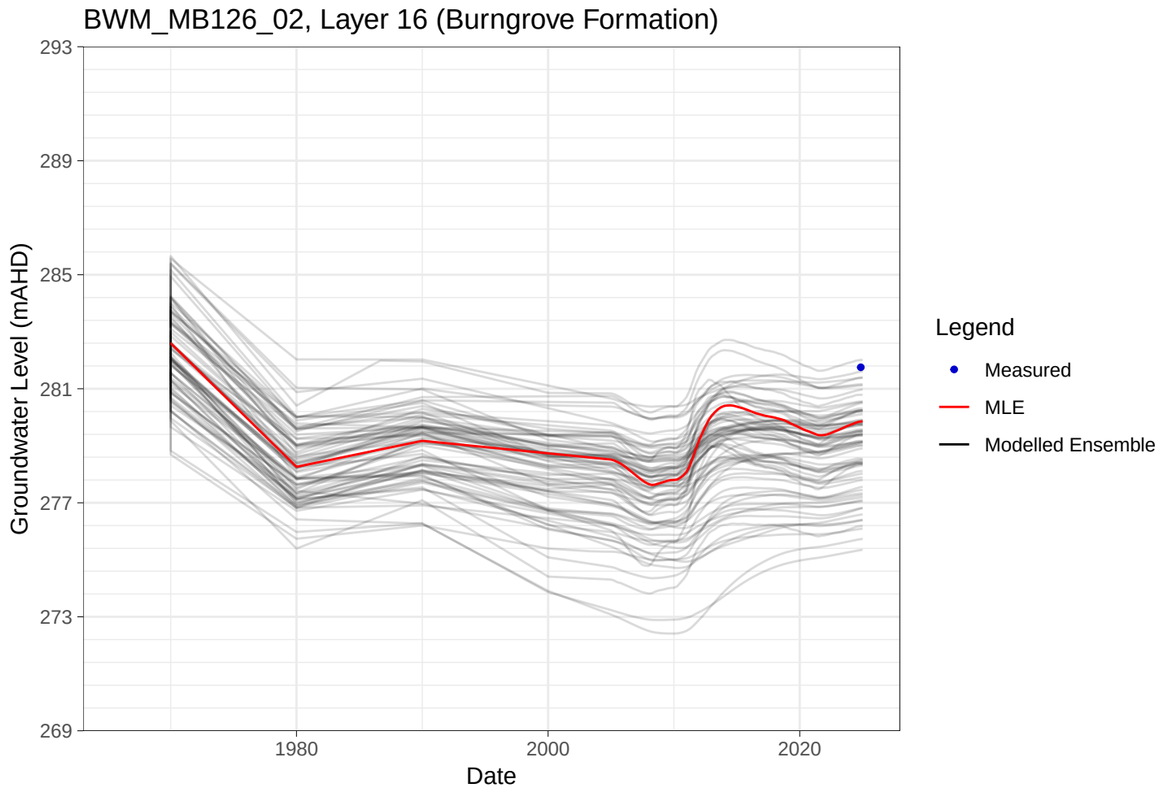

BWM_MB117_01, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
278
276
274
272
270
268
266
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

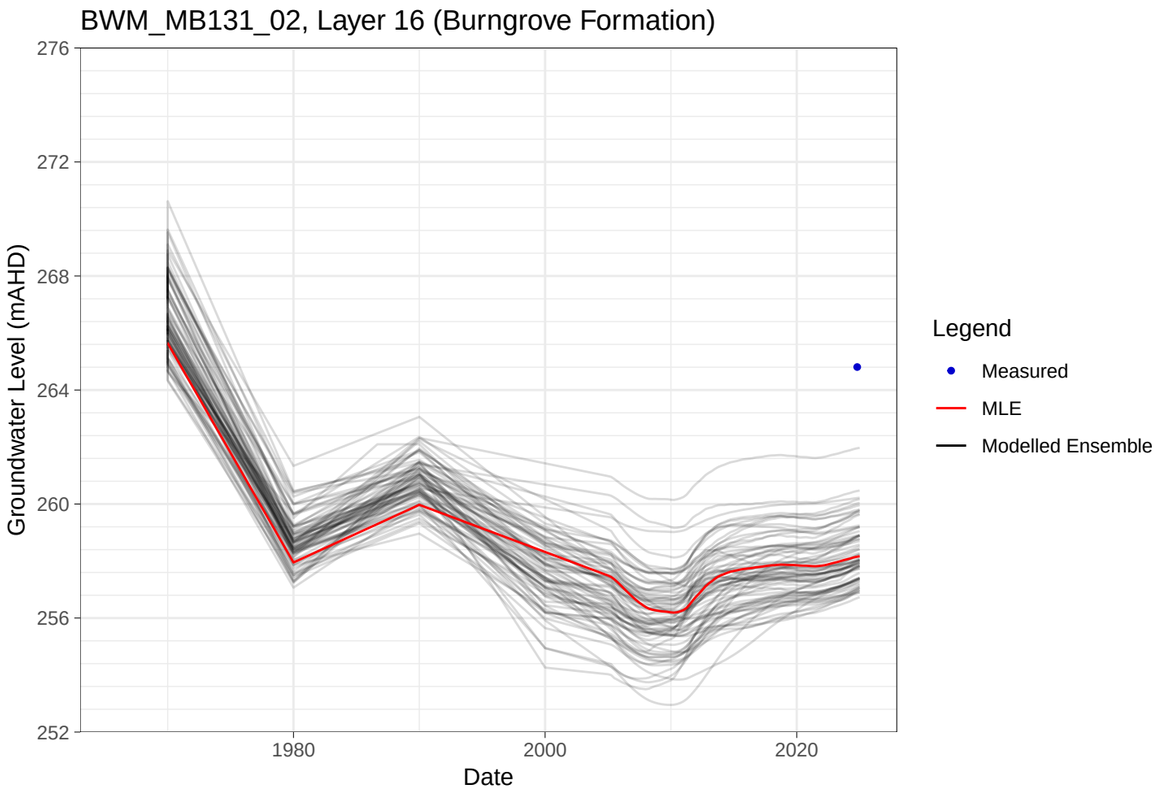

BWM_MB118_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
266
264
262
260
258
256
254
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

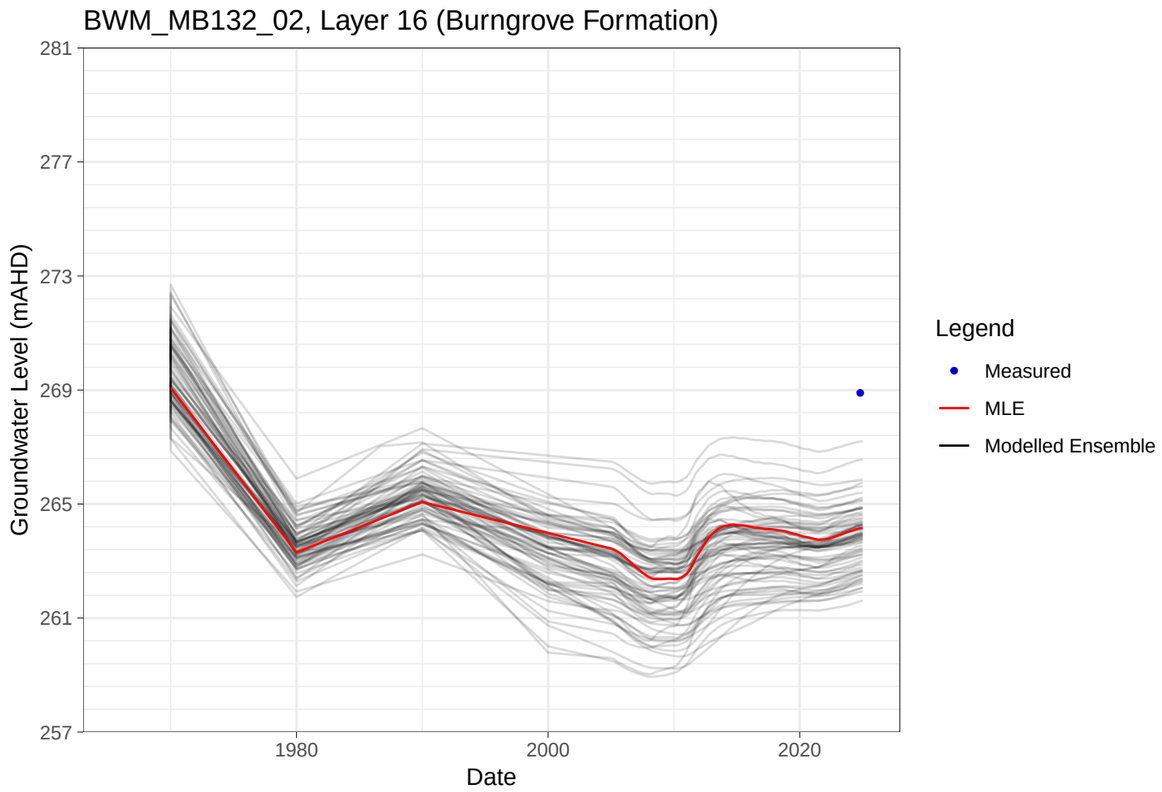

BWM_MB121_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
285
281
277
273
269
265
261
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

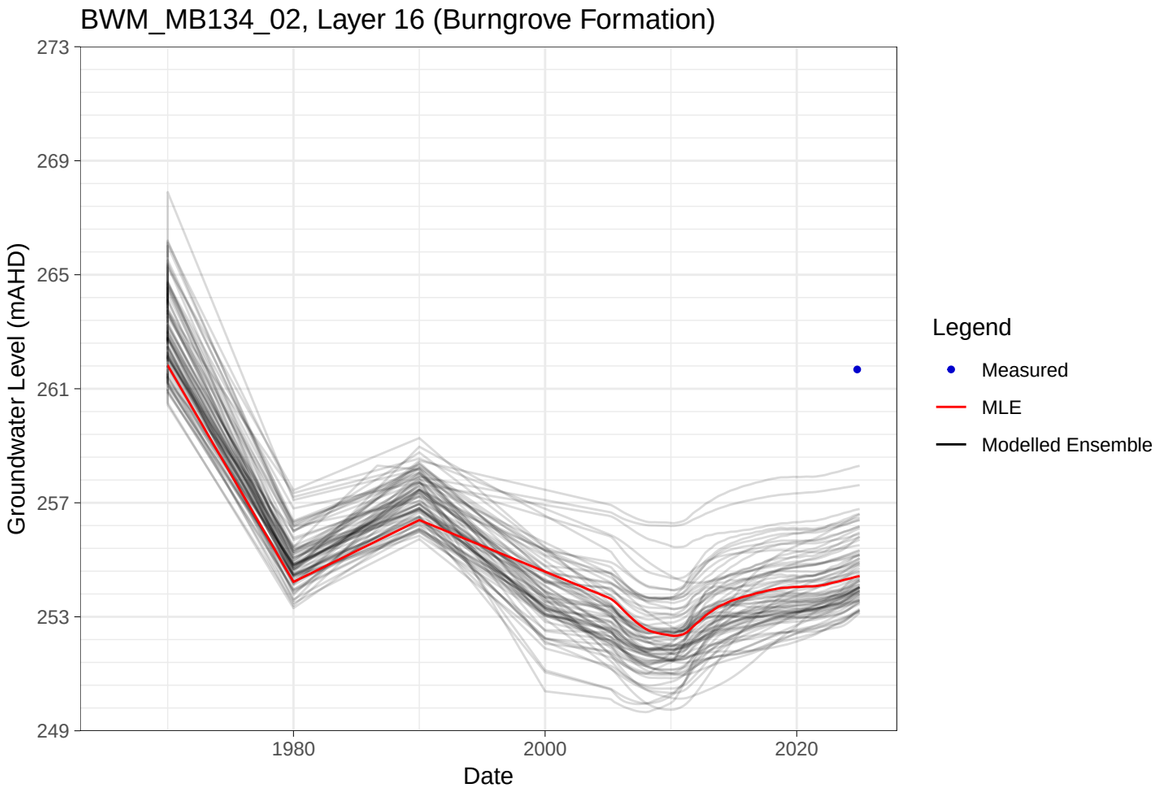

BWM_MB123_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
293
289
285
281
277
273
269
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

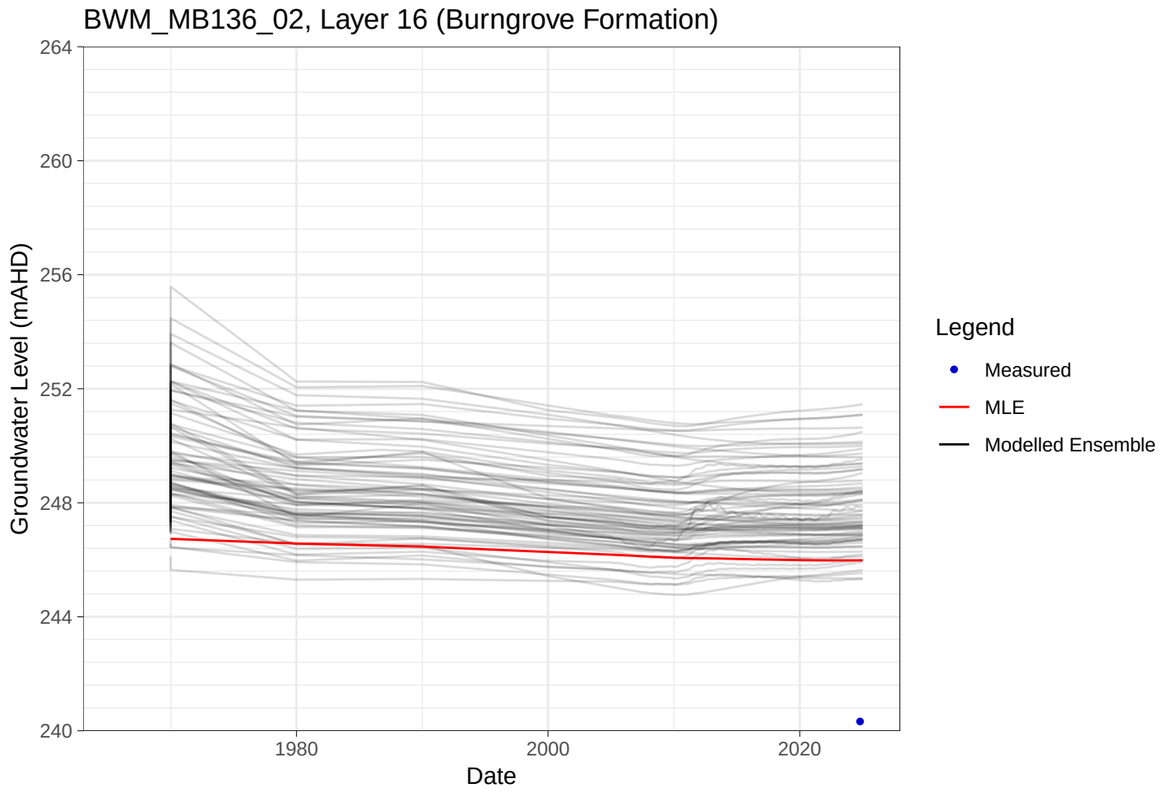

BWM_MB126_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
293
289
285
281
277
273
269
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

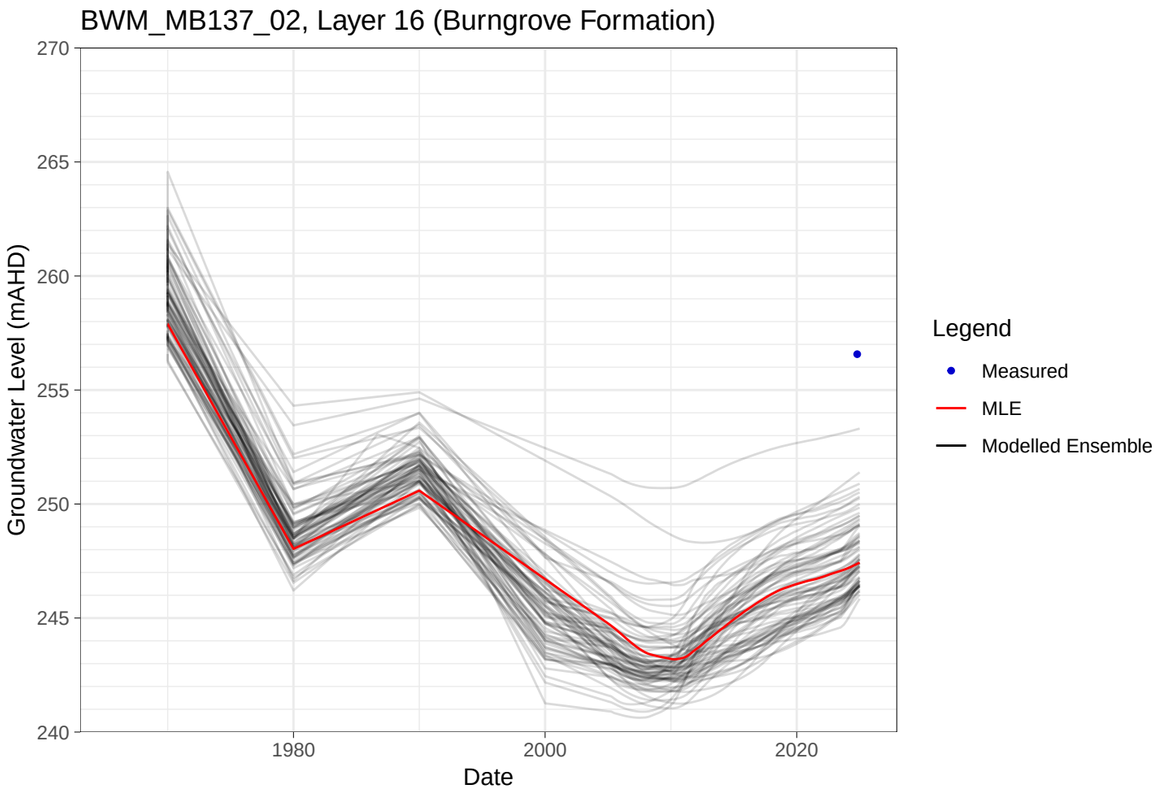

BWM_MB131_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
276
272
268
264
260
256
252
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

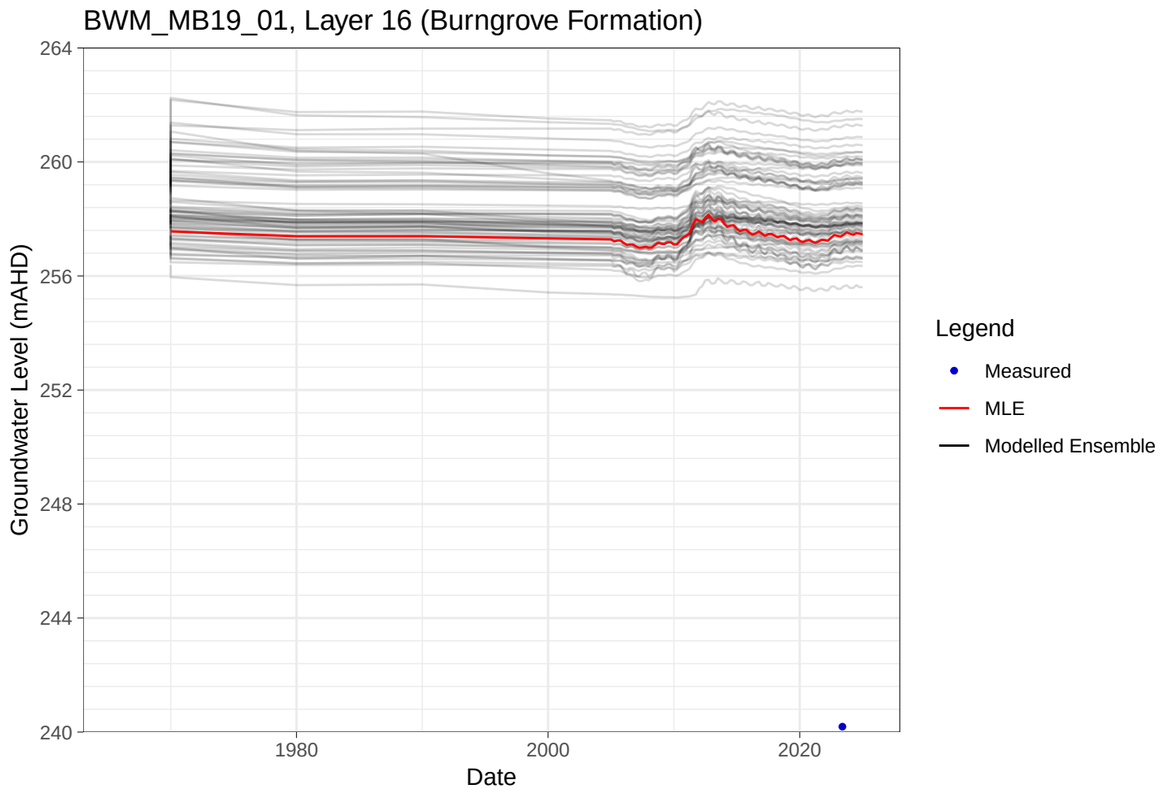

BWM_MB132_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
281
277
273
269
265
261
257
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

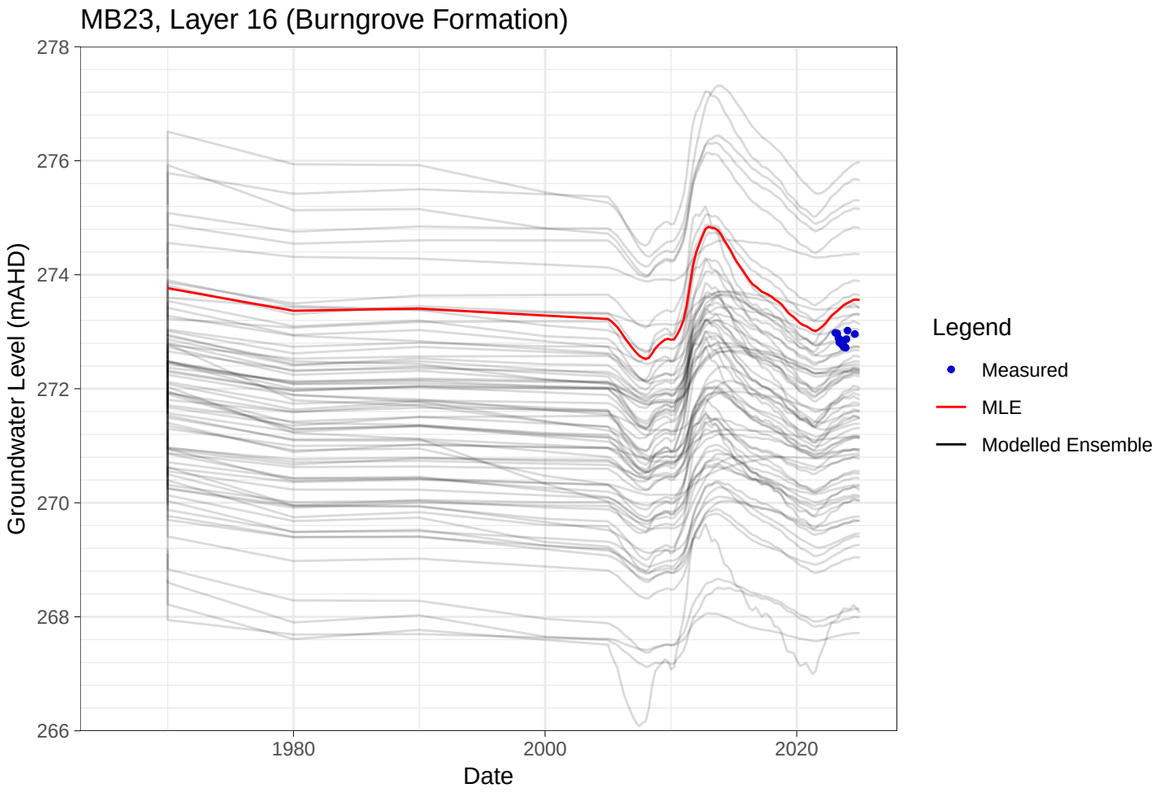

BWM_MB134_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
273
269
265
261
257
253
249
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

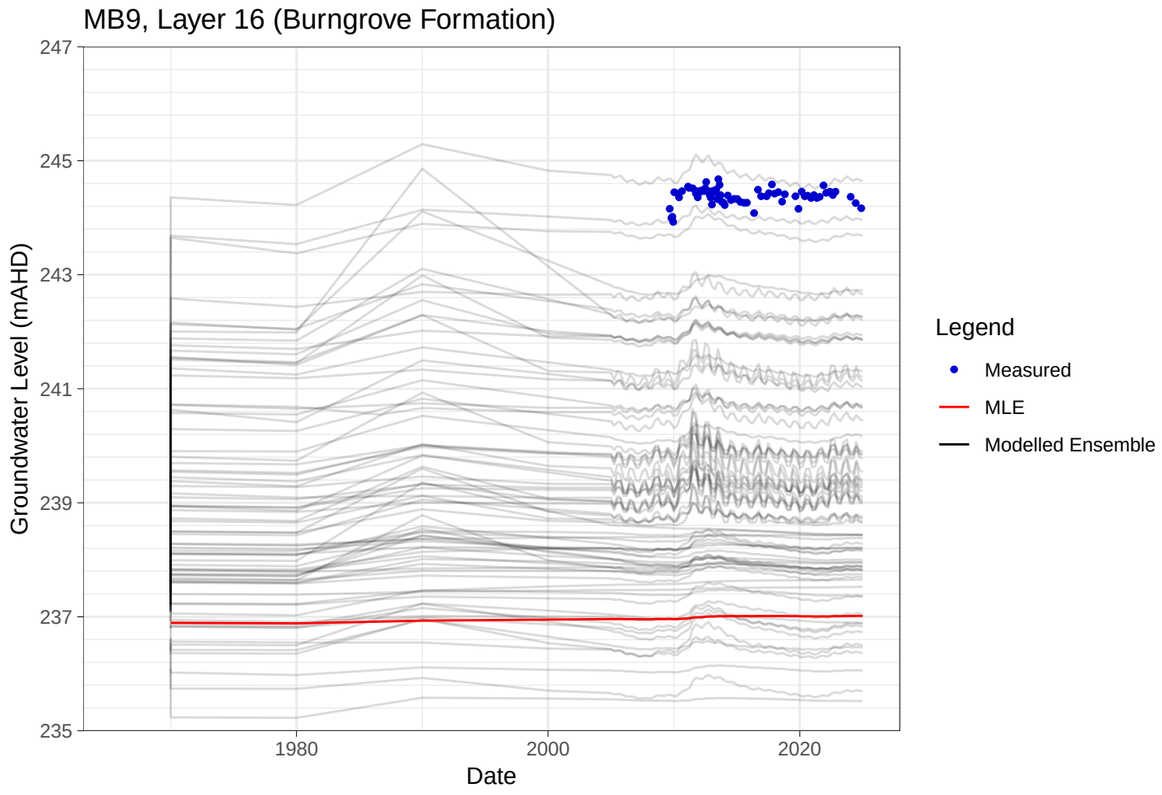

BWM_MB136_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
264
260
256
252
248
244
240
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,

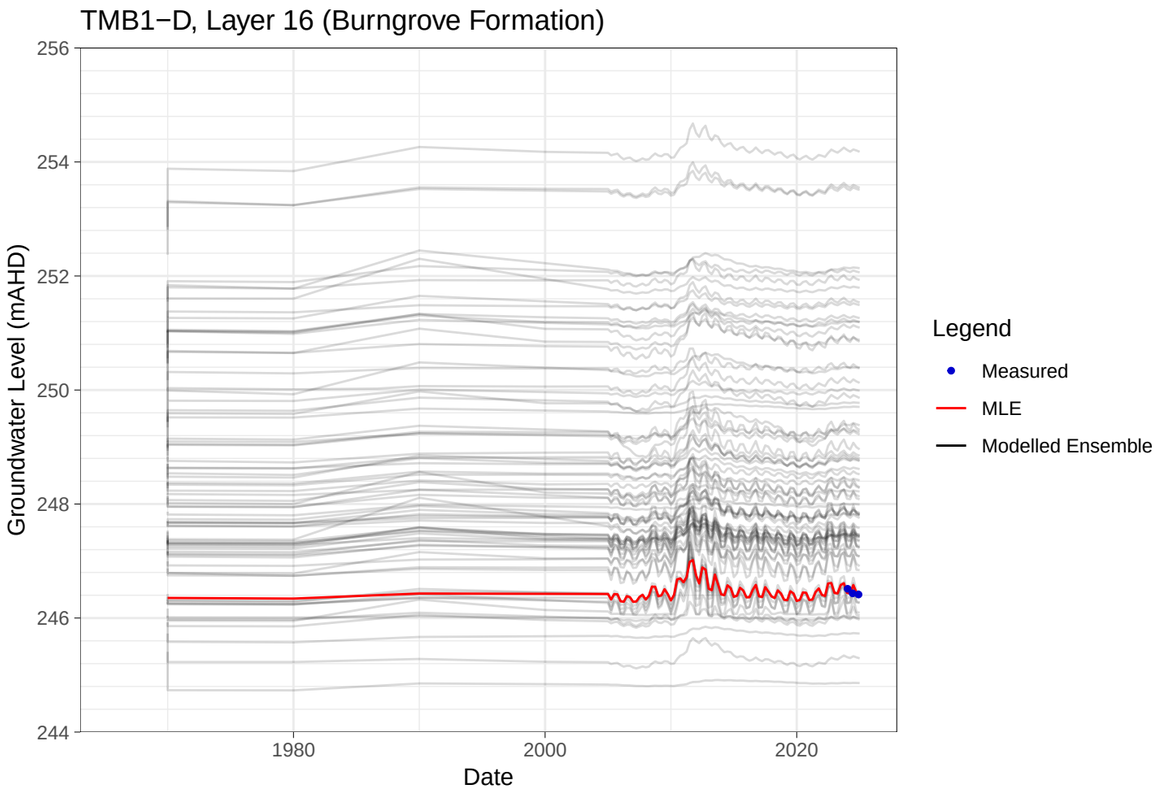

BWM_MB137_02, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
270
265
260
255
250
245
240
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

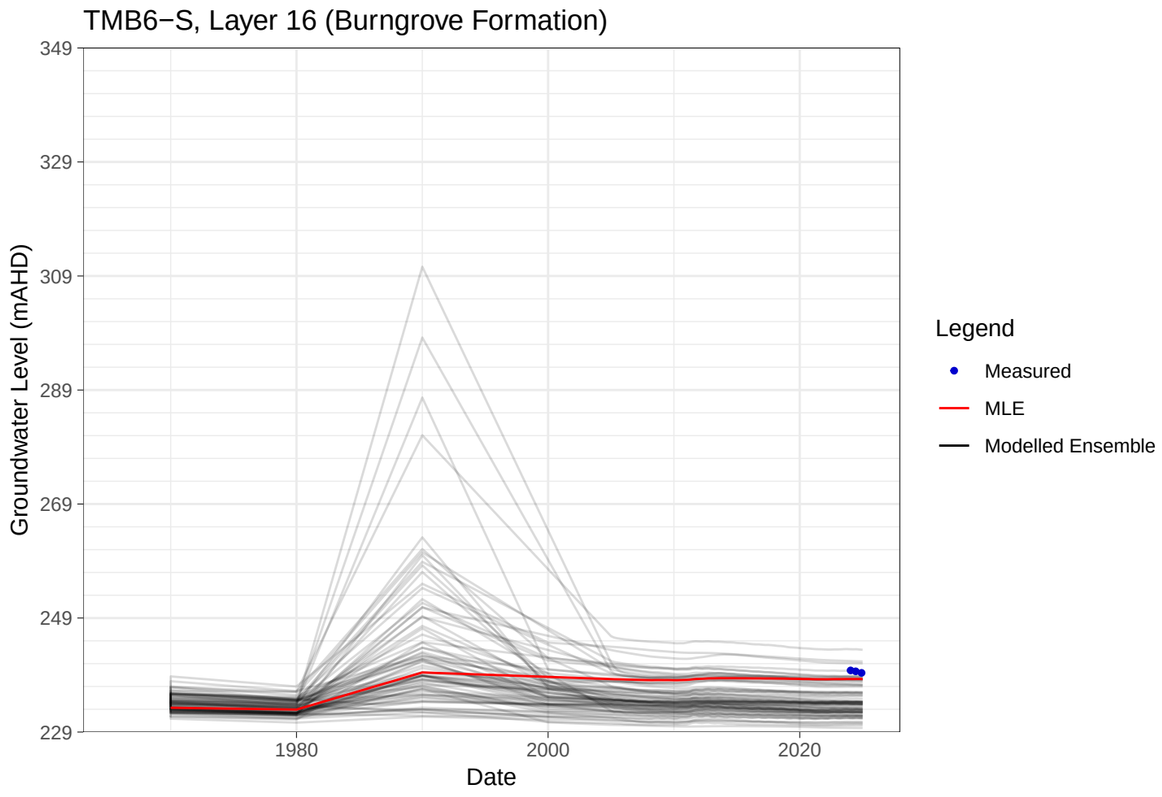

BWM_MB19_01, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
264
260
256
252
248
244
240
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

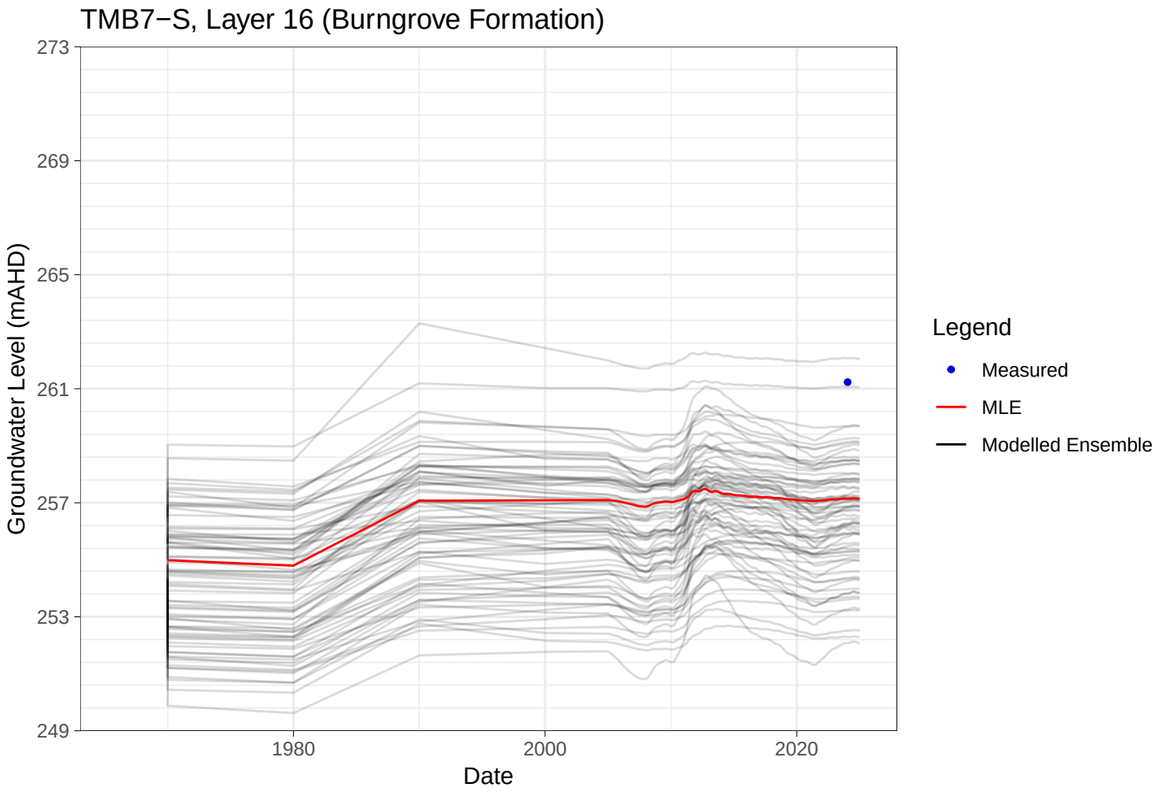

MB23, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
278
276
274
272
270
268
266
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

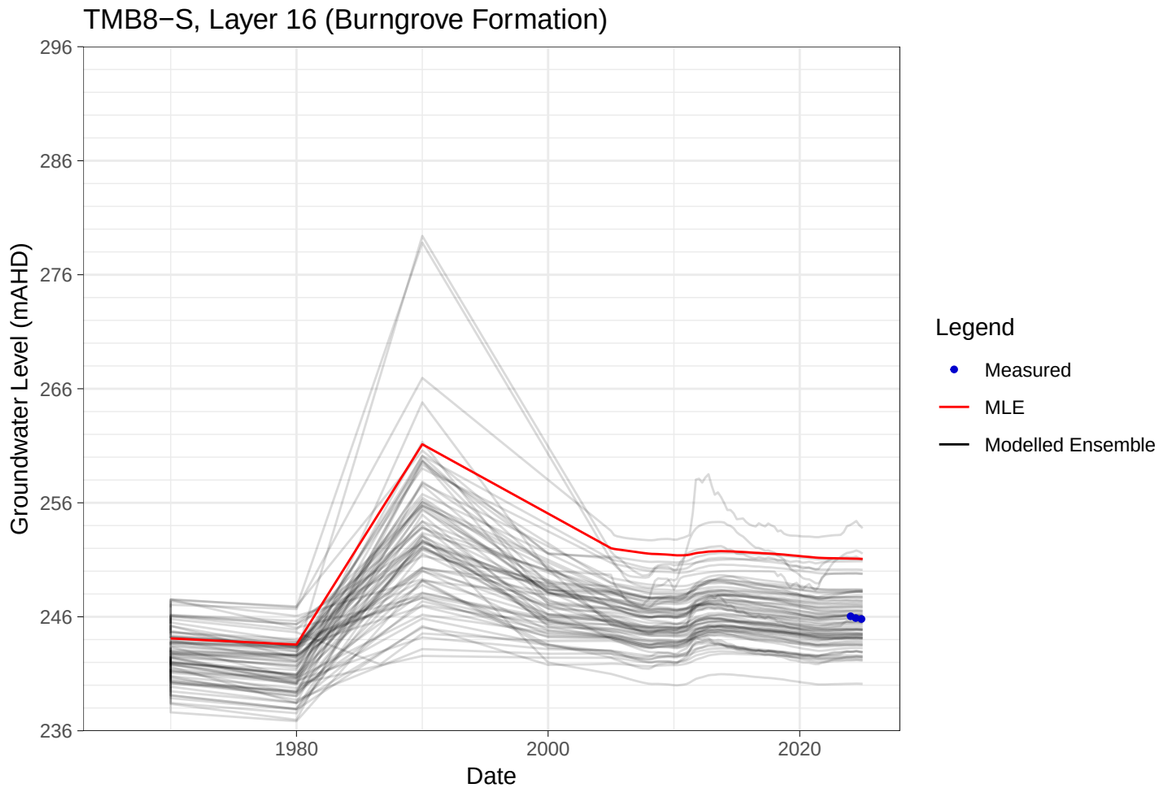

MB9, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
247
245
243
241
239
237
235
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

,


TMB1−D, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
256
254
252
250
248
246
244
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble


TMB6−S, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
349
329
309
289
269
249
229
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble


TMB7−S, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
273
269
265
261
257
253
249
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble


TMB8−S, Layer 16 (Burngrove Formation)
Groundwater Level (mAHD)
296
286
276
266
256
246
236
1980
2000
2020
Date
Legend
Measured
MLE
Modelled Ensemble

Appendix C Predictive Period Timing

Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

SLR Project No.: 640.031809.00001

7 October 2026

Interval	Stress Period	Date (from)	Date (to)	Blackwater North (OC)	Blackwater South (OC)	Cook Colliery (UG)
Annually	86	01-01-2025	31-12-2025	x	x	x
Annually	87	01-01-2026	31-12-2026	x	x	x
Annually	88	01-01-2027	31-12-2027	x	x	x
Annually	89	01-01-2028	31-12-2028	x	x	x
Annually	90	01-01-2029	31-12-2029	x	x	x
Annually	91	01-01-2030	31-12-2030	x	x	x
Annually	92	01-01-2031	31-12-2031	x	x	x
Annually	93	01-01-2032	31-12-2032	x	x	x
Annually	94	01-01-2033	31-12-2033	x	x	x
Annually	95	01-01-2034	31-12-2034	x	x	x
Annually	96	01-01-2035	31-12-2035	x	x	x
Annually	97	01-01-2036	31-12-2036	x	x	x
Annually	98	01-01-2037	31-12-2037	x	x	x
Annually	99	01-01-2038	31-12-2038	x	x	x
Annually	100	01-01-2039	31-12-2039	x	x	x
Annually	101	01-01-2040	31-12-2040	x	x	x
Annually	102	01-01-2041	31-12-2041	x	x	x
Annually	103	01-01-2042	31-12-2042	x	x	x
Annually	104	01-01-2043	31-12-2043	x	x	x
Annually	105	01-01-2044	31-12-2044	x	x	x
Annually	106	01-01-2045	31-12-2045	x	x	x
Annually	107	01-01-2046	31-12-2046	x	x	x
Annually	108	01-01-2047	31-12-2047	x	x	x
Annually	109	01-01-2048	31-12-2048	x	x	x
Annually	110	01-01-2049	31-12-2049	x	x	x
Annually	111	01-01-2050	31-12-2050	x	x	x
Annually	112	01-01-2051	31-12-2051	x	x	x
Annually	113	01-01-2052	31-12-2052	x	x	x
Annually	114	01-01-2053	31-12-2053	x	x	x
Annually	115	01-01-2054	31-12-2054	x	x	x
Annually	116	01-01-2055	31-12-2055	x	x	x
Annually	117	01-01-2056	31-12-2056		x	x
Annually	118	01-01-2057	31-12-2057		x	x
Annually	119	01-01-2058	31-12-2058		x	x
Annually	120	01-01-2059	31-12-2059		x	x
Annually	121	01-01-2060	31-12-2060		x	x



Interval	Stress Period	Date (from)	Date (to)	Blackwater North (OC)	Blackwater South (OC)	Cook Colliery (UG)
Annually	122	01-01-2061	31-12-2061		x	x
Annually	123	01-01-2062	31-12-2062		x	x
Annually	124	01-01-2063	31-12-2063		x	x
Annually	125	01-01-2064	31-12-2064		x	x
Annually	126	01-01-2065	31-12-2065		x	x
Annually	127	01-01-2066	31-12-2066		x	x
Annually	128	01-01-2067	31-12-2067		x	x
Annually	129	01-01-2068	31-12-2068		x	x
Annually	130	01-01-2069	31-12-2069		x	x
Annually	131	01-01-2070	31-12-2070		x	x
Annually	132	01-01-2071	31-12-2071		x	x
Annually	133	01-01-2072	31-12-2072		x	x
Annually	134	01-01-2073	31-12-2073		x	x
Annually	135	01-01-2074	31-12-2074		x	x
Annually	136	01-01-2075	31-12-2075		x	x
Annually	137	01-01-2076	31-12-2076		x	x
Annually	138	01-01-2077	31-12-2077		x	x
Annually	139	01-01-2078	31-12-2078		x	
Annually	140	01-01-2079	31-12-2079		x	
Annually	141	01-01-2080	31-12-2080		x	
Annually	142	01-01-2081	31-12-2081		x	
Annually	143	01-01-2082	31-12-2082		x	
Annually	144	01-01-2083	31-12-2083		x	
Annually	145	01-01-2084	31-12-2084		x	
Annually	146	01-01-2085	31-12-2085		x	
Annually	147	01-01-2086	31-12-2086		x	
Annually	148	01-01-2087	31-12-2087		x	
Annually	149	01-01-2088	31-12-2088		x	
Annually	150	01-01-2089	31-12-2089		x	
Annually	151	01-01-2090	31-12-2090		x	
Annually	152	01-01-2091	31-12-2091		x	
Annually	153	01-01-2092	31-12-2092		x	
Annually	154	01-01-2093	31-12-2093		x	

Appendix D Post-mining predicted water levels

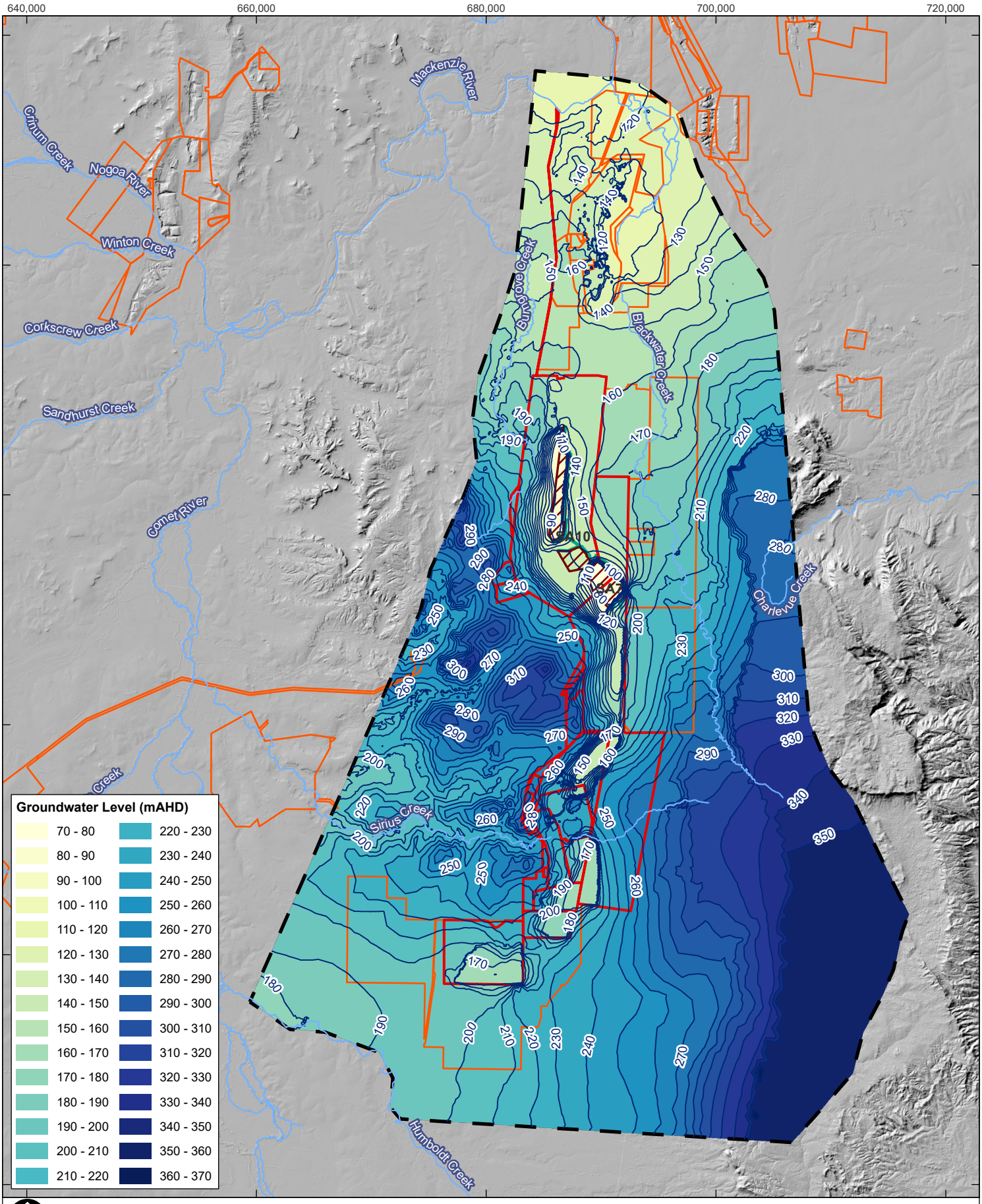
Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

SLR Project No.: 640.031809.00001

7 October 2026



BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER ASSESSMENT

GROUNDWATER TABLE RECOVERY (POST-MINING)

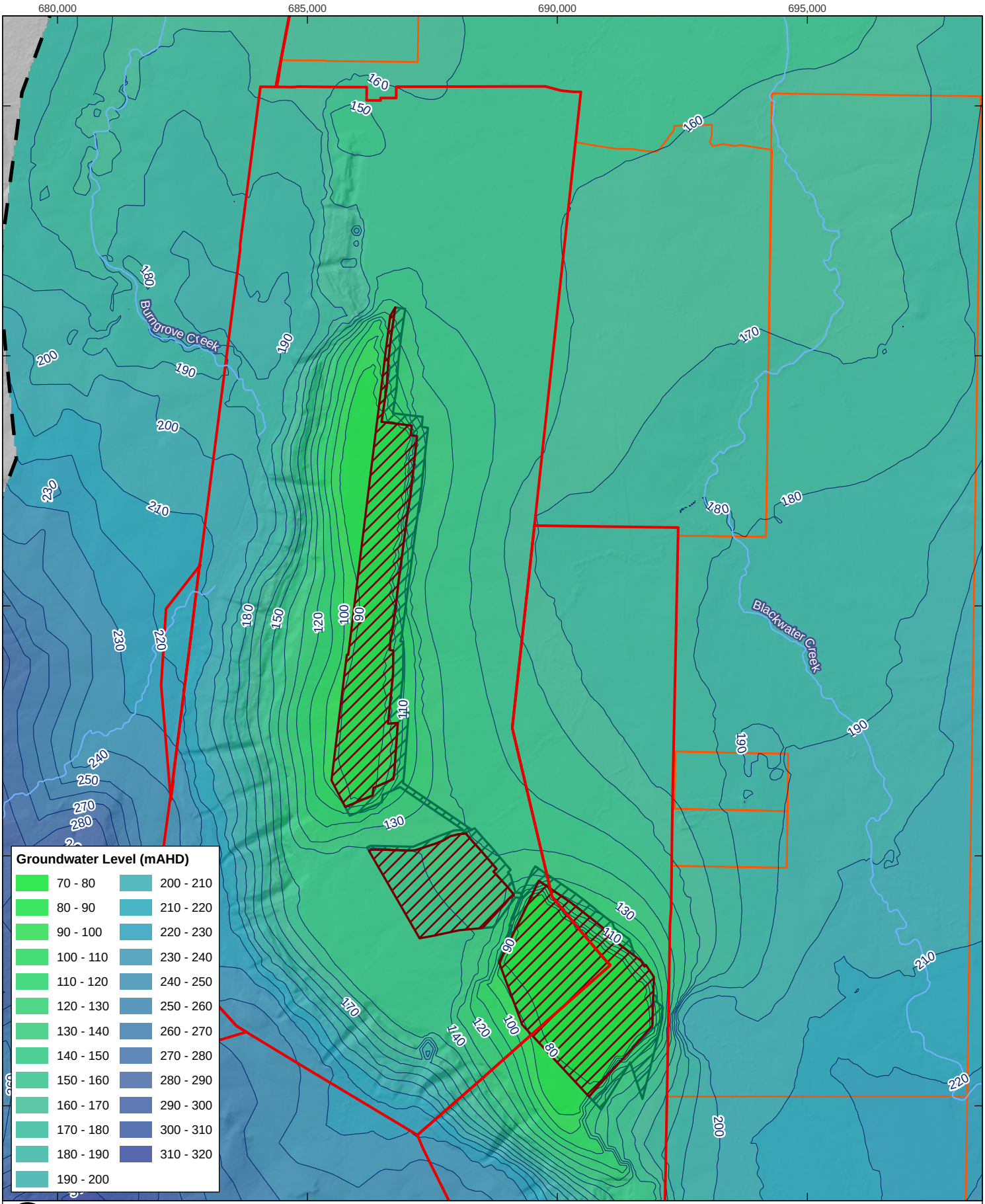
Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:433,846 at A4
Project Number:	640.031809.00001
Date Drawn:	16-Feb-2026
Drawn by:	RB

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_F05_08_Groundwater Table Recovery (post-mining)



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	RB

LEGEND

- Groundwater Level Contour (m)
- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

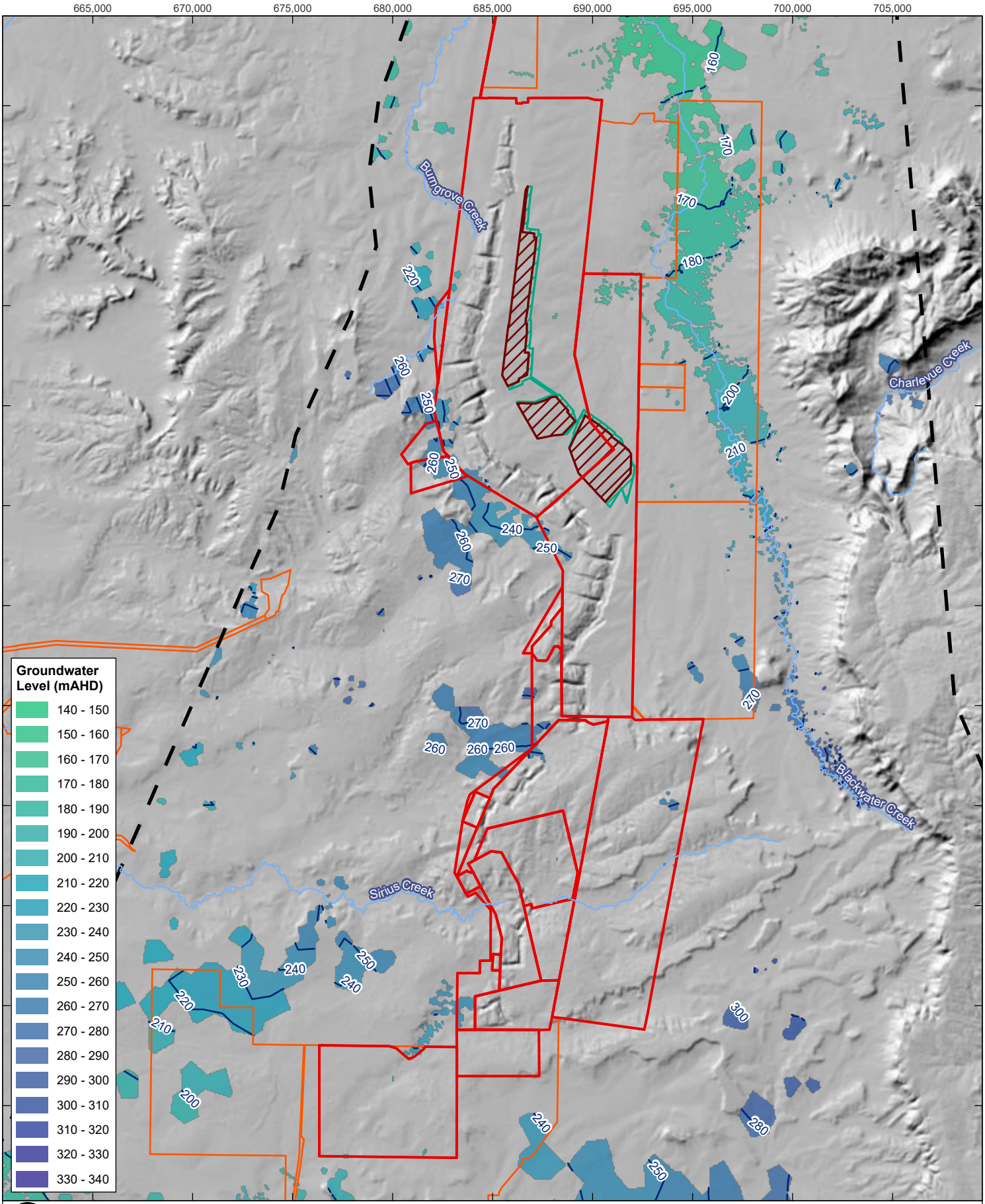
GROUNDWATER TABLE RECOVERY (POST-MINING) - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-2

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Groundwater Table Recovery (post-mining)



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

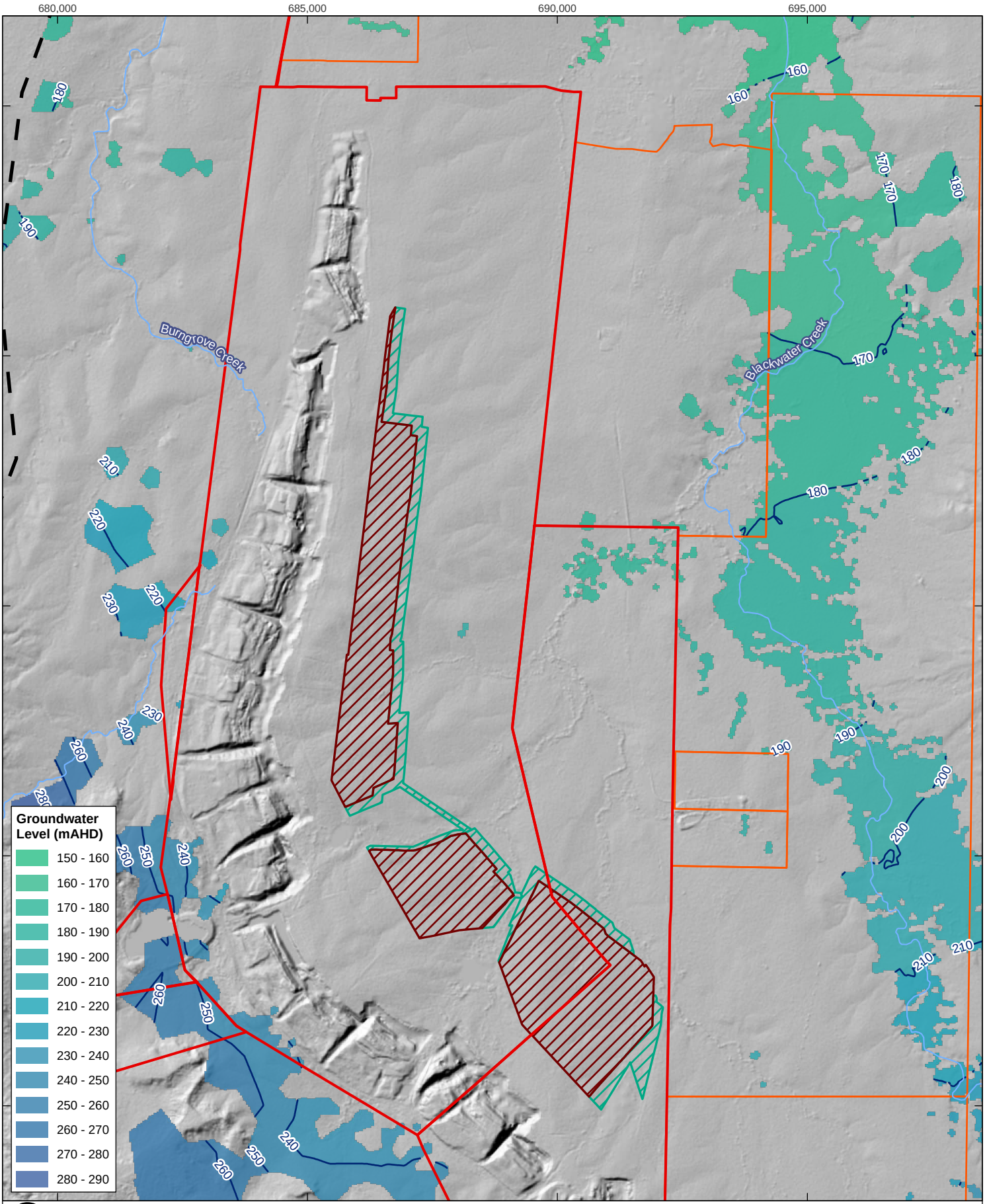
PREDICTED WATER LEVEL
WITHIN TERTIARY SEDIMENTS (LAYER 1)
AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-3

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

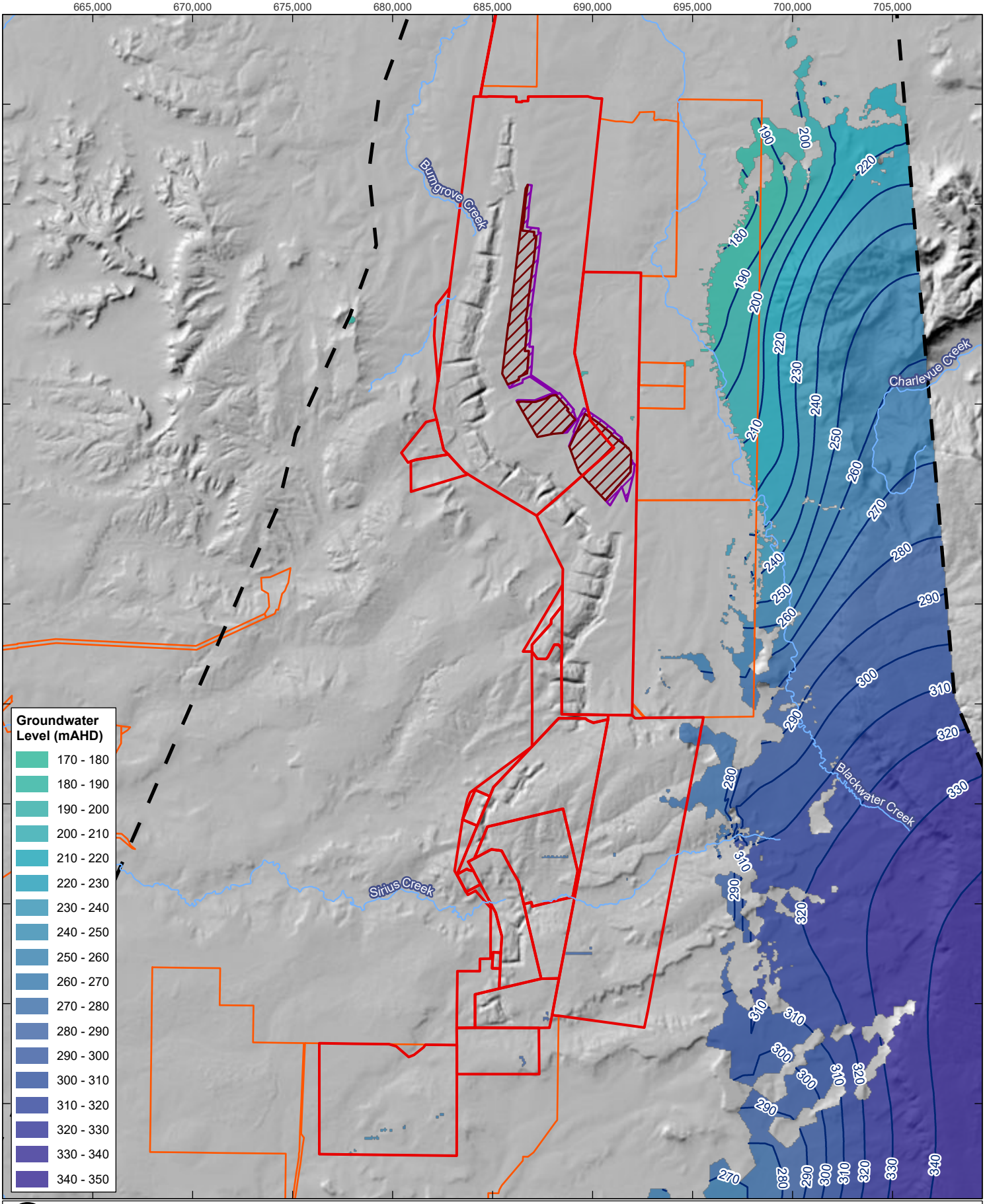
PREDICTED WATER LEVEL WITHIN TERTIARY SEDIMENTS (LAYER 1) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-4

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within Tertiary Sediments (Layer 1) at PME



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

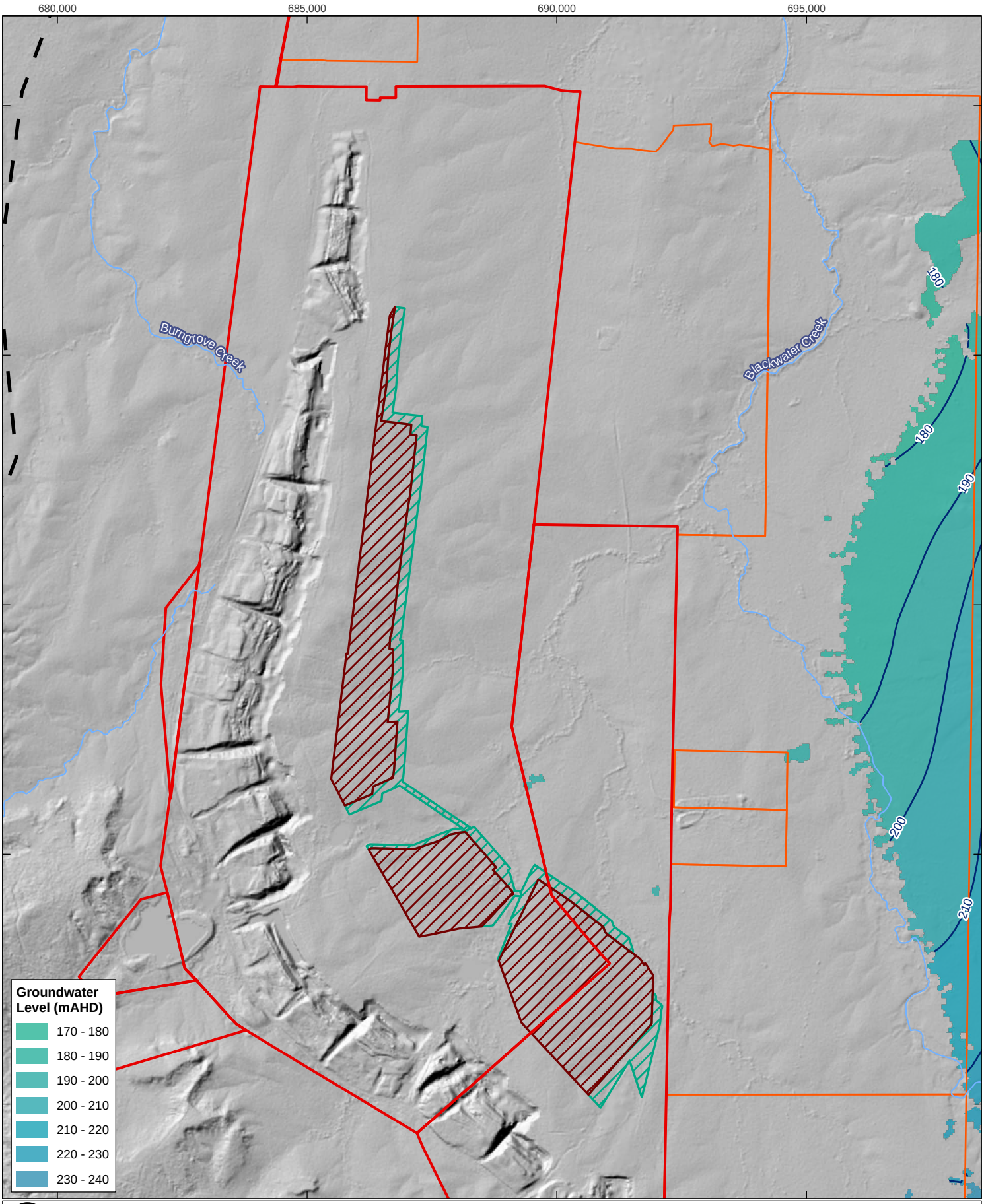
PREDICTED WATER LEVEL
WITHIN REWAN FORMATION - UPPER (LAYER 4)
AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-5

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

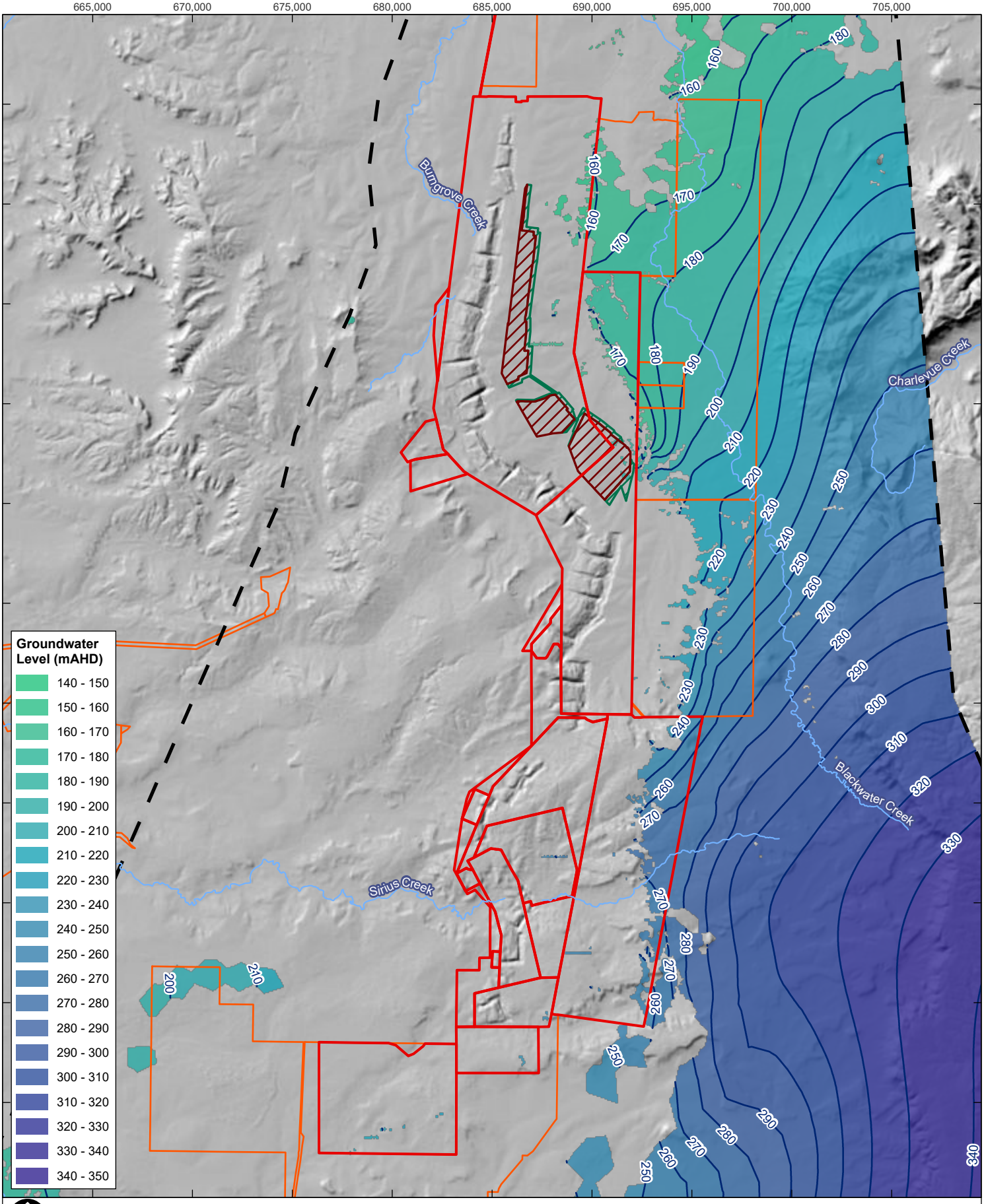
PREDICTED WATER LEVEL WITHIN REWAN FORMATION - UPPER (LAYER 4) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-6

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within Rewan Formation - Upper (Layer 4) at PME



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

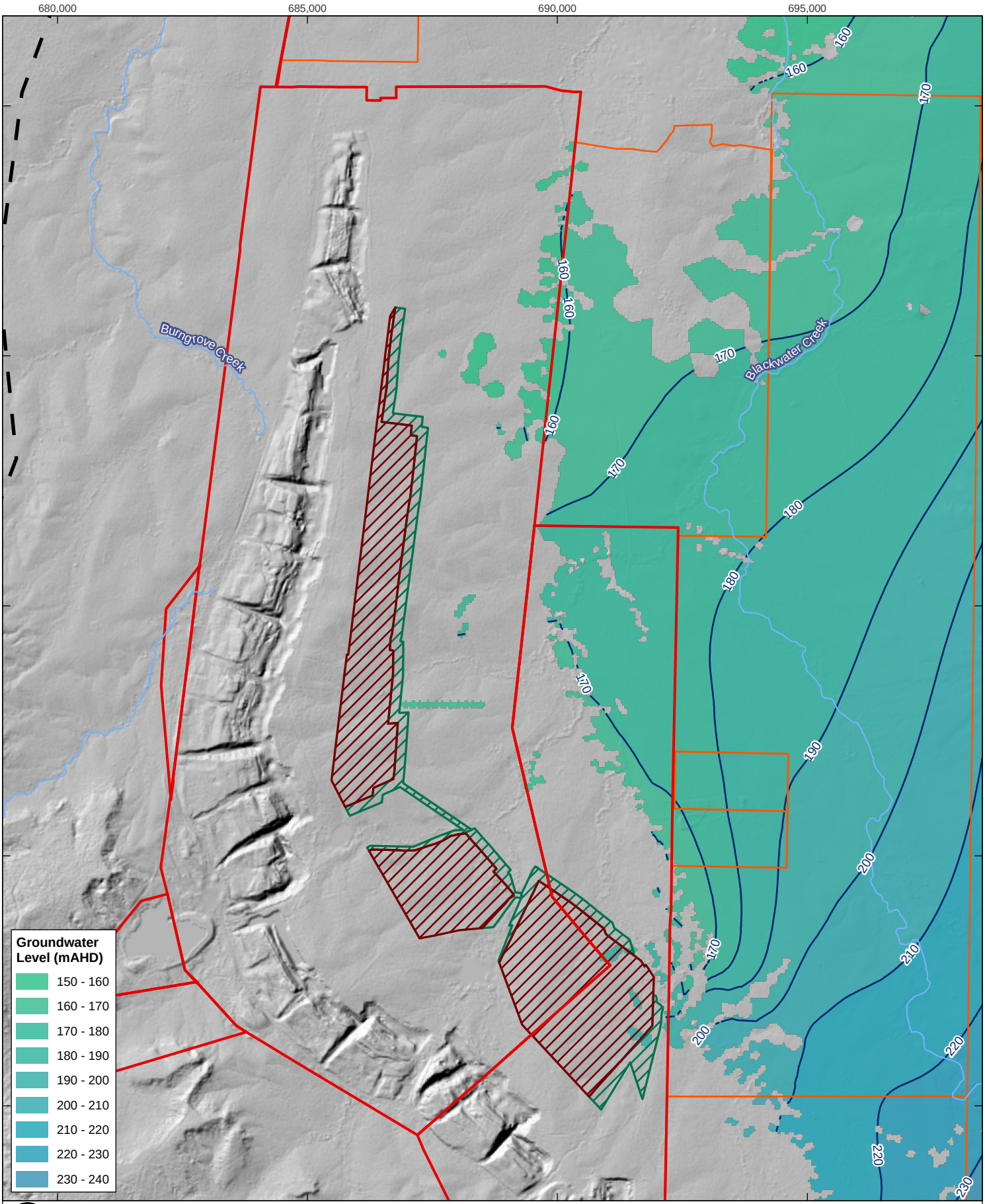
PREDICTED WATER LEVEL
WITHIN REWAN FORMATION - MIDDLE (LAYER 5)
AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-7

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

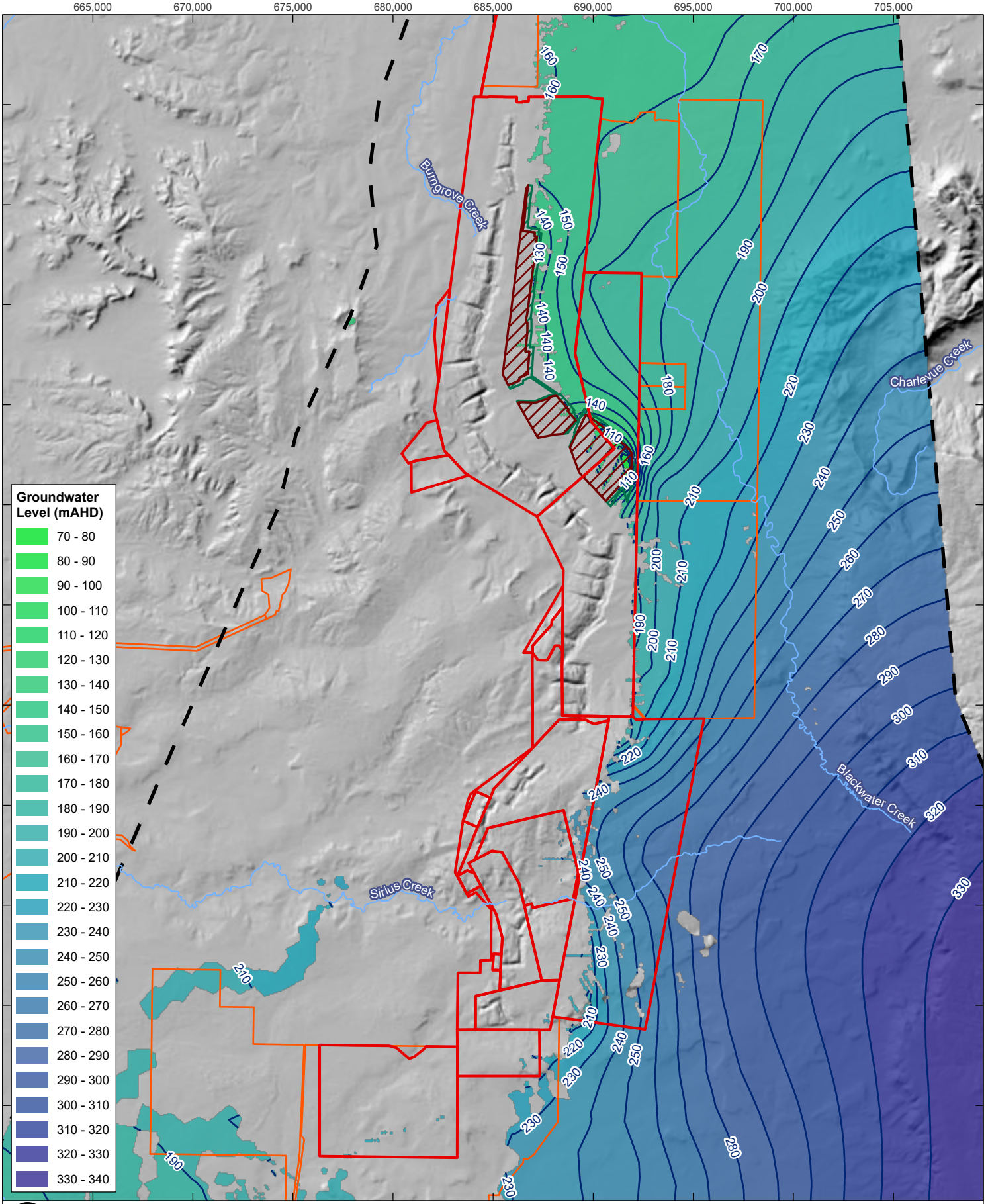
PREDICTED WATER LEVEL WITHIN REWAN FORMATION - MIDDLE (LAYER 5) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-8

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within Rewan Formation - Middle (Layer 5) at PME



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

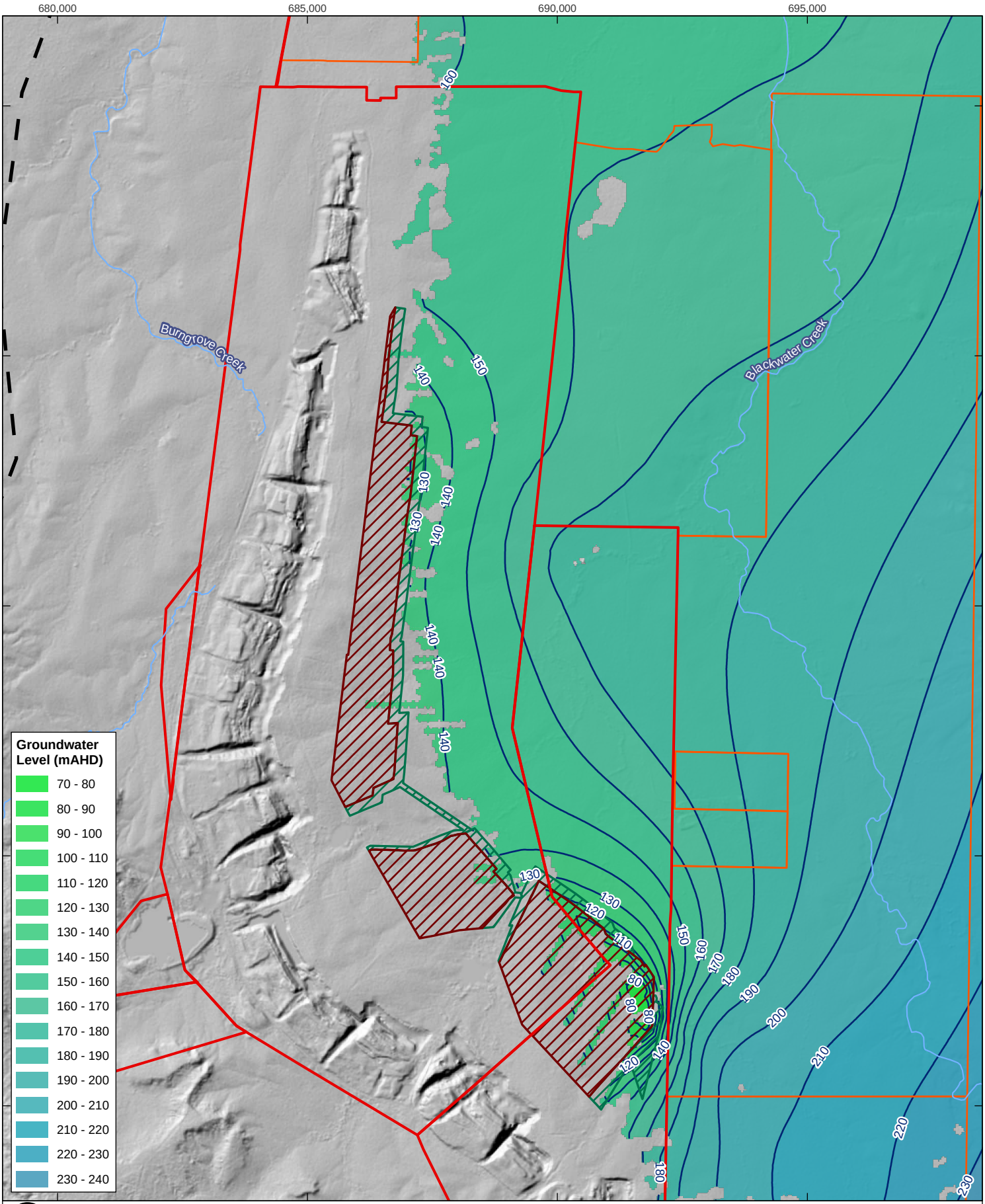
PREDICTED WATER LEVEL
WITHIN REWAN FORMATION - LOWER (LAYER 6)
AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-9

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

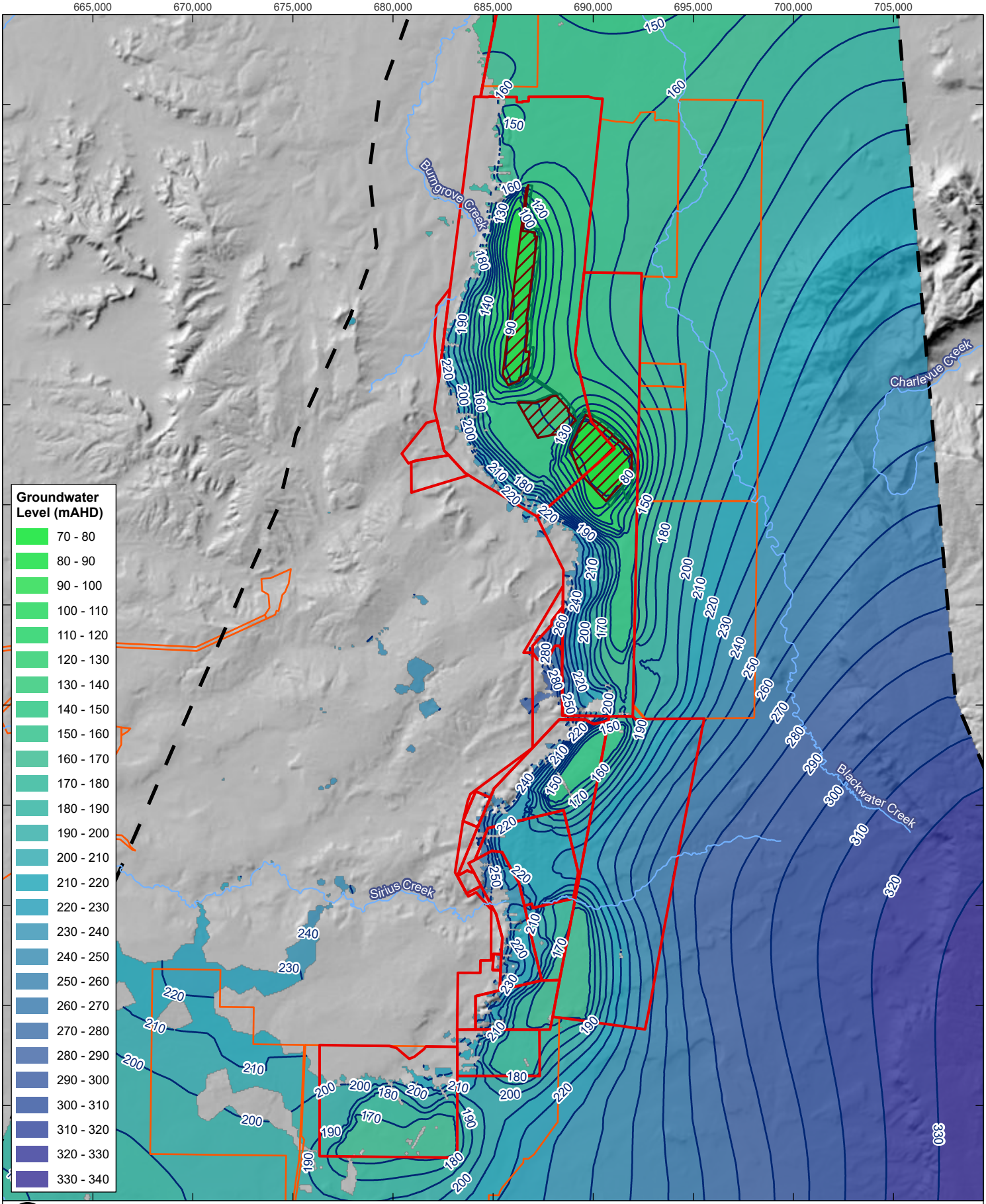
PREDICTED WATER LEVEL WITHIN REWAN FORMATION - LOWER (LAYER 6) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-10

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within Rewan Formation - Lower (Layer 6) at PME



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

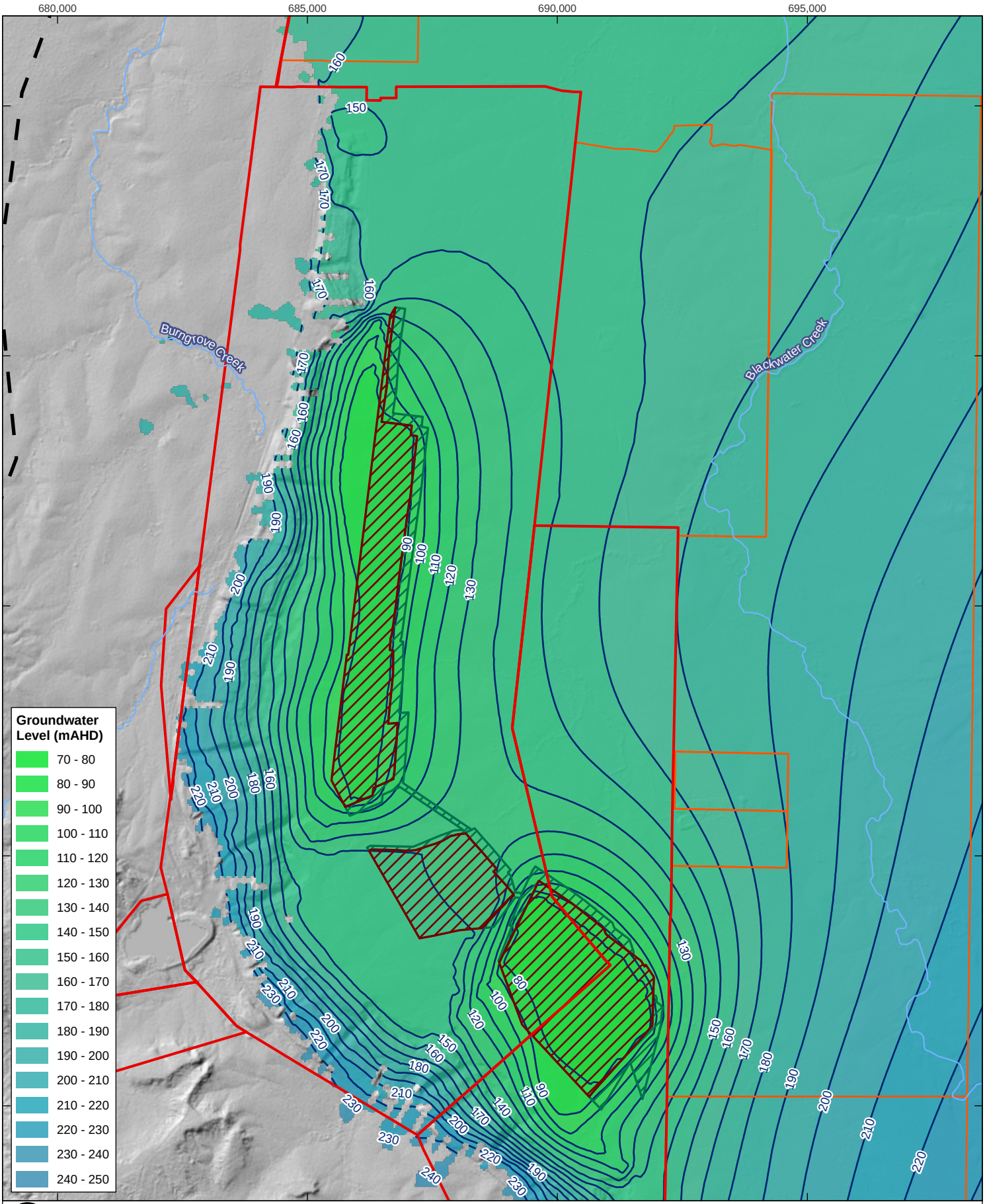
PREDICTED WATER LEVEL WITHIN RCM REPRESENTATIVE COAL SEAM (POLLUX) (LAYER 12) AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-11

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

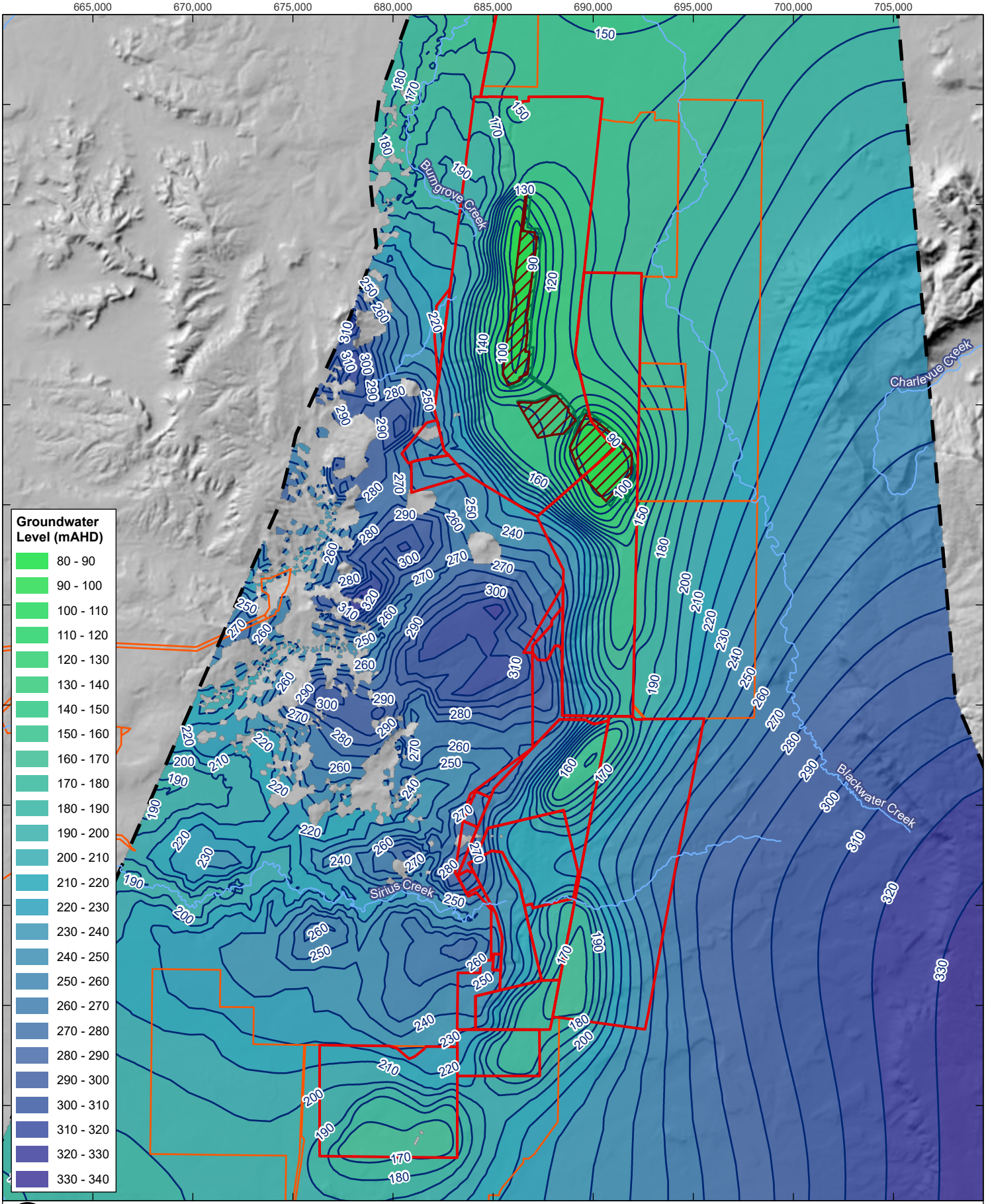
PREDICTED WATER LEVEL WITHIN RCM REPRESENTATIVE COAL SEAM (POLLUX) (LAYER 12) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-12

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within RCM Pollux (Layer 12) at PME



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	20-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

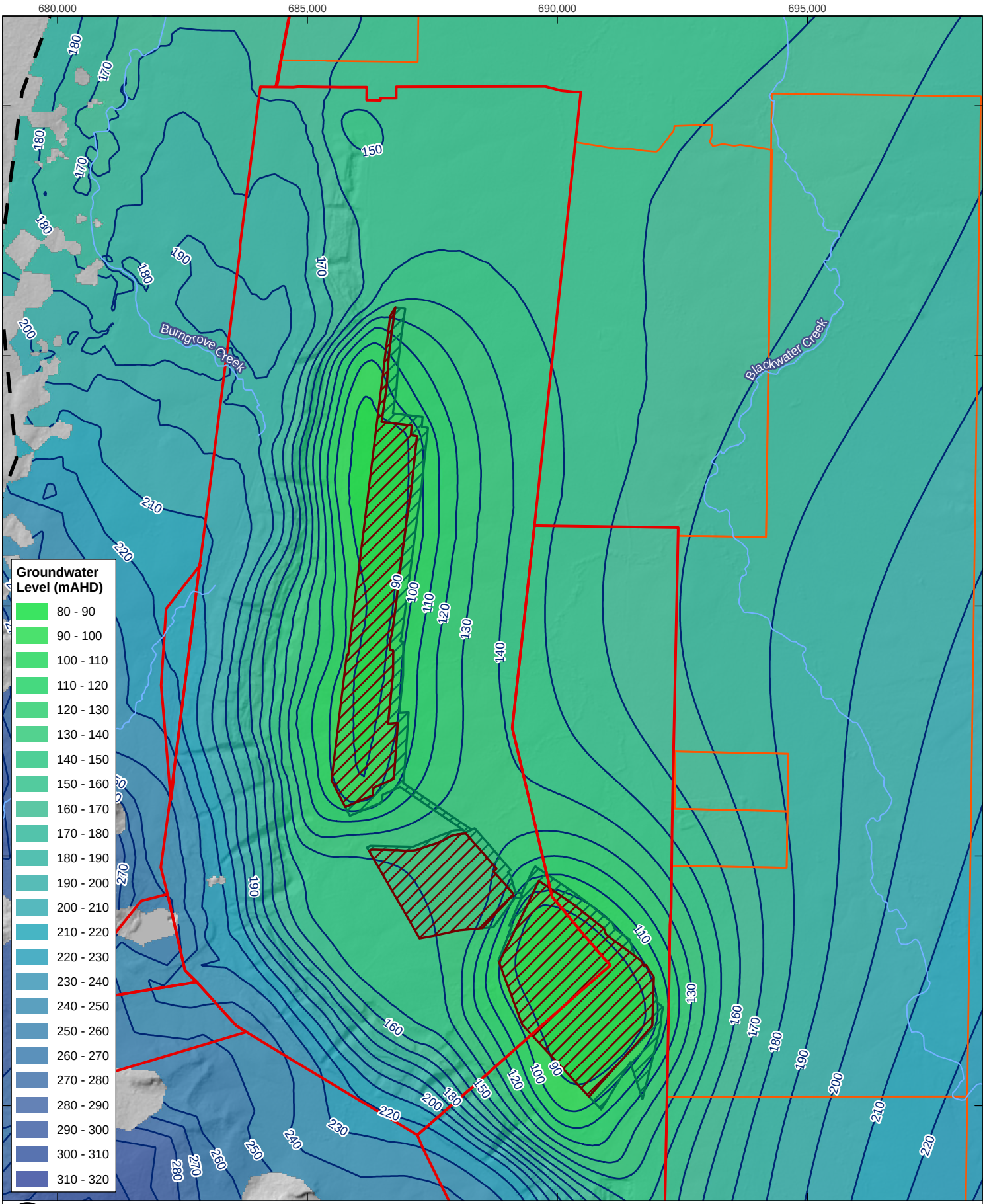
PREDICTED WATER LEVEL WITHIN BURNGROVE FORMATION (LAYER 16) AT POST-MINING EQUILIBRATED

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-13

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	640.031809.00001
Date Drawn:	19-Aug-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Contour (mAHD)
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER NORTH EXTENSION PROJECT
GROUNDWATER MODELLING TECHNICAL REPORT

PREDICTED WATER LEVEL WITHIN BURNGROVE FORMATION (LAYER 16) AT POST-MINING EQUILIBRATED - NORTHERN VOIDS

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE D-14

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_FXX_Predicted Water Level within Burngrove Formation (Layer 16) at PME

Appendix E Parameter Distribution Plots for Sampled Prior and Calibrated Ensemble

Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

SLR Project No.: 640.031809.00001

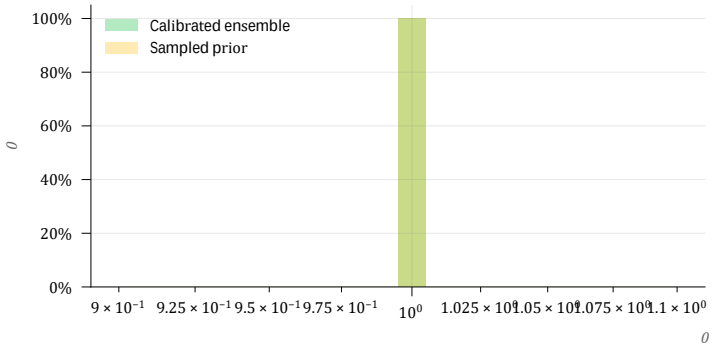
7 October 2026


evtf_z01
evtf_z02
evtf_z03
evtf_z04
exdp_z01
exdp_z02
exdp_z03
exdp_z04
kx_z01
kx_z02
Calibrated ensemble
Sampled prior
0
Parameters

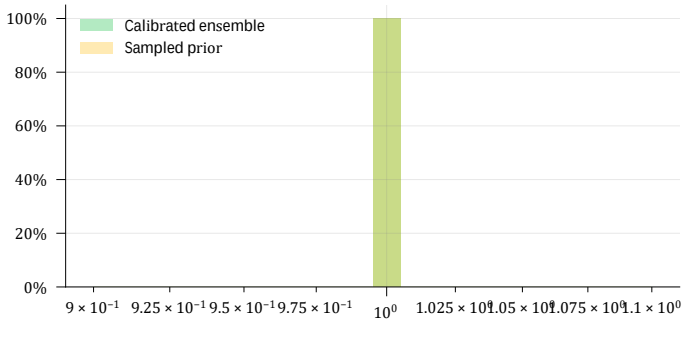

kx_z03
kx_z04
kx_z05
kx_z06
kx_z07
kx_z08
kx_z09
kx_z10
kx_z11
kx_z12
Calibrated ensemble
Sampled prior
0
Parameters


kx_z13
kx_z14
kx_z15
kx_z16
kx_z17
kx_z18
kx_z19
kzf_z01
kzf_z02
kzf_z03
Calibrated ensemble
Sampled prior
Parameters

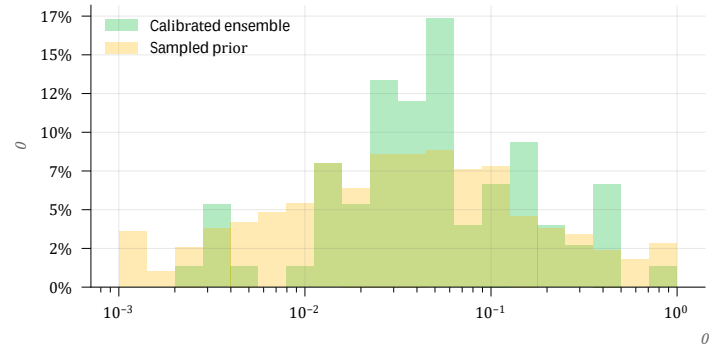
kzf_z04



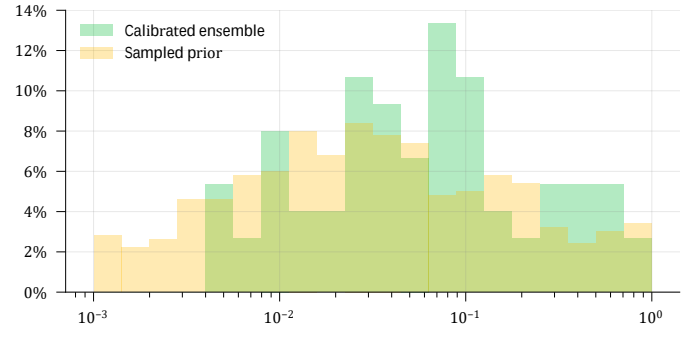
kzf_z05



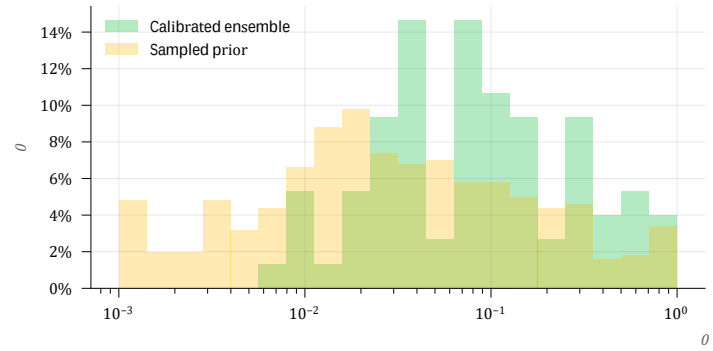
kzf_z06



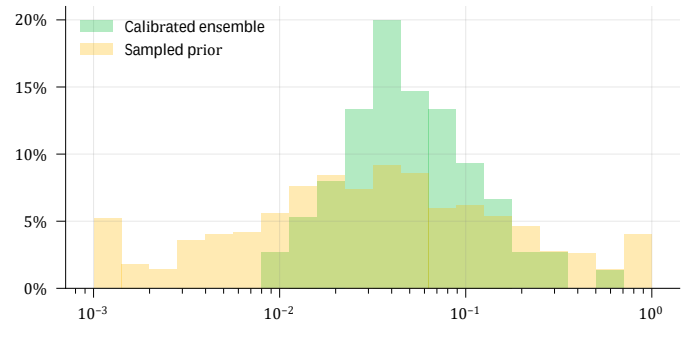
kzf_z07



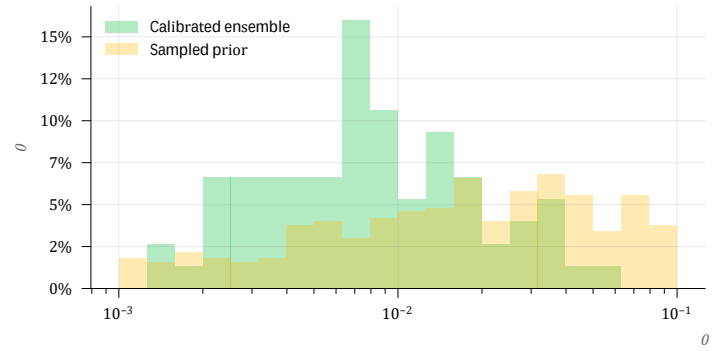
kzf_z08



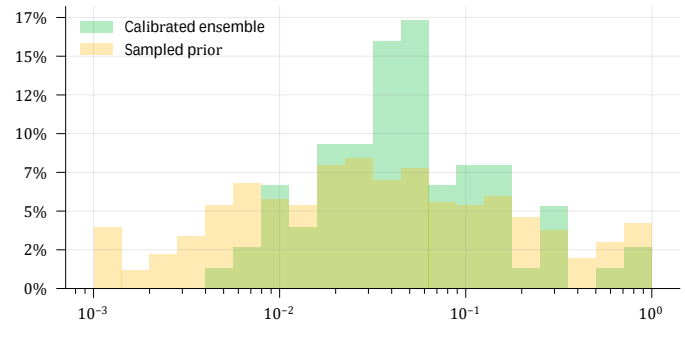
kzf_z09



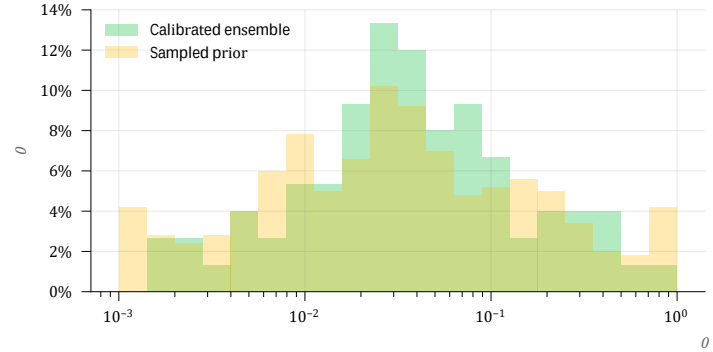
kzf_z10



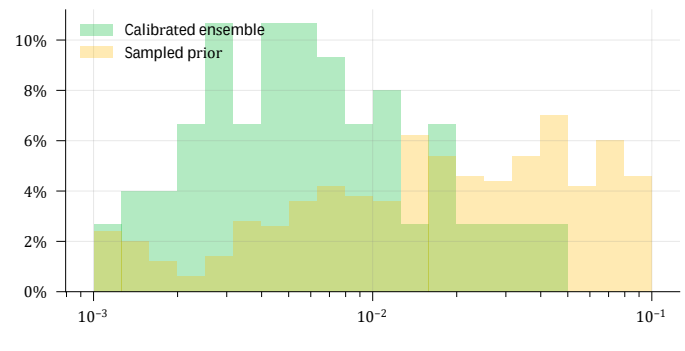
kzf_z11

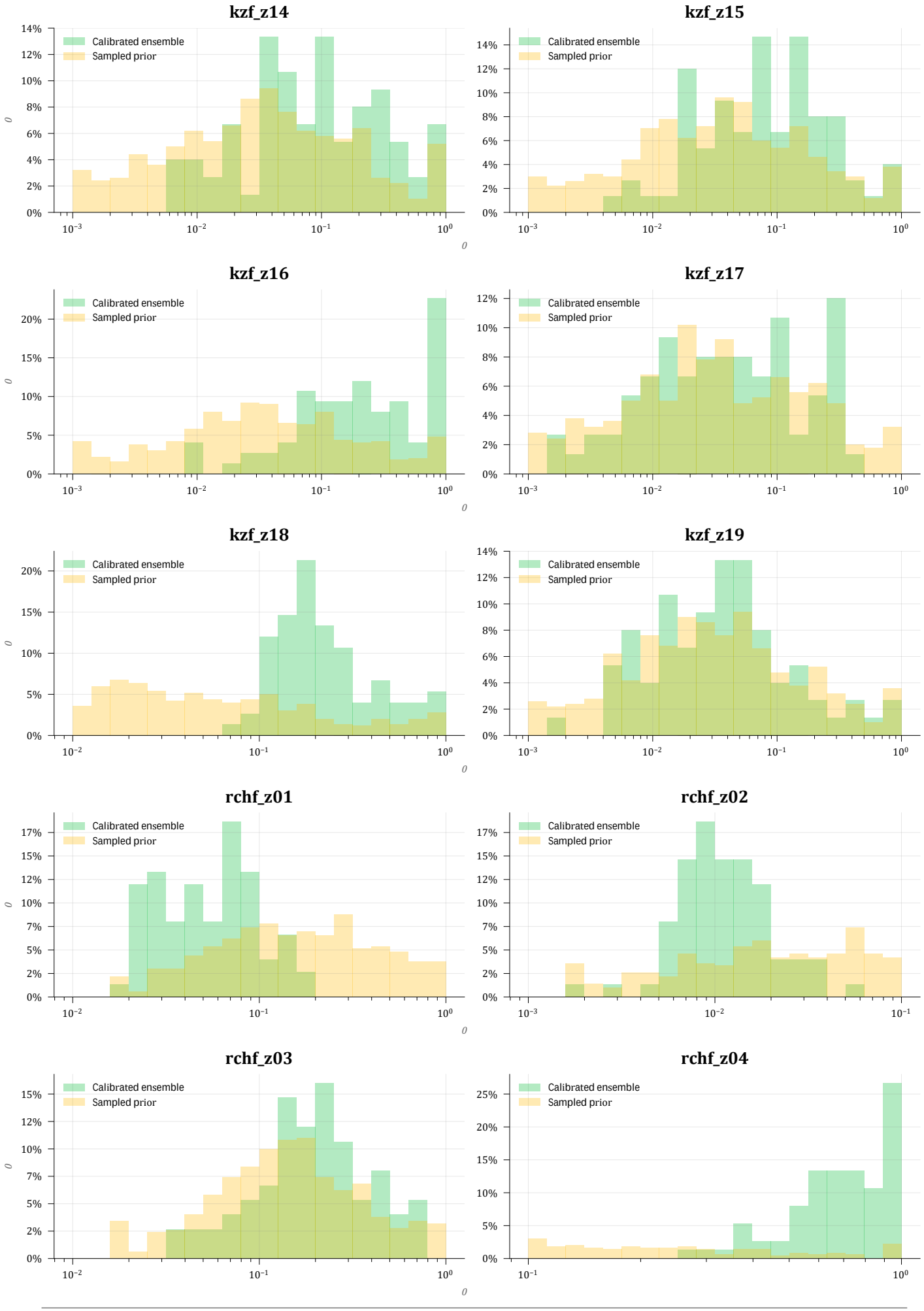


kzf_z12

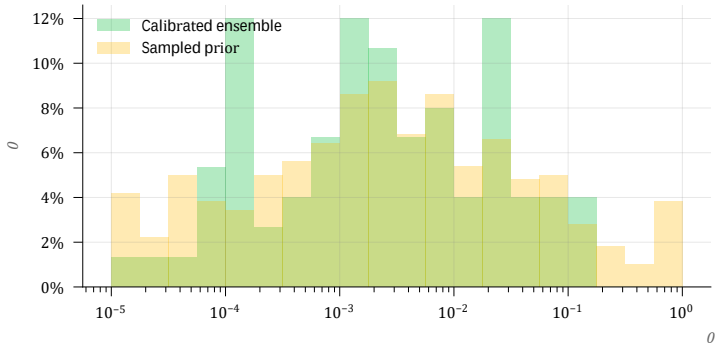


kzf_z13

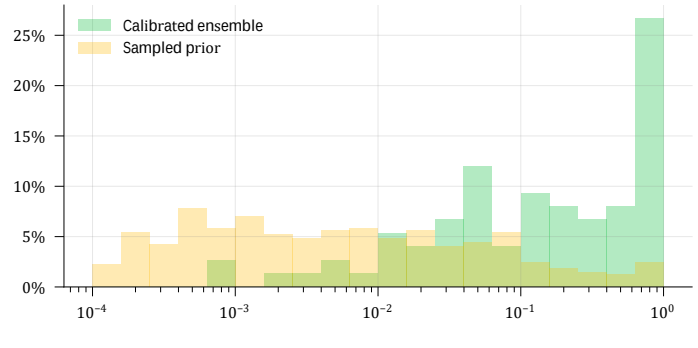



kzf_z14
kzf_z15
kzf_z16
kzf_z17
kzf_z18
kzf_z19
rchf_z01
rchf_z02
rchf_z03
rchf_z04
Calibrated ensemble
Sampled prior
Parameters

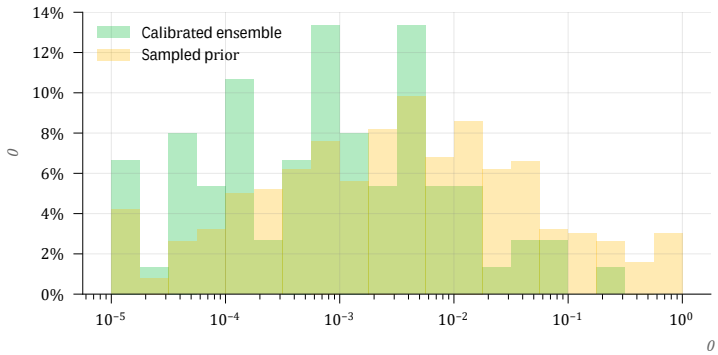
rivk_z01



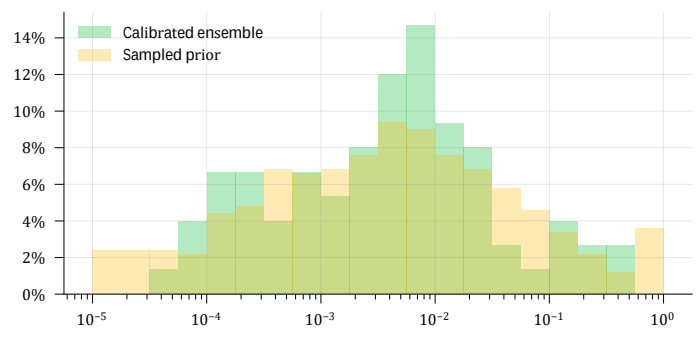
rivk_z02



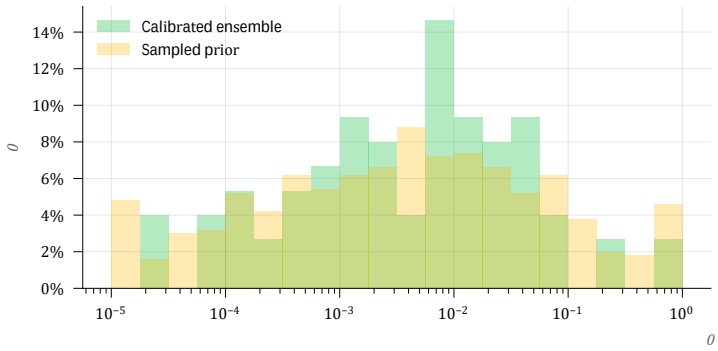
rivk_z03



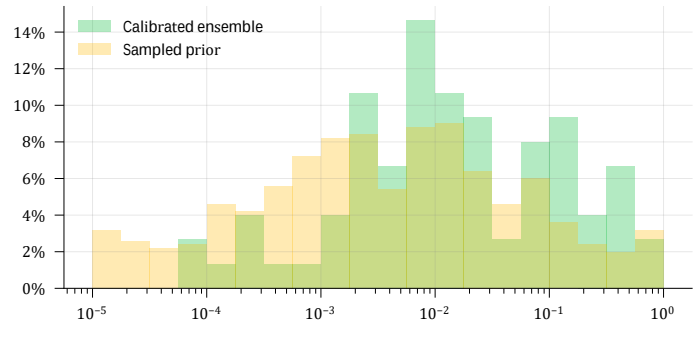
rivk_z04



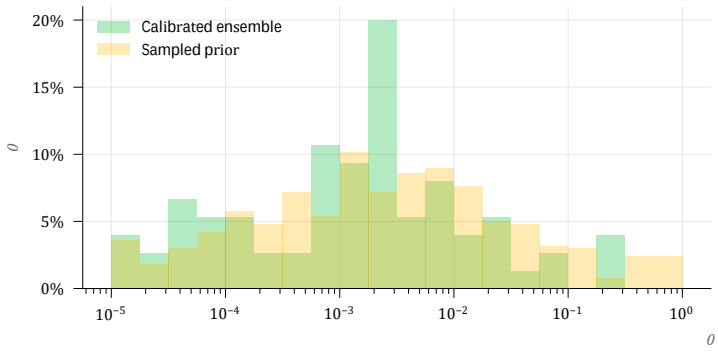
rivk_z05



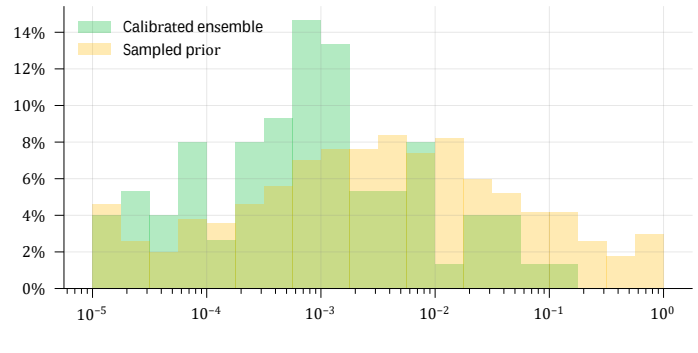
rivk_z06



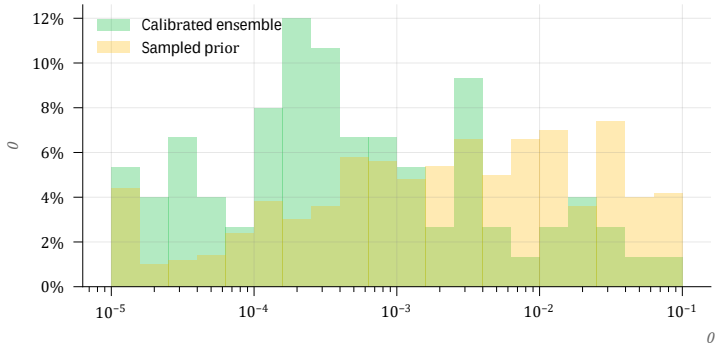
rivk_z07



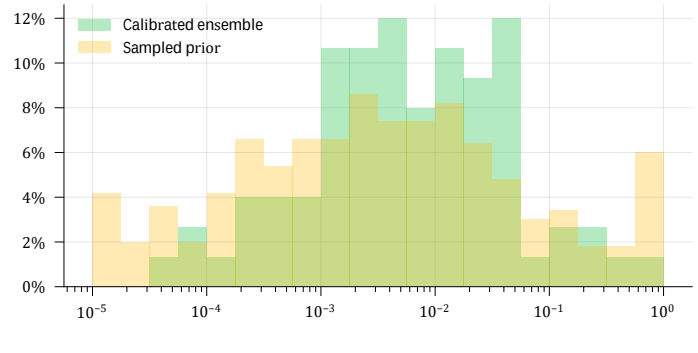
rivk_z08

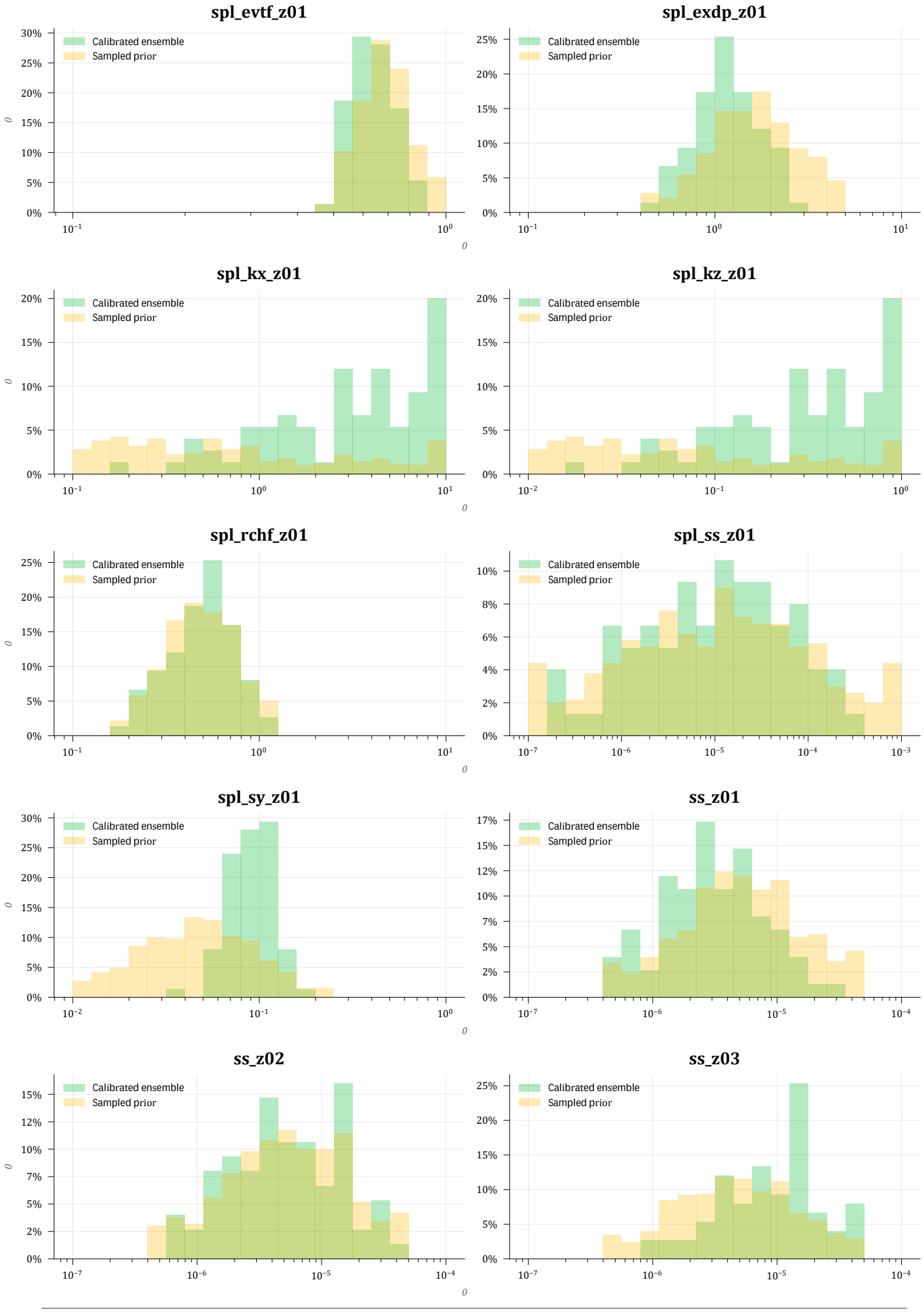


rivk_z09



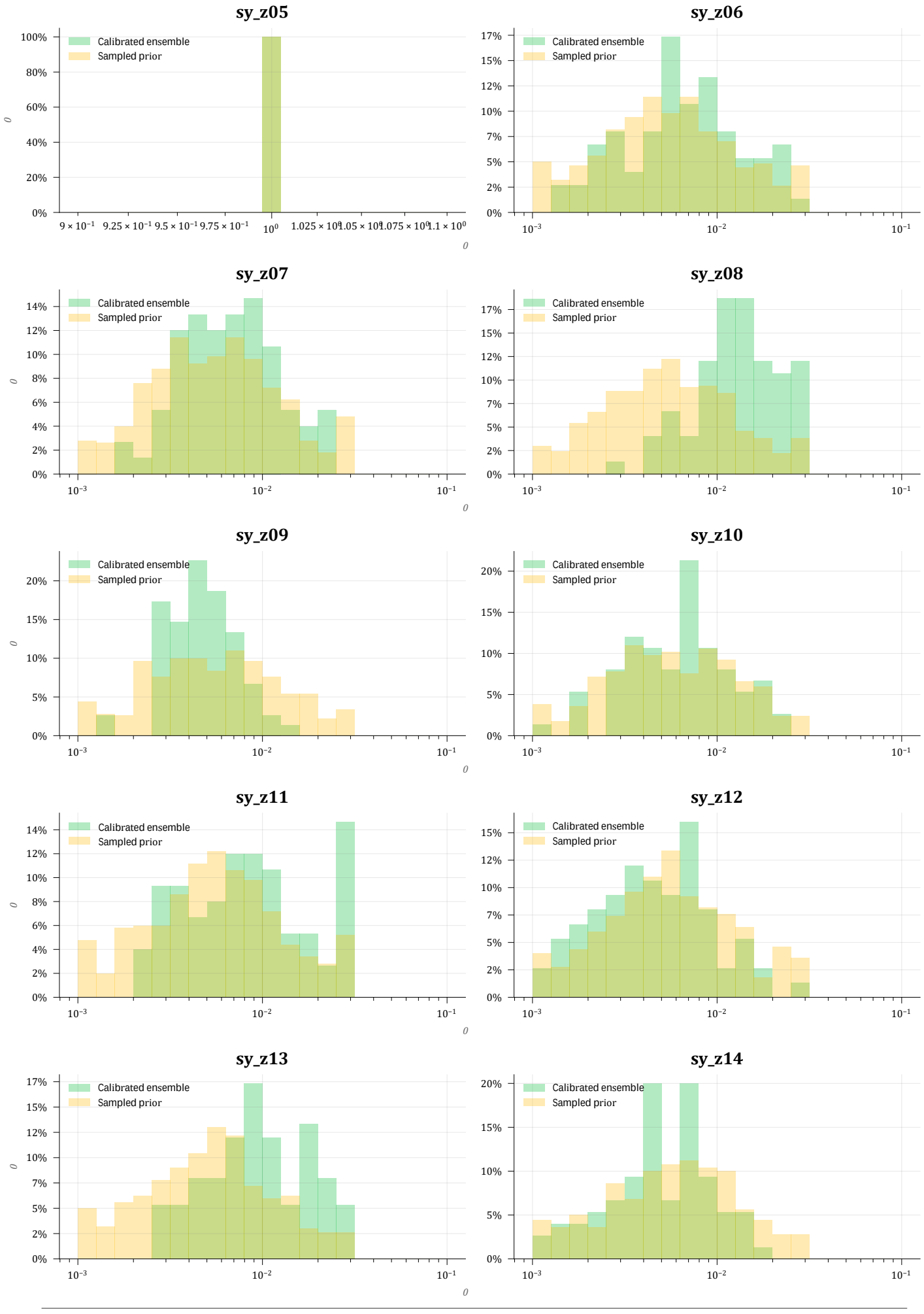
rivk_z10

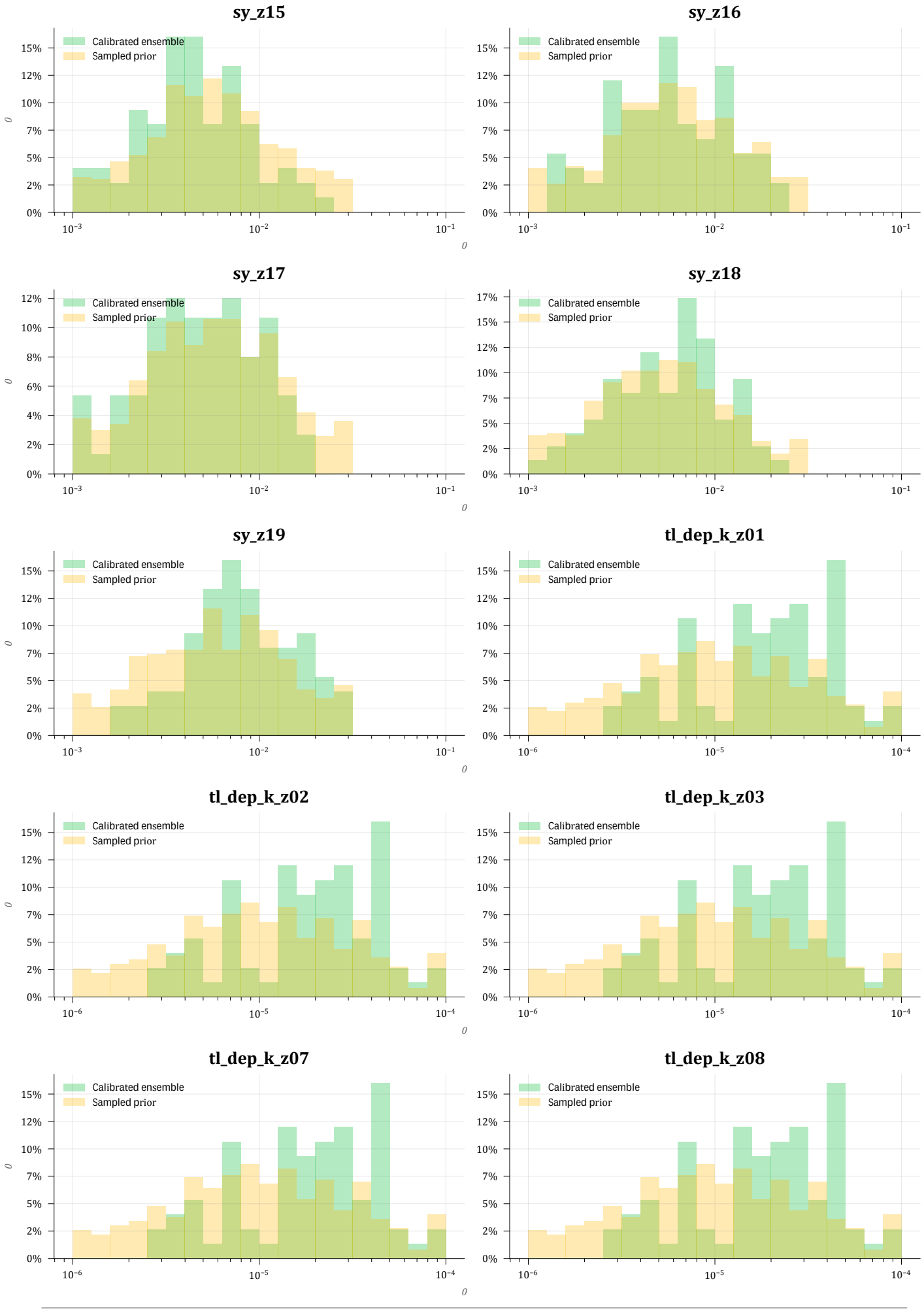


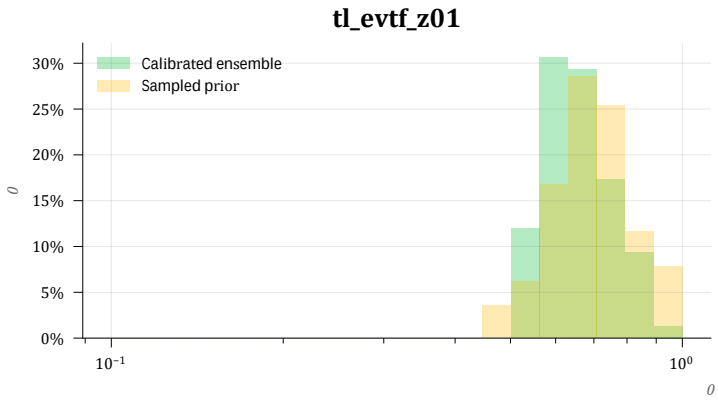

spl_evtf_z01
spl_exdp_z01
spl_kx_z01
spl_kz_z01
spl_rchf_z01
spl_ss_z01
spl_sy_z01
ss_z01
ss_z02
ss_z03
Calibrated ensemble
Sampled prior
0
Parameters

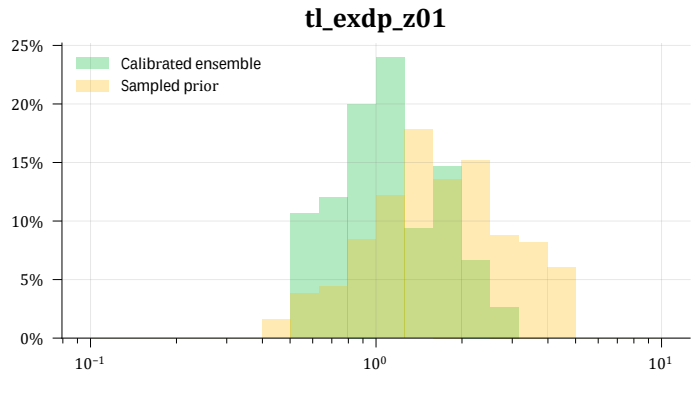

ss_z04
ss_z05
ss_z06
ss_z07
ss_z08
ss_z09
ss_z10
ss_z11
ss_z12
ss_z13
Calibrated ensemble
Sampled prior
0
Parameters

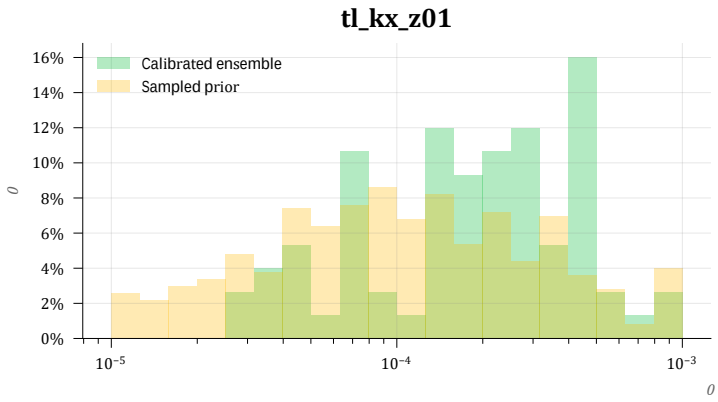

ss_z14
ss_z15
ss_z16
ss_z17
ss_z18
ss_z19
sy_z01
sy_z02
sy_z03
sy_z04
Calibrated ensemble
Sampled prior
Parameters

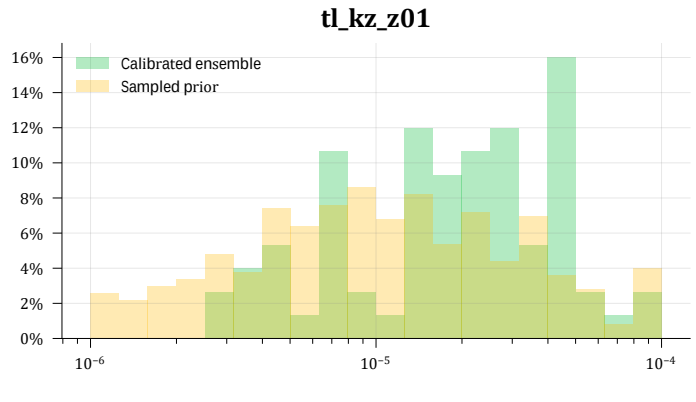

sy_z05
sy_z06
sy_z07
sy_z08
sy_z09
sy_z10
sy_z11
sy_z12
sy_z13
sy_z14
Calibrated ensemble
Sampled prior
Parameters

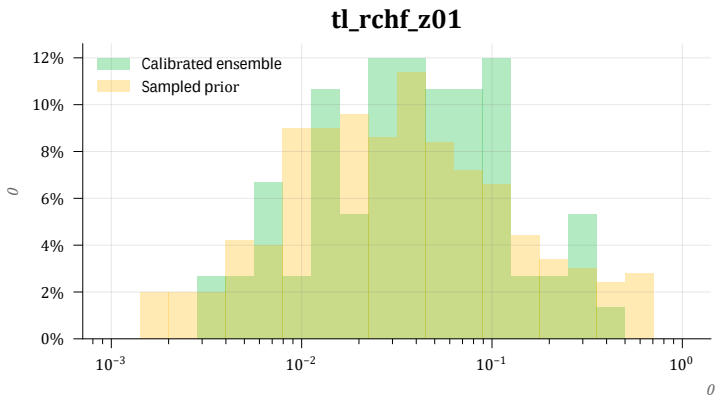

sy_z15
sy_z16
sy_z17
sy_z18
sy_z19
tl_dep_k_z01
tl_dep_k_z02
tl_dep_k_z03
tl_dep_k_z07
tl_dep_k_z08
Calibrated ensemble
Sampled prior
0
Parameters

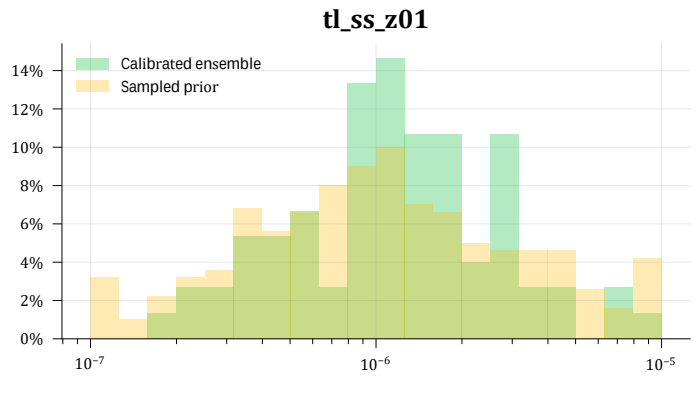

tl_evtf_z01
Calibrated ensemble
Sampled prior
30%
25%
20%
15%
10%
5%
0%
0
10^{-1}
10^{0}
0

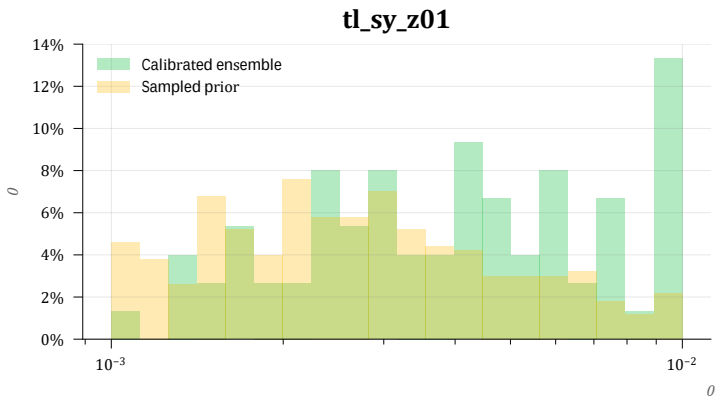

tl_exdp_z01
Calibrated ensemble
Sampled prior
25%
20%
15%
10%
5%
0%
10^{-1}
10^{0}
10^{1}


tl_kx_z01
Calibrated ensemble
Sampled prior
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
10^{-5}
10^{-4}
10^{-3}
0


tl_kz_z01
Calibrated ensemble
Sampled prior
16%
14%
12%
10%
8%
6%
4%
2%
0%
10^{-6}
10^{-5}
10^{-4}


tl_rchf_z01
Calibrated ensemble
Sampled prior
12%
10%
8%
6%
4%
2%
0%
0
10^{-3}
10^{-2}
10^{-1}
10^{0}
0


tl_ss_z01
Calibrated ensemble
Sampled prior
14%
12%
10%
8%
6%
4%
2%
0%
10^{-7}
10^{-6}
10^{-5}


tl_sy_z01
Calibrated ensemble
Sampled prior
14%
12%
10%
8%
6%
4%
2%
0%
0
10^{-3}
10^{-2}
0

Appendix F Sensitivity Analysis Plots

Blackwater North Extension Project

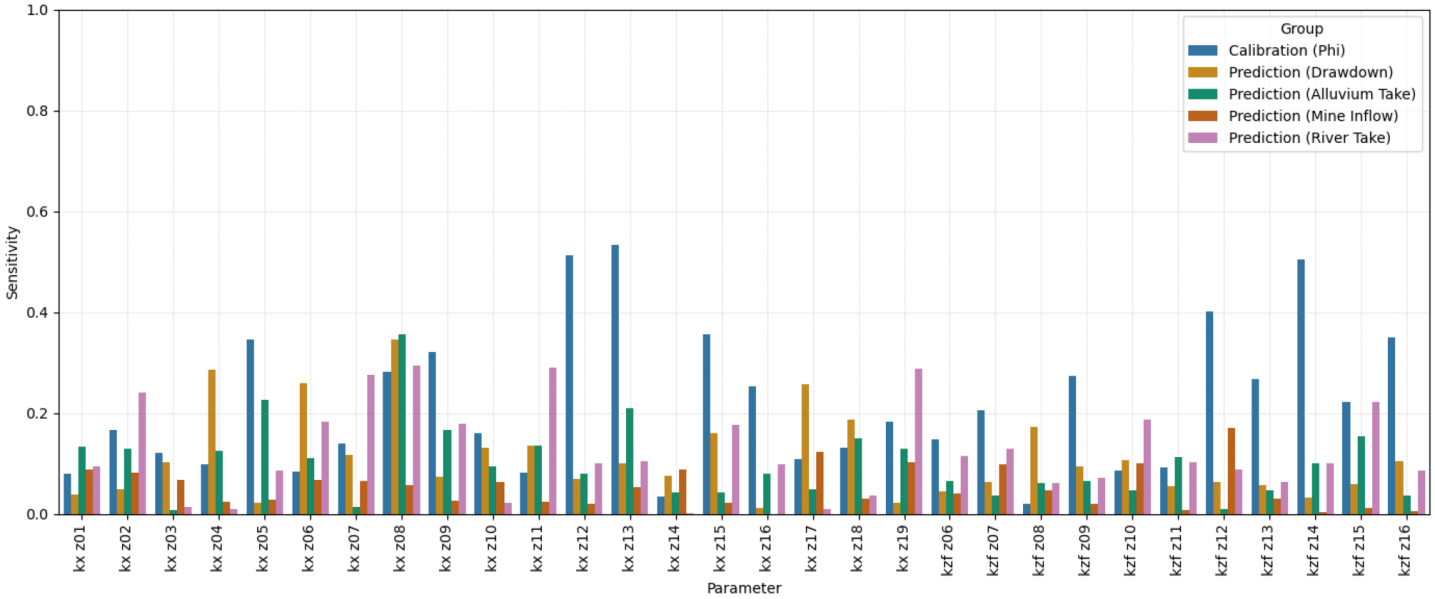
Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

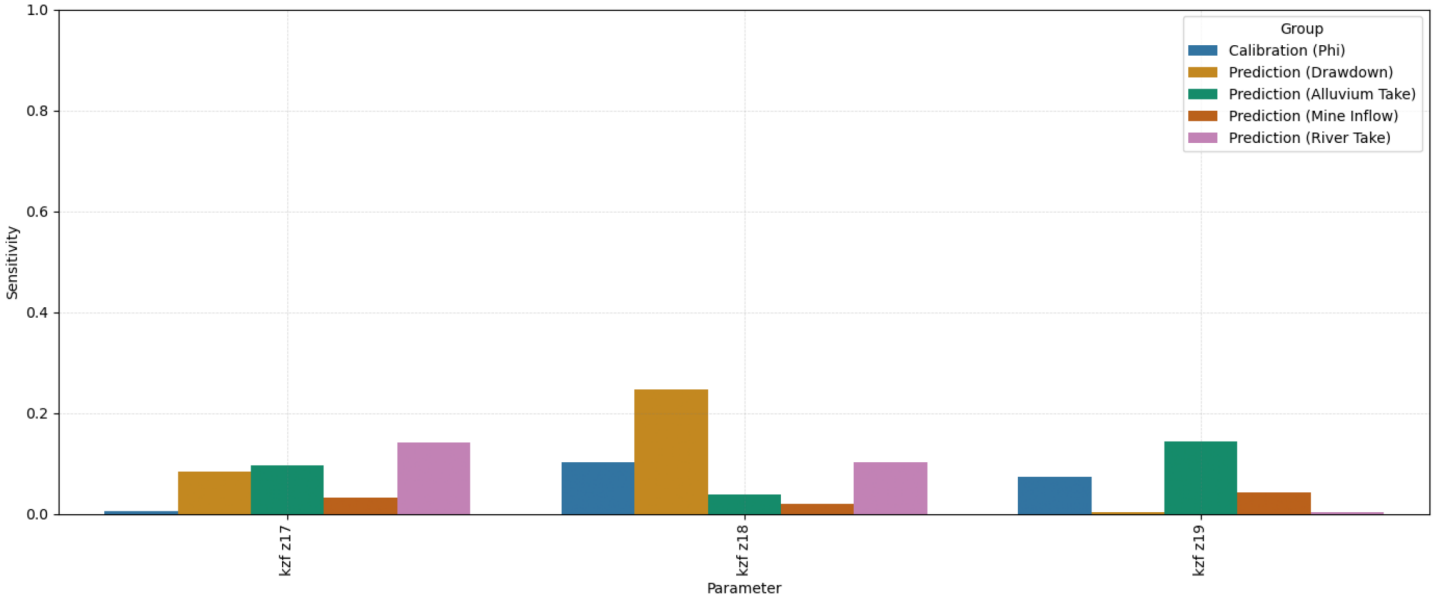
SLR Project No.: 640.031809.00001

7 October 2026

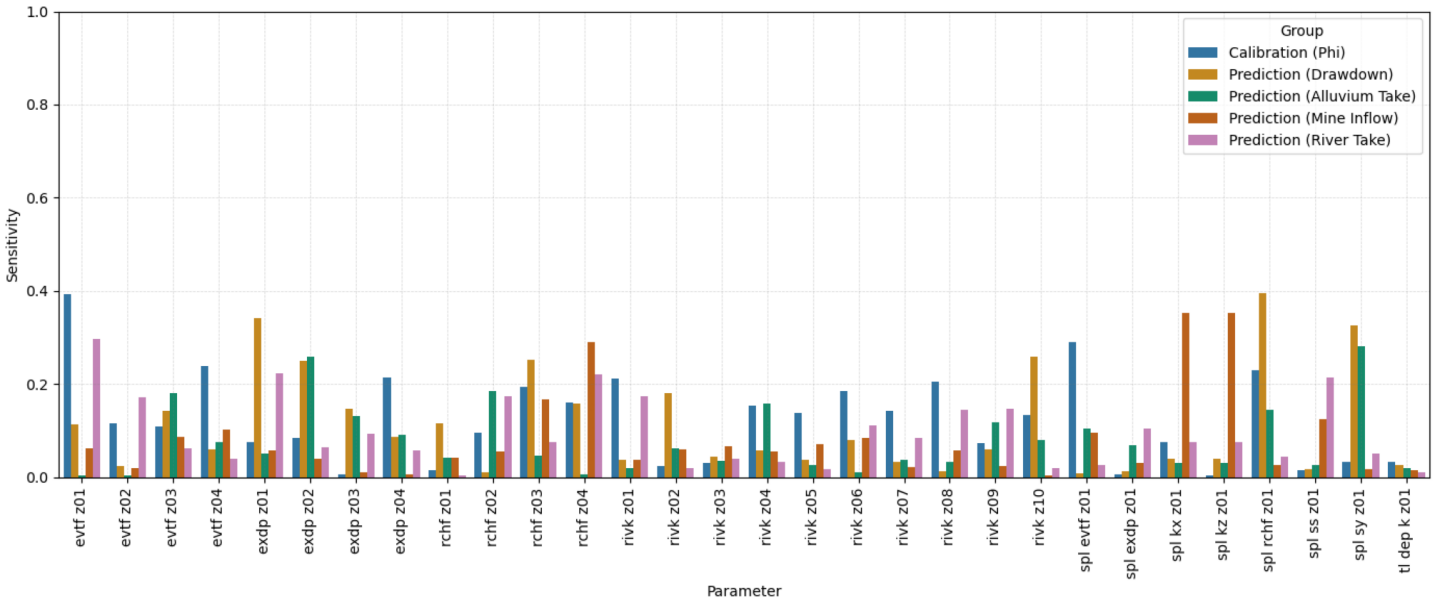
Linear Regression Sensitivity Coefficient (Absolute Value)_Hydraulic Conductivity_Figure1



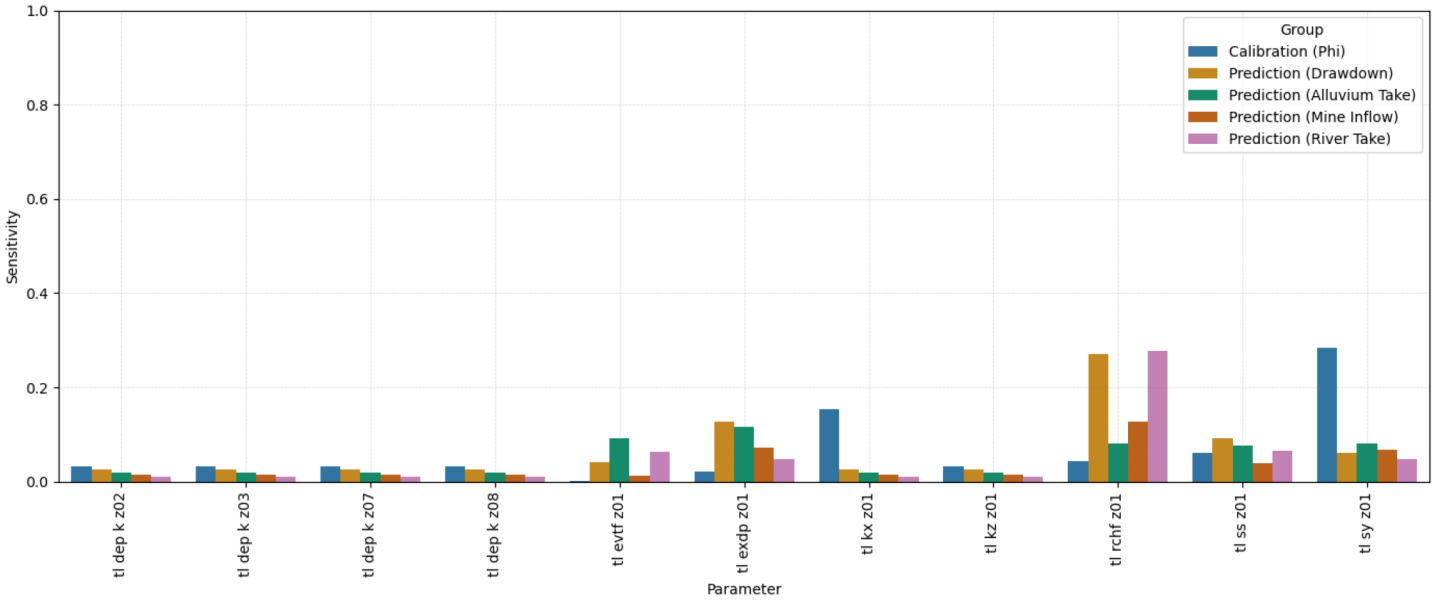
Linear Regression Sensitivity Coefficient (Absolute Value)_Hydraulic Conductivity_Figure2



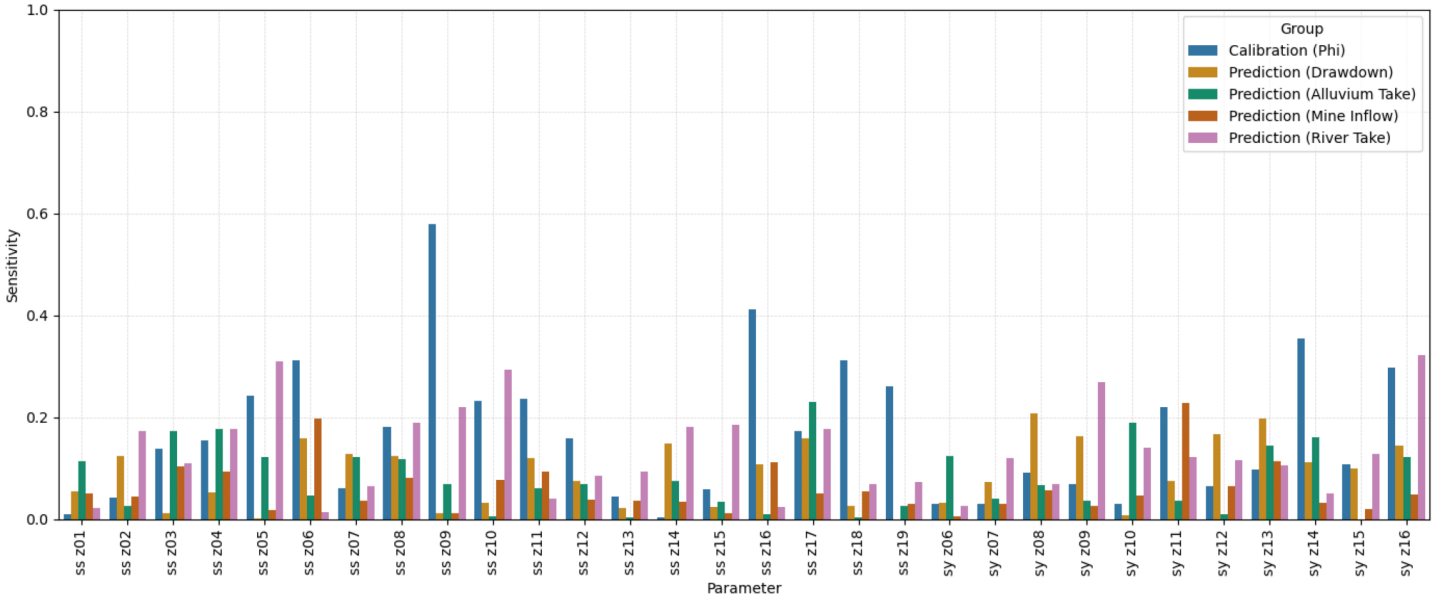
Linear Regression Sensitivity Coefficient (Absolute Value)_Boundary Conditions and Spoil_Figure1



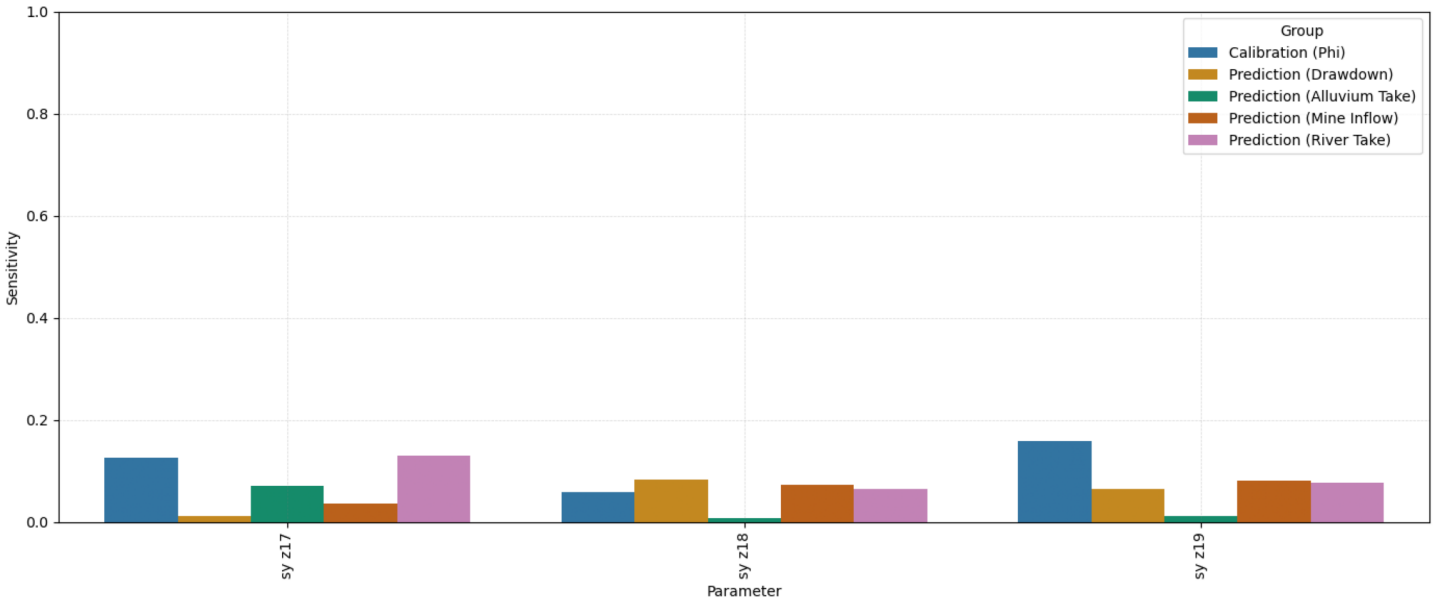
Linear Regression Sensitivity Coefficient (Absolute Value)_Boundary Conditions and Spoil_Figure2



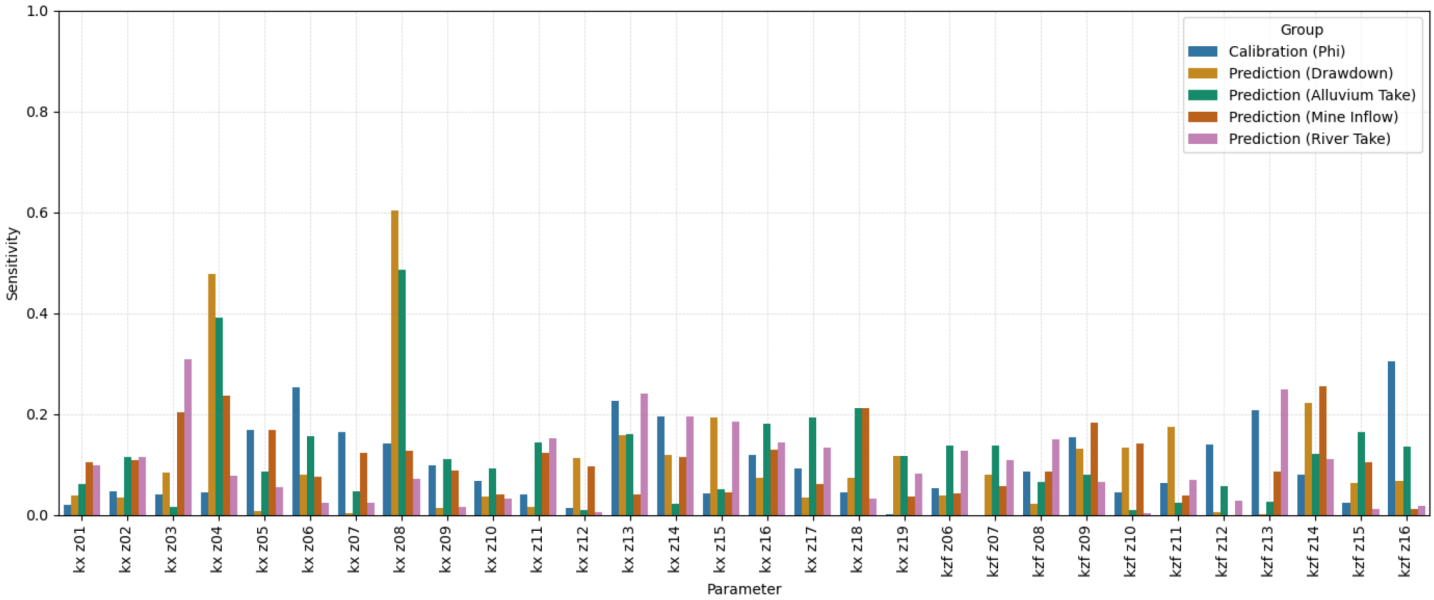
Linear Regression Sensitivity Coefficient (Absolute Value)_Storage Parameters_Figure1



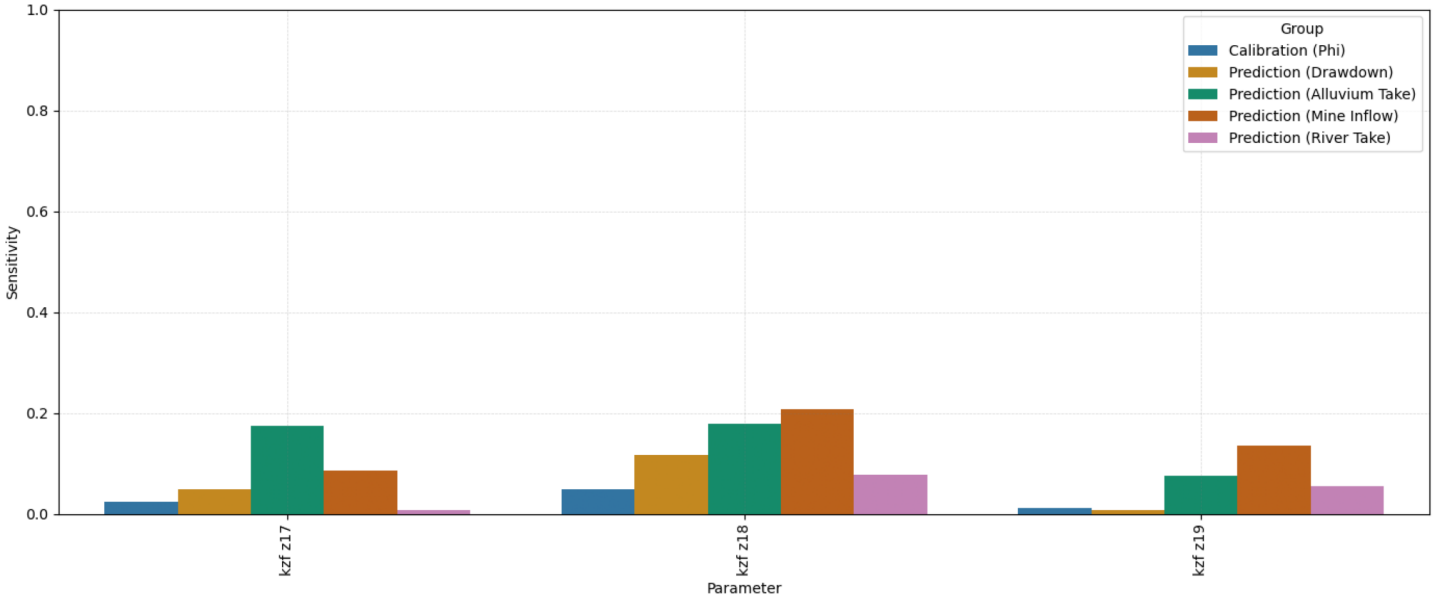
Linear Regression Sensitivity Coefficient (Absolute Value)_Storage Parameters_Figure2



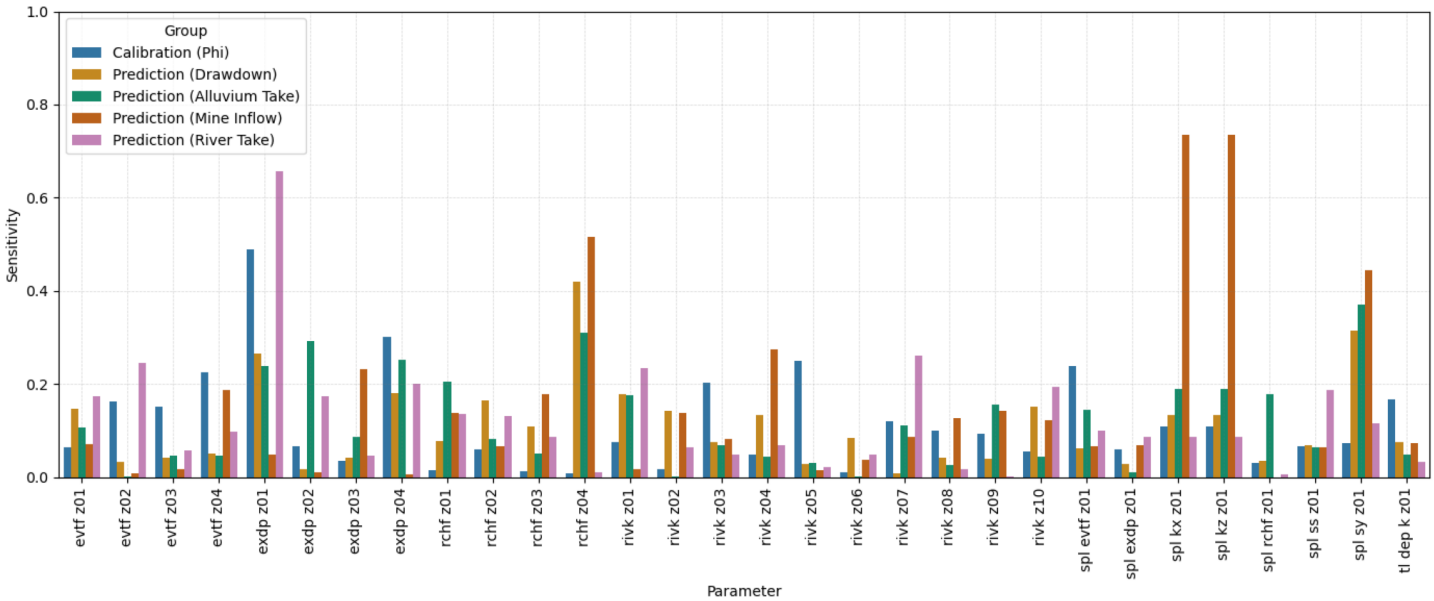
Spearman Rank Correlation Coefficient (Absolute Value)_Hydraulic Conductivity_Figure1



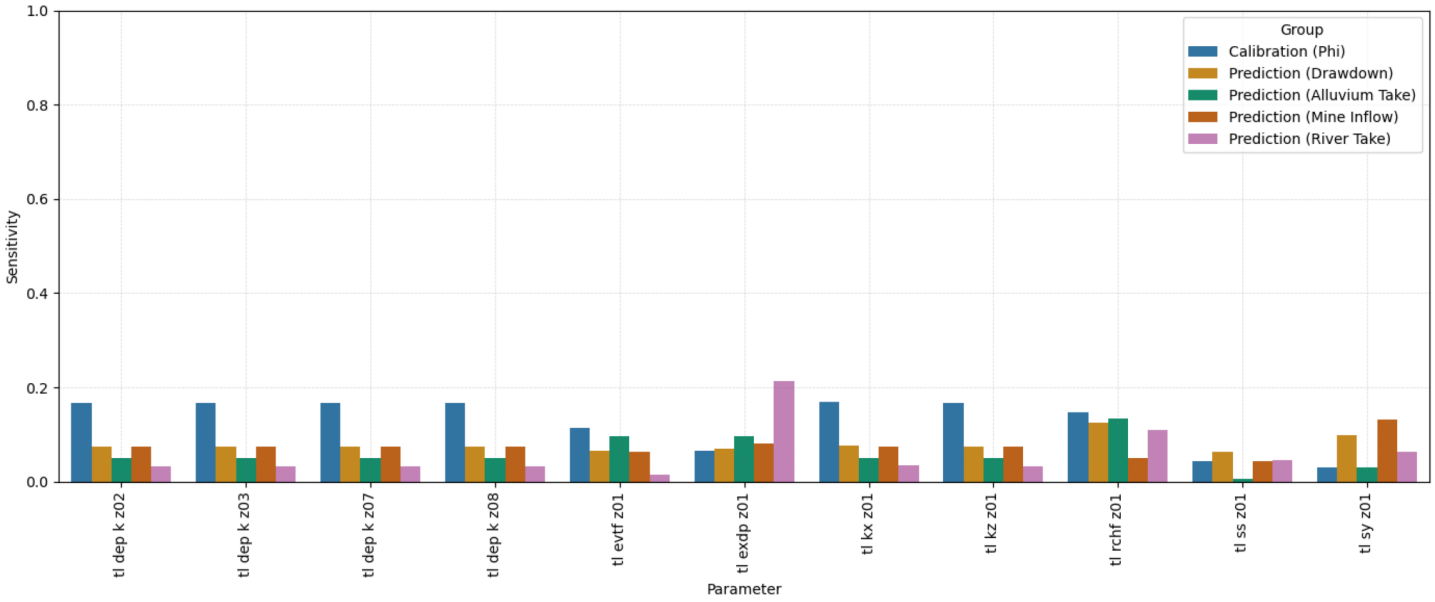
Spearman Rank Correlation Coefficient (Absolute Value)_Hydraulic Conductivity_Figure2



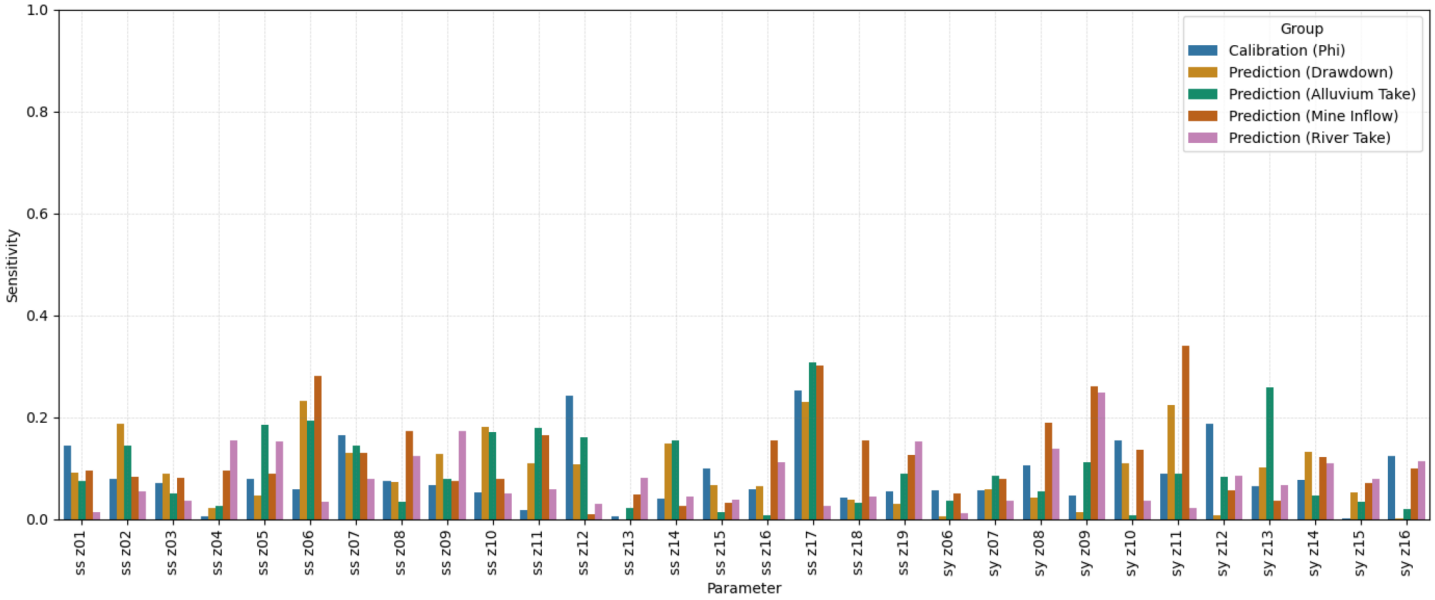
Spearman Rank Correlation Coefficient (Absolute Value)_Boundary Conditions and Spoil_Figure1



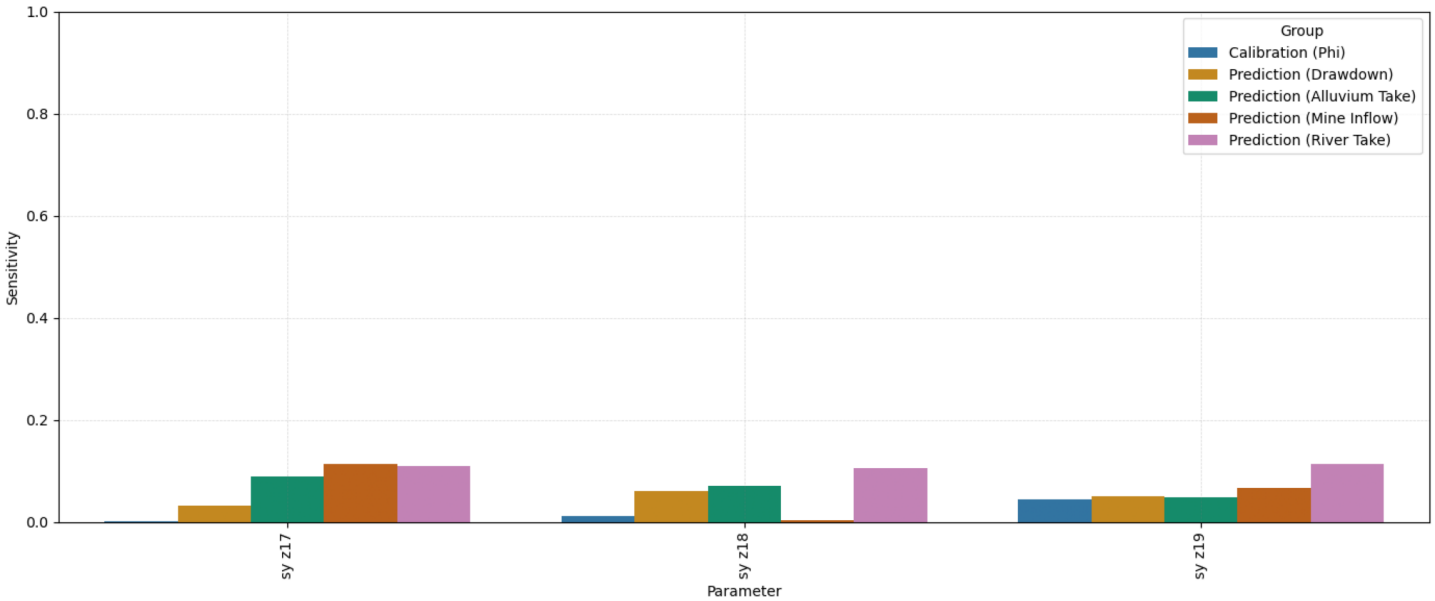
Spearman Rank Correlation Coefficient (Absolute Value)_Boundary Conditions and Spoil_Figure2



Spearman Rank Correlation Coefficient (Absolute Value)_Storage Parameters_Figure1



Spearman Rank Correlation Coefficient (Absolute Value)_Storage Parameters_Figure2



Appendix G Uncertainty in 1 m Drawdown Contours

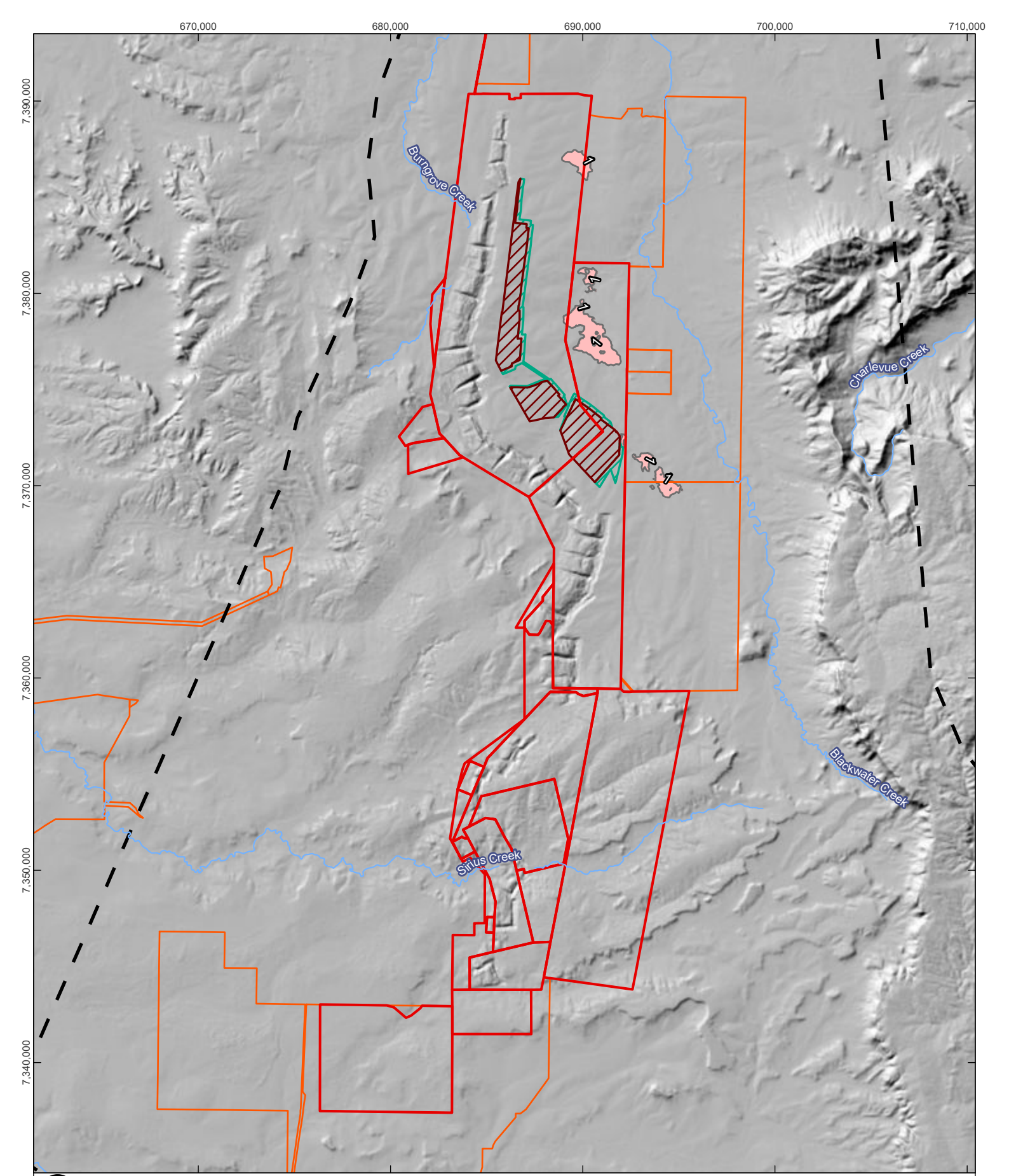
Blackwater North Extension Project

Groundwater Modelling Technical Report

Whitehaven Blackwater Pty Ltd

SLR Project No.: 640.031809.00001

7 October 2026



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

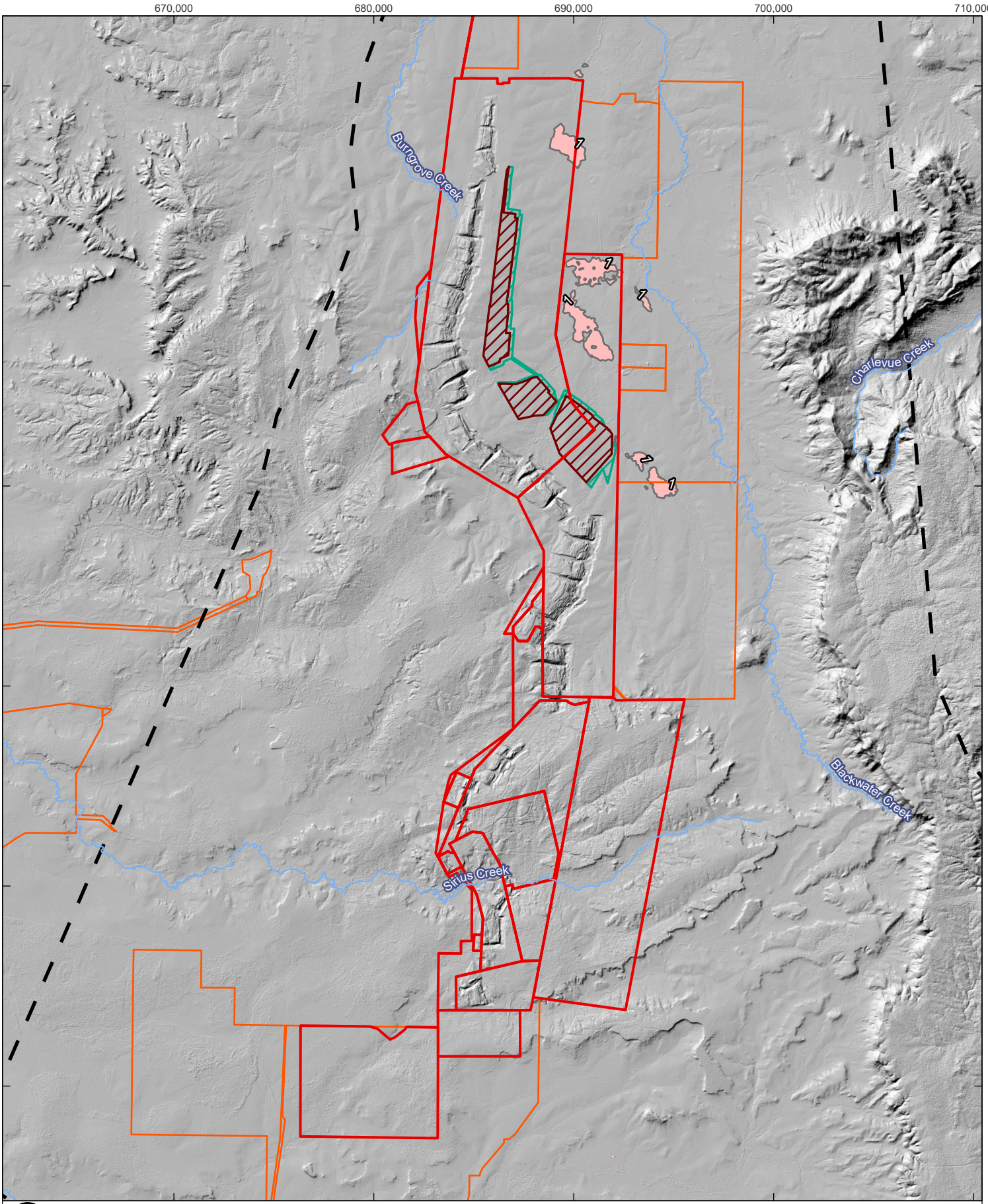
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ALLUVIUM/TERTIARY (END OF MINING) (LAYER 1)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-1

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E01_Uncertainty in Predicted 1m Incremental DD in Alluvium and Tertiary (EoM) L1



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

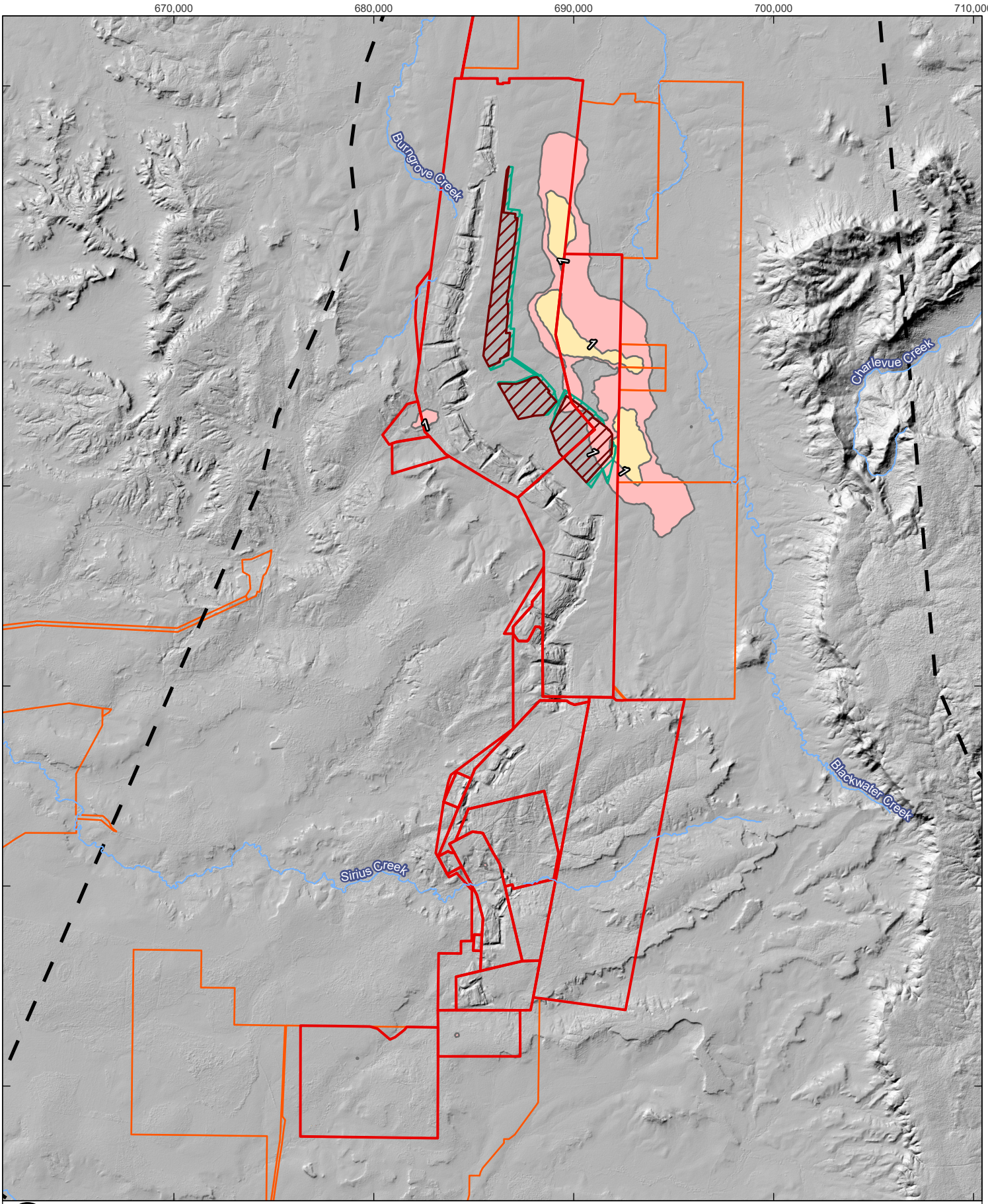
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ALLUVIUM/TERTIARY (END OF RECOVERY) (LAYER 1)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-2

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E02_Uncertainty in Predicted 1m Incremental DD in Alluvium and Tertiary (EoR) L1



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

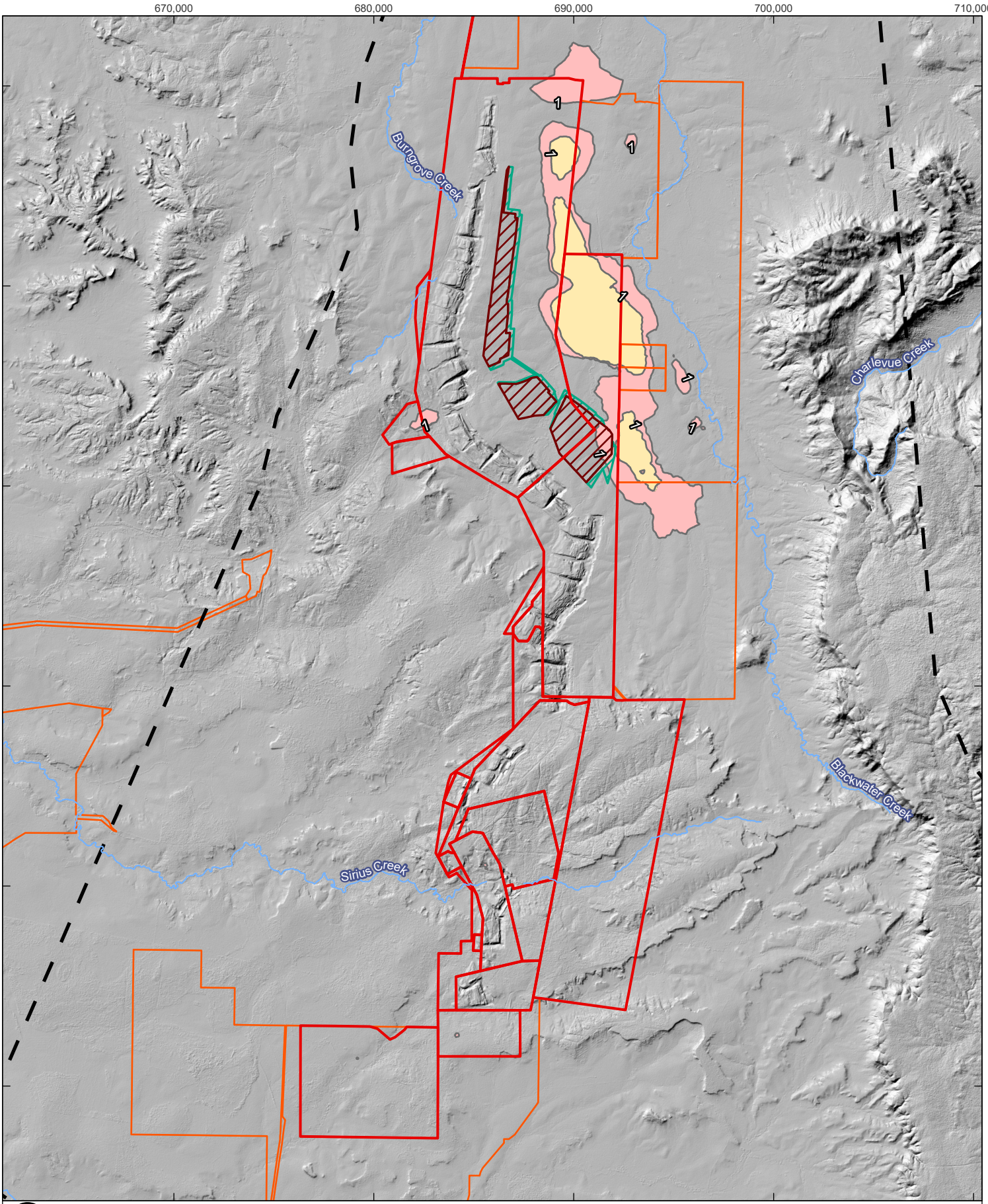
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ALLUVIUM/WEATHERED (END OF MINING) (LAYER 2)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-3

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E03_Uncertainty in Predicted 1m Incremental DD in Alluvium and Weathered (EoM) L2



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

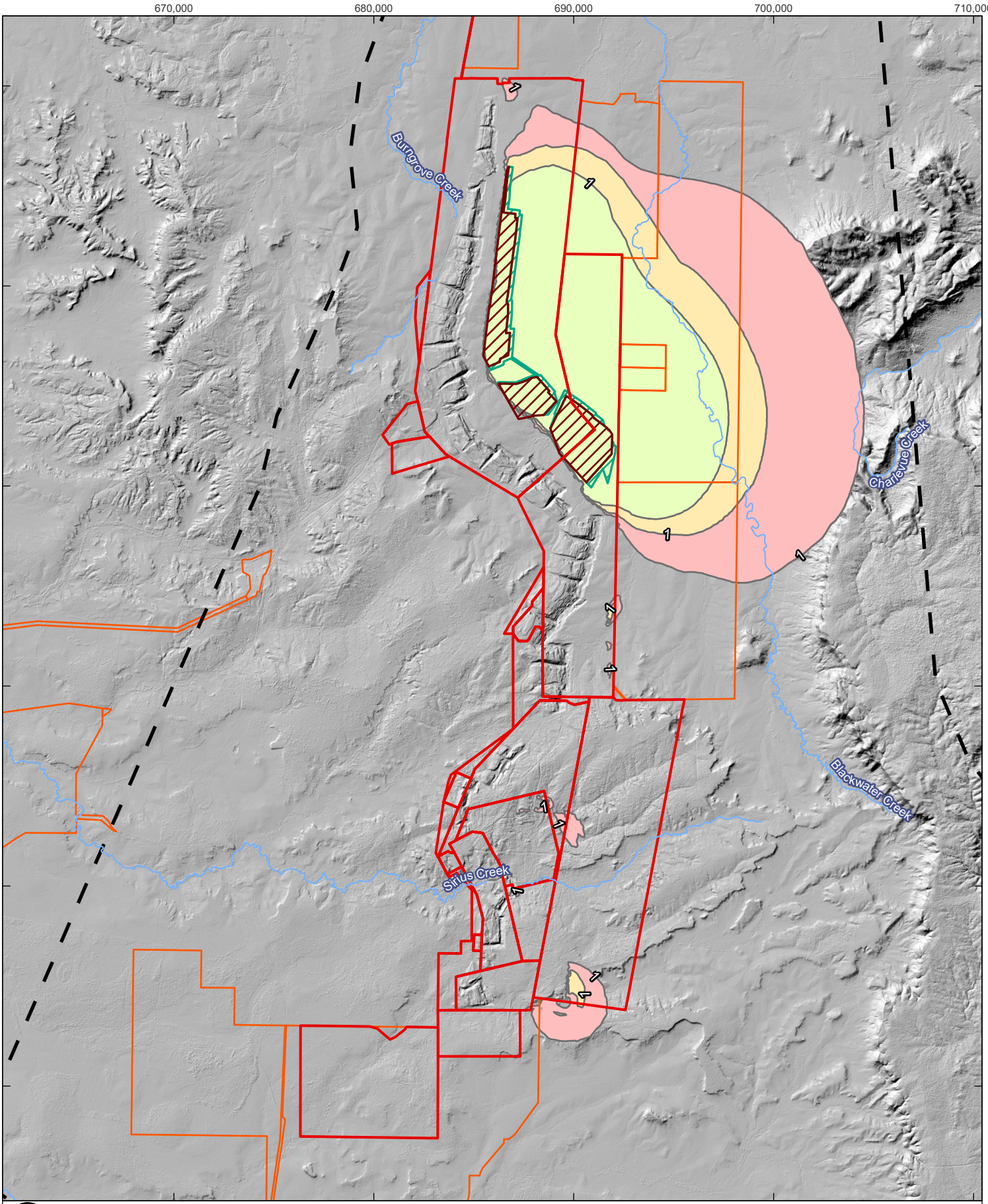
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ALLUVIUM/WEATHERED (END OF RECOVERY) (LAYER 2)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-4

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E04_Uncertainty in Predicted 1m Incremental DD in Alluvium and Weathered (EoR) L2



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

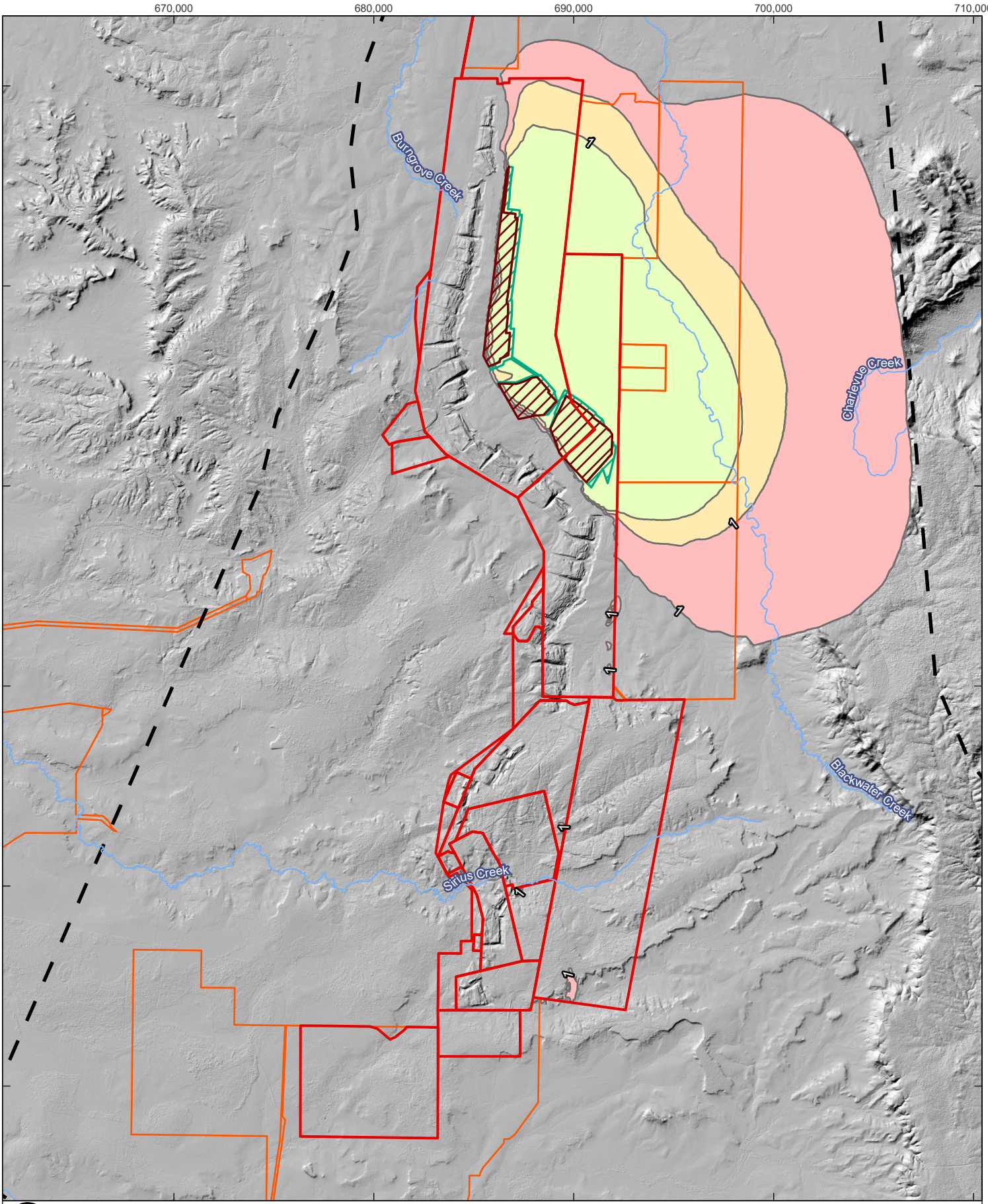
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ARIES SEAM (END OF MINING) (LAYER 8)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-5

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E05_Uncertainty in Predicted 1m Incremental DD in Aries Seam (EoM) L8



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

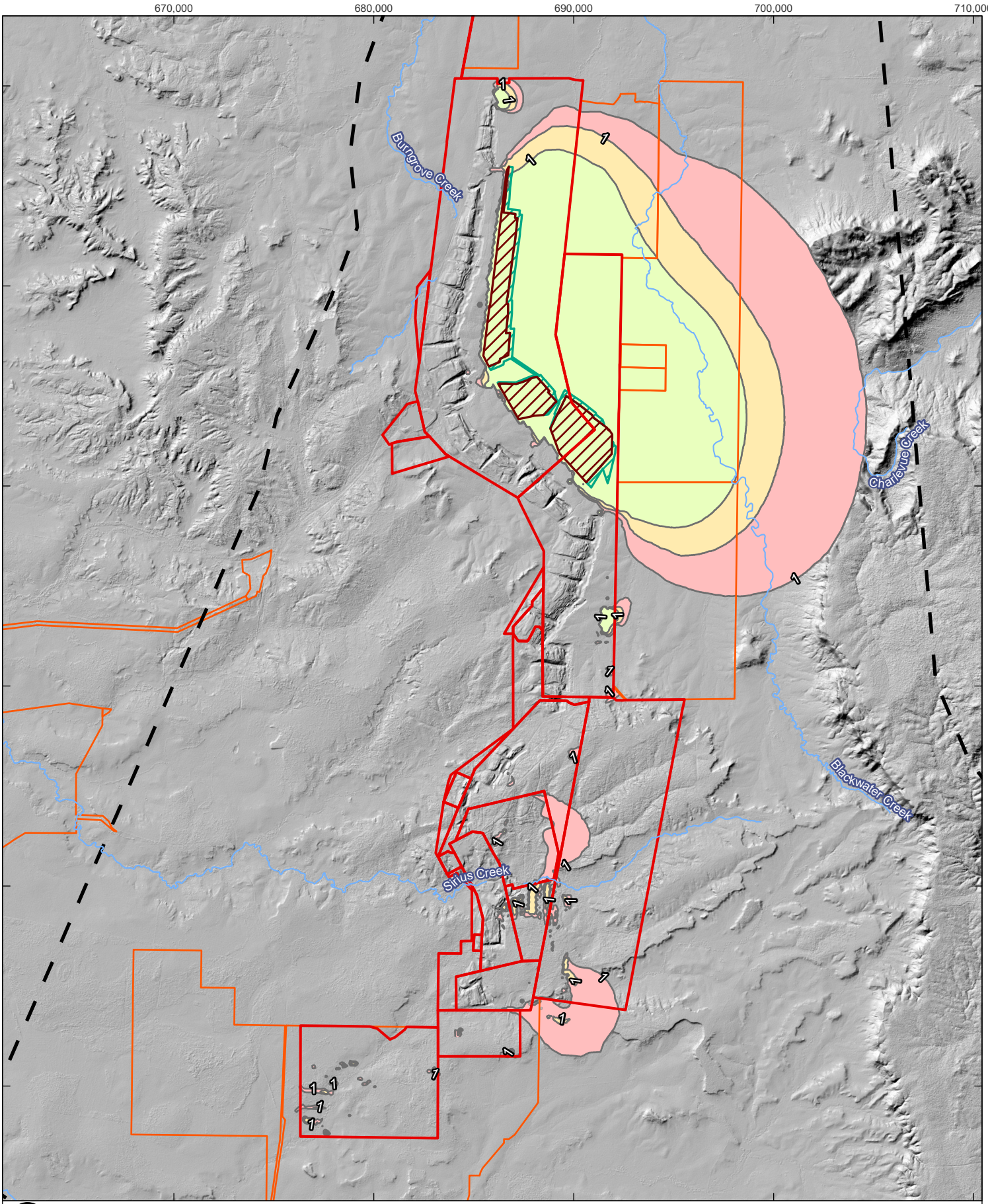
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN ARIES SEAM (END OF RECOVERY) (LAYER 8)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-6

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E06_Uncertainty in Predicted 1m Incremental DD in Aries Seam (EoR) L8



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

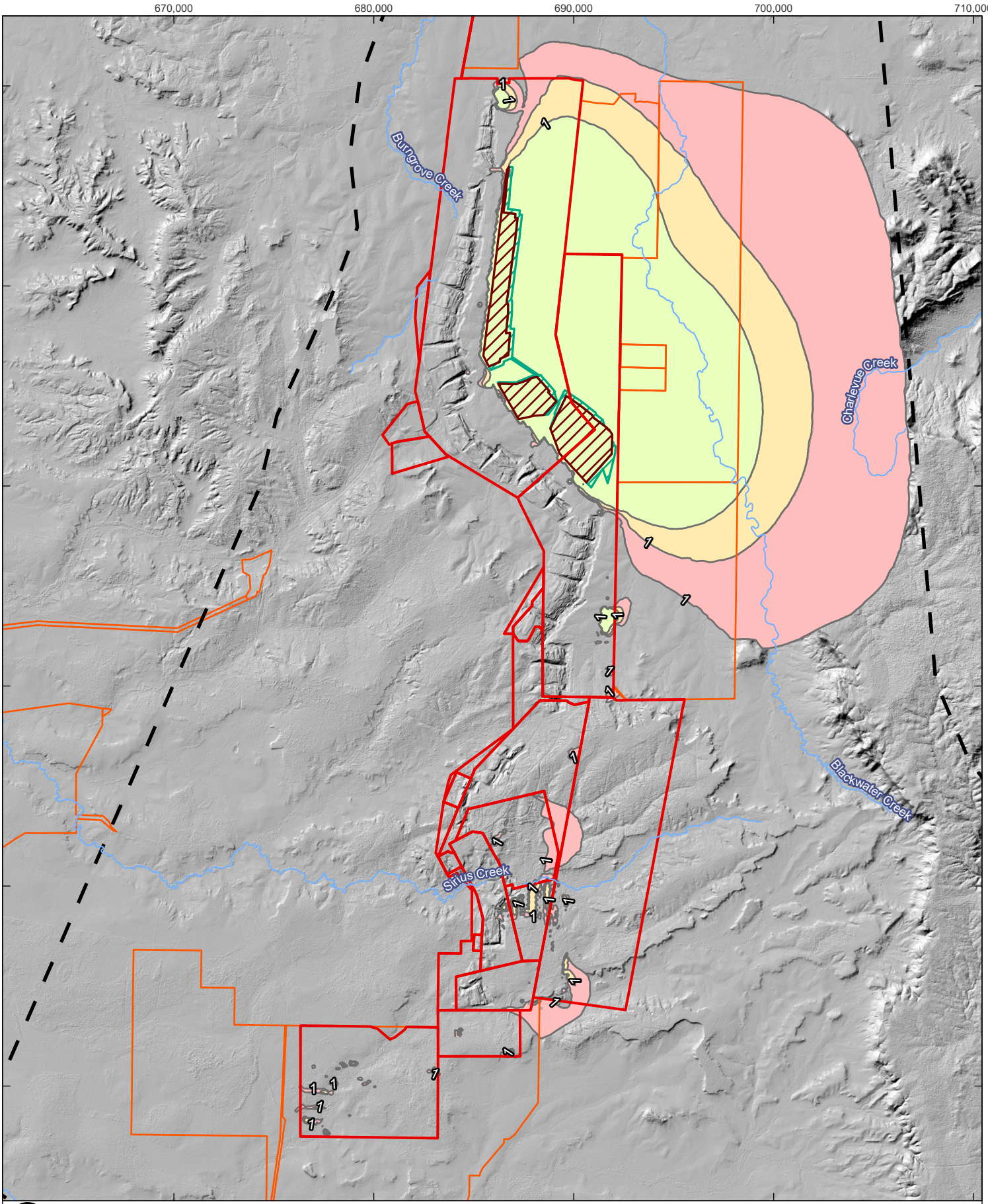
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN POLLUX SEAM (END OF MINING) (LAYER 12)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-7

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E07_Uncertainty in Predicted 1m Incremental DD in Pollux Seam (EoM) L12



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

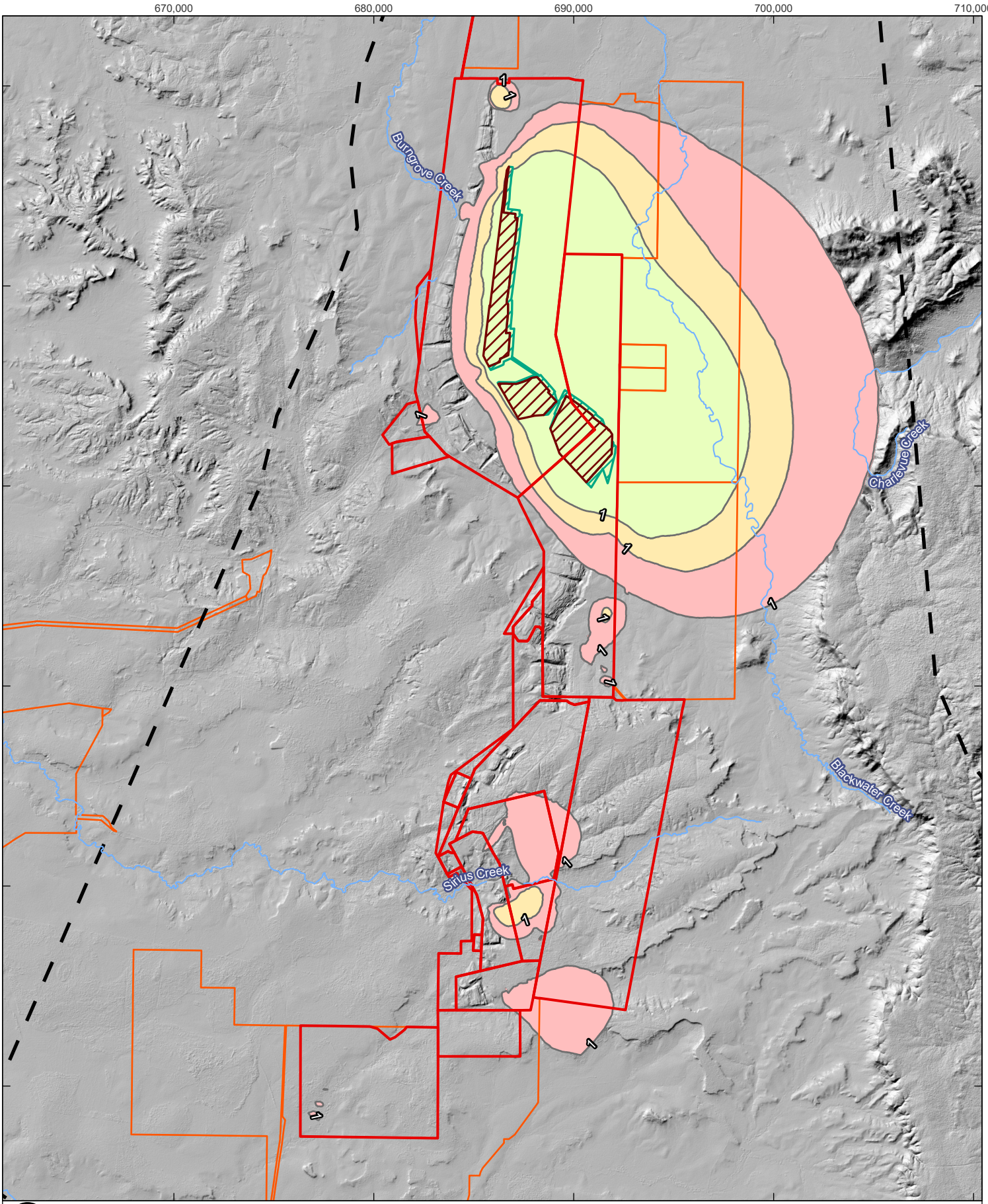
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN POLLUX SEAM (END OF RECOVERY) (LAYER 12)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-8

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E08_Uncertainty in Predicted 1m Incremental DD in Pollux Seam (EoR) L12



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

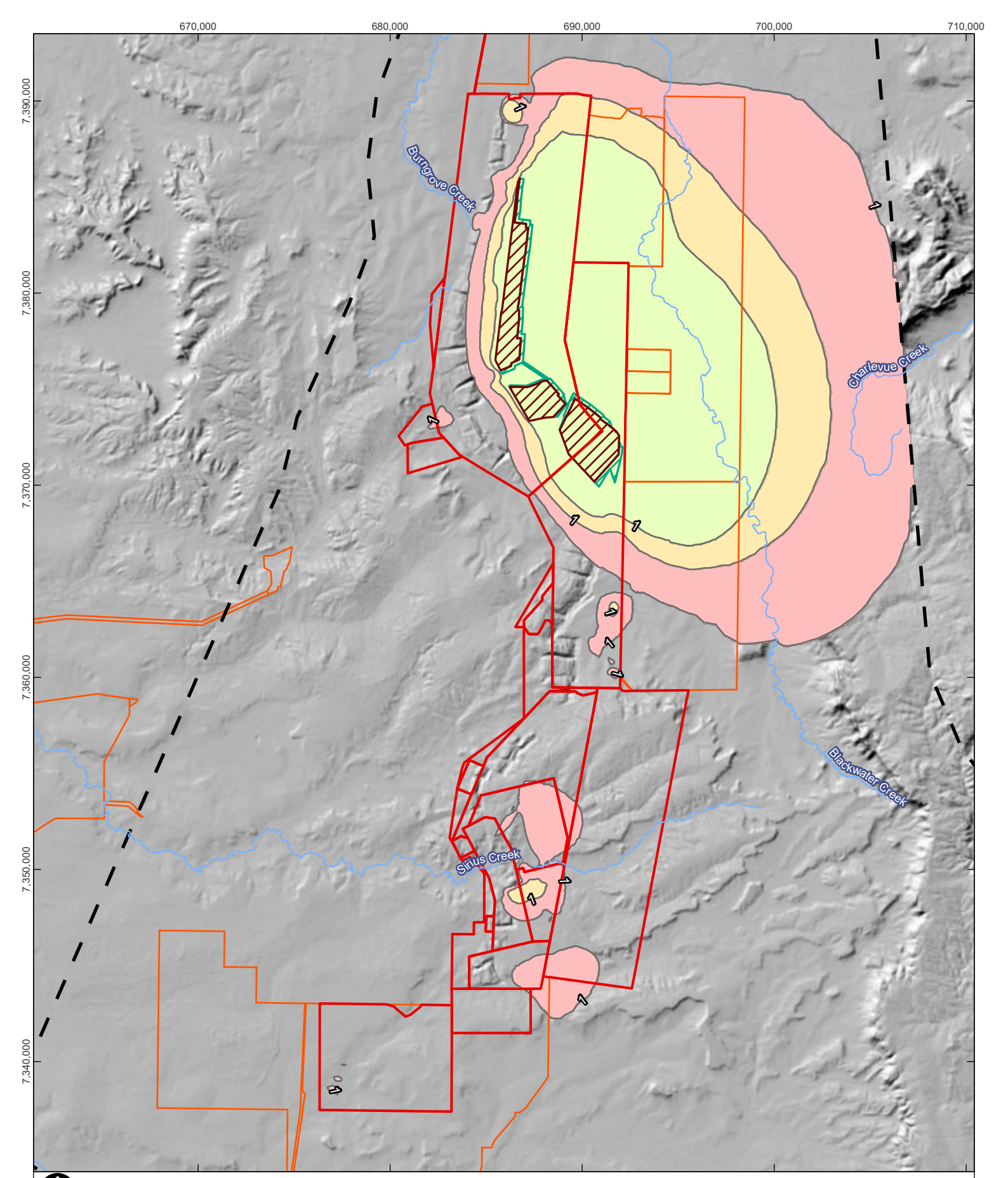
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN BURNGROVE FORMATION (END OF MINING) (LAYER 16)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-9

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E09_Uncertainty in Predicted 1m Incremental DD in Burngrove Formation (EoM) L16



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

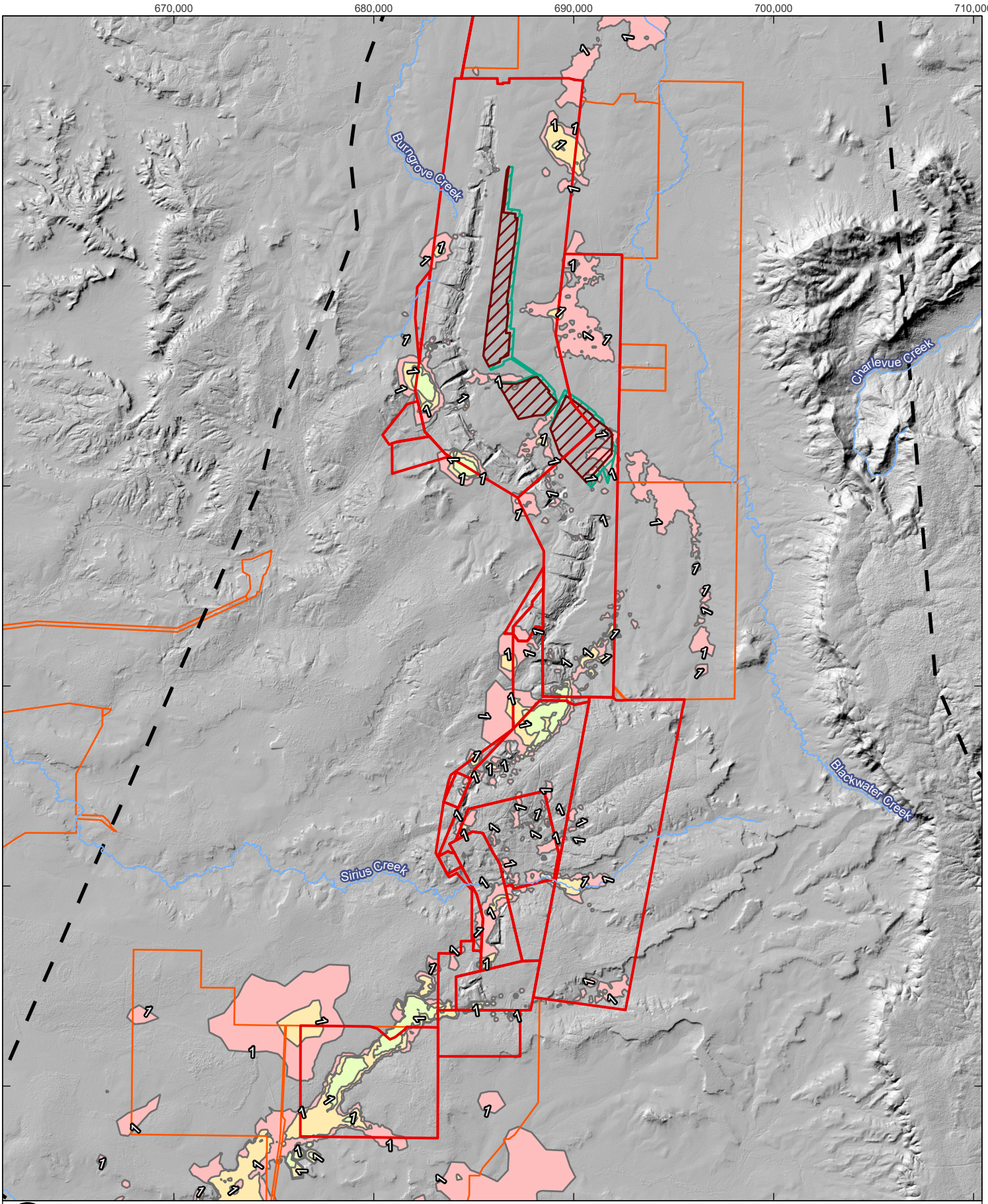
UNCERTAINTY IN PREDICTED 1M INCREMENTAL DRAWDOWN IN BURNGROVE FORMATION (END OF RECOVERY) (LAYER 16)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-10

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E10_Uncertainty in Predicted 1m Incremental DD in Burngrove Formation (EoR) L16



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

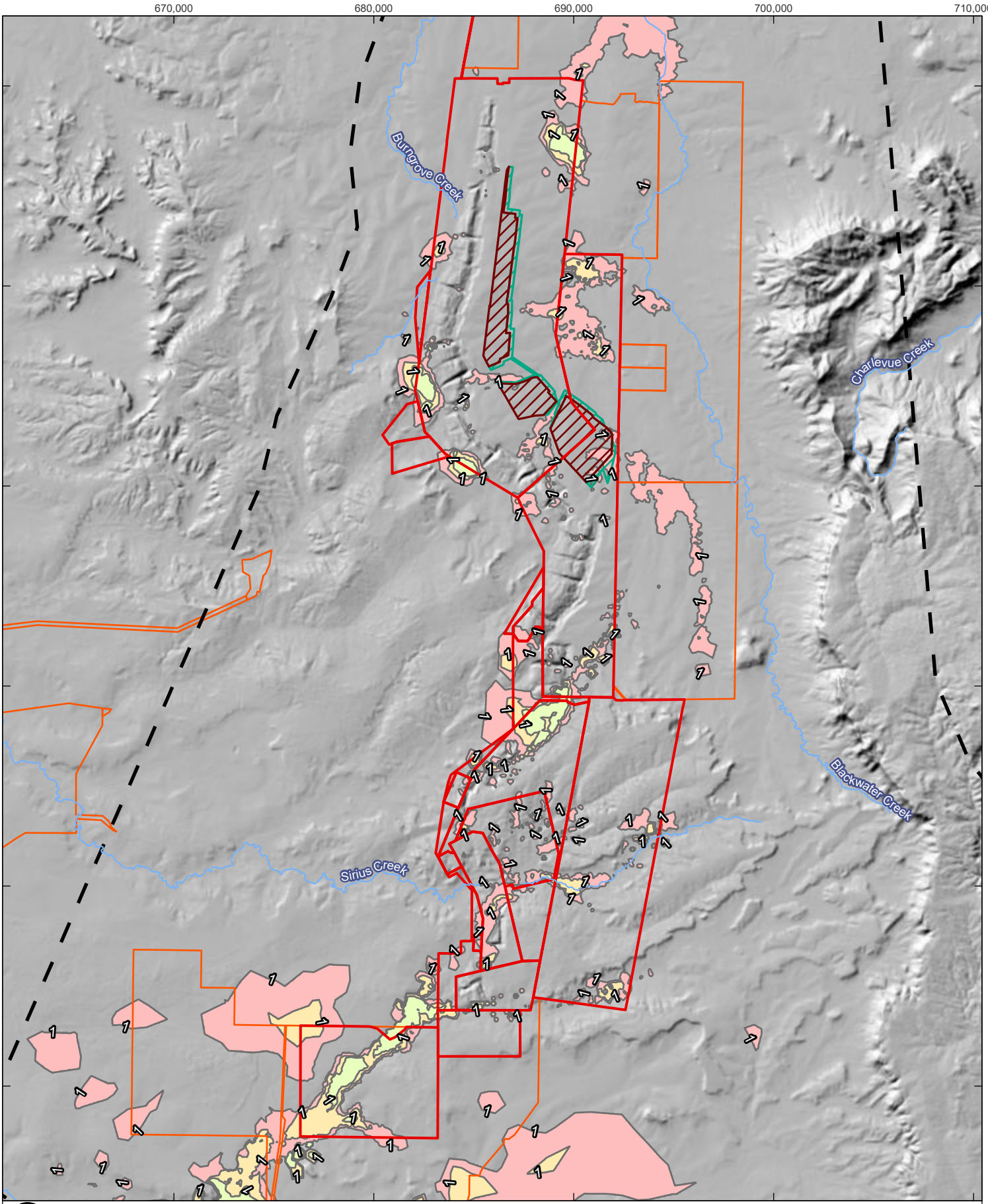
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ALLUVIUM/TERTIARY (END OF MINING) (LAYER 1)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-11

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E11_Uncertainty in Predicted 1m Cumulative DD in Alluvium and Tertiary (EoM) L1



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

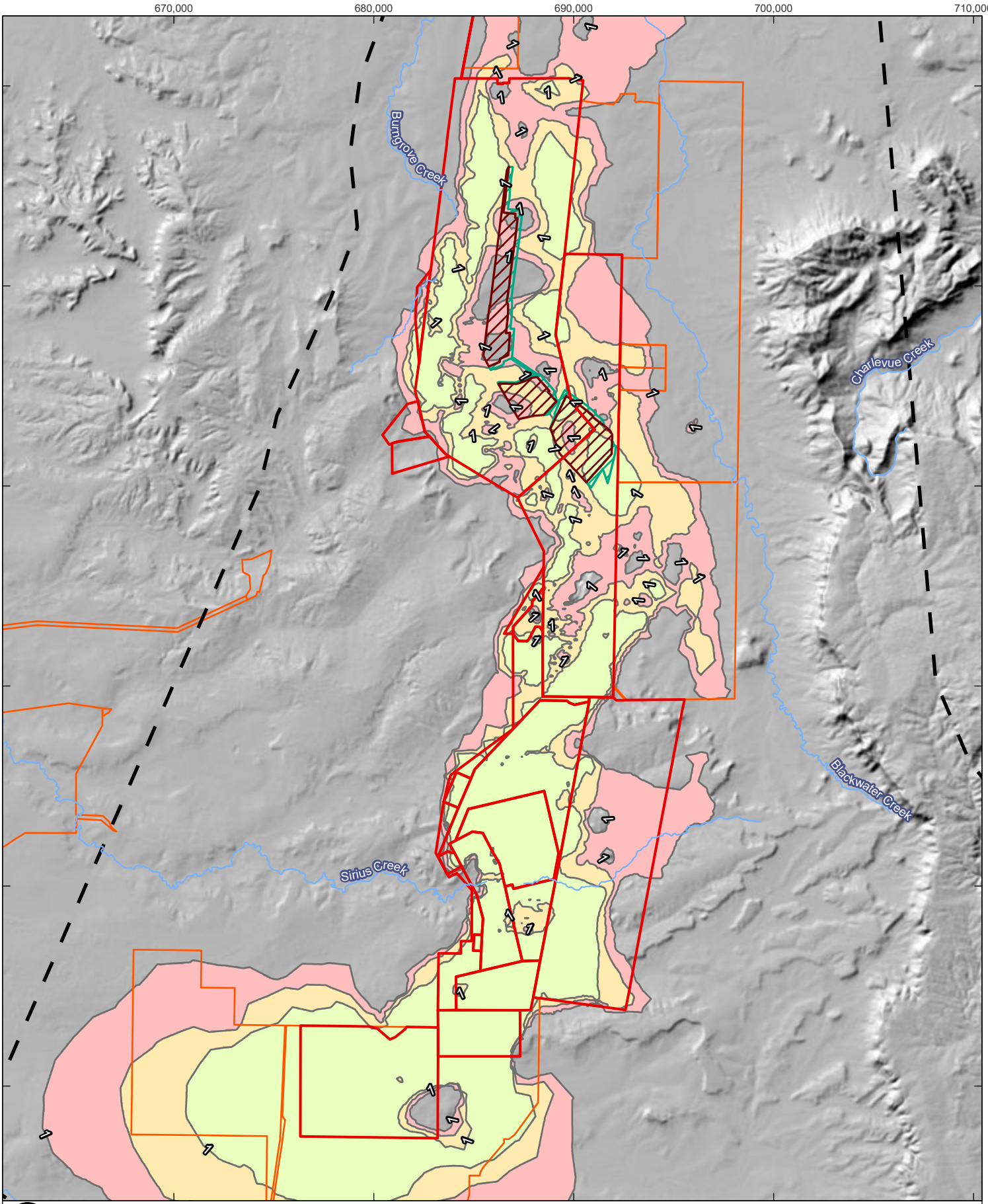
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ALLUVIUM/TERTIARY (END OF RECOVERY) (LAYER 1)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-12

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E12_Uncertainty in Predicted 1m Cumulative DD in Alluvium and Tertiary (EoR) L1



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

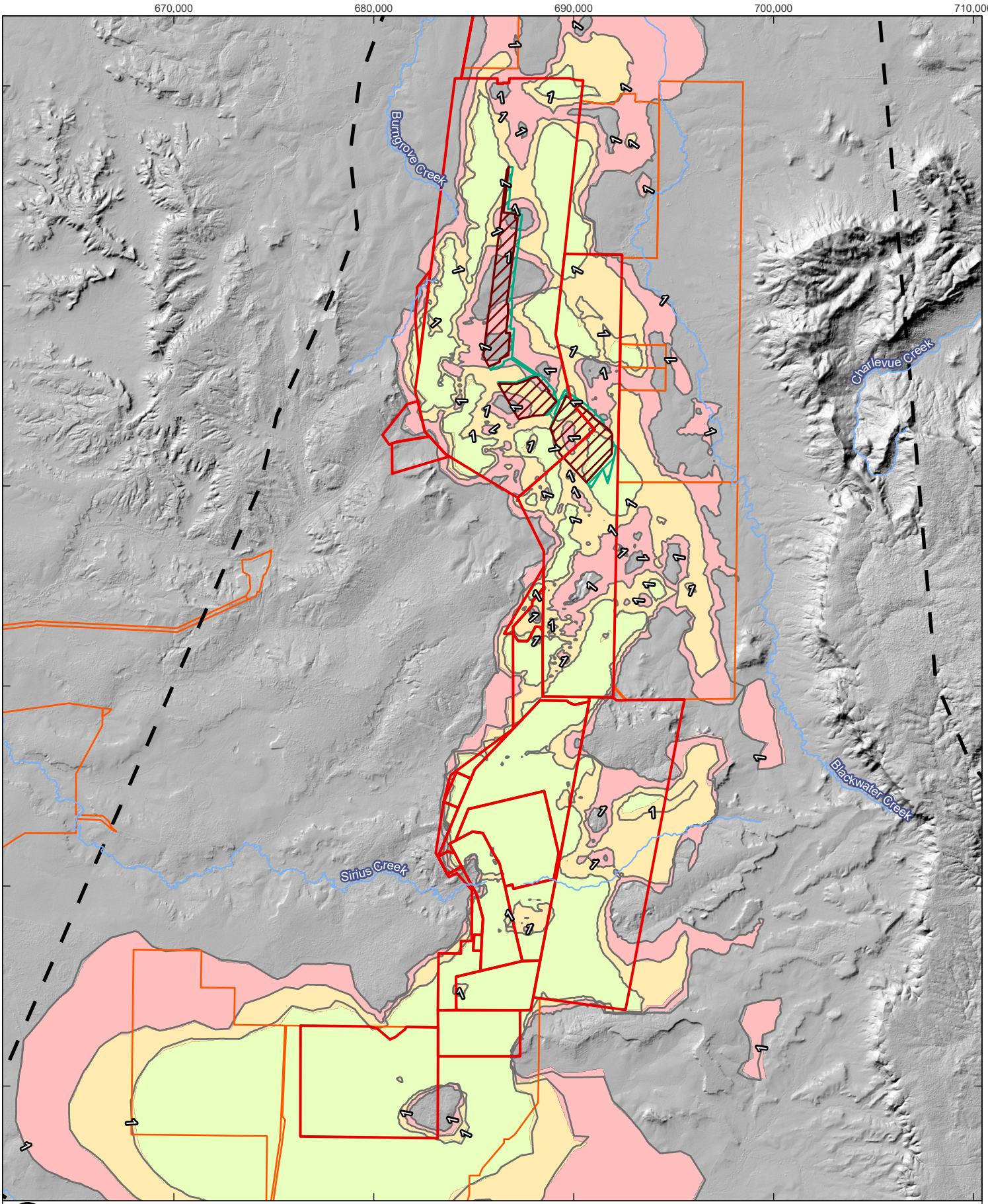
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ALLUVIUM/WEATHERED (END OF MINING) (LAYER 2)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-13

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E13_Uncertainty in Predicted 1m Cumulative DD in Alluvium and Weathered (EoM) L2



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

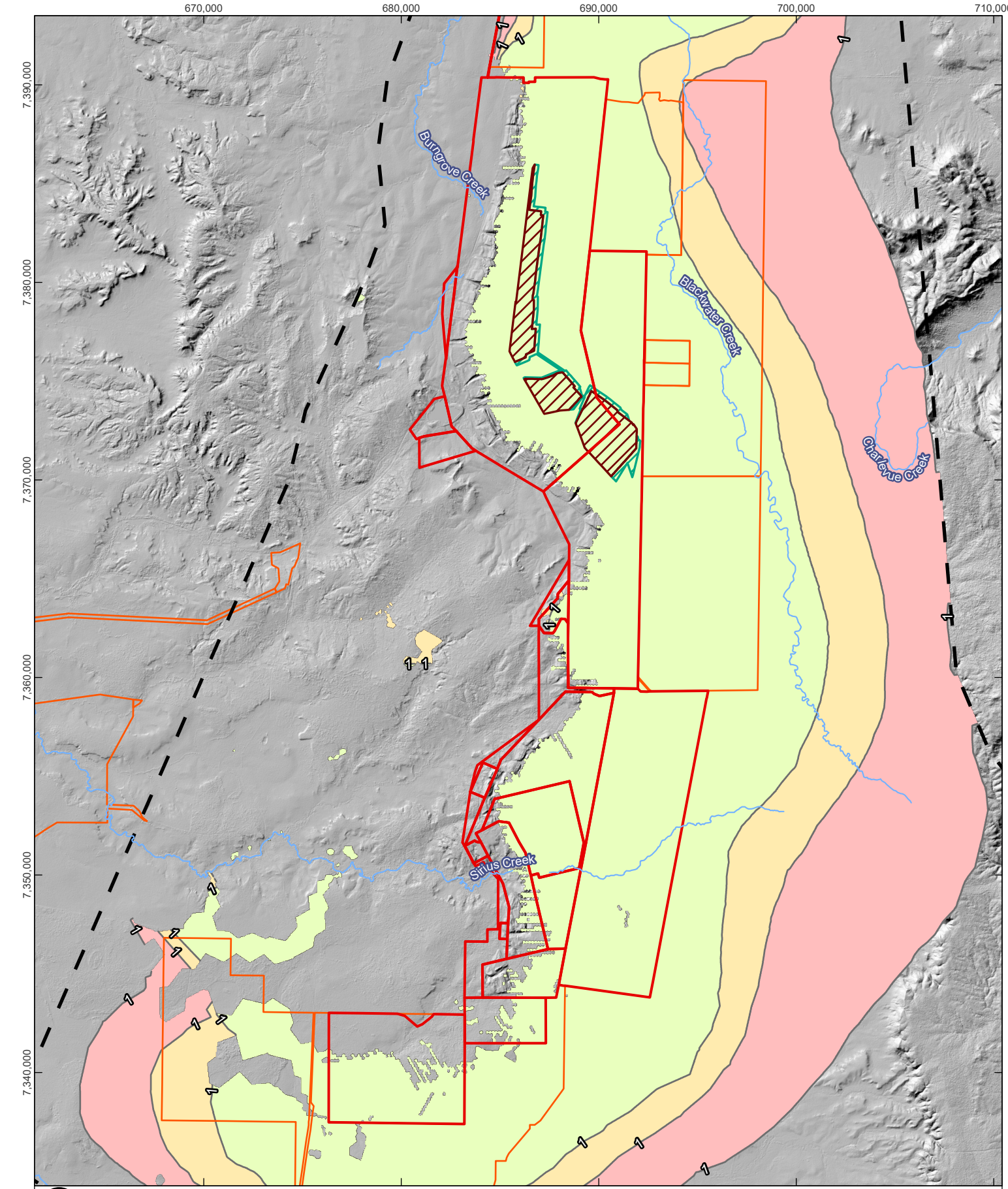
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ALLUVIUM/WEATHERED (END OF RECOVERY) (LAYER 2)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-14

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E14_Uncertainty in Predicted 1m Cumulative DD in Alluvium and Weathered (EoR) L2



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

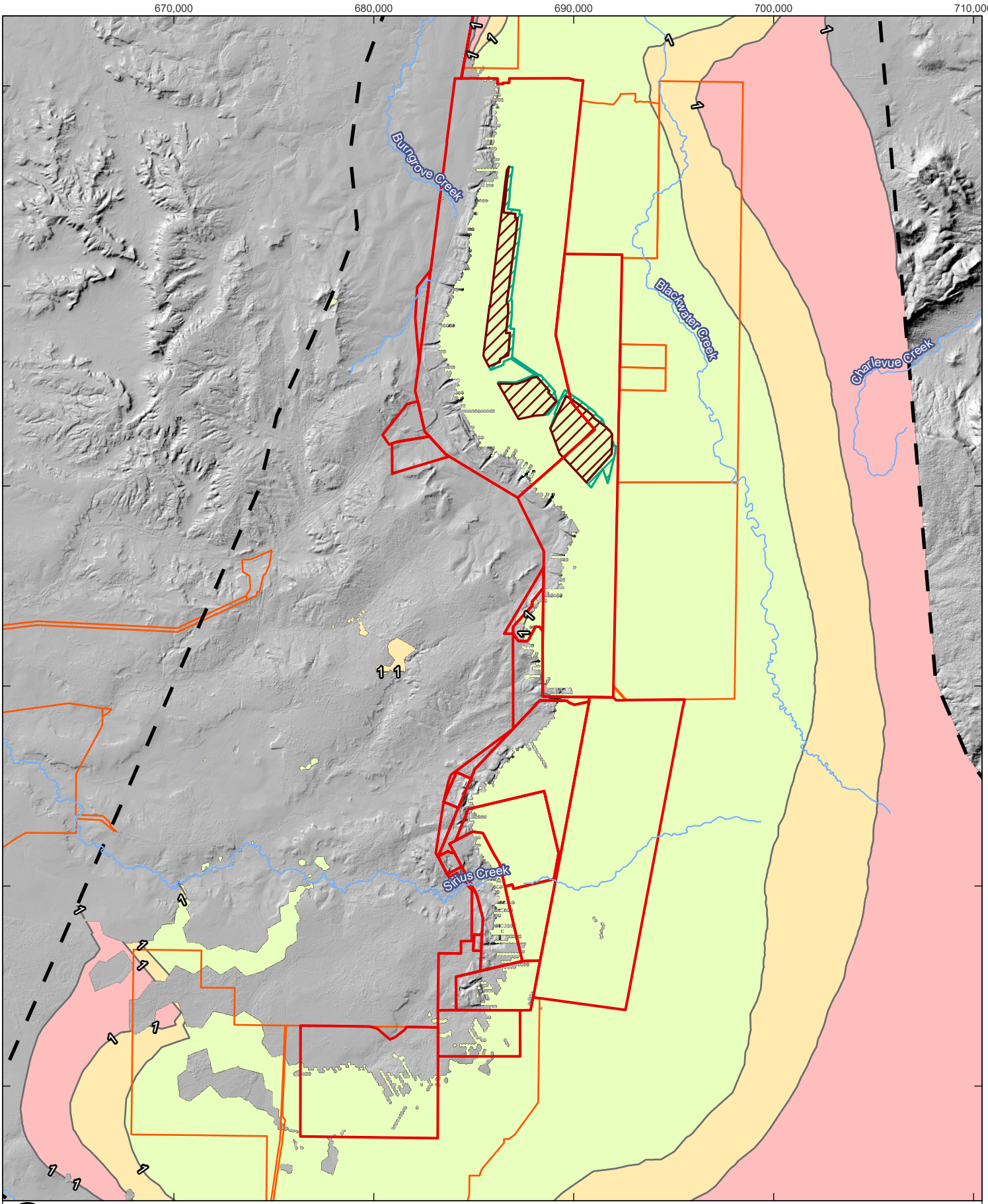
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ARIES SEAM (END OF MINING) (LAYER 8)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-15

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E15_Uncertainty in Predicted 1m Cumulative DD in Aries Seam (EoM) L8



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

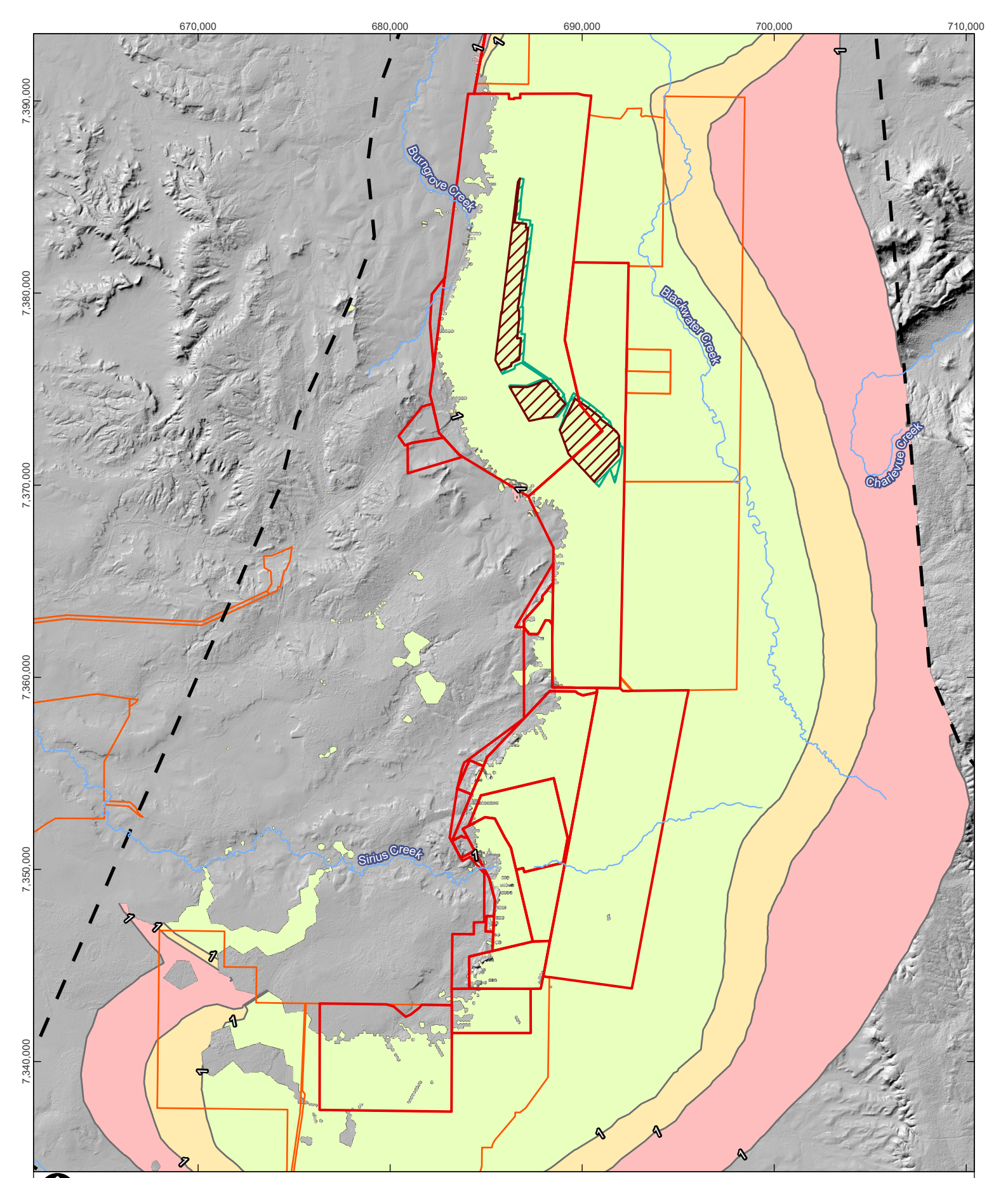
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN ARIES SEAM (END OF RECOVERY) (LAYER 8)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-16

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E16_Uncertainty in Predicted 1m Cumulative DD in Aries Seam (EoR) L8



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

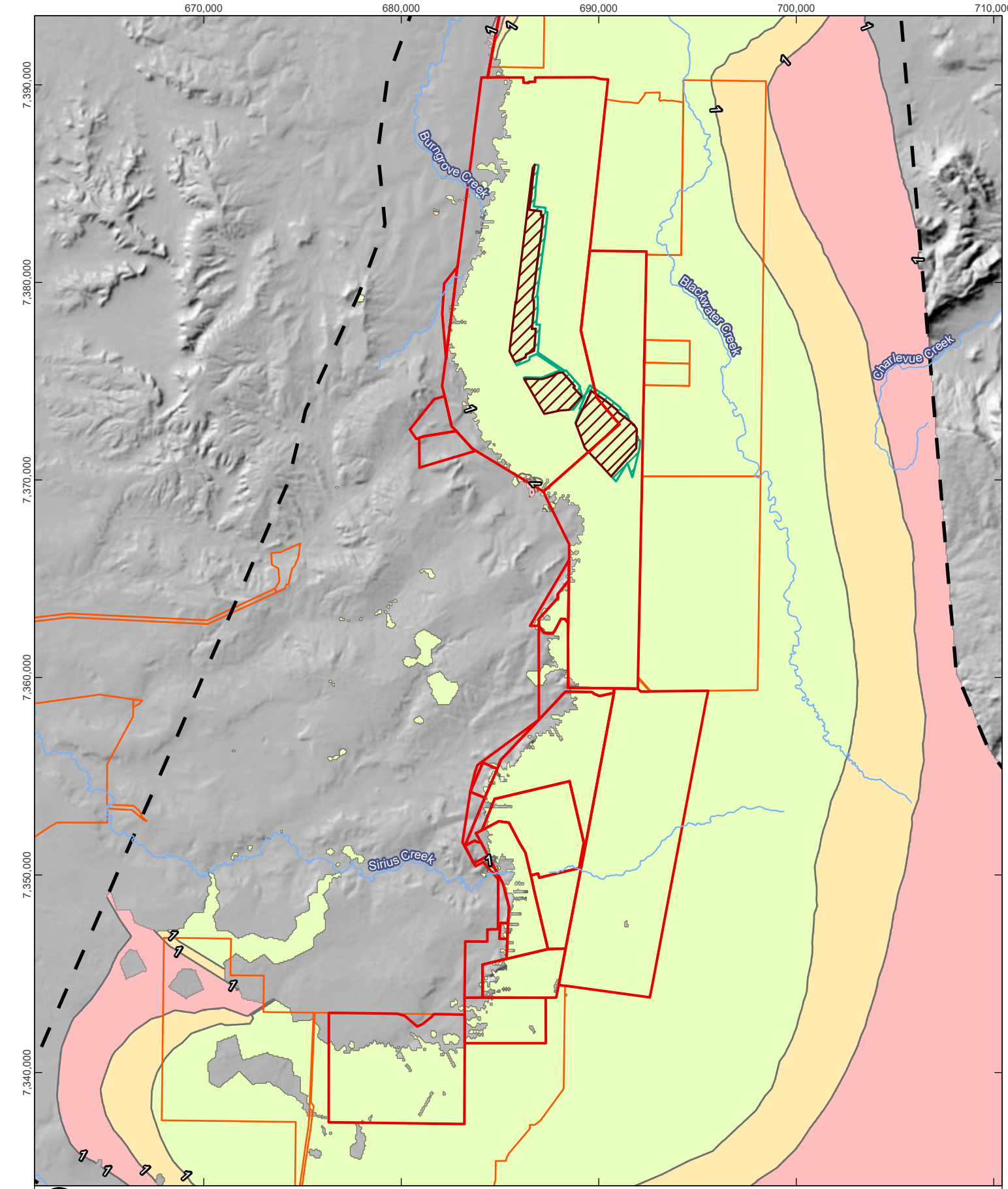
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN POLLUX SEAM (END OF MINING) (LAYER 12)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-17

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E17_Uncertainty in Predicted 1m Cumulative DD in Pollux Seam (EoM) L12



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

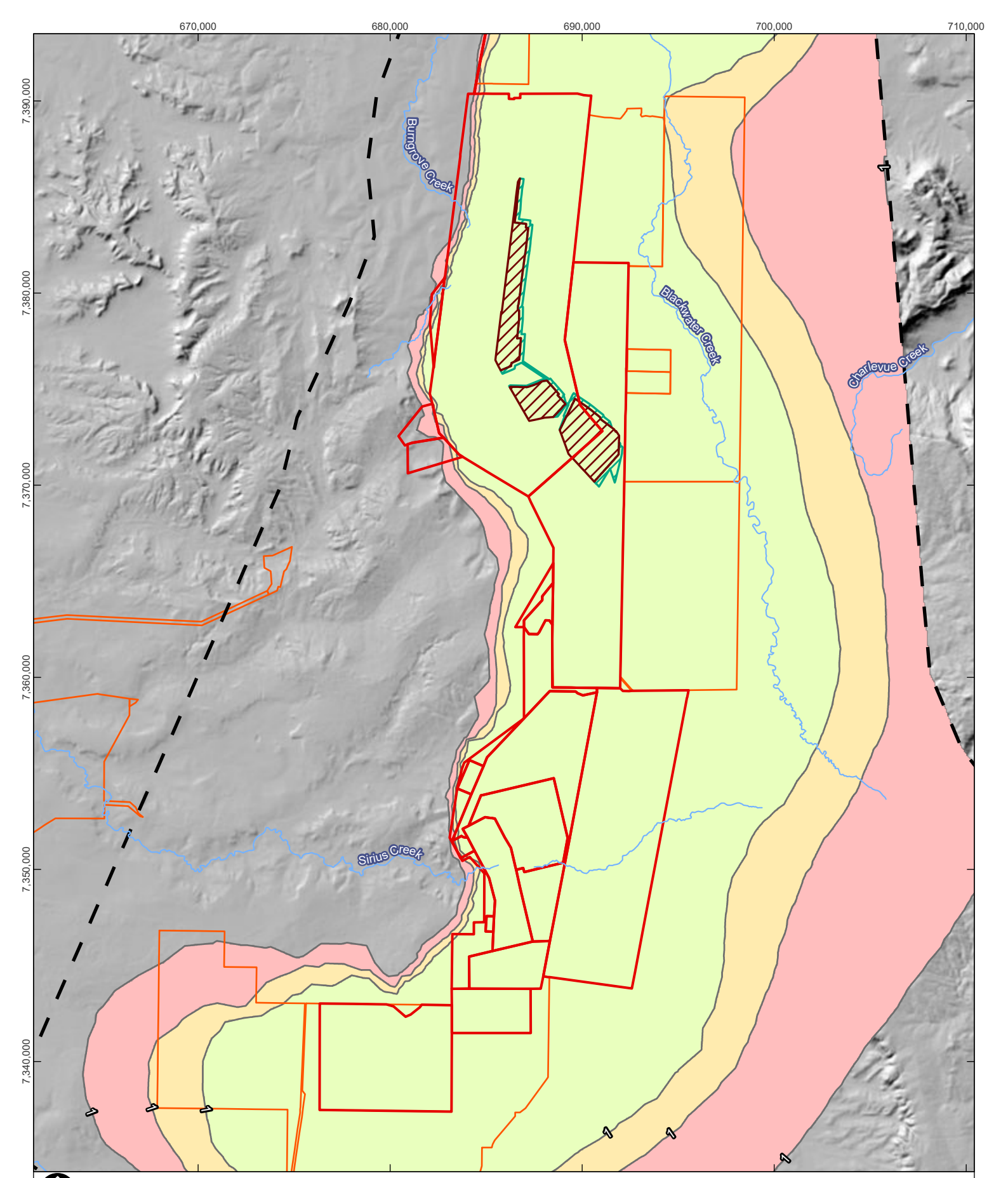
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN POLLUX SEAM (END OF RECOVERY) (LAYER 12)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-18

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E18_Uncertainty in Predicted 1m Cumulative DD in Pollux Seam (EoR) L12



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	08-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

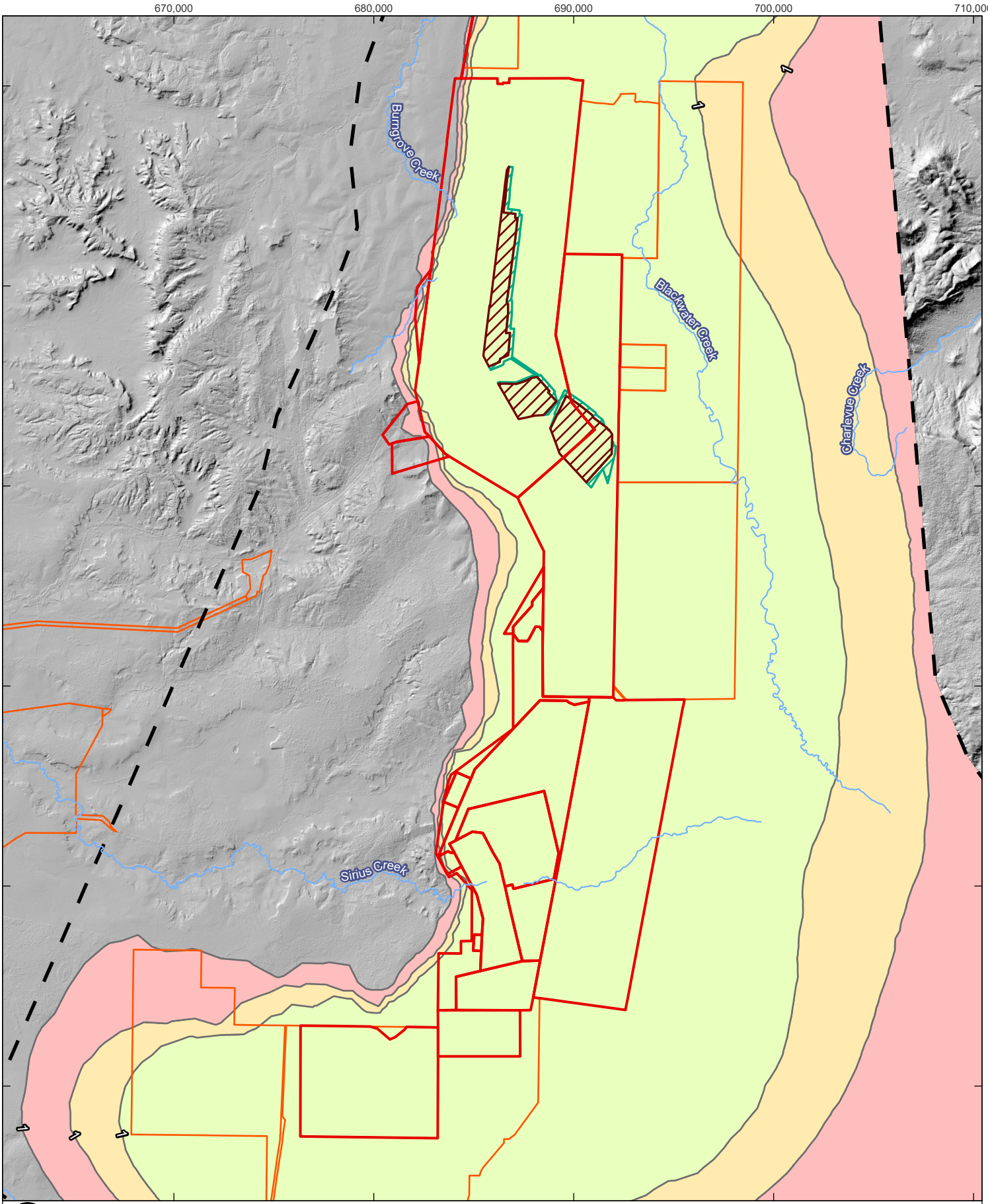
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN BURNGROVE FORMATION (END OF MINING) (LAYER 16)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-19

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E19_Uncertainty in Predicted 1m Cumulative DD in Burngrove Formation (EoM) L16



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	640.031809.00001
Date Drawn:	10-Apr-2026
Drawn by:	RB

LEGEND

- Watercourse
- BWM Mining Lease
- Mining Lease
- Model Boundary
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Maximum Drawdown (m)

- 5th Percentile
- 50th Percentile
- 95th Percentile

BLACKWATER NORTH EXTENSION PROJECT GROUNDWATER MODELLING TECHNICAL REPORT

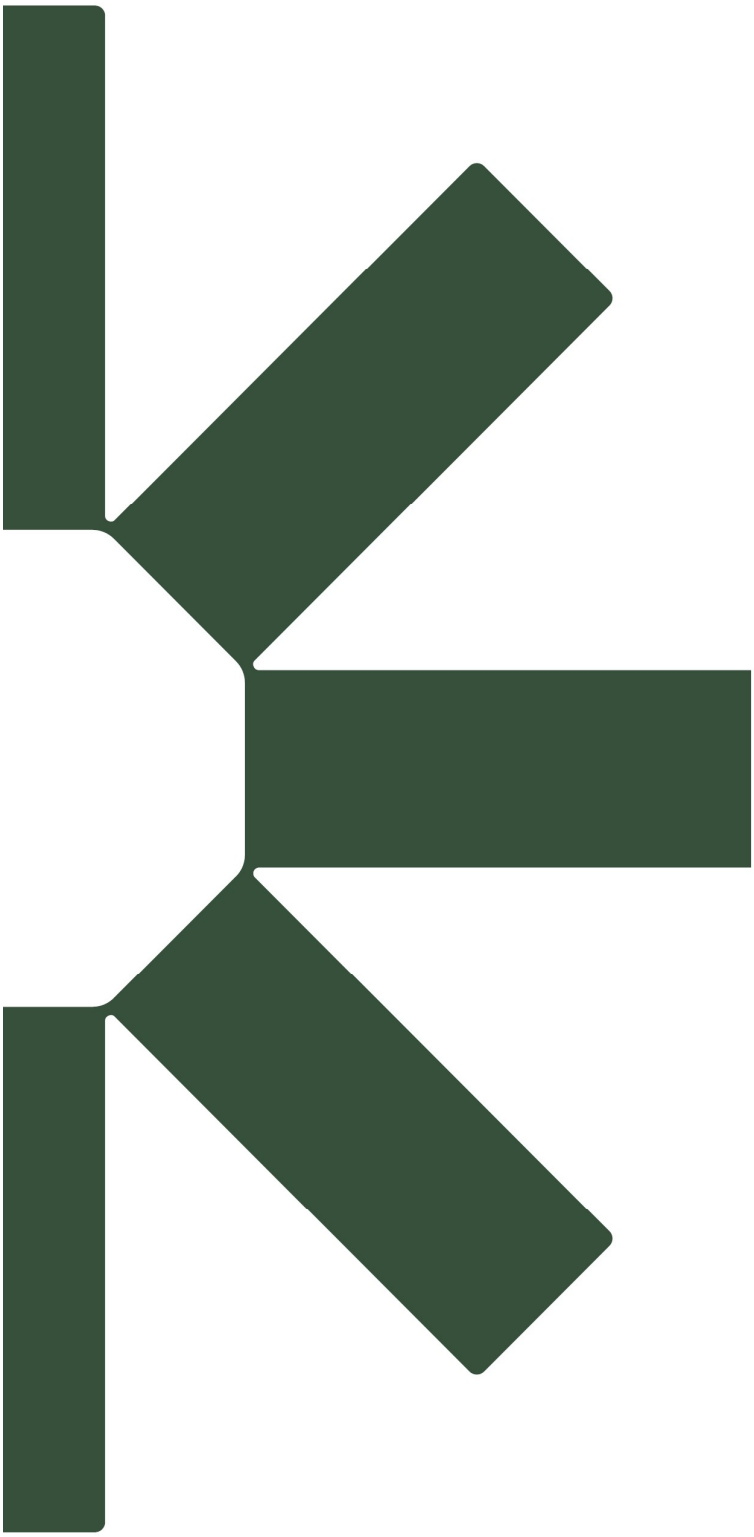
UNCERTAINTY IN PREDICTED 1M CUMULATIVE DRAWDOWN IN BURNGROVE FORMATION (END OF RECOVERY) (LAYER 16)

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

APPENDIX G-20

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031809.00001 BWM North EIS - Groundwater As\06 SLR Data\01 GIS\640_031809_BWN_EIS.aprx\640031809_MOD_APP_E20_Uncertainty in Predicted 1m Cumulative DD in Burngrove Formation (EoR) L16



Making Sustainability Happen

Appendix C Post Mining Period Starting Heads

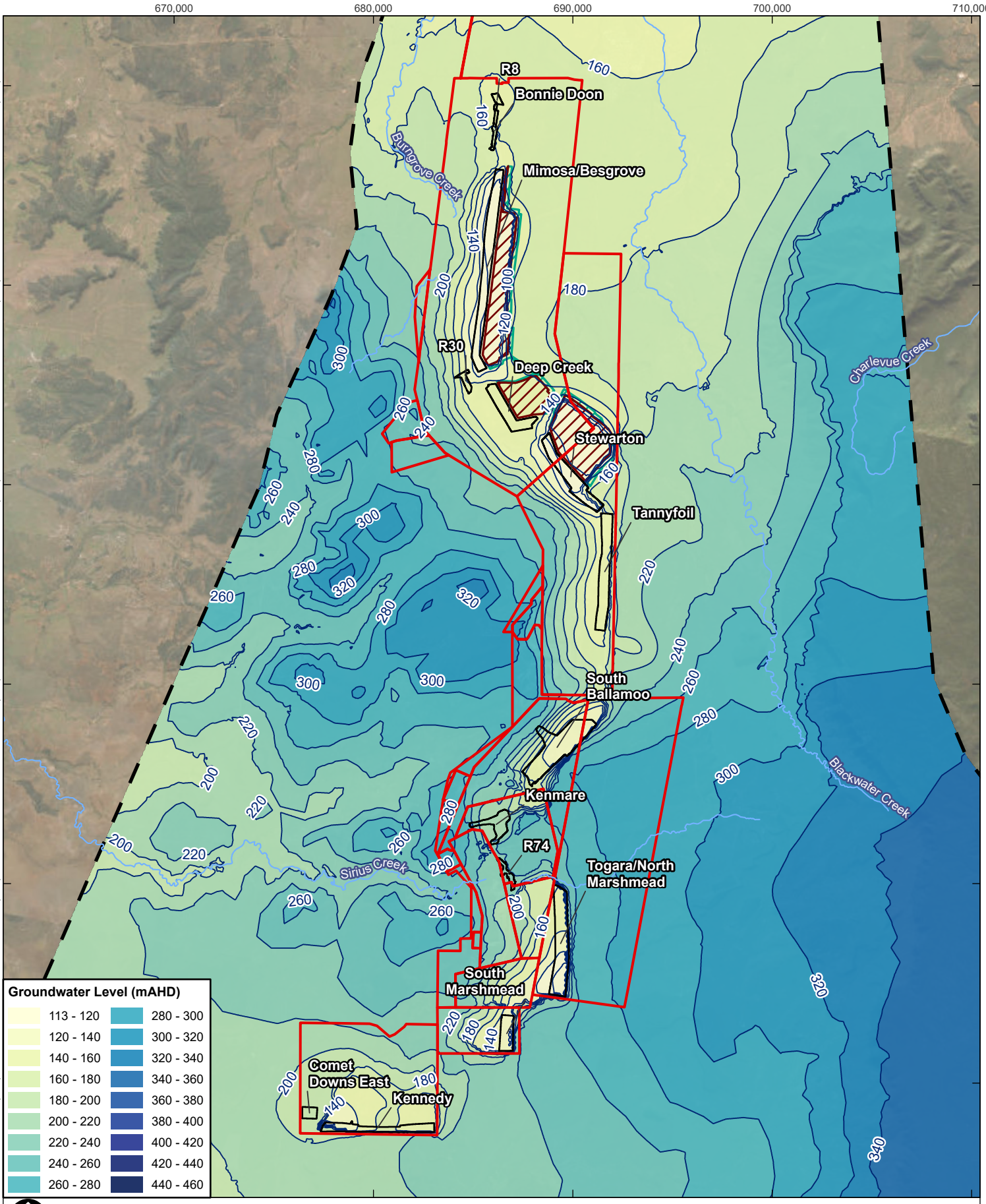
Blackwater Mine

PRC Plan Hydrogeology Assessment – Revision 3

Whitehaven Blackwater Pty Ltd

SLR Project No.: 620.040199.00017

28 September 2026



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	08-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

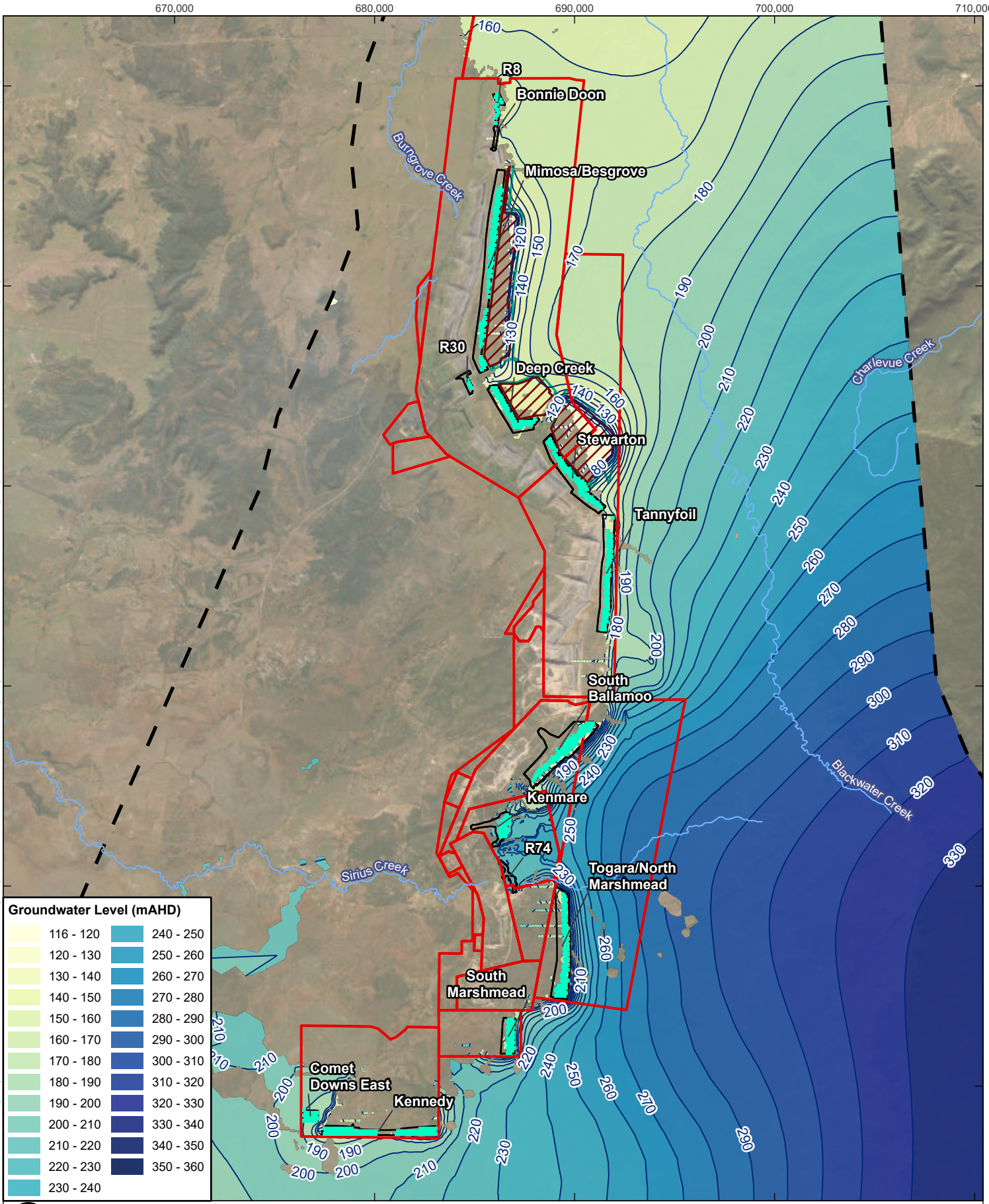
END OF MINING GROUNDWATER LEVELS – WATER TABLE

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE C-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_AppC_01_End of Mining Groundwater Levels – Water Table



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	08-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

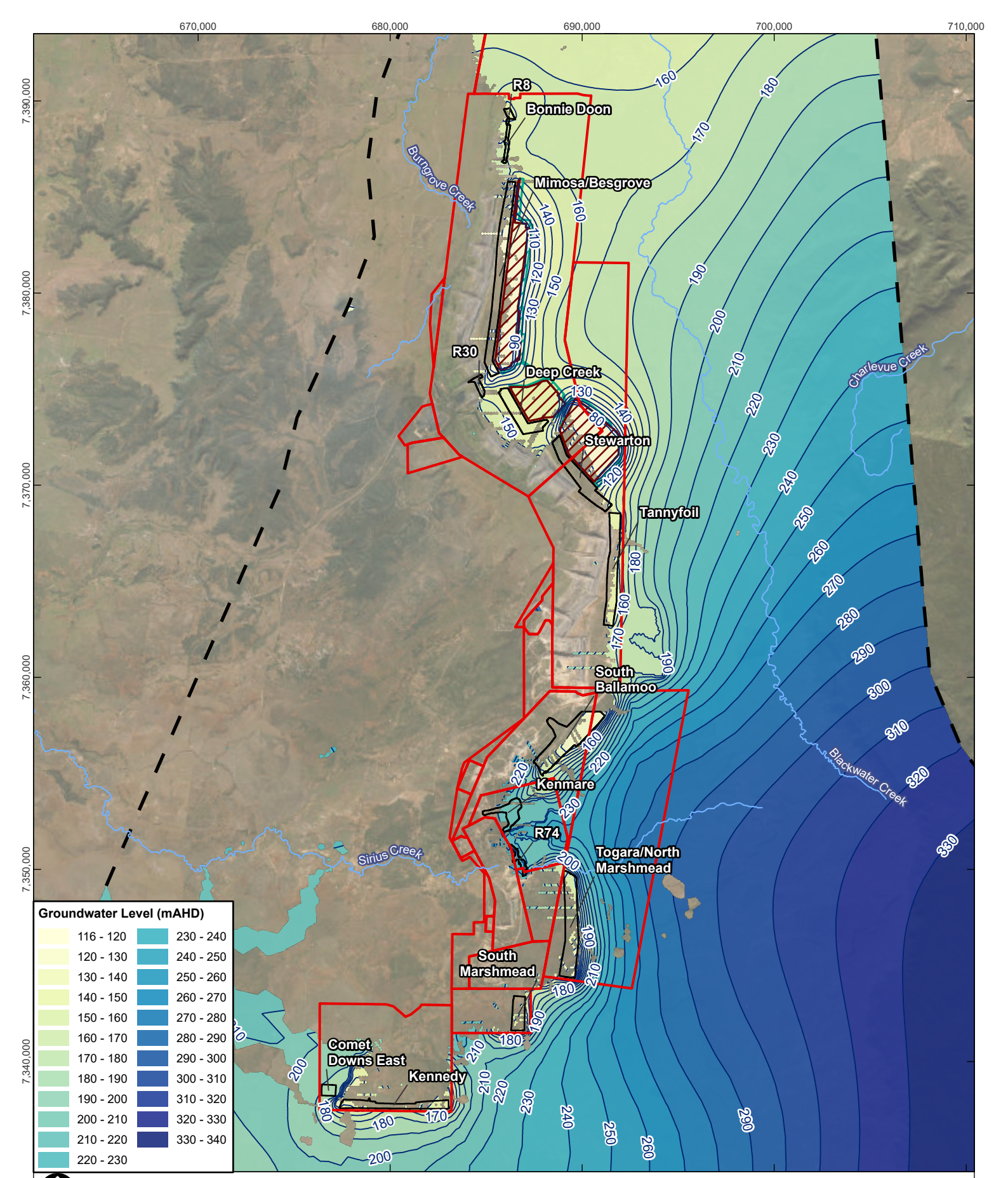
END OF MINING GROUNDWATER LEVELS – ARIES SEAM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE C-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_AppC_02_End of Mining Groundwater Levels – Aries Seam



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	08-May-2026
Drawn by:	AS

LEGEND

- Watercourse
- Groundwater Level (mAHD)
- BWM Mining Lease
- GIA Study Area
- Void Extent
- Void Lake
- Proposed Open Cut Extension
- Proposed Infrastructure Area

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

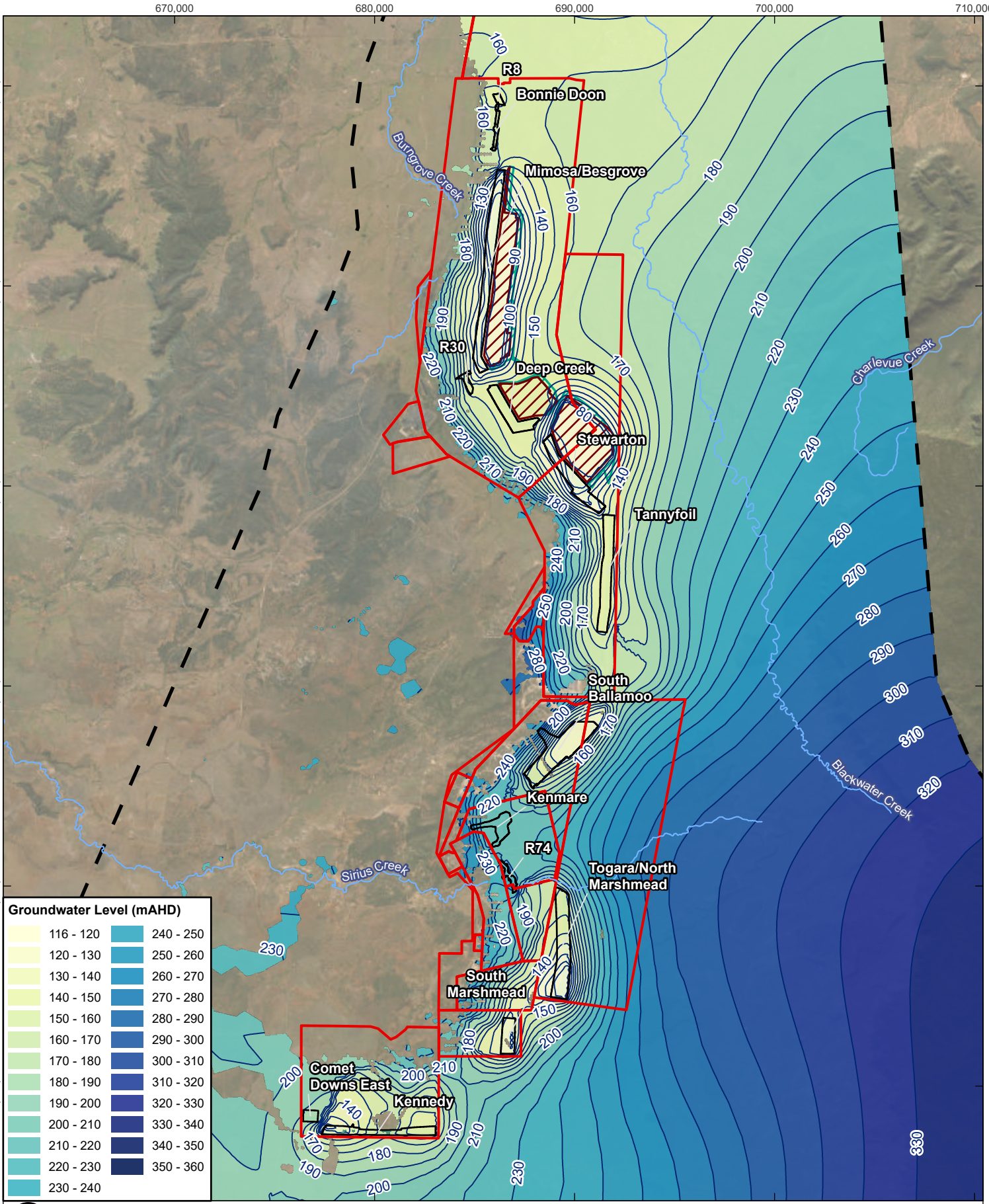
END OF MINING GROUNDWATER LEVELS – CASTOR SEAM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE C-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_AppC_03_End of Mining Groundwater Levels – Castor Seam



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.040199
Date Drawn:	08-May-2026
Drawn by:	AS

BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT

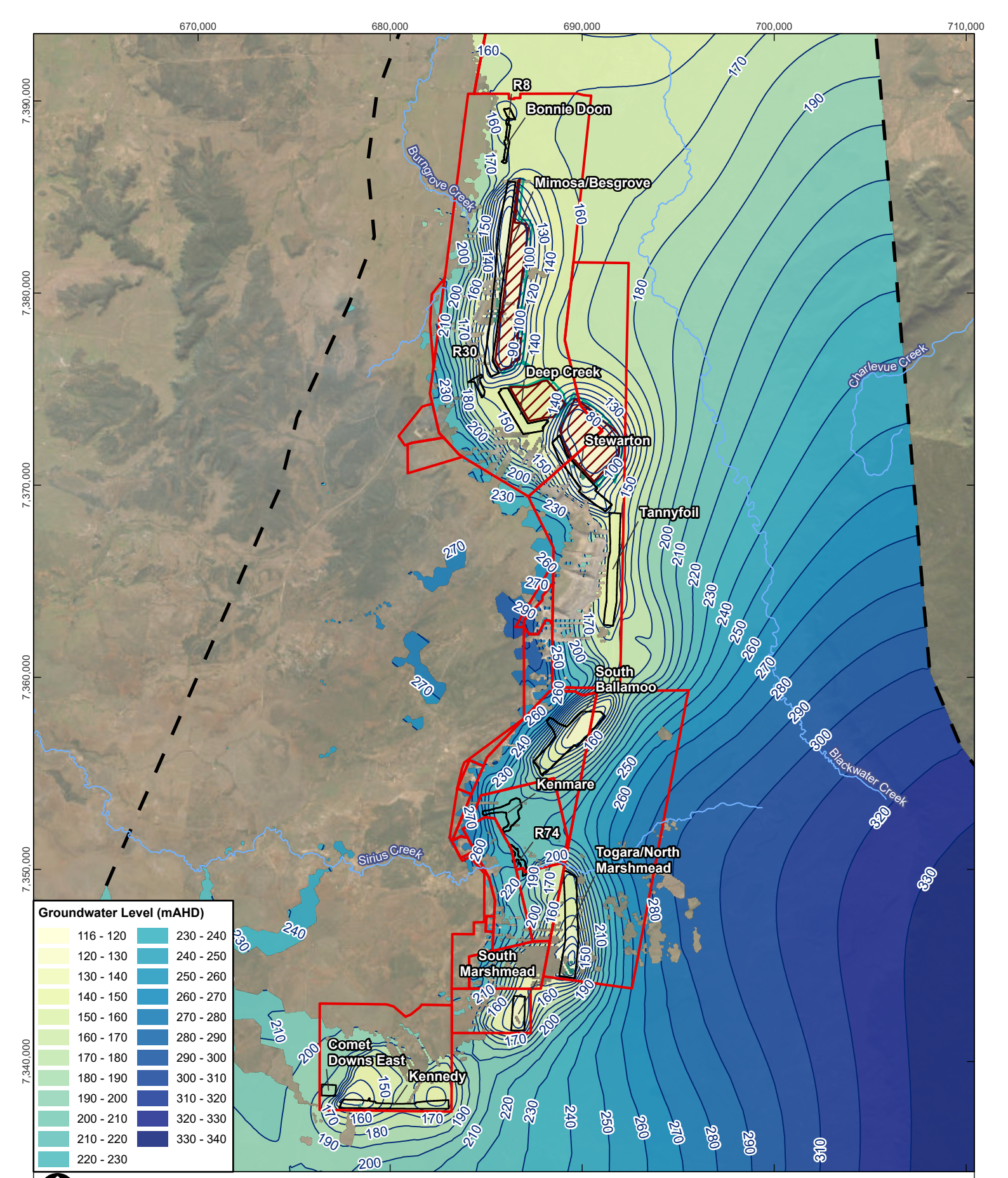
END OF MINING GROUNDWATER LEVELS – POLLUX SEAM

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE C-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_AppC_04_End of Mining Groundwater Levels – Pollux Seam


670,000
680,000
690,000
700,000
710,000
7,390,000
7,380,000
7,370,000
7,360,000
7,350,000
7,340,000
R8
Bonnie Doon
Mimosa/Besgrove
Burngrove Creek
R30
Deep Creek
Stewarton
Charlevue Creek
Tannyfoil
South Ballamoo
Kenmare
R74
Togara/North Marshmead
Blackwater Creek
Sirius Creek
South Marshmead
Comet Downs East
Kennedy
Groundwater Level (mAHD)
116 - 120
120 - 130
130 - 140
140 - 150
150 - 160
160 - 170
170 - 180
180 - 190
190 - 200
200 - 210
210 - 220
220 - 230
230 - 240
240 - 250
250 - 260
260 - 270
270 - 280
280 - 290
290 - 300
300 - 310
310 - 320
320 - 330
330 - 340
0
2.5
5
km
LEGEND
Watercourse
Groundwater Level (mAHD)
BWM Mining Lease
GIA Study Area
Void Extent
Void Lake
Proposed Open Cut Extension
Proposed Infrastructure Area
Coordinate System: GDA2020 MGA Zone 55
Scale: 1:250,000 at A4
Project Number: 620.040199
Date Drawn: 08-May-2026
Drawn by: AS
BLACKWATER MINE - PRCP HYDROGEOLOGY ASSESSMENT
END OF MINING GROUNDWATER LEVELS – BURNGROVE FORMATION
SLR
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.
FIGURE C-5
Path: H:\Projects-SLR\620-BNE\620-BNE\620.040199.00001 BWM PRCP – GW\03 SLR Data\01 CADGIS\GIS\ArcPro\BWM PRCP – GW\BWM PRCP – GW.aprx\620040199_AppC_05_End of Mining Groundwater Levels – Burngrove Formation

Appendix D Predictive Hydrographs Adjacent Final Void Lakes

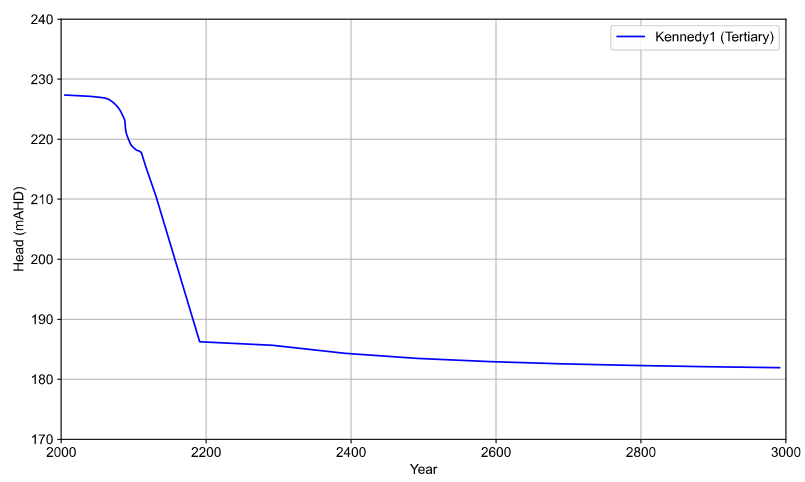
Blackwater Mine

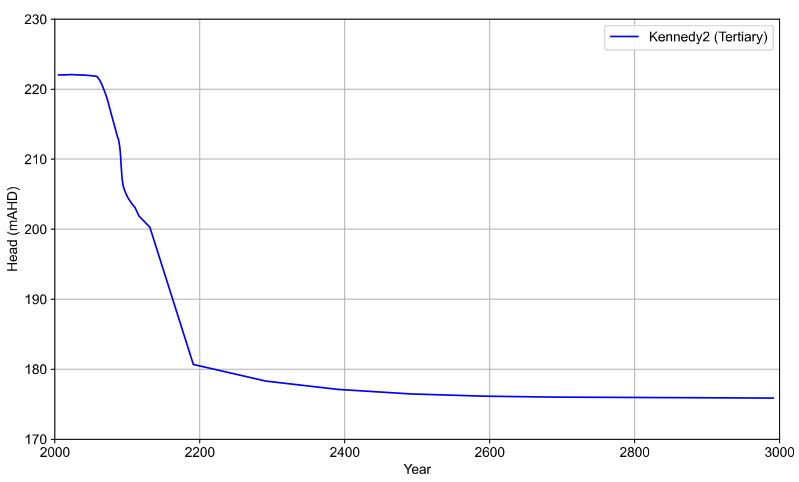
PRC Plan Hydrogeology Assessment – Revision 3

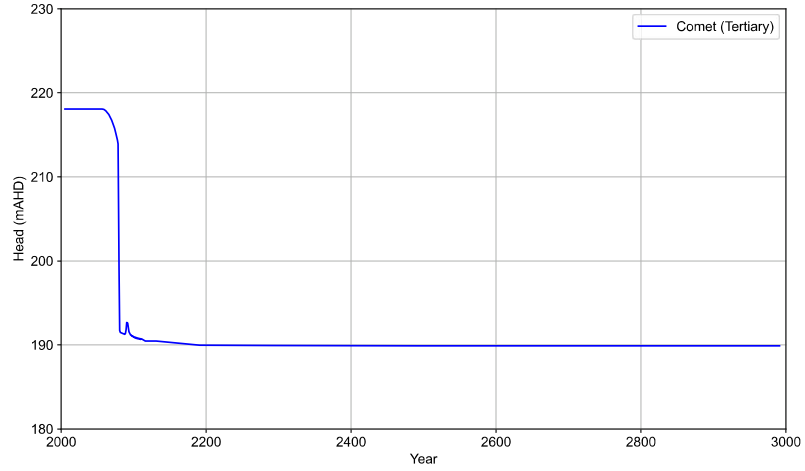
Whitehaven Blackwater Pty Ltd

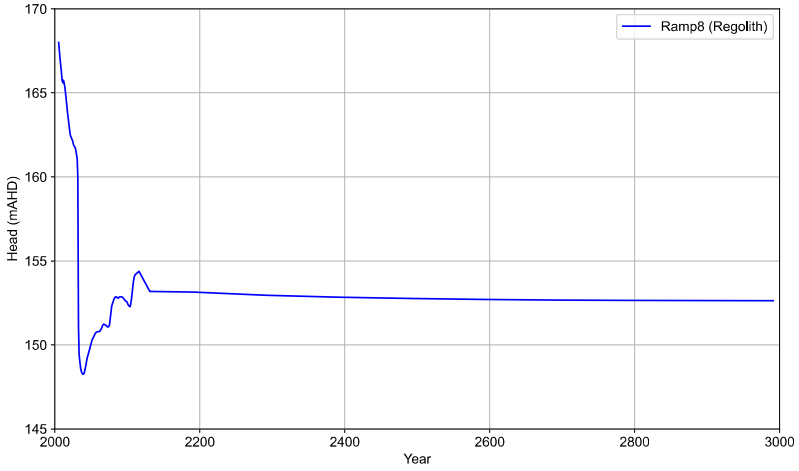
SLR Project No.: 620.040199.00017

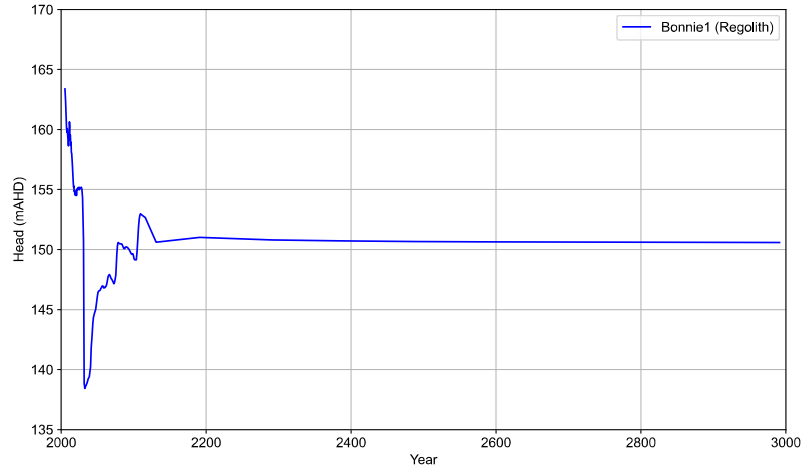
28 September 2026

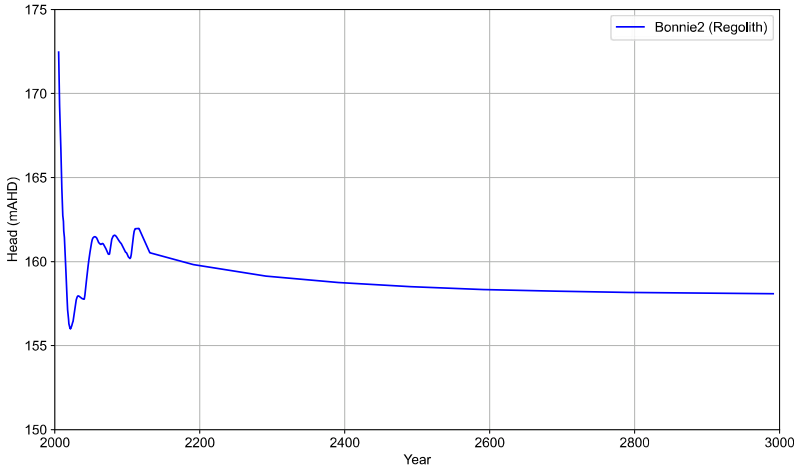

Kennedy1 (Tertiary)
Head (mAHD)
Year
240
230
220
210
200
190
180
170
2000
2200
2400
2600
2800
3000

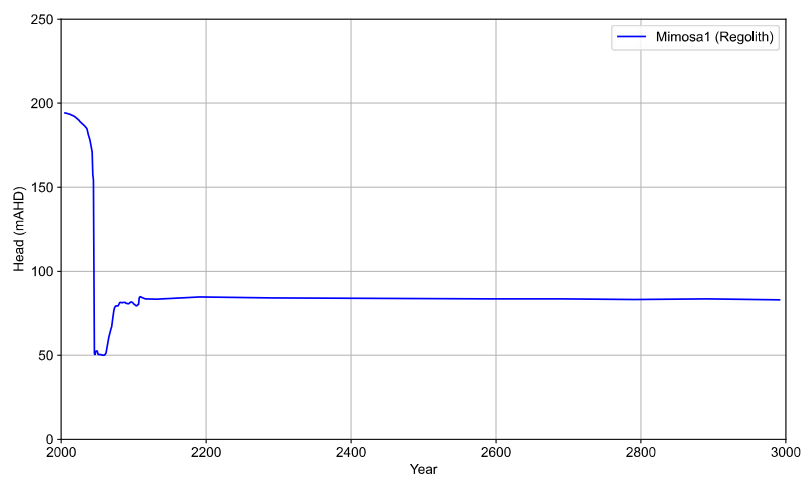

Kennedy2 (Tertiary)
Head (mAHD)
Year
230
220
210
200
190
180
170
2000
2200
2400
2600
2800
3000

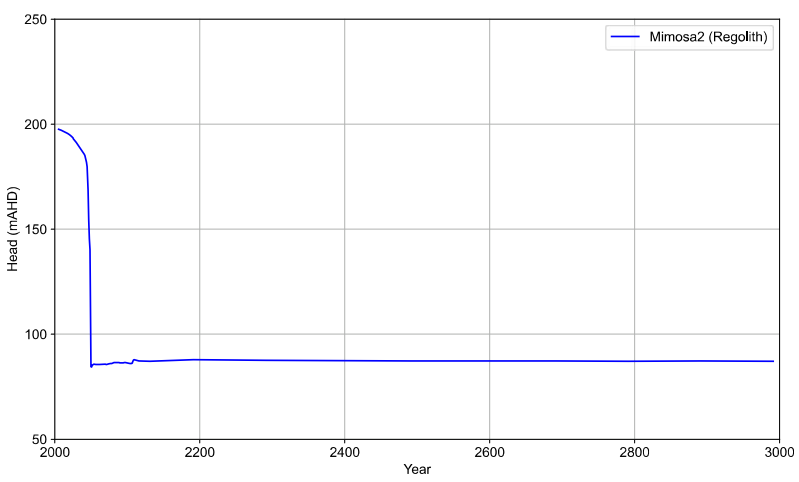

Comet (Tertiary)
Head (mAHD)
Year
230
220
210
200
190
180
2000
2200
2400
2600
2800
3000

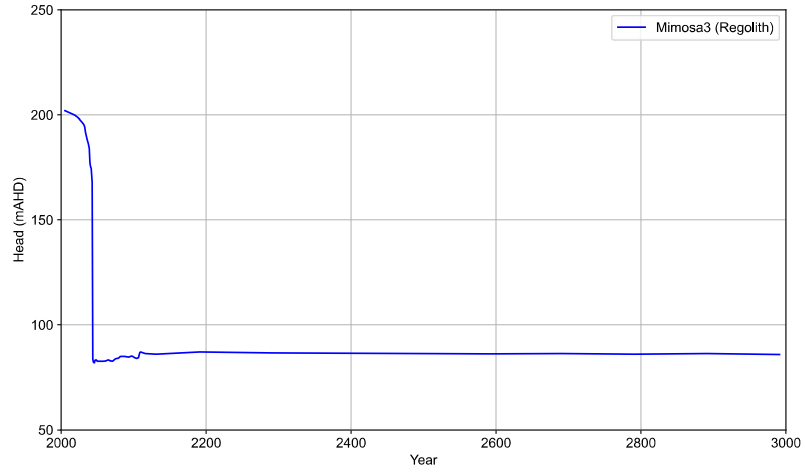

Ramp8 (Regolith)
Head (mAHD)
Year
170
165
160
155
150
145
2000
2200
2400
2600
2800
3000

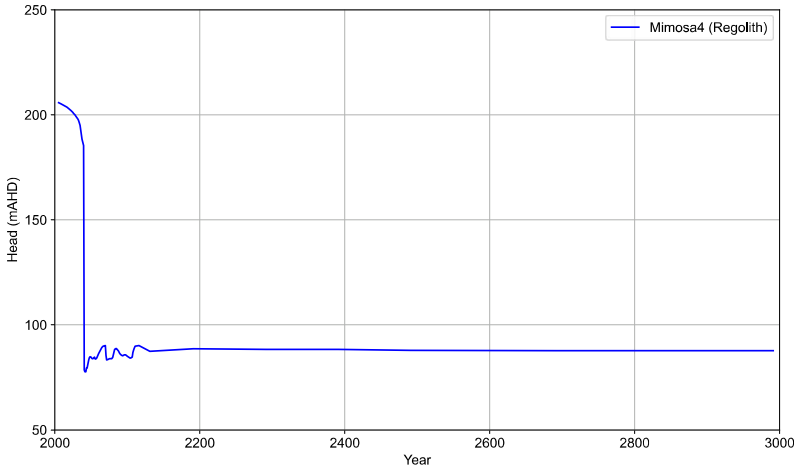

Bonnie1 (Regolith)
Head (mAHD)
Year
170
165
160
155
150
145
140
135
2000
2200
2400
2600
2800
3000

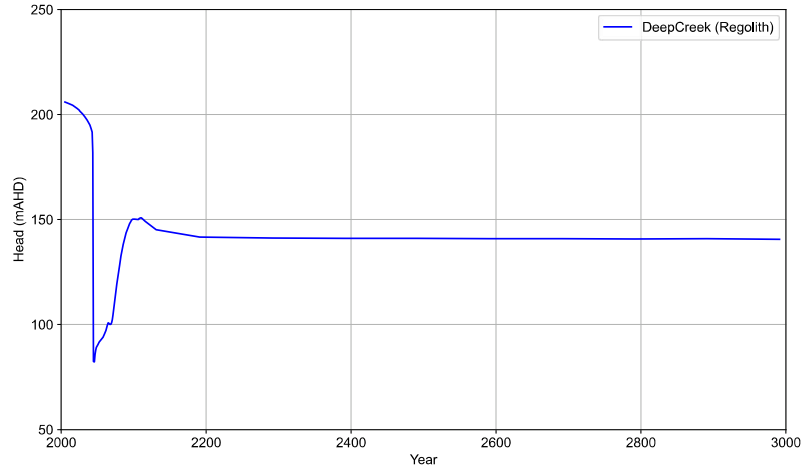

Bonnie2 (Regolith)
Head (mAHD)
Year
175
170
165
160
155
150
2000
2200
2400
2600
2800
3000

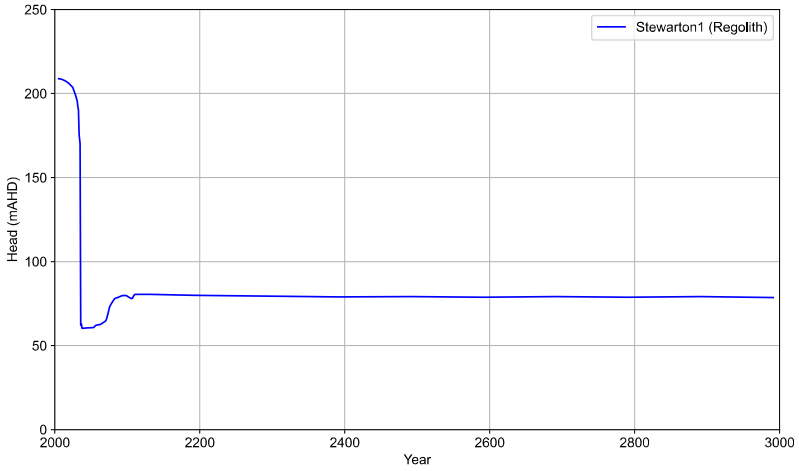

Mimosa1 (Regolith)
Head (mAHD)
Year
250
200
150
100
50
0
2000
2200
2400
2600
2800
3000

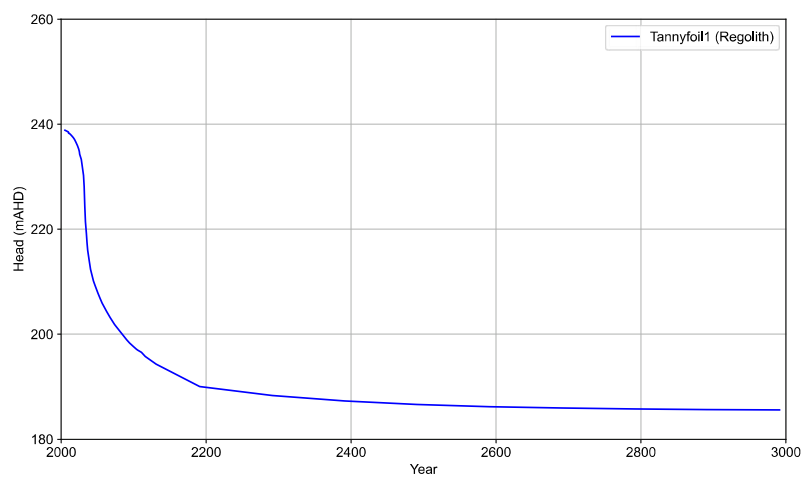

Mimosa2 (Regolith)
Head (mAHD)
Year
250
200
150
100
50
2000
2200
2400
2600
2800
3000

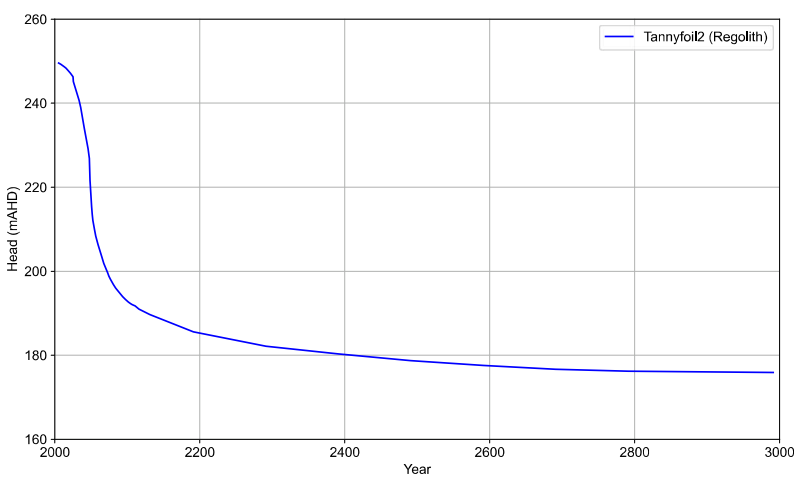

Mimosa3 (Regolith)
Head (mAHD)
Year
250
200
150
100
50
2000
2200
2400
2600
2800
3000

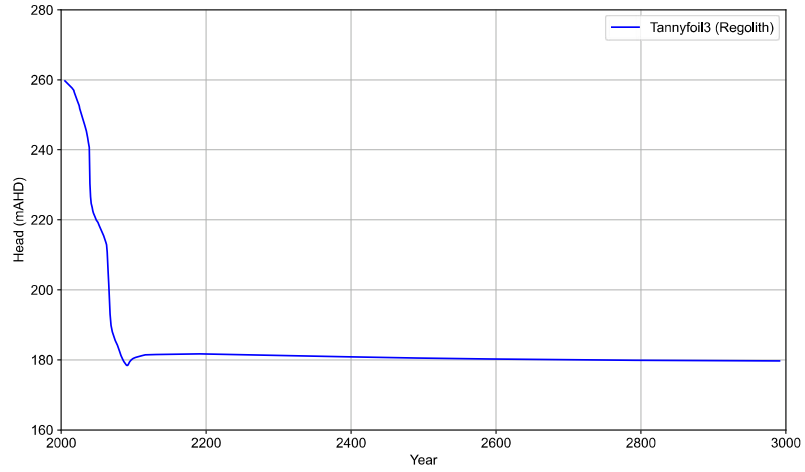

Mimosa4 (Regolith)
Head (mAHD)
Year
250
200
150
100
50
2000
2200
2400
2600
2800
3000

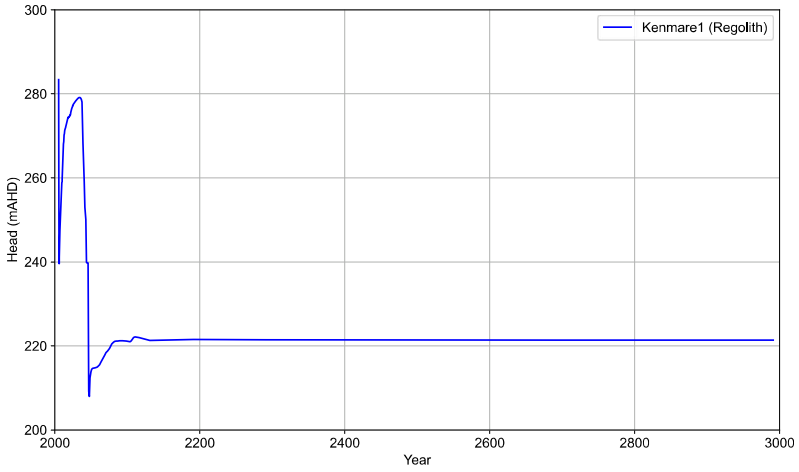

DeepCreek (Regolith)
Head (mAHD)
Year
250
200
150
100
50
2000
2200
2400
2600
2800
3000

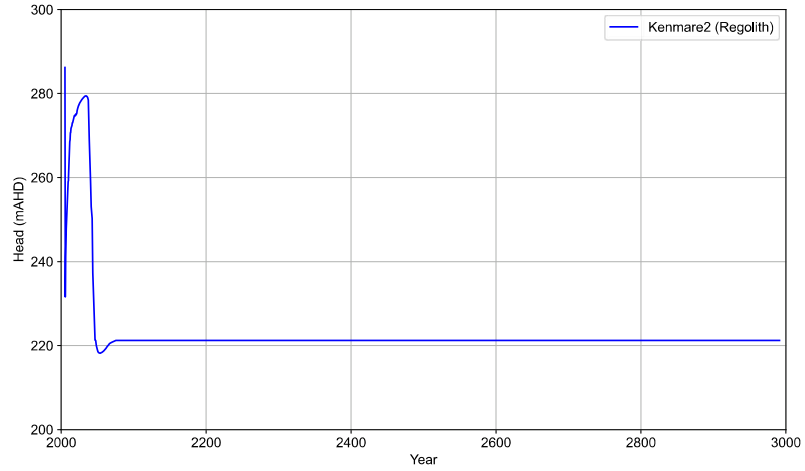

Stewarton1 (Regolith)
Head (mAHD)
Year
250
200
150
100
50
0
2000
2200
2400
2600
2800
3000

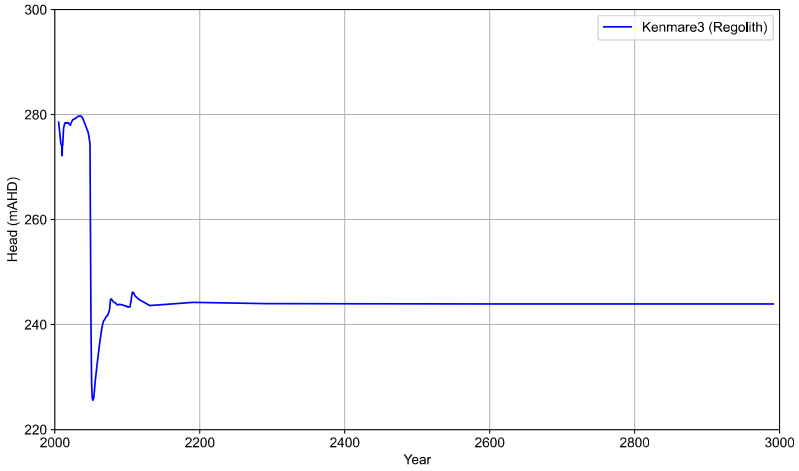

Tannyfoil1 (Regolith)
Head (mAHD)
Year
260
240
220
200
180
2000
2200
2400
2600
2800
3000

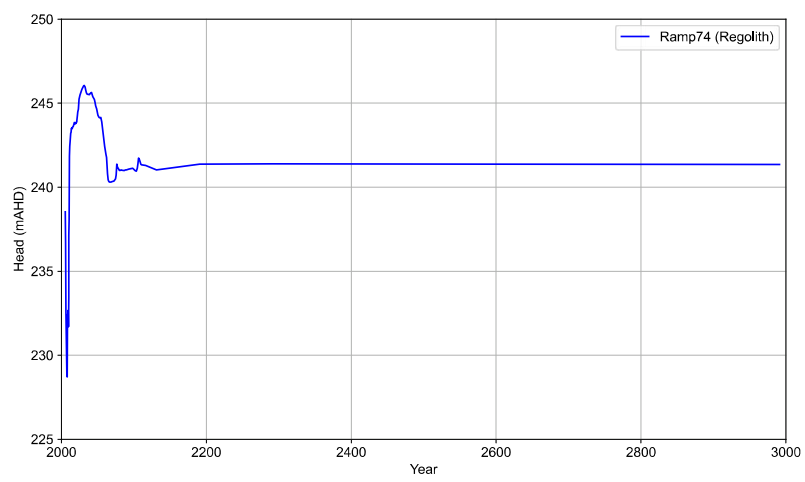

Tannyfoil2 (Regolith)
Head (mAHD)
Year
260
240
220
200
180
160
2000
2200
2400
2600
2800
3000

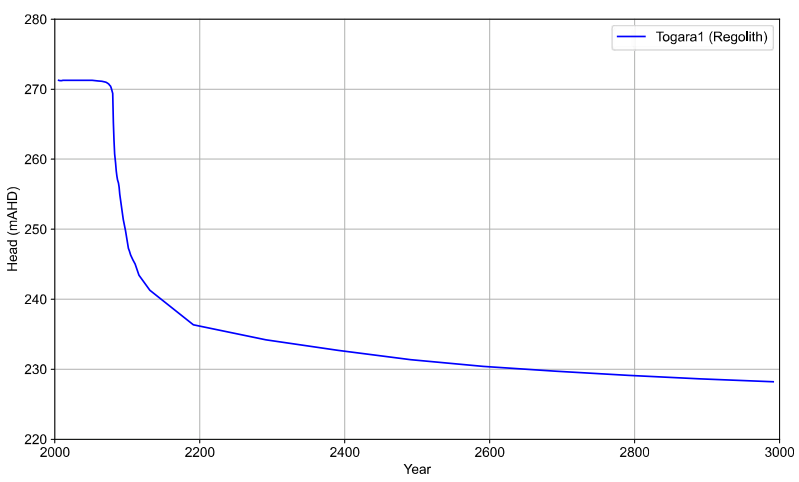

Tannyfoil3 (Regolith)
Head (mAHD)
Year
280
260
240
220
200
180
160
2000
2200
2400
2600
2800
3000

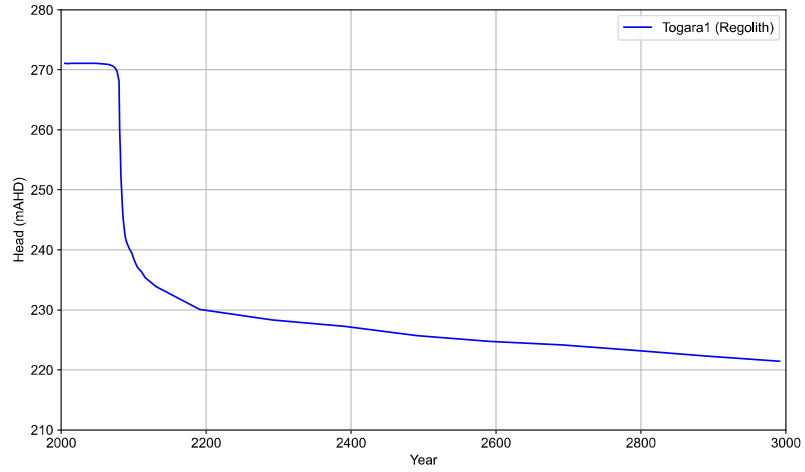

Kenmare1 (Regolith)
Head (mAHD)
Year
300
280
260
240
220
200
2000
2200
2400
2600
2800
3000

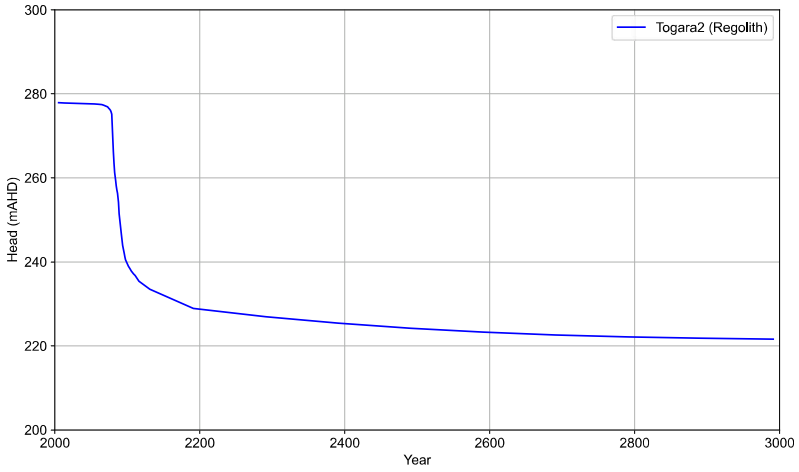

Kenmare2 (Regolith)
Head (mAHD)
Year
300
280
260
240
220
200
2000
2200
2400
2600
2800
3000

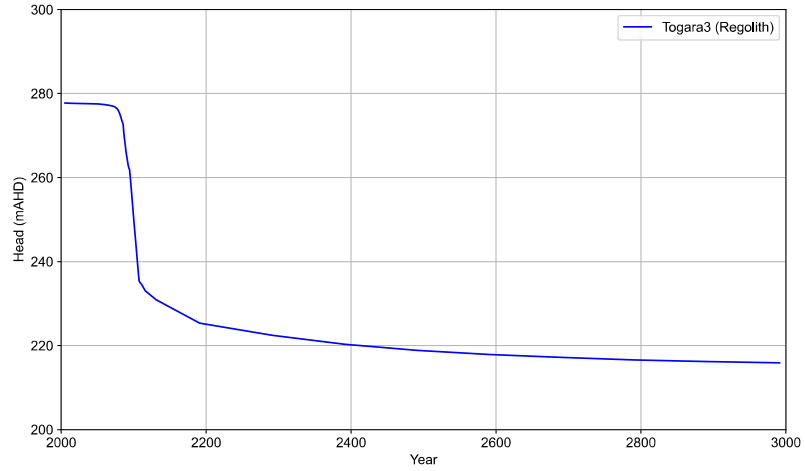

Kenmare3 (Regolith)
Head (mAHD)
Year
300
280
260
240
220
2000
2200
2400
2600
2800
3000

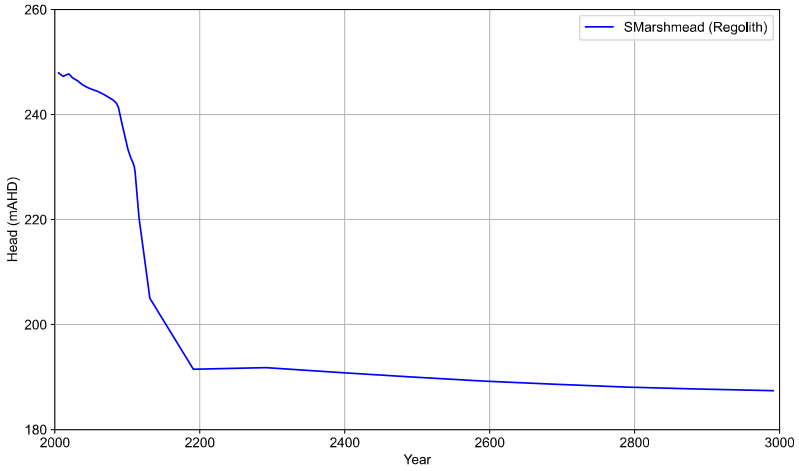

Ramp74 (Regolith)
Head (mAHD)
Year
250
245
240
235
230
225
2000
2200
2400
2600
2800
3000

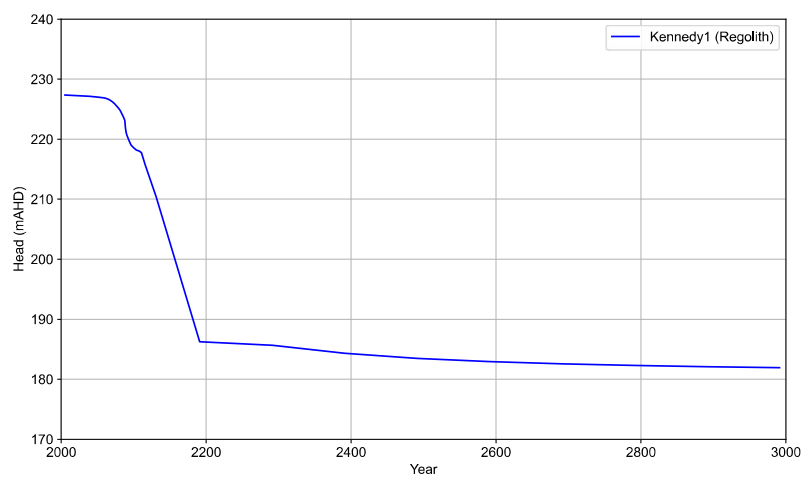

Togara1 (Regolith)
Head (mAHD)
Year
280
270
260
250
240
230
220
2000
2200
2400
2600
2800
3000

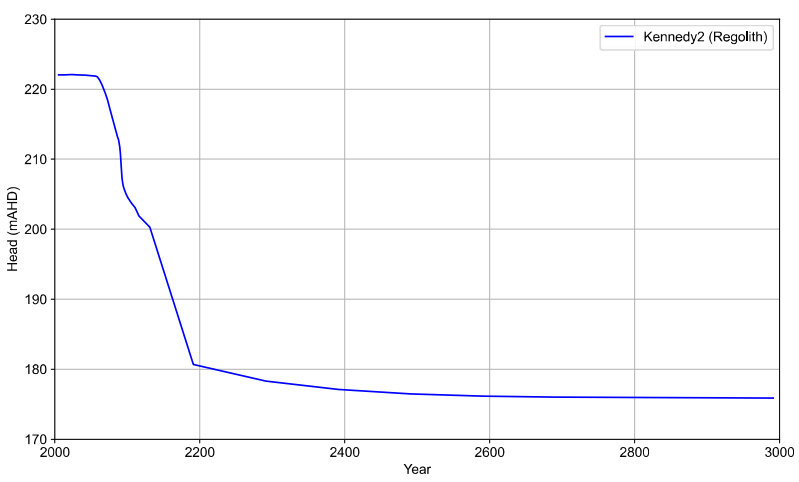

Togara1 (Regolith)
Head (mAHD)
Year
280
270
260
250
240
230
220
210
2000
2200
2400
2600
2800
3000

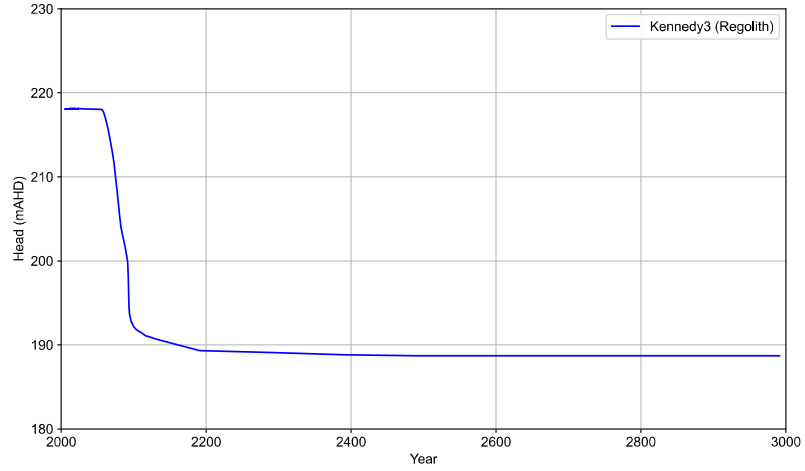

Togara2 (Regolith)
Head (mAHD)
Year
300
280
260
240
220
200
2000
2200
2400
2600
2800
3000

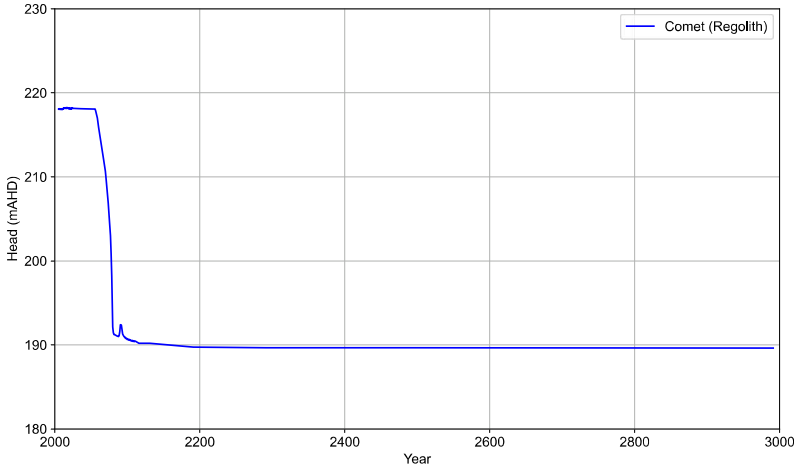

Togara3 (Regolith)
Head (mAHD)
Year
300
280
260
240
220
200
2000
2200
2400
2600
2800
3000


SMarshmead (Regolith)
Head (mAHD)
Year
260
240
220
200
180
2000
2200
2400
2600
2800
3000


Kennedy1 (Regolith)
Head (mAHD)
Year
240
230
220
210
200
190
180
170
2000
2200
2400
2600
2800
3000


Kennedy2 (Regolith)
Head (mAHD)
Year
230
220
210
200
190
180
170
2000
2200
2400
2600
2800
3000


Kennedy3 (Regolith)
Head (mAHD)
Year
230
220
210
200
190
180
2000
2200
2400
2600
2800
3000


Comet (Regolith)
Head (mAHD)
Year
230
220
210
200
190
180
2000
2200
2400
2600
2800
3000

Appendix E Predictive Hydrographs at Third-Party Bores

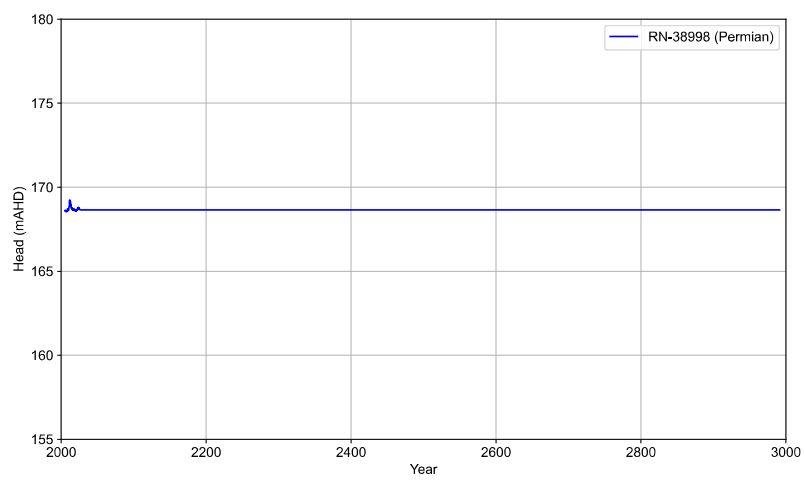
Blackwater Mine

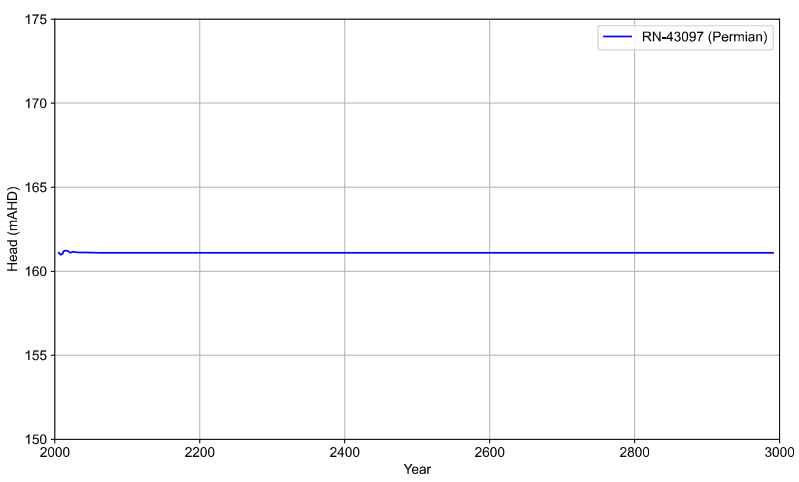
PRC Plan Hydrogeology Assessment – Revision 3

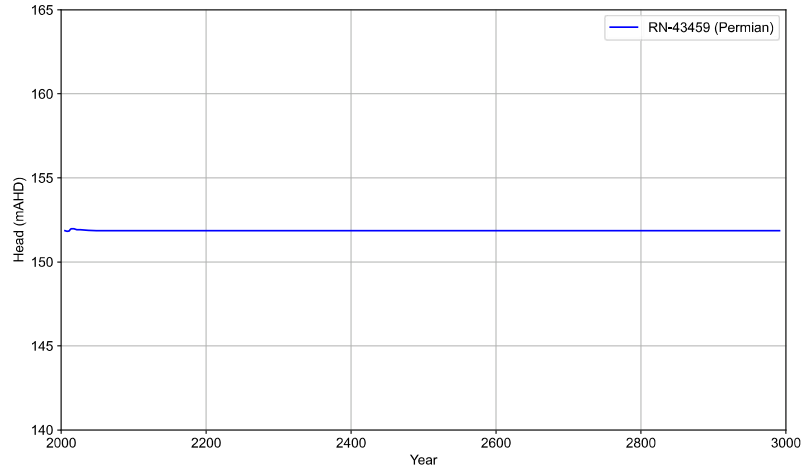
Whitehaven Blackwater Pty Ltd

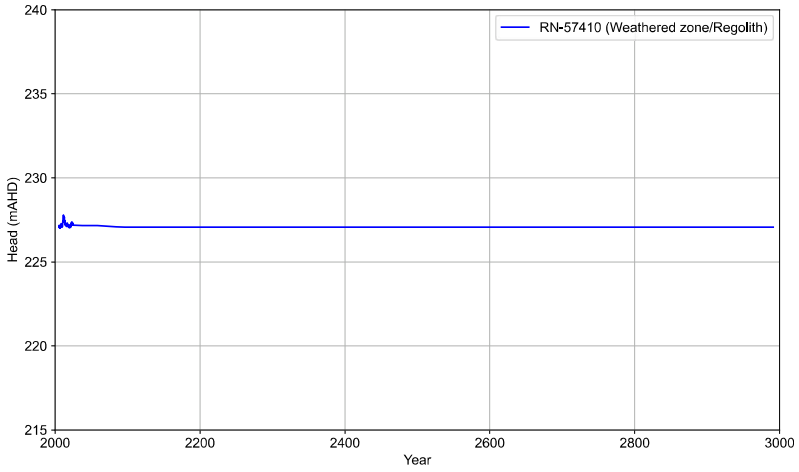
SLR Project No.: 620.040199.00017

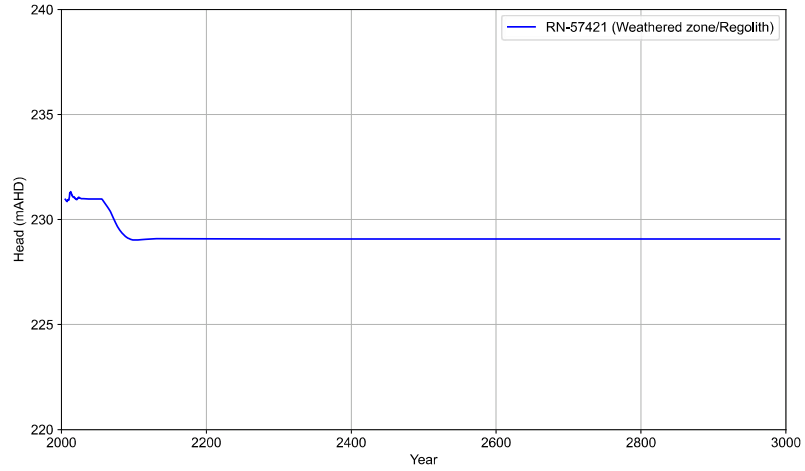
28 September 2026

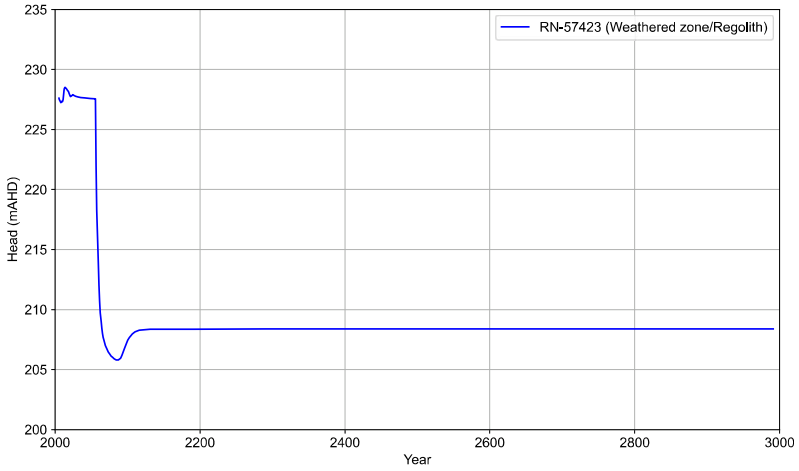

RN-38998 (Permian)
Head (mAHD)
Year
180
175
170
165
160
155
2000
2200
2400
2600
2800
3000

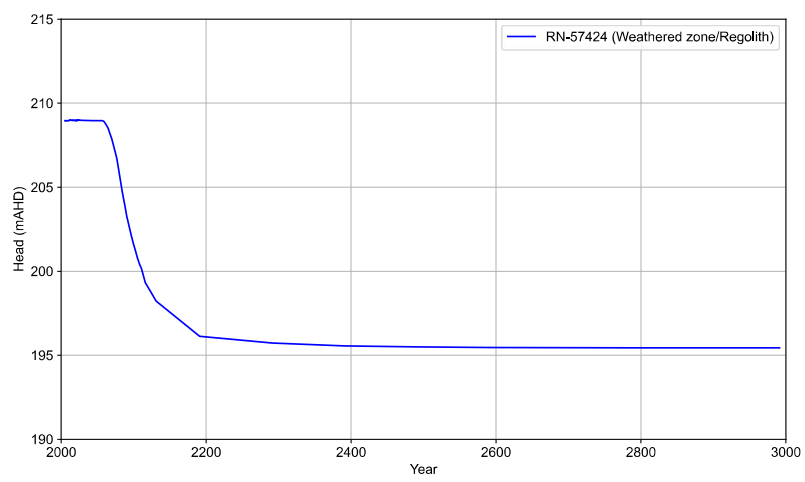

RN-43097 (Permian)
Head (mAHD)
Year
175
170
165
160
155
150
2000
2200
2400
2600
2800
3000

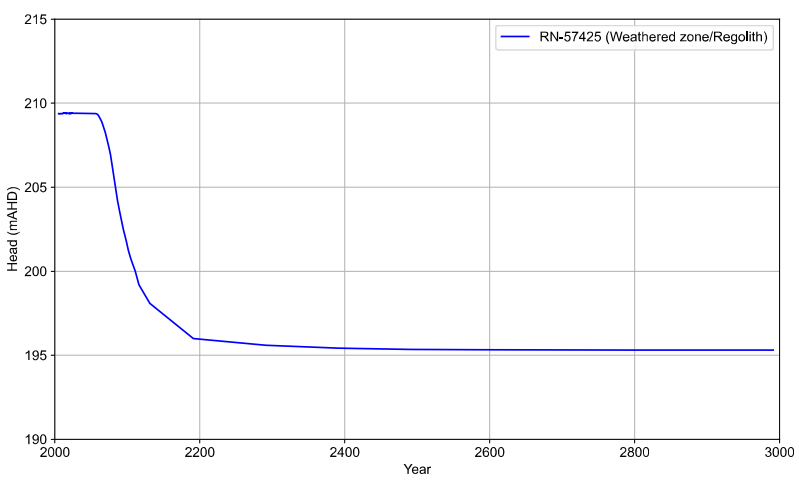

RN-43459 (Permian)
Head (mAHD)
Year
165
160
155
150
145
140
2000
2200
2400
2600
2800
3000

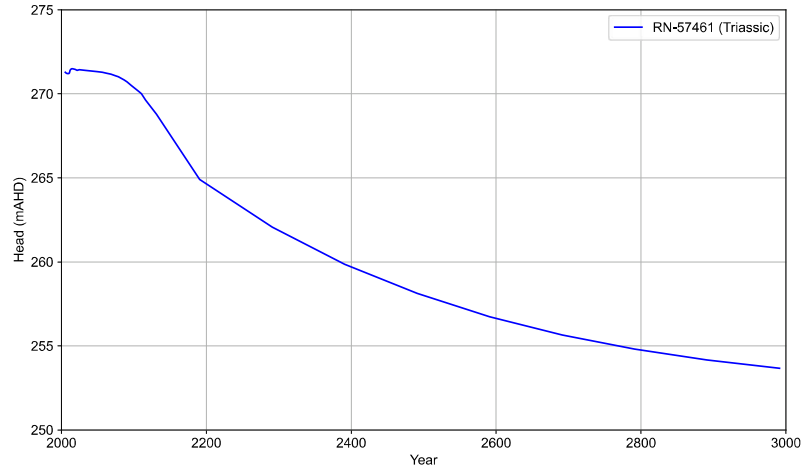

RN-57410 (Weathered zone/Regolith)
Head (mAHD)
Year
240
235
230
225
220
215
2000
2200
2400
2600
2800
3000

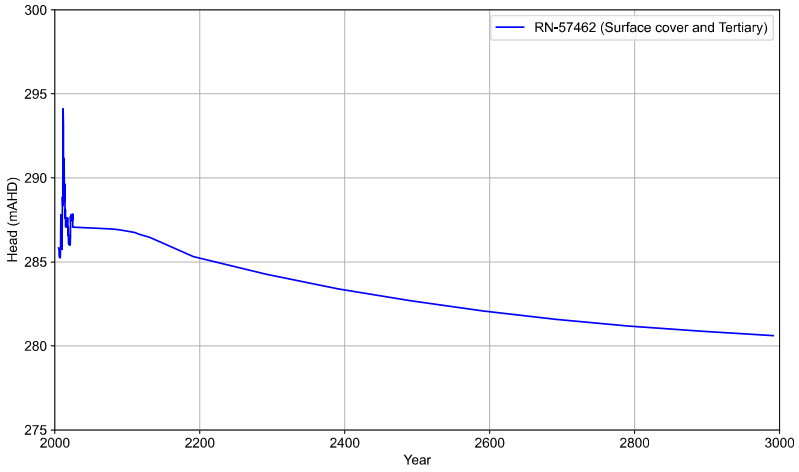

RN-57421 (Weathered zone/Regolith)
Head (mAHD)
Year
240
235
230
225
220
2000
2200
2400
2600
2800
3000

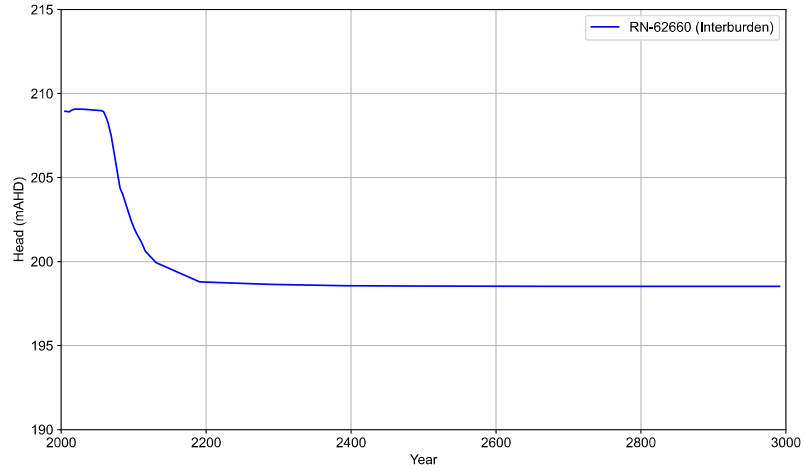

RN-57423 (Weathered zone/Regolith)
Head (mAHD)
Year
235
230
225
220
215
210
205
200
2000
2200
2400
2600
2800
3000

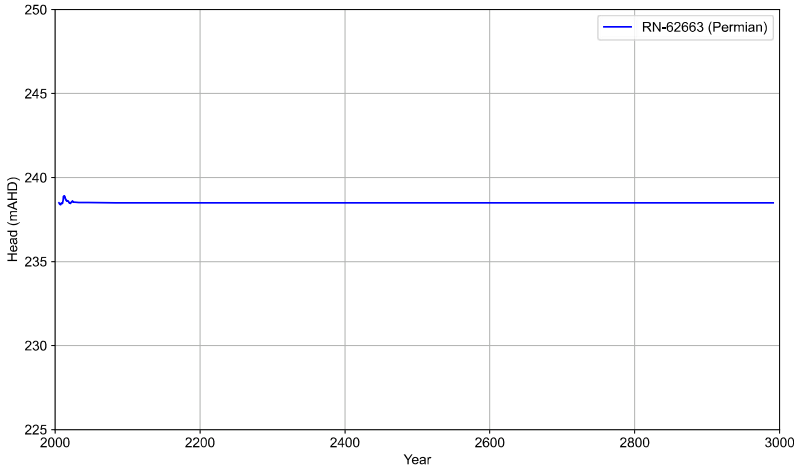

RN-57424 (Weathered zone/Regolith)
Head (mAHD)
Year
215
210
205
200
195
190
2000
2200
2400
2600
2800
3000

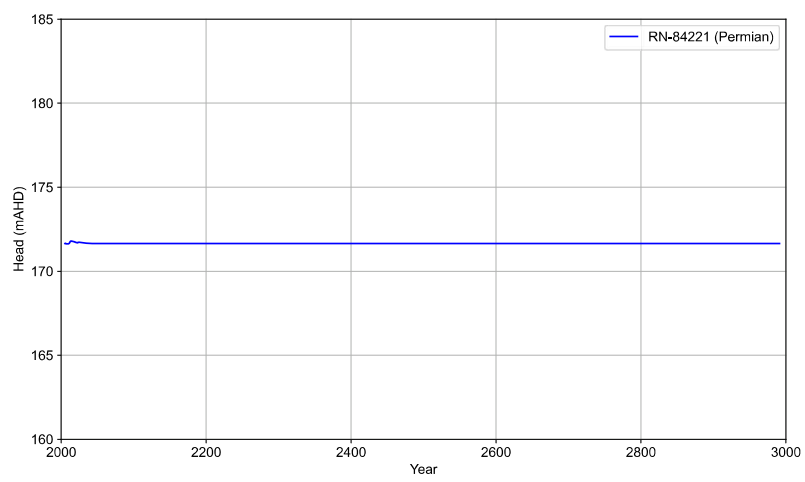

RN-57425 (Weathered zone/Regolith)
Head (mAHD)
Year
215
210
205
200
195
190
2000
2200
2400
2600
2800
3000

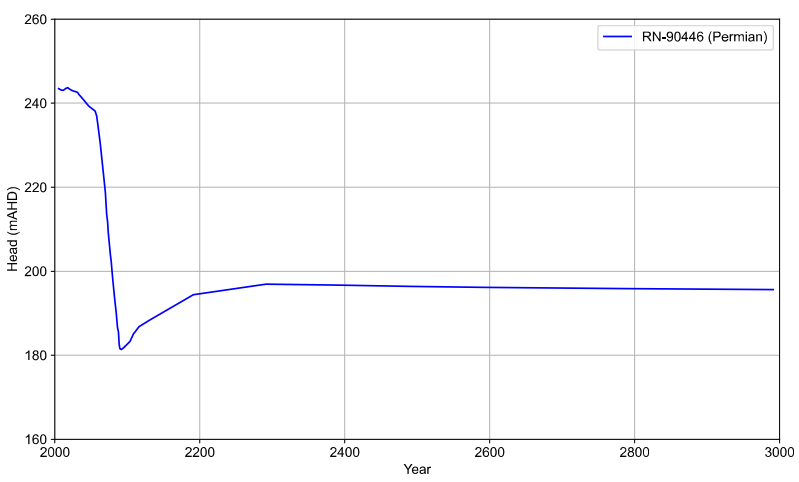

RN-57461 (Triassic)
Head (mAHD)
Year
275
270
265
260
255
250
2000
2200
2400
2600
2800
3000

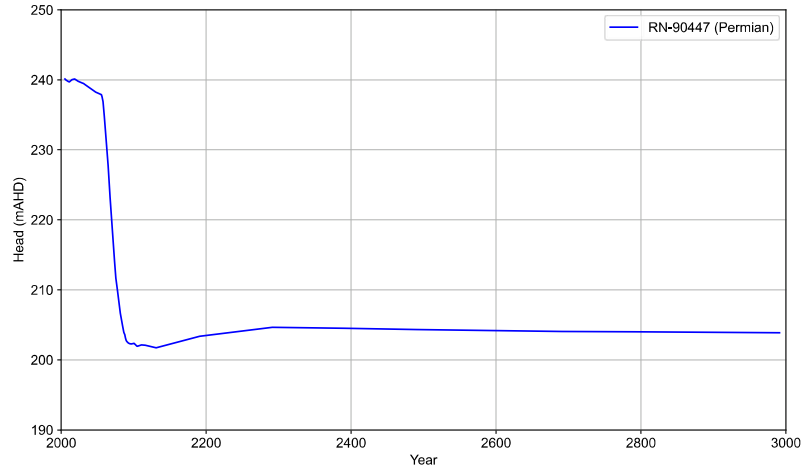

RN-57462 (Surface cover and Tertiary)
Head (mAHD)
Year
300
295
290
285
280
275
2000
2200
2400
2600
2800
3000

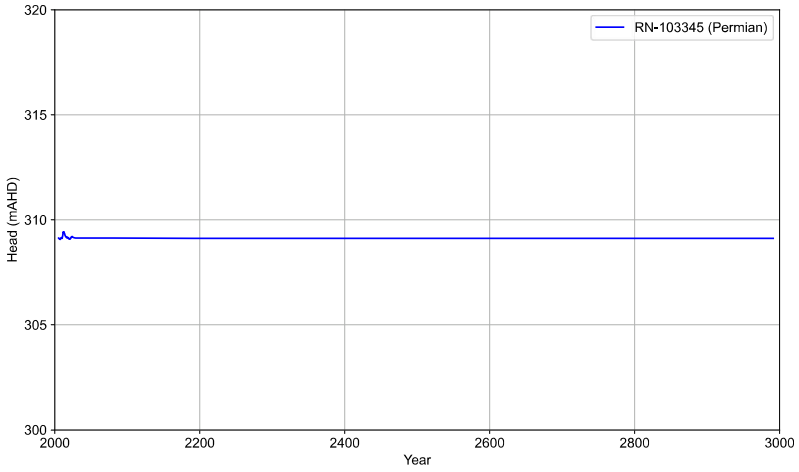

RN-62660 (Interburden)
Head (mAHD)
Year
215
210
205
200
195
190
2000
2200
2400
2600
2800
3000

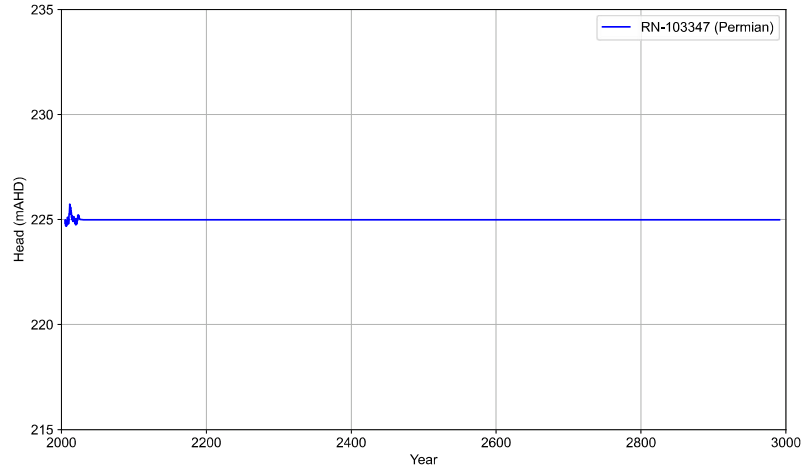

RN-62663 (Permian)
Head (mAHD)
Year
250
245
240
235
230
225
2000
2200
2400
2600
2800
3000

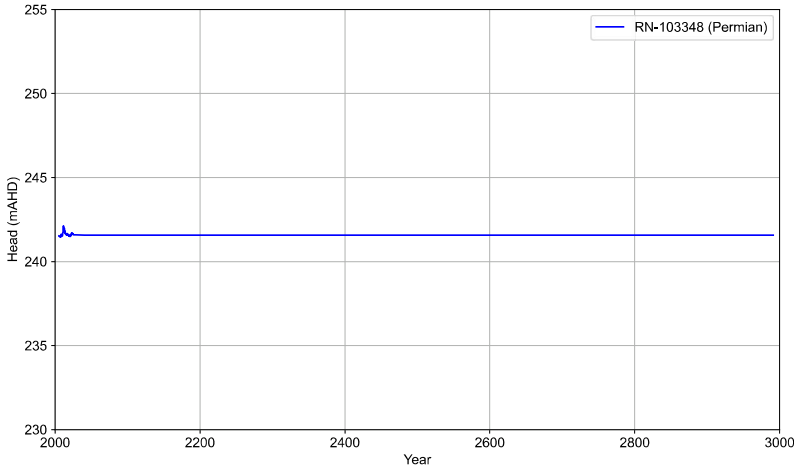

RN-84221 (Permian)
Head (mAHD)
Year
185
180
175
170
165
160
2000
2200
2400
2600
2800
3000

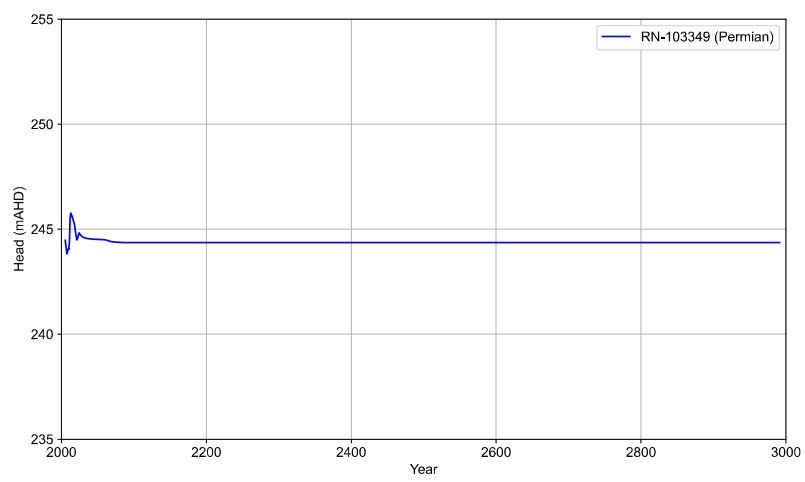

RN-90446 (Permian)
Head (mAHD)
Year
260
240
220
200
180
160
2000
2200
2400
2600
2800
3000

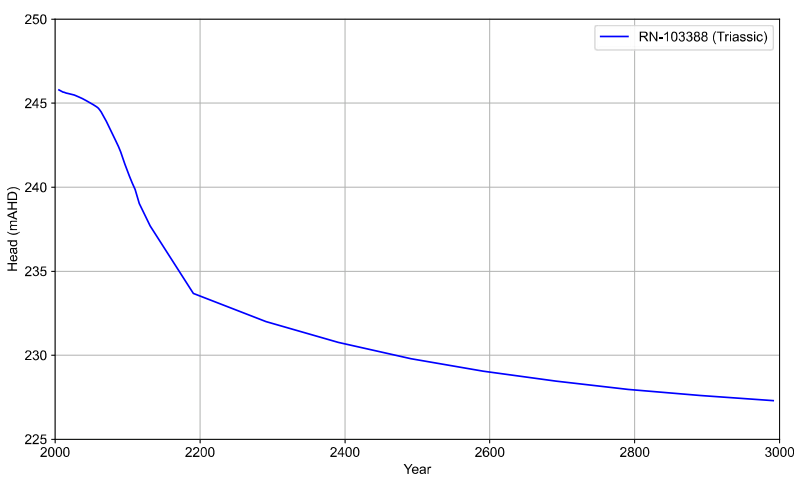

RN-90447 (Permian)
Head (mAHD)
Year
250
240
230
220
210
200
190
2000
2200
2400
2600
2800
3000

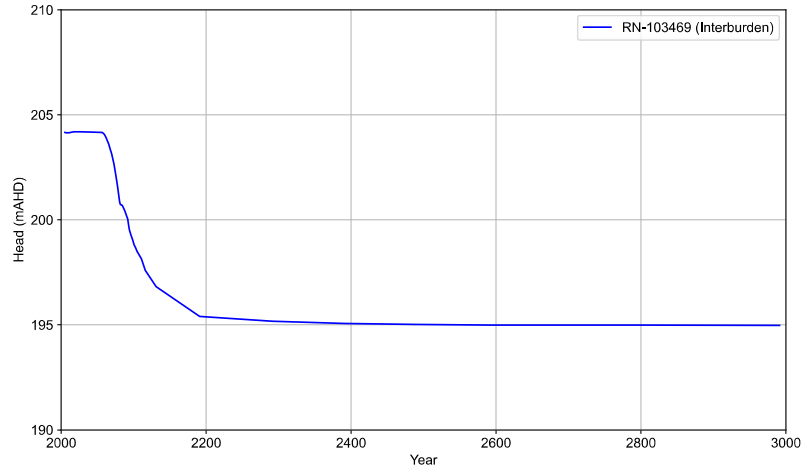

RN-103345 (Permian)
Head (mAHD)
Year
320
315
310
305
300
2000
2200
2400
2600
2800
3000

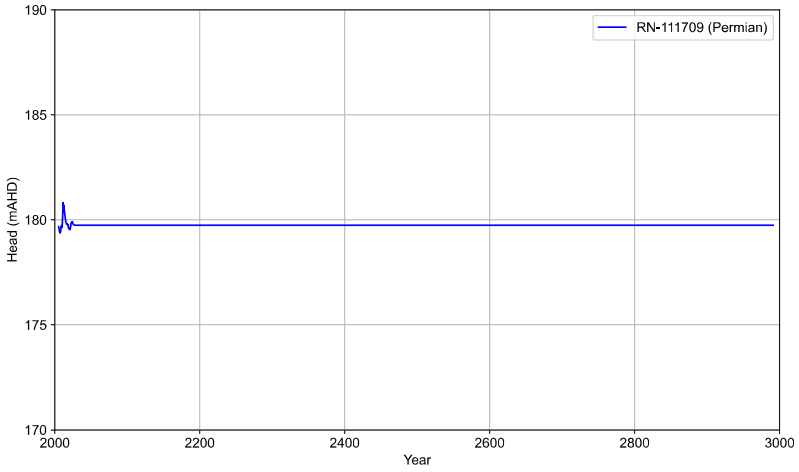

RN-103347 (Permian)
Head (mAHD)
Year
235
230
225
220
215
2000
2200
2400
2600
2800
3000

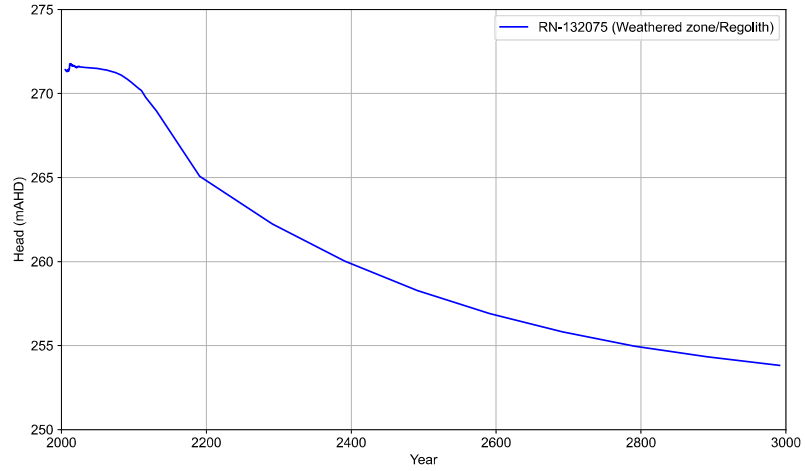

RN-103348 (Permian)
Head (mAHD)
Year
255
250
245
240
235
230
2000
2200
2400
2600
2800
3000

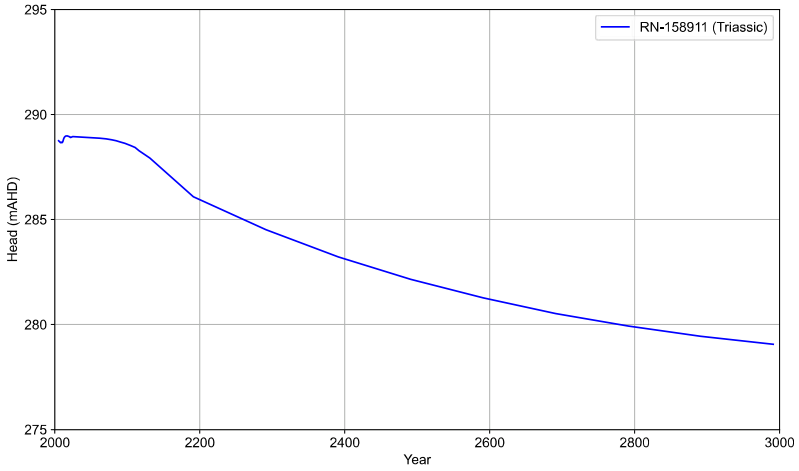

RN-103349 (Permian)
Head (mAHD)
Year
255
250
245
240
235
2000
2200
2400
2600
2800
3000

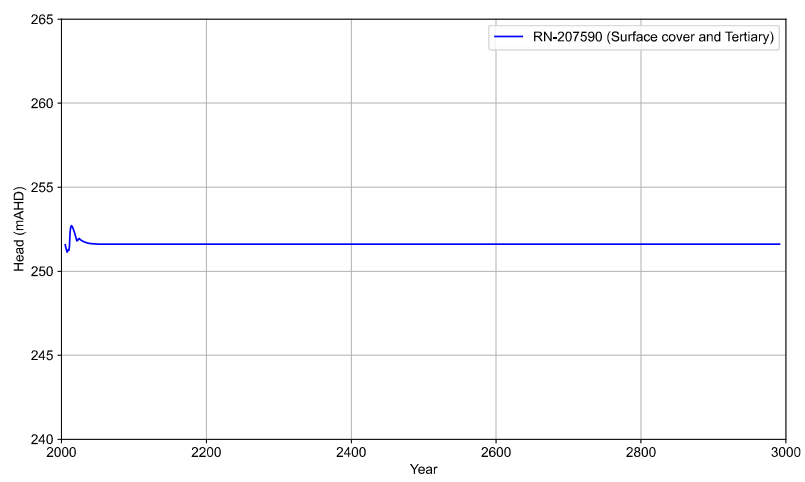

RN-103388 (Triassic)
Head (mAHD)
Year
250
245
240
235
230
225
2000
2200
2400
2600
2800
3000

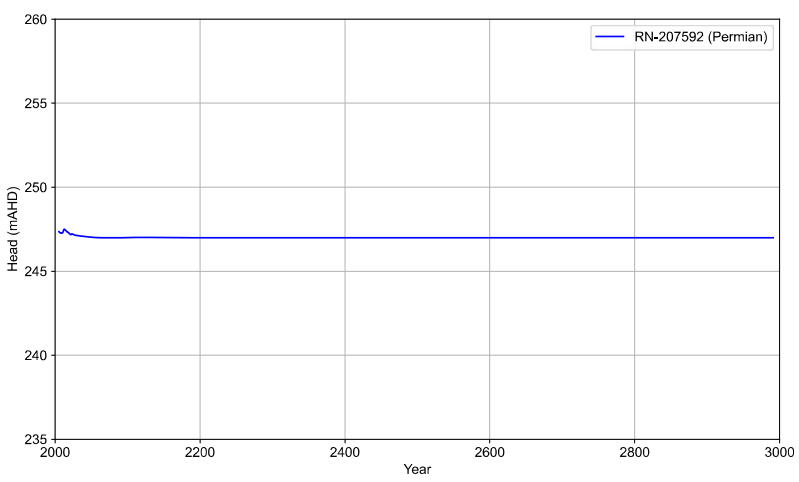

RN-103469 (Interburden)
Head (mAHD)
Year
210
205
200
195
190
2000
2200
2400
2600
2800
3000

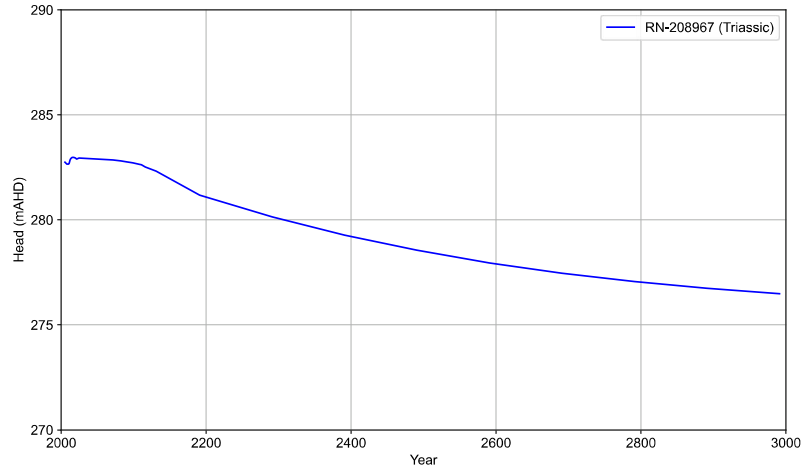

RN-111709 (Permian)
Head (mAHD)
Year
190
185
180
175
170
2000
2200
2400
2600
2800
3000

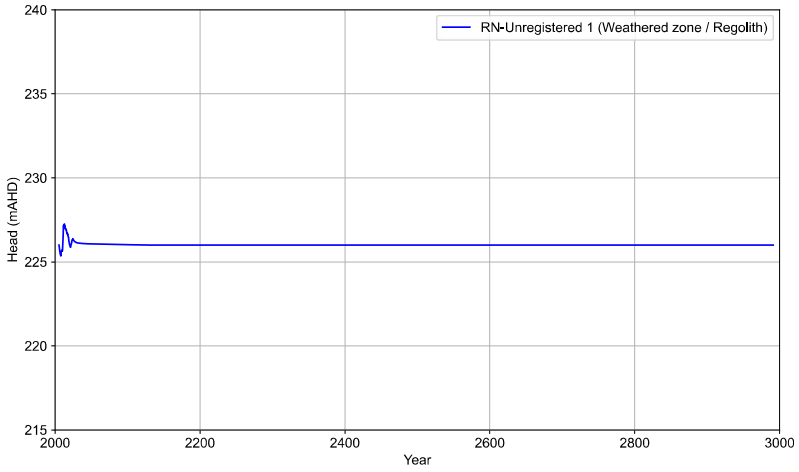

RN-132075 (Weathered zone/Regolith)
Head (mAHD)
Year
275
270
265
260
255
250
2000
2200
2400
2600
2800
3000

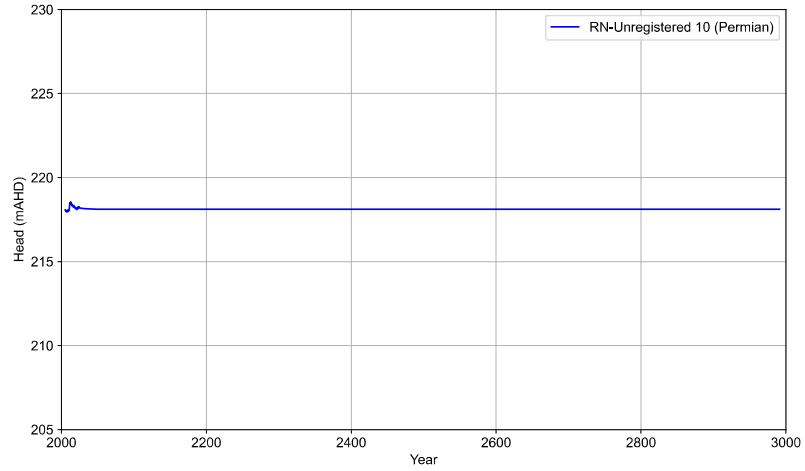

RN-158911 (Triassic)
Head (mAHD)
Year
295
290
285
280
275
2000
2200
2400
2600
2800
3000


RN-207590 (Surface cover and Tertiary)
Head (mAHD)
Year
265
260
255
250
245
240
2000
2200
2400
2600
2800
3000


RN-207592 (Permian)
Head (mAHD)
Year
260
255
250
245
240
235
2000
2200
2400
2600
2800
3000


RN-208967 (Triassic)
Head (mAHD)
Year
290
285
280
275
270
2000
2200
2400
2600
2800
3000


RN-Unregistered 1 (Weathered zone / Regolith)
Head (mAHD)
Year
240
235
230
225
220
215
2000
2200
2400
2600
2800
3000


RN-Unregistered 10 (Permian)
Head (mAHD)
Year
230
225
220
215
210
205
2000
2200
2400
2600
2800
3000

