Klohn Crippen Berger

Westside Corporation Ltd

Westside PL94 (EPPG00783713)

Underground Water Impact Report 2025

Final

Rev 2

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February 2026

24 February 2025

Westside Corporation Ltd
Level 11, 175 Eagle Street
Brisbane, QLD
4000

Mark Rodiger
Senior Environmental Advisor

Dear Mr. Rodiger:

Westside PL 94 (EPPG00783713)
Underground Water Impact Report 2025
Final – Rev2

KCB Australia Pty Ltd (KCB) is pleased to provide this final Underground Water Impact Report update of the PL 94 to Westside Corporation Pty Ltd for the three-year period from 2025. This report has been updated following the receipt of comments from the Department of Environment, Tourism, Science and Innovation (DETSI). Should you have any queries regarding this document, please do not hesitate to contact the undersigned on +61 7 3004 0237 or cwaterhouse@klohn.com

Yours truly,

KCB AUSTRALIA PTY LTD.

Carly Waterhouse
Project Manager, Senior Hydrogeologist

CW/SW

KCB Australia Pty Ltd.
Level 3, 150 Mary St ▪ Brisbane QLD 4000 ▪ Australia
t +617.3004.0244 ▪ www.klohn.com

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CLARIFICATIONS REGARDING THIS REPORT

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1 INTRODUCTION

KCB Australia Pty Ltd (KCB) was commissioned by Westside Corporation Pty Ltd (Westside) to prepare an Underground Water Impact Report (UWIR) for the operation of Petroleum Lease (PL) 94 (EPPG00783713) (the Project), which comprises part of the Greater Meridian Coal Seam Gas Project. This report covers the 2025 to 2028 UWIR period.

This report has been prepared in accordance with the *Queensland Water Act 2000* (the Water Act) and the Guideline for Underground Water Impact Reports and Final Reports (State of Queensland 2024).

1.1 Project Overview

The Project is located near Moura in the southeastern portion of the Bowen Basin (Figure 1.1). The Project lies within the Fitzroy Basin surface water catchment. Directly adjacent to the Project, to the east and southeast, is Anglo American's Dawson Mining Complex (Dawson): an open-cut and historic underground mine that commenced operations in the 1960s producing a mixture of coking, soft coking, and thermal coal.

The Meridian Project was first explored by various operators such as Mount Isa Mining (MIM) in the early 1990s, Conoco in the mid-1990s and Oil Company of Australia (now Origin) at the beginning of the 2000s. Conoco undertook the initial development in the Moura field in 1996 and Oil Company of Australia undertook most of the development drilling in the other fields in the period 1999 to 2002 in the Project (PL 94) area. Anglo Coal undertook the operation of PL 94 in 2006, and Westside took operatorship of PL 94 on 1 July 2010.

The Project area (PL 94) is presently held by Westside entities and Mitsui E&P Australia Pty Ltd (MEPAU) and is situated directly south of existing petroleum leases also operated by Westside (PL 1048 and PL 1049).

Westside CSG A PTY LTD, Westside CSG D Pty Ltd and Mitsui E&P Australia Pty Ltd are the joint holders of PL 94 (EPPG00783713). Westside Corporation Pty Ltd is the operator of PL 94 pursuant to a Joint Operating Agreement dated 2 July 2010 (JOA). Westside is authorised under the JOA to submit this UWIR on behalf of Westside CSG A PTY LTD, Westside CSG D Pty Ltd and Mitsui E&P Australia Pty Ltd.

The progressive development of gas infrastructure on PL 94 will encompass the following:

- 600 Wellheads comprising of vertical wells, lateral wells and multi – lateral wells;
- Ancillary linear infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;
- Water management infrastructure; and
- Other ancillary activities and facilities to support gas field development.

1.2 Background to the UWIR

The *Petroleum and Gas (Production and Safety) Act 2004* entitles the holder of a PL to take or interfere with underground water (i.e., groundwater) as part of approved CSG operations. This entitlement is termed the PL holder's 'underground water rights'.

Groundwater that is taken or interfered with while exercising the underground water rights is termed 'associated water'. The holder of the PL is entitled to use associated water for any purpose. In order to exercise the underground water rights for the project - the PL holder must:

- Obtain an Environmental Authority (EA) under the *Environmental Protection Act 1994* (EP Act); and
- Comply with its reporting obligations under Chapter 3 of the *Water Act 2000* (Water Act). The administering authority for Chapter 3 of the Water Act is the Department of Environment, Tourism, Science and Innovation (DETSI).
- Comply with lease holder obligations under Chapter 3 of the Water Act including undertaking baseline assessments of the groundwater regime and water supply bores, preparing UWIRs to provide for ongoing assessment, reporting of groundwater take and (where necessary) entering into make good agreements with owners of affected water supply bores.

An initial UWIR was prepared and submitted to DETSI by Westside in 2013. UWIRs were subsequently submitted in 2017, 2020, 2019 and 2022 (CDM Smith 2016a; 2019; KCB 2022).

This report (UWIR 2025) is relevant for the next reporting period from August 2025 to August 2028.

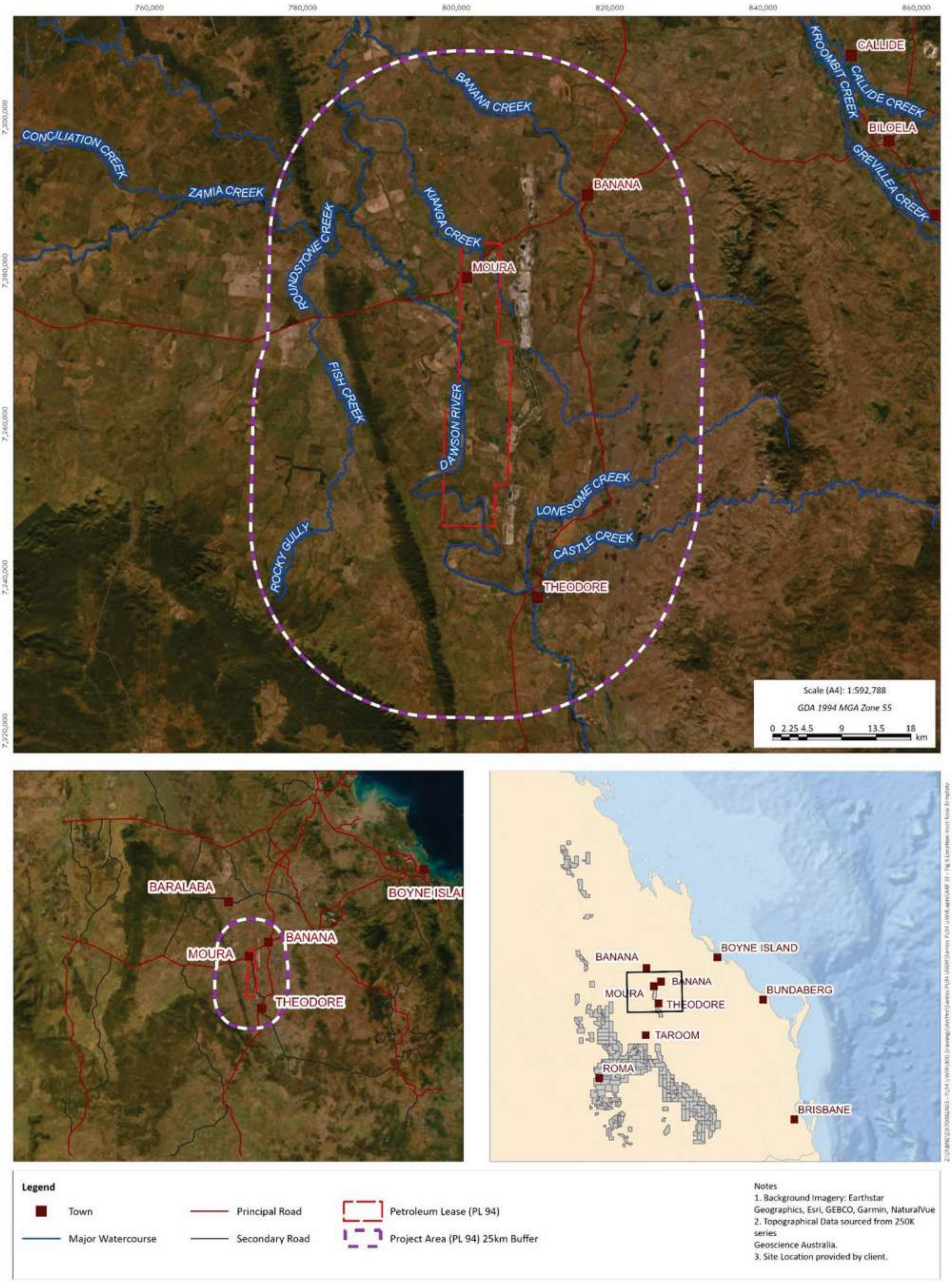

Figure 1.1Project Location

1.3 UWIR Scope and Structure

This updated UWIR (2025) addresses the next three years (three-year Anniversary) of the Project from the date that Westside exercises its underground water rights on the Project site.

This updated UWIR for 2025 to 2028 has been prepared in accordance with the requirements described in Section 376 of the Water Act and the DESTI guideline: Underground water impact reports and final reports (the UWIR guideline), where relevant. The requirements of Section 376 of the Water Act are complimentary to the information requirements of the Section 126A and 227AA of the EP Act.

The specific scope of this UWIR includes:

- Presenting the relevant groundwater, geological and environmental information for the Project;
- Undertaking a review of the Queensland Government groundwater database and QSpatial database to confirm the current water bores registered within the Project, the immediate affected areas (IAA) and the long-term affected areas (LTAA);
- Presenting the conceptual understanding of the groundwater regime within the Project and its surrounds, based on historical groundwater studies and relevant public domain data;
- Updating and presenting the current conceptual understanding of the groundwater regime within the Project and its surrounds, based on historical groundwater studies and relevant public domain data;
- Simulation of the 3D numerical groundwater flow model to include the water production to date and updated production plans for the life of the Project;
- Using the numerical groundwater flow model to produce predictions of the Project groundwater effects during the UWIR period, including drawdown predictions and predictions of groundwater take for years 1, 2 and 3 of the UWIR period;
- Using water production “type curves” from comparable gas wells within the vicinity of the Project, produce water production volumes for years 1, 2 and 3 of the UWIR period;
- Assessing the groundwater impacts and developing feasible mitigation and management strategies in the event of potential adverse impacts being identified. Impacts assessed included:
  - Measured and future potential groundwater drawdown impacts on groundwater supply bores;
  - Potential groundwater drawdown impacts on the Dawson River and other surface water features;
  - Potential groundwater drawdown impacts on Groundwater Dependent Ecosystems (GDEs);
  - Potential cumulative drawdown impacts with adjacent resource activities, including existing coal seam gas and mining activities; and

- Potential impacts on existing groundwater quality pre-mining as a result of the Project development.

- Confirming the existing approved EA groundwater monitoring program, the revised groundwater monitoring program, and management measures.

The structure of this UWIR has been prepared in accordance with that outlined in the Guideline: (Water Act 2000) Underground Water Impact Reports and Final Reports(State of Queensland 2024) (UWIR Guideline). This guideline specifies that a UWIR must contain information that has been outlined in each of the following parts of the guideline:

- Part A: Information about underground water extractions resulting from the exercise of underground water rights (Section 6);
- Part B: Information about aquifers affected, or likely to be affected (Section 7);
- Part C: Maps showing the area of the affected aquifer(s) where underground water levels are expected to decline (Section 8);
- Part D: An assessment of the impacts to the environmental values from the exercise of underground water rights (Section 9);
- Part E: A water monitoring strategy (Section 10);
- Part F: A spring impact management strategy (Section 11); and
- Part G: For a Cumulative Management Area (CMA), assignment of responsibilities to resource tenure holders (Section 12).

The relevant Water Act requirements for each part of the UWIR Guideline above are listed at the beginning of the relevant sections in this report. Westside's current Environmental Authority for PL 94 (EPPG00783713) is also referenced with regards to the groundwater monitoring program which is currently implemented for the Project.

Report Update

Following submission of the 2025 UWIR to DETSI, Westside received comments from DETSI (dated November 24, 2025) who required clarification on four matters. This report has been updated in response to these comments, the comments are presented in Table 1.1.

Table 1.1 DETSI Comments (Nov, 2025) and Westside Response

DETSI Comment	Action Proposed	Response
Provide an analysis of the trends in water level change for the aquifer because of the exercise of any previous relevant underground water rights as required by section 376(1)(b)(iii) of the Water Act.	The UWIR includes hydrographs for the analysis of water level trends. Section 7.4 states that Westside performs water level monitoring in four monitoring bores and 19 CSG bores within the area. However, eight of the production wells do not appear on the hydrograph between the period of 2022-2024 in Figure 7.6 Baralaba Coal Measures – PL 94 CSG Production Wells: Water Levels. Also Condition 2 of the approved UWIR states that water level monitoring for the Baralaba Coal Measures must be undertaken at intervals no longer than one month. Therefore the UWIR must be updated to include all water level readings or supply details on why monitoring of water levels have not been completed in consideration of condition 2 of the approved UWIR.	Refer to updates in Section 7.4. Hydrograph has been updated to include all monitored CSG production wells. All water level readings are provided, wells are monitored monthly (where operationally possible, water levels cannot be monitored when the CSG wells are offline e.g. shut-in).
Provide a summary of information about all water bores located within the immediately affected area (IAA), including the number of bores, and the location and authorised use or purpose of each bore as required by section 376(1)(d) of the Water Act.	Section 9.1.3.1 of the UWIR refers to figure 5.23 as supplying a summary of the estimated purpose for bores located within the 25km buffer of the project area. There is no figure 5.23 included in the UWIR. The UWIR states that one water supply bore is predicted to experience a drawdown that exceeds the trigger thresholds (>5 m) during the UWIR period (IAA) (RN128255). This bore is noted as abandoned but usable (Queensland Globe, July 2025). However the authorised use or purpose of RN128255 has not been included in the UWIR and the bore has not been included on the IAA map. A baseline assessment has not been completed for RN128255 to confirm the status on Queensland Globe as abandoned but usable. Therefore the UWIR must be updated to include the authorised use or purpose of RN128255 and it must be included on the IAA map.	Refer to Section 9.2.3 for updates. Bore RN128255 has been added to the IAA map (Figure 8.5). Confirmed that this bore is a monitoring bore and not a water supply bore, therefore it does not require a baseline assessment.

DETSI Comment	Action Proposed	Response
Provide a timetable for implementing the WMS strategy as required by 378(1)(c).	Water level and quality monitoring details have been included in the UWIR, however two of the three Westside Rewan Group monitoring bores are required to be replaced as no monitoring is able to be completed. New monitoring bores are proposed to replace GW14 and Mungi Yard. The UWIR states that monitoring of the new bores installation is dependent on negotiations with landholders. It is noted that monitoring of GW14 and Mungi Yard did not occur in the last annual review. One water supply bore is predicted to experience a drawdown that exceeds the trigger thresholds (>5 m) during the UWIR period (IAA) (RN128255). This bore is noted as abandoned but usable (Queensland Globe, July 2025). Under section 417 of the Water Act it is a requirement to complete a bore assessment 60 days after the report takes effect. The UWIR does not include a timetable with the expected date (dd/mm/yy) for the completion of this bore assessment. The UWIR must be updated to include a timetable including dates (dd/mm/yyyy) for: i. the installation of the new monitoring bores to replace GW14 and Mungi Yard and include details on the last time monitoring was completed at GW14 and Mungi Yard bores; and ii. the completion of RN128255 bore assessment as required under section 417 of the Water Act.	A timeline is provided in Section 10, Table 10.3 Confirmed that bore RN128255 is a monitoring bore and not a water supply bore, therefore it does not require a baseline assessment.
Provide an analysis of the trends in water level change for the aquifer because of the exercise of any previous relevant underground water rights as required by section 376(1)(b)(iii) of the Water Act. As required by section 378(3) of the Water Act—The WMS must include a program for the responsible tenure holder(s) to undertake a baseline assessment for each water bore that is outside the area of a resource tenure, but within the predicted LTAA.	The UWIR states that baseline assessments for the bores within the LTAA will be conducted in this UWIR period in conjunction with Westside's annual groundwater monitoring campaign (expected to occur in 2026). However the current approved UWIR 2023 states that baseline assessments for RN128253, RN128254 and RN128255 would be completed in Q2 2023 in conjunction with Westside's annual groundwater monitoring campaign. The approved UWIR also includes a statement that ongoing groundwater level and quality monitoring of baseline bores will be completed as per the schedule outlined in Section 8.1.5 and Table 8.3 following completion of the baseline assessment. No baseline assessments of RN128253, RN128254 and RN128255 have been completed. The UWIR must be updated to include a timetable including dates (dd/mm/yyyy) for baseline assessments for RN128253, RN128254 and RN128255. The chief executive has identified that baseline assessments have not completed in accordance with section 390(1)(b) of the Water Act – to comply with an approved UWIR. It is requested that you provide a submission by 9 January 2026 detailing why baseline assessments have not been completed. In particular RN128255 that has now been identified as an IAA bore and no baseline assessment has been completed. Refer to Guideline Baseline assessments (ESR/2016/1999) that sets out the minimum requirements for a baseline assessment.	The identified bores have been confirmed as monitoring bores and do not require baseline assessments under the Water Act. DETSI was notified as to why these baseline assessments had not occurred by 9 January 2026. Bore RN128253 cannot be located and is assumed to be destroyed.

2 REGULATORY FRAMEWORK

2.1 Petroleum and Gas (Production and Safety) Act 2004

The *Petroleum and Gas (Production and Safety) Act 2004* is an Act relevant to exploring for, recovering and transporting by pipeline, petroleum and fuel gas, and ensuring the safe and efficient undertaking of those activities. The key purpose of this Act is to facilitate and regulate the undertaking of responsible petroleum activities and the development of a safe, efficient and viable petroleum and fuel gas industry.

This Act identifies underground water rights for petroleum tenures, and states that the holder of a petroleum tenure may take or interfere with underground water in the area of the tenure if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity for the tenure.

The Act prescribes mandatory compliance with the Queensland Department of Resources (DoR), formerly the Department of Natural Resources, Mines and Energy's (DNRME), '*Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 1'* (State of Queensland 2019). The purpose of this Code is to provide guidance that all petroleum wells, CSG wells and associated bores are constructed, maintained and abandoned to a minimum acceptable standard resulting in long-term well integrity, containment of petroleum and the protection of groundwater resources.

2.2 Water Act 2000

2.2.1 General Purpose of the Water Act

The Water Act is an Act to provide for the sustainable management of water and the management of impacts on underground water, among other purposes. This Act provides a framework for:

- The sustainable management of Queensland's water resources by establishing a system for the planning, allocation and use of water;
- The sustainable and secure water supply and demand management for designated regions;
- The management of impacts on underground water caused by the exercise of underground water rights by the resource sector; and
- The effective operation of water authorities.

This Act covers water in a watercourse, lake or spring, underground water (or groundwater), overland flow water, or water that has been collected in a dam.

2.2.2 Water Act and CSG-Related Activities

The Water Act provides for the identification and management of potential impacts on underground water caused by the exercise of underground water rights by resource tenure holders, which are regulated under the *Petroleum and Gas (Production and Safety) Act 2004.* The Act also outlines the requirements for make good agreements, if required, associated with the impacts to underground water.

Chapter 3 of the Water Act has a stated purpose to provide for the management of impacts on underground water caused by the exercise of underground water rights by resource tenure holders, which includes petroleum tenure holders. To achieve the stated purpose, a regulatory framework is provided which requires:

- Resource tenure holders to monitor and assess the impacts of the exercise of underground water rights on water bores and to enter into make good agreements with the owners of the groundwater bores as necessary;
- The preparation of UWIR that establish underground water obligations, including obligations to monitor and manage impacts on aquifers and springs; and
- Manage the cumulative impacts of the activities of two or more resource tenure holders' underground water rights on underground water.

Under this regulatory framework, where there is an area of concentrated development, a cumulative management area (CMA) can be declared. The Project is located beyond the northern extents of the Surat CMA, which was declared in 2011. Of relevance to this Project, UWIRs have been previously compiled for:

- PL 1048 and PL 1049 (Mungi West / Mungi North) (KCB 2025);
- ATP 564 (now ATP 2027) - Harcourt Petroleum N.L. (CDM Smith 2016c);
- ATP 602 – Harcourt Petroleum N.L. (CDM Smith 2016b); and
- ATP 769 - Underground Water Impact Report for ATP769 Paranui Pilot Project (AGE 2019).

2.2.3 Trigger Thresholds

Under Section 362 of the Water Act, a bore trigger threshold, for a consolidated aquifer, of 5 m applies (2 m for an unconsolidated aquifer). The 5 m threshold represents the maximum allowable groundwater level decline in a groundwater bore, due to petroleum tenure holder's activities, prior to triggering an investigation into the water level decline and potentially make good activities.

Under Section 379 of the Water Act, a spring trigger threshold for an aquifer applies. This includes vent springs / complexes and watercourse springs (i.e., gaining streams). This threshold value (0.2 m) represents the maximum allowable decline in the water level of an aquifer in connection with a spring, at the spring location, prior to triggering an investigation into the water level decline.

2.2.4 UWIR Requirements

Section 376 of the Water Act specifies the UWIR content requirements.
lists the specific content requirements and provides an explanation of where each requirement is addressed in this UWIR.

Table 2.1 UWIR Content Requirements

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
376(1)(a)	An underground water impact report must include each of the following — for the area to which the report relates: (i) the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights; and (ii) an estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report.	(i) Section 6.1 describes the groundwater produced (ii) Section 6.2 describes the estimated groundwater take over the UWIR period.
376(1)(b)	For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights: (i) a description of the aquifer; (ii) an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers; and (iii) an analysis of the trends in water level change for the aquifer because of the exercise of the rights mentioned in paragraph (a)(i). (iv) a map showing the area of the aquifer where the water level is predicted to decline, because of the taking of the quantities of water mentioned in paragraph (a), by more than the bore trigger threshold within 3 years after the consultation day for the report; and, (v) a map showing the area of the aquifer where the water level is predicted to decline, because of the exercise of relevant underground water rights, by more than the bore trigger threshold at any time.	(i) and (ii) Section 7 describes the groundwater regime in the relevant aquifers. (iii) Model results/analysis is described in Section 7.5.1 (iv) Section 8.2 provides discussion on the predicted groundwater level drawdown associated with the proposed CSG development during the UWIR period. (v) Section 8.2 provides discussion on the predicted groundwater level drawdown associated with the proposed CSG development at any time during the development.
376(1)(c)	A description of the methods and techniques used to obtain the information and predictions under paragraph (b).	Section 4 describes the UWIR methodology
376(1)(d)	A summary of information about all water bores in the area shown on a map mentioned in paragraph (b)(iv), including the number of bores, and the location and authorised use or purpose of each bore.	Section 9 describes the water bores identified from the DRDMW groundwater database.
376(1)(d,a)	A description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.	Section 9.2 presents the assessment of the environmental values due to the CSG Development.
376(1)(d,b)	An assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights: i. during the period mentioned in paragraph (a)(ii); and, ii. over the projected life of the resource tenure.	Section 9.2 presents an assessment of potential groundwater impacts due to CSG development.

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
376(1)(e)	A program for: i. conducting an annual review of the accuracy of each map prepared under paragraph (b)(iv) and (v); and, ii. giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps.	Section 12 describes the UWIR review and reporting process for the affected aquifers.
376(1)(f)	A water monitoring strategy.	Section 10 describes the groundwater monitoring program.
376(1)(g)	A spring impact management strategy.	There are no springs within the Project site or its surrounds. Hence, a strategy for spring management is not required.
376(1)(h)	If the responsible entity is the office: i. a proposed responsible tenure holder for each report obligation mentioned in the report; and, ii. for each immediately affected area—the proposed responsible tenure holder or holders who must comply with any make good obligations for water bores within the immediately affected area.	Not applicable.
376(1)(i)	The information or matters prescribed under a regulation.	No other relevant information or matters have been prescribed under a regulation.
376(2)	However, if the underground water impact report does not show any predicted water level decline in any area of an affected aquifer by more than the bore trigger threshold during the period mentioned in subsection (1)(b)(iv) or at any time as mentioned in subsection (1)(b)(v), the report does not have to include the program mentioned in subsection (1)(e).	Section 12 describes the UWIR review and reporting process for the affected aquifers.

Section 378 of the Water Act lists the content requirements for the water monitoring strategy. Table 2.2 lists the specific content requirements and provides an explanation of where each requirement is addressed in this UWIR.

Table 2.2 UWIR Water Monitoring Strategy Content Requirements

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
378(1)	A responsible entity's water monitoring strategy must include the following for each immediately affected area and long-term affected area identified in its underground water impact report or final report: a) a strategy for monitoring— (i) the quantity of water produced or taken from the area because of the exercise of relevant underground water rights; and (ii) changes in the water level of, and the quality of water in, aquifers in the area because of the exercise of the rights; b) the rationale for the strategy; c) a timetable for implementing the strategy; d) a program for reporting to the office about the implementation of the strategy.	Section 10 describes the groundwater monitoring program.
378(2)	The strategy for monitoring mentioned in subsection (1)(a) must include: a) the parameters to be measured; b) the locations for taking the measurements; and, c) the frequency of the measurements.	Section 10 describes the groundwater monitoring program.
378(3)	If the strategy is prepared for an underground water impact report, the strategy must also include a program for the responsible tenure holder or holders under the report to undertake a baseline assessment for each water bore that is: a) outside the area of a resource tenure; but b) within the area shown on the map prepared under section 376(b)(v).	Section 9 describes the water bores identified from the Department of Regional Development, Manufacturing and Water (DRDMW) groundwater database.
378(4)	If the strategy is prepared for a final report, the strategy must also include a statement about any matters under a previous strategy that have not yet been complied with.	Not applicable.

2.3 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is an Act with the objective to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This Act states that 'to carry out an environmentally relevant activity (ERA) an Environmental Authority (EA) is required'. A resource activity, specifically a petroleum activity, is defined as an ERA.

2.3.1 Environmental Authority EPPG00783713

PL 94 currently operates under an approved Environmental Authority (EA) (EPPG00783713) which took effect on August 2, 2021. The EA authorises the construction and operation of up to 600 production wells and other ancillary activities to support gas field development across PL 94.

Under the EP Act, streamlined model conditions for petroleum activities have been developed for incorporation into EA's. These are provided in a guideline published by the State of Queensland Department of Science and Environment (DES 2016). The streamlined conditions are based on acceptable management approaches and constraints to protect environmental values.

3 PROJECT SETTING AND DESCRIPTION

3.1 Project Location and Land Use

The Project is located in the Moura-Theodore district of the Banana Shire, central Queensland, and covers a total area of ~260 km^2. The Project area extends approximately 45 km north to south and up to 10 km east to west and lies between the Anglo American Coal Mine to the east and Moura in the west.

The Project area (PL 94) is held by Westside entities and Mitsui E&P Australia Pty Ltd and is situated directly south of existing petroleum leases also operated by Westside (PL 1048 and PL 1049). There is no overlap in tenures between PL 94, PL 1048, PL 1049 and adjacent mining leases.

Dominant land use within the vicinity of the Project is grazing native vegetation. Other land use types surrounding the Project area include cropping, irrigated cropping, coal mining and production native forests. Figure 3.1 presents the mapped land use distribution within the vicinity of the Project area.

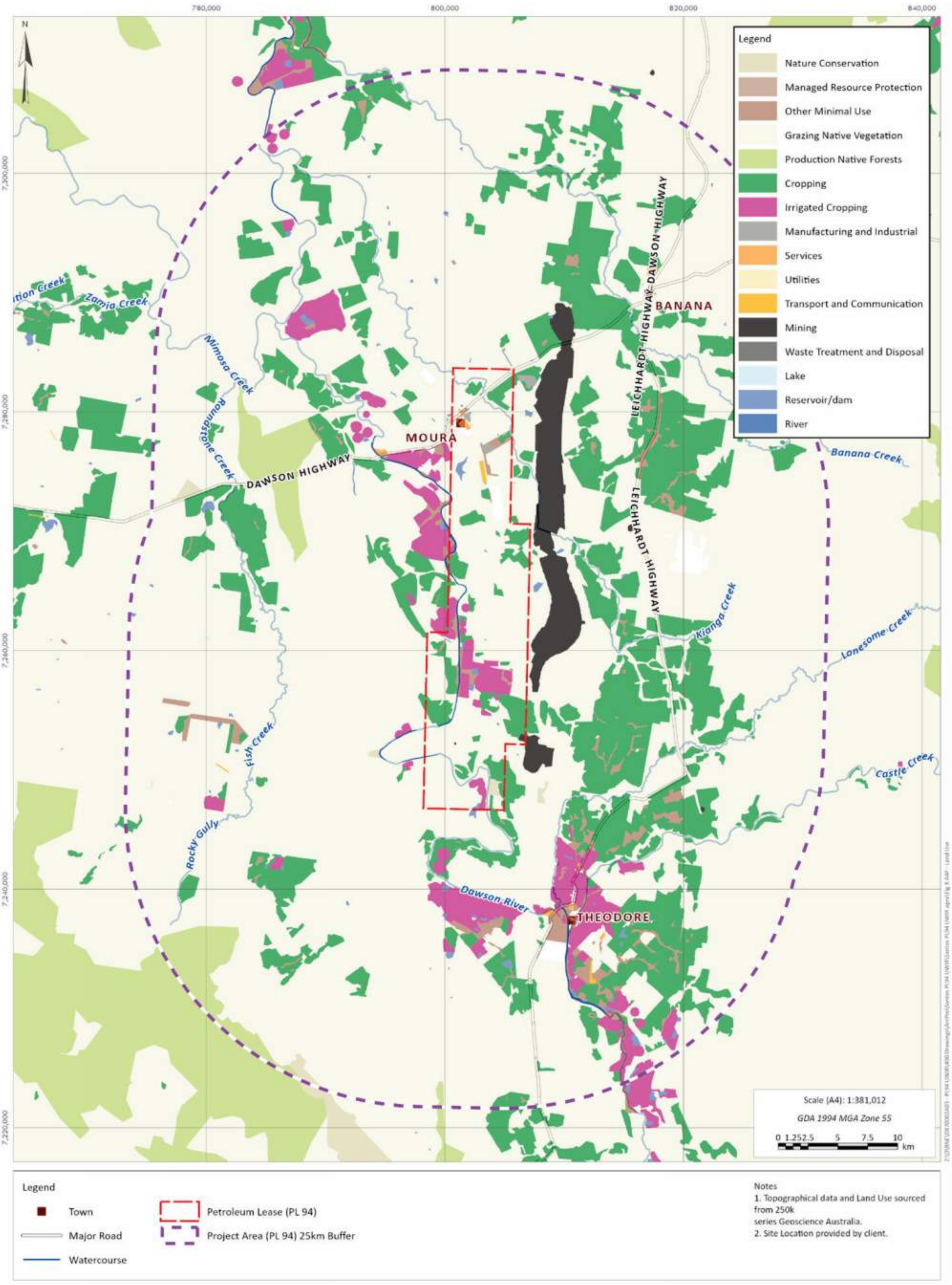

Figure 3.1Project Development Area Current Land Use

3.2 Topography and Drainage

The Project area is generally undulating and is situated between three topographic highs; the Malakoff Range, a north-south trending ridge 3 km to the southeast of the Project area; the Banana and Auburn Ranges, ~40 km east of the Project area; and the Dawson Range, 8 km to the west of PL94. The Banana, Auburn and Dawson Ranges are prominent northwest – southeast trending ridges, as shown in Figure 3.2.

The Project area is located in the Lower Dawson Sub-Basin Catchment, part of the Fitzroy Basin (State of Queensland 2013). The Fitzroy River Basin is the second largest externally drained basin in Australia and the largest on the eastern coast of the continent. Covering an area of 150,000 km^2, the basin contains several significant tributaries, including the Nogoa, Comet, Mackenzie and Dawson Rivers. The basin discharges into the Coral Sea, east of Rockhampton.

The Dawson River drainage sub-basin is 565 km^2 (DES 2019).The Lower Dawson catchment is bounded by the Shotover Ranges (URS 2014), ~120 km to the northwest of the Project area. The catchment consists of an extensive network of watercourses that are ephemeral. The Dawson River is a perennial watercourse due to inflow from groundwater springs throughout the year (URS 2014), although there are sections of ephemeral flow (DNRME 2018).

In the vicinity of the Project area, the Dawson River and tributaries to the Dawson River, the Kianga and Banana Creeks, drain towards the northwest. The Kianga and Banana Creeks converge with the Dawson River more than 25 km to the northwest of the Project area.

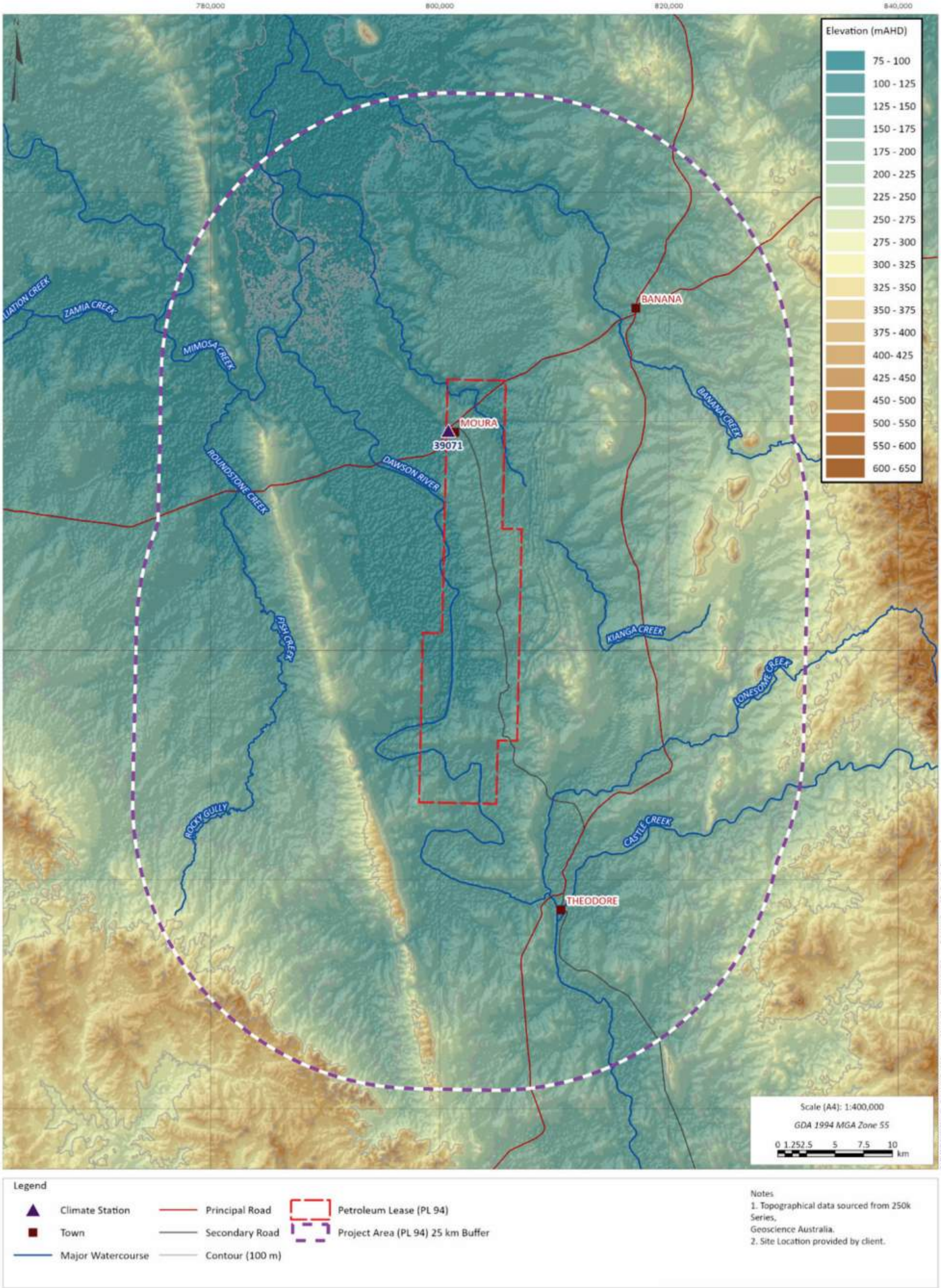

Figure 3.2Topography and Drainage

3.3 Climate

The climate of the Project area is classified as subtropical with a moderately dry winter, based on the modified Köppen classification system (BOM 2016). Climate statistics sourced from the Bureau of Meteorology (BOM) are presented in Table 3.1 for the climate station Thangool Airport (39089), situated 55 km east of the Project area. The locations of the station is provided in Figure 3.2.

Table 3.1 Climate Statistics for Thangool Airport, Site Number 39089 (BOM 2022)

Thangool Airport (39089)				
Statistic Element	**Mean Maximum Temperature (°C)**	**Mean Minimum Temperature (°C)**	**Mean Monthly Rainfall (mm)**	**Mean Daily Evaporation (mm)**
Period of Record	1992 - 2025	1993 - 2025	1929 - 2025	1997 - 2009
January	33.8	19.7	94.4	7.4
February	33.2	19.8	92.3	6.6
March	32.1	18.1	63.8	6.4
April	29.6	14.1	33.9	5.1
May	26.2	10.0	37.3	4
June	23.5	7.0	30.9	2.9
July	23.2	5.8	28.6	3.1
August	25.1	6.4	23.5	4
September	28.2	9.8	24.6	5.5
October	30.6	13.6	57.9	6.7
November	31.9	16.4	74.6	6.8
December	33.2	18.7	93.8	7.4

Mean maximum temperature ranges between 33.8°C in the summer months and 23.2°C in the winter months. Mean minimum temperature ranges between 19.8°C in the summer months and 5.8°C in the winter months. The highest rainfall occurs during December to February, with the lowest rainfall occurring between April to September.

Evaporation data shows a mean daily evaporation to range between 2.9 mm to 7.4 mm. The highest evaporation occurs during the summer months (November to January; 6.6 mm to 7.4 mm), while the lowest evaporation occurs during the winter months (May to August; 2.9 mm to 4 mm).

Figure 3.3 presents daily rainfall between 1929 and 2025 for the Thangool Airport rainfall station, and a rainfall excess / deficit trend for the same period. Rainfall excess / deficit trends present a running deviation of long-term actual rainfall against the average. This provides seasonal-scale identification of trends (wet / dry) and longer term (e.g., decadal) deviation from average conditions. These trends result in a natural tempering of peaks for rainfall events and therefore support the correlation of rainfall events to aquifer responses.

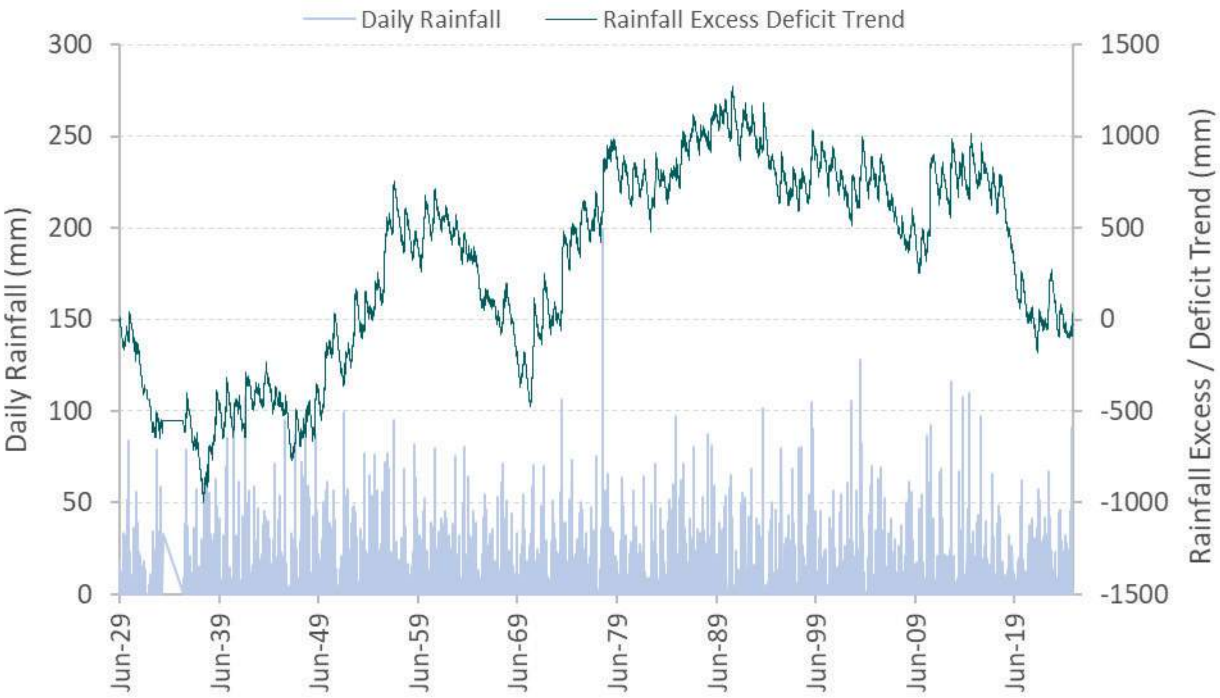

Figure 3.3 Daily Rainfall and Rainfall Excess / Deficit Trend (Thangool Airport)

Observations from the rainfall / excess deficit trend include:

- The overall rainfall trend is characterised by the cyclic nature of the wet and dry seasons, with annual fluctuations of ~80 mm evident across the record.
- Large rainfall events were recorded in 1978 and 2003 where more than 120 mm was recorded in a day. The highest rainfall was recorded in 1978 at 200 mm.
- The overall rainfall excess/deficit trend reflects a general increase between 1929 and 1957. This is followed by a decrease until 1970. After 1970, the rainfall excess/deficit trend increases until 1980.
- The rainfall excess/deficit trend is relatively stable from 1980 to 2018. The rainfall excess/deficit trend decreases with a notable drop in 2018, ending a 40-year period of rainfall in excess of the historical average.
- The rainfall trend has remained relatively stable since 2018.

4 ASSESSMENT METHODOLOGY

This section describes the UWIR methodology, including the desktop study of relevant groundwater bores, geological and environmental information, and groundwater monitoring data. It also provides an overview of the numerical groundwater modelling method. A detailed description of the numerical groundwater modelling method is provided in Section 8.

4.1 Information and Data Sources

A preliminary desktop assessment utilised data and information provided by Westside, the Office of Groundwater Impact Assessment (OGIA) and publicly available reports and data. Primary data and information utilised in this assessment includes:

4.1.1 Datasets

- Registered bore data from the DRDMW Groundwater Database (GWDB) (DRDMW 2025).
- Queensland Spring Register, published by the Queensland Herbarium (Queensland Herbarium 2018).
- Potential Groundwater Dependent Ecosystem (GDE) mapping published by DETSI (DES 2018a).
- The Queensland Spatial Catalogue (QSpatial), via Queensland Globe – comprising records of petroleum and coal seam gas (CSG) exploration, production and monitoring wells.
- Groundwater monitoring records (levels and quality) provided by Westside.
- Aquifer attribution dataset for third-party groundwater bores, provided by OGIA (OGIA 2022).
- Geological model from Westside of the Project area localised geological regime.
- Regional geological layers and associated hydraulic parameters from OGIA (OGIA 2022).

4.1.2 Reports

- Greater Meridian Field Groundwater Assessment (KCB 2020).
- Mungi West / Mungi North Underground Water Impact Report (KCB 2021).
- Updated Geology and Geological Model for the Surat Cumulative Management Area (OGIA 2019c).
- Meridian Gas Project – PL94 Underground Water Impact Report (CDM Smith 2019).
- Underground Water Investigation Report for ATP769 Paranui Pilot Project (AGE 2018).
- Meridian Gas Project – Underground Water Impact Report (CDM Smith 2016a).
- Underground Water Impact Report Mungi West / Mungi North (KCB 2021).
- PL 94 - Annual Groundwater Monitoring Report (Arris, 2023).
- Underground Water Impact Report Update (KCB 2023).
- PL 1048/PL 1049 Underground Water Impact Report Update (KCB 2025).

OGIA's provision of interpretive data was limited to available data in the Project area and surrounds. The Project area, being distant to the main CSG developments within the Surat CMA is subject to limited data availability and interpretation. This limitation will subsequently be reflected in the confidence of the OGIA geological model, parameterisation and aquifer attribution in the area.

4.2 Impact Assessment Methodology

This assessment has been completed to assess potential impacts on the groundwater system from the proposed CSG development of PL 94 for the UWIR period (Immediately Affected Areas (IAA)) and for the proposed overall development (Long-Term Affected Areas (LTAA)).

All relevant data (as identified in Section 3.1) were collated and analysed to develop a conceptual understanding of the groundwater regime, including the key hydrostratigraphic units, groundwater flow and groundwater quality characteristics. This conceptualisation served as the basis for the development and simulation of the numerical groundwater model, which was used to undertake the prediction of potential impacts to the groundwater regime. Details of the numerical groundwater model are provided in the following section.

4.2.1 Numerical Groundwater Modelling

A 3D numerical groundwater flow model was developed to predict the extents of depressurisation and the associated impacts on the groundwater regime and the surrounding environment. The groundwater model for the Project was developed using the MODFLOW-USG platform. MODFLOW is considered to be an industry standard modelling platform. A detailed description of the groundwater model is provided in Section 8.

The groundwater model was constructed using a detailed geological model developed by Westside, which was further enhanced by inclusion of bore logs from groundwater monitoring bores and CSG production wells installed within the Project area and surrounds, and all published lithological logs within the model extents. Geological data compiled from the public domain, and provided by OGIA, were incorporated with the local Project data provided by Westside to allow construction of the model to the adopted extents. The model was calibrated to existing groundwater levels using reliable measurements from local and regional bores within the model domain.

Once calibrated, the model was used to predict the groundwater response to the project, including changes in groundwater levels as a result of the proposed CSG development. The groundwater model allowed the impacts of the existing approved CSG operations and adjacent Dawson Mining Complex to be distinguished from those of the Project.

The groundwater model has been used to specifically predict the magnitude and extent of groundwater depressurisation; with these predictions used to identify the IAA and LTAA for the UWIR. These predictions have also been used to assess the impacts of the Project on groundwater users and the sensitive environmental features.

5 REGIONAL GEOLOGY AND HYDROGEOLOGY

5.1 Geological Setting

The regional geology of the Project area comprises sediments from the Early Permian to middle Triassic age Bowen Basin. The Bowen Basin is an elongated, north-south trending basin extending over 160,000 km^2 from central Queensland to the New South Wales border. Deposition is predominantly within two south–southeast trending troughs, the Taroom Trough to the east and the Denison Trough to the west, which are separated by the Comet Ridge (OGIA 2019b). The Project area is located on the southeastern portion of the Bowen Basin, on the northeastern limb of the Taroom Trough and lies to the west of the Auburn Arch (OGIA 2019c)

Regionally, the Bowen Basin, comprises thick successions of shallow marine and non-marine sediments and volcanics, deposited in a foreland basin in the Late Permian (Korsch and Totterdell 2009). The southern Queensland and northern-most New South Wales portion of the basin is overlain by up to 2.5 km of Early Jurassic to Early Cretaceous Surat Basin sedimentary sequences. In the vicinity of PL 94, sediments from the Surat Basin have been eroded and the Bowen Basin units reside under Cenozoic cover.

Prior to the formation of the Bowen Basin, the basement rocks derived from magmatic origin were deposited during the Carboniferous – early Permian. The volcanic arc, known as the Connor – Auburn Province, is a linear magmatic belt comprising two sub-provinces: the Auburn to the south and Connor to the north. The sub-provinces are separated by the Gogango Thrust zone which comprises strongly deformed Permian sediments ((Green 1997), (Withnall and Cranfield 2013)). A change in geochemical patterns and bimodal volcanism suggests a period of extensional tectonics, lending to the initiation of deposition within the Bowen Basin (Withnall and Cranfield 2013). The Camboon Volcanics overlies Carboniferous volcanics along the western edge of the Auburn Arch and form the basal unit of the Taroom Trough (Green 1997).

The Bowen Basin began as an extensive north-south trending back-arc basin to the west of the continental Camboon Volcanic Arc (Connor – Auburn Province) (Green 1997). The period of extension on the western margin of the Bowen Basin produced a series of half-grabens, such as the Denison Trough, in which fluvial and lacustrine sediments were deposited (Dickins, J.M, and E.J Malone. 1973). In the east of the Bowen Basin: volcanics were also deposited during that time, whilst a thick succession of coals and non-marine sediments were deposited in the west of the Bowen Basin (Geoscience Australia. 2019) (Green 1997).

Sedimentation in the Bowen Basin ceased in Middle to Late Triassic by the Goondiwindi event which caused regional compression and significant extension and thrust faults in the Bowen Basin strata. This was followed by widespread erosion prior to the deposition of the Surat Basin sediments (OGIA 2019c).

A large intra-cratonic sag developed following the extended period of erosion and shallow platform basins including the Surat Basin, amongst others, formed as a result. Sedimentation in the Surat Basin was predominately focused within the Mimosa Syncline, which unconformably overlies the Permian strata deposited in the Taroom Trough. Sedimentation occurred between the Triassic to Middle Cretaceous, which coincided with a compressional event, causing the uplift and erosion of the Bowen and Surat Basins and their related volcanic arcs (Green 1997).

Cenozoic sedimentary deposits overlay the Bowen Basin units regionally, formed through subsidence-related faulting and erosion in conjunction with fluvial sedimentary depositional processes (Korsch and Totterdell 2009). Crustal thinning caused by extensional tectonic events resulted in magma upwelling and intermittent volcanism, expressed as basaltic lava flows as well as interbedded tuff and volcanolithic fragments within the Cenozoic sedimentary sequences (Korsch and Totterdell 2009).

The mapped geology in the vicinity of the Project is presented in Figure 5.1 and Figure 5.2
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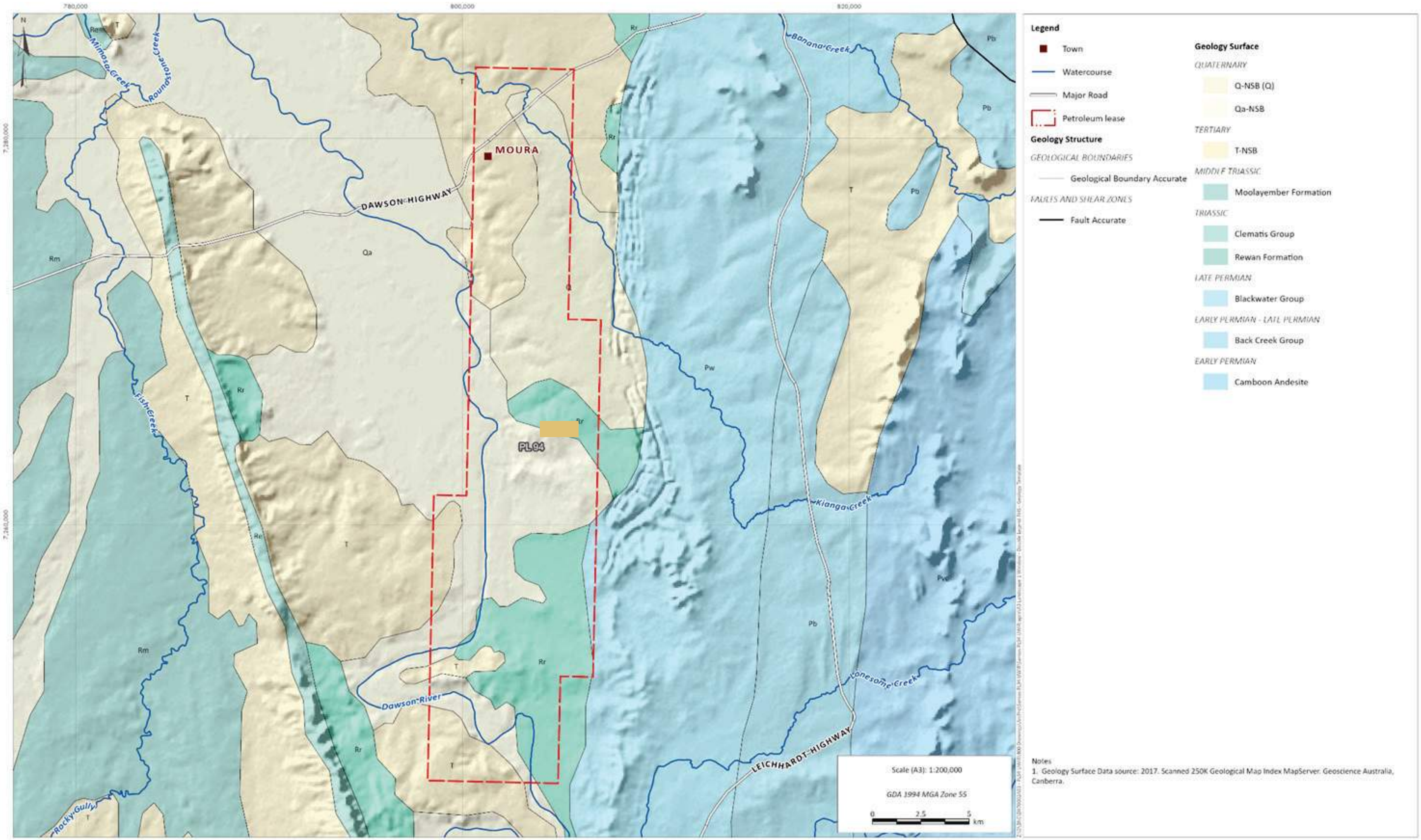

Figure 5.1 Surface Geology within the Vicinity of the Project Area

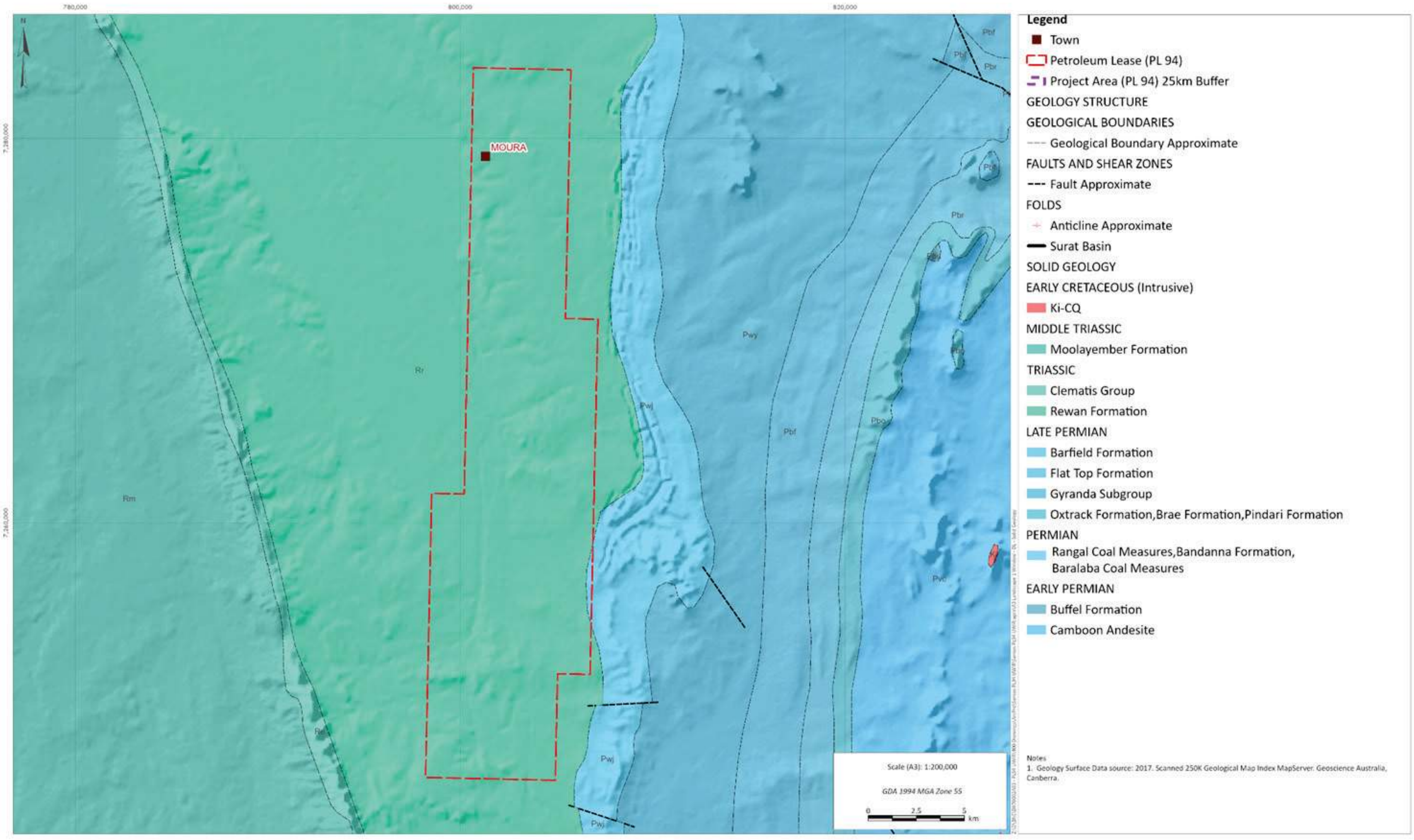

Figure 5.2 Solid Geology within the Vicinity of the Project Area

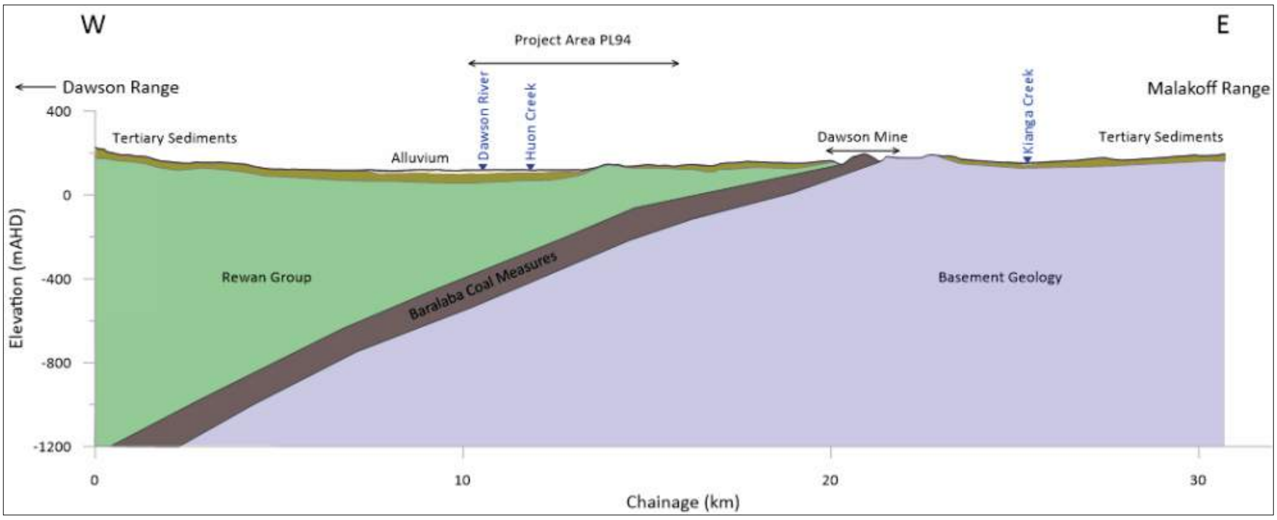

Figure 5.3 West – East Conceptual Geological Cross-section across the Project Area

5.1.1 Structural Elements

The Project area is located at the northeastern boundary of the Taroom Trough, on the eastern limb of the Mimosa syncline. The Project area is located west of the Auburn Arch which is intersected by a series of northeasterly faults (Dickins, J.M, and E.J Malone. 1973).

Regionally, the Bowen Basin has experienced a mixture of thrust faults, volcanic activity, extensional fault systems and reactivation of structures which creates a structurally complex basin (OGIA 2019c).

The main structural feature located in the southern part of the Bowen Basin is the Mimosa Syncline, located ~45 km west of the Project area. The axis of the Mimosa Syncline follows that of the Taroom Trough and developed and filled with sediment during the Triassic (Dickins and Malone 1973). To the northeast of the Project area, discontinuous northwest – southeast trending faults occur. Phases of deformation occurred throughout history resulting in the reactivation of historic structures as well as the creation of new structural elements. During the Middle Cretaceous, a compressional event caused the uplift and erosion of the Bowen and Surat Basin and their associated volcanic arcs (Elliott 1994 Green 1997). Further deformation occurred during the Late Cretaceous and Tertiary as a result of epeirogeny movements as well as larger divergent plate motion related to the break-up of Gondwana (Exon 1976)(Green 1997).

5.2 Regional Hydrostratigraphy

Stratigraphic units of relevance to the Project include:

- Quaternary alluvium deposits located along the Dawson River and major tributaries;
- Surficial Cenozoic deposits;
- Jurassic sediments of the Boxvale Member, Evergreen Formation and Precipice Sandstone;
- Early to Middle Triassic sediments of the Clematis Group and Moolayember Formation;
- Early Triassic sediments of the Rewan Group;

- Late Permian sediments of the Baralaba Coal Measures; and
- Pre-Permian to Early Permian basement geology.

Table 5.1 presents the stratigraphic column for the key units occurring in the vicinity of the Project area. The table also indicates the hydrogeology condition of each unit (OGIA 2019a), and relevance to the Project area.

The surface geology in the Project area is dominated by Quaternary aged alluvium deposits, Tertiary aged sediments and Triassic aged sandstones of the Rewan Group.

Table 5.1 Stratigraphic Summary of Regional Geology

<table>
<tr><th colspan="2">Age</th><th colspan="2">Formation</th><th>Hydrostratigraphic Description (OGIA 2019b)</th><th>Relevance to Project Area</th></tr>
<tr><td rowspan="2">Cenozoic</td><td>Quaternary</td><td colspan="2">Alluvium</td><td>Aquifer</td><td>Mapped associated with watercourses</td></tr>
<tr><td></td><td colspan="2">Tertiary Sediments (includes residual Tertiary aged cover, Colluvium (Qr) and Duaringa Formation)</td><td>-</td><td>Deposits across the Project area</td></tr>
<tr><td rowspan="2">Jurassic</td><td rowspan="2">Early</td><td>Boxvale Sandstone Member</td><td>Evergreen Formation</td><td>-</td><td rowspan="2">Outcrops 25 km south of the Project area</td></tr>
<tr><td colspan="2">Precipice Sandstone</td><td>Aquifer</td></tr>
<tr><td rowspan="3">Triassic</td><td rowspan="2">Middle</td><td colspan="2">Moolayember Formation</td><td>Tight Aquitard</td><td rowspan="3">Predominantly located to the west of the Project area. However, the Rewan Group is also present within the Project area</td></tr>
<tr><td colspan="2">Clematis Group</td><td>Major Aquifer</td></tr>
<tr><td>Early</td><td colspan="2">Rewan Group</td><td>Tight Aquitard</td></tr>
<tr><td rowspan="2">Permian</td><td>Late</td><td colspan="2">Baralaba Coal Measure</td><td>Interbedded Aquitard</td><td>Target CSG formation</td></tr>
<tr><td>Middle</td><td colspan="2">Back Creek Group</td><td>-</td><td rowspan="2">Located east of the Project area</td></tr>
<tr><td colspan="2">Pre-Permian Basement</td><td colspan="2">Basement Rocks</td><td>-</td></tr>
</table>

A summary of each of the relevant geological units is provided in the following sections.

5.2.1 Quaternary Alluvium

The Quaternary alluvium deposits comprise unconsolidated alluvium associated with the Dawson River and associated creeks that traverse the Project area. Major alluvium deposits associated with the Dawson River, occur within the southern half of the Project area as well as to the west of the Project area where multiple creeks (Fish Creek, Mimosa Creek, Kianga Creek) converge with the Dawson River. Lesser alluvium deposits associated with the Kianga Creek are also present in the north of the Project area.

The alluvium consists of fine to coarse grained gravels and channel sands interbedded with clays. The formation overlies Tertiary deposit sand Triassic to Permian units. The alluvium varies in thickness and lateral extent.

5.2.2 Tertiary Sediments

Tertiary-Quaternary colluvium consisting of clay, silt, sands, and gravel (DNRME 2018) underlay the alluvium deposits in some areas. This colluvium unit is however not observed within the Project area; it is prevalent in the surface geology beyond the Dawson Ranges while areas of limited extent also occur between 4 and 7 km west of the Project area.

The Duaringa Formation unconformably overlies the Permian units of the Bowen Basin and is the most prevalent surface geology throughout the Project area. This unit comprises mudstone, sandstone, conglomerate, siltstone, shale, lignite and basalt (Murray, C.G, and L.C Cranfield 1989). The Duaringa Formation is the dominant Tertiary-age sediment present in the Project area, distributed across the northern half of PL 94 and in smaller lateral extents in the south, as well as to the west of the Project area, on either side of the topographic high (Dawson Range).

Published geological mapping have identified lithological similarities between the Tertiary-Quaternary colluvium and the Duaringa Formation; with the contacts between these units being frequently indistinguishable. These units are therefore considered to form a single unit, and hereafter referred to as the Tertiary sediments.

5.2.3 Jurassic Deposits

Jurassic deposits are related to the Surat Basin and unconformably overlie the Permian strata of the Bowen Basin. The Jurassic units comprise Boxvale Sandstone Member, Evergreen Formation and the Precipice Sandstone. The units are located to the southeast of the Project area, where the Surat Basin overlaps the Bowen Basin.

Boxvale Sandstone Member

The Upper Jurassic unit in the vicinity of the Project area is known as the Boxvale Sandstone Member, comprising fine to coarse grained quartzose sandstone with carbonaceous siltstone, shale and coal interbeds. The sediments are interpreted to be deposited in shallow non-marine environments where sand was reworked and sorted, with periods of sea inundation. The Boxvale Sandstone Member lies conformably on the Evergreen Formation.

Evergreen Formation

The Evergreen Formation comprises chemically weathered sandstone overlain by carbonaceous mudstone, siltstone and minor coal (Geoscience Australia 2019). The lower part of the formation was likely laid down in an estuarine or lacustrine setting, with periodic marine inundation.

Precipice Sandstone

The Precipice Sandstone is the oldest unit within the Jurassic sequence situated in the Project area. It was formed by folding and subsequent erosion of pre-existing units (such as the Clematis Group) during the late Triassic; creating the unconformity between the Triassic and Jurassic sequences (Martin et al. 2018).

The Precipice Sandstone consists of quartz sandstone with common cross-bedding and cut and fill structures; attributed to deposition in a fluviatile environment (La Croix et al. 2020). Evidence of marine influence throughout sedimentation has been reported (Martin et al. 2018). Deposits are laterally extensive across the Bowen Basin, indicating vast distances of sediment transport (Martin et al. 2018). The unit is considered a major aquifer (OGIA 2019a) and outcrops to the west of the Dawson Ridge southeast of the Project area.

5.2.4 Triassic Deposits

The Triassic sequence can be subdivided into three recognisable units; the Moolayember Formation, the Clematis Group and the Rewan Group.

Moolayember Formation

The Middle to Upper Triassic Moolayember Formation is the youngest unit in the Bowen Basin and comprises interbedded mudstones, lithic, medium to coarse grained sandstone, carbonaceous shales, siltstones, and conglomerates (Green 1997).

The lower part of the Moolayember Formation was deposited in a lacustrine depositional environment that grades upwards into an alluvial plain with alluvial fans on the eastern margin (Golin and Smyth 1986). The thickness of this formation varies from 200 m on the Springsure Shelf to nearly 1,500 m in the centre of the Taroom Trough (Radke et al 2000). The Moolayember Formation is characterised as a tight aquitard (OGIA 2019b). The formation outcrops to the west and southwest of the Project area.

Clematis Group

The Lower to Middle Triassic Clematis Group (formally, Clematis Sandstone) comprises medium to coarse grained, cross-bedded, quartzose to sub-labile and micaeous sandstone; siltstone and thin beds of mudstone, deposited in fluvial environment. The Clematis Group includes two geological formations within the Denison Trough: the Expedition Sandstone (a quartzose sandstone, conglomerate, siltstone and mudstone package) and the Glenidal Formation (thinly bedded, very fine to medium-grained sandstone with common siltstones and mudstones), which overlies the Early Triassic Rewan Group (Brakel et al. 2009). The Expedition Sandstone is equivalent to the Showgrounds Sandstone in the Taroom Trough (Hoffmann, Green, and Gray 1997).

The Clematis Group forms the Dawson Range which outcrops to the west of the Project area.

The Clematis Group is considered to be a major aquifer of the Great Artesian Basin (GAB). The Clematis Group is separated from the Baralaba Formation (targets for CSG production) by a thick sequence of the Rewan Group aquitard.

Rewan Group

The Rewan Group is described as containing thick-bedded, fine to medium-grained, commonly micaceous, and feldspathic sandstones. However, near the top of the unit, thin, medium-coarse grained, poorly sorted sandstones were observed (Olgers et al. 1966). Overall, the Rewan Group is dominated by reddish-brown to greenish-grey siltstones and mudstones. This is similar to observations recorded in the Paranui 10 well, drilled within Westside's existing ATP769/PCA196 license, west of PL 94. In this well, the Rewan Group was described as containing mostly greenish-grey siltstone with thin beds of fine to medium-grained quartz-lithic sandstone (Figure 5.4). Sandstones were observed to have low to medium visible porosity and low permeability. Some 60-70 degree fractures were present through the lower part of the section, however, these likely developed as a result of the core drilling process. Multiple healed and carbonate-filled fractures were also observed.

Figure 5.4 Drill Core from Paranui 10 Well Showing Rewan Group Core

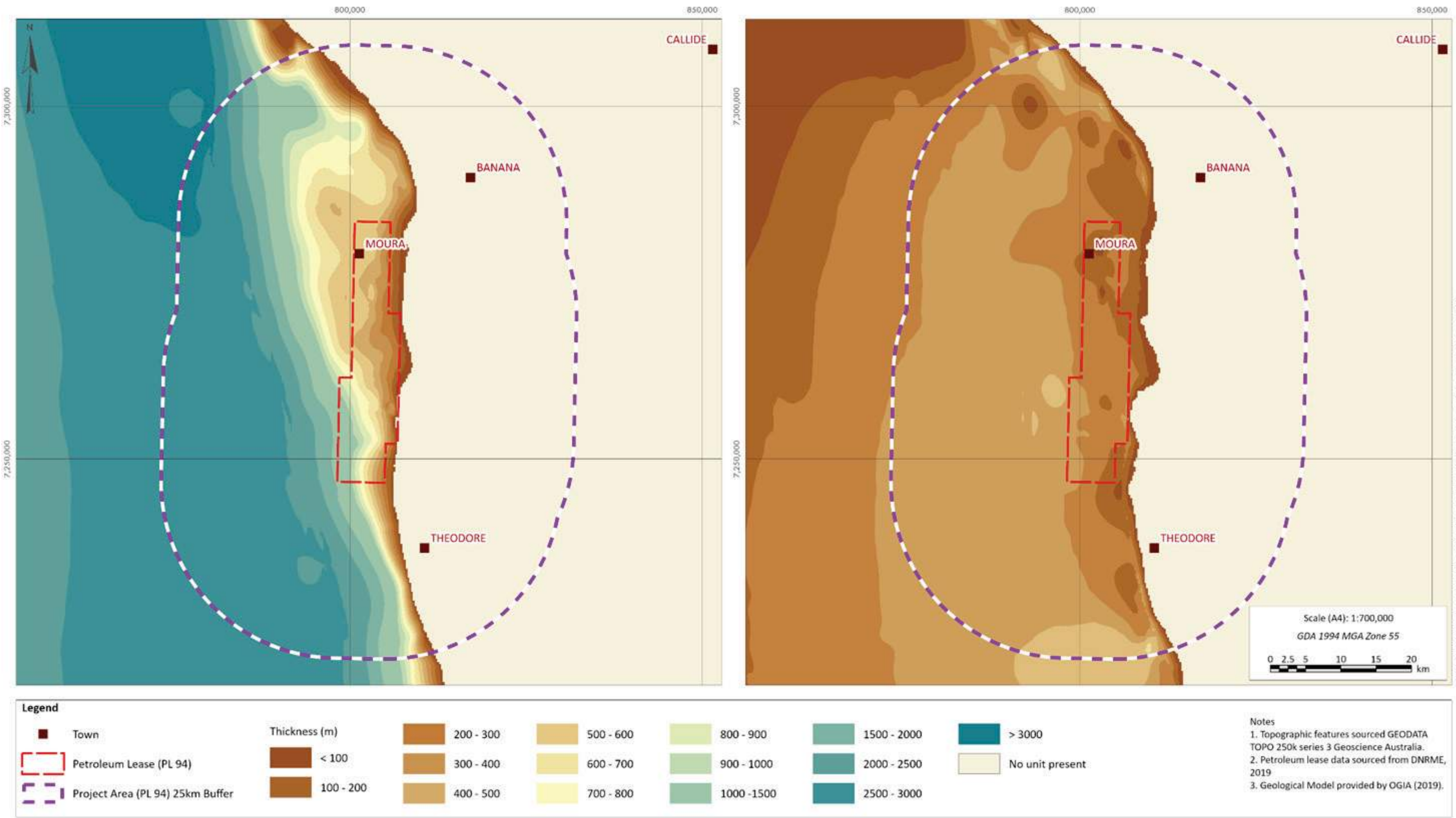

Figure 5.5 Formation Isopachs for Rewan Group and Baralaba Coal Measures (Sourced from OGIA 2019b)

5.2.5 Permian Units

Baralaba Coal Measures

The Late Permian Baralaba Coal Measures is part of a larger group known as the Blackwater Group. The Baralaba Coal Measures forms part of the upper units, comprising economical coal seams interbedded with calcareous mudstone, siltstone and shales (CDM Smith 2016a). The Baralaba Coal Measures were deposited in paludal and lacustrine environments. Whilst the lower part comprises carbonaceous shale, limestones, coal and sandstone, laid down during the transition from marine to freshwater sedimentation. The Baralaba Coal Measures correlates with the Banadanna Formation located in the southwestern Bowen Basin and the Rangal Coal Measures located in southeastern Bowen Basin and northern Bowen Basin (Ayaz et al. 2016).

The strata of the Baralaba Coal Measures and underlying formations are north-south trending and dipping to the west. Reported dips for the Baralaba Coal Measures range between 5^{o} and 16^{o} (AGE 2011). Review of the geological maps of the areas indicates that the lower end of the range of these values is likely to be the more representative over the scale of the Project area. Based on these dip measurements, the upper coal seams of the target Baralaba Coal Measures lie approximately 40 m below ground level in the eastern area of PL 94 and greater than 1,500 m below ground level in the western section.

The Baralaba Coal Measures comprises the target coal seams, which are interbedded with sandstone, siltstone and shales that occur as interburden or overburden relative to the coal seams. The fine-grained shale and siltstone are observed as having low permeability and are interpreted to function as aquitards. In comparison, the target coal seams generally have a higher permeability.

The Baralaba Coal Measures outcrop to the east of the Project area and dips to the west / northwest (CDM Smith 2019). The Baralaba Coal Measures are considered as an interbedded aquitard (OGIA 2019b).

Kaloola Member

The Kaloola Member (equivalent to the Burngrove Formation) comprises mudstone, siltstone, sandstone, conglomerate and minor coal (Geoscience Australia 2019) and is the basal sub-unit of the Baralaba Coal Measures.

The Kaloola Member outcrops to the east of the Project area, immediately east of the Dawson Mine. This unit is considered an interbedded aquitard.

5.2.6 Undivided Permian – Carboniferous Units

The basement geology, interpreted for the Project area, encompasses Upper Permian, Lower Permian and Upper Devonian-age units, broadly identified as any stratigraphic unit underlying the Baralaba Coal Measures. This group includes the Gyranda Subgroup, Back Creek Group and Camboon Volcanics. The units have been combined for the purpose of the geological model and the relevance to the Project and purpose of the hydrogeological model as designed by KCB.

Generally, the Back Creek Group comprises sandstone, siltstone and carbonaceous shale, which unconformably overlie the Camboon Volcanics. Units of the Back Creek Group: Flat Top, Barfield Formation and Oxtrack Formations unit (OGIA 2019a), outcrop to the east of the Project area. The Camboon Volcanics comprise basaltic to andesitic composition volcanic rocks that outcrop to the east of the Project area.

In general, the basement geology is not considered an aquifer due to confinement beneath the Rewan Group and the Baralaba Coal Measure. The “Undivided Permian Group” forms the base of the geological model.

6 PART A: UNDERGROUND WATER EXTRACTION / INJECTION

6.1 CSG Project Description

The following is a summary of the regional Project setting, with further details included in the remainder of the report:

- The gas producing target for the Project are within the Baralaba Coal Measures, of the Permo-Triassic Bowen Basin (Section 5).
- The Project is located in the Lower Dawson Sub-Basin, which forms the larger Fitzroy Basin.
- Groundwater systems in the Project area include Cenozoic–age deposits comprising alluvium associated with the Dawson River alluvium and reworked Tertiary sediments.
- Groundwater dependent assets identified in the Project area include third-party groundwater bores and potential terrestrial groundwater dependent ecosystems (TGDEs) (Section 9.1).
- The operating life of individual CSG production wells is anticipated to be approximately 20 years.
- Hydraulic fracturing, which is applied to stimulate oil and gas wells and increase production and gas recovery rates, will not be undertaken at PL 94 during the forthcoming UWIR (3 year) period.

6.1.1 Other Developments

The Project is located in the vicinity of other resource developments, including:

- Dawson Mining Complex – located on the eastern boundary of the Project area. The mine, which has been in operation since 1961, comprises three operating pits – North, Central and South. This mining complex extracts coal from the Baralaba Coal Measures, where the coal measures are outcropping/sub-cropping to the east of the Project.
- PL 94 is situated directly south of existing petroleum leases also operated by Westside (PL 1048 and PL 1049) which comprise the Mungi North and Mungi West gas fields. Gas production from these fields commenced in January 2022 and involves the progressive development of gas infrastructure including the following activities:
- 400 wellheads comprising of vertical wells, lateral wells and multi – lateral wells;
- Ancillary linear infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;
- Water management infrastructure; and,
- Other ancillary activities and facilities to support gas field development.

6.1.2 PL 94 Production Operations Overview

Production facilities are located in the Dawson River gas field (Dawson River Compressor Station) and the Moura gas field (Moura Central Compressor Station) with booster compressor stations located in the Nipan gas field and Moura gas field (Moura C) (Figure 6.1). Sales gas is produced and transferred via the 47 km pipeline (PPL 26) running north to south connecting to the Jemena operated Wallumbilla – Gladstone pipeline and to a 3 km lateral pipeline (PPL 26) to the Queensland Nitrate Plant. A second sales gas pipeline (PPL 61) delivers gas from the Hillview gas compressor station (which is located on the Anglo American Mining Lease but is interconnected to PL 94) to the GLNG gas pipeline, which provides gas to the GLNG LNG facility located in Gladstone for export. The pipeline is also connected to the domestic market via the Queensland Gas Pipeline (QGP).

The Project consists of a cluster of gas wells spaced approximately 1 km apart for vertical wells and up to 3 km apart for pad drilling with horizontal wells in each gas field. Production of gas is gathered via a network of field pipelines (gathering system) to a field production facility.

Groundwater is removed via production wells to depressurise the coal seams, which liberates gas flow. The production of CSG water is also collected in the water gathering network and delivered to the water treatment plant located in the Dawson River gas field for beneficial reuse. CSG water management is discussed in Section 6.1.3.

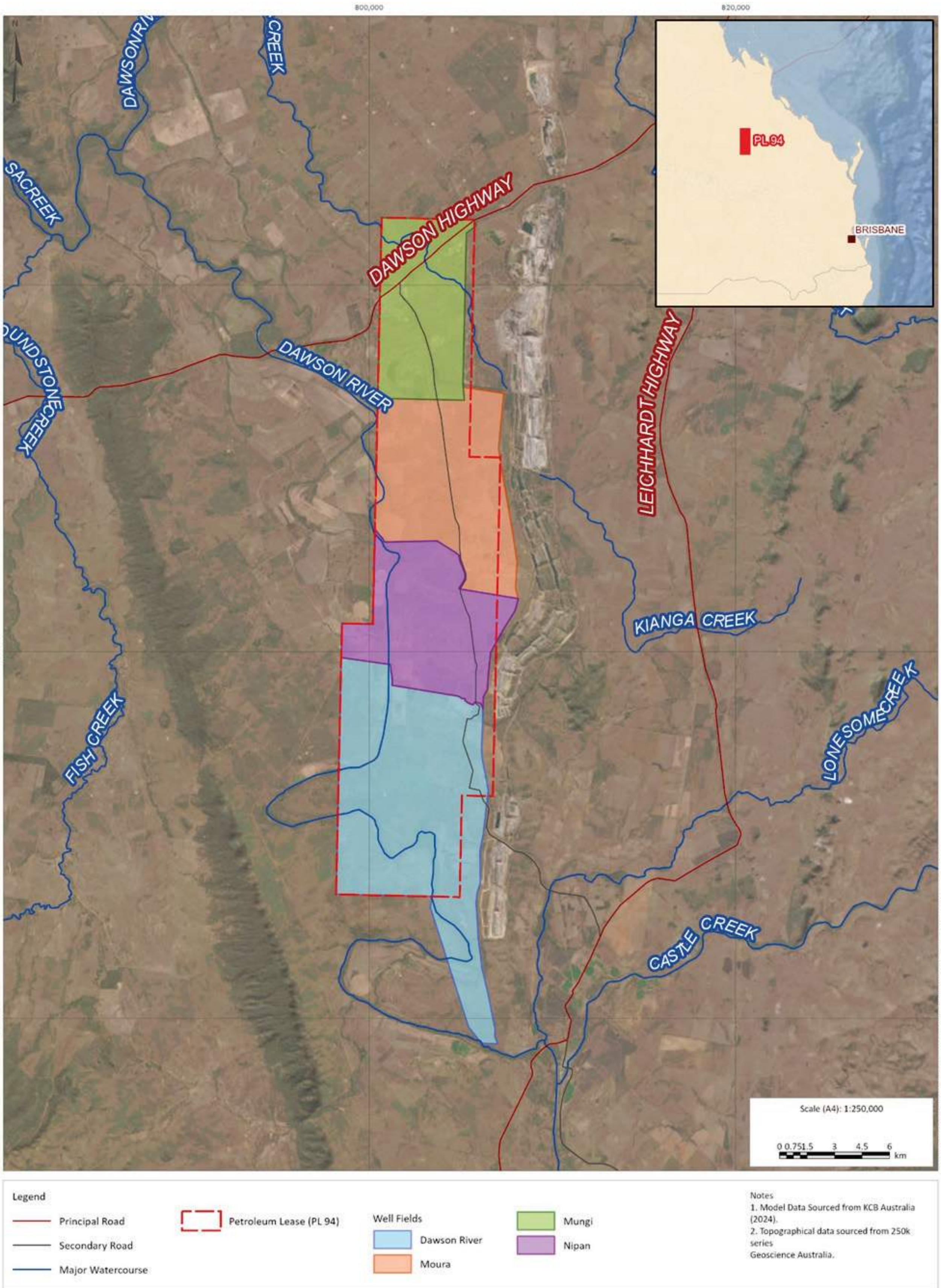

Figure 6.1 Westside Well Fields

6.1.3 CSG Water Management

Water management is undertaken in accordance with the Produced Water Management Plan – Petroleum Lease 94 (Westside 2020) and the PL 94 EA (EPPG00783713). The Produced Water Management Plan has been developed to meet the requirements of the CSG Water Management Policy (DEHP 2012) and to maximise the beneficial use of produced water (i.e. full beneficial reuse of all water produced from the Project).

Westside's strategy for produced water management is based on the CSG Water Management Policy prioritisation hierarchy (DEHP 2012). The prioritisation hierarchy for managing and using CSG water is:

- Priority 1 – CSG water is used for a purpose that is beneficial to one or more of the following:
  - The environment;
  - Existing or new water users; and/or
  - Existing or new water dependent industries.
- Priority 2 – After feasible beneficial use options have been considered, treating and disposing CSG water in a way that firstly avoids, and then minimises and mitigates, impacts on environmental values.

Figure 6.2 presents the indicative water management process for the Project. Further details on the management of the produced water is provided in the Produced Water Management Plan – Petroleum Lease 94 (Westside 2020).

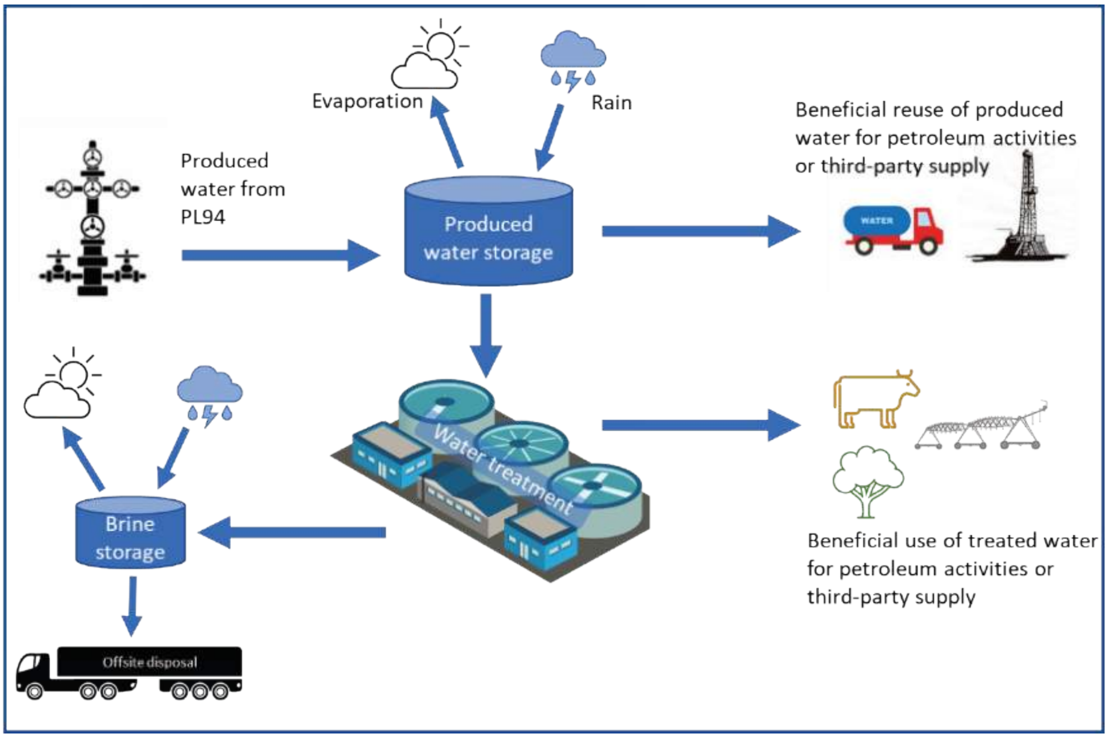

Figure 6.2 Produced Water Process Flow Diagram (Westside 2020)

6.2 Quantity of Water Produced to Date

6.2.1 Current Production Status

The production wells within PL 94 consist of vertical wells associated with stimulation programs, and single lateral wells. Current operations entail 180 production wells (Table 6.1) of which 152 are operational (August 2024). The present EA (EPPG00783713) authorises the construction and operation of up to 600 production wells and other ancillary activities to support gas field development across PL 94.

Table 6.1 PL 94 Production Wells Status as in July 2025

Gas Field	Current Operational Gas Production Wells
Dawson	31
Moura	77
Mungi	44
Nipan	28

Historical Groundwater Extraction

Current and historical water production rates for the CSG wells were estimated on a regular basis by Westside using bucket-tests for vertical wells and by counting the surface separator dumps for horizontal wells. Production data from PL 94 for the period July 2011 to August 2024 was collated and is presented in Table 6.2 and Figure 6.3.

Production years are considered from September 1 to August 31 every year. Peak water production for the current operations occurred during the 2023/2024 period.

Table 6.2 PL 94 Historical Water Production (ML)

Period	Dawson River	Moura	Mungi	Nipan	Total
2011/2012	6	31	8	7	52
2012/2013	16	7	1	6	30
2013/2014	4	1	0	4	9
2014/2015	13	5	0	13	31
2015/2016	19	12	0	12	43
2016/2016	53	17	0	11	81
2017/2018	97	26	12	10	145
2018/2019	81	24	18	11	134
2019/2020	92	35	8	54	189
2020/2021	54	18	5	39	116
2021/2022	75	31	11	68	186
2022/2023	62	39	21	91	213
2023/2024	107	40	18	69	234

Note: All annual volumes are from 1 September to 31 August

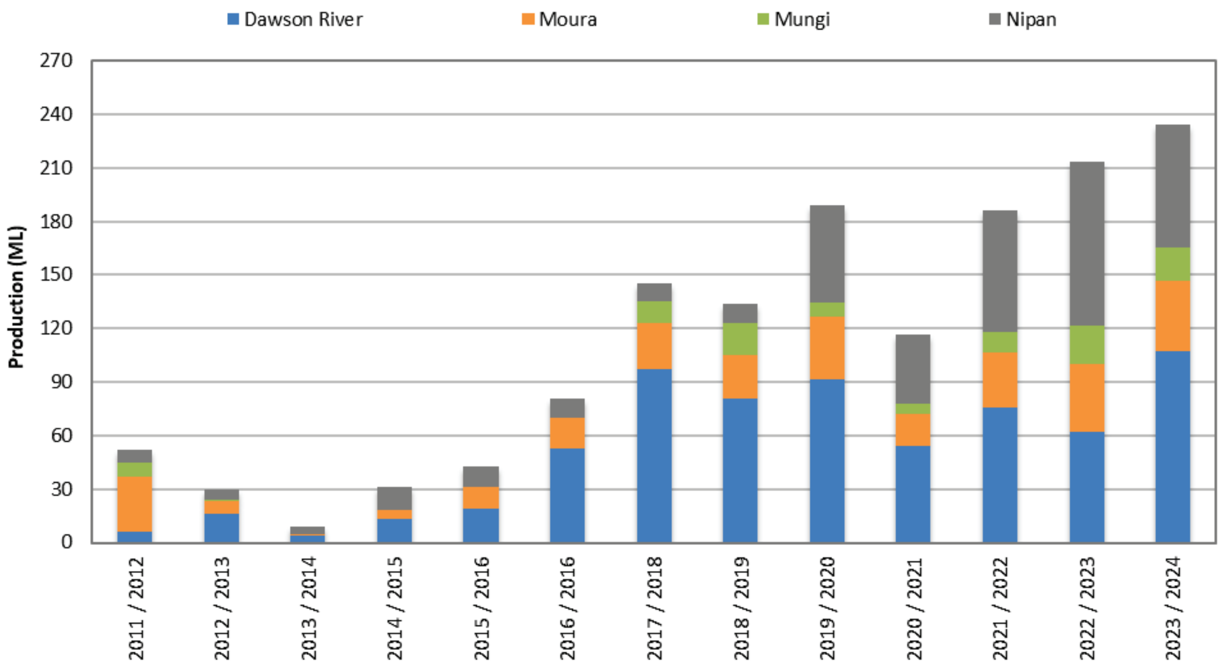

Figure 6.3 PL 94 Historical Water Production

6.3 Project Water Production Volume for Next Three Years

6.3.1 Methodology for Predicting Future Water Extraction Volumes

Produced water volumes and rates for the Project are predicted using a stochastic reservoir modelling tool which produces probabilistic distributions applied to several key reservoir parameters (i.e., permeability, porosity, and net coal). The model predictions generate production profiles (type curves) for wells across the CSG field. The production profiles are used in field development planning to provide a water forecast. Type curves are updated during the life of the project as more information (e.g. further and refined key reservoir parameters) becomes available.

Figure 6.4 displays the predicted water production rate for the Project. The estimated cumulative water production volume is also presented in Figure 6.4. The total volume of groundwater that will be abstracted for the duration of the Project is estimated to be ~14 GL.

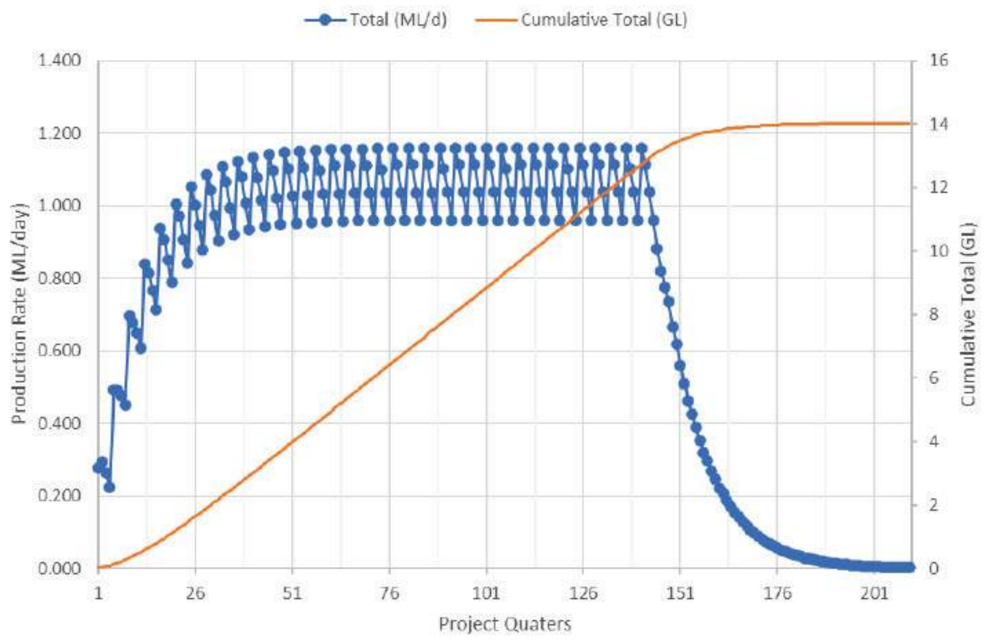

Figure 6.4 Predicted Water Production Rate and Cumulative Volume for the Project

Table 6.3 provides the annual groundwater take for Years 1, 2, and 3 of the next UWIR period (August 2025 to August 2028). The predicted groundwater take represents the theoretical volume of groundwater that could be removed from the groundwater regime.

Table 6.3 Predicted Volume of Groundwater Take During the UWIR Period

Year of UWIR Period	Predicted Water Production Volume (ML)
1	381
2	415
3	417
Total for UWIR Period	**1,183**

6.3.2 Coal Seam Gas Development Activities

Since 2024, seven pads have been completed and nine gas wells (MR191L, MR146L, NP048L, NP050L, NP080L, NP052L, MR127L, MR130L and MR131L) have commenced production on PL 94. In this UWIR, the CSG wells will continue to be commissioned from northeast to southwest; from the shallowest point of the target coal seam to the deepest. Over the first year of the UWIR period (August2025 to July 2026) it is planned for fourteen wellheads to be commissioned and online on four pads. In year two and year three (August 2026 to July 2028) a total of forty-five wells on fourteen pads is anticipated to be commissioned.

7 PART B: AQUIFER INFORMATION AND UNDERGROUND WATER FLOW

7.1 Local Hydrogeology

The Project area is directly underlain by Quaternary alluvium and broader deposits of Tertiary sediments. Unconformably underlying the Quaternary and Tertiary surficial geology are Triassic (Moolyamber Formation, Clematis Group, Rewan Group) and Permian (Baralaba Coal Measures, Kaloola Member, Back Creek Group) sedimentary units that are gently dipping towards the west in the vicinity of the Project area. As a result of the dipping units, the Rewan Group outcrops within and to the west of the Project area, while the Baralaba Coal Measures outcrop to the east of the Project area, in the vicinity of the Dawson Mining Complex (Figure 5.2).

The mapped alluvium in the Project area is associated predominantly with the Dawson River, Kianga Creek, Banana Creek, and associated contributing water courses. A review of available data from the GWDB 'stratigraphy table' (DNRME 2019) indicates the alluvium associated with these water courses is up to ~20 m thick.

Isopachs for the Rewan Group and Baralaba Formation are presented in Figure 5.5. The Rewan Group aquitard is present across the Project area but does not extend east of the tenure due to formation outcropping in that area. The Rewan Group thickness beneath the Project area increases east to west from >100 m in the east to >1,500 m along the southwestern boundary of the Project area. The Baralaba Coal Measures are 100 m to 300 m thick beneath the Project area. Individual coal seams within the coal measure are reported to be up to 6 m thick.

7.1.1 Local Structure

The Project area is located on the eastern limb of the Mimosa Syncline, the central axis of which is located ~30 km west of the Project area. A series of compressional events to the east of the Project area resulted in multiple northwest-southeast trending faults. Between those major disturbance zones, minor normal faults have been identified in bore holes (Taylor 1971).

Two-dimensional seismic surveys were completed across PL 94 (directly south of the Project area) to support CSG development activities (KCB 2020). Observations from the seismic survey results show few large-scale faults interpreted within the Baralaba Coal Measures and even fewer which extend into the overlying Rewan Group. No faults extending more than 30 m were observed above the youngest target coal seam of the Baralaba Coal Measures, illustrating that faults do not extend to the top of Rewan Group and adjacent to overlying surficial hydrostratigraphic units. The seismic character of the Rewan Group is generally low reflectivity, indicating more homogenous lithologies, which supports the mudstone/siltstone dominant lithologies identified from the drill core obtained from within the vicinity of the Project area.

7.2 Aquifer / Aquitard Hydraulic Properties

Hydraulic conductivity values for the hydrostratigraphic units located at the Westside PL94 CSG Project are based on data provided by the Queensland Office of Groundwater Impact Assessment (OGIA), which were compiled to support the development of the Surat CMA UWIR (OGIA 2016a). Although PL94 is not located within the Surat CMA, the hydrostratigraphic units identified at PL94 are associated with the Southern Bowen Basin, which are incorporated in the Surat CMA located to the west of PL94. Hydraulic testing for hydraulic conductivity has been undertaken on the hydrostratigraphic units of the Southern Bowen Basin to support development of the groundwater model associated with the Surat CMA.

OGIA present a range of hydraulic conductivity values, which have been estimated from core, drill-stem tests (DSTs) and pumping tests. Table 7.1 presents a range of hydraulic conductivities estimated from core DSTs and pumping tests (OGIA 2016c).

Table 7.1 Horizontal Hydraulic Conductivity Ranges (After OGIA 2016b)

Source	Statistic	Hydrostratigraphic Unit Hydraulic Conductivity (m/day)					
		Alluvium	Moolayember Formation	Clematis Group	Rewan Group	Lower Permian	Basement
Core	10th Percentile		2.90×10^{-6}	2.0×10^{-6}	5.4×10^{-7}	3.2×10^{-6}	8.5×10^{-7}
	Median		1.44×10^{-4}	1.6×10^{-4}	4.0×10^{-5}	1.4×10^{-5}	3.3×10^{-4}
	90th Percentile		7.21×10^{-2}	0.2	0.1	2.2×10^{-4}	0.4
DST	10th Percentile		9.18×10^{-5}	6.7×10^{-5}	1.7×10^{-5}	8.3×10^{-5}	7.2×10^{-4}
	Median		1.52×10^{-3}	2.3×10^{-3}	4.2×10^{-4}	1.2×10^{-4}	7.2×10^{-4}
	90th Percentile		2.13×10^{-1}	0.6	0.03	1.2×10^{-3}	7.2×10^{-4}
Pumping Test	10th Percentile	2.44	2.16×10^{-2}	0.1	-	-	-
	Median	1.63×10^{1}	4.32×10^{-1}	0.4	-	-	-
	90th Percentile	1.16×10^{2}	5.33	15.2	-	-	-

Data reproduced from OGIA (2016a). Converted from millidarcies using the reported conversion factor of 1.27×10^{-3}.

DSTs and pumping tests have been referenced in the Hydrogeological Conceptualisation Report for the Surat CMA (OGIA 2016a) that are within the vicinity of the Project area, and across different hydrostratigraphic units. A summary of these tests is provided as follows:

- Alluvium (associated with the Dawson River).
    - 6 pumping tests.
    - 1.27 m/d to >12.7 m/d.
- Moolayember Formation.
    - 2 pumping tests, 2 drill-stem tests (DST).
    - 0.127 m/d to 1.27 m/d.
- Clematis Group.
    - 2 DSTs.
    - 0.0127 m/d to 0.127 m/d.
- Rewan Group.
    - 6 DSTs.
    - 1.27×10^{-5} m/d to 1.27×10^{-3} m/d.
- Baralaba Coal Measures.
    - 83 DSTs.
    - Median = 4.57×10^{-4} m/d; Geomean = 5.32×10^{-4} m/d.

A statistical summary of this data is presented in Table 7.2. Additional testing of the Baralaba Coal Measures permeability will be undertaken as CSG production wells are drilled.

Table 7.2 Site-Specific Baralaba Horizontal Hydraulic Conductivity Statistics

Statistic	Hydraulic Conductivity – Site-Specific DST (m/day)
10th Percentile	6.35×10^{-5}
90th Percentile	7.64×10^{-3}
Median	4.57×10^{-4}
Geomean	5.32×10^{-4}

7.3 Groundwater Recharge

Key processes of recharge include localised recharge, preferential pathway flow, and diffuse recharge:

- Localised recharge occurs beneath drainage features including rivers, and free-draining unconsolidated sedimentary cover, such as alluvium.
- Preferential pathway flow arises from changes in permeability within aquifers and in overlying regolith, providing conduits for water to infiltrate. Zones of higher permeability may include fissures, faults, joints, tree roots and high-permeability beds within individual formations and along bedding planes (Kellett et al. 2003; Sucklow et al. 2016). This mechanism is considered the dominant recharge process in the GAB (Kellett et al. 2003).
- Diffuse recharge is the process by which rainfall infiltrates directly into outcropping hydrostratigraphic units. This is expected to occur within all outcrop areas and therefore this process applies to the largest spatial extent (Kellett et al. 2003).

Recharge in the Project area will occur as diffuse recharge with rainfall infiltration occurring at outcropping aquifers. Estimates of long-term average recharge rates have been made by OGIA as part of the 2016 UWIR (OGIA 2016a) sing chloride mass balance recharge estimation method. For the units outcropping within the vicinity of the Project area, the following recharge rates were estimated by OGIA:

- Alluvium – 6.8 mm/year
- Moolayember Formation (outcrops to southwest) – 2.5 mm/year
- Clematis Group (outcrops to southwest) – 26.9 mm/year
- Rewan Group (outcrops to south-southwest and within Project area) – 1.2 mm/year
- Baralaba Coal Measures (outcrops to east) – 5.0 mm/year
- Older Permian Units (outcrops to east) – 6.8 mm/year

Recharge into the alluvium associated with the Dawson River is anticipated to occur during high flow periods, following significant rainfall events, although insufficient data is available to quantify the recharge. Recharge from the alluvium into the units underlying may also occur. Further discussion on groundwater surface water interaction in the Project area is provided in Section 5.8.

7.4 Groundwater Levels and Flow

A total of 110 groundwater bores with water level readings is registered on the GWDB in a 25 km radius of the Project area. Most of these groundwater bores recorded a single water level reading. In terms of monitoring:

- There is one active government monitoring bore (RN 13030827) within 25 km of the Project area. This bore is located approximately 10 km east of the Project and is monitoring the Barfield Formation of the Back Creek Group (late Permian; the basement), this unit is present at depth below the coal measures.
- Westside performs water level monitoring in four monitoring bores and 19 CSG bores within the Project area.
- There are 109 former government monitoring and investigation bores within 25 km of the Project area. Most of these bores are located in the vicinity of the township of Theodore, located to the south of PL 94.

The following section provides a summary of the most recent groundwater monitoring data available from Westside and publicly accessible databases at the time of reporting.

Groundwater level hydrographs for bores screened within the Quaternary alluvium (upstream and downstream Dawson River), the Tertiary sediments and the Rewan Group are presented in Figure 7.2, Figure 7.3, Figure 7.4, and Figure 7.5 respectively. Appendix I presents individual hydrographs for the Westside groundwater monitoring bores.

Note: the upstream Quaternary alluvium area contains a high number of bores. The hydrographs include only a selection of these bores to provide a representative geographical spread for ease of interpretation.

Groundwater flow is in a southwesterly direction, based on the current conceptual understanding of the hydrogeological environment. On a more local scale, shallow groundwater flow directions will be driven by the topography and other factors such as groundwater surface water interactions and groundwater extraction. There is also local influence from the Dawson open-cut coal mine located directly east.

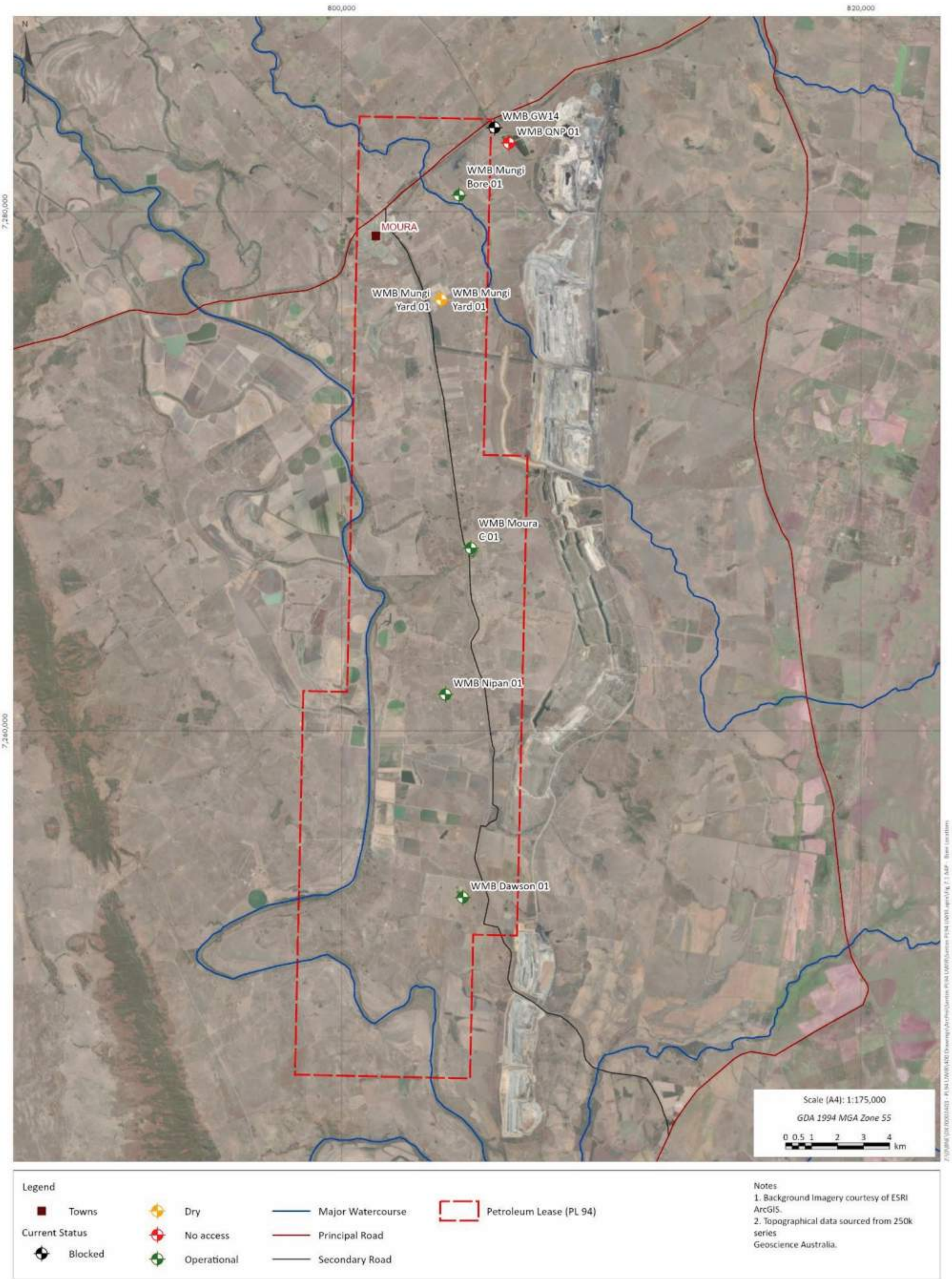

Figure 7.1 Location of Westside Groundwater Monitoring Bores

7.4.1 Alluvium

Recharge to groundwater in the alluvium and the Tertiary sediments is driven by regional diffuse recharge during rain events or localised recharge from watercourses during flood events.

The long-term data for the alluvium shows that the groundwater level response generally follow the rainfall/excess deficit trend with variations of up to 4 m observed across the monitoring period.

The groundwater levels in the Westside groundwater monitoring bores (Moura and Nipan) remained relatively stable since 2020 and water levels in these bores do not appear to follow the rainfall/excess deficit trend. Between November 2023 and January 2024 water levels in the Mungi WMB Moura 01 bore fell by approximately 1 m, possibly due to a prolonged dry period.

Figure 7.2 Alluvium Groundwater Elevation Hydrographs – Selected Upstream Dawson River

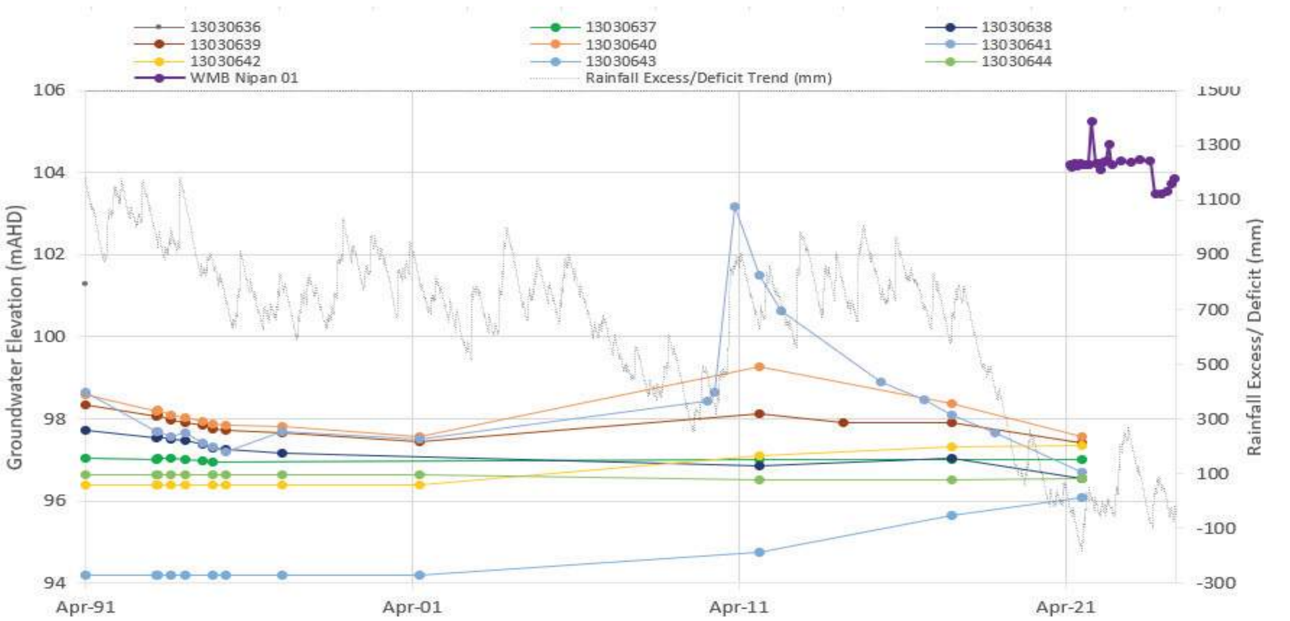

Figure 7.3 Alluvium Groundwater Elevation Hydrographs – Downstream Dawson River

7.4.2 Tertiary Sediments

The groundwater levels in the Westside groundwater monitoring bores (Mungi and Dawson) remained stable since the start of monitoring (Figure 7.4). Between November 2023 and January 2024 water levels in both bores fell by approximately 1 m. This might be due to a prolonged dry period. However, there appears to be no correlation between the groundwater and rainfall excess/deficit.

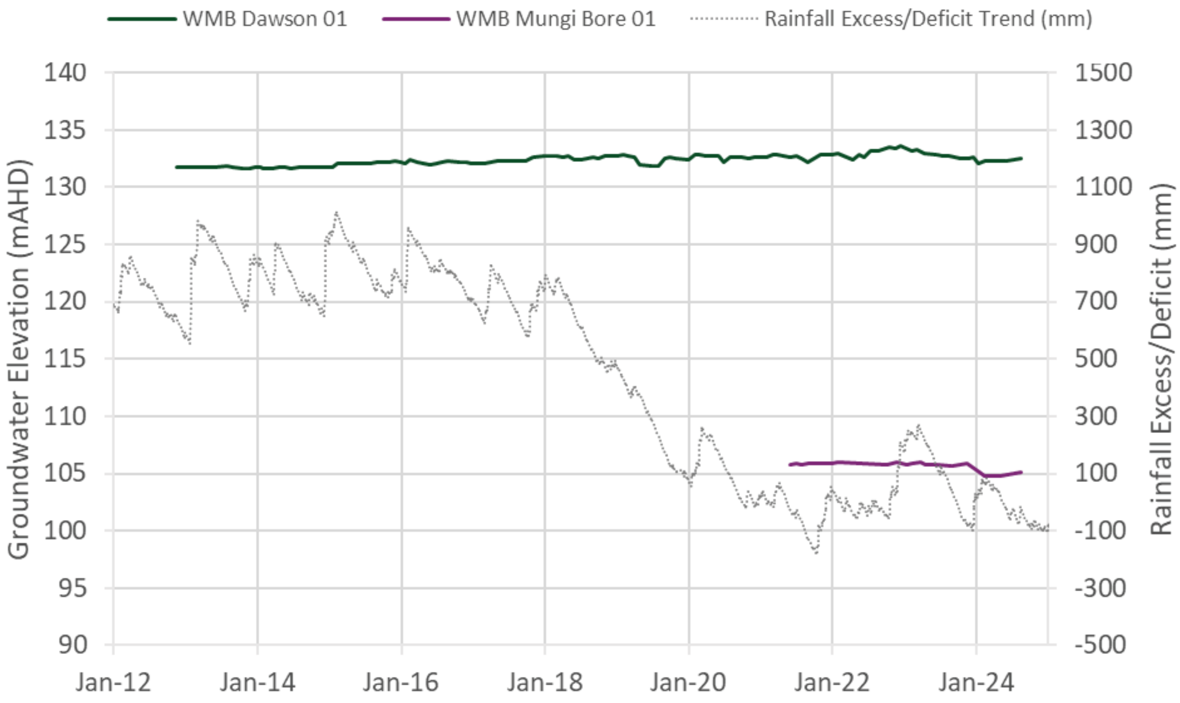

Figure 7.4 Tertiary Sediments Groundwater Elevation Hydrographs

7.4.3 Rewan Group

There is limited data for the Rewan Group with only one former government monitoring bore (RN13030830A) screened in this aquifer while Westside have three former monitoring bores within the Rewan (GW14, QNP1, Mungi Yard). Data is available only for QNP1.

The government monitoring bore recorded stable groundwater levels during the period of monitoring. The QNP1 bore, formerly monitored by Westside but since replaced by GW14, experienced a substantial decrease (15 m) between January 2018 and January 2020. It is not clear whether this is a data error, if this is related to the drier period which spans the same timeframe, or if it could be connected to activities occurring on the QNP site. This decrease is not considered to be related to the gas and water extraction activities within the Baralaba Coal seam.

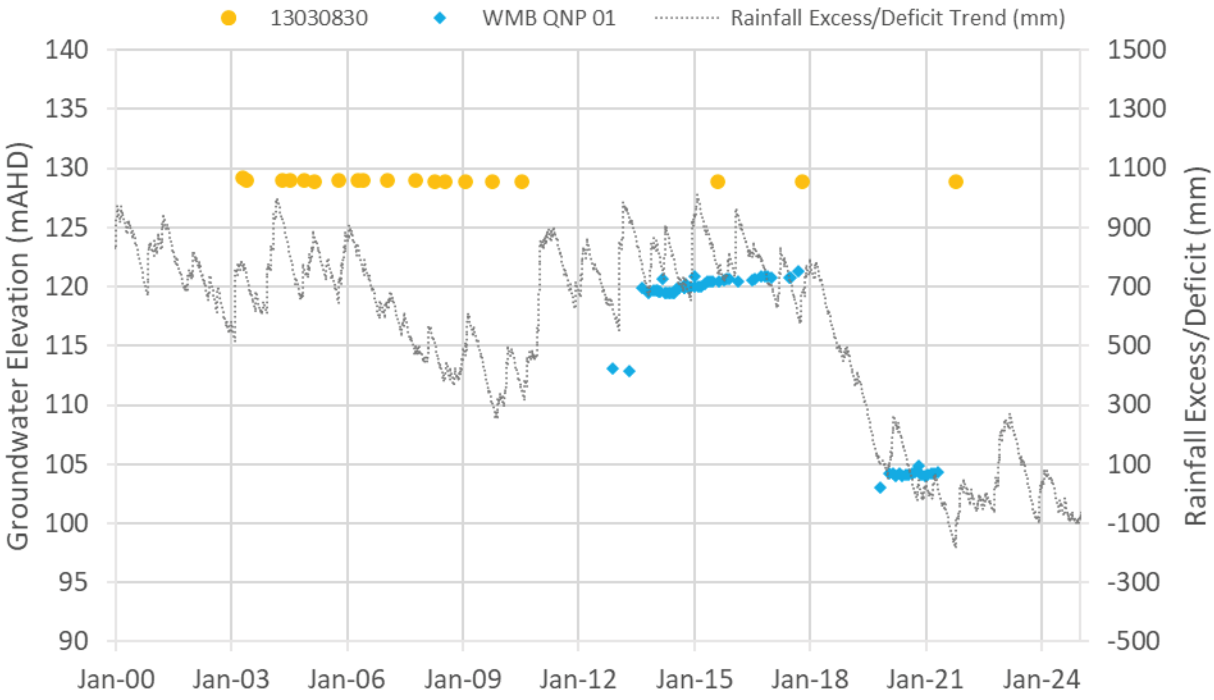

Figure 7.5 Rewan Group Groundwater Elevation Hydrographs

7.4.4 Baralaba Coal Measures

Water level monitoring is conducted in a range of gas wells across the four gas fields. Water levels in gas wells were recorded monthly throughout 2023-2024 (where operationally possible, water levels cannot be monitored when the CSG wells are offline e.g. shut-in). The gas monitoring wells are active, and groundwater levels are heavily influenced by the pumping activity (Figure 7.6).

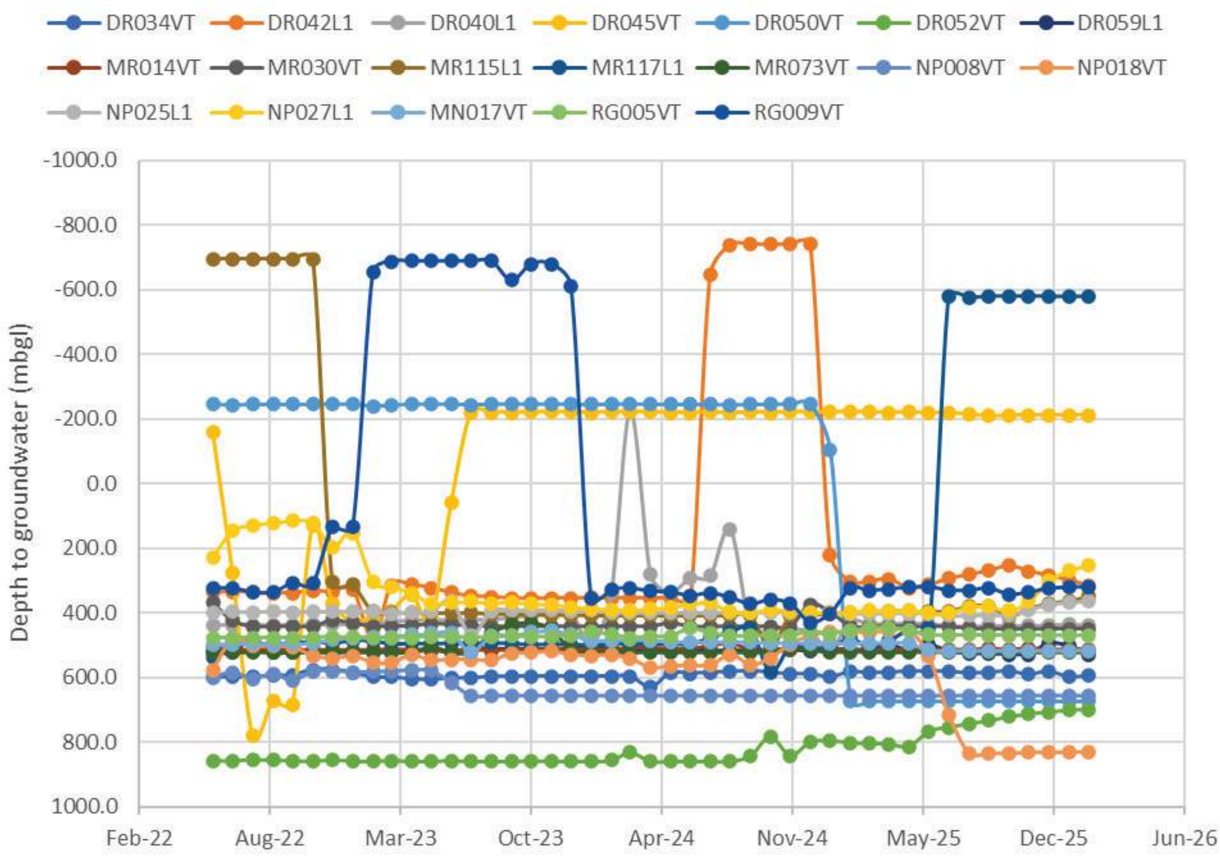

Figure 7.6 Baralaba Coal Measures – PL 94 CSG Production Wells: Water Levels

7.5 Groundwater Chemistry

Groundwater chemistry within the hydrostratigraphic units of the Bowen Basin was considered using information reported by OGIA (2019c) and data sourced from the GWDB. Table 7.3 presents a summary of regional groundwater chemistry from (OGIA 2019b) for formations present within the Project area.

Table 7.3 Surat CMA Groundwater Chemistry Summary (Sourced from OGIA 2019b)

Analyte	Percentile	Alluvium	Evergreen Formation	Precipice Sandstone	Moolayember Formation	Clematis Sandstone	Rewan Group	Undivided Permian Upper
Ca	25th	30	5	1.1	13.5	9.4	27.4	31.5
	50th	46	20	2.7	27	23.5	80.6	61.8
	75th	76.8	52	7	89.3	39	281	84.3
Mg	25th	22	1	0.3	4.9	5.3	51.3	36.3
	50th	40	8.7	1	21.5	14	71.8	52.2
	75th	80	22	1.7	81.3	39	200.9	85.1
Na	25th	100	33	31	118.8	31.5	252	143.3

Analyte	Percentile	Alluvium	Evergreen Formation	Precipice Sandstone	Moolayember Formation	Clematis Sandstone	Rewan Group	Undivided Permian Upper
	50th	205	87	45	384	76	706	372
	75th	500	356	75.3	1123.8	120	2326.3	628
K	25th	0.05	0.05	2	0.05	8	0.05	1.25
	50th	1	2	2	1.03	12	1	2.5
	75th	3	5	3	5.75	16	8.25	5.5
Alkalinity	25th	308	122	73.8	150	120	143.3	474
	50th	403	195	112	282	322.5	342	722
	75th	511.7	478	172	460	465	381	890
Cl	25th	84	25	10	98	34	272	137
	50th	250	54	16	444.5	50	1141	342
	75th	780	310	44	1654	68	4215	595
SO_4	25th	5	0.1	0.1	0.1	2	1	0.1
	50th	15	8.1	1	4.9	5.5	25.9	16
	75th	70	24.5	2	24	16.8	164.9	85
F	25th	0.1	0.1	0.1	0.1	0.1	0.16	0.22
	50th	0.2	0.2	0.2	0.3	0.17	0.3	0.35
	75th	0.3	0.42	0.5	0.59	0.23	0.45	0.62
TDS	25th	649	223	128	537	227	1138	1244
	50th	1064	411	184	1401	522	2648	1770
	75th	2016	1458	302	3657	745	7009	2342
pH	25th	7.6	7.2	7	7.5	7.1	7.4	7.9
	50th	7.9	7.6	7.3	7.9	7.8	7.4	8
	75th	8.2	8.2	8	8.2	8	7.6	8.1
SAR	25th	2.9	1.7	3	5	1.7	5.8	3.4
	50th	5.4	6.4	7.8	13.2	2.3	17	7.9
	75th	11.9	12.5	10.7	26.1	3.9	28.5	14.9

Groundwater chemistry data was sourced from the GWDB for bores within 25 km of the Project area. This include bores screened in the Alluvium, Moolayember Formation, Clematis Group, Rewan Group, Baralaba Coal Measures and the Tertiary Sediments. Water quality data from the Westside – PL 94 includes bores screened in the Alluvium, Tertiary sediments, and Baralaba Coal Measures.

Appendix II presents the Piper and Durov diagrams for the groundwater quality of the hydrostatic units of the registered groundwater bores and the PL 94 monitoring bores. Appendix III presents the time-series plots for the Westside groundwater monitoring bores for key analytes.

The following observations are made for the local hydrochemistry:

- The Alluvium pH ranges from 6.4 to 8.9, with an average of 7.8. The Clematis Group pH ranges from 7.8 to 8.8 and a higher average pH of 8.2. Similarly, the Moolayember Formation and Tertiary Sediments have average pH values of 7.8, with ranges of 7.3 to 8.6 and 7.3 to 8.3, respectively. The Baralaba Coal Measures exhibit the highest pH values overall, ranging from 7.2 to 9.3 and averaging 8.3. In contrast, the Rewan Group presents the lowest average pH at 7.4, with a range between 7.0 and 8.1.

- The groundwater samples from the alluvium vary between sodium- chloride and sodium- bicarbonate types. Salinity levels from the alluvium groundwater samples indicate that the water quality is predominantly fresh to slightly brackish.
- The water quality results indicate that the Rewan Group groundwater is sodium-chloride dominated and is brackish to saline.
- Water quality analysis of the Baralaba Coal Measures indicate that the groundwater is sodium-chloride to bicarbonate dominated, with a quality ranging from fresh to brackish.

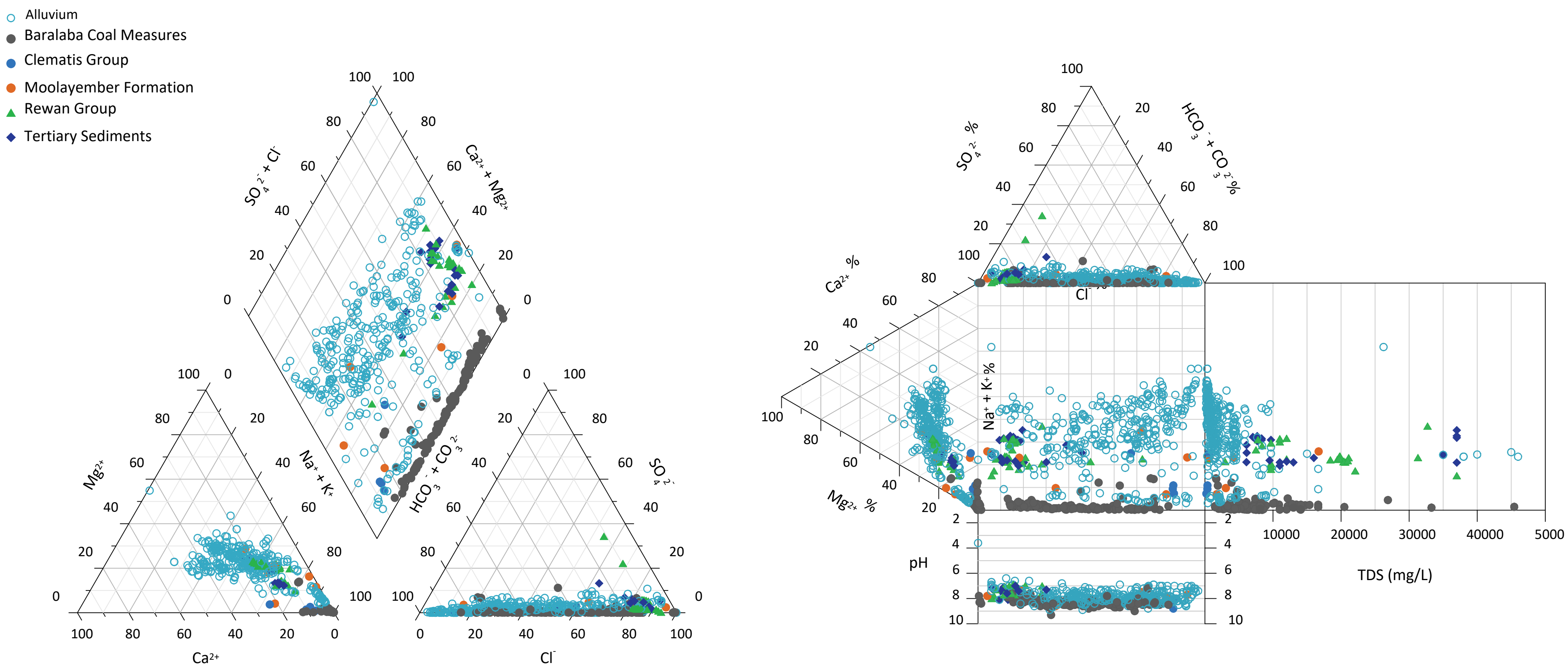

Figure 7.7 Piper and Durov Diagram – All Water Quality Data for the Hydrostratigraphic Units

7.6 Site-Specific Water Quality

Water quality analysis of the Westside groundwater monitoring bores are represented in Figure 7.8 to Figure 7.10, while bore locations are presented on Figure 7.1. The bores are sampled a minimum of twice per annum. Time-series plots for these bores are presented in Appendix III. In summary:

- Dawson, Moura C, and Mungi bores show relatively stable electrical conductivity (EC) levels over time, with Mungi and Dawson exhibiting a slight increase in 2024. Nipan bore displays elevated EC values in 2022, though these remain within the historical range since monitoring began in mid-2021. EC at Nipan also shows notable variability, particularly between 2022 and 2024.
- pH can be considered stable for the four groundwater monitoring bores.

The conclusions of the annual monitoring report (Arris 2024) suggest:

- Bores and wells that were sampled showed normal water quality and no indication that adverse impacts are occurring within the target aquifers are observed. Therefore, compliance with the monitoring requirements outlined in the approved 2021 UWIR has been met wherever operationally possible.

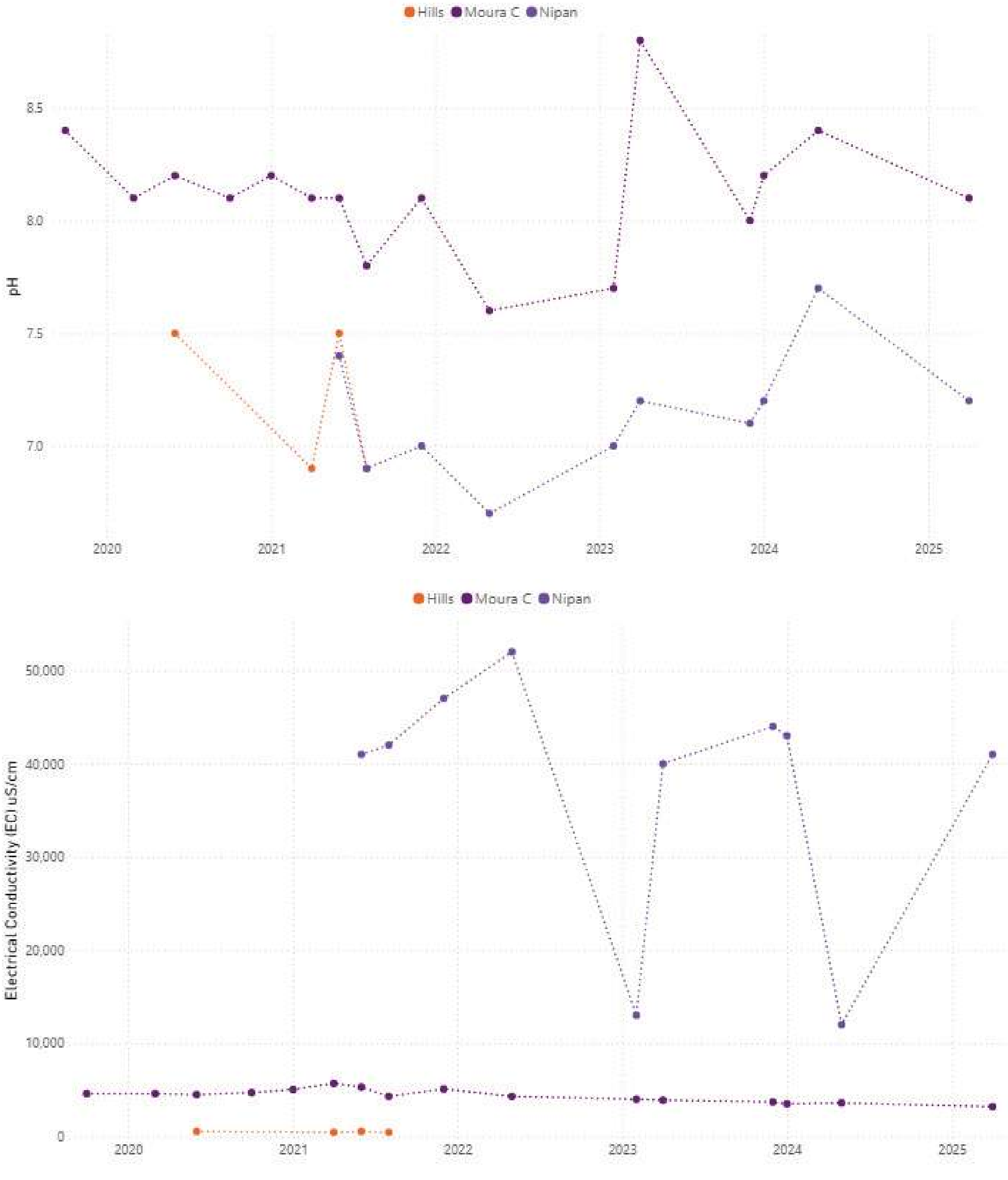

Figure 7.8 Westside Alluvium Monitoring Bores: pH; Electrical Conductivity (EC)

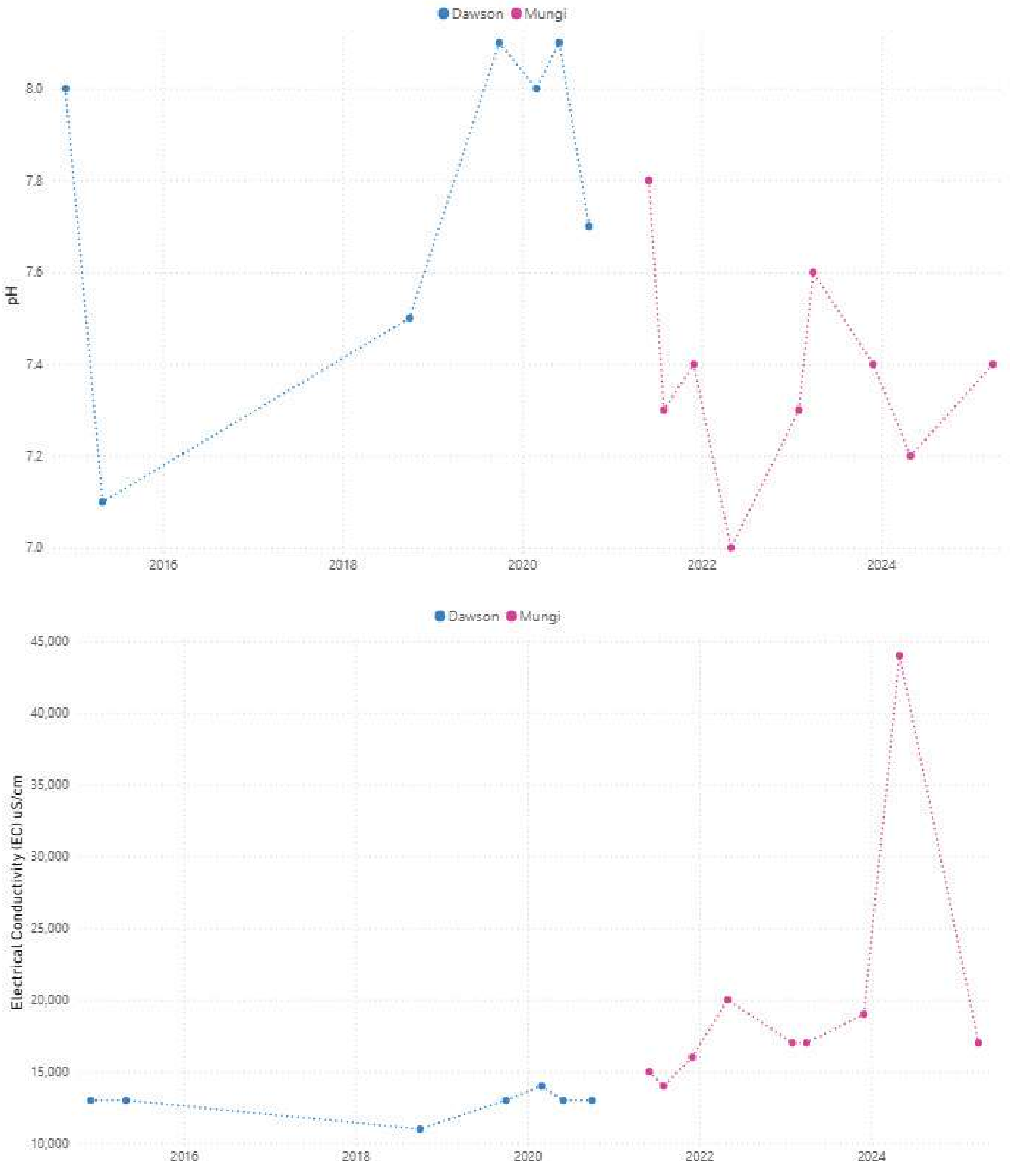

Figure 7.9 Westside Tertiary Sediments Monitoring Bores: pH; Electrical Conductivity (EC)

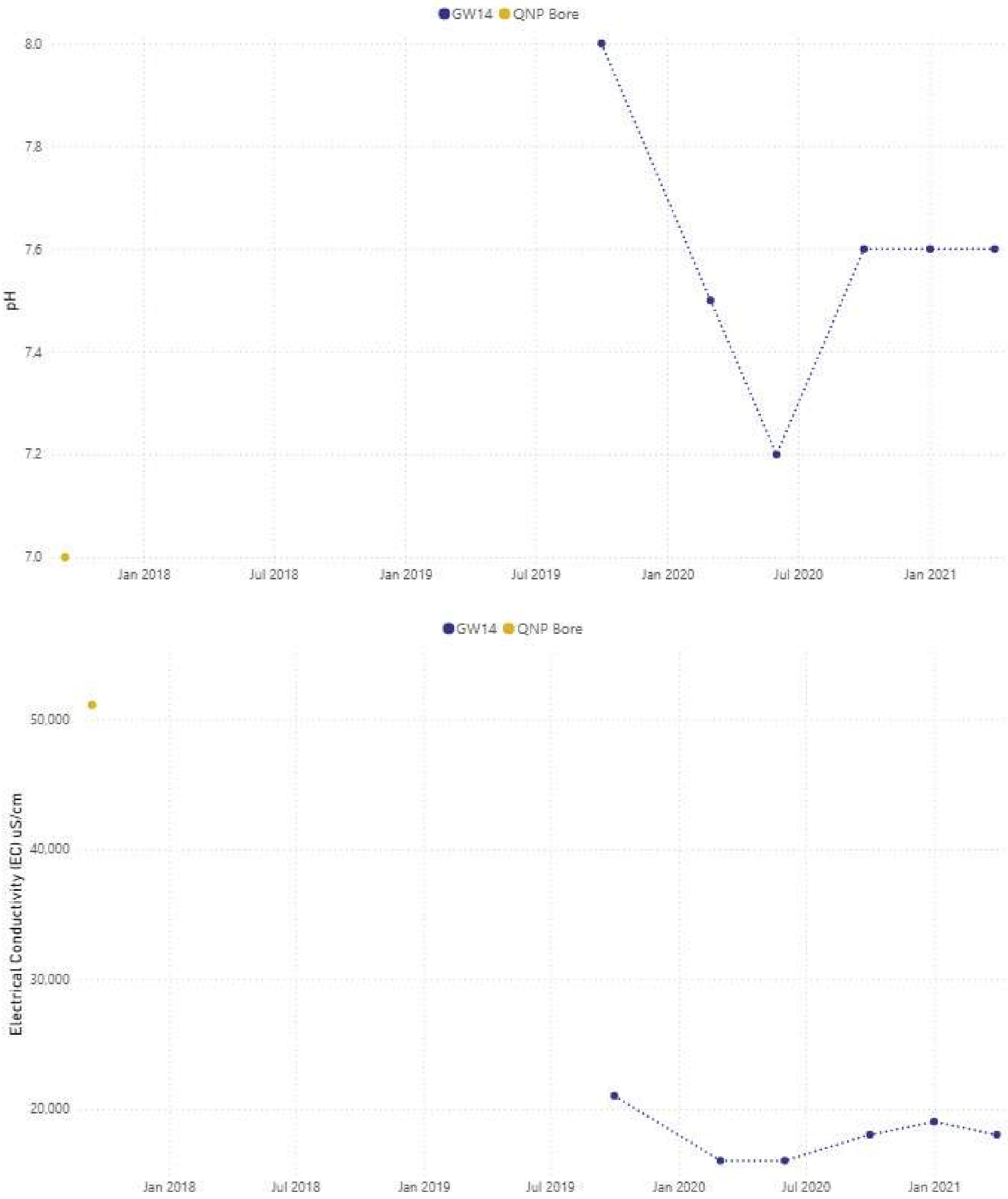

Figure 7.10 Westside Rewan Formation Monitoring Bores: pH; Electrical Conductivity (EC);

8 PART C: PREDICTED WATER LEVEL CHANGES FOR AFFECTED AQUIFERS

8.1 Groundwater Model

8.1.1 Conceptual Model Summary

A summary of the conceptual model is as follows:

- The target for gas production for the Project is the Baralaba Coal Measures, which occurs beneath PL 94, from ~40 m in the east of the tenure to more than 1,500 m along the southwestern boundary of the Project area.
- Geology within the Project area comprises Quaternary aged alluvium associated with watercourses (predominately Dawson River), with Tertiary sediments covering the majority of the area beyond the extents of the alluvium adjacent to the creeks. The Rewan Group aquitard sub-crops directly beneath the Cenozoic cover within the Project area, and to the south of the tenure; and outcrops in areas where the Cenozoic cover has eroded away. The strata of the Baralaba Coal Measures are north-south trending and dip to the west at between 5^{o} and 16^{o}, underlie the Rewan Group, and outcrop to the east of the Project area. The outcrop of these coal measures coincides with the location of the Dawson Coal Mine. Undivided Permian bedrock underlie the Baralaba Coal Measures and outcrop to the east of the Project area.
- The Baralaba Coal Measures are interbedded with sandstone, siltstone and shales that occur as interburden or overburden relative to the coal seams. The fine-grained shale and siltstone are observed as having low permeability and are interpreted to function as aquitards. In comparison, the target coal seams generally have a higher permeability.
- Localised faulting has been identified within the Project area and is associated with the Baralaba Coal Measures. However, detailed mapping of these fault structures has identified the faults to be limited to the coal measures and partially into the Rewan Group. The faults are not observed through the Rewan Group and into the overlying Cenozoic cover; and therefore, are not considered to be a conduit for groundwater flow or a concern for the proposed Project development.
- There is a significant thickness of the Rewan Group aquitard within the vicinity of the Project Area, thickness increase from ~40 m in the east of the Project area, to >1500 m in the southwest; the Rewan Group separates the Quaternary aged alluvium and Tertiary sediments from the Baralaba Coal Measures.
- The hydraulic connection between the Rewan Group and the Baralaba Coal Measures is expected to be limited as both of these units are identified as aquitards. The undivided Permian basement is not generally considered an aquifer due to confinement beneath the Rewan Group and the Baralaba Coal Measures (OGIA 2021).
- The watercourses within the Project area are characteristically ephemeral and typically only flow during significant rainfall events. The exception to this is the Dawson River, which is interpreted to receive groundwater baseflow up-catchment of the Project area (refer to Section 9.1.1).

- Potential terrestrial GDEs associated with the watercourses, if groundwater dependant (or at least in part), would likely be sourcing groundwater from the alluvium associated with the Dawson River and key tributaries.
- Spring complexes are present to the south and southwest of the Project area and are predominantly associated with the Precipice Sandstone, with a few associated with the Hutton Sandstone and the Clematis Sandstone. The mapped spring complexes are beyond the 25 km buffer of the Project and are not considered to be a concern for this Project development.
- The majority of the groundwater-source for water supply in the vicinity of the Project area is predominately associated with the alluvium and Undivided Permian/Basement Rock.
- Groundwater is used for general water supply, stock and irrigation watering, with 184 water supply bores identified within the vicinity of the Project.

8.1.2 Numerical Groundwater Model Summary

A calibrated groundwater flow model was previously developed for the initial Westside – Mungi UWIR (KCB, 2021) to assess the potential impacts of CSG development on the local and regional groundwater systems. The domain for the previously developed groundwater model includes PL 94 and therefore was able to be adopted to undertake this assessment.

8.1.3 Model Code Selection

MODFLOW-USG is an “unstructured grid” version of MODFLOW that can use an irregular grid structure with arbitrary cell/node connections. This enables focused grid refinement to occur in areas where detail is important, without the need for continuation of grid refinement to the extremes of the model domain. It also facilitates implementation of pinching-out layers and/or layer discontinuities within the modelled domain. This can greatly reduce the number of grid cells within the model domain and thus greatly reduce model runtimes. In addition, MODFLOW-USG implements an “upstream weighting” formulation of the groundwater flow equation that allows cells to dewater and re-saturate easily.

For these reasons, MODFLOW-USG was selected for this assessment.

8.1.4 Model Processing and Discretisation

Algomesh was used to develop an unstructured grid based on Voronoi polygons and to calculate cell connectivities along with geometries of connected cell interfaces necessary for execution of the MODLOW-USG model. In doing so, grid mesh refinement was focused around:

1. The Quaternary alluvium;
2. Major surface water drainage lines; and
3. The development areas – CSG development and Dawson Mining Complex.

The maximum allowable grid cell edge length was limited to 1,000 m and the minimum allowable internal angle in any single cell was set to 32 degrees. The minimum allowable cell thickness was set at 0.2 m thereby instructing Algomesh to pinch-out cells that have thicknesses less than this. In the vicinity of the CSG development area, a combination of a structured grid and unstructured grid was adopted to allow easier representation of the open pit developments to the east of the Project area and the proposed CSG wellfield development (i.e. project development and potential future development) over time, respectively. The resulting grid cell mesh developed from these settings is shown in Figure 8.1. The model grid comprises 98,903 active cells. To represent the hydrostratigraphic units in the vicinity of the Project, a total of 11 model layers were used.

The transient period used for model calibration consists of monthly time-steps with quarterly stress periods over the period October 1990 to June 2019 and a combination of quarterly and annual stress periods were used in the predictive runs to simulate operational development and post-development groundwater level recovery.

8.1.5 Model Layers

The hydrostratigraphy of the Project area was represented using 11 model layers. The uppermost surface is defined by project-specific LiDAR data, for the localised Project area, combined with public domain SRTM data for the wider model domain. Table 8.1 presents the model layers and the primary geological units that are represented by each.

Table 8.1 Summary of Model Layers

Model Layer	Hydrogeological Unit	Geological Age
1	Alluvium	Quaternary
2	Tertiary Sediments	Quaternary-Tertiary
3	Tertiary Basalt	Tertiary
4	Boxvale Sandstone	Jurassic
5	Evergreen Formation	
6	Precipice Sandstone	
7	Moolayember Formation	Triassic
8	Clematis Group	
9	Rewan Group	
10	Baralaba Coal Measures	Permian
11	Undivided Basement Units	Permian and older

8.1.5.1 Model Layer Assumptions

A key assumption that was adopted in the development of the numerical model domain was the simulation of the Baralaba Coal Measures as a single model layer. Section 5.2.5 identify the Baralaba Coal Measures as a series of interbedded sedimentary strata comprising the target coal seams and interbeds of sandstones, siltstones and shales; however, these discrete interbeds have not been simulated in the model domain.

The simulation of the Baralaba Coal Measures as a single model layer is considered conservative as the simulation of the gas development activities (i.e. depressurisation of the target coal seam), will be directly from the representative layer (Layer 9). This would result in the immediate propagation of drawdown into the overlying strata. If the lower permeability interburden and overburden strata of the Baralaba Coal Measures were included in the model, this would result in a more subdued drawdown response in the overlying strata. Therefore, the simulation of the Baralaba Coal Measures as a single model layer is considered a conservative assumption and is appropriate for this assessment.

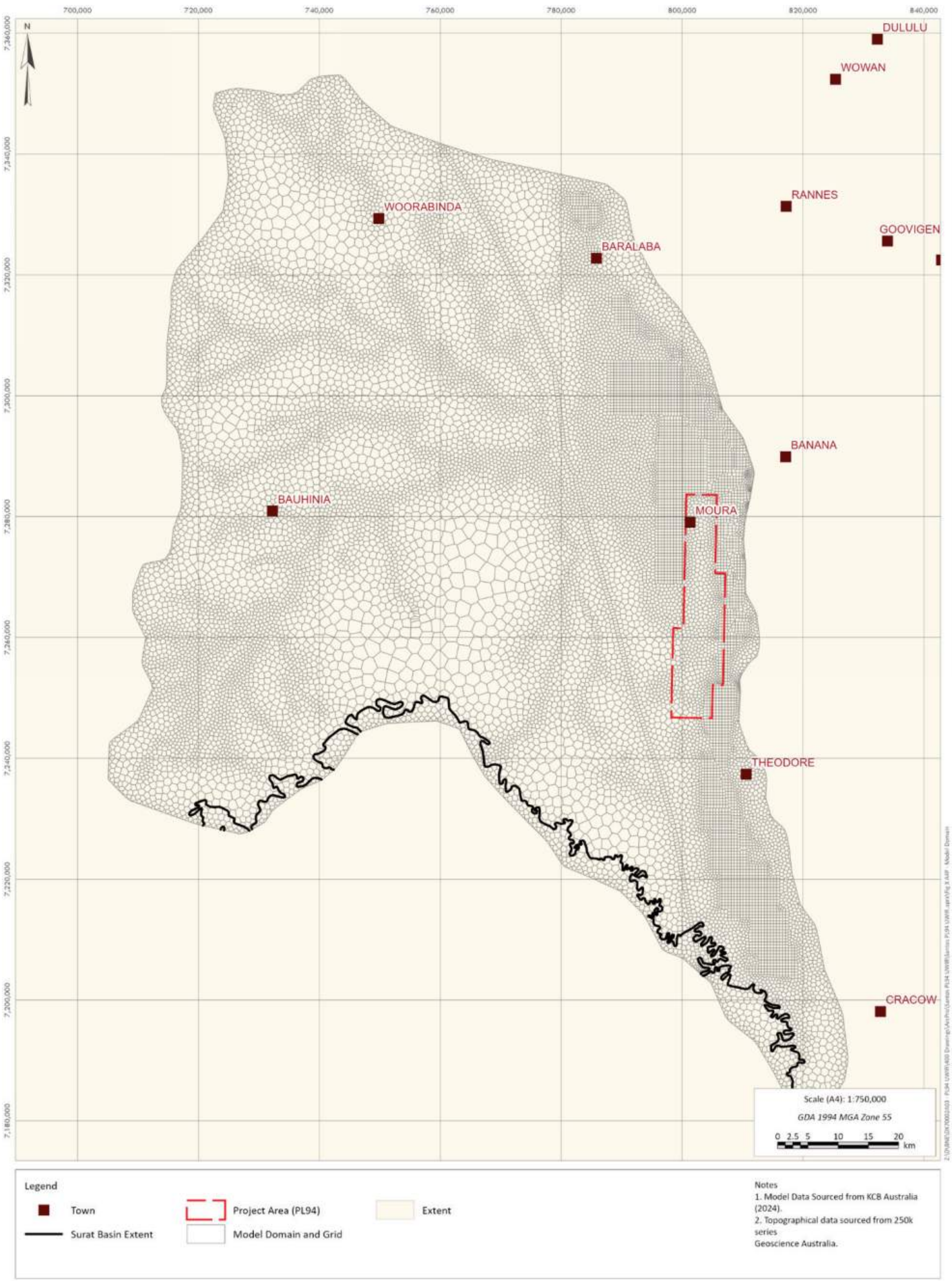

Figure 8.1 Groundwater Model Domain

8.1.6 Model Boundary Conditions

Boundary conditions are necessary for solution of the 3D groundwater flow equation that is implemented by MODFLOW-USG. They also provide a means by which auxiliary groundwater fluxes and stresses can be specified within the model. The following boundary conditions have been adopted in the model:

- Rainfall Recharge was applied in zones (Figure 8.2) based on the extents of outcropping geological units, using the RCH package of MODFLOW. Recharge has been applied as the fraction of rainfall that passes through the unsaturated zone and arrives at the groundwater surface. Within the model, recharge has been applied as a percentage of rainfall. Three recharge zones are defined, and each has a unique recharge rate that reflects the hydraulic characteristics of the strata through which it infiltrates. The percentage of rainfall that enters the model as recharge in each zone went through a calibration process. The zones are defined by the extents/outcrop of Alluvium, Tertiary sediments and Tertiary basalt, Jurassic sediments, Triassic sediment, Permian sediments, and Undivided Basement units.
- Evapotranspiration can be a significant component of the water budget for a groundwater system. In this model, it has been implemented using the EVT package in MODFLOW. A uniform extinction depth has been applied across the domain and set at 1.5 m below the natural surface, meaning no evaporative losses will occur this depth. The starting maximum rate of evapotranspiration is set as 584 mm/annum. This value is approximately 34% of the average areal potential evapotranspiration of the Project (Bureau of Meteorology 2020) and was further refined through calibration.

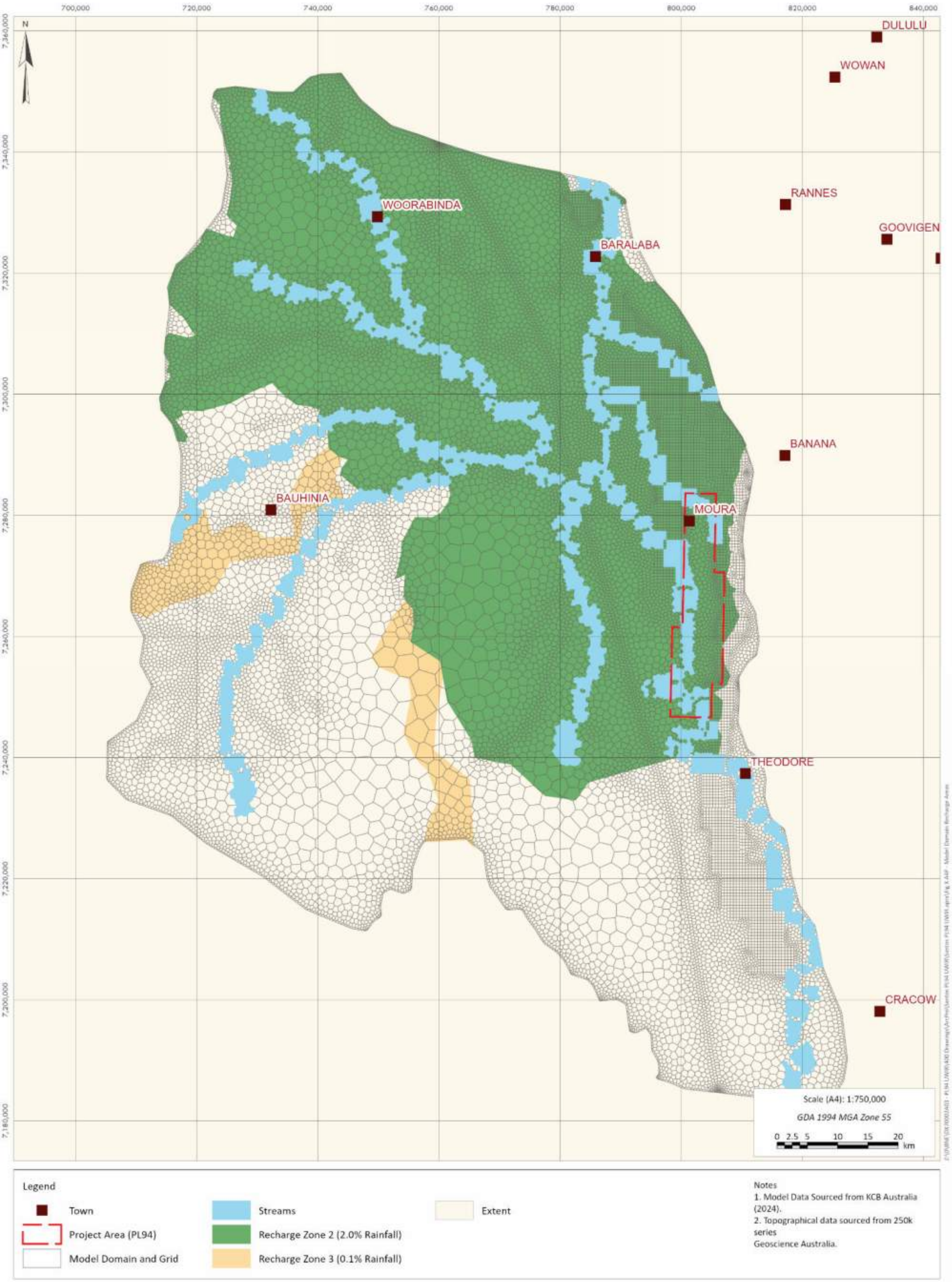

Figure 8.2 Recharge Zones Applied in the Groundwater Model

- General head boundary cells (GHB package) were implemented around the perimeter of the model domain. These GHBs are applied to all layers where that layer is present at the boundary. Use of this boundary type allows for the regional groundwater flow system to be better replicated in the semi-regional model domain. Conductance values applied to the GHB cells were calculated to be consistent with hydraulic conductivity values for each hydrostratigraphic unit and the average cross-sectional area of the boundary cells. A reference head for these cells was calculated as 15 m below ground surface. This boundary is sufficiently distant from the Project area to not materially influence model performance.
- The major water courses in the model domain are represented using the MODFLOW Streams package (STR7). This boundary type is appropriate where stream flows are intermittent or variable; as is the case in this Project area. The package also allows for head-dependent surface water/groundwater exchanges to take place. This package calculates a stream stage height through application of Mannings' equation. Streambed conductances for three main water courses were calculated using properties and geometries presented in Table 8.2. Estimates of stream flows used as input in this package, were calculated from data recorded at stream gauge stations along the Dawson River at Bindaree (130374A) and Woodleigh (1303178B).
- Drains cells (DRN package) have been used to simulate existing open-cut mining activities in the vicinity of the Project area. For open-cut mining, drains are placed in all layers above and including the target extraction layer (Layer 10), where the open pit extents are located. Reference heads for the Drain cells were specified as the bottom of the target seam while conductances were refined during calibration.
- Coal seam gas extraction, both existing and proposed (as part of the predictive simulation), is simulated using Drain cells (DRN package). At the location of each CSG production well, targeting the Baralaba Coal Measures (Layer 10), Drains have been activated to represent well production. The reference head for these Drains are set at 30 m above the top of the Baralaba Coal Measures. This reference head simulates the partial depressurisation of the target seam to an elevation that is considered optimal for CSG extraction. Drain conductance values for these cells were refined as part of the calibration process.
- The default, no flow boundary condition is applied to the base of the model which is located approximately 500 m below the base of the Baralaba Coal Measures, in the Undivided Basement Units.

Table 8.2 Summary Stream Bed Properties

Stream Segment	Stream Bed Vertical Hydraulic Conductivity (m/day)	Stream Width (m)	Stream Bed Thickness (m)
Dawson River	1.25	45.5	10
Fish Creek	1.25	10.5	5
Mimosa Creek	1.25	15.5	3

8.1.7 Model Calibration

Model calibration was performed to adjust model parameter values so that the model can better replicate actual historical observations of the system state. The outcome of the calibration process then provides the initial conditions for transient predictive simulations used to assess potential impacts of this development project on the groundwater regime.

8.1.7.1 Calibration Approach

Calibration on this model focused on parameter estimation over the period from October 1990 to June 2019, which correlates with existing reliable groundwater level monitoring records from the across the Project area.

The calibration model run was initiated in steady-state conditions with boundary conditions applied to replicate known developments (mining associated with the Dawson Mining Complex) at the beginning of October 1990. Following this initial model conditioning period, the model transitions to transient mode for the calibration period (1990 to 2020), with quarterly stress periods applied. This stress period is sufficient to allow seasonal climatic variability to be included; and replicate the gradual development of the Dawson Mining Complex and the commencement of CSG development. Further, the monitoring records used during the calibration process correlate with the stress periods adopted for the transient calibration.

Automatic parameter estimation was implemented with the use of PEST. Parameters that were included in the PEST process include hydraulic conductivity, storage properties, drain conductance and recharge.

Using the 2021 model as a base for this self-assessment, manual calibration was further applied to refine the mass balance of the model domain, with the focus on hydraulic properties, recharge, and evapotranspiration rate.

Calibration Targets

Groundwater level records from across the Project were reviewed, filtered, and compiled to form the calibration dataset. These records were compiled from 77 monitoring facilities (i.e., monitoring bores and vibrating-wire piezometers) for which water level measurements were available over the transient period. A total of 4,340 individual measurements were used in the calibration process.

Calibration Results

Figure 8.3 presents a comparison between observed groundwater levels and the calibrated model output equivalents. During calibration, all measurements of the calibration dataset were given equal weight, thereby seeking to extract maximum information from the calibration dataset for inference of parameters.

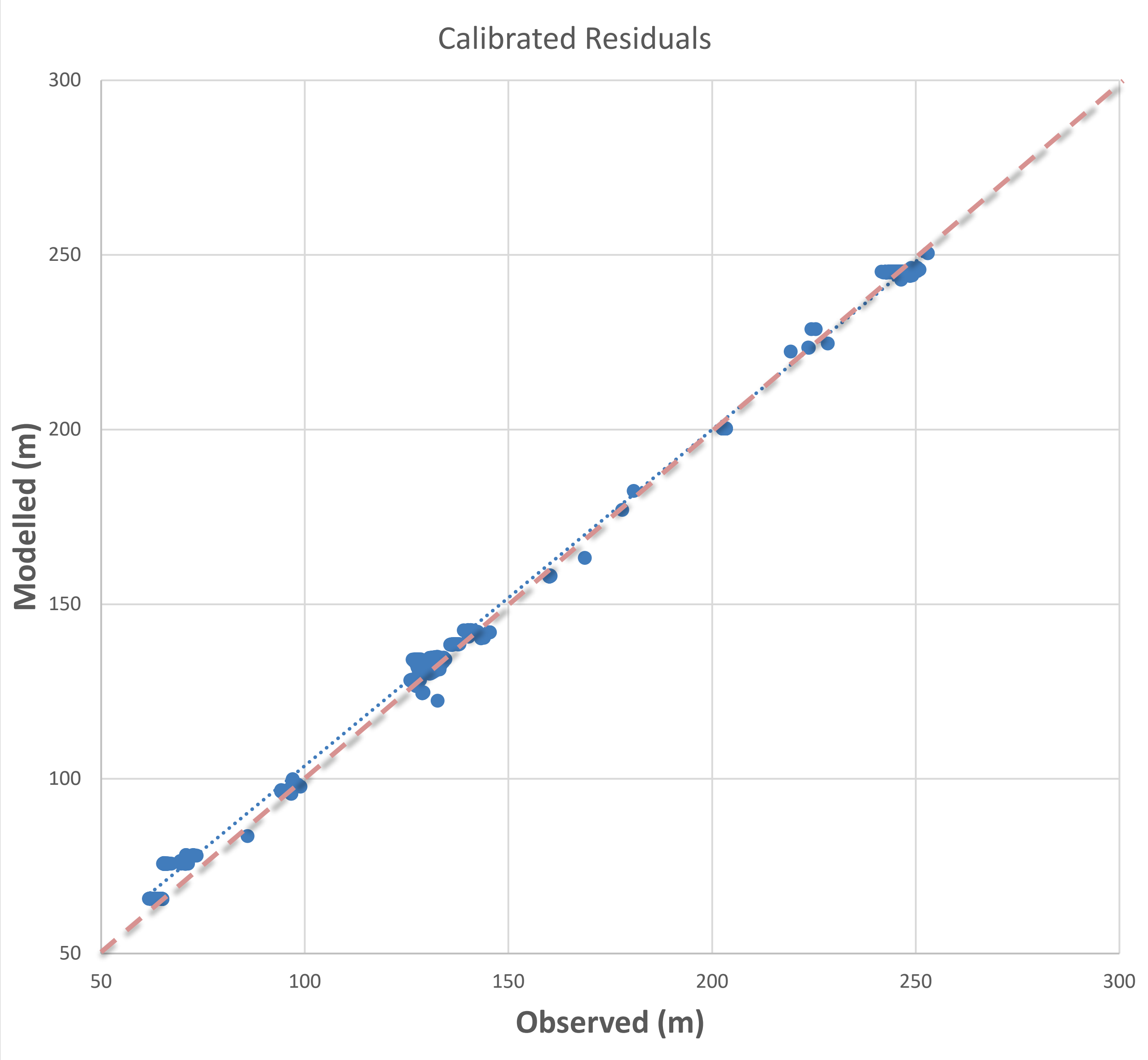

Figure 8.3 Comparison of Modelled Results and Observed Records

Table 8.3 presents statistics from the groundwater model calibration process. The calibration statistics indicated a Scaled Root Mean Square (SMRS) of errors of 3.54%, which is within limits recommended by the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) of 10% SRMS.

Table 8.3 Summary of Model Calibration Performance

Statistical Metric	Value
Number of Observations	4,340
RMS error (m)	3.54
Scaled RMS (%)	0.42
Mean Sum of Residuals (m)	1.85
Correlation coefficient	0.99

8.1.8 Calibrated Hydraulic Parameters

Table 8.4 summarises the calibrated hydraulic conductivity values and calibrated storage parameters for each model layer. A summary of horizontal hydraulic conductivity data ranges, gathered from a combination of core tests, drill-stem tests and pumping tests is provided in Figure 8.4 for comparison with the model calibrated values. This comparison indicates that the majority of calibrated horizontal hydraulic conductivities from the model are comparable to field tested values.

Table 8.4 Summary Calibrated Hydraulic Parameters

Model Layer	Hydrogeological Unit	Calibrated Kh (m/day)	Calibrated Kv (m/day)	Calibrated Specific Yield	Calibrated Specific Storage
1	Alluvium	8.9	1.9	3.4×10^{-2}	1.2×10^{-5}
2	Tertiary Sediments	2.1	0.2	2.5×10^{-2}	1.1×10^{-5}
3	Tertiary Basalt	0.4	0.04	2.5×10^{-3}	1×10^{-5}
4	Boxvale Sandstone	1.9×10^{-2}	1.9×10^{-3}	6.0×10^{-3}	1.5×10^{-5}
5	Evergreen Formation	2.3×10^{-4}	2.4×10^{-5}	5.0×10^{-3}	7.2×10^{-3}
6	Precipice Sandstone	7.6	0.7	6.0×10^{-3}	7.0×10^{-6}
7	Moolayember Formation	4.8×10^{-4}	6.1×10^{-5}	6.0×10^{-3}	4.4×10^{-6}
8	Clematis Group	2.7×10^{-2}	2.7×10^{-3}	6.0×10^{-3}	3.1×10^{-6}
9	Rewan Group	3.9×10^{-4}	3.9×10^{-5}	5.0×10^{-3}	1.0×10^{-6}
10	Baralaba Coal Measures	1.3	0.1	1.8×10^{-2}	1.0×10^{-6}
11	Undivided Basement Units	2.2×10^{-4}	2.2×10^{-5}	5.0×10^{-3}	9.9×10^{-7}

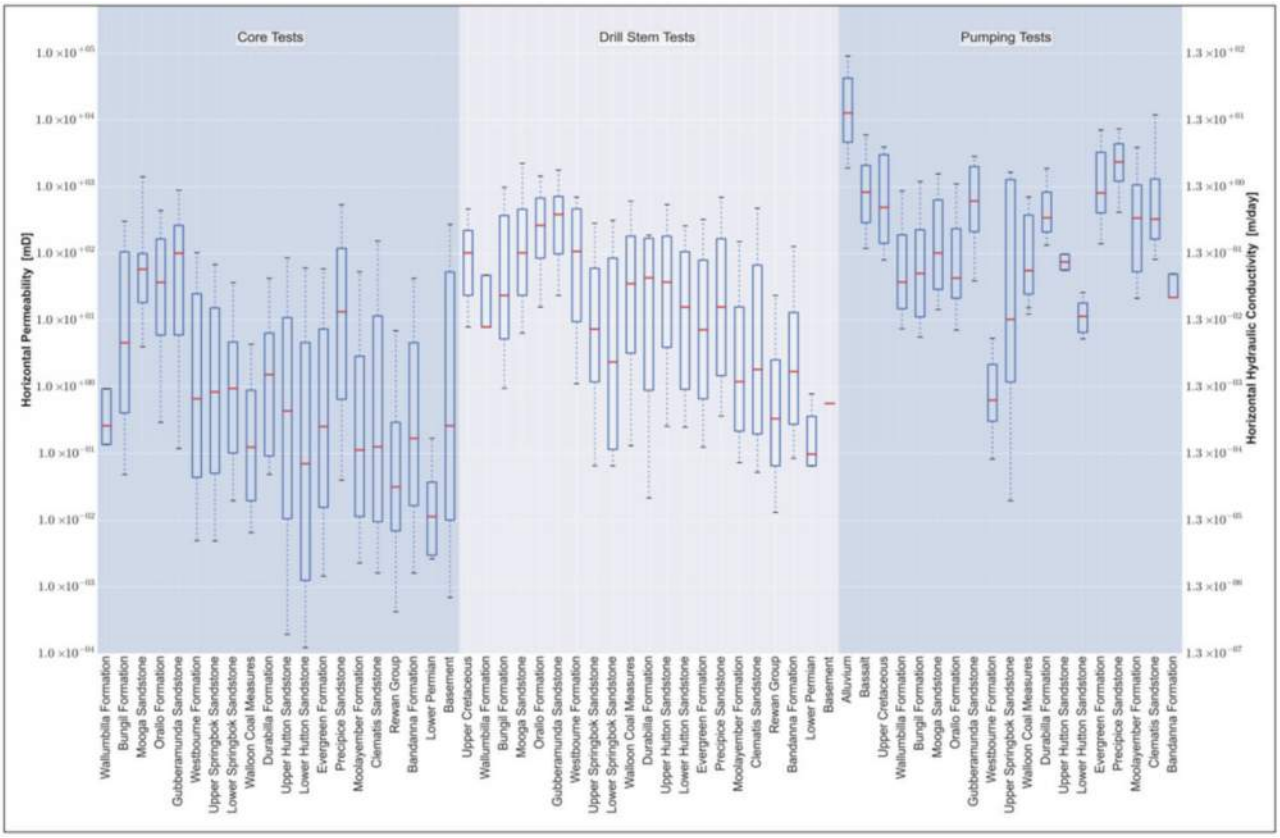

Figure 8.4Horizontal Hydraulic Conductivities Data Ranges by Formation (OGIA 2016a)

8.1.9 Calibrated Recharge and Evapotranspiration Rates

Calibrated effective recharge values and evapotranspiration rates are provided in Table 8.5.

Table 8.5 Summary of Calibrated Recharge and Evapotranspiration Rates

Modelled Recharge Zones	Percentage of Daily Rainfall	Max Evapotranspiration Rate (mm/year)
Alluvium	2.4%	365
Tertiary	0.5%	
Others	0.02% – 0.03%	

8.1.10 Calibrated Water Balance

The mass balance error represents the difference between model inflows and model outflows calculated through the transient model. An error of approximately 1% is considered acceptable (Anderson and Woessner 1991).

The model reported water budget for the final stress period of the transient calibration model is presented in Table 8.6. The water balance error is less than 1%, indicating that convergence of the numerical solution of the groundwater flow problem has been achieved.

Table 8.6 Summary Water Balance at the End of Calibration Model

Water Budget Item	Inflow (m^3/day)	Outflow (m^3/day)
Storage	99517.2	7045.0
Drain (Outflow from CSG wells and mining operations)	0.0	7832.0
Evapotranspiration	0.0	428868.0
GHB (Regional flow across model extents)	554799.2	186648.2
Recharge (Rainfall deep drainage)	92278.0	0.0
Stream	282299.0	398496.2
TOTAL	**1028894.2**	**1028889.4**
Mass balance error	< 1%	

8.2 Predictive Simulation

Two predictive model scenarios were simulated to allow assessment of potential impacts to surrounding water resource as a result of the Project development. These scenarios comprised:

- Scenario A – Cumulative Scenario; which comprises existing CSG wells, coal mining activities associated with the adjacent Dawson Mine and the CSG wells associated with the proposed Project development[1].
- Scenario B – Current Conditions Scenario; which comprises the development activities identified in Scenario A, with the proposed Project development in PL 94 removed.

[1] This includes the Mungi Project to the north and east of the PL 94, also operated by Westside but not federally approved to date (August 2025).

Groundwater level drawdown associated with the Project development is estimated based on the difference between the drawdown results from Scenario A and Scenario B, which provides a Project only scenario. Scenario A provides the cumulative drawdown within the vicinity of the Project area.

The predictive simulation was completed for the entire duration of the proposed Project development, with the predicted drawdowns abstracted from the model after three (3) years of development and at the completion of development to represent the drawdown for the IAA at the end of the UWIR period and the LTAA, respectively.

8.2.1 Scenario Results

Numerical modelling outputs for the scenarios detailed in the previous section have been used to assess the extent and magnitude of drawdown related to CSG production from the Project.

Drawdown as a result of the proposed Project development was observed in Layer 9 (Rewan Group), Layer 10 (Baralaba Coal Measures) and Layer 11 (Undivided Basement). Predicted drawdown in Model Layers 9 to 11 (Rewan Group to Undivided Basement) for Project year 3 (IAA) are presented in

Figure 8.5, Figure 8.6, and Figure 8.7, respectively. The maximum predicted drawdown from the entire model simulation period (LTAA) for Model Layers 9 to 11 (Rewan Group to Undivided Basement) are presented in Figure 8.8, Figure 8.9 and Figure 8.10, respectively. Drawdown associated with the proposed Project development was not predicted, or minor, in Layers 1 to 8, therefore, drawdown figures for those layers have not been presented in this report.

Key observations from the predicted drawdowns include:

- Predicted drawdown / depressurisation is limited to the Rewan Group, Baralaba Coal Measures, and Undivided Basement.
- There is minor drawdown predicted for the hydrostratigraphic units above the Rewan Group (<0.5 m in the Tertiary sediments, <0.2 m in the alluvium). There is no predicted drawdown in the GAB sediments (the Boxvale Sandstone, Evergreen Formation, Precipice Sandstone, Moolayember Formation and Clematis Group).
- Predicted drawdown greater than 5 m (consolidated hydrostratigraphic unit bore trigger threshold) is predicted in the Rewan Group, Baralaba Coal Measures, and Undivided Basement for both IAA and LTAA drawdown predictions. The highest drawdown is predicted in the Baralaba Coal Measures: the target seam for CSG production.
- The lateral extent of the predicted drawdown in the Rewan Group aquitard, the Baralaba Coal Measures aquitard and the undivided Permian basement (which is not considered an aquifer) is limited and reflective of the low permeability of these units. The Rewan Group displays limited drawdown propagation during the IAA (a maximum of ~30 m is predicted while a drawdown of over 700 m is predicted in the Baralaba Coal Measures). This notable difference highlights the limited hydraulic connection between the Baralaba Coal Measures and the Rewan Group.

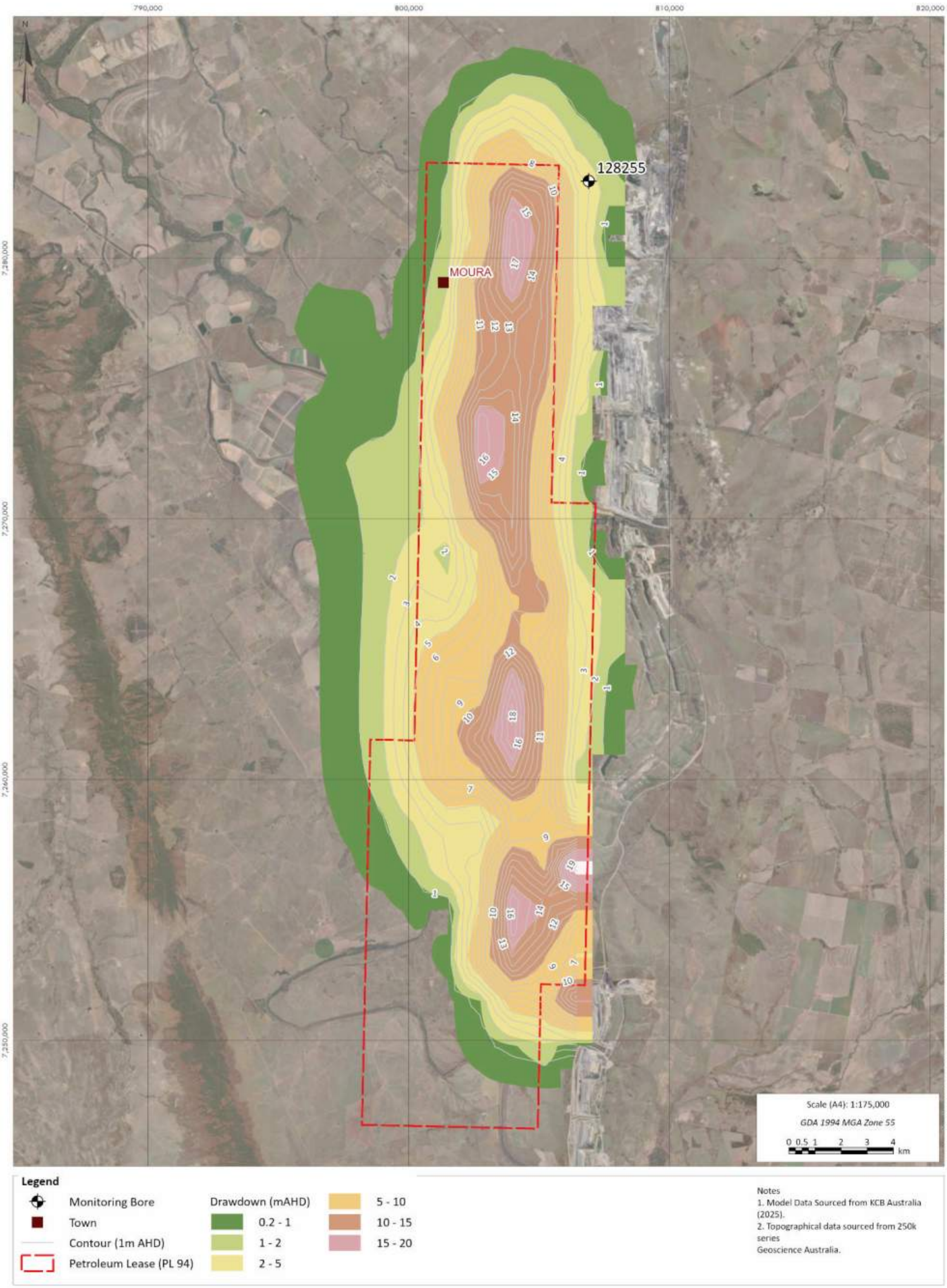

Figure 8.5 Project Year 3 Predicted Drawdown Model Layer 9 – Rewan Group

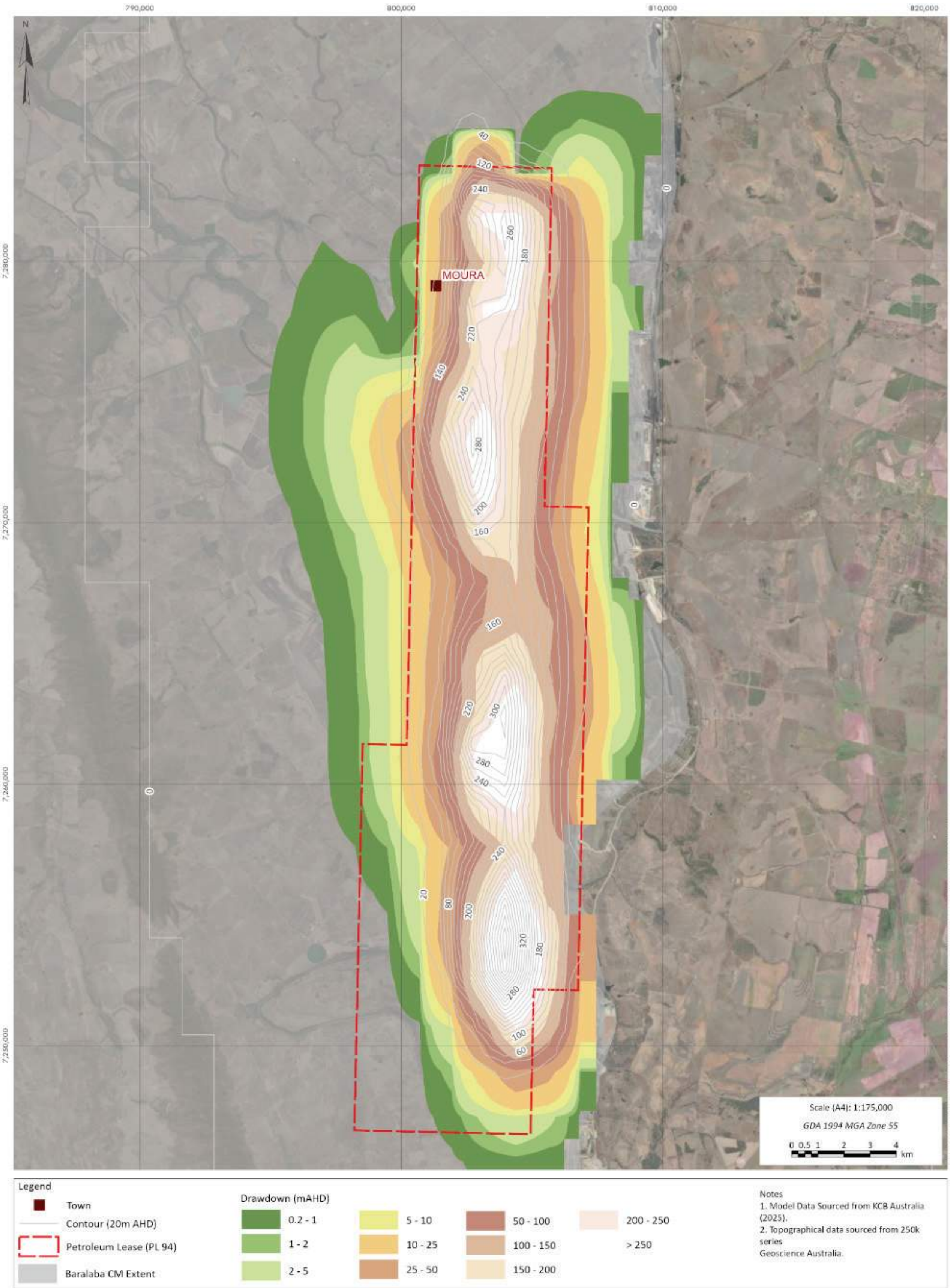

Figure 8.6 Project Year 3 Predicted Drawdown Model Layer 10 – Baralaba Coal Measures

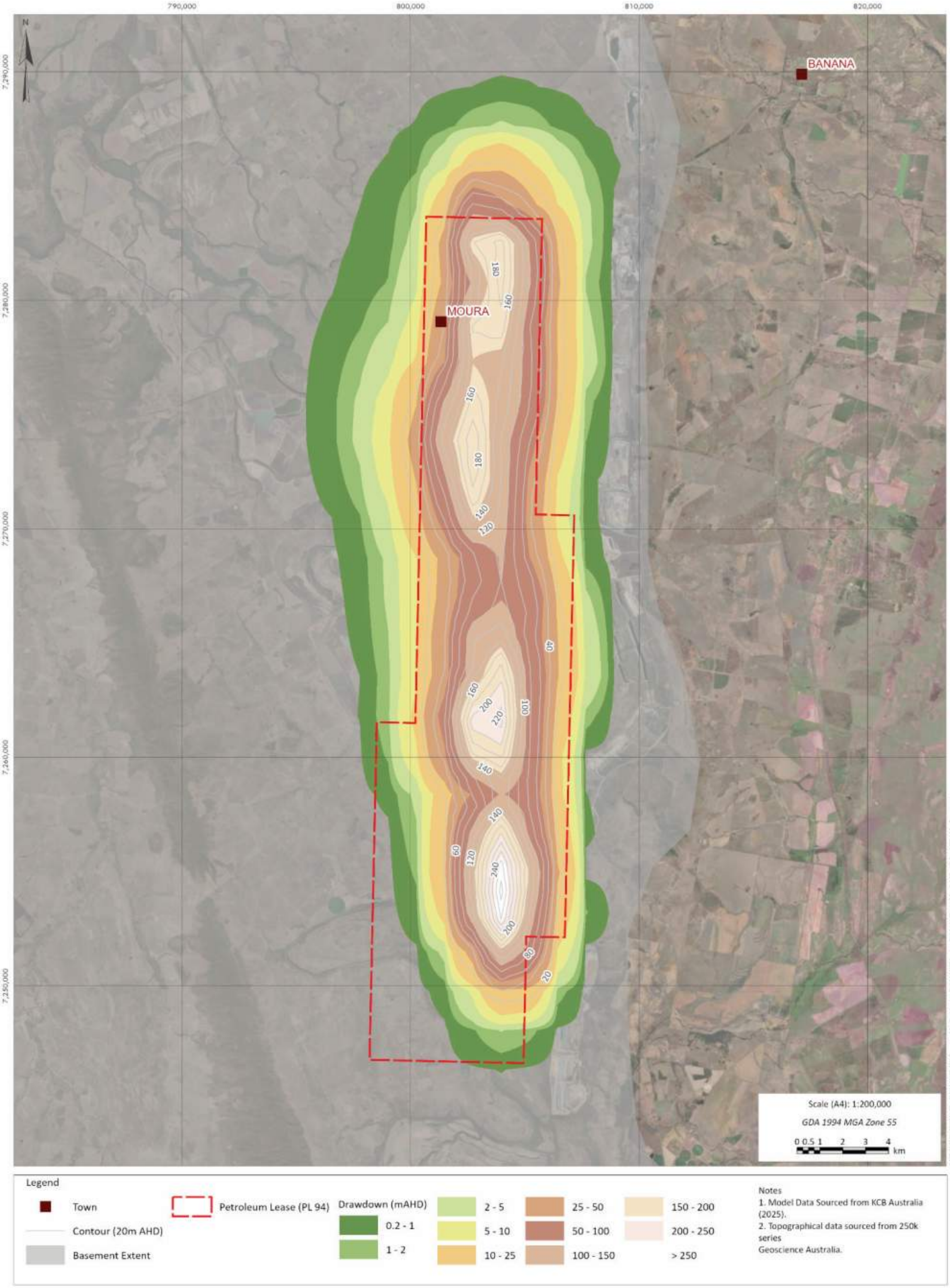

Figure 8.7 Project Year 3 Predicted Drawdown Model Layer 11 – Undivided Basement

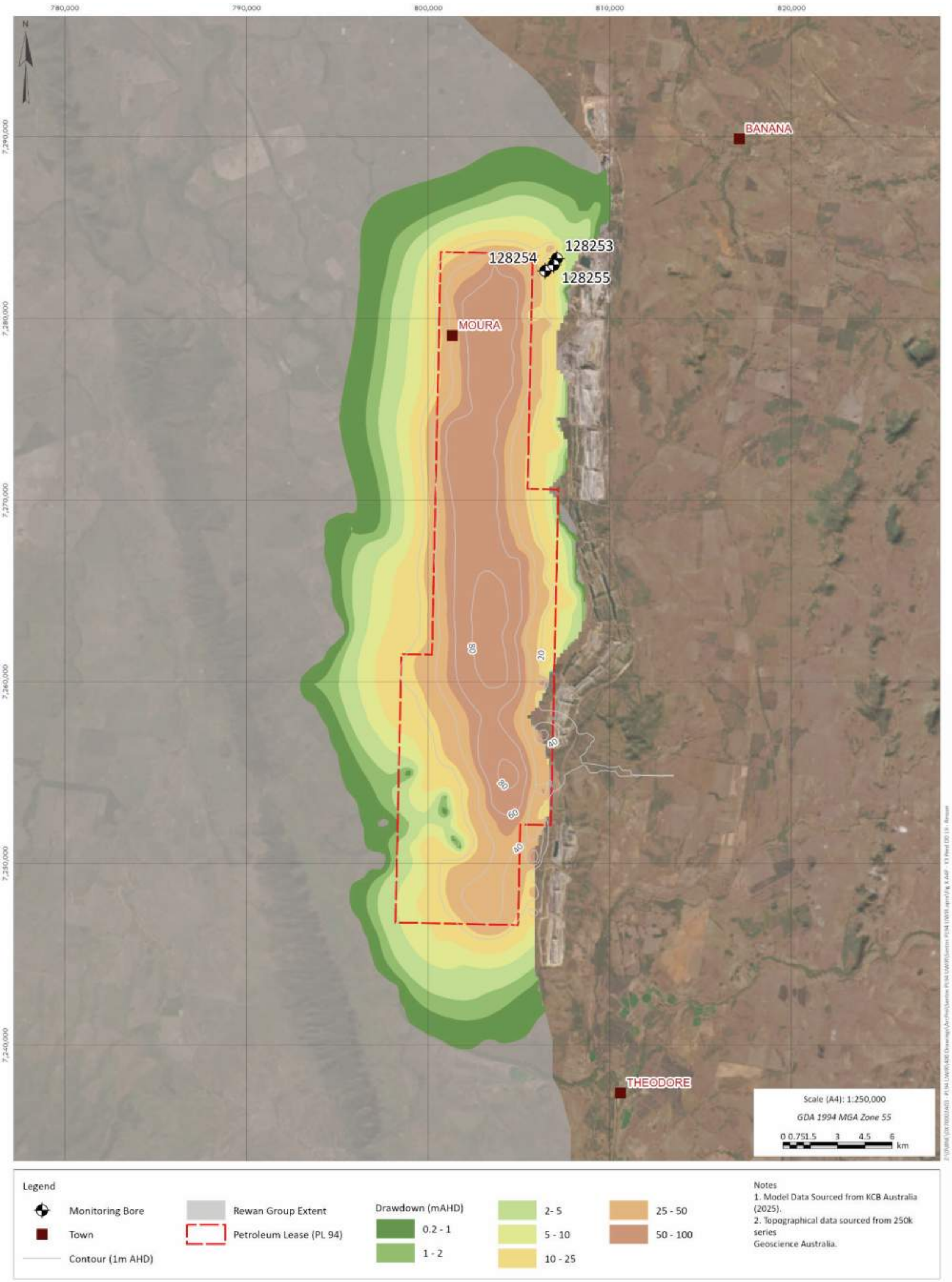

Figure 8.8 Project Maximum Predicted Drawdown Model Layer 9 – Rewan Group

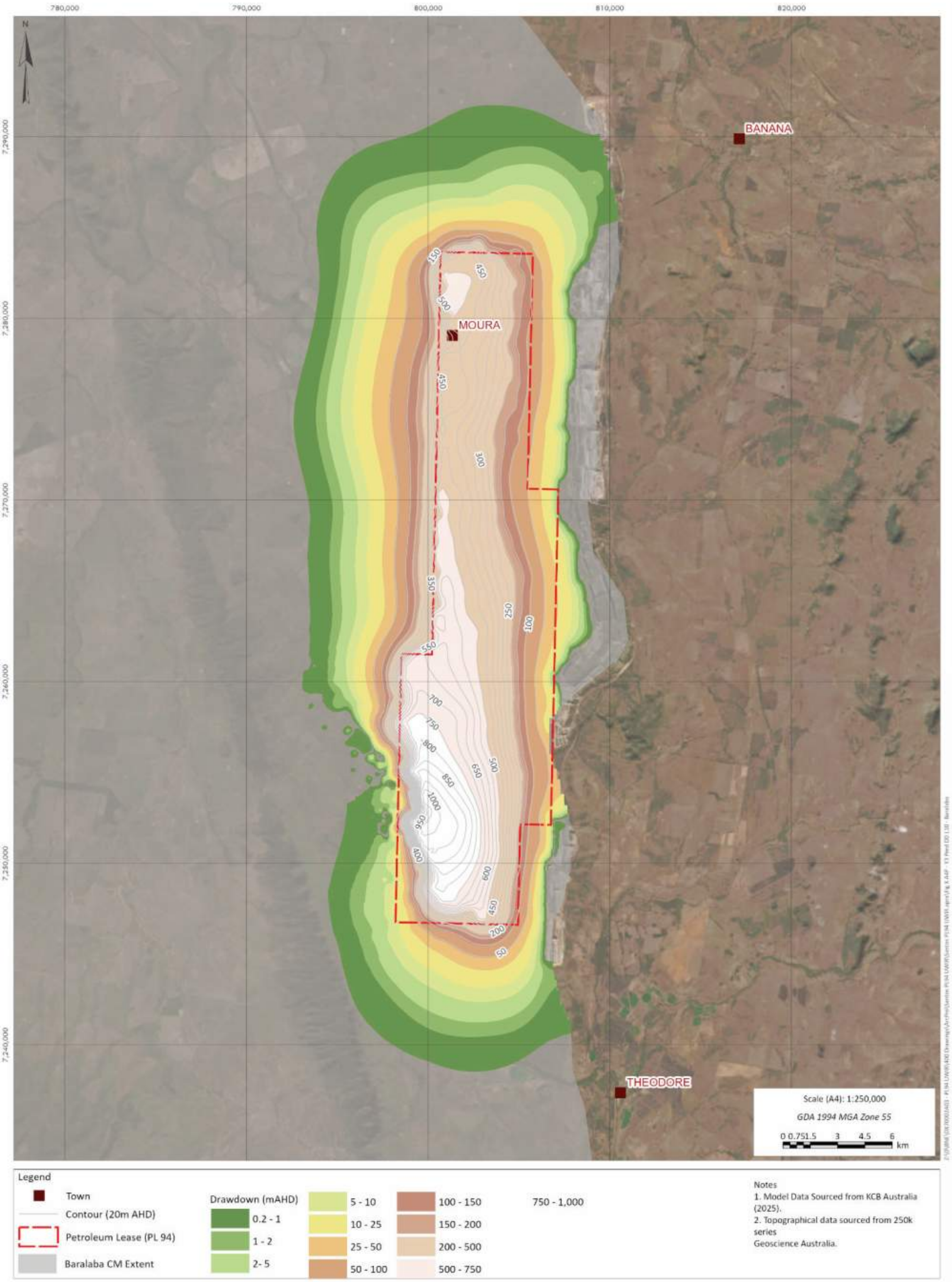

Figure 8.9 Project Maximum Predicted Drawdown Model Layer 10 – Baralaba Coal Measures

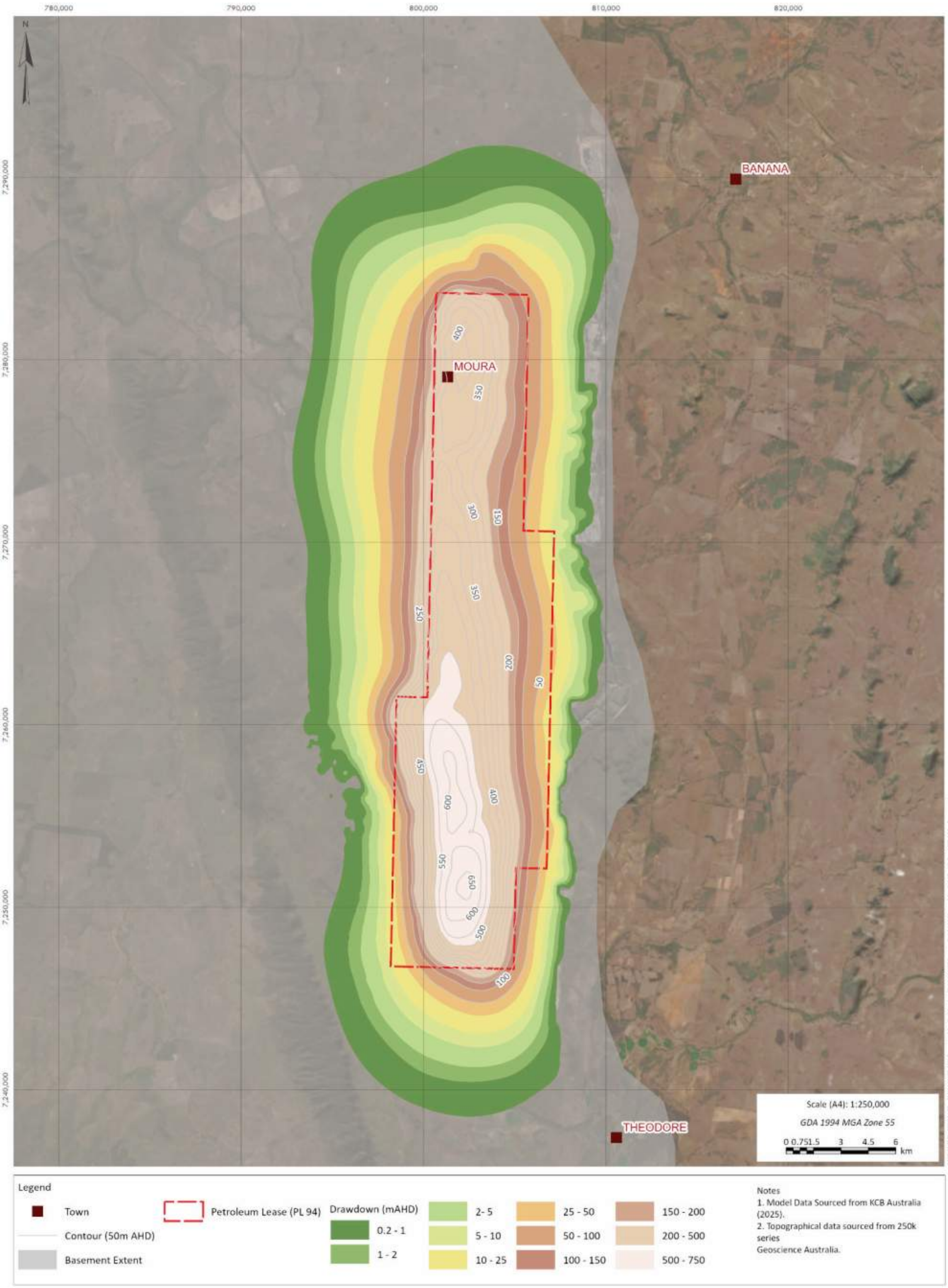

Figure 8.10 Project Maximum Predicted Drawdown Model Layer 11 – Undivided Basement

8.2.2 Groundwater Depressurisation During the UWIR Period

As identified in Section 8.2.1, predicted drawdown for the UWIR period as a result of the Project development is restricted to the Rewan Group, Baralaba Coal Measures, and Undivided Basement. Drawdown of less than 0.5 m is predicted in the surficial Cenozoic units (e.g. Quaternary alluvium, Tertiary sediments) overlying the Rewan Group. There is no predicted drawdown in the Tertiary basalt, Boxvale Sandstone, Evergreen Formation, Moolayember Formation, and the Clematis sandstone.

Figure 8.5 shows that a maximum of ~29 m of drawdown is predicted in the Rewan Group within the IAA period. The lateral extent of drawdown in the Rewan Group aquitard exceeding 5 m (drawdown trigger threshold for bores screened in a consolidated aquifer), the IAA, is mostly restricted to the PL boundary.

The greatest drawdown is predicted in the Baralaba Coal Measures, as a result of the proposed CSG development, where a maximum drawdown of ~749 m is predicted during the UWIR period (Figure 8.6). Peak drawdown is anticipated for the Baralaba Coal Measures as this is the target seam for gas production. The lateral extent of drawdown in the Baralaba Coal Measures exceeding 5 m is predicted to extend approximately 4 km from the CSG development area.

8.2.3 Groundwater Depressurisation Over the Project Life

Figure 8.8 shows maximum predicted depressurisation in the Rewan Group over the entire Project life (LTAA). Drawdown within the Rewan Group is predicted to be greatest in the central region of the Project where the highest density of CSG wells are proposed to be located. The maximum drawdown in the Rewan Group is predicted to be ~99 m. The zone of depressurisation exceeding 5 m is ~4 km west and south of the Project site, and less than 2 km to the east and north.

Figure 8.9 shows maximum predicted depressurisation within the Baralaba Coal Measures over the entire Project life (LTAA). Depressurisation within the Baralaba Coal Measures is predicted to be greatest in the central, and southeastern regions of the Project. The Baralaba Coal Measures layer is predicted to experience a maximum depressurisation of ~1000 m as a result of the CSG development. The zone of depressurisation is predicted to extend furthest to the west with a maximum extent of ~6 km (drawdown exceeding 5 m).

Drawdown of less than 0.2 m and 0.5 m is predicted in the surficial Cenozoic units (e.g. Quaternary alluvium, Tertiary sediments respectively) overlying the Rewan Group. Drawdown is not expected in the GAB sediments (Clematis Sandstone, Moolayember Formation, Precipice Sandstone, Evergreen Formation, or Boxvale Sandstone). Stratigraphically, the Rewan Group aquitard is the highest stratigraphic unit within the GAB sequence that is predicted to observe depressurisation impacts from the development.

9 PART D: IMPACTS TO THE ENVIRONMENTAL VALUES

9.1 Identified Environmental Values

9.1.1 Groundwater and Surface Water Interactions

Groundwater surface water interaction within the Project area may occur as a result of two key processes:

- Recharge of aquifers as leakage from watercourses; and
- Discharge of groundwater to watercourses as baseflow.

Recharge to groundwater systems from watercourses may occur across the Project area, however this only occurs when there are conditions of sufficient saturation in the alluvium and associated hydraulic head to allow water to infiltrate into the underlying aquifers. This is likely for the majority of the ephemeral watercourses across the Project area where flow is only observed during and following rainfall event. The Dawson River, however, is perennial.

Alluvial aquifers deposited by fluvial processes in river channels or floodplains are found along the Dawson River, and associated tributaries. Based on the information from surface water flow gauges, and groundwater level data from the alluvium, limited potential for baseflow from the groundwater system to contribute to the Dawson River is interpreted. The Greater Meridian Field Groundwater Assessment (KCB 2020) compared groundwater levels in the alluvium monitoring bore (RN 13030385) to data from the surface water gauging station on the Dawson River at Woodleigh (130317B)). Groundwater levels recorded in monitoring bore 13030385, over the duration of the surface water gauging records that correlated with the groundwater level monitoring records (October 1985 to May 2012), indicate that groundwater levels gradually rose from 120.62 mAHD to 126.2 mAHD throughout the recorded period. In comparison, the recorded river elevation at the Dawson River at Woodleigh gauging station fluctuated from 126.254 mAHD to 144.509 mAHD, with a median of 126.808 mAHD. This indicates that the river levels were consistently higher than the recorded groundwater levels in the alluvium during the recorded period which implies that perennial surface water flow in the Dawson River, through the Project area, may largely be dependent on groundwater baseflow contribution up-catchment of the Project area.

The laterally extensive and thick Rewan Group aquitard underlies the surficial Quaternary and Tertiary aquifers and separates these aquifers from the target Baralaba Coal Measures by between 40 to >1,500 m (increasing from east to west), further limiting hydraulic connectivity between the surface water system and the Baralaba Coal Measures.

9.1.2 Groundwater Dependent Ecosystems (GDEs)

Project by the DES (DES 2018b). GDEs are defined in water-related responses to coal seam gas extraction and coal mining (DoEE 2015) as:

> *'Natural ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services'* (Richardson et al. 2011)*. The broad types of GDE are* (Eamus et al. 2006)*:*

- *Ecosystems dependent on surface expression of groundwater;*
- *Ecosystems dependent on subsurface presence of groundwater; and*
- *Subterranean ecosystems.*

OGIA (2019a) provides further terminology relating to surface expression GDE’s, which include spring vents / complexes:

- Spring vents are described as a single location in the landscape where groundwater discharges at the surface. A spring vent can be mounded or flat and can also present as wetland vegetation, with no visible water at the location of the spring.
- A spring complex is a group of spring vents located close to each other. The spring vents are located in the same surface geology and share the same source aquifer and landscape position. No adjacent pair of spring vents in the complex is more than 10 km apart.
- A watercourse spring is a section of a watercourse where groundwater from an aquifer enters the stream through the streambed. This includes waterholes and flowing sections of streams dependent on groundwater. This type of spring is also referred to as a baseflow-fed section of a watercourse.

Potential terrestrial GDEs are mapped as present in the vicinity of the Project area and are discussed in the following section.

9.1.2.1 Spring Complexes

Spring complexes, as recorded in the Queensland spring database (Queensland Herbarium. 2018), are presented in Figure 9.1. The majority of spring complexes are located >60 km south and over 80km west of the Project area. The nearest spring complexes were identified ~35 km southwest and ~ 50km south of the Project area.

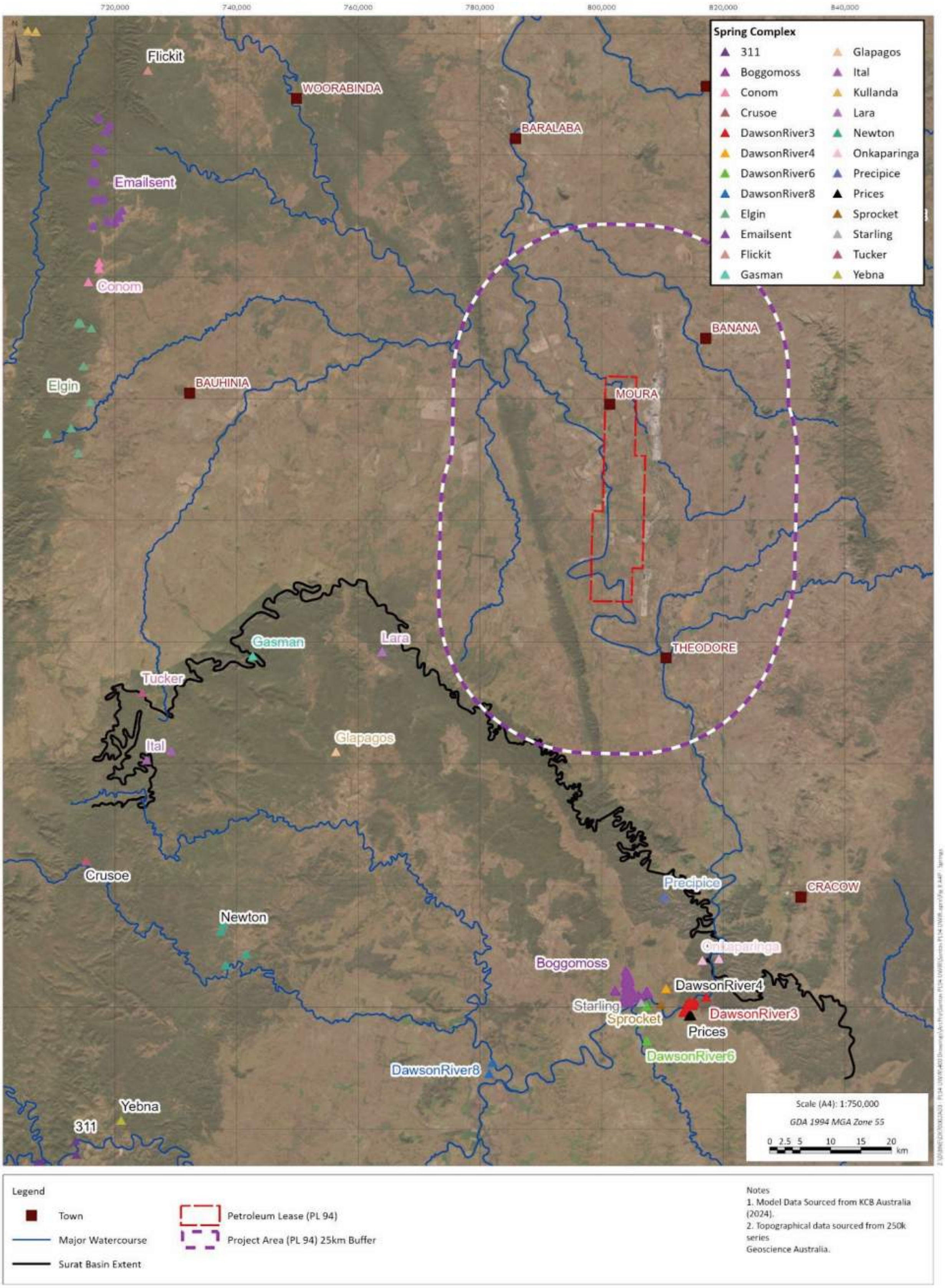

Figure 9.1 Location of Spring Vents / Complexes in the Vicinity of the Project

9.1.2.2 Potential Terrestrial GDEs

The potential GDEs as mapped by DES (2018b) are generally located in the vicinity of watercourses, such as the Dawson River and associated tributaries (Fish Creek / Zamia Creek) (Figure 9.2). Most of potential GDEs are mapped as being 'low confidence' and are all derived from satellite or regional ecosystem mapping, rather than assigned based on known groundwater dependence.

Figure 9.3presents the potential terrestrial GDEs using the GDE mapping rule-sets as defined by the Queensland Government (2017) in '*Groundwater dependent ecosystem mapping rule-sets for the Comet, Dawson and Mackenzie River Catchments'.* The rule set occurring in the vicinity of the Project include:

- SURAT_RS_01A: Quaternary alluvial aquifers overlying sandstone ranges with fresh, intermittent groundwater connectivity regime.
- SURAT_RS_01C: Quaternary alluvial aquifers with fresh, intermittent groundwater connectivity regime.
- SURAT_RS_01D: Quaternary alluvial aquifers with fluctuating, intermittent groundwater connectivity regime and neutral pH.
- SURAT_RS_02A: Permeable rock aquifers (basalts) greater than or equal to 100 ha in size with fresh, intermittent groundwater connectivity regime.
- SURAT_RS_02B: Permeable rock aquifers (basalts) less than 100 ha in size with fresh, episodic groundwater connectivity regime.
- SURAT_RS_03A: Permeable consolidated sedimentary rock aquifers with fresh, intermittent groundwater connectivity regime.
- SURAT_RS_05: Permeable old loamy or sandy plain aquifers with fresh, intermittent groundwater connectivity regime.
- SURAT_RS_07: Fractured rock aquifers (igneous rocks) with fresh, intermittent groundwater connectivity regime.

Further discussion of the potential terrestrial GDEs, in the context of impacts, is provided in Section 9.2.4.

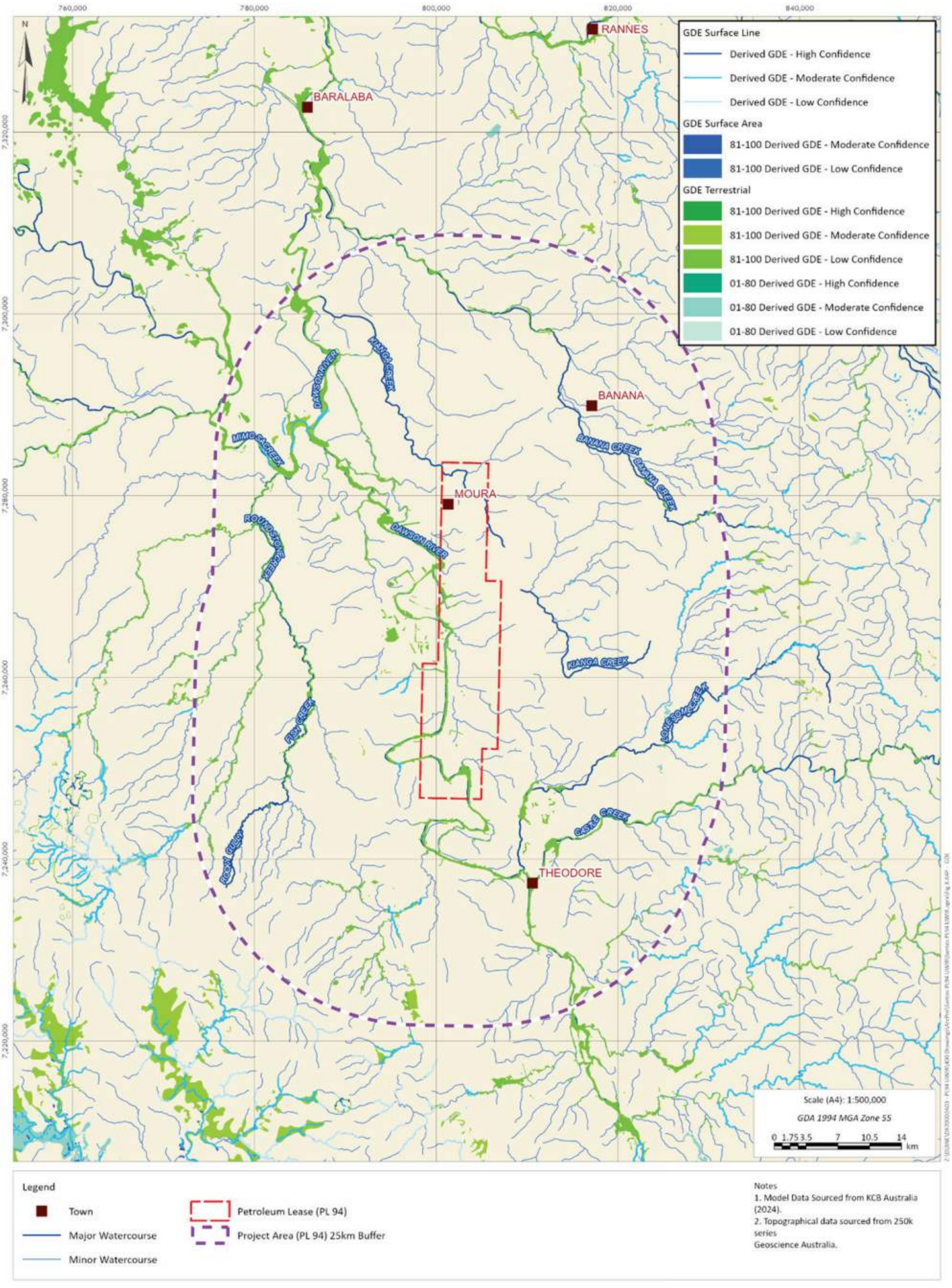

Figure 9.2 Location of Potential Terrestrial GDEs in the Vicinity of the Project

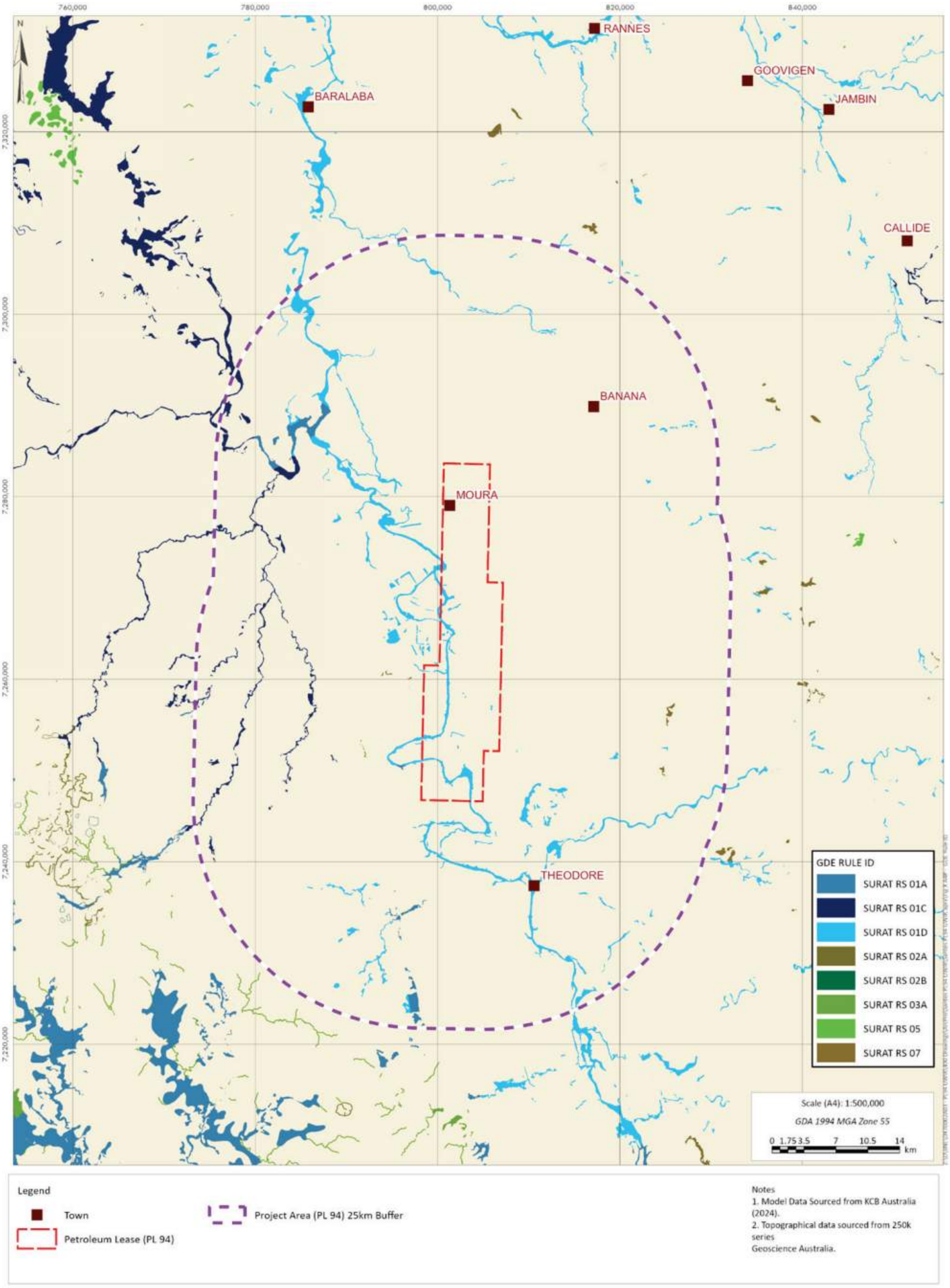

Figure 9.3 Site Potential Terrestrial GDEs by Rule Set

9.1.3 Third-Party Groundwater Users

9.1.3.1 Registered Groundwater Bores

Within the vicinity of the Project area (i.e. within PL 94 and a 25 km buffer outside), there are 522 registered groundwater bores recorded in the GWDB, as of May 2025 (DRDMW 2025). Of these registered bores, 412 are existing bores or abandoned but usable; the remaining bores are 'abandoned and destroyed' or decommissioned. A summary of registered bores is presented in Table 9.1 along with their type and status, as derived from the GWDB. Bores 'abandoned and destroyed' have not been presented in the associated figures.

Table 9.1 Summarised Bore Type and Condition within a 25 km Radius of the Project Area

Type	Abandoned and Destroyed (AD)	Abandoned But Usable (AU)	Existing (EX)	Total
Artesian - Condition Unknown (AB)	0	0	46	46
Artesian - Controlled Flow (AF)	0	0	5	5
Sub-Artesian Facility (SF)	110	78	281	469
Surface Water Facility (SW)	0	2	0	2
Total	**110**	**80**	**332**	**522**

Other groundwater bores may also be present within the Project area that are not registered in the GWDB (e.g. installed prior to the requirement to register water bores with the DRDMW). It is not known how many unregistered bores may exist; however, these bores may be identified during future bore baseline assessments. The data from baseline assessments is provided to OGIA and DRDMW for incorporation into future updates to the GWDB.

Groundwater Use and Purpose

Groundwater is used for various purposes in the vicinity of the Project area including stock and domestic; irrigation; town water supplies; and industrial / mining purposes.

Groundwater abstraction for water supply is the dominant water use purpose within the vicinity of the Project, with 191 bores considered as potential water supply bores (total of water supply plus irrigation & stock). Water supply bores located within the 25 km buffer of the Project area are shown in Figure 9.4.

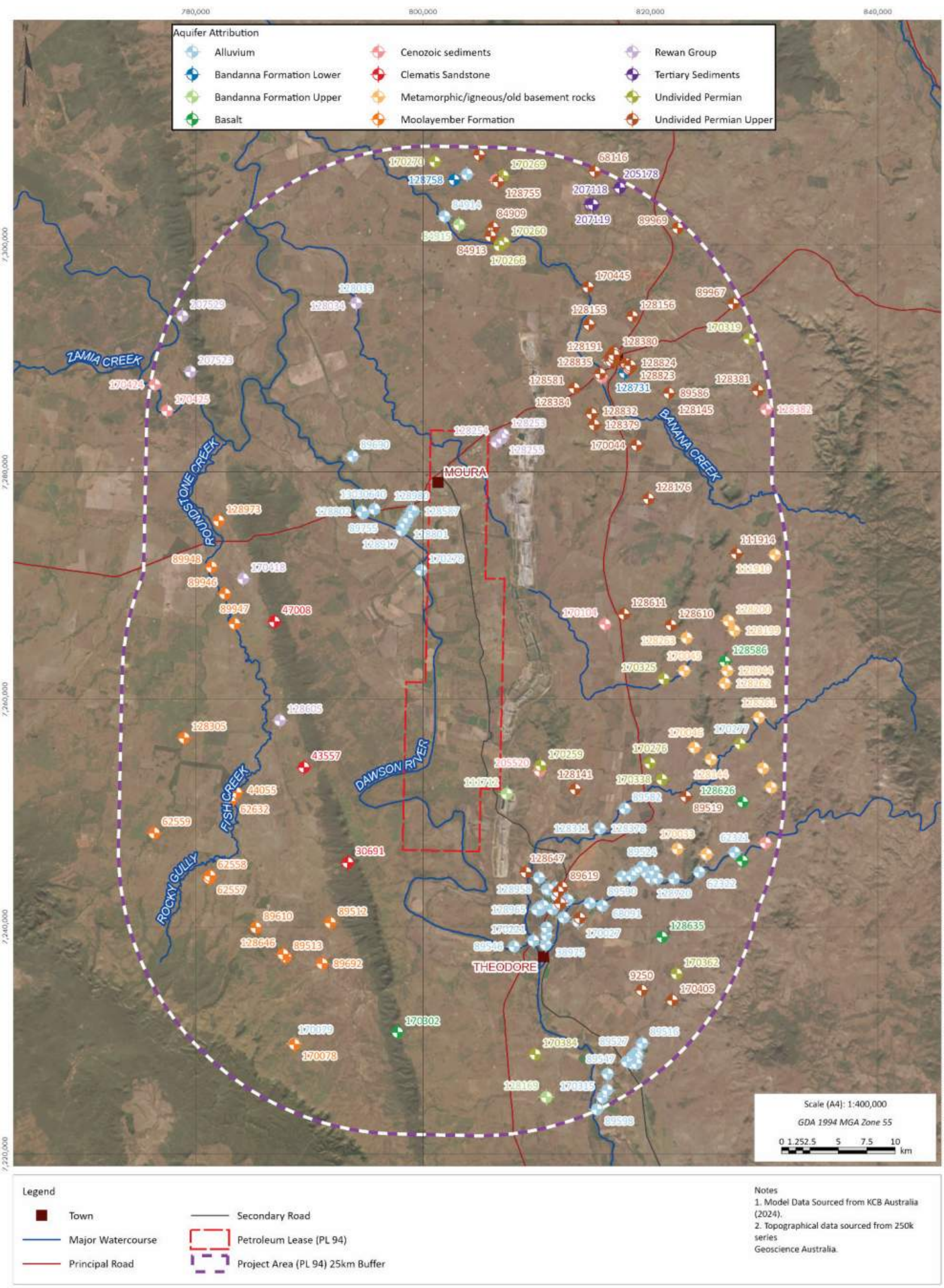

Figure 9.4 Location of Potential Groundwater Supply Bores

Bore Baseline Assessment

Under the Water Act, petroleum tenure holders are required to undertake baseline assessments of water bores prior to commencement of production. Baseline assessments are undertaken in accordance with the 'Baseline Assessment Guideline' (DES 2017a), to obtain information such as:

- Bore status;
- Type and purpose;
- Information related to construction of the bore;
- Baseline water levels;
- Baseline water quality; and
- Bore equipment.

Baseline assessments for bores located in the vicinity of the Project area were undertaken as part of the Baseline Groundwater Study – Meridian Seam Gas Field (AGE 2011) and the Mungi West CSG EA Application Groundwater Assessment (SLR Consulting Australia Pty Ltd 2019), which were completed in accordance with Water Act requirements. A summary of the groundwater bores within the Project area, for which baseline assessment have been undertaken, are provided in Figure 9.2. Figure 9.4 presents the locations of the bores where baseline assessments were completed / attempted.

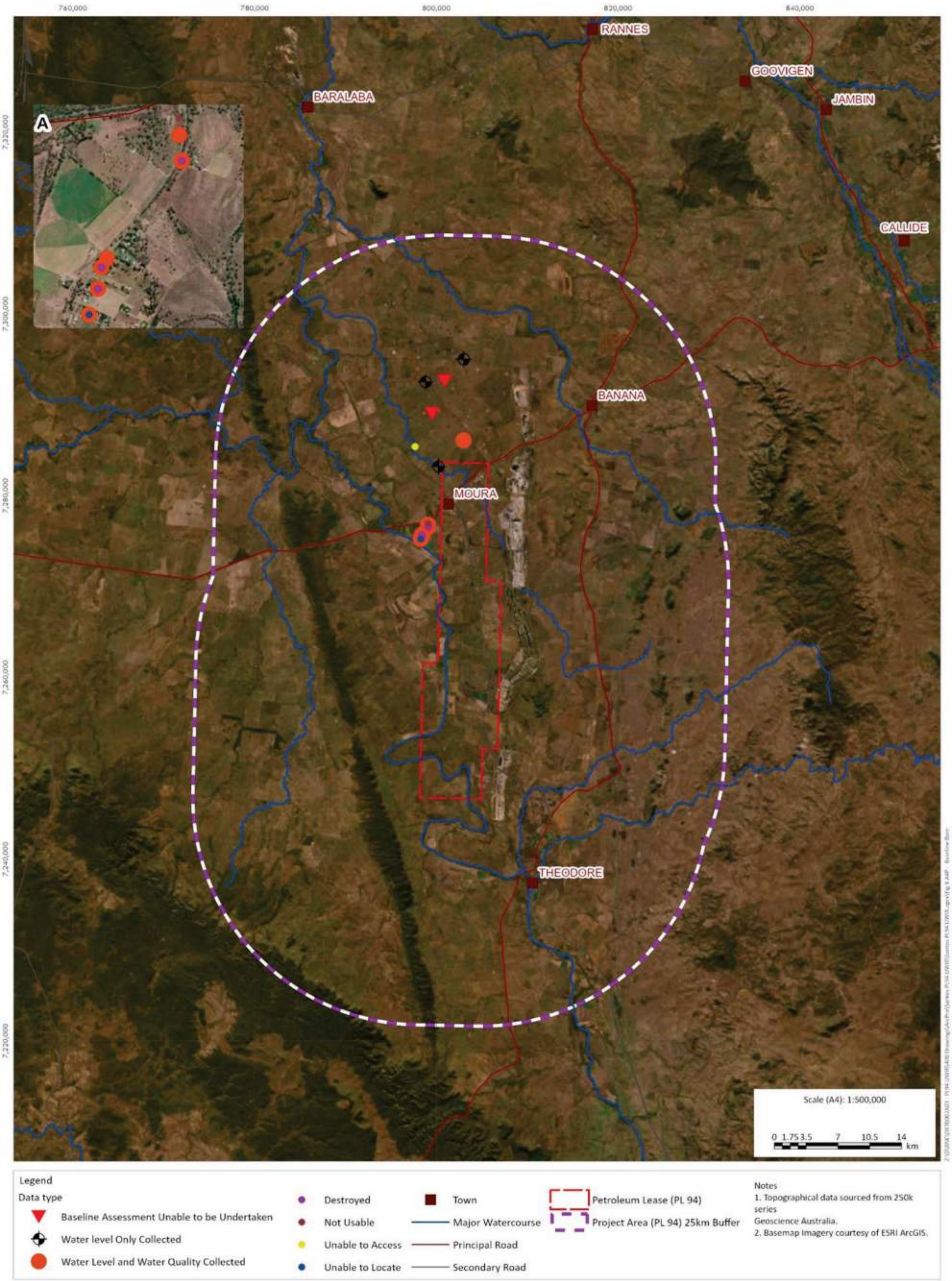

Figure 9.5 Locations of Completed / Attempted Bore Baseline Assessments

Table 9.2 Summary of Completed / Attempted Bore Baseline Assessments

Bore ID / Name	Easting	Northing	Data Type Collected
Unknown Bore 1	798810	7292497	Water level only
Unknown Bore 2	800910	7292622	No water level or quality data
128580	802998	7294999	Water level only
128574	799547	7289008	No Water Level or Quality Data
128576	800242	7283198	Water level only
128577	802990	7286080	Water level and water quality
128587	799106	7276551	Water level and water quality
128898	799106	7276556	Water level and water quality
128585	798376	7275440	Water level and water quality
128583	798407	7275627	Water level and water quality
128801	798299	7275216	Water level and water quality
128980	799084	7276780	Water level and water quality
128584	798455	7275707	Water level and water quality
13030640	799106	7276551	Water level and water quality
100312	799106	7276556	Believed to be destroyed
100313	798376	7275440	Believed to be destroyed
100314	798407	7275627	Believed to be destroyed
128575	798299	7275216	Unable to find bore during assessment
100212	797661	7285376	Unable to access
UNK	799079	7276928	Not usable

* Coordinates in GDA94, Zone 55.

9.2 Impacts to Environmental Values

Groundwater level drawdown/depressurisation predictions from the numerical modelling results presented in Section 8.2.1 identify that >0.5 m drawdown/depressurisation associated with the Project only is restricted to the Rewan Group, the Baralaba Coal Measures, and the Undivided Basement. There is no predicted drawdown impact to the shallow groundwater in the overlying Quaternary alluvium or Tertiary sediments, therefore, there will be no predicted impacts to environmental values associated with the shallow groundwater system.

9.2.1 Impacts Associated with Exercise of Previous Water Rights

Groundwater level and quality monitoring between January 2022 and July 2024 (as discussed in Section 7.4), does not indicate adverse impacts to EVs as a result of the previous exercise of underground water rights.

9.2.2 Impacts on Groundwater Resources

Groundwater abstraction occurs as part of the CSG production process. Groundwater is removed via production wells to depressurise the coal seams, which liberates gas flow. This depressurisation, and associated gas flow, results in groundwater abstraction that is required to maintain the target operational pressure for gas production.

Water Production is authorised under the P&G Act (Section 2.1). Potential impacts as result of water production may include:

- Decline in groundwater level / pressure at water bores, reducing water availability and potentially impacting groundwater EVs;
- Reduction in groundwater head resulting in reduction of groundwater discharge at spring complexes, potentially causing degradation of GDEs; and
- Reduction of baseflow to watercourses, potentially resulting in reduced availability of water to GDEs and reduced water availability to potential users downstream.

Those potential impacts, where receptors exist within the vicinity of the Project, are assessed against the Water Act trigger thresholds as outlined in Section 2.2.

Monitoring, management, and mitigation practices associated with the above activities are discussed further in Section 9.

9.2.3 Impacts on Groundwater Users

Potential short term and long-term impacts to groundwater bores have been assessed against the Water Act bore trigger threshold of 2 m for an unconsolidated aquifer (e.g. alluvium), and 5 m for a consolidated aquifer (e.g. Rewan Group; Baralaba Coal Measures; Undivided Basement), using the drawdown predictions from the numerical model (Section 8.2.1). The Year 3 (IAA) predicted drawdown is presented for this assessment alongside the maximum (LTAA) predicted drawdown for the Project, irrespective of timing.

Potential third-party water supply bores within a 25 km radius of the Project that are predicted to experience drawdown as a result of the Project development are presented in Table 9.3. Drawdown is only observed in three potential water supply bores located in the Rewan Group in close proximity to the Project area. On further investigation it was confirmed that bores are not water supply bores but are monitoring bores at a neighbouring property (QNP). Bore RN128253 cannot be located and is assumed to be destroyed. As these bores are not water supply bores, they are not subject to the make good requirements under the Water Act 2000.

Table 9.3 Summary of Drawdown Predictions for Potential Water Supply Bores

RN	Bore Use	Layer	Easting	Northing	IAA Drawdown (m)	LTAA Drawdown (m)
128253	Cannot be located, assumed destroyed	Rewan	807079	7283288	2.0	6.3
128254	Monitoring bore	Rewan	806444	7282624	4.5	18.3
128255	Monitoring bore	Rewan	806902	7282953	5.3	10.0

*Coordinates in GDA94, Zone 55

Bores installed within unconsolidated aquifers (i.e. applicable to the groundwater bore trigger threshold of 2 m) are not predicted to have an induced drawdown in groundwater levels as a result of Project development.

In summary:

- One bore is predicted to experience a drawdown that exceeds the trigger thresholds (>5 m) during the UWIR period (IAA) (RN 128255). This bore is noted as abandoned but usable (Queensland Globe, July 2025) and has been confirmed by Westside as a monitoring bore.

- Three bores have predicted drawdowns that exceed the trigger threshold over the Project life (LTAA). All are confirmed as either monitoring bores, or assumed destroyed, and not water supply bores.

The locations of these bores are presented in Figure 8.8. Two of these bores are identified as 'abandoned but usable' by OGIA (OGIA 2022). Bore assessments and make good agreements are not required under the Water Act for these monitoring bores.

9.2.4 Impacts on Groundwater Dependent Ecosystems

Section 9.1.2 identified the potential TGDEs that have been mapped in the vicinity of the Project area. Typically, the mapped areas of TGDEs are located adjacent to watercourses (e.g., Dawson River), which are reliant on groundwater within the shallow Quaternary alluvium or Tertiary sediments.

The predicted groundwater level drawdowns from the numerical modelling (Section 8.2.1) indicate that drawdown resulting from the proposed Project development will be limited to the Rewan Group, Baralaba Coal Measures, and Undivided Basement; and will not propagate to the shallow Cenozoic units (i.e. Quaternary alluvium, Tertiary sediments). Therefore, there will be no impacts to the mapped potential TGDEs as a result of the Project development.

9.2.5 Impacts on Subsidence

As part of gas production, groundwater and gas are extracted from the Baralaba Coal Measures. This is achieved by a reduction in water pressure, which can result in compaction of the producing seams of the Baralaba Coal Measures. Desorption of gas from the coal seams can also result in additional compaction (IESC 2014). This compaction can result in subsidence, which is a localised lowering of the land surface (IESC 2014).

Predicted surface subsidence impacts associated with gas production have been calculated previously for the Bandanna Formation (Baralaba Coal Measures equivalent) by Santos GLNG (Santos 2014). The estimated subsidence from this study was 0.05 m for the coal seams and 0.1 m for the remaining thickness of the formation, and was based on a drawdown of ~1,000 m. The predicted drawdown in the Baralaba Coal Measures for this Project is ~725 m, which is less than the Santos study. The Project only subsidence for the Westside Mungi Project to the north and west of PL 94 is predicted between 0.002 m and 0.57 m. The maximum change in ground slope from CSG-induced subsidence is expected to be less than 0.57% (57 cm over a km) (KCB 2025).

Based on the above estimates, it is interpreted that potential impacts from subsidence can be considered as negligible in terms of impacts to water resources.

9.2.6 Impacts on Springs

The nearest spring complex to the Project area is approximately ~35 km to the southwest of the Project. Predicted depressurisation/drawdown from the proposed Project will not propagate to the spring locations, therefore, no impacts to surrounding spring complexes are expected as a result of Project development.

9.2.7 Impacts on Surface Drainage

The Project does not include any planned discharge to, or abstraction from (including abstraction due to groundwater drawdown impacts), the surface water system. Numerical modelling did not predict drawdown associated with Project development within the surficial Quaternary alluvium or Tertiary sediments aquifer which are potentially hydraulically connected to surface water systems in the Project area. Other potential impacts associated with Project construction and operation such as sedimentation and dust generation during construction, increased stormwater runoff and potential hydrocarbon releases will be managed through implementation of the appropriate management, mitigation, and monitoring practices associated with construction and operation as detailed in Westside's Meridian Seam Gas Environmental Management Plan (EMP) (WestSide 2021).

Westside's Management Plans (contained in the EMP) aims to: "maintain the existing chemical, physical and biological integrity of water quality within acceptable parameters, so as to minimise potential impacts to the principal environmental value of stock watering and irrigation, and to maintain and preserve the 'ecological integrity' of freshwater ecosystems, including biological diversity, relative abundance and ecological processes". The Management Plan identifies a number of control strategies related to infrastructure planning, water-, soil-, air quality- and biodiversity management, rehabilitation, material storage and waste management, to support these objectives (WestSide 2021).

There will be no discernible impacts to the surface water system, or surface water users as a result of Project development.

Drawdown of the groundwater table will therefore not impact the overlying surface drainage features.

10 PART E: GROUNDWATER MONITORING STRATEGY

The following sections describe the monitoring and management measures for groundwater levels and quality and groundwater take. Each section provides an overview of the existing monitoring requirements and proposed monitoring and management measures. These measures will be implemented.

10.1 Groundwater Level and Quality Monitoring and Management

10.1.1 Environmental Authority Requirements

The EA for PL 94 (Permit Number EPPG00783713, effective from 2 August 2021) has identified conditions, and associated procedures, for the monitoring and management of groundwater. These comprise:

- EA Condition A4 - *All monitoring must be undertaken by a suitably qualified person.*
- EA Condition A6 - *All laboratory analyses and tests must be undertaken by a laboratory that has NATA accreditation for such analyses and tests.*
- EA Condition A8 - *Monitoring and sampling must be carried out in accordance with the requirements of the following documents (as relevant to the sampling being undertaken), as amended from time to time: - (b) for groundwater, Groundwater Sampling and Analysis – A Field Guide (2009:27 GeoCat #68901).*
- EA Condition A9 - *i) groundwater monitoring results from a landholder's active groundwater bore monitored under the stimulation impact monitoring program which is a 10 percent or greater increase from a previous baseline value for that bore and which renders the water unfit for its intended use; and j) monitoring results where two out of any five consecutive samples do not comply with the relevant limits in the Environmental Authority.*
- EA Conditions G12 to G14– *conditions relate to the establishment of a seepage monitoring network and program to detect/monitor seepage of contaminants to groundwater from on-site contaminant storage facilities. Condition G14 - The Groundwater Monitoring Program, must include, but not necessarily be limited to: a) locations of monitoring sites, monitoring methodology and trigger values for detecting impacts on groundwater quality.*
- Condition G17 - *Groundwater samples must be monitored for the water quality parameters at the minimum frequencies as specified in 'Schedule G, Protecting Water Values, Table 2 – Groundwater Monitoring Parameters and Monitoring Frequency'; as represented in* Table 10.1.

Table 10.1 EPPG00783713, Schedule G, Protecting Water Values, Table 2 – Groundwater Monitoring Parameters and Monitoring Frequency

Groundwater Parameter	Monitoring Frequency
Water level (m)	Quarterly
Groundwater pressure in geological strata (kPa)	Biannually
pH	Biannually
Electrical conductivity (µS/m)	Biannually
Total dissolved solids (mg/L)	Biannually
Temperature (°C)	Biannually
Dissolved oxygen (mg/L)	Biannually
Alkalinity (bicarbonate, carbonate, hydroxide and total as $CaCO_3$) (mg/L)	Biannually
Sodium adsorption ratio (SAR)	Biannually
Anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) (mg/L)	Biannually
Cations (aluminium, calcium, magnesium, potassium, sodium) (mg/L)	Biannually
Silica (mg/L)	Biannually
Dissolved and total metals (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, chromium III, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc (µg/L)	Biannually
Total phosphorus as phosphorus (mg/L)	Biannually
Ammonia, nitrate and nitrite as nitrogen (mg/L)	Biannually
Total petroleum hydrocarbons (mg/L)	Biannually
BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para-xylene, meta-xylene and total xylene (µg/L)	Biannually
Polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo(a)pyrene) (µg/L)	Biannually
Gross alpha + gross beta or radionuclides by gamma spectroscopy (Bq/L)	Biannually

- EA Conditions I12 to I13:

Condition I12 – Prior to undertaking stimulation activity, a baseline bore assessment must be undertaken of the water quality of:

(a) all landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a two (2) kilometre horizontal radius from the location of the stimulation initiation point within the target gas producing formation; and

(b) all landholder's active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200 m above or below the target gas producing formation and is spatially located within a two (2) kilometre radius from the location of the stimulation initiation point; and

(c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the finding of the risk assessment required by conditions (I9) and (I10).

Condition I13 – Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (I14)

- Condition I14 – *Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to:*

  (a) pH

  (b) electrical conductivity (µS/m)

  (c) turbidity (NTU)

  (d) total dissolved solids (mg/L)

  (e) temperature (°C)

  (f) dissolved oxygen (mg/L)

  (g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulphide) (mg/L)

  (h) alkalinity (bicarbonate, carbonate, hydroxide and total $CaCO_3$) (mg/L)

  (i) sodium adsorption ration (SAR)

  (j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) (mg/L)

  (k) cations (aluminium, calcium, magnesium, potassium, sodium) (mg/L)

  (l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) (µg/L)

  (m) total petroleum hydrocarbons (µg/L)

  (n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) (µg/L)

  (o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo(a)pyrene) (µg/L)

  (p) sodium hypochloride (mg/L)

  (q) sodium hydroxide (mg/L)

  (r) formaldehyde (mg/L)

  (s) ethanol (mg/L)

  (t) gross alpha + gross beta or radionuclides by gamma spectroscopy (Bq/L)

- Condition I15 – I17 - *Conditions relate to the development of a Stimulation Impact Monitoring Program and associated monitoring requirements.*

Some of the groundwater-related conditions identified in the EA (EPPG00783713) relate to monitoring associated with contaminate seepage to the groundwater or baseline monitoring prior to the undertaking of hydraulic fracturing and stimulation activities; on-site contaminant storage and well stimulation is not proposed to be undertaken as part of forthcoming UWIR period. Relevant EA requirements were taken into consideration during compilation of the monitoring program presented in this section.

10.1.2 Groundwater Monitoring: Previous UWIR Period

Since the approval of the original UWIR in 2013, westside has undertaken monitoring in several groundwater bores and gas wells. Westside has undertaken annual monitoring during the previous UWIR period (2022 to 2025) at four bores (see Table 10.2, locations shown on Figure 7.1). These bores are:

- Dawson (unknown unit).
- Moura C (Quaternary alluvium).
- Nipan (Quaternary alluvium).
- Mungi (Tertiary sediments).

The results for the groundwater level data for the project bores and surrounding registered groundwater bores are presented in Section 7.4. The water quality sampling for the registered groundwater bores and Project monitoring bores are presented in Section 7.5.

A number of Westside monitoring bores are dry, blocked or have limited access (Mungi Yard, QNP, GW14).

Table 10.2 Westside Groundwater Monitoring Bores

Bore RN	Westside Name	Easting	Northing	Depth	Tenure	Assumed Aquifer Attribution	Current Status
-	WMB Dawson 01	804668	7253578	34	PL 94	Unknown (assumed Tertiary)	Operational
170043	WMB GW14	805887	7283235	54	-	Rewan Group	Blocked
170082	WMB Moura C 01	804979	7267031	21.3	PL 94	Alluvium	Operational
170052	WMB Mungi Bore 01	804522	7280626	30.5	PL 94	Tertiary Sediments	Operational
170081	WMB Nipan 01	804002	7261398	20.8	PL 94	Alluvium	Operational
128254	WMB QNP 01	806442	7282635	30	-	Rewan Group	No access
-	WMB Mungi Yard 01	803827	7276599	25	PL 94	Tertiary Sediments	Dry
-	WMB Mungi Yard 01	803835	7276605	50	PL 94	Rewan Group	Dry

10.1.3 Proposed Monitoring and Management Measures (2025-2028)

Predicted drawdown/depressurisation results from the numerical modelling of the proposed Project development (Section 8.2) has identified that:

- One third-party monitoring bore (originally identified by QLD Globe as a potential water supply bore) is located within the IAA.
- Three third-party monitoring bores (originally identified by QLD Globe as a potential water supply bores) are located within the LTAA Impacts to the surface water system, surrounding springs and mapped TGDEs are not anticipated. As a result, limited groundwater monitoring of the Quaternary alluvium and Tertiary sediments is considered warranted for the Project.

The proposed monitoring and sampling program and schedule for 2025 to 2028 considers the predicted drawdown, and recommendations from the current and annual UWIR monitoring report. The following changes to the groundwater monitoring network are recommended:

- Since the current Rewan monitoring bores are either inaccessible or dry, additional monitoring bores in the Rewan are required. For ease of access, these will be drilled next to existing Westside monitoring bores. These replacement bores will be drilled by the end of Q2 2026.
- Removal of inaccessible bores from the list of groundwater monitoring bores.

The proposed groundwater monitoring program (excluding baseline bore assessments) for 2025 to 2028 is presented in Table 10.3. Groundwater monitoring results are to be reported annually.

Table 10.3 Groundwater Monitoring Bore Locations (2025 to 2028 UWIR Period)

Bore RN	Westside Name	Easting	Northing	Assumed Aquifer Attribution	Current Status	Tenure	Water Quality and Level Monitoring Frequency	Comment	Implementation Date
-	WMB Dawson 01	804668	7253578	Unknown	Operational	PL 94	Biannually	-	-
170082	WMB Moura C 01	804979	7267031	Alluvium	Operational	PL 94	Biannually	-	-
170052	WMB Mungi Bore 01	804522	7280626	Tertiary Sediments	Operational	PL 94	Biannually	-	-
170081	WMB Nipan 01	804002	7261398	Alluvium	Operational	PL 94	Biannually	-	-
TBC	TBC – Replacement for Mungi Yard Bore	TBC	TBC	Tertiary Sediments	To be drilled	PL 94	Biannually	Location chosen due as close to the LTAA bores	End of Q2 2026
TBC	TBC – Replacement for Mungi Yard Bore	TBC	TBC	Rewan	To be drilled	PL 94	Biannually	Replacement	End of Q2 2026
TBC	TBC – Replacement for GW14	TBC	TBC	Rewan	To be drilled	PL94	Biannually	Replacement bore at the Pony Club	End of Q2 2026

*Coordinates in GDA94, Zone 55

* Bore installation dates are dependent on negotiations with landholders. Bore monitoring to commence within 3 months following bore installation.

Water Quality Monitoring Schedule and Parameters

Groundwater monitoring will focus on the recording of groundwater levels and the collection of groundwater samples for preliminary laboratory testing. This monitoring program is proposed to focus on the assessment/identification of potential impacts to third-party water supply bores as a result of CSG development, therefore, changes in water levels and changes in basic groundwater quality (e.g. salinity) as discussed above are considered as triggers for the identification of potential impacts.

The water quality monitoring requirements are designed to assess whether gas operations are affecting the groundwater quality within the monitored aquifers by establishing a baseline dataset. The analytical suite described in Table 10.4 includes all parameters as per Condition I14 of EPPG00783713, as well as phosphorus and ammonia / nitrate / nitrate (identified by the Meridian Project EA as parameters of interest). The parameter suite is deemed suitable to establish water type and general quality as well as to assess concentrations of potential contaminants that may be present due to gas activities. It is also aligned with monitoring performed during previous UWIR periods.

Bores screened in the Rewan Group and bores with an unknown aquifer attribution will be monitored for a more comprehensive analytical suite, while monitoring bores screened in the Tertiary sediments and alluvium (indicated as ‘Other’ in Table 10.4) will be monitored for parameters of a screening nature. It is recommended that ongoing monitoring requirements are refined based on annual review of monitoring results.

Should specific chemicals be known or suspected to have been used in a field or specific well, the analytical suites should be augmented to include relevant indicator parameters. Water quality monitoring should be synchronous with water level monitoring such that relationships between level and quality could be better understood.

Table 10.4 Groundwater Analytical Suite and Frequency

Groundwater Parameter		Monitoring Scenario		
		New Monitoring and 3rd Party Bores	Ongoing - Rewan Monitoring Bores	Ongoing- Other Monitoring Bores
Field Parameters	Temperature	X	X	X
	Turbidity	X	X	X
	Electrical Conductivity (EC) and pH	X	X	X
	Dissolved Oxygen (DO) and Oxidation-Reduction Potential (ORP)	X	X	X

Groundwater Parameter	Monitoring Scenario		
	New Monitoring and 3rd Party Bores	Ongoing - Rewan Monitoring Bores	Ongoing- Other Monitoring Bores
pH & Electrical conductivity	X	X	X
Turbidity	X		
Total dissolved solids	X	X	X
Temperature	X	X	
Dissolved oxygen	X	X	
Dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulphide)	X		
Alkalinity (bicarbonate, carbonate, hydroxide and total as CaC03)	X	X	
Sodium adsorption ratio (SAR)	X	X	
Anions (bicarbonate, carbonate, hydroxide, chloride, sulphate)	X	X	X
Cations (aluminium, calcium, magnesium, potassium, sodium)	X	X	X
Silica	X	X	
Dissolved and total metals (including but not necessarily limited to: aluminium, arsenic, barium, borate (boron), cadmium, chromium Ill, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc)	X	X	X
Total phosphorus as phosphorus	X	X	
Ammonia, nitrate and nitrite as nitrogen	X	X	X
Total petroleum hydrocarbons	X	X	X
BTEX (as benzene, toluene, ethylbenzene, o, p, m and total xylene)	X	X	
Polycyclic aromatic hydrocarbons (including but not necessarily limited to: naphthalene, phenanthrene, benzo[a]pyrene)	X	X	
Sodium hypochlorite	X		
Sodium hydroxide	X		
Formaldehyde	X		
Ethanol	X		
Gross alpha + gross beta or radionuclides by gamma spectroscopy	X	X	
Monitoring Frequency	Biannually	Once per Annum	Once per Annum

10.1.4 Baseline Bore Monitoring and Make Good Arrangements

Predicted drawdown/depressurisation results from the numerical modelling of the proposed Project development (Section 8.2.1) has identified that one registered bore will be impacted during the UWIR period (i.e. one bore within the IAA). Over the duration of the Project development period (LTAA) three water bores screened in / attributed to the Rewan Group, in the vicinity of the Project, are predicted to have the bore trigger threshold exceeded.

Given that these bores have been identified as monitoring bores, baseline assessments for these bores are not required under the Water Act 2000.

Baseline assessments of third-party groundwater bores within the vicinity of the CSG wells are required as they are commissioned/developed. The baseline bore monitoring program will be based on the following:

- Baseline assessments are to be conducted on water supply bores screened within the Rewan Group or Baralaba Coal Measures that are located within 2 km of a proposed CSG well, prior to the establishment and development of the well.
- Water quality parameters to be analysed as part of this monitoring program should comprise:
  - pH.
  - Electrical Conductivity (EC).
  - Total Dissolved Solids (TDS).
  - Major ionic constituents – Ca, Mg, K, Na, Cl, CO_3, HCO_3, SO_4.
  - Heavy metals.
  - TRH and PAH.

As per the requirements of the Water Act: should monitoring indicate that the bore trigger threshold will be exceeded make good agreements will be implemented with each bore owner where required, prior to the trigger threshold being exceeded.

10.2 Groundwater Production Monitoring and Management

10.2.1 Regulatory Requirements

As per the requirements outlined in the P&G Act, the volume of produced water will be monitored and recorded and provided to the relevant authority as required. Results will be included in annual reports.

10.2.2 Proposed Monitoring and Management Measures

The volume of CSG produced water from each operating gas well within PL 94 is monitored and recorded daily by Westside. In accordance with the requirements of the P&G Act, Westside will continue to assess actual groundwater abstraction associated with the PL 94 Project.

The actual groundwater take assessed under the P&G Act requirements will be compared to the predicted groundwater take presented in this UWIR. This comparison will be undertaken annually. If the monitoring program shows groundwater take exceeds the predictions presented in this

UWIR, an investigation will be undertaken to confirm whether the actual impacts on groundwater users or sensitive environmental features are likely to be significantly greater than expected. The investigation outcomes will be considered as part of the annual UWIR review described in Section 12.2.

11 PART F: SPRING IMPACT MANAGEMENT STRATEGY

According to the GAB Spring Register, there are no discharge springs, recharge springs, or watercourse springs located within the vicinity of PL 94 (Figure 9.1). The nearest discharge spring is located approximately 35 kilometres to the southwest of the project (Figure 9.1).

As discussed in Section 9.2.5, no impacts to surrounding spring complexes are expected as a result of the Project. A spring impact management strategy is not required and has not been developed.

12 PART G: UWIR UPDATES AND REVIEW

12.1 Roles and Responsibilities

Westside is responsible for ensuring that the UWIR is implemented.

12.2 Review and Revision

As discussed in Section 9.2, depressurisation of the Rewan Group due to the Project development is predicted to exceed the bore trigger threshold.

Hence, Westside will undertake an annual review of the accuracy of the IAA and LTAA mapping, as required by section 376(1)(e) of the Water Act.

The review process will comprise:

- An initial review of any new geology or groundwater data to identify potentially significant departures from the data used in the UWIR to develop the IAA and LTAA mapping.
- Where potentially significant departures are identified, the potential effect of these departures on the IAA and LTAA will be investigated.
- If the investigation concludes that the IAA or LTAA are likely to have been under-estimated and additional water bores are likely to be affected, the IAA and LTAA will be revised.

The UWIR has been designed to align with the current, relevant EA groundwater conditions. It is therefore necessary to review and update the UWIR in response to any material changes to the EA conditions.

12.3 Reporting and Record Keeping

The outcome of each annual review will be reported to the DETSI following completion of each annual review. The reported outcomes will include a statement of whether there has been a material change in the information or predictions used to prepare the maps.

13 CONCLUSIONS

The key conclusions of the 2025 UWIR are:

- The impacts of the Project over the UWIR period and the life of the Project has been assessed based a conceptualisation of the hydrogeological system and proposed Project development; which served as the basis for the development of a numerical groundwater model that was used to quantify the potential impacts to the groundwater regime.
- CSG development will result in localised depressurisation of the target Baralaba Coal Measures, the overlying Rewan Group and underlying undivided Permian basement.
- The shallow surficial Cenozoic aquifers (i.e. Quaternary alluvium, Tertiary sediments) are not predicted to experience significant drawdown (<0.5 m) as a result of the Project due to the laterally extensive, homogeneous and thick low permeability Rewan Group aquitard that limits propagation of drawdown from the Baralaba Coal Measures to the surficial units.
- The Project will not impact surface waters, TGDEs or spring complexes during the Project duration because:
- Drawdown induced by the Project development does not propagate through the Rewan Group aquitard to impact the surface water system. Maximum drawdown in the alluvium is predicted to be <0.2 m;
- Mapped TGDEs are interpreted to source groundwater from the shallow surficial Cenozoic aquifers, which are not interpreted to be impacted by the Project development; and
- The nearest spring complex is approximately ~35 km away from the Project and will not be impacted by drawdown/depressurisation.
- Drawdown/depressurisation above the trigger threshold is predicted to occur in three water supply bores screened in / attributed to the Rewan Group during the Project development (LTAA), with one predicted to be impacted during the current UWIR period (IAA). Baseline assessments and a monitoring and management plan for these bores will be implemented prior to the establishment and development of CSG wells within the vicinity of these bores.

This groundwater report demonstrates that impacts to surficial Cenozoic aquifers as a result of the Project is limited based on the model predictions. Some depressurisation of the Baralaba Coal Measures used for CSG production can be expected, with limited propagation to the layers immediately above it. The depressurisation does not propagate to the surface. It is considered that Westside’s current CSG activities pose little risk to the Fitzroy Basin surface water, shallow groundwater systems and associated ecosystems.

14 CLOSING

We thank you for the opportunity to work on this assignment. Should you have any further queries please do not hesitate to contact the undersigned.

Yours truly,

KCB AUSTRALIA PTY LTD.

Carly Waterhouse, RPGeo
Senior Hydrogeologist Associate

CW:SW

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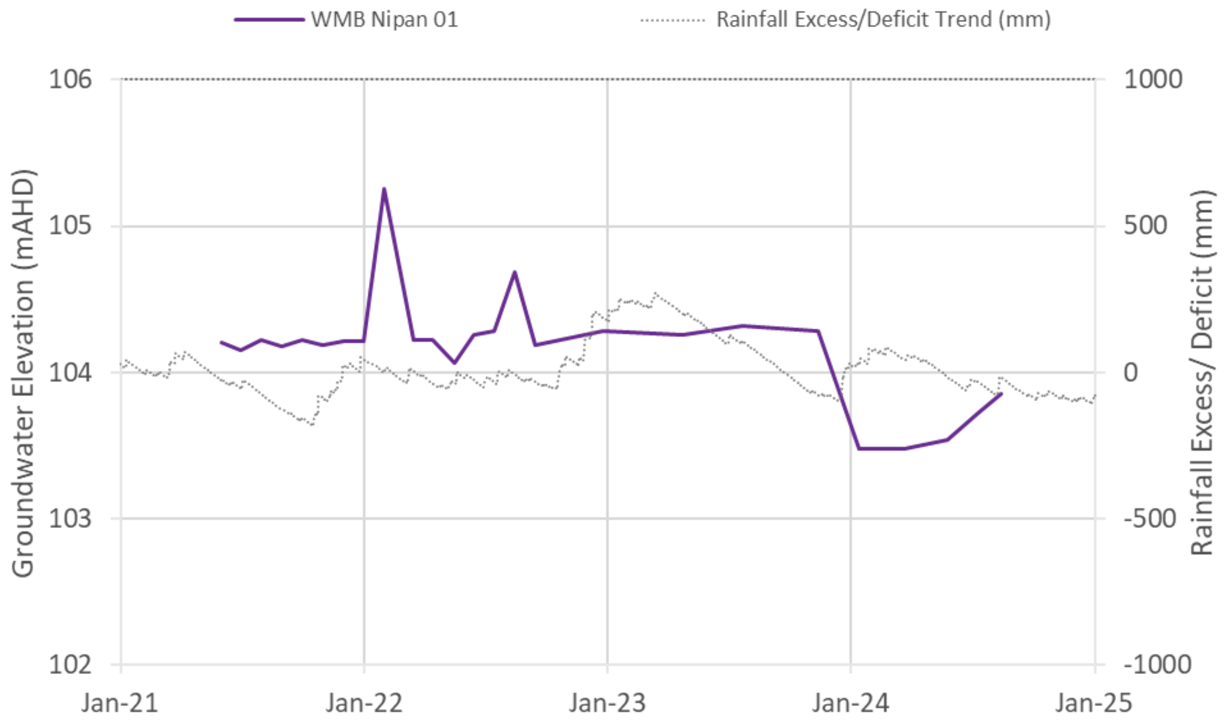
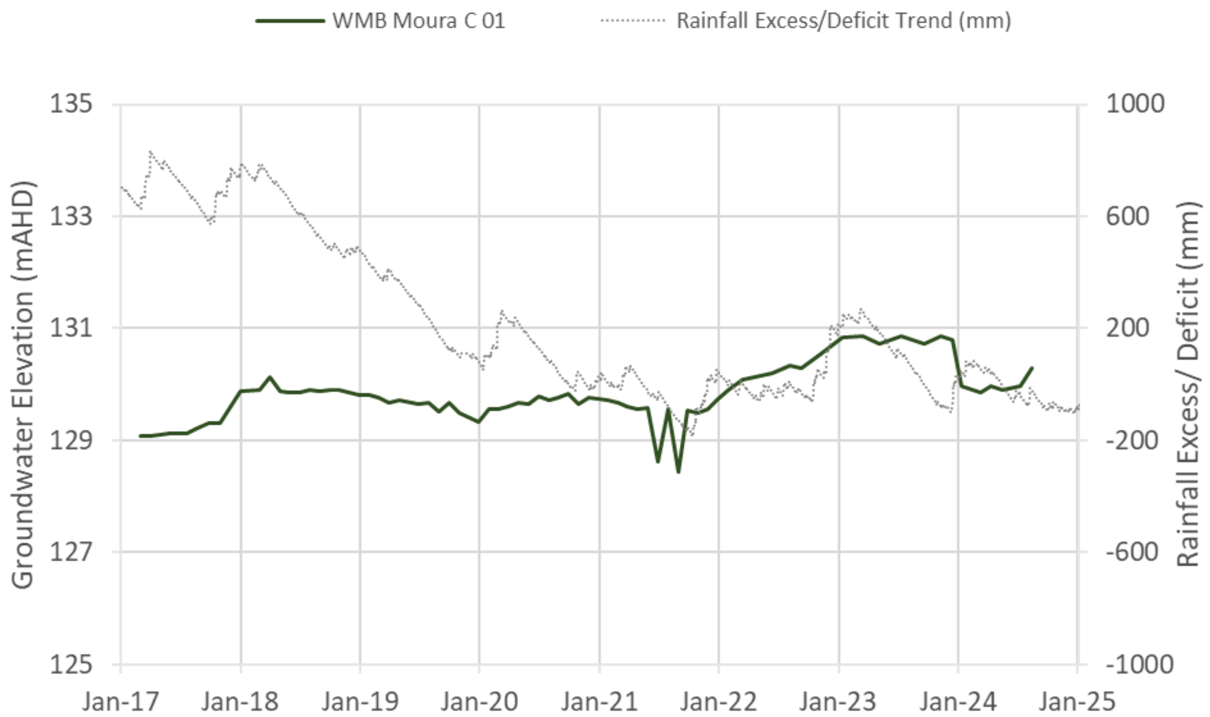
APPENDIX I

Westside Monitoring Bores Hydrographs

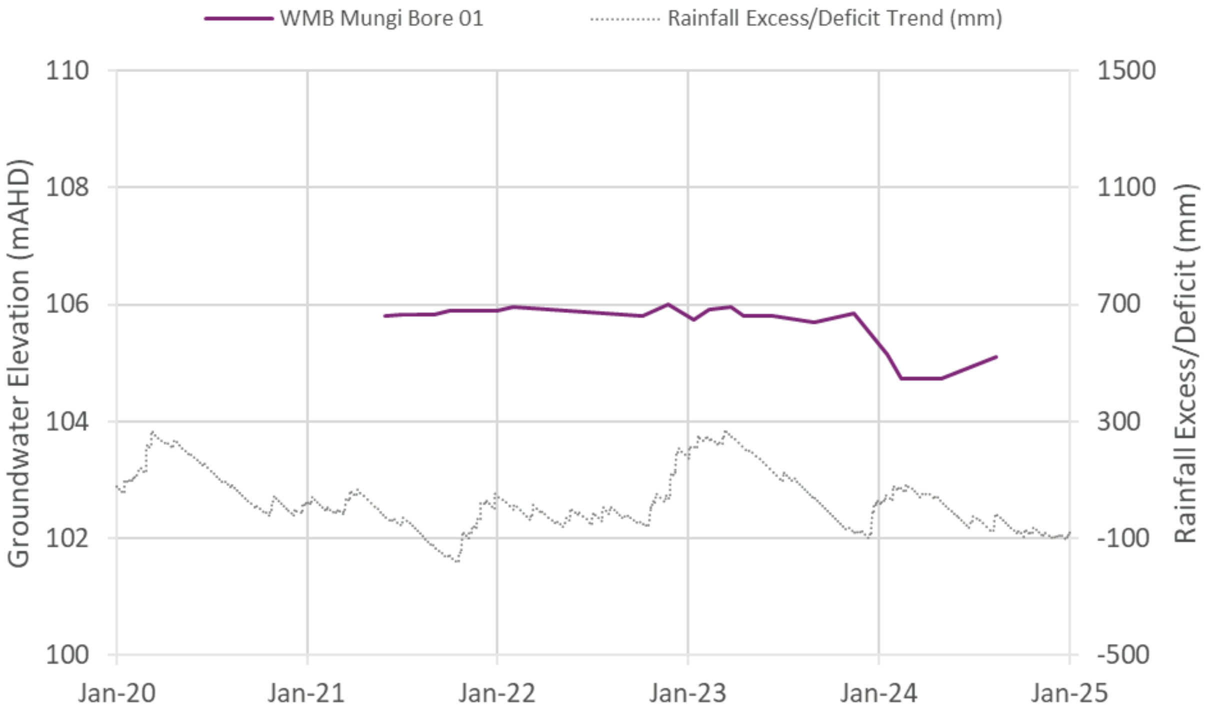
Appendix I
Monitoring Bore Hydrographs

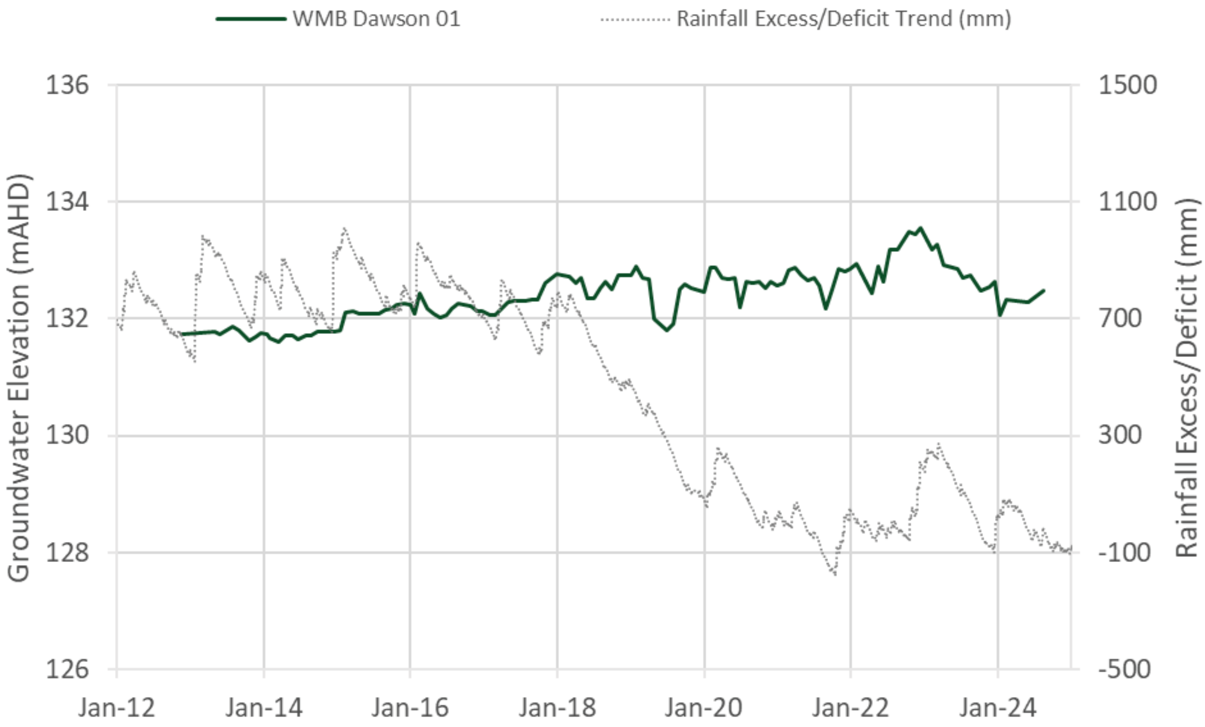
I-1 ALLUVIUM



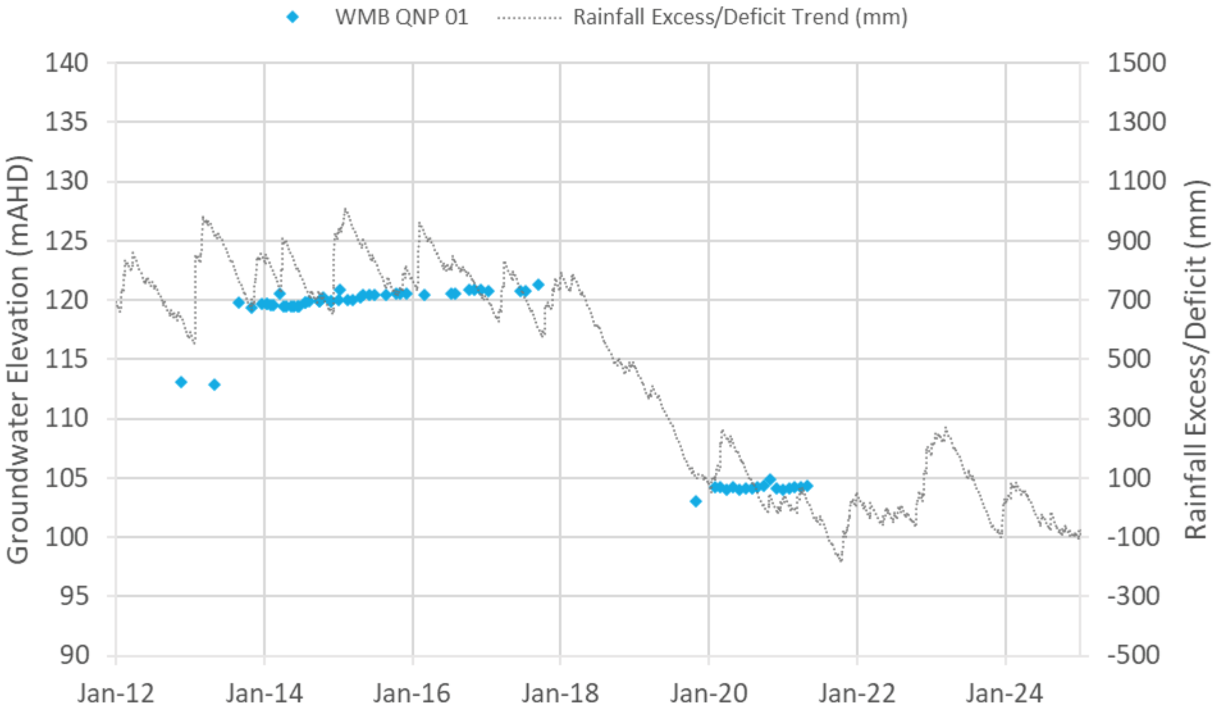


I-2 TERTIARY SEDIMENTS





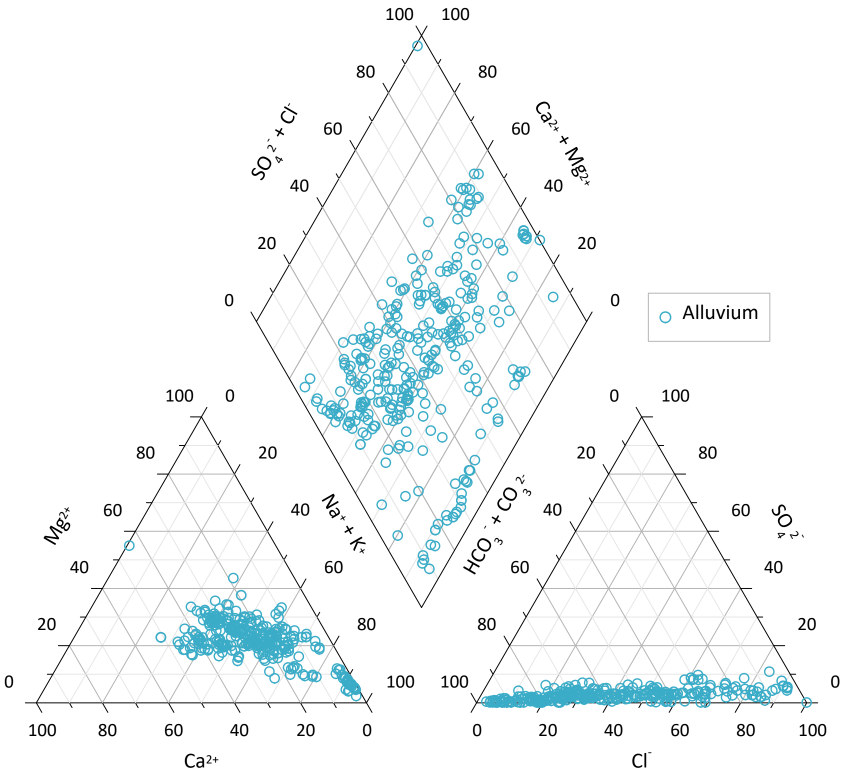
I-3 REWAN FORMATION



APPENDIX II

Groundwater Quality Piper Plots

Appendix II
Water Quality Pipers



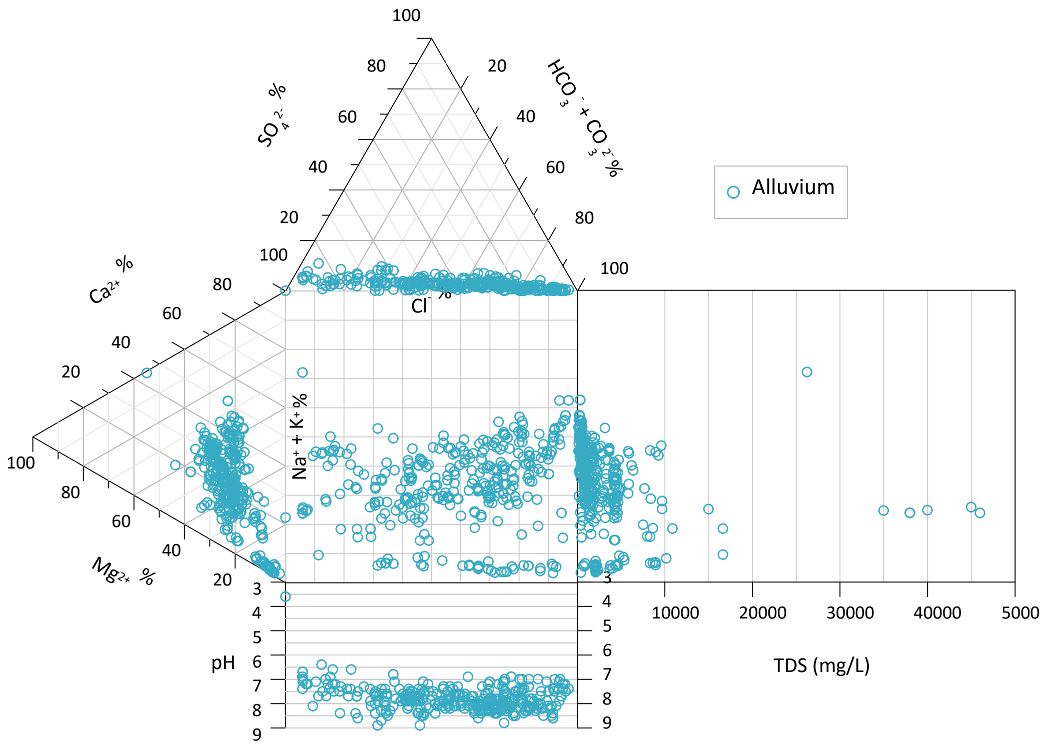


Figure 1 **Piper and Durov Diagram – Alluvium**

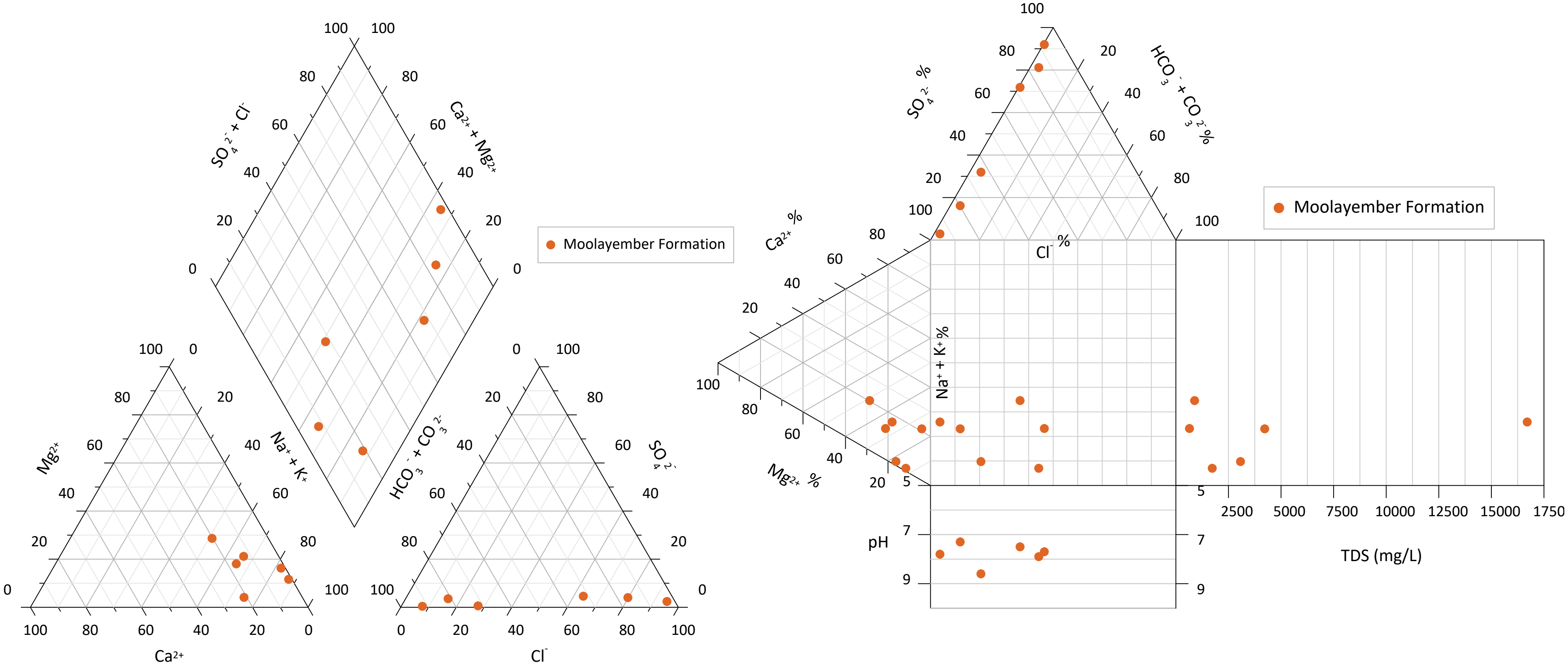


Figure 2 **Piper and Durov Diagram – Moolayember Formation**

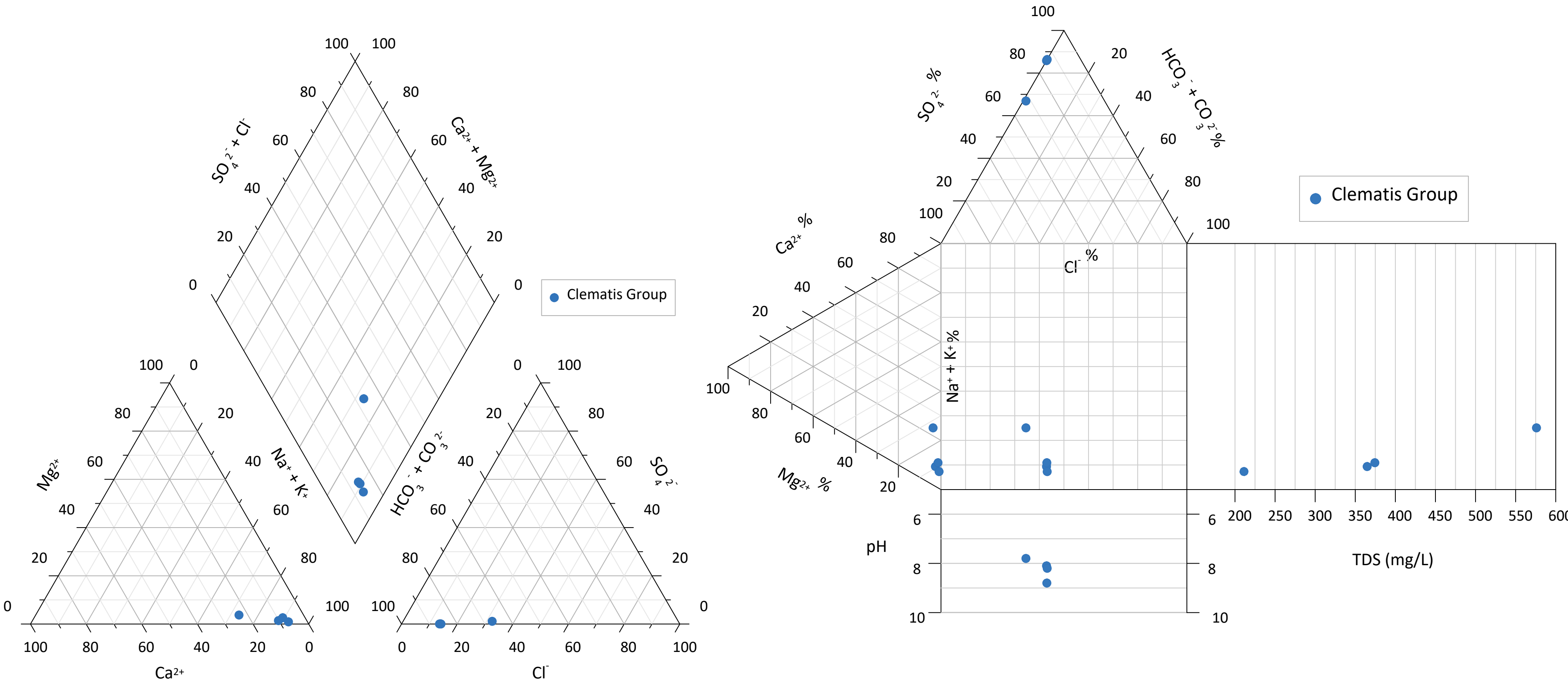


Figure 3 Piper and Durov Diagram – Clematis Group

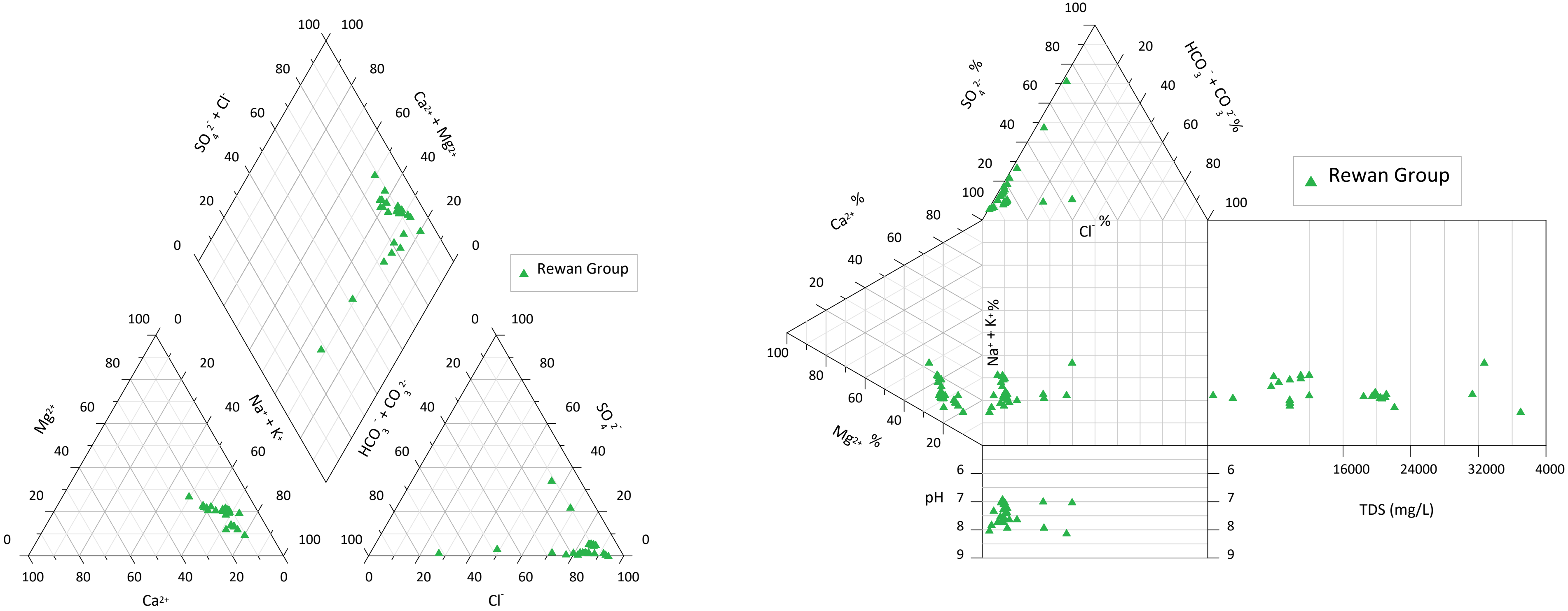
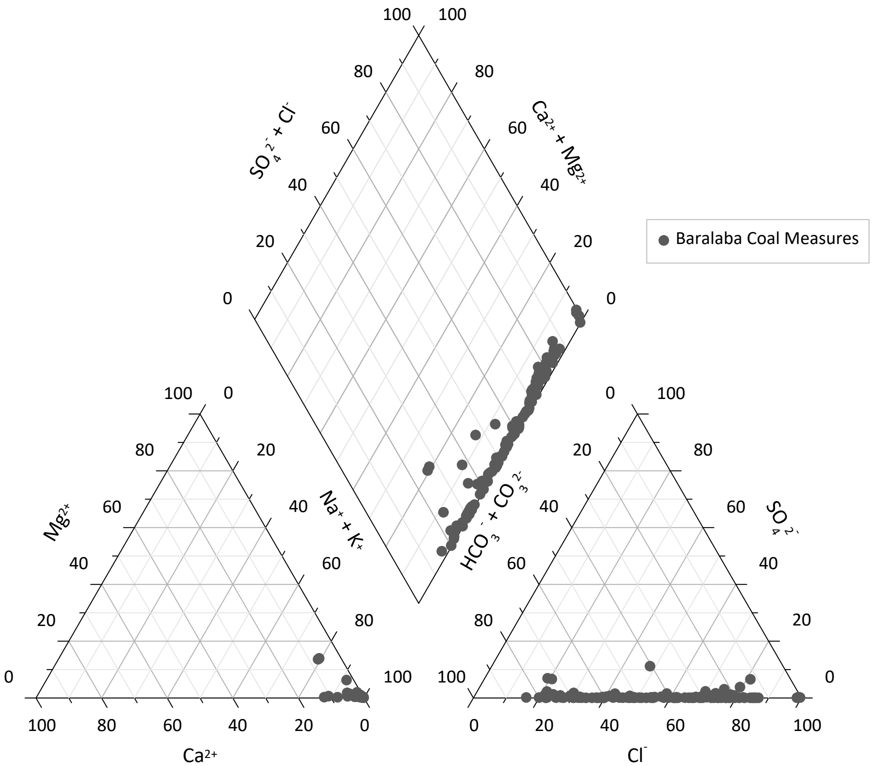


Figure 4 **Piper and Durov Diagram – Rewan Group**



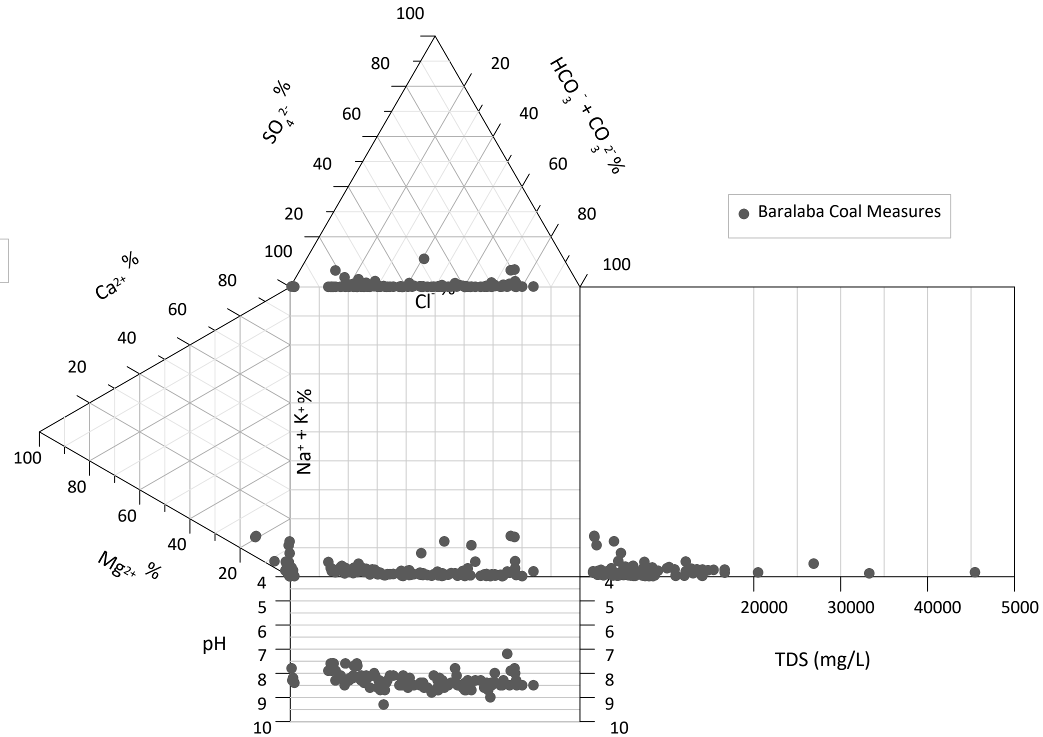


Figure 5 **Piper and Durov Diagram – Baralaba Coal Measures**

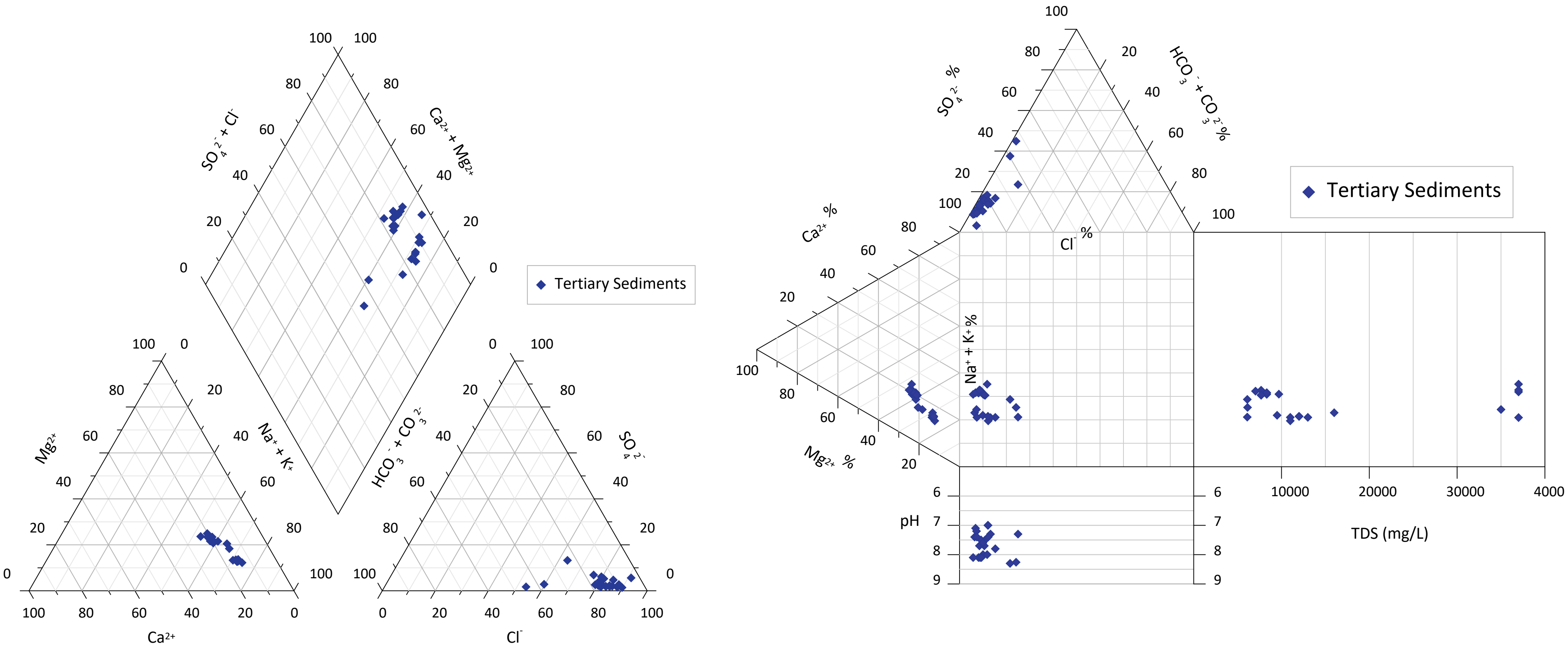


Figure 6 **Piper and Durov Diagram – Tertiary Sediments**

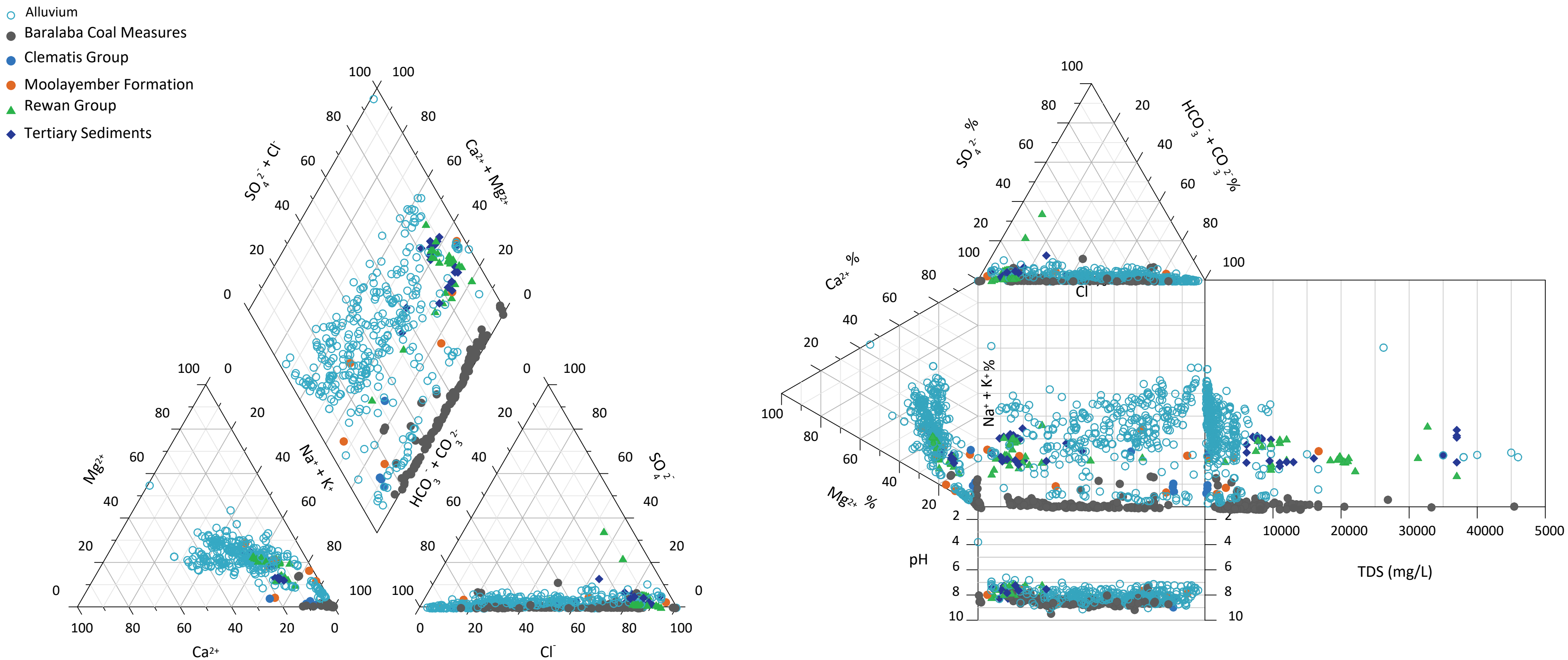
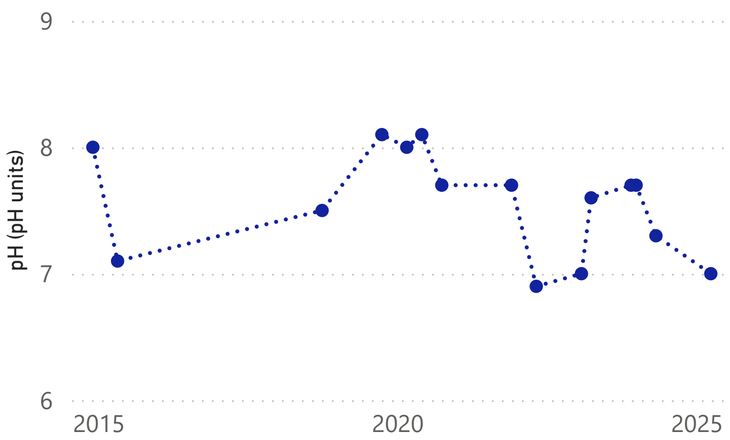


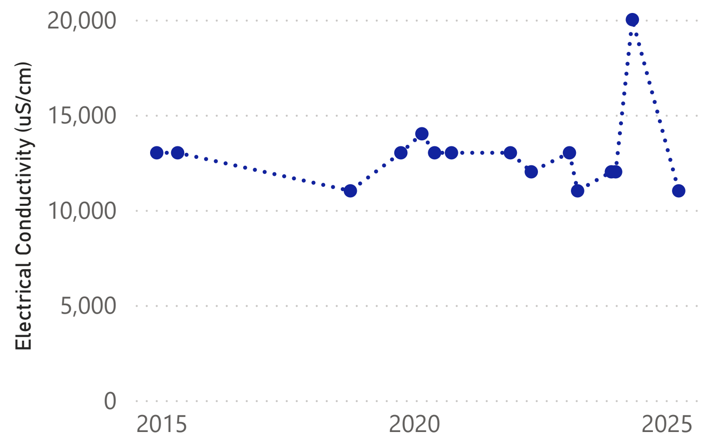
Figure 7 Piper and Durov Diagram – All Water Quality Data for the Hydrostratigraphic Uni

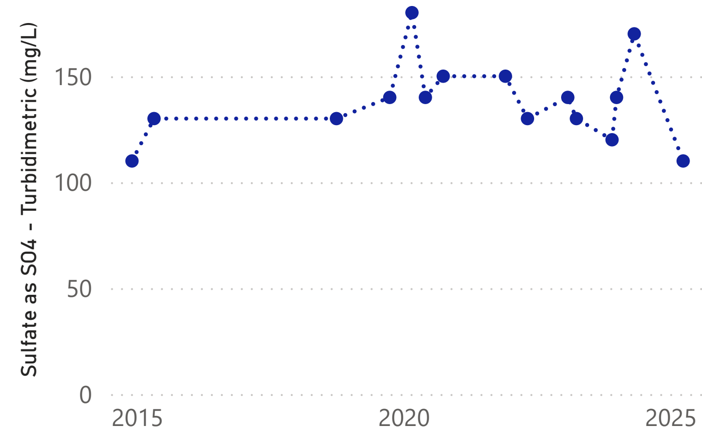
APPENDIX III

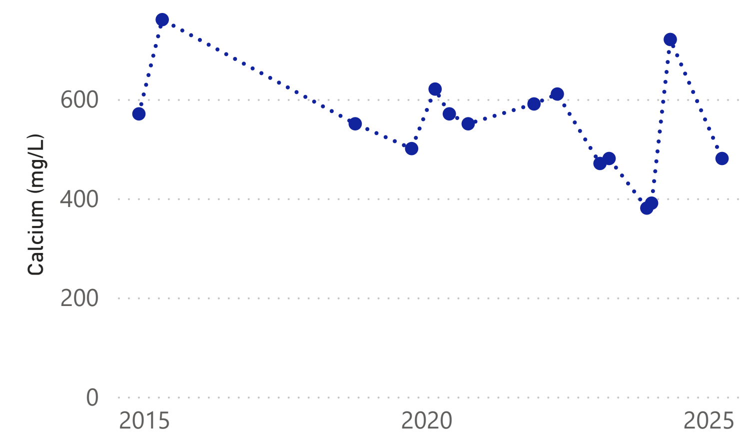
Westside Monitoring Bores Water Quality Time-Series Plots

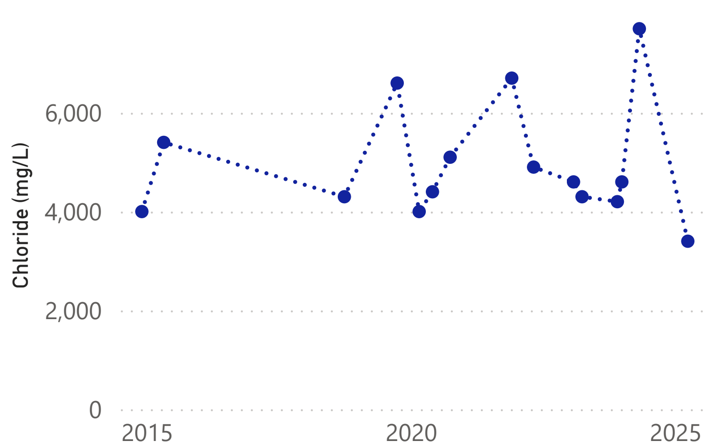
Dawson

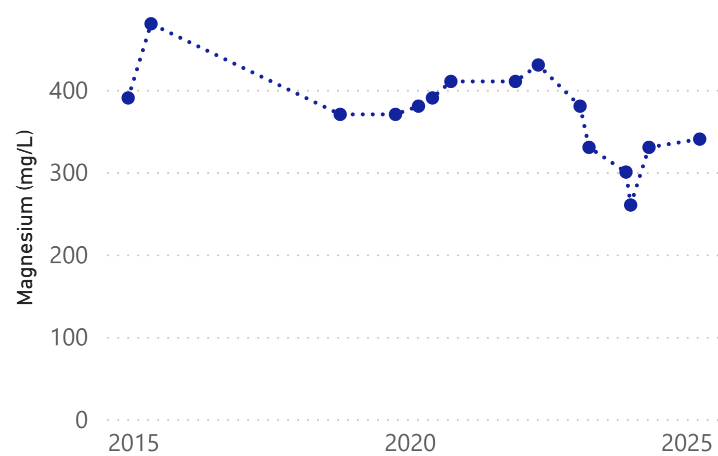

pH (pH units)
9
8
7
6
2015
2020
2025

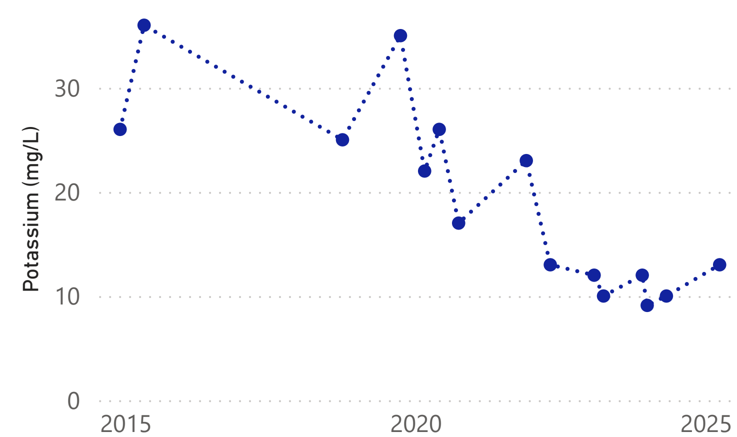

Electrical Conductivity (uS/cm)
20,000
15,000
10,000
5,000
0
2015
2020
2025

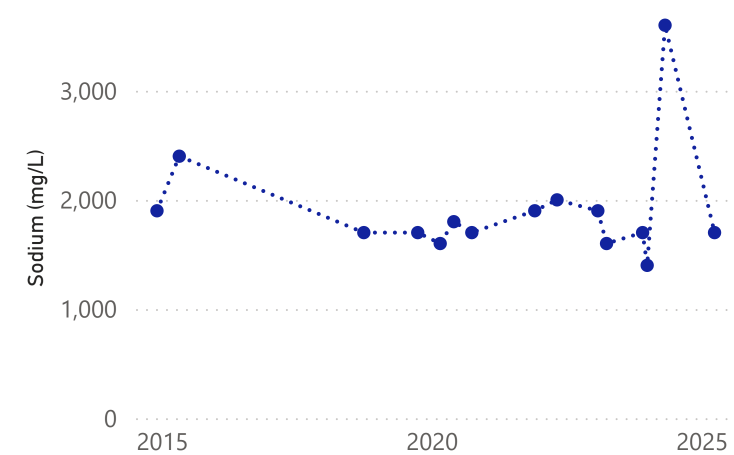

Sulfate as SO4 - Turbidimetric (mg/L)
150
100
50
0
2015
2020
2025

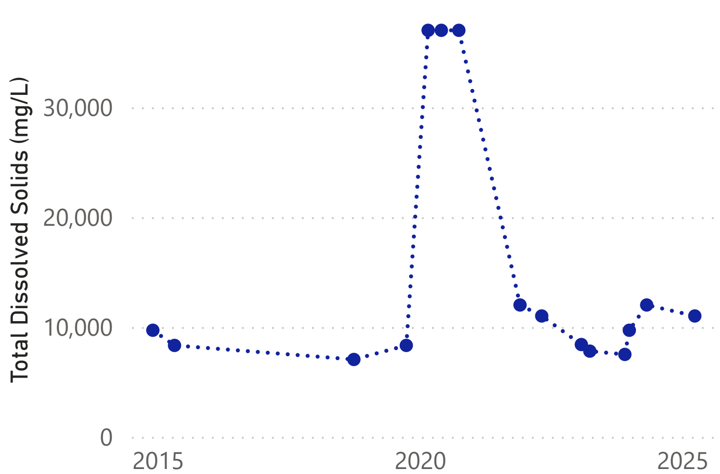

Calcium (mg/L)
600
400
200
0
2015
2020
2025

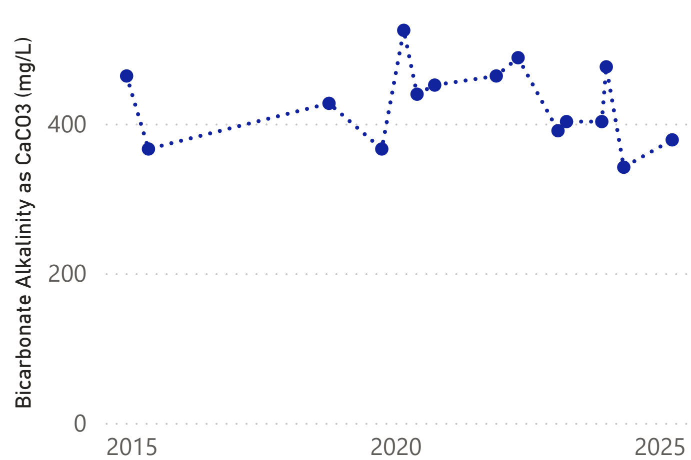

Chloride (mg/L)
6,000
4,000
2,000
0
2015
2020
2025


Magnesium (mg/L)
400
300
200
100
0
2015
2020
2025

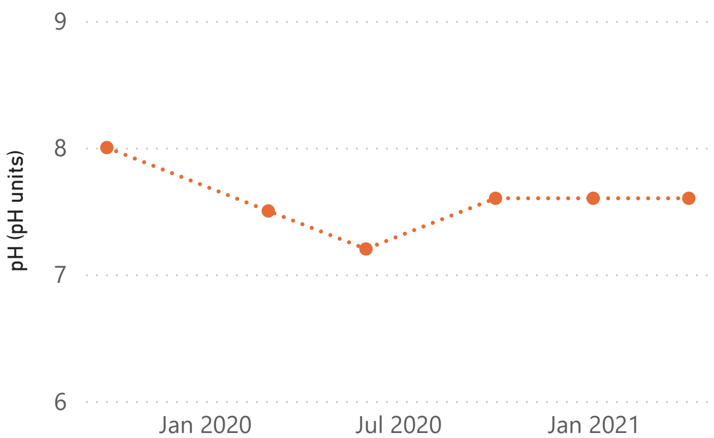

Potassium (mg/L)
30
20
10
0
2015
2020
2025

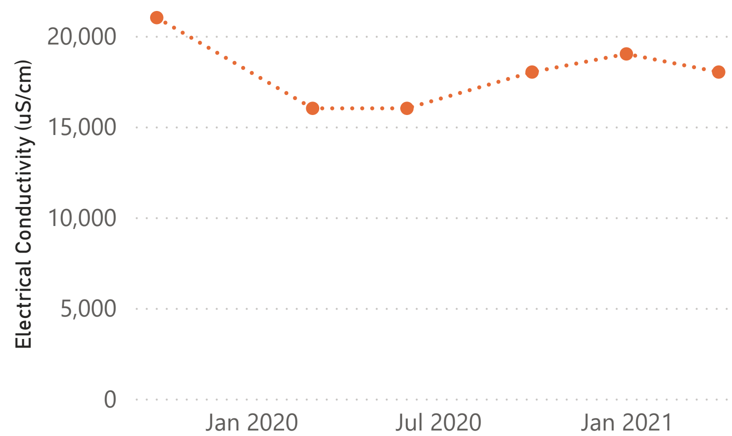

Sodium (mg/L)
3,000
2,000
1,000
0
2015
2020
2025

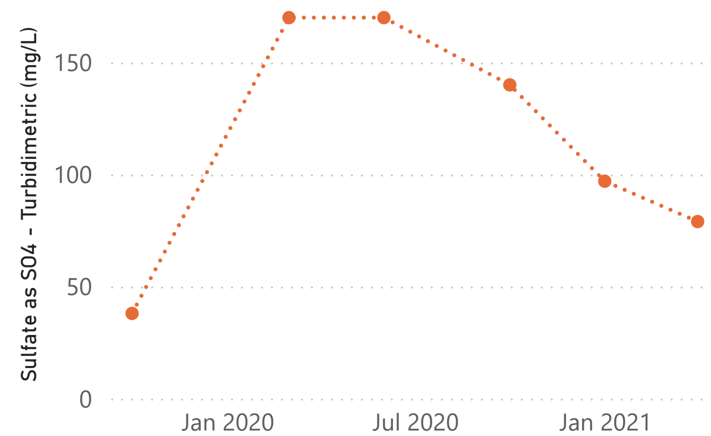

Total Dissolved Solids (mg/L)
30,000
20,000
10,000
0
2015
2020
2025

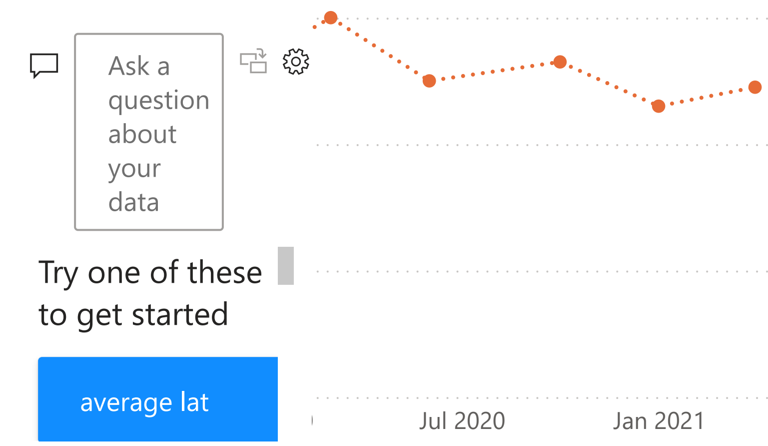

Bicarbonate Alkalinity as CaCO3 (mg/L)
400
200
0
2015
2020
2025

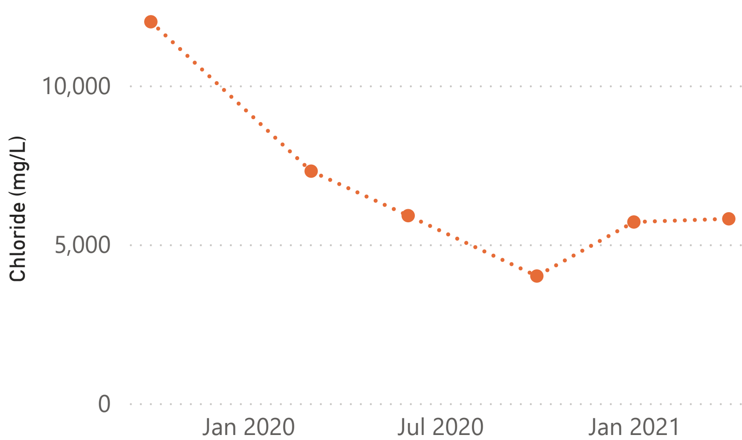
GW14

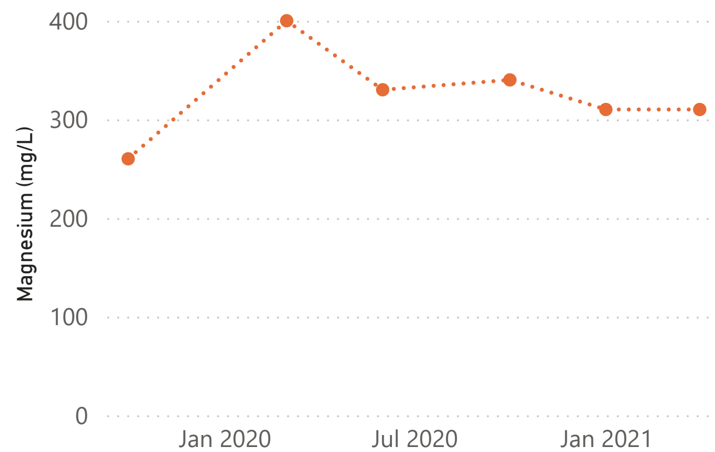

pH (pH units)
9
8
7
6
Jan 2020
Jul 2020
Jan 2021

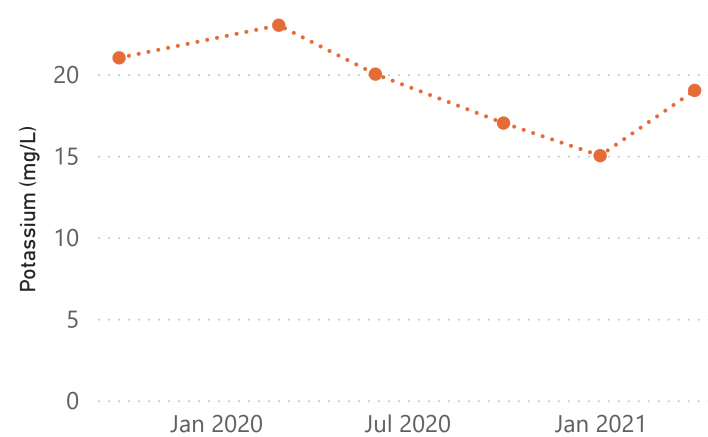

Electrical Conductivity (uS/cm)
20,000
15,000
10,000
5,000
0
Jan 2020
Jul 2020
Jan 2021

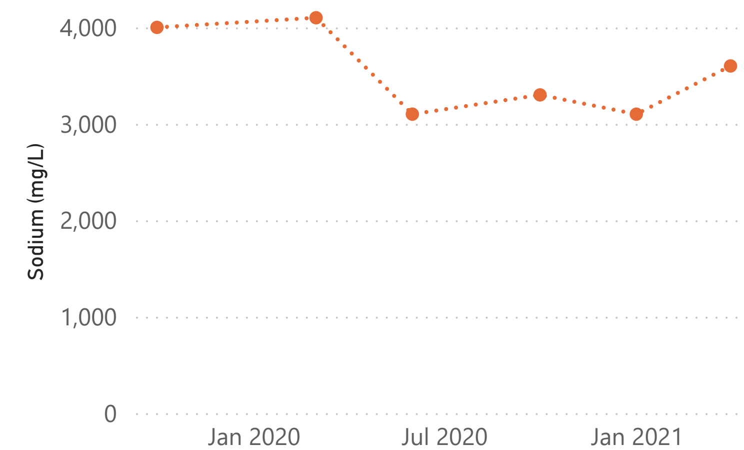

Sulfate as SO4 - Turbidimetric (mg/L)
150
100
50
0
Jan 2020
Jul 2020
Jan 2021

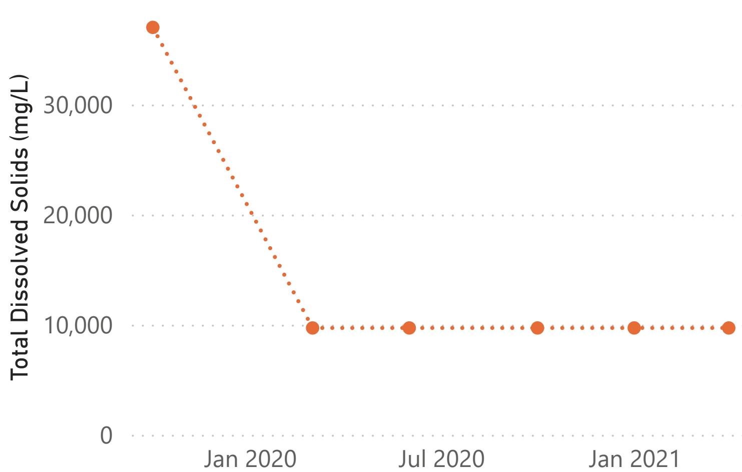

Ask a question about your data
Try one of these to get started
average lat
Jul 2020
Jan 2021

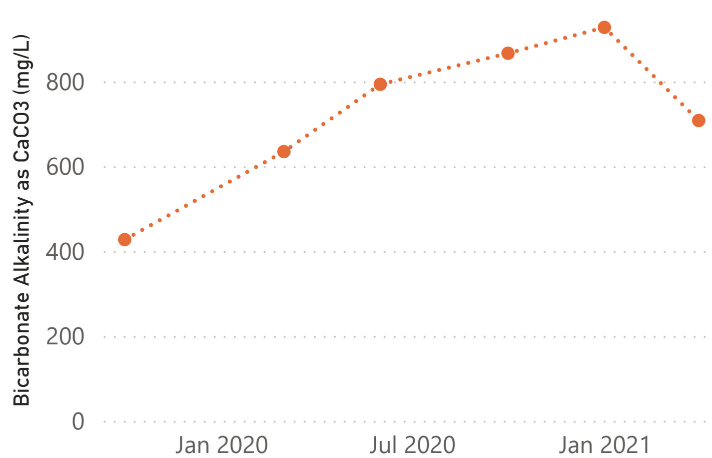

Chloride (mg/L)
10,000
5,000
0
Jan 2020
Jul 2020
Jan 2021


Magnesium (mg/L)
400
300
200
100
0
Jan 2020
Jul 2020
Jan 2021

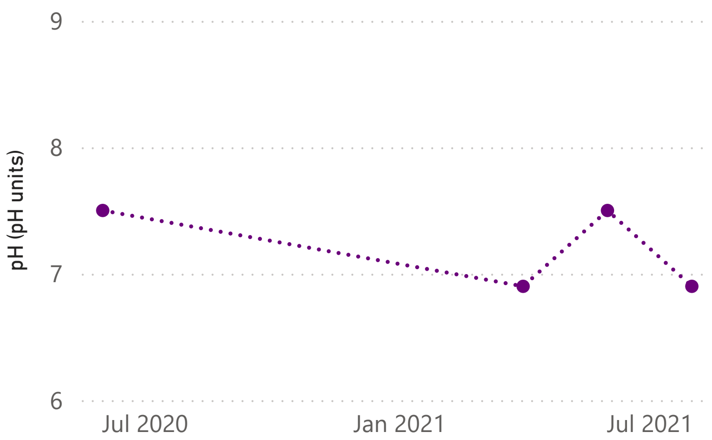

Potassium (mg/L)
20
15
10
5
0
Jan 2020
Jul 2020
Jan 2021

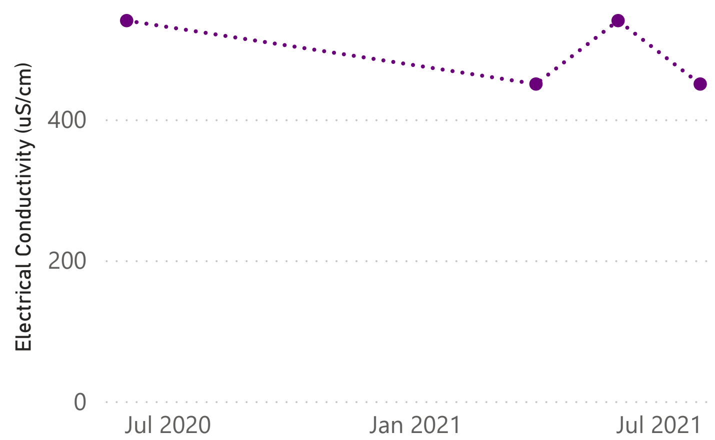

Sodium (mg/L)
4,000
3,000
2,000
1,000
0
Jan 2020
Jul 2020
Jan 2021

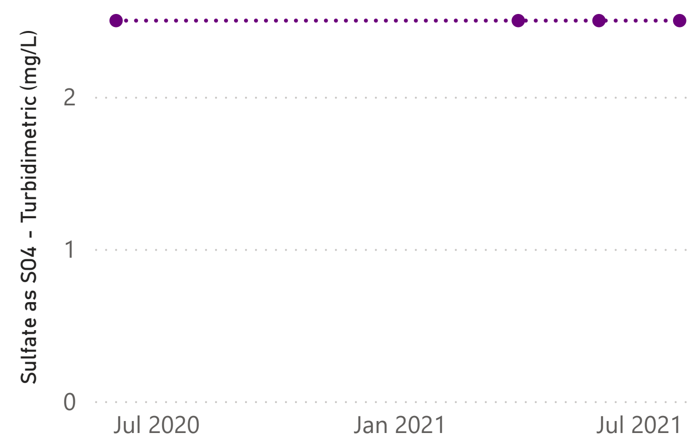

Total Dissolved Solids (mg/L)
30,000
20,000
10,000
0
Jan 2020
Jul 2020
Jan 2021

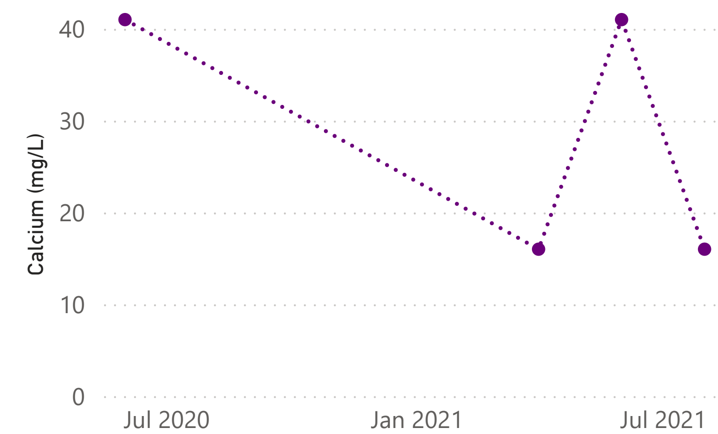

Bicarbonate Alkalinity as CaCO3 (mg/L)
800
600
400
200
0
Jan 2020
Jul 2020
Jan 2021

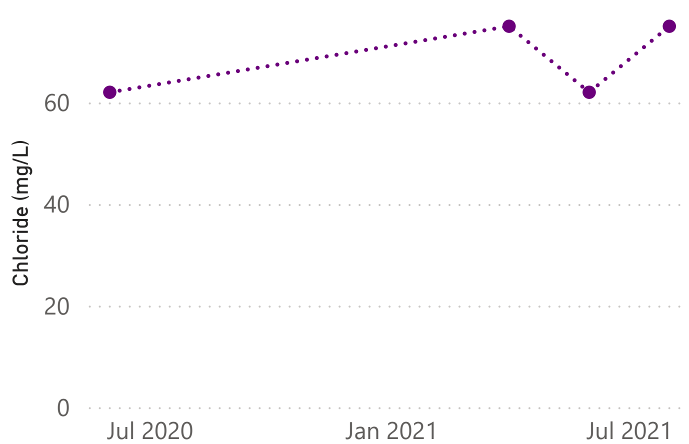
Hills

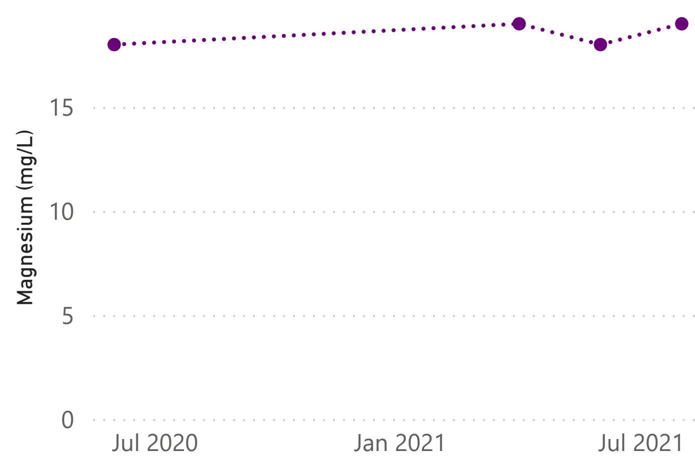

pH (pH units)
9
8
7
6
Jul 2020
Jan 2021
Jul 2021

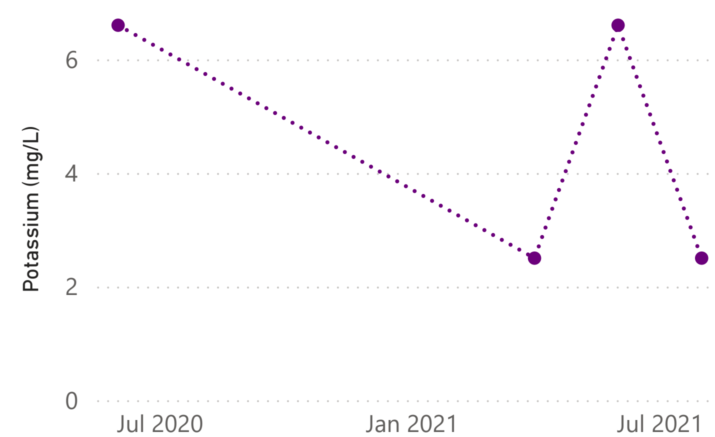

Electrical Conductivity (uS/cm)
400
200
0
Jul 2020
Jan 2021
Jul 2021

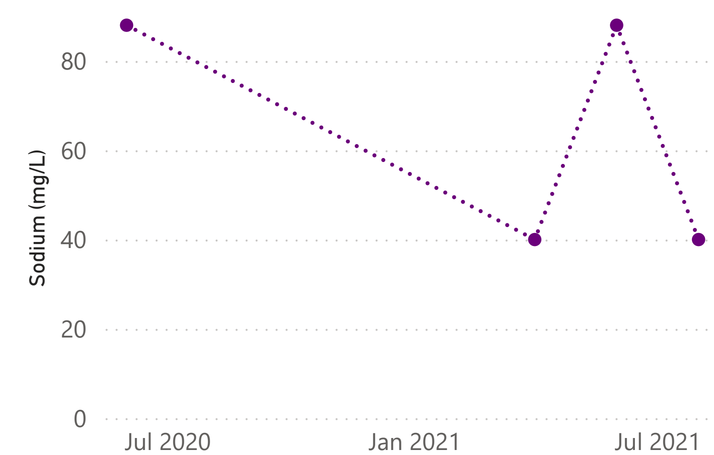

Sulfate as SO4 - Turbidimetric (mg/L)
2
1
0
Jul 2020
Jan 2021
Jul 2021

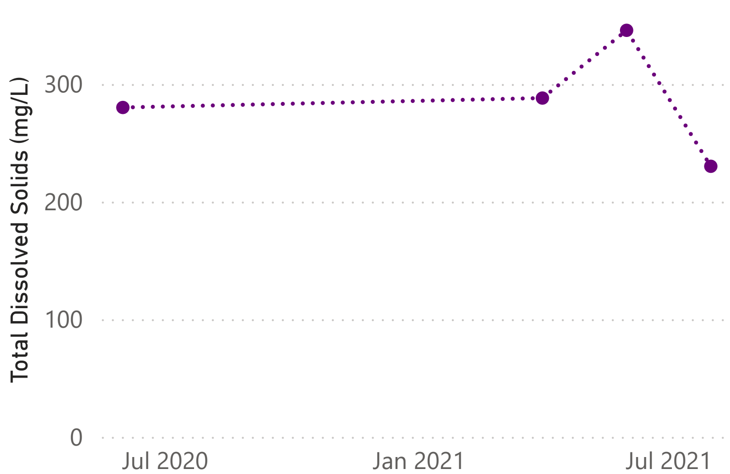

Calcium (mg/L)
40
30
20
10
0
Jul 2020
Jan 2021
Jul 2021

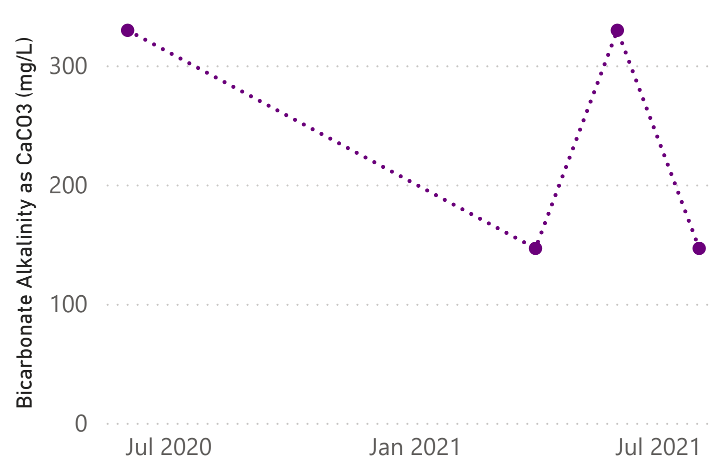

Chloride (mg/L)
60
40
20
0
Jul 2020
Jan 2021
Jul 2021


Magnesium (mg/L)
15
10
5
0
Jul 2020
Jan 2021
Jul 2021

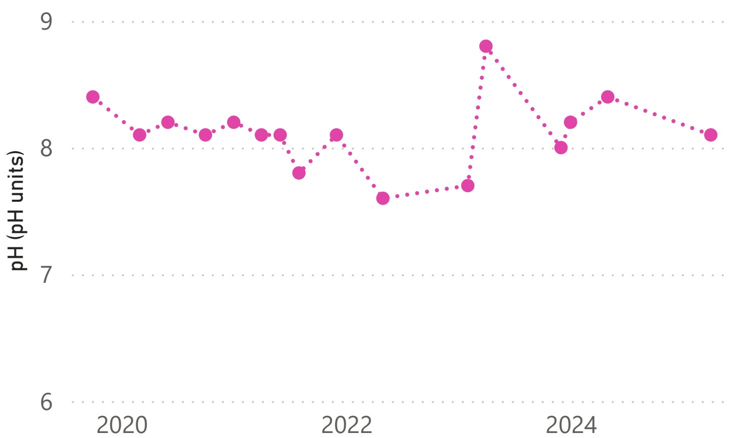

Potassium (mg/L)
6
4
2
0
Jul 2020
Jan 2021
Jul 2021

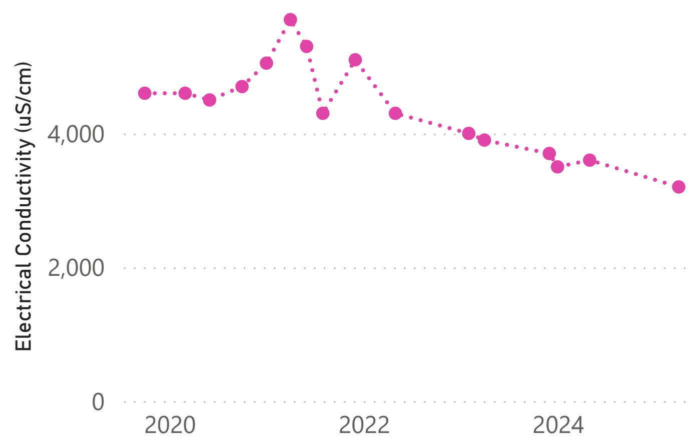

Sodium (mg/L)
80
60
40
20
0
Jul 2020
Jan 2021
Jul 2021

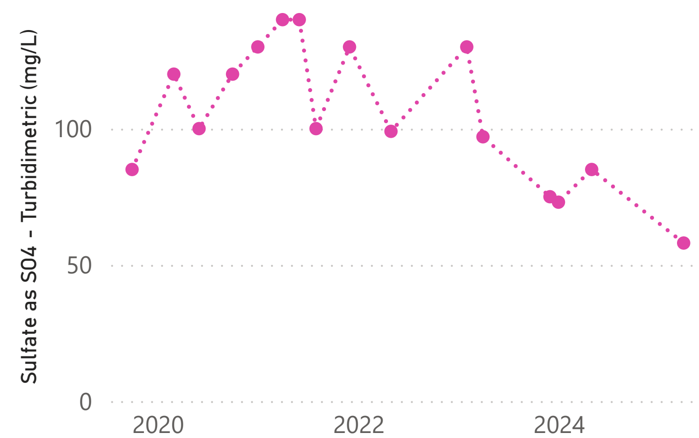

Total Dissolved Solids (mg/L)
300
200
100
0
Jul 2020
Jan 2021
Jul 2021

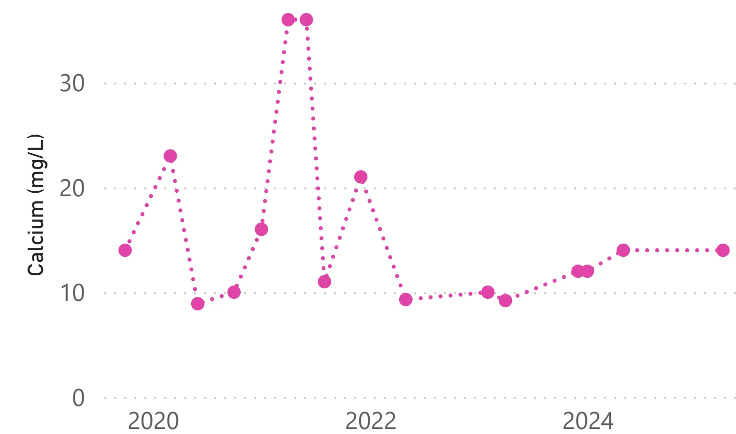

Bicarbonate Alkalinity as CaCO3 (mg/L)
300
200
100
0
Jul 2020
Jan 2021
Jul 2021

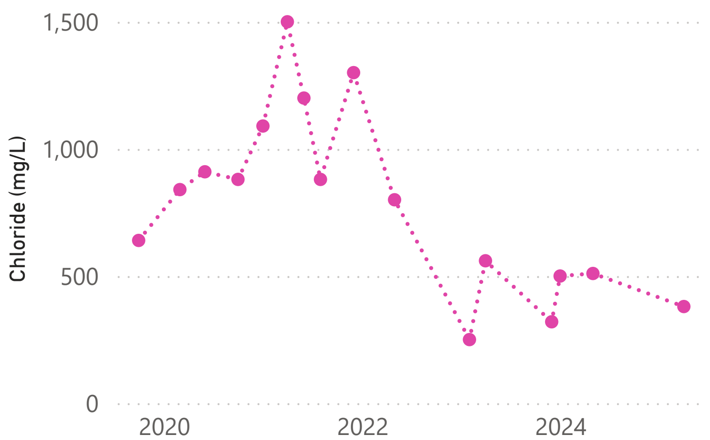
Moura C

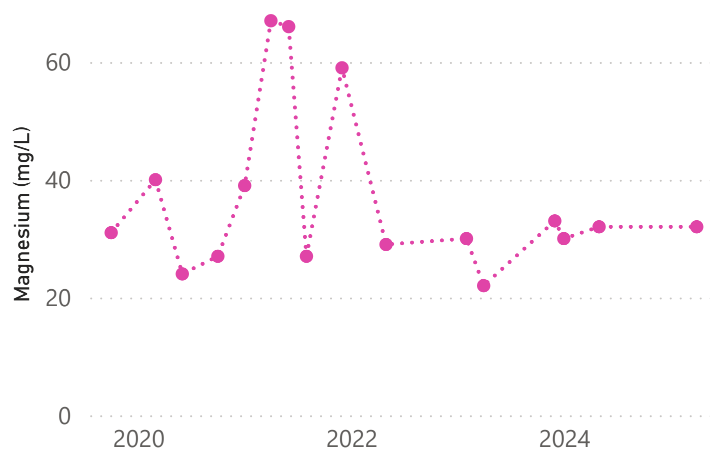

pH (pH units)
9
8
7
6
2020
2022
2024

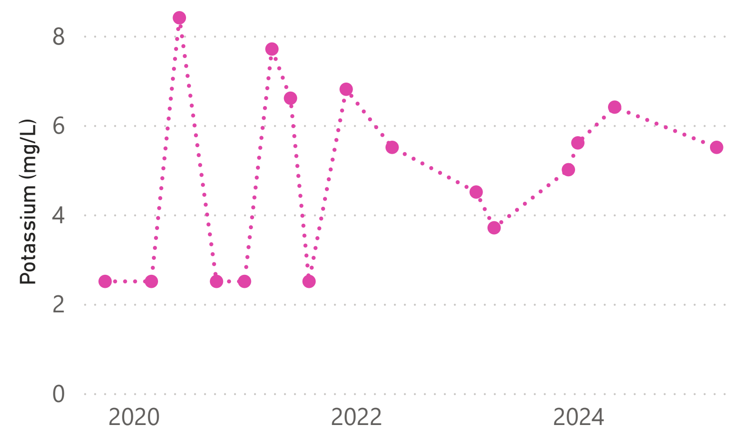

Electrical Conductivity (uS/cm)
4,000
2,000
0
2020
2022
2024

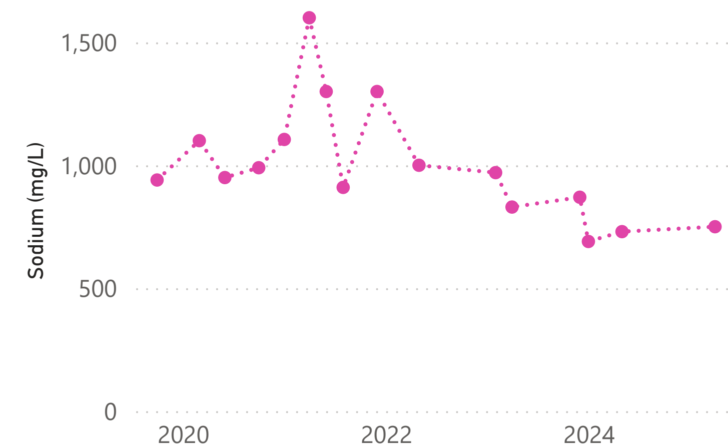

Sulfate as SO4 - Turbidimetric (mg/L)
100
50
0
2020
2022
2024

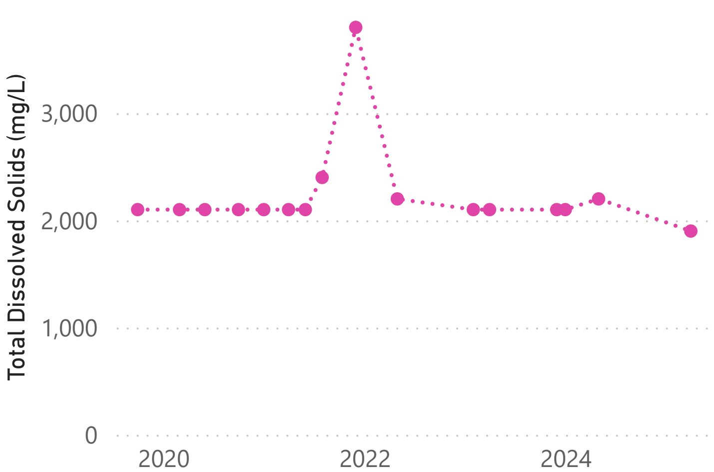

Calcium (mg/L)
30
20
10
0
2020
2022
2024

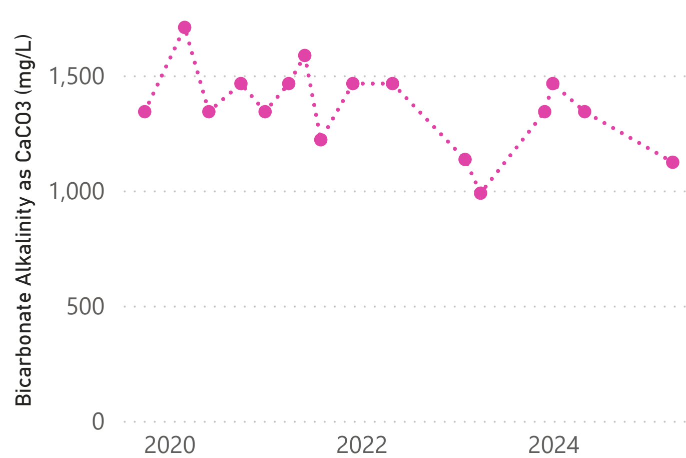

Chloride (mg/L)
1,500
1,000
500
0
2020
2022
2024


Magnesium (mg/L)
60
40
20
0
2020
2022
2024

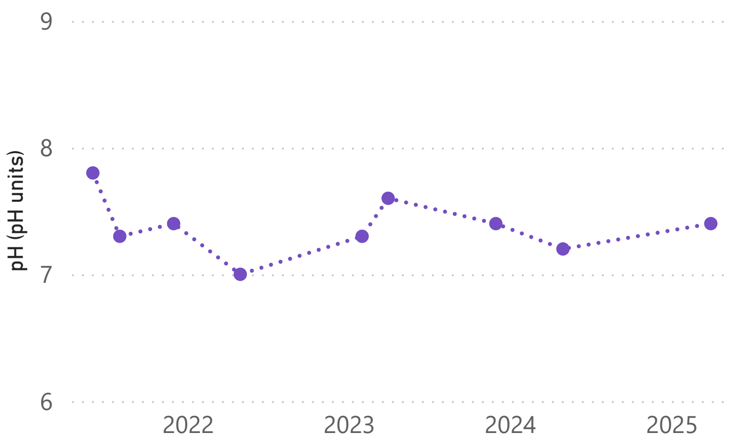

Potassium (mg/L)
8
6
4
2
0
2020
2022
2024

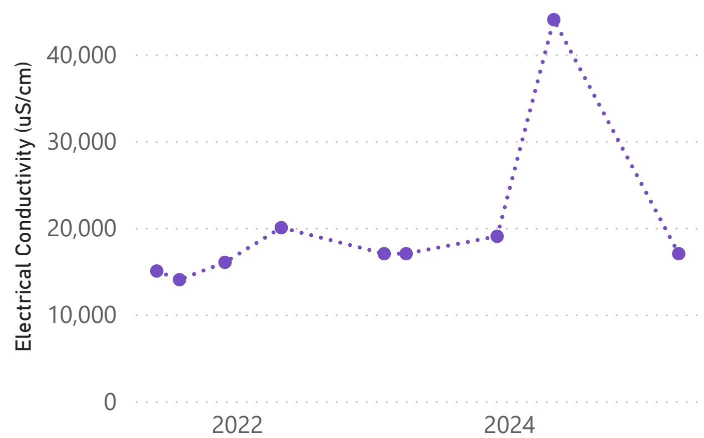

Sodium (mg/L)
1,500
1,000
500
0
2020
2022
2024

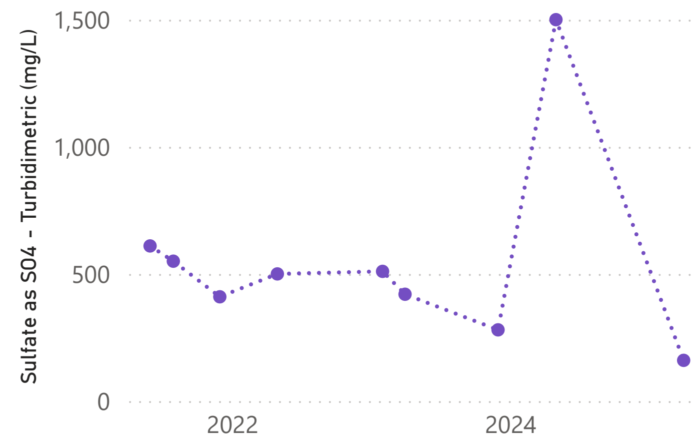

Total Dissolved Solids (mg/L)
3,000
2,000
1,000
0
2020
2022
2024

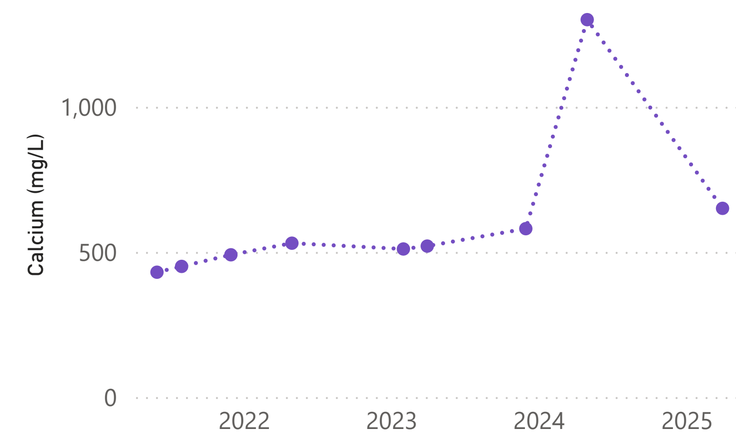

Bicarbonate Alkalinity as CaCO3 (mg/L)
1,500
1,000
500
0
2020
2022
2024

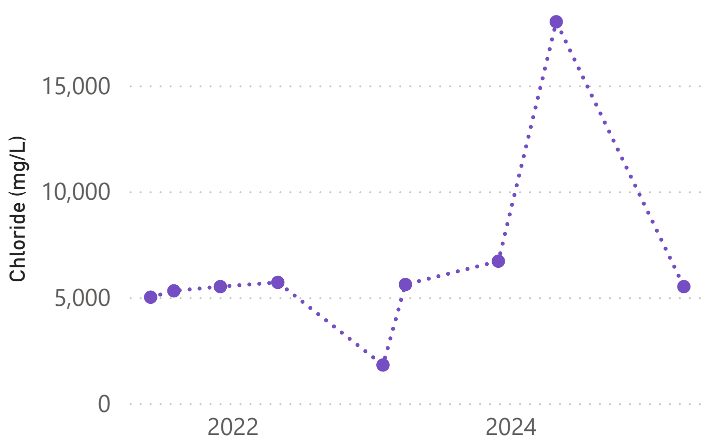
Mungi

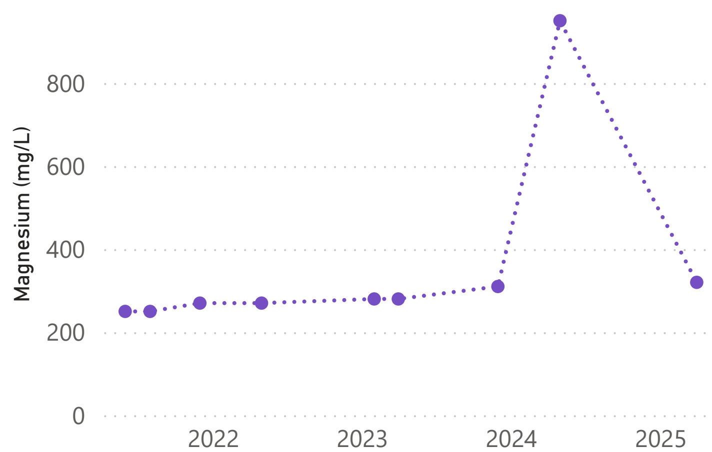

pH (pH units)
9
8
7
6
2022
2023
2024
2025

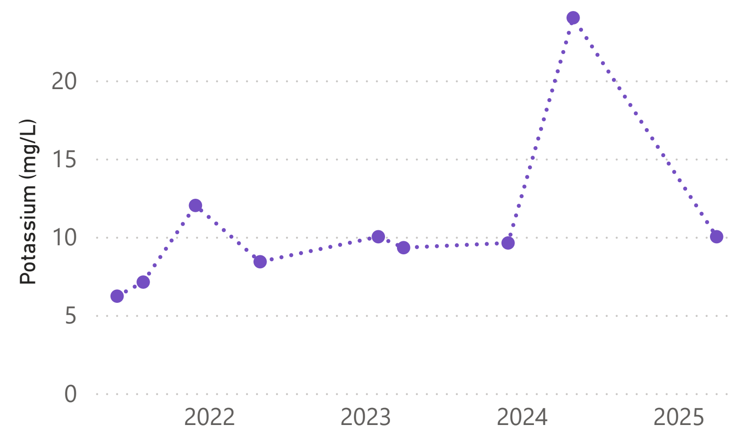

Electrical Conductivity (uS/cm)
40,000
30,000
20,000
10,000
0
2022
2024

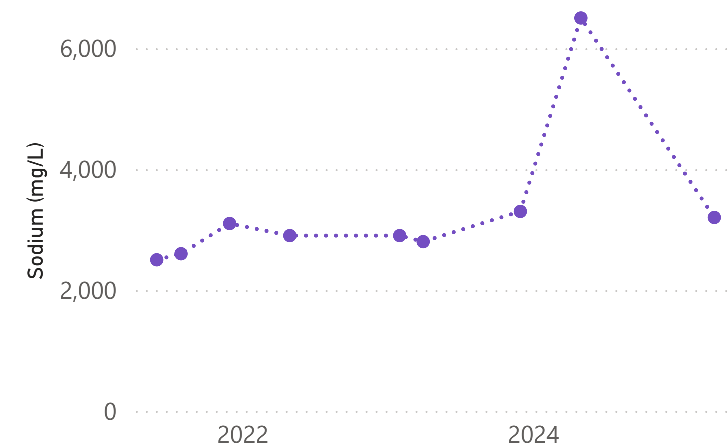

Sulfate as SO4 - Turbidimetric (mg/L)
1,500
1,000
500
0
2022
2024

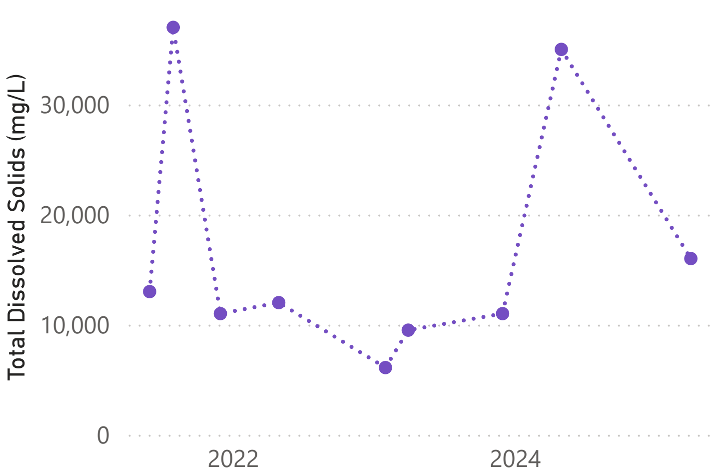

Calcium (mg/L)
1,000
500
0
2022
2023
2024
2025

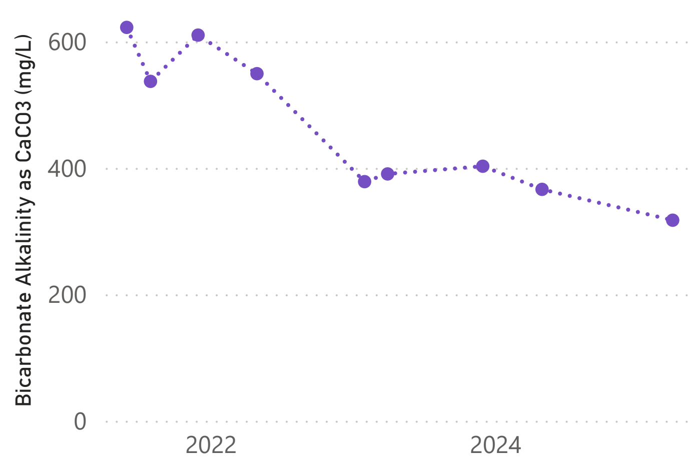

Chloride (mg/L)
15,000
10,000
5,000
0
2022
2024


Magnesium (mg/L)
800
600
400
200
0
2022
2023
2024
2025

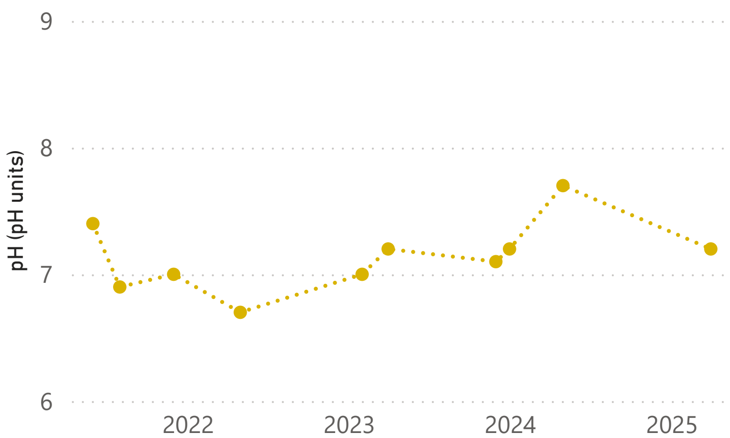

Potassium (mg/L)
20
15
10
5
0
2022
2023
2024
2025

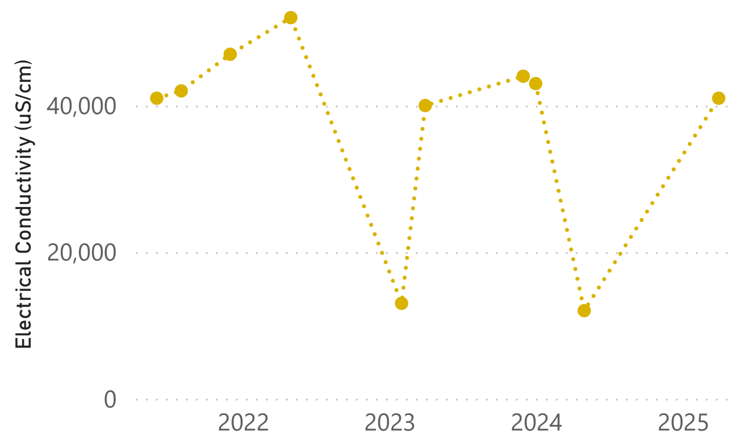

Sodium (mg/L)
6,000
4,000
2,000
0
2022
2024

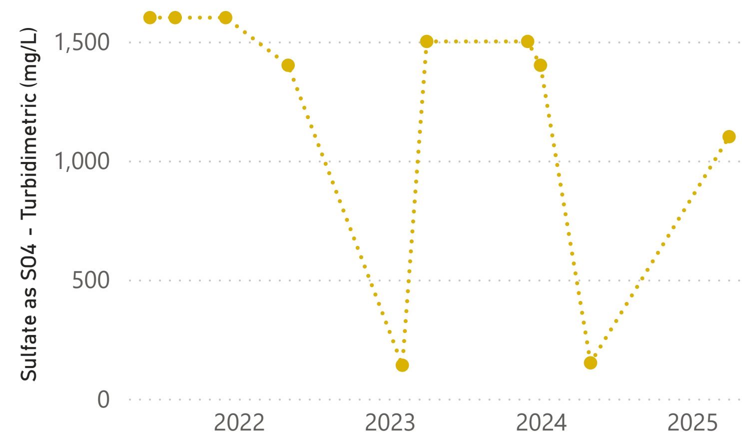

Total Dissolved Solids (mg/L)
30,000
20,000
10,000
0
2022
2024

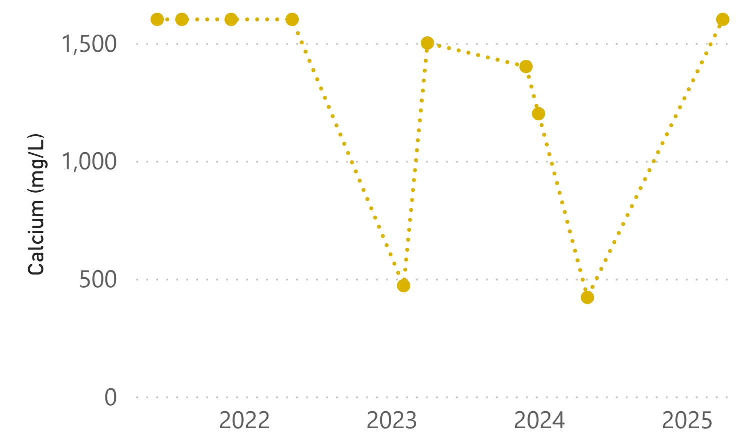

Bicarbonate Alkalinity as CaCO3 (mg/L)
600
400
200
0
2022
2024

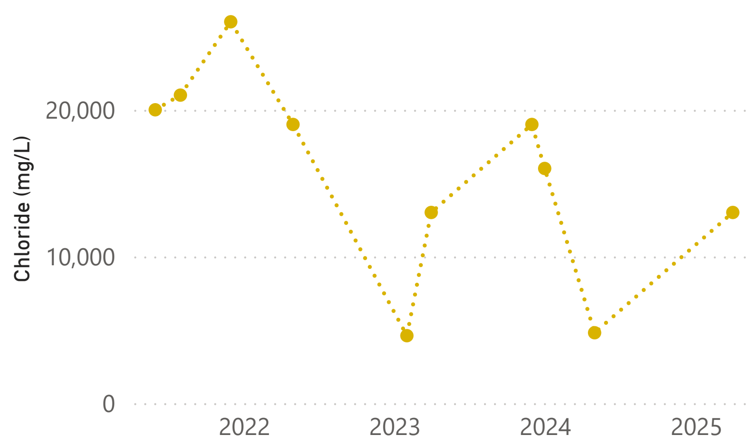
Nipan

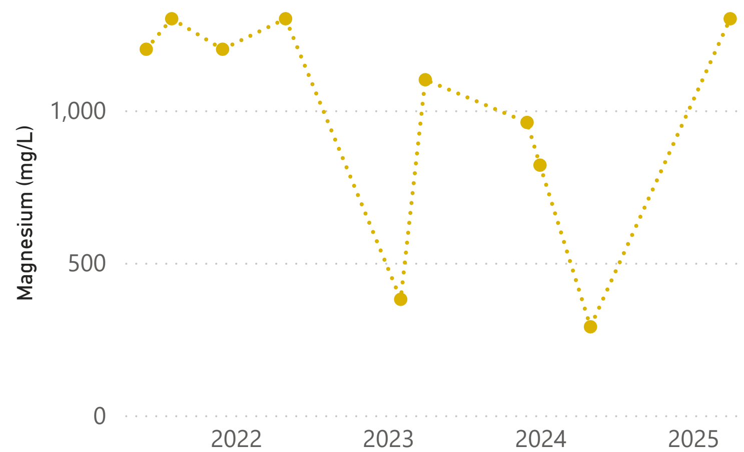

pH (pH units)
9
8
7
6
2022
2023
2024
2025

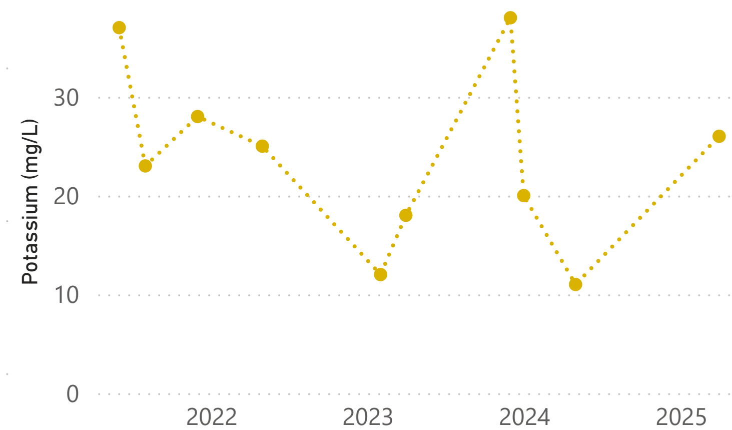

Electrical Conductivity (uS/cm)
40,000
20,000
0
2022
2023
2024
2025

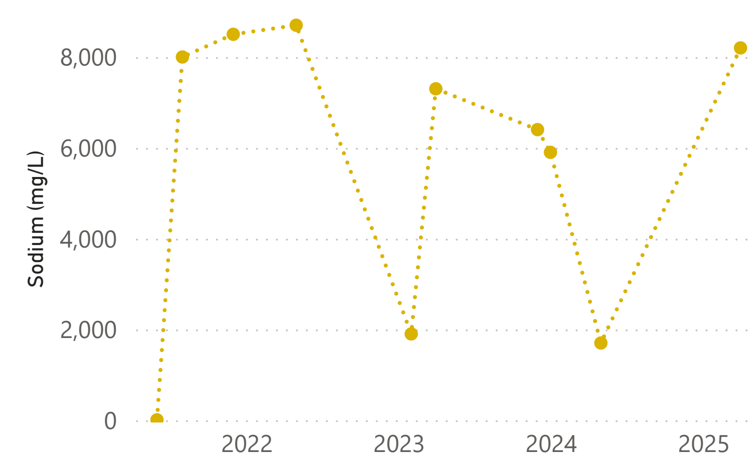

Sulfate as SO4 - Turbidimetric (mg/L)
1,500
1,000
500
0
2022
2023
2024
2025

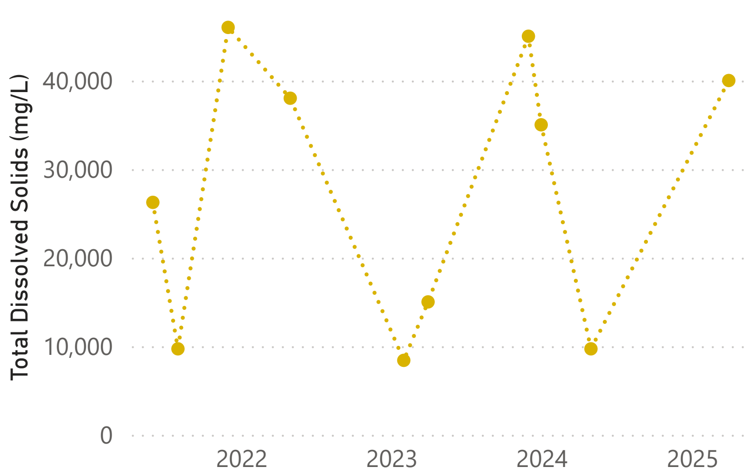

Calcium (mg/L)
1,500
1,000
500
0
2022
2023
2024
2025

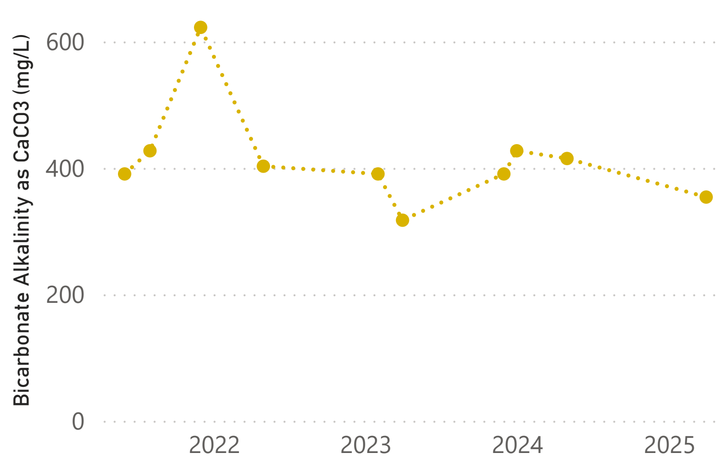

Chloride (mg/L)
20,000
10,000
0
2022
2023
2024
2025


Magnesium (mg/L)
1,000
500
0
2022
2023
2024
2025


Potassium (mg/L)
30
20
10
0
2022
2023
2024
2025


Sodium (mg/L)
8,000
6,000
4,000
2,000
0
2022
2023
2024
2025


Total Dissolved Solids (mg/L)
40,000
30,000
20,000
10,000
0
2022
2023
2024
2025


Bicarbonate Alkalinity as CaCO3 (mg/L)
600
400
200
0
2022
2023
2024
2025