Andover Lithium - Hydrogeological Assessment

Prepared for Azure Minerals Ltd

December 2025

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Azure Minerals Ltd

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December 2025

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Executive Summary

This hydrogeological assessment supports the environmental approvals process for the proposed Andover Lithium Project, located approximately 35 kilometres (km) south-east of Karratha in the Pilbara region of Western Australia. The project involves mining lithium-bearing pegmatite ore bodies, including the TA3 pit, which will extend below the groundwater table. The assessment aims to develop a conceptual hydrogeological model to evaluate potential impacts on inland water values associated with groundwater abstraction for construction water supply and dewatering during below-water-table mining.

The project area is characterised by an arid climate with highly variable rainfall and high evaporation rates, resulting in a persistent moisture deficit. Surface hydrology is dominated by ephemeral systems such as the Harding River and Jones River, which provide episodic recharge during cyclonic or intense storm events. The construction of Harding Dam in 1984 has significantly reduced downstream flows, further limiting the frequency and magnitude of recharge events in the lower catchment.

Six principal hydrostratigraphic units have been identified in the study area. Quaternary alluvial deposits form discontinuous but locally productive shallow aquifers, particularly along major drainage lines. Tidal aquifers occur in coastal flats, where groundwater is saline to hypersaline and strongly influenced by tidal processes. Weathered and fractured rock units have limited extent and low transmissivity, providing only minor localised storage and flow. Within the Andover Intrusion, groundwater is largely confined to near-surface fractures and fault zones, with deeper sections typically dry. The remaining basement formations act mostly as low-permeability aquitards, further restricting regional groundwater movement.

Groundwater occurs within a combination of shallow alluvial units, tidally influenced coastal aquifers, and fracture-controlled zones in the Andover Intrusion. In the Andover Intrusion, a mafic–ultramafic body with very low matrix permeability, groundwater is largely confined to shallow fracture zones and structurally controlled corridors, while the intrusion and surrounding basement rocks function predominantly as aquitards away from these features. Alluvial deposits along major drainage lines host discontinuous but locally productive shallow groundwater, and tidal aquifers in the coastal flats contain saline to hypersaline groundwater that responds to tidal fluctuations. Across all units, productive bores generally yield modest rates of approximately 1.0–1.5 litres per second (L/s), confirming the limited potential for groundwater abstraction, with recharge remaining highly event-driven and constrained by both the geological setting and the arid climate.

Connectivity between groundwater and surface water is weak and episodic, occurring mainly during high-flow or flood events. Riparian vegetation along the Harding River and its tributaries displays some groundwater dependence, but no high-certainty groundwater-dependent ecosystems were identified within the project footprint. Groundwater salinity ranges from fresh to hypersaline (approximately 580 - 35,000 milligrams per litre (mg/L) TDS), with values strongly influenced by geology and proximity to coastal flats. Surface water in the Harding River is generally fresh near the dam but becomes increasingly saline downstream during dry periods as evaporation concentrates salts in residual pools.

Analytical modelling using the Thiem–Dupuit equation indicates that dewatering requirements will increase substantially as mining progresses below the water table. Under a conservative and plausible parameter set, with hydraulic conductivity of about 0.01 metres per day (m/d) and specific yield of about 0.001, predicted inflows average approximately 5.5 L/s over the 20-year life-of-mine, increasing from less than 1 L/s in early years to around 20 L/s by year 20, with the radius of influence expanding to about 905 m. These estimates are semi-quantitative and indicative only, reflecting the limited hydrogeological data and the simplifying assumptions inherent in the analytical approach.

To support more confident and defensible predictions of mine inflows and drawdown, it is recommended that a numerical groundwater model be developed. This model should incorporate a refined conceptual understanding of the hydrogeological system and a robust mathematical framework, and be calibrated against site-specific monitoring and aquifer testing data. A numerical model will enable more reliable scenario testing and impact assessment for both the operational and post-closure phases of the project.

Key recommendations arising from this assessment include the expansion of the groundwater monitoring network, with the implementation of water level and salinity triggers near sensitive receptors; further investigations through additional aquifer testing, hydrochemical sampling and ecological assessments to address current data gaps; and development of a dewatering strategy underpinned by a calibrated numerical model, with progressive refinement of inflow estimates and consideration of staged pumping and water reuse to optimise water management and minimise potential environmental impacts.

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1 Introduction

1.1 Overview

Azure Minerals Pty Ltd (Azure) is currently undertaking exploration activities for the proposed Andover Lithium Project (the project), located in the Pilbara region of Western Australia, approximately 35 kilometres (km) south-east of Karratha and immediately south of the town of Roebourne (Figure 1.1).

Azure is a wholly owned subsidiary of SH Mining Pty Ltd, a company jointly owned by Sociedad Química y Minera de Chile S.A. (through its subsidiary SQM Australia Pty Ltd) and Hancock Prospecting Pty Ltd (through its subsidiary Hanrine Future Metals Pty Ltd).

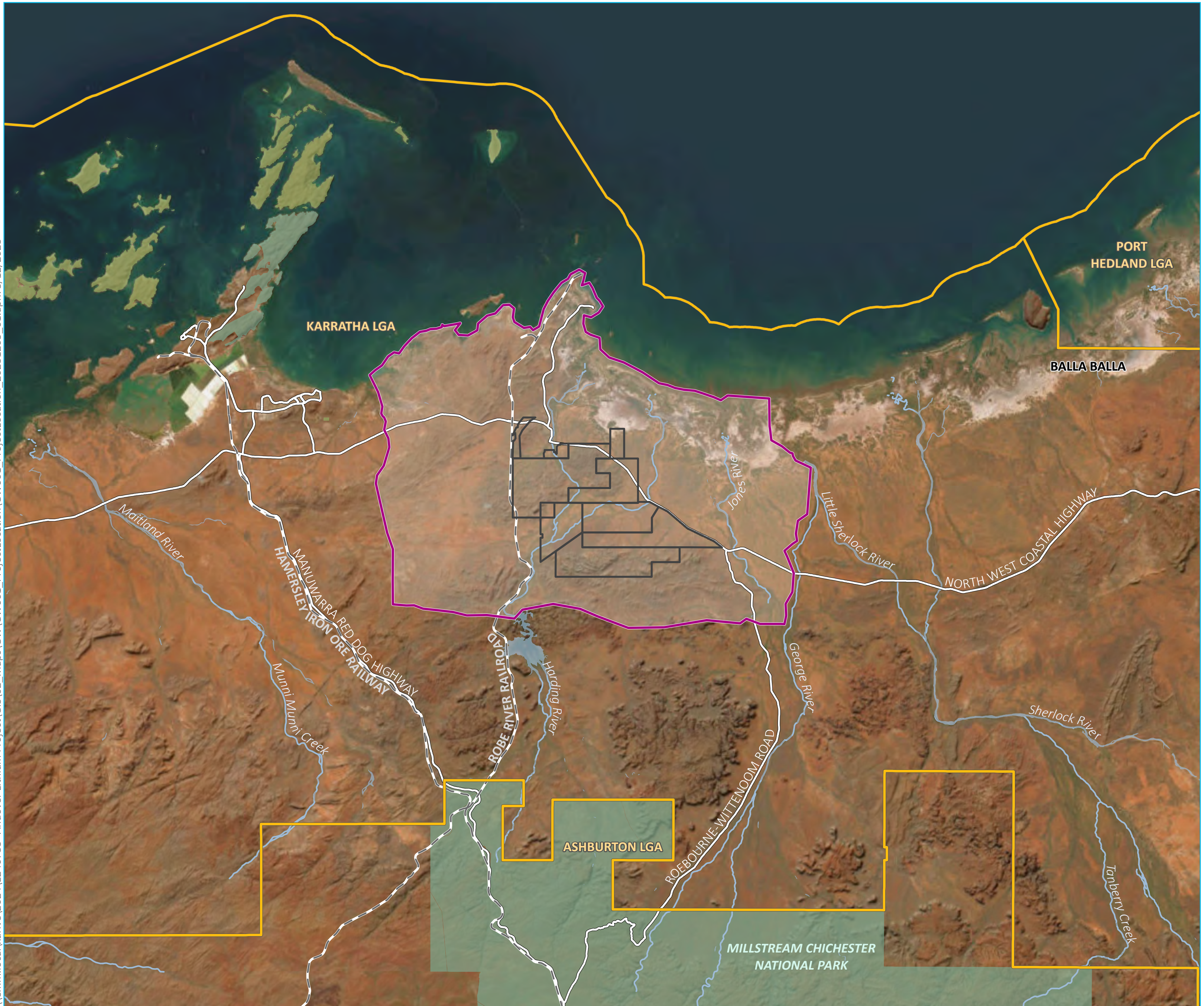
The project comprises a lithium bearing, stacked pegmatite ore body dissected by the nearby Harding River. The western ore body is referred to as TA3 and the easter orebody is referred to as TA1. The proposed TA3 mine void is planned to be mine below the groundwater table.

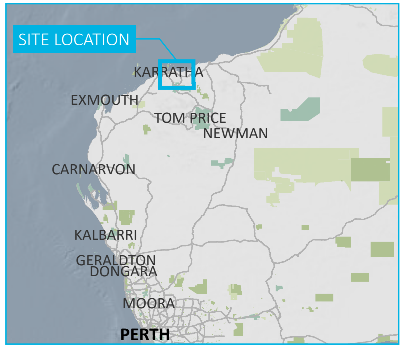
The objective of this report is to support the government environmental approvals process by developing a conceptual hydrogeological model for the project to assess the potential impacts, during operations and post-closure, on inland water values associated with groundwater abstraction for mine construction water supply and dewatering required for below water table mining at the TA3 mine void.

1.1.1 Proposed dewatering and water supply activities

The following dewatering and water supply activities are proposed for the project:

- Mining of the TA3 mine void to -480 m Australian Height Datum (m AHD), which is approximately 490 m below the current groundwater level of approximately 10 m AHD.
- Water supply for dust suppression for earthworks and construction; exploratory drilling; general campsite; mineral ore processing and other mining purposes and potable water supply. The project water demand for mineral processing is expected to be in the order 6 Gigalitres per annum (GL/a)) to be supplied from a proposed third-party desalination plant.





KEY

Study area

Azure minerals mining lease

Existing environment

Rail line

Major road

Named watercourse

Waterbody

Local government area

National Park

Reserve

INSET KEY

Major road

National Park

Reserve

Other conservation/ management area

Source: EMM (2025); ABS (2021); Landgate (2021, 2025); Esri (2025); GA (2009)

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Project location

Andover Lithium
Hydrogeological Assessment
Figure 1.1

creating opportunities

2 Project setting

2.1 Climate

Figure 2.1 presents monthly rainfall and evaporation statistics based on SILO data from January 1960 to October 2025. The seasonal rainfall regime is classified as arid, and the temperature's humidity classification corresponds to a hot, dry summer and mild winter. Rainfall statistics include historical monthly maximum, minimum, and key percentiles, alongside observed rainfall for 2023 and 2024. In 2024, a total of 178 millimetres (mm) of rainfall was recorded, significantly below the multiannual average of 312 mm. This aligns with the broader pattern of low and variable rainfall typical of arid climates. Notably, the maximum daily rainfall occurred on 6 March 2019, with 581 mm recorded.

Evaporation data for the same period, also shown in Figure 2.1, indicates that median monthly evaporation consistently exceeds median monthly rainfall, highlighting the prevailing moisture deficit.

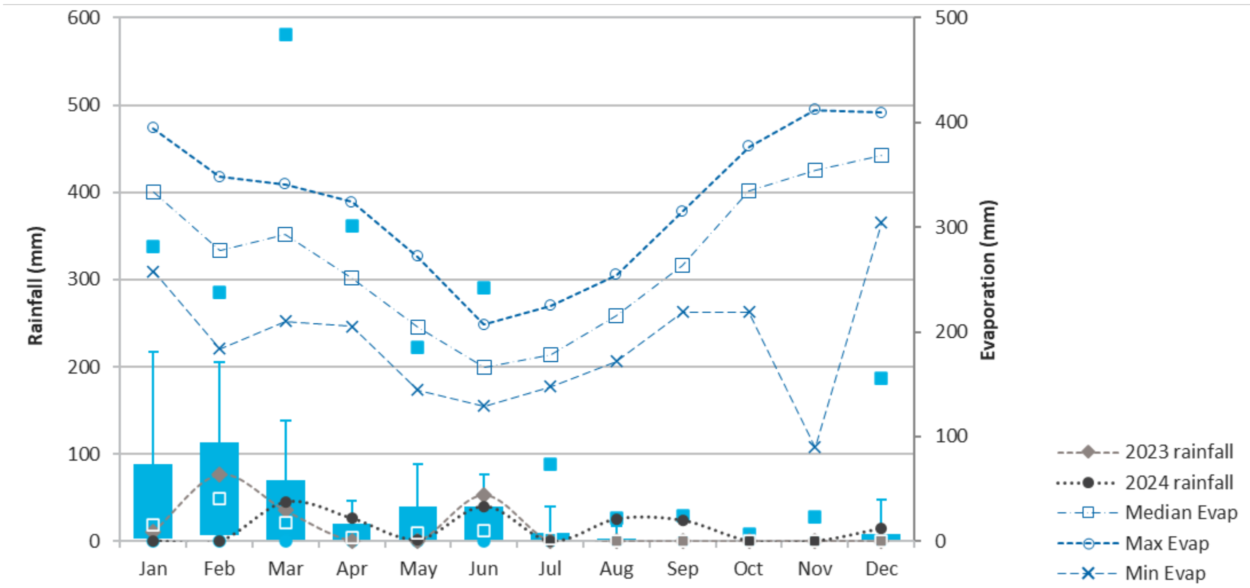


Figure 2.1 Monthly rainfall and evaporation statistics from SILO gridded data (1960 – 2025)

Figure 2.2 shows the annual rainfall deviations from the long-term average between 1971 and 2025, with values categorised as either greater than average (blue) or less than average (yellow), alongside an 11-year moving average (grey line). The data reveals a high degree of interannual variability, with several notable peaks and troughs. Significant positive deviations occurred in years such as 1973, 2005 and 2013, indicating years of well-above-average rainfall. Conversely, prolonged periods of below average rainfall are evident, particularly during the early 1980s, early 2000s, early 2010s and the period from 2021 onwards.

The moving average line highlights longer-term trends, showing a gradual decline through the 1970s, followed by a steady increase from the 1980s to the late 2000s. A slight decline is recorded again in the late 2010s, followed by a modest increase in the 2020s. This pattern suggests increased rainfall variability in recent decades, with more frequent dry years interspersed with isolated wet years

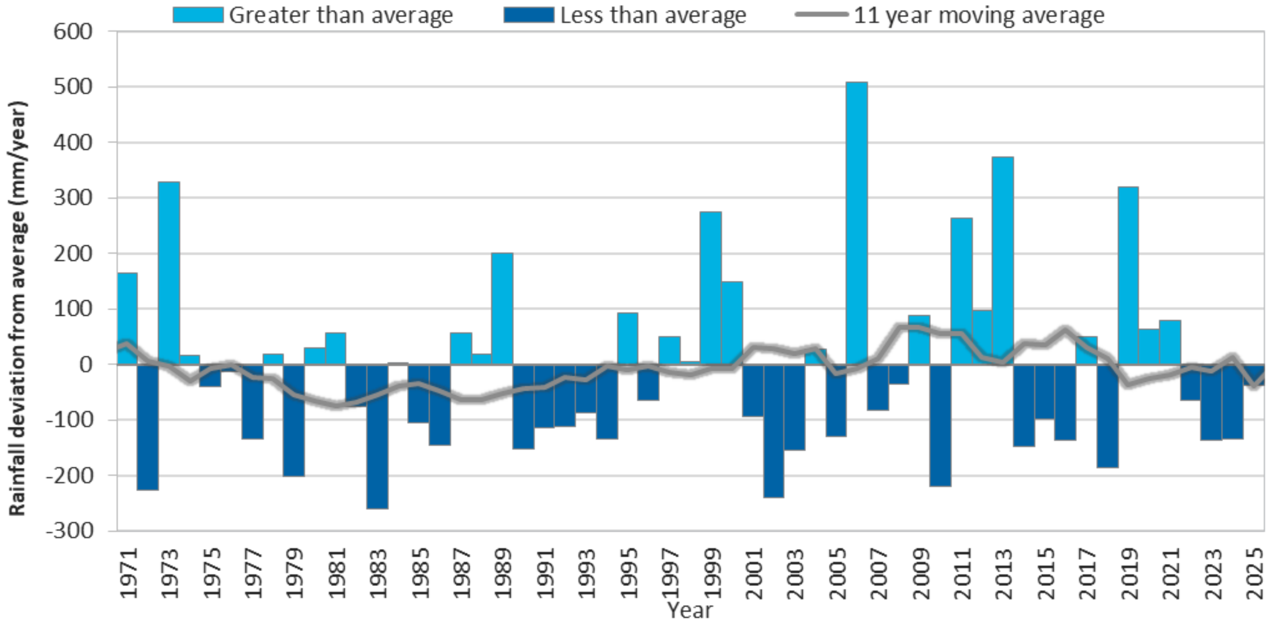


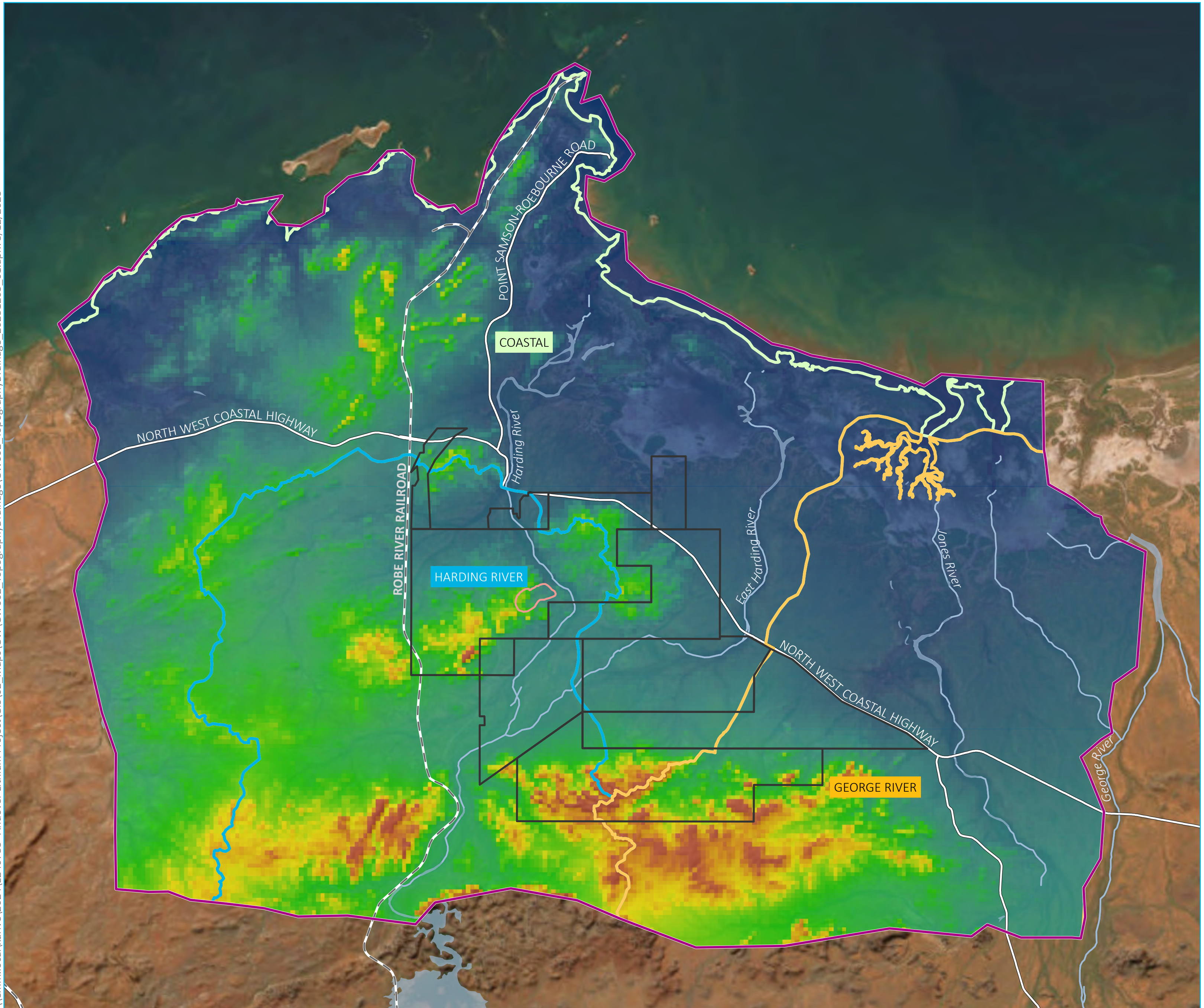
Figure 2.2 Annual Rainfall Deviations from Long-Term Average (1971 – 2025) with 11-Year Moving Average

2.2 Topography

The topography in the project area displays a clear elevation gradient, generally increasing from the low-lying coastal plain in the north towards the more elevated interior regions in the south and south-west. Coastal towns such as Point Samson, Wickham, Cossack, and Roebourne are situated within flat to gently undulating terrain, typically below 20 m AHD. The surrounding landscape remains subdued until further inland, where elevations begin to rise steadily.

A significant increase in elevation is observed in the central and southern portions of the area, particularly in zones underlain by the Andover Intrusion. This region features some of the highest topographic values in the project area, with several ridgelines and high points ranging between 120 and 150 m AHD. These elevated landforms are likely due to the erosion-resistant nature of the intrusive geology, which stands in contrast to the surroundings of the eastern side of the study area, where elevations tend to range between 50 and 150 m AHD.

To the west, in areas associated with the Nickol River Formation and Karratha Granodiorite, local relief is also notable, with terrain rising to approximately 100 – 140 m AHD in places. In contrast, the eastern and far northern extents of the area are comparatively lower, with widespread regions sitting between 5 and 50 m AHD.



Source: EMM (2025); Landgate (2021, 2025); DWER (2025); Esri (2025); GA (2009)

0 5 10 km
GDA 1994 MGA Zone 50
N

KEY

- Study area
- Pit
- Azure minerals mining lease

Catchment

- Coastal
- George River
- Harding River

Topography (m)

- 140
- 0

Existing environment

- Rail line
- Major road
- Named watercourse
- Waterbody

Topography, drainage and catchments

Andover Lithium
Hydrogeological Assessment
Figure 2.3

EMM creating opportunities

2.3 Hydrology

The project area lies within the Harding River catchment, the Jones River catchment and the Coastal catchments, all draining north towards the Indian Ocean (Figure 2.3).

2.3.1 Harding River Catchment

The Harding River, located near Roebourne and the Andover Intrusion, is a seasonal river system that flows generally westward into the Indian Ocean. It forms part of the Port Headland Coast basin, characterised by highly variable and episodic runoff, with flow events predominantly associated with tropical cyclones and intense summer storms. These events generate rapid surface runoff and short-duration, high-intensity streamflow, followed by extended dry periods during which the riverbed is typically dry (Haig 2009).

The Harding Dam, constructed on the Harding River in 1984, impounds flow approximately 40 km upstream of Roebourne and is a key component of the West Pilbara Water Supply Scheme (Water Corporation 2025). Since the dam construction, downstream flows have significantly decreased, altering the natural hydrological regime and reducing the frequency and magnitude of recharge events to the downstream alluvial aquifers (Water and Rivers Commission 1999; AquaGeo 2025). The dam captures most surface runoff from the upper catchment and stores water for supply to towns such as Karratha and Roebourne, thereby further limiting the proportion of high-flow events that reach the lower Harding River.

The lower catchment, where the Andover Intrusion is situated, therefore receives only episodic recharge from surface water, primarily during infrequent high-flow events that overtop or bypass storage and during localised storm runoff. Combined with the low permeability of the underlying mafic–ultramafic and granitoid rocks, this results in a hydrological setting characterised by intermittent surface water flow, limited aquifer recharge, and a groundwater system largely controlled by fractures, faults and localised alluvial deposits (Haig 2009; AquaGeo 2025).

2.3.2 George River catchment

The George River catchment lies to the east of the Harding River catchment, the main waterway of this catchment that it is within the study area is the Jones River in the eastern side and also forms part of the broader Port Headland Coast basin drainage network. Like the Harding River, the Jones River is ephemeral, with flow occurring mainly in response to cyclonic and intense convective rainfall events (Haig 2009). Regional assessments indicate that the Jones River alluvium has potential to host localised groundwater resources within deeper channel gravels, calcrete and fractured bedrock, with indicative yields on the order of several hundred kilolitres per day in favourable zones (Haig 2009).

The lower Jones River and its tributaries draining toward the coastal plain near Roebourne are incised into Proterozoic granites, volcanic rocks and Archaean greenstones. Alluvial deposits along the main channel and adjacent floodplains provide the principal zones of infiltration during flow events. As in the Harding River system, recharge is highly episodic and controlled by the magnitude and frequency of large storms (Haig 2009). There is no dam equivalent to the Harding Dam in this catchment. However, the combination of arid climate, high potential evaporation and relatively low storage in the alluvium means that sustained baseflow is still uncommon. For the project, the Jones River catchment is hydrologically relevant as an adjacent system that contributes to the broader regional groundwater framework but does not constitute a primary water source or receptor.

2.3.3 Coastal catchments

North of Roebourne and seaward of the Harding River and Jones River, the landscape is dominated by coastal and estuarine catchments, including tidal creeks, mudflats, supratidal flats and low-relief coastal plains. Hydrology in these areas is governed by a combination of episodic fluvial inputs from inland catchments and semi-diurnal tidal processes, rather than by sustained river flow (Haig 2009). During major rainfall events, floodwaters from the Harding River and Jones River systems spread across coastal flats and tidal channels, but between such events, surface water is largely absent, and hydrological dynamics are dominated by tidal inundation, ponding in depressions, and evaporation.

The surface geology in these coastal zones comprises marine and estuarine sediments, including muds, sands, evaporitic deposits and local coastal limestones, which host shallow saline to hypersaline groundwater systems that respond to tidal fluctuations (Haig 2009; AquaGeo 2025). These coastal aquifers are hydraulically separate from the fractured-rock systems of the Andover Intrusion and function primarily as saline boundary conditions rather than fresh groundwater resources. For the project, the coastal catchments are important in understanding down-gradient discharge and salinity patterns, but they do not provide fresh surface water or groundwater inflow to the project area.

2.4 Geology

This section has been prepared with reference to Hickman (2002), which provides a detailed description of the geology of the Roebourne area.

2.4.1 Regional geology

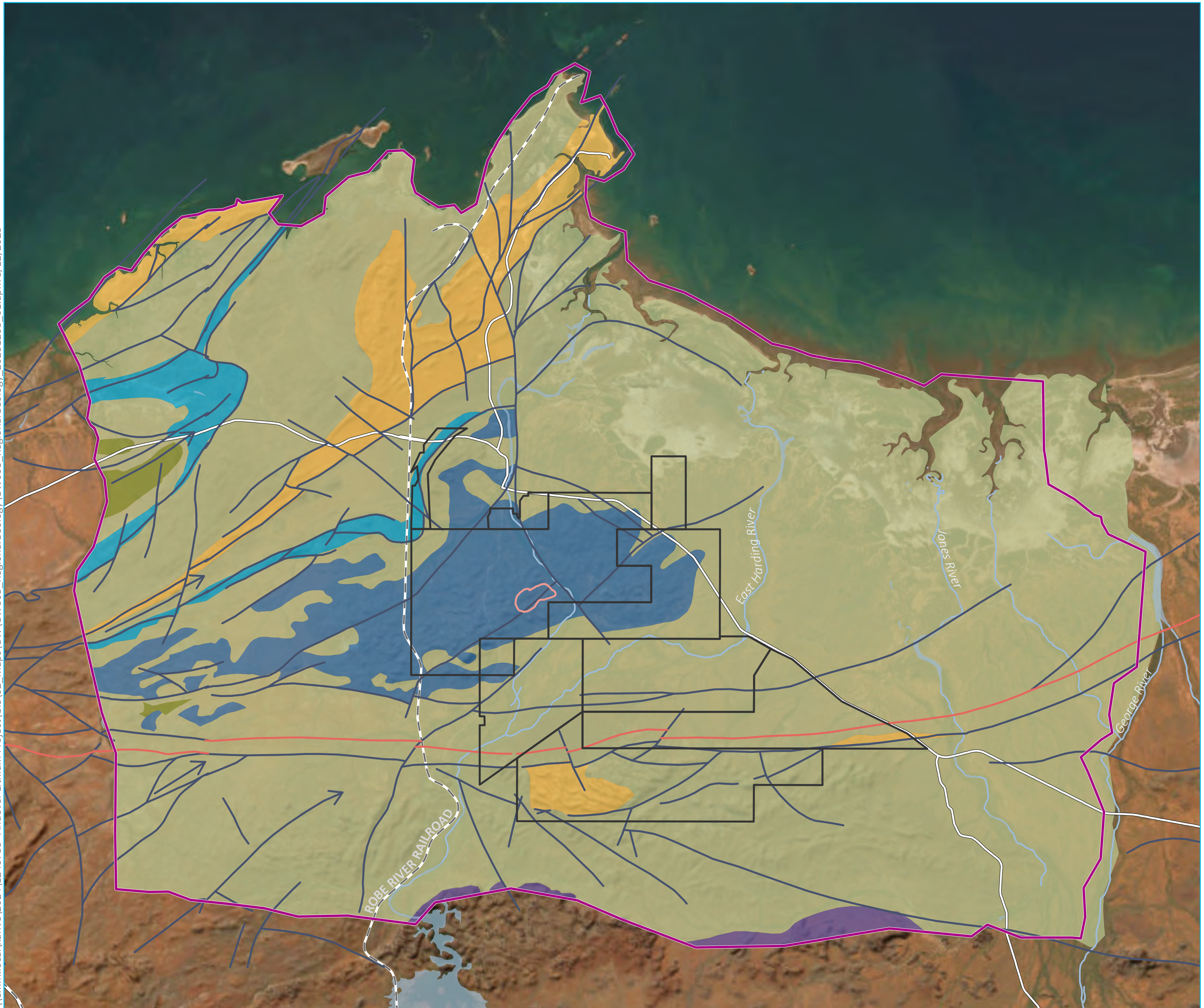
The study area lies within the north-western portion of the Pilbara Craton, almost entirely within the Roebourne 1:100,000 geological map sheet (Figure 2.4). Regionally, it is situated in the West Pilbara Granite – Greenstone Terrane encompassing parts of the Mallina Basin, Hamersley Basin, and adjacent granitoid complexes. The area forms part of the broader North Pilbara Terrain, which is dominated by Archaean greenstone-granite assemblages and Proterozoic sedimentary cover sequences.

The Roebourne region records a complex tectonic history, shaped by multiple Archaean deformation events spanning from circa 3,270 mega annum (Ma) to 2,920 Ma. Early tectonic activity is associated with rifting and deposition of volcanic and sedimentary rocks, primarily within the Roebourne Group and Whundo Group. By circa 3,160 Ma, tectonic processes began to shift towards crustal shortening, leading to thrusting, folding, and the intrusion of granitoids, including the Andover Intrusion.

A major structural feature influencing the regional setting is the Sholl Shear Zone, which represents a long-lived and significant tectonic boundary that accommodated both sinistral and dextral strike-slip deformation during different tectonic episodes between circa 3,070 Ma and 2,920 Ma. This zone separates major lithotectonic domains and hosts some of the most structurally complex and metamorphosed rocks in the area.

The regional structural framework is dominated by north-easterly trending faults and shear zones, consistent with the broader structural trend of the West Pilbara. The Regal Thrust and Prinsep Thrust are major reverse faults mapped to the south-west of the study area, responsible for uplifting and stacking of older units over younger successions.

Within the Roebourne domain, folds and sheared contacts are common, particularly in the Cleaverville Formation and ultramafic sequences near the Regal Thrust. The deformation style is predominantly compressional to transpressional, transitioning to strike-slip kinematics during later events.



Source: *EMM (2025); Landgate (2021, 2025); DMIRS (2025); Esri (2025); GA (2009)*

0 5 10 km
GDA 1994 MGA Zone 50
N

KEY

- Study area
- Azure minerals mining lease
- Pit
- Fault
- Sholl shear zone

Bedrock

- Andover intrusion
- Cleaverville formation
- Cooya pooya dolerite
- Karratha granodiorite
- Basement
- Nickol river formation

Existing environment

- Rail line
- Major road
- Named watercourse
- Waterbody

Basement geology

Andover Lithium
Hydrogeological Assessment
Figure 2.4

EMM
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2.4.2 Local geology

i Andover Intrusion

The dominant geological feature within the project area is the Andover Intrusion, one of the largest mafic–ultramafic bodies in the north-west Pilbara, covering approximately 200 km^2, south-east of Roebourne. This complex intrusion is geologically significant due to its size, lithological diversity, and structural setting along the Sholl Shear Zone, which influenced its emplacement during dextral strike-slip movement.

The Andover Intrusion consists of layered mafic to ultramafic rocks, with a structural trend generally oriented east-north-east to west-south-west. The intrusion includes serpentinised peridotite and dunite, minor metapyroxenite, interbedded lithium bearing pegmatite sills and metamorphosed gabbro and leucogabbro, interpreted to be related to the Harding Granitoid Complex. These lithologies are exposed as rugged, dark ridges and outcrops across the intrusion. Layering within gabbroic rocks is typically well developed, and in some areas, deformation and intrusion by later granitic phases have disrupted the original stratigraphy.

Geochronological data place the intrusion age at older than 3,016 ± 4 Ma, based on zircon analyses, making it one of the early mafic-ultramafic events in the West Pilbara region. Structural and textural observations indicate multiple intrusive phases, including late-stage gabbroic injections, brecciation, and possible assimilation of adjacent wall rocks.

ii Surface geology

The surface geology of the project area is dominated by Cenozoic sedimentary deposits, which cover approximately 50% of the region (Figure 2.5). These deposits represent a range of alluvial, colluvial, estuarine, coastal, and eolian environments, and are mostly unconsolidated or weakly consolidated. They reflect a complex history of recent landscape evolution, surface processes, and climatic influences.

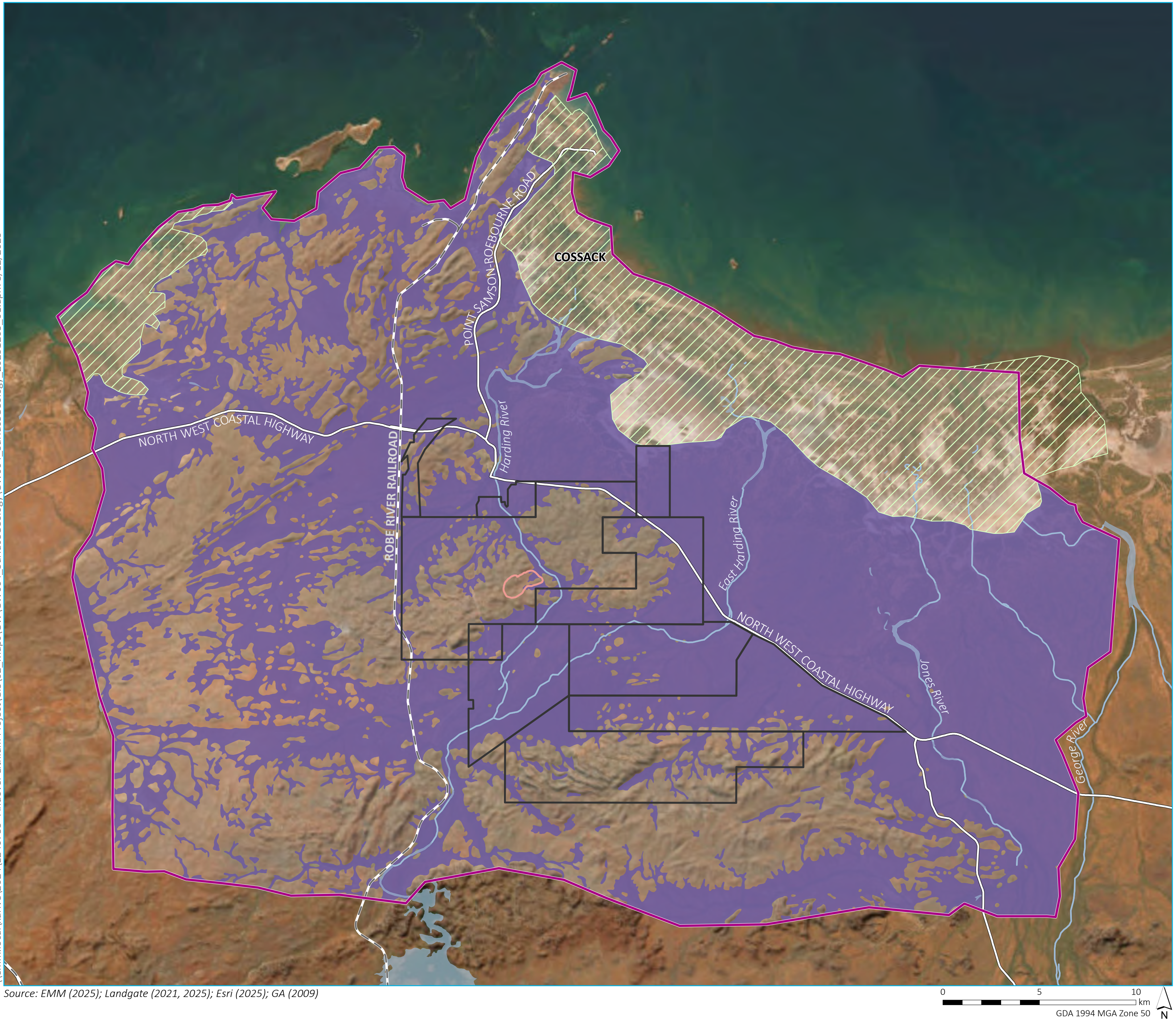
Cenozoic rocks in the area comprise both clastic and chemical deposits that are primarily of Eocene to early Pleistocene age. The clastic units include alluvial gravels, colluvium, and floodplain or terrace-related silts and clays. These deposits are mostly confined to valleys, low-lying plains, and broad drainage areas, such as those near the Jones River and the Harding River. In some cases, they reach up to 5 m in thickness, especially in the larger valley fills and proximal fan systems.

Notably, colluvial deposits occur on the flanks of ridges and steep slopes, often forming aprons of coarse, angular debris derived from nearby hills. These fans commonly display radial drainage patterns and slope gradients typically between 5 – 15%. In flatter areas, these slope deposits transition into broader sheetwash plains, where clay and silt dominate.

More recent surface units include alluvial silt, sand, and gravel associated with active drainage and paleochannels, and eolian dune sands. These are particularly prominent near the coast and around Wickham, where loose red to yellow dune sands accumulate. These sands lack significant shell fragments, contrasting with coastal marine deposits.

Also present are residual gravels developed over granitoid bedrock, forming shallow profiles of quartz-rich, lateritised material. In some places, the residual and colluvial surfaces have been deeply weathered, suggesting prolonged subaerial exposure and soil formation.

Along the coast, marine, estuarine, and tidal flat deposits are widespread. Units such as lagoonal mudflat sediments, and a coastal limestone interpreted as a cemented beach rock or reef deposit. These are often found in mangrove flats, lagoons, and low-energy shoreline environments. In particular, the lagoonal mudflat sediments can be saline and organic-rich, with limited flushing due to tidal isolation.



Source: EMM (2025); Landgate (2021, 2025); Esri (2025); GA (2009)

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KEY

- Study area
- Azure minerals mining lease
- Pit
- Quaternary alluvial deposit
- Tidal

Existing environment

- Rail line
- Major road
- Named watercourse
- Waterbody

Surface geology

Andover Lithium
Hydrogeological Assessment
Figure 2.5

EMM creating opportunities

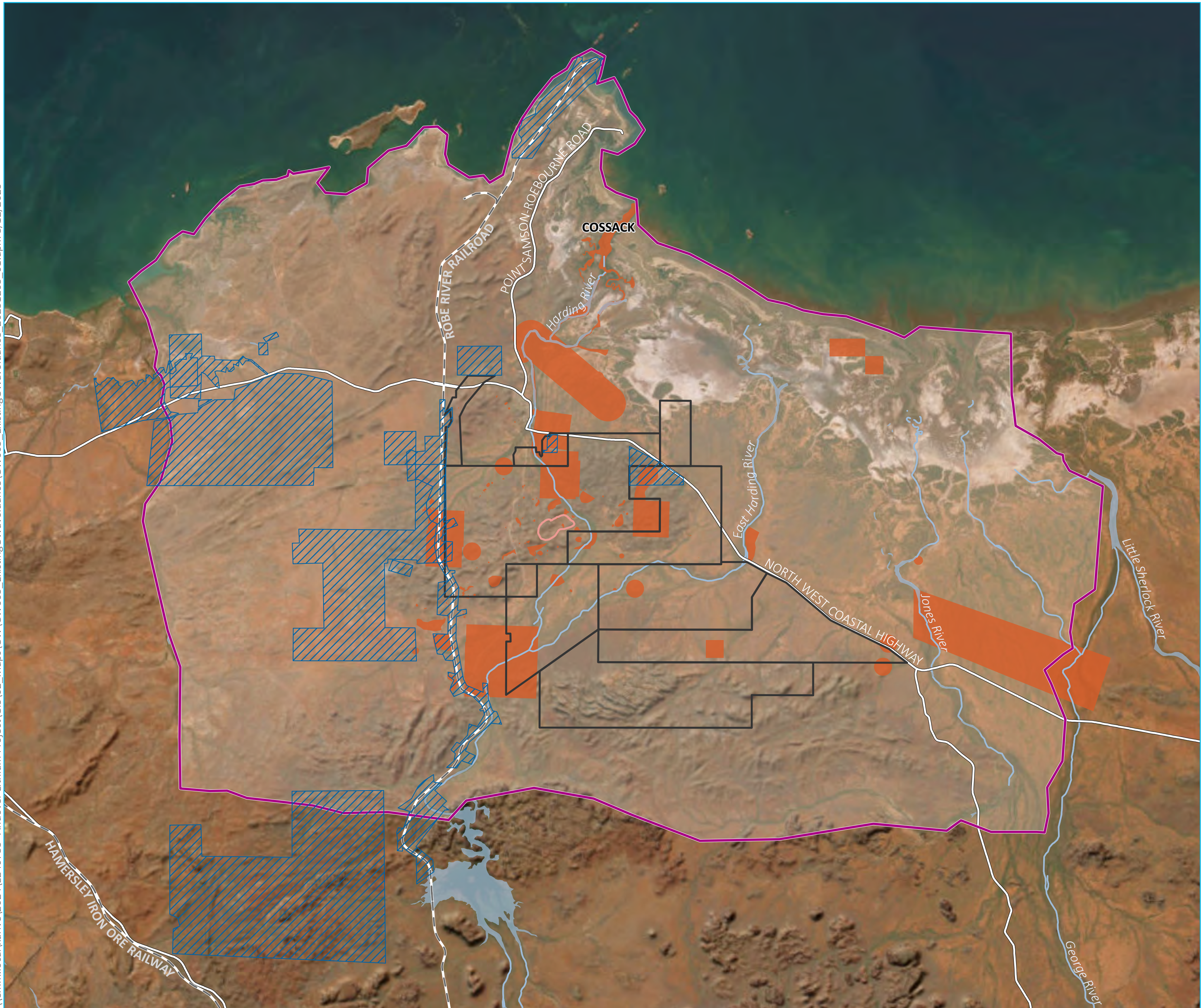
2.5 Existing groundwater use

The project lies within the Pilbara Fractured Rock aquifer of the Ashburton subarea within the Pilbara Groundwater Management Area (GMA).

Within approximately 10 – 30 km of the project area, there are multiple licensed groundwater users in the fractured rock as recorded in the Department of Water and Environmental Regulation (DWER) register (DWER 2025a) (Table 2.1 and Figure 2.6). These include pastoral, community, and industrial users. Allocation volumes are modest relative to regional mining operations, and no large-scale municipal or agricultural extraction occurs within the immediate project area. Actual groundwater abstraction is unknown.

Table 2.1 Groundwater users (DWER 2025a)

Licence number	Issue date	Expiry date	Licence allocation (kL)	Party	Groundwater area	Groundwater subarea	Aquifer
165810	22/07/2024	21/07/2034	220,000	Pilbara Iron Company (Services) Pty Ltd	Pilbara	Ashburton	Pilbara - Fractured Rock
173533	14/04/2016	13/04/2026	30,000	Pilbara Iron Company (Services) Pty Ltd			
174830	24/11/2016	23/11/2026	20,000	P.M.R Quarries Pty Ltd as the trustee for WA Limestone Unit Trust			
176810	24/01/2018	23/01/2028	450,000	Robe River Mining Co. Pty Ltd			
200166	17/08/2017	17/08/2027	20,000	Artemis Resources Ltd			
201197	07/09/2018	06/09/2028	95,000	Karratha Gold Pty Ltd			
201197	07/09/2018	06/09/2028	95,000	Karratha Gold Pty Ltd			
204480	30/06/2020	29/06/2030	1,500	Nor-West Jockey Club Incorporated			
205752	23/04/2021	22/04/2031	25,000	Department of Primary Industries and Regional Development			
208481	15/03/2023	14/03/2033	26,000	Cheeditha Group Aboriginal Corporation			
212726	21/10/2025	20/10/2035	1,600	Mingullatharndo Community Association			



KEY

- Study area
- Azure minerals mining lease
- Pit
- Avoidance area
- Licenced groundwater user

Existing environment

- Rail line
- Major road
- Named watercourse
- Waterbody

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Source: EMM (2025); Landgate (2021, 2025); Esri (2025); GA (2009)

Existing groundwater users and avoidance areas

Andover Lithium
Hydrogeological Assessment
Figure 2.6

creating opportunities

2.6 Groundwater and surface water receptors

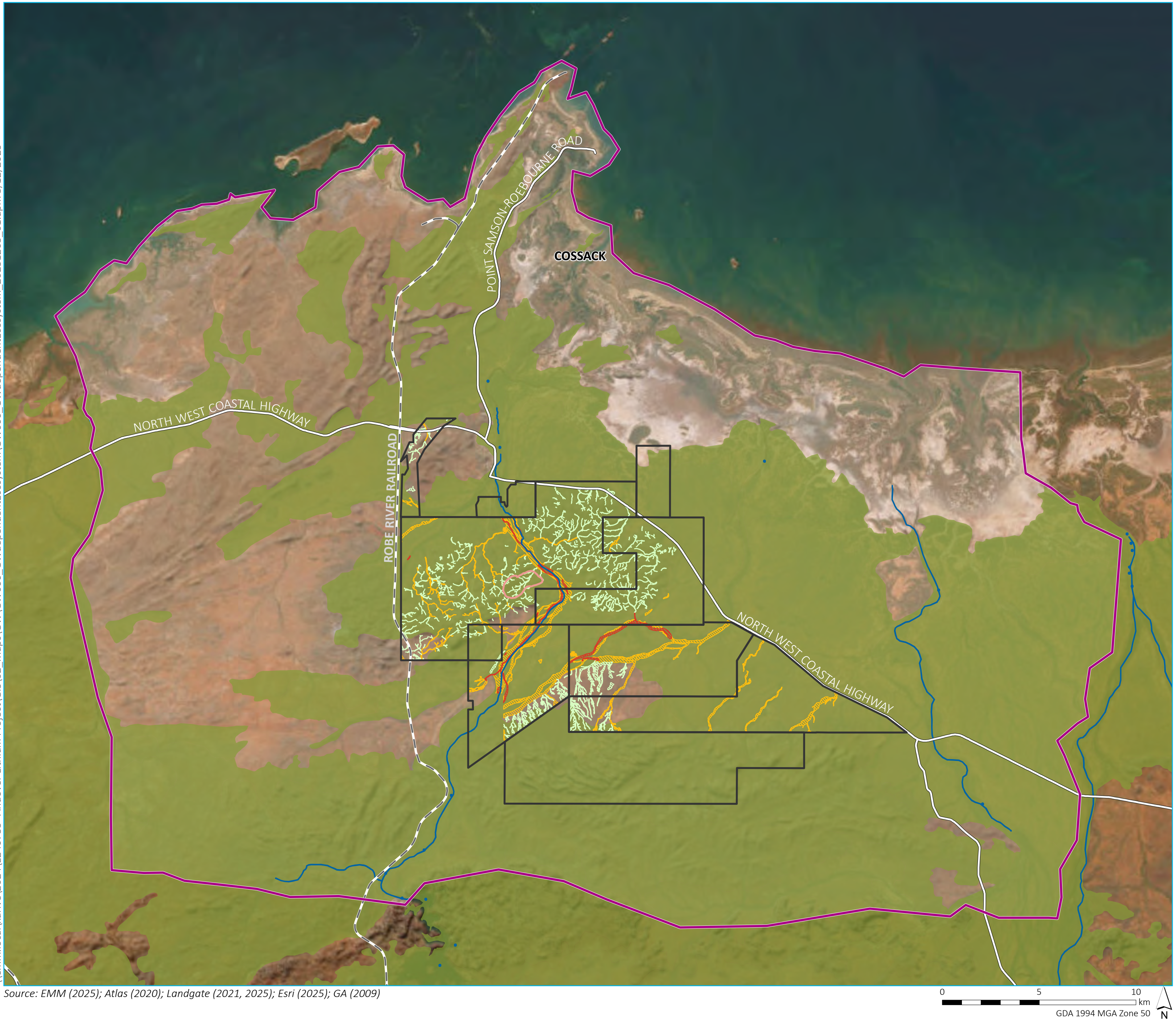
Surface water receptors are limited and strongly influenced by regional hydrological constraints. The Harding River is the principal surface water feature intersecting the project area. Historically, river flows contributed episodic recharge to the downstream alluvium. However, the construction and operation of the Harding Dam since 1984 has markedly reduced downstream flow frequency, altering the natural hydrological regime and constraining recharge opportunities in the lower reaches of the Harding River and its tributaries (Water Corporation 2025; Water and Rivers Commission 1999). Given the arid climate, episodic rainfall, and low permeability of the Andover Intrusion and surrounding basement rocks, sustained surface water–groundwater connectivity is inherently limited (AquaGeo 2025).

The presence and distribution of groundwater dependent ecosystems (GDEs) were assessed using multiple information sources, including the Bureau of Meteorology's (BoM) National GDE Atlas and field-based vegetation mapping (Figure 2.7). The BoM GDE Atlas identifies no high-certainty aquatic or terrestrial GDEs within the project area, with mapped features restricted to the major Pilbara river corridors and coastal wetlands further north and north-west of Roebourne, outside the project boundaries (BoM 2025). This regional dataset aligns with ecological findings from the *Detailed Flora and Vegetation Survey* (Biologic Environmental Survey 2025a), which concluded that most land systems, including basaltic plains, colluvial slopes, and upland stony terrains, have negligible potential for groundwater dependence.

Groundwater dependence is confined to riparian vegetation communities along the Harding River, East Harding River, and major tributaries. Within these drainage lines, phreatophytes (i.e. species that rely on groundwater) such as *Melaleuca argentea* (obligate), *Eucalyptus camaldulensis* and *Sesbania formosa* (facultative), and *Eucalyptus victrix* (vadophyte to facultative) were recorded (Biologic Environmental Survey 2025a). These species indicate access to shallow groundwater or bank-stored soil moisture following flood events, reflecting localised and episodic groundwater reliance. One mapped vegetation unit was classified as having a high groundwater-dependence potential, with several others rated moderate or low, consistent with riparian systems that experience intermittent but not perennial access to the groundwater table (Biologic Environmental Survey 2025a).

No groundwater dependent wetlands, springs, baseflow-fed pools, or subterranean aquatic ecosystems (other than stygofauna, see Section 2.7) were identified within or adjacent to the project area.

Coastal tidal flats to the north-east, although hydrologically dynamic, are dominated by tidal and marine processes rather than freshwater discharge and therefore do not constitute freshwater GDEs (Haig 2009 and Biologic Environmental Survey 2025b).



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Source: EMM (2025); Atlas (2020); Landgate (2021, 2025); Esri (2025); GA (2009)

KEY

- Study area
- Azure minerals mining lease
- Pit

GDE (Atlas)

- Aquatic
- Terrestrial

Groundwater dependency

- High
- Moderate
- Low

Existing environment

- Rail line
- Major road

Identified (potential) groundwater dependent ecosystems

Andover Lithium
Hydrogeological Assessment
Figure 2.7

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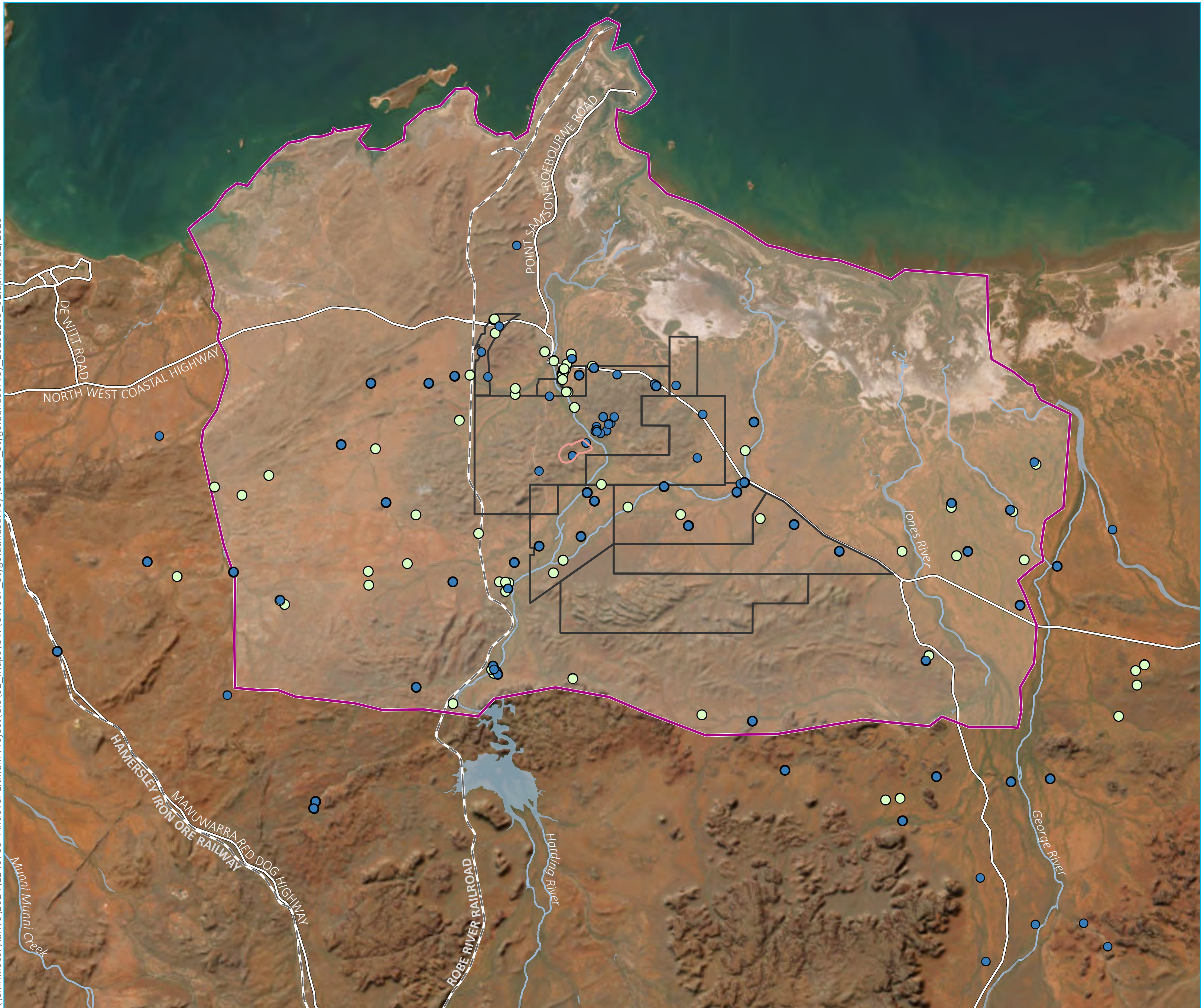
2.7 Subterranean fauna

A stygofauna survey was undertaken at the project in 2024, to characterize the subterranean aquatic biodiversity. The survey was conducted by Biologic Environmental Survey on behalf of Azure, with sampling completed during two field campaigns (29 April to 3 May 2024, and 7 to 13 November 2024).

A total of 62 samples were collected from 58 sites, using methods including net hauling from exploration drill holes, monitoring bores, and wells (60 samples), and filtered pump outflow (2 samples). Physicochemical parameters of groundwater were recorded at most locations prior to biological sampling. Samples were preserved in ethanol and stored on ice to maintain DNA integrity (Biologic Environmental Survey 2025b).

Stygofauna identification was conducted using both morphological assessment under microscopes and molecular techniques, including DNA barcoding targeting the mitochondrial COI gene. Genetic sequencing was successful for 94 specimens, representing 84.7% of those analysed, and was compared against reference databases (Biologic Environmental Survey 2025b).

The findings highlight a diverse and poorly characterised stygofauna community, with many species showing high local endemism, including singletons and taxa known only from limited sampling. Additional stygofauna surveys are almost certain to detect additional species and will be required to adequately characterise the assemblage in accordance with current guidance (Biologic Environmental Survey 2025b).



KEY
- Study area
- Azure minerals mining lease
- Pit
- Stygofauna sample
- Regional stygofauna site- November 2024

Existing environment
- Rail line
- Major road
- Named watercourse
- Waterbody

Source: EMM (2025); Landgate (2021, 2025); Esri (2025); GA (2009)

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Stygofauna survey locations

Andover Lithium
Hydrogeological Assessment
Figure 2.8

EMM
creating opportunities

3 Hydrogeological investigations

3.1 Previous hydrogeological investigations

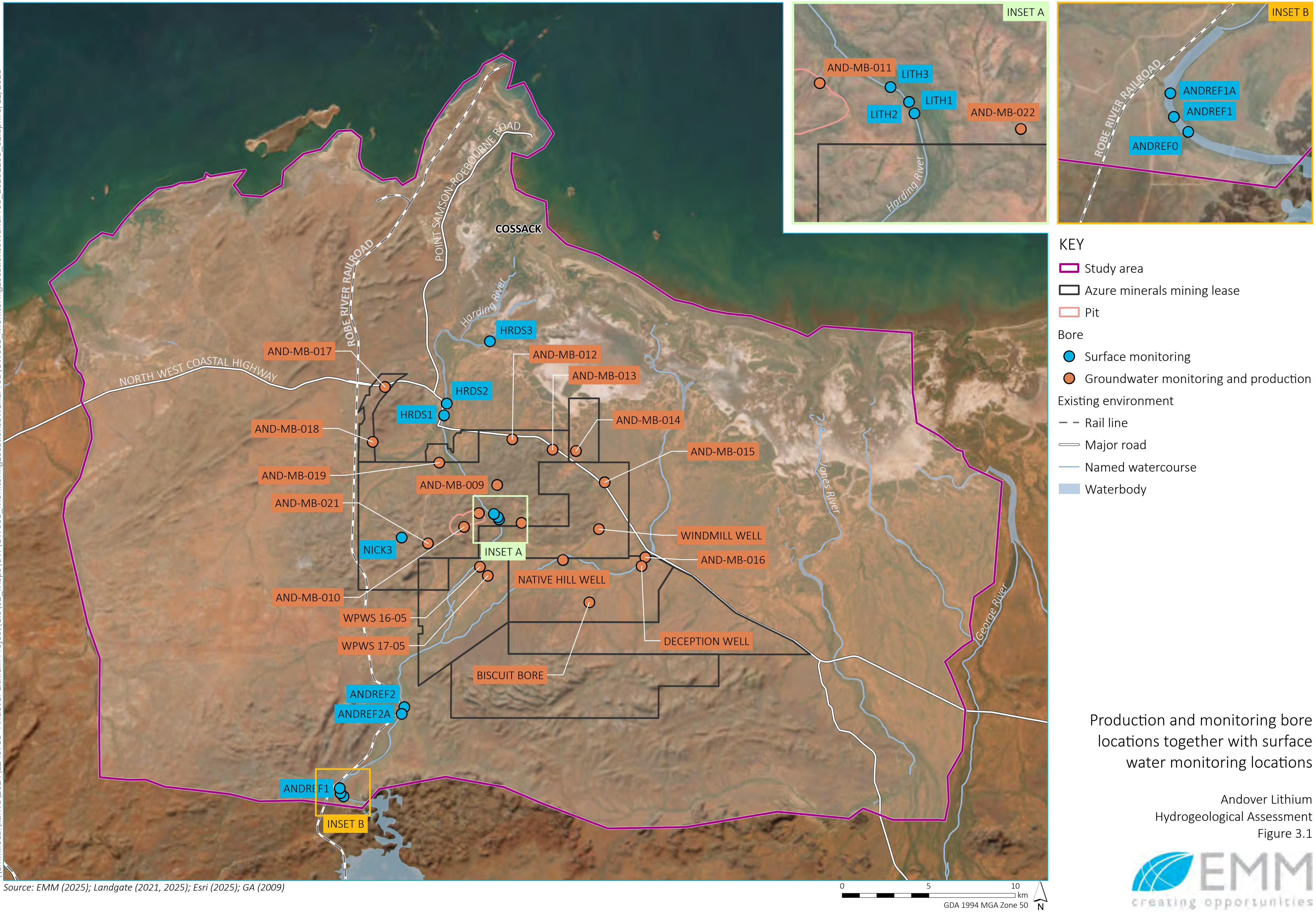
A summary of relevant previous hydrogeological investigations undertaken for the project is provided below.

- Water Source Protection Plan: West Pilbara Water Supply Scheme WRP 15 (Water and Rivers Commission, 1999): a catchment-scale investigation focused on the Harding River and Harding Dam, evaluating the impact of dam construction (1984) on downstream flows and groundwater. The study concluded that reduced post-dam flows have limited recharge to downstream alluvial aquifers and contributed to increasing salinity in borefields near Roebourne, which is directly relevant to the lower Harding River segment intersecting the project area. (Water and Rivers Commission 1999; Water Corporation 2025).

- Pilbara coast water study (Haig 2009): a regional assessment of surface water and groundwater systems along the Pilbara coast, including the Harding River and Jones River catchments. It describes the strongly episodic nature of recharge, the ephemeral behaviour of rivers, and the presence of fresh to hypersaline groundwater within coastal alluvial and estuarine systems, providing the regional hydrogeological context for the project area.

- Exploration drilling and bore installation programs (various campaigns 2010s – 2020s): mineral exploration by Azure Minerals and previous operators generated extensive drillhole logs and incidental groundwater observations (water strikes, seepage, dry holes), confirming the fracture controlled nature of groundwater occurrence in the Andover Intrusion and surrounding basement. More recent programs installed dedicated monitoring and production bores with screened intervals and continuous logger data, which now form the primary dataset for groundwater levels, salinity distributions and aquifer behaviour at the site (AquaGeo 2025). Locations of production and monitoring bores are shown on Figure 3.1.

- H2 Hydrogeological Assessment – Andover Project (AquaGeo 2025): a project-scale hydrogeological study that integrated regional datasets, DWER bore records, exploration drilling, geological mapping and groundwater monitoring to develop a conceptual model for the Andover Intrusion. It identified that groundwater is largely restricted to shallow fracture zones (< ~25 m), that the mafic–ultramafic units act mostly as low-transmissivity aquitards, and that groundwater quality ranges from fresh to saline, with saline to hypersaline conditions present in the coastal margin.



Source: EMM (2025); Landgate (2021, 2025); Esri (2025); GA (2009)

Production and monitoring bore locations together with surface water monitoring locations

Andover Lithium
Hydrogeological Assessment
Figure 3.1

creating opportunities

\\emm.local\xdrive\2024\E240785- Andover Lithium Project\GIS\02_Maps\GW\GW008_MonitoringLocationsSWandProd\GW008_MonitoringLocationsSWandProd_20251208_02.aprx 8/12/2025

3.2 Aquifer testing

Four production bores were drilled in 2024 where earlier exploration drilling had intersected groundwater along mapped fault and fracture structures. Two of the four bores were dry, consistent with the generally low groundwater occurrence in the Andover Intrusion and the strong structural control on water bearing zones. The remaining two bores (AND-PB-011 and AND-PB-008) recorded airlift yields of 1.2 L/s and 0.8 L/s respectively.

Aquifer testing was undertaken at these two production bores installed within the Andover Intrusion to characterise the hydraulic properties of the fractured rock aquifer and assess sustainable yields for project water supply (AquaGeo 2025).

The details of pumping test on AND-PB-011 and AND-PB-008 that took place on 6 and 8 December 2024, respectively are presented in Table 3.1.

Table 3.1 Andover pumping test details

Bore ID	AND-PB-011	AND-PB-009
Screened hydrostratigraphic unit	Fractured rock (Andover Intrusion)	Fractured rock (Andover Intrusion)
CRT duration (hours)	7	7
CRT rate (L/s)	1.42	1.1
Saturated thickness (m)	~22 m (screened 12 - 34 m)	~12 m (screened 22 - 34 m)
Maximum observed drawdown (m)	Similar drawdown in MB & PB; derivative indicates radial flow	3.98 m
Transmissivity (m^2/day)	103 m^2/day	9.75 m^2/day
Storativity	0.00022	6×10^{-7}
Hydraulic Conductivity (m/day)[1]	1×10^{-6} - 2×10^{-5}	1×10^{-6} - 2×10^{-5}
Test interpretation method	Flow Characteristic (FC) program; derivative analysis indicating fracture-bounded radial flow.	Neuman–Witherspoon leaky aquifer solution using Aqtesolv; delayed drainage behaviour observed.

Notes: 1: Representative values for unfractured igneous and metamorphic basement (Schwartz 1990)

3.3 Groundwater level observations

The groundwater monitoring network comprises 22 monitoring bores drilled between April 2024 to October 2025 (Figure 3.1 and Appendix A).

3.3.1 Spatial variations in groundwater levels

Pre-mining groundwater elevation contours were developed based on interpreted groundwater level data from the project's monitoring bores and DWER's regional bores (DWER 2025b) (Figure 3.3). The contours were prepared in m AHD, with hand-drawn interpolation used to refine the groundwater elevation, particularly in areas of sparse data coverage. In these cases, some contour lines were manually adjusted to honour the hydrogeological interpretation and observed topographic relationships.

The groundwater elevation contours indicate a general groundwater gradient from the elevated south-western terrain south of the Harding River Dam (approximately 35 m AHD) towards the low-lying areas in the north and north-east (around 1 m AHD). The groundwater gradient follows the regional topographic gradient and the natural drainage direction toward the Harding River and its tributaries.

The groundwater gradient in the TA3 area is consistent with the regional gradient from south-west to north-east, towards the Harding River. The groundwater elevations range from 20 m AHD to approximately 10 m AHD.

The orientation of the contours adjacent to the Harding River demonstrates that the stream is losing in nature (i.e. groundwater flows from the river channel toward surrounding terrain, but not the other way around). This suggests that the river contributes to groundwater recharge rather than receiving baseflow, particularly during periods of sustained surface flow following rainfall events or dam releases.

In the north-eastern portion of the project area, the groundwater elevation is the shallowest reflecting the minimal topographic gradient and proximity to the ocean. Within this tidal surface aquifer, groundwater levels are influenced by tidal fluctuations. Consequently, groundwater flow in the eastern part of the project area becomes more subdued and planar, trending consistently toward the sea. This contrasts with the more dynamic gradients observed further inland in the south-western area. Additionally, the creek lines and rivers indicate the presence of Quaternary alluvial deposits, which locally host unconfined aquifers and contribute to shallow groundwater expression, particularly along features like the Harding River and local creeks.

Groundwater elevations across the Andover Intrusion reflect the underlying topographic controls (see Figure 3.2), with higher water levels recorded in the elevated southern and central portions of the catchment and progressively lower levels observed toward the northern and coastal margins. In most locations, the water table lies well below ground level (typically 10–30 m bgl), indicating an unconfined system with appreciable vertical separation from the surface. Bores positioned along ridgelines and upper slopes (e.g., AND-MB-010, AND-MB-021, Harding River-2-200) record the highest groundwater elevations (15–77 m AHD), consistent with their topographic position. Conversely, bores along the Harding River valley and tributaries (e.g., AND-MB-013, AND-MB-016) show markedly lower elevations (3–10 m AHD) and shallow depths to water (<5 m bgl), reflecting local topography and the presence of alluvial deposits. These drainage lines function as losing streams during flow events, providing episodic recharge rather than continuous discharge. Across both the Andover Intrusion and surrounding basement units, groundwater elevation declines follow the natural surface gradient, demonstrating a hydraulically subdued system where topography and structural features exert the dominant control on flow direction and distribution.

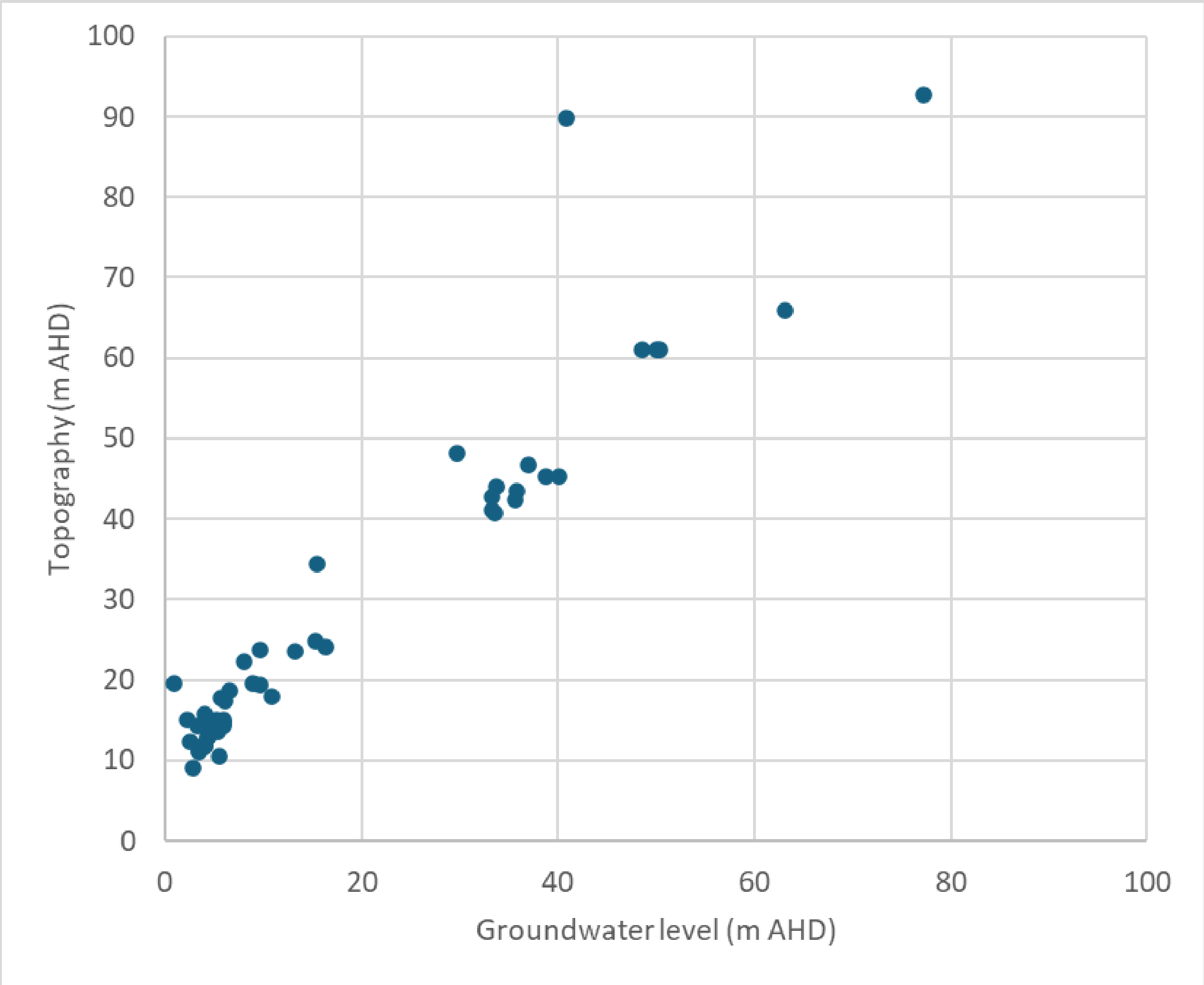
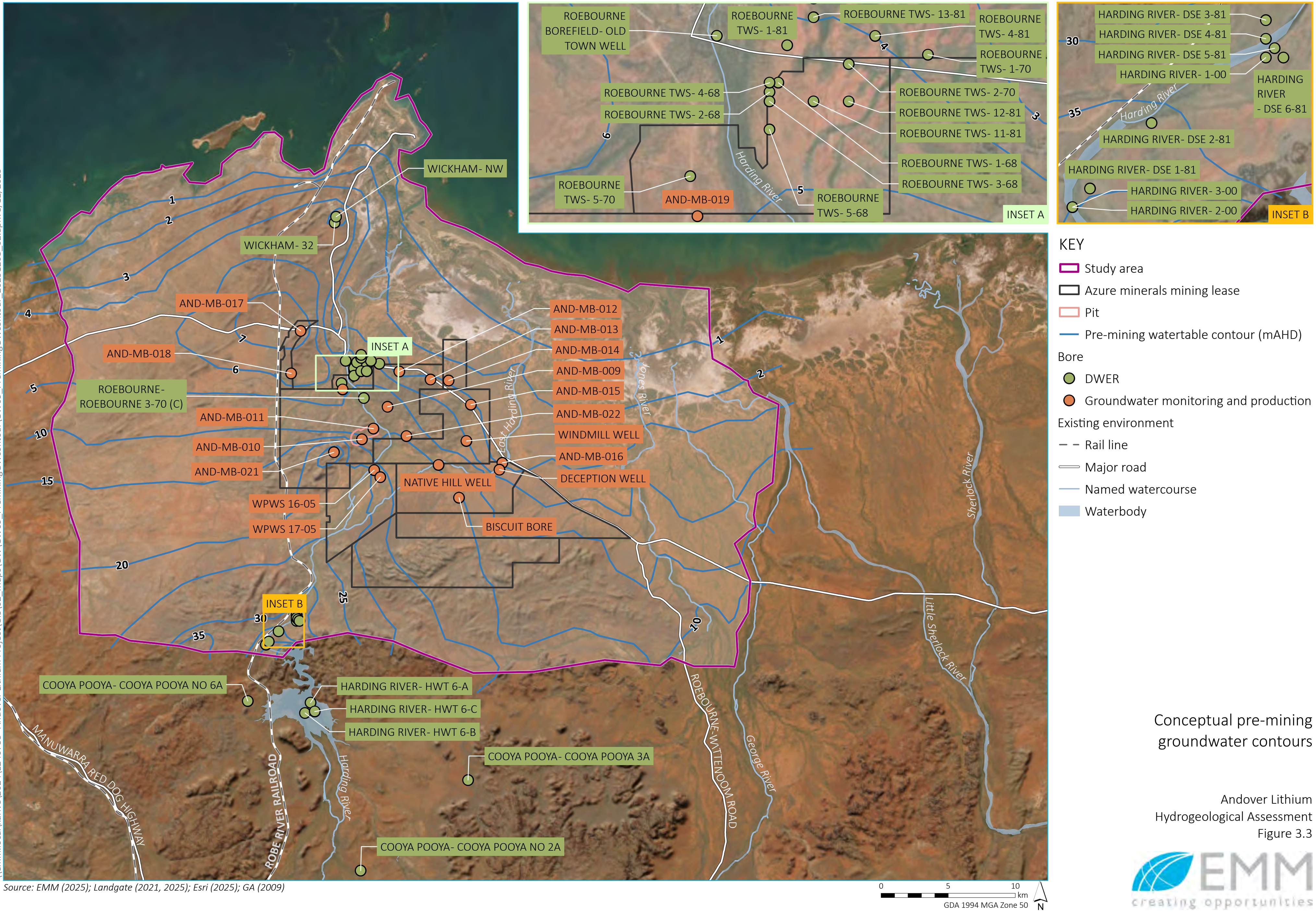


Figure 3.2 Groundwater level and topography correlation



Source: EMM (2025); Landgate (2021, 2025); Esri (2025); GA (2009)

Conceptual pre-mining groundwater contours

Andover Lithium
Hydrogeological Assessment
Figure 3.3

3.3.2 Temporal variations in groundwater levels

Groundwater elevations range from 0.8 m AHD to more than 32.0 m AHD (Figure 3.4). In summary:

- Monitoring bores installed in the western and central parts of the project area generally show higher groundwater levels, with AND-MB-010, AND-MB-021, and Native Hill Well consistently recording some of the highest groundwater elevations (between approximately 13.5 and 32.5 m AHD). These monitoring bores also record minimal short-term fluctuations, suggesting that they intersect confined or low-transmissivity hydrogeological units where groundwater levels respond slowly to surface recharge or disturbance.

In contrast, several bores show clear evidence of recent drawdown followed by gradual recovery. This behaviour is most apparent in AND-MB-011, AND-MB-016, and Deception Well, where groundwater levels decline significantly in early 2025 before beginning to rise again.

Mid-range groundwater levels, generally between 4.0 and 9.5 m AHD, are observed in bores such as AND-MB-009, AND-MB-014, and Windmill Well. These hydrographs are relatively flat over time, suggesting stable conditions in aquifers that are disconnected from active recharge features. Their consistent levels indicate equilibrium in unconfined or semi-confined systems, away from significant recharge or discharge boundaries.

Several bores recorded the lowest groundwater levels in the network, including AND-MB-016 (~0.8–2.5 m AHD), AND-MB-013, and Biscuit Bore. The low levels in AND-MB-016 and its early-2025 drawdown support the interpretation of ongoing equilibration post-installation. Conversely, bores such as AND-MB-013 and AND-MB-017 show rising trends over the monitoring period, possibly due to natural recharge or delayed recovery from earlier purging.

A small number of bores, including AND-MB-012, AND-PB-009, and AND-PB-011, recorded only isolated data points, limiting interpretation. These sparse readings should be treated cautiously when used in contouring or trend assessments. Their values are nonetheless consistent with adjacent bores and support broader spatial patterns in groundwater elevation across the site.

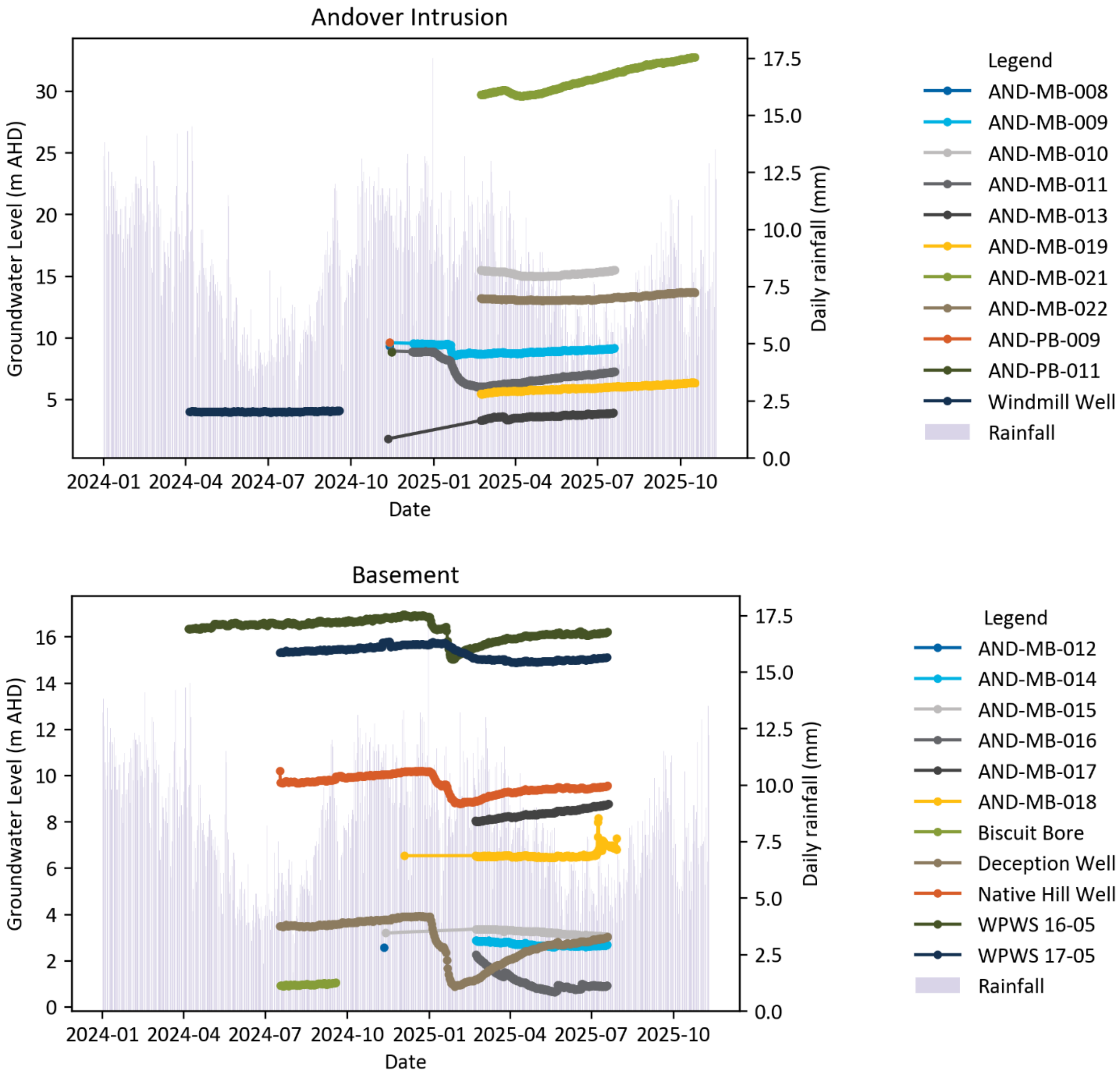


Figure 3.4 Temporal changes in groundwater levels

3.4 Groundwater and surface water chemistry

Salinity, expressed as total dissolved solids (TDS), varies markedly between groundwater and surface-water environments across the Andover area and is strongly controlled by geology and hydrological setting (see Figure 3.6 and Appendix A). Groundwater in the Basement typically ranges from fresh to moderately saline (TDS ~580–2,800 mg/L), except at a few highly mineralised sites (e.g., AND-MB-014 and AND-MB-015, 7,900–11,000 mg/L) where deep groundwater interacts with mafic lithologies. In contrast, groundwater within the Andover Intrusion shows a broader spectrum, from fresh conditions (~750–1,800 mg/L) to extremely saline pockets (e.g., AND-MB-013, 35,000 mg/L), reflecting strong structural control, compartmentalisation and prolonged water–rock interaction within the fractured mafic intrusive. Surface-water salinity shows a completely different pattern: the Harding River near the dam is consistently fresh (~600–800 mg/L), whereas upstream and downstream reaches exhibit strong seasonal and hydrological variability, ranging from very fresh conditions in February–April (<400 mg/L) to extremely saline floodplain pools in the dry season (e.g., HRDS2/HRDS3 up to >120,000 mg/L TDS). These extreme dry-season values reflect evaporation concentration in disconnected pools rather than true river flow.

Groundwater across the project area is consistently neutral to slightly alkaline, with pH values typically ranging from about 7.4 to 8.7, reflecting buffering by carbonate minerals and prolonged interaction with mafic and basement lithologies. In contrast, surface-water pH shows a narrower and slightly lower range, generally between 7.6 and 8.3 where reported, and tends to fluctuate more with seasonal flow and dilution conditions. Overall, groundwater exhibits more stable and uniformly alkaline pH, while surface water is slightly less buffered and more variable, reflecting rapid changes in flow, runoff and evaporation within the Harding River system. For reference see Figure 3.6 and Appendix A.

Across the Piper diagram (Figure 3.5), groundwater samples from the Basement, Andover Intrusion, and the western side of the project area form a broad but coherent cluster with generally similar major-ion proportions. These waters are predominantly mixed-cation types plotting between the Ca–Mg and Na+K fields, and on the anion ternary they align along the HCO_3–SO_4–Cl continuum, with most samples trending toward bicarbonate-sulphate dominance. In contrast, surface-water samples from the Harding River system show a much wider spread. Upstream samples plot closer to the fresh, low-salinity end of the hydrochemical spectrum, while downstream and near-project samples shift toward Na–Cl-rich compositions, reflecting the progressive influence of evaporation, saline alluvium, and tidal mixing closer to the coast. Although some overlap exists—particularly between upstream river samples and the fresher groundwater sources.

The diamond field reinforces this pattern: groundwater from the Basement and Andover Intrusion lithologies plots as relatively tight, moderate-salinity mixed-type waters, whereas surface-water samples from the Harding River plot along a well-defined salinity gradient, ranging from fresh Ca–Mg–HCO_3-type water upstream to increasingly Na–Cl-dominated water downstream near the coast. These trends indicate that, unlike groundwater, surface water undergoes rapid chemical evolution driven by episodic flow, evaporation, and mixing with more saline environments. As such, while some compositional overlap occurs during fresher flow conditions, surface-water chemistry diverges strongly from groundwater at higher salinities, suggesting limited but episodically enhanced connectivity rather than continuous interaction.

The Durov diagram (Figure 3.6) further highlights these distinctions. In the Cl vs Na+K and TDS vs Na+K panels, surface-water samples follow a steep salinity gradient, extending to very high TDS values (>100,000 mg/L), whereas groundwater samples remain confined to the low- to moderate-salinity range (<10,000 mg/L) along the same general mixing line. This indicates that both water types share similar geochemical controls—principally rock–water interaction within mafic and ultramafic lithologies—but surface water undergoes much stronger evaporative concentration. The pH vs Cl plot shows groundwater maintaining a near-neutral to moderately alkaline pH (7.4–8.3), while surface-water samples display similar pH values despite their broader salinity range.

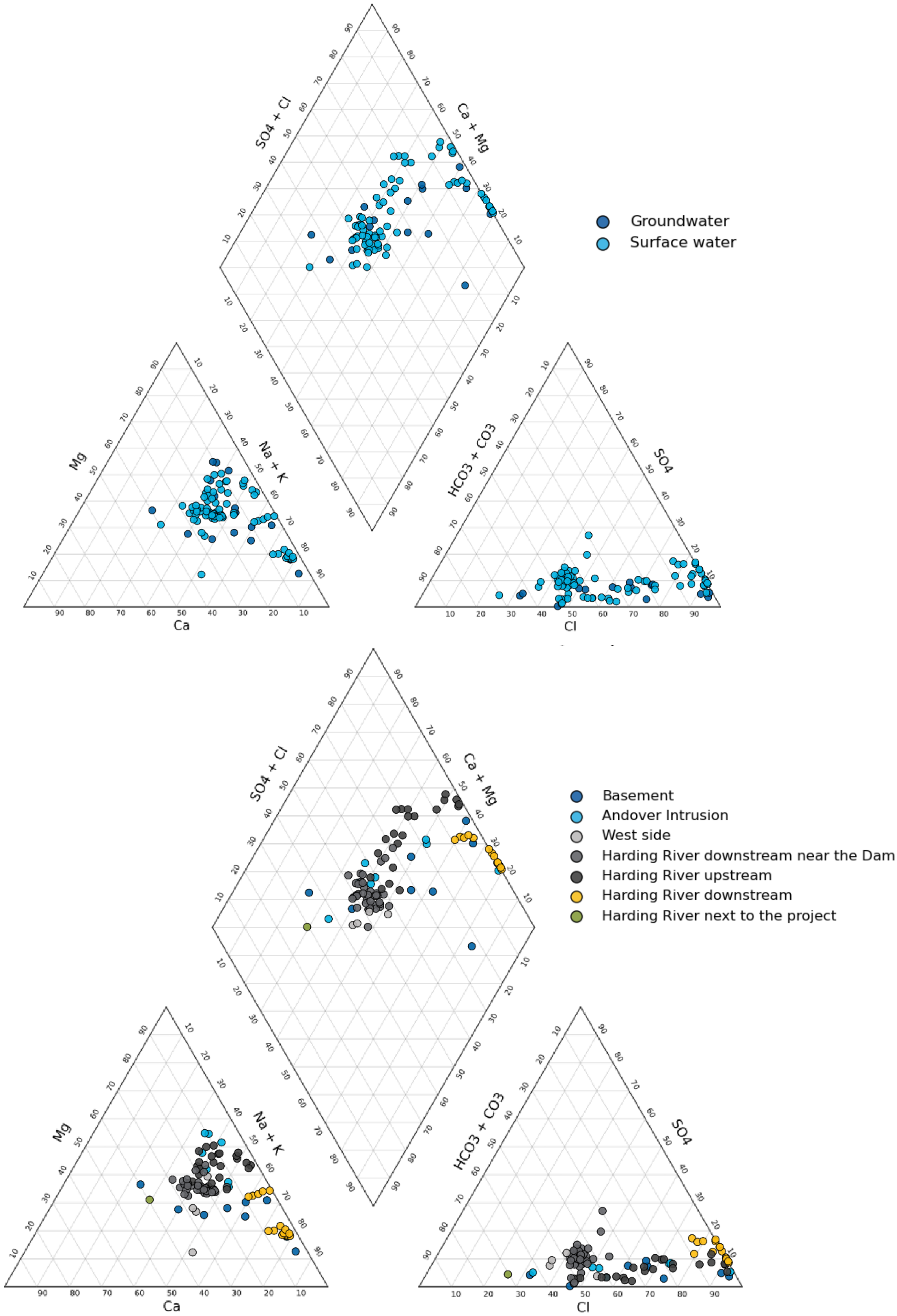


Figure 3.5 Piper diagram by source of water (groundwater and surface water) and by Formation/Location

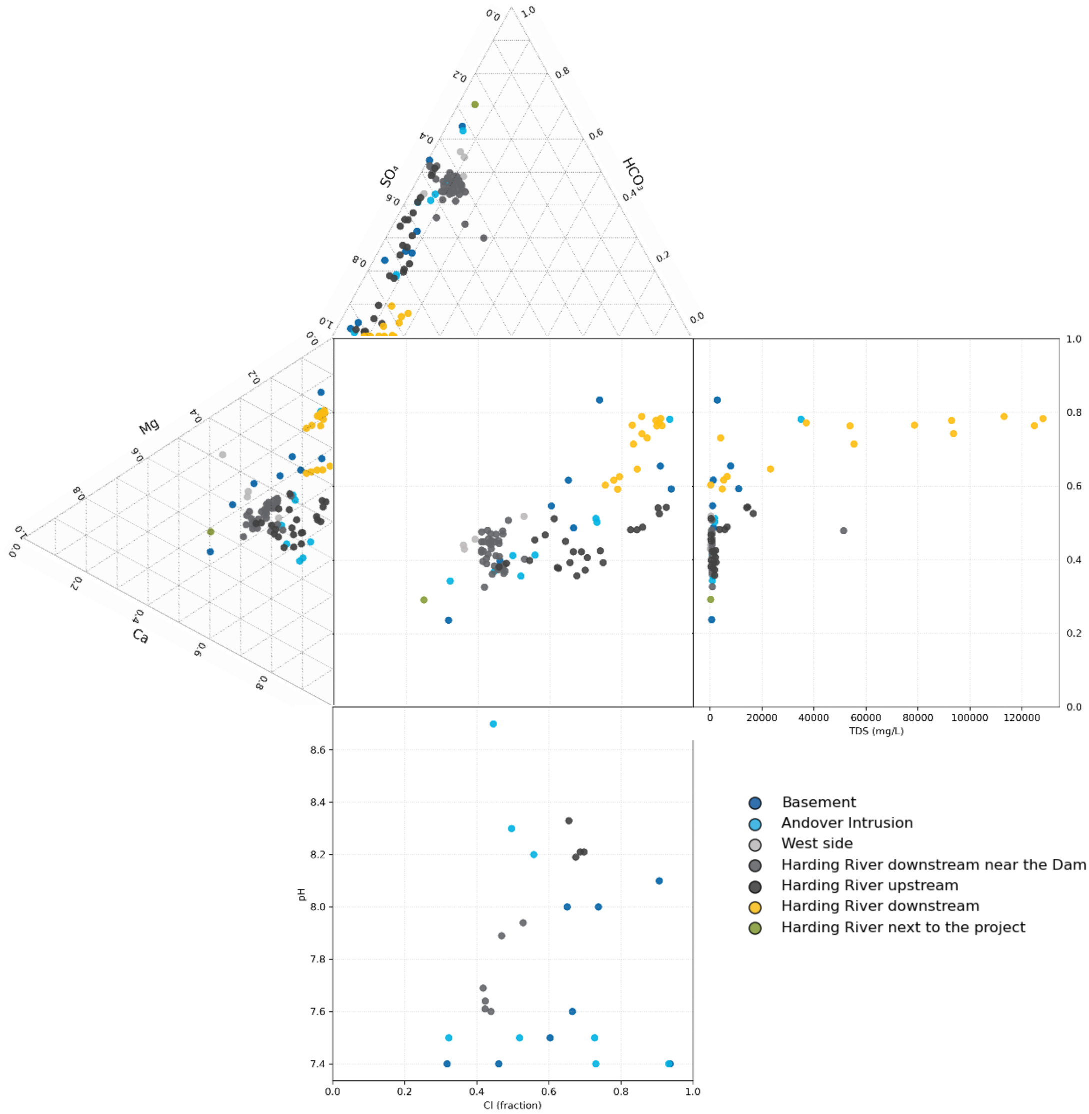


Figure 3.6 Extended Durov diagram

3.5 Groundwater and surface water interaction

Groundwater-surface water interaction in the project area is constrained by the arid climate (low, variable rainfall and high evaporation) and the dominance of low permeability basement rocks. Recharge occurs episodically during high intensity rainfall and cyclone events; otherwise, prolonged baseflow is uncommon. This climate signal is evident in the long-term rainfall context (SILO) and in the hydrologic characterisation of the Pilbara coastal catchments (AquaGeo 2025; Haig 2009 and SILO dataset summary in Section 2.1.).

Along the Harding River and its main tributaries, groundwater-surface water interaction is focused and event-driven. Flood pulses promote streambed infiltration, short-lived bank storage and local recharge of adjacent alluvium; however, the construction and operation of Harding Dam (1984) substantially reduced downstream flow frequency and magnitude, limiting sustained aquifer replenishment in the lower catchment. In dry periods the channels behave as losing systems, with infiltration to shallow alluvium rather than gaining baseflow from the regional groundwater system (Water Corporation 2025; Harding Dam WSPP WRP 15 and AquaGeo 2025).

Across interfluves and uplands underlain by the Andover Intrusion and surrounding granitoid-greenstone units, groundwater-surface water connectivity is weak. The mafic-ultramafic intrusive rocks (gabbro, peridotite, pyroxenite) and many granitoids exhibit very low matrix permeability; groundwater is largely restricted to shallow fractures and structurally favourable zones, which strongly compartmentalises flow and limits lateral exchange with surface waters outside the alluvial corridors (AquaGeo 2025).

In the coastal margin, the regime shifts to a tidal - saline system. Estuarine and marine sediments (tidal flats, mangrove zones, supratidal plains) host a shallow water table that tracks sea level and tidal amplitude; fresh surface-water inputs are minor, and the dominant exchange is between groundwater and the ocean. Salinity typically increases toward the coast, consistent with a shallow, laterally extensive transition zone governed by tidal mixing and evaporation over flats.

Vegetation supports this hydrogeological picture: the only settings with credible groundwater dependence are drainage-line and riparian landforms (e.g. assemblages including *Melaleuca argentea, Eucalyptus camaldulensis, Sesbania formosa, Eucalyptus victrix*), while plains and uplands are mapped as negligible for groundwater dependence. These phreatophyte patterns indicate access to shallow groundwater/bank storage along active channels after flood events, rather than widespread regional discharge (Biologic Environmental Survey 2025a).

3.6 Saline water interface

The project area lies south of the coastal estuarine environment near Roebourne, where saline groundwater is present in alluvial aquifers associated with tidal flats and salt marshes. Several monitoring bores to the north and north-west of the Andover Intrusion record elevated TDS values (35,000 mg/L at AND-MB-013, 11,000 mg/L at AND-MB-015 and 7,900 mg/L at AND-MB-014), indicating highly saline conditions likely influenced by the nearby salt flats.

4 Conceptual hydrogeological model

A conceptual hydrogeological model is a simplified representation of the hydrogeological regime. The conceptualisation is used to describe and model groundwater flow. It is a fundamental tool for understanding the behaviour of groundwater and predicting how it will respond to natural (climate) and anthropogenic change.

4.1 Aquifers

The hydrogeological framework of the study area is dominated by fractured rock units of varying permeability and storage characteristics, with only a few units functioning as aquifers capable of yielding groundwater suitable for local abstraction.

The main aquifer types identified at the project area are detailed in Table 4.1.

Table 4.1 Aquifer types

Aquifer type	Hydrogeological characteristics
Alluvial aquifer	Discontinuous, but productive aquifer where saturated. High permeability, high storage and high recharge aquifer. Expected to display unconfined responses.
Tidal aquifer	Shallow aquifer in coastal flats, strongly influenced by tides. Groundwater is saline to hypersaline, with negligible recharge and limited hydrogeological significance beyond saltwater–groundwater interaction
Weathered fractured rock aquifer	Strata bound aquifer of limited extent in the Jaspilitic Breccia of Cleaverville Formation and in the weathered portions of the Nickol River Formation. Expected to have low transmissivity and low storage.
Fractured rock aquifer	Minor aquifer zones where jointing and faulting within fresh rock mass can provide enhanced permeability but low storage. Permeability is expected to decrease with depth. Expected to display semi-confined responses.
Fresh rock aquitard	Low transmissivity and low storage.

4.2 Hydrostratigraphic units

The hydrostratigraphic framework for the study area has been developed by integrating the published geological mapping and descriptions of the Roebourne area with site-specific hydrogeological information and professional judgement. The regional geology is primarily based on the 1:100 000 and 1:500 000 Roebourne sheets and associated explanatory notes, which define the distribution, lithology and structural relationships of units such as the Andover Intrusion, Cleaverville Formation, Nickol River Formation and surrounding granitoid–greenstone sequences (Hickman 2002). These geological units were then grouped into hydrostratigraphic units according to their expected hydraulic behaviour (distinguishing between fractured rock aquitards, potential fractured rock aquifers, and surface aquifers hosted in Quaternary sediments) using information from drilling, aquifer testing, groundwater level monitoring and regional hydrogeological assessments (AquaGeo 2025).

On this basis, six principal hydrostratigraphic units are recognised in the study area:

- Quaternary alluvial deposits
- tidal surface aquifers
- the Jaspilitic Breccia within the Cleaverville Formation
- the Nickol River Formation

- the Andover Intrusion
- the broader fractured-rock basement.

The following subsections describe the key characteristics and groundwater significance of each unit.

4.2.1 Quaternary alluvial deposits

The surface Quaternary alluvium comprises colluvium, alluvial fan deposits, and riverine sediments associated primarily with drainage lines such as the Harding River (and its east branch), Murray Camp Creek, and Jones River system. These sediments are typically found in valley floors, drainage corridors, and low-lying areas, where they may attain sufficient thickness and permeability to host shallow groundwater. These materials include sands, gravels, silts, and clays, which form a discontinuous, unconfined surface aquifer of variable thickness.

This aquifer hosts shallow groundwater with variable thickness and is locally significant, particularly where recent recharge occurs from rainfall and streamflow. Observed groundwater levels within alluvium correspond to low depths to water, especially along major creeks, consistent with localized recharge and losing stream behaviour.

4.2.2 Tidal aquifer

In the north-eastern part of the project area, adjacent to the coast, lies a tidally influenced surface aquifer. This coincides with low-elevation estuarine and coastal flat terrain. Groundwater levels in this area are very shallow, with water table elevations ranging from near sea level to approximately 2 m AHD, indicating strong hydraulic connectivity with tidal fluctuations. This aquifer is saline to hypersaline, and its groundwater flow direction is subdued and generally toward the sea, reflecting a relatively flat hydraulic gradient. Its hydrogeological role is mostly limited to coastal saltwater-groundwater interactions.

4.2.3 Jaspilitic Breccia (Cleaverville Formation)

The Jaspilitic Breccia unit of the Cleaverville Formation includes ferruginous cherts, and banded iron formations that locally exhibit secondary porosity due to fracturing and brecciation. This unit is recognised as a known fractured rock aquifer in the region. While matrix permeability is low, fracture networks and brecciated zones may support limited groundwater movement, particularly in weathered or tectonically stressed zones. Although the location of and thickness of the Jaspilitic Breccia unit within the Cleaverville Formation have not been defined with the area.

4.2.4 Nickol River Formation

The Nickol River Formation is a heterogeneous unit composed of quartzose sandstone, conglomerate, breccia, carbonate rocks, banded iron formation, with local development of chert and felsic volcanics.

Groundwater storage and flow within the Nickol River Formation are likely to occur within weathered and fractured zones, particularly where carbonate dissolution or iron-rich units have enhanced secondary porosity and permeability. However, its aquifer status remains provisional, with field-based hydraulic testing and water chemistry data required to confirm its productivity and recharge characteristics.

4.2.5 Andover Intrusion

The Andover Intrusion underlies much of the project area and the TA3 proposed pit. It is composed of gabbro, serpentinised peridotite, dunite, pyroxenite, and minor anorthosite, with layered pegmatite sills. The Andover Intrusion shows wide spread alteration and development of secondary minerals indicative of metamorphism.

In the Andover Intrusion groundwater is largely confined to shallow fracture networks and fault zones, typically encountered at depths of approximately 15 to 25 m, with deeper sections of the intrusion being predominantly dry (AquaGeo 2025).

Shallow fractured zones in valleys where structural features intersect the surface may host limited groundwater (e.g. where production bores AND-PB-009 and AND-PB-011 are located). These shallow zones have shown yields of 1.0 to 1.5 L/s, though deeper parts of the intrusion are typically dry, reflecting poor aquifer connectivity and low transmissivity. Away from these structural corridors, the intrusion behaves mainly as a low-transmissivity aquitard.

4.2.6 Basement

The remaining geological formations, which constitute most of the study area's basement, include volcanics, granitoids, and metasedimentary rocks such as the Regal Formation, Mount Roe Basalt, Louden Volcanic Member, Hardey Formation, and others. These units predominantly function as fractured rock aquitards, with extremely low permeability and restricted groundwater storage. Groundwater movement is generally confined to weathered or fractured zones near surface or along shear zones.

4.3 Hydrogeological barriers to flow

Locally, the Andover Intrusion, is largely impermeable in its unfractured state. These crystalline igneous rocks exhibit extremely low porosity and permeability, acting as aquicludes across most of the intrusion.

Hydrogeological testing has shown that groundwater is only present in shallow fractured zones, within deeper portions (below approximately 25 m) being mostly dry (AquaGeo 2025). Therefore, much of the Andover Intrusion acts as a lithological barrier, inhibiting lateral and vertical groundwater movement.

Regionally, it is intersected by several major shear zones and faults, including the Sholl Shear Zone and local fault structures mapped through the Andover deposit. While some faults serve as conduits for groundwater where fracturing enhances permeability, many shear zones exhibit clay-rich gouge or silicified zones, which can behave as hydraulic barriers, compartmentalising aquifers.

4.4 Recharge and discharge

Groundwater recharge within the study area is limited by the arid climate, high potential evaporation, and the predominance of low permeability igneous and metamorphic basement rocks. Regional investigations for the Pilbara coast indicate that recharge occurs mainly during infrequent but intense rainfall events, typically associated with tropical cyclones and major storm systems, when short lived but high magnitude runoff is generated in the Harding River and Jones River catchments and their tributaries (Haig 2009). Under these conditions, infiltration is focused along drainage lines and into more permeable alluvial and colluvial deposits, while direct diffuse recharge through the hard rock uplands is expected to be minimal (Haig 2009 and AquaGeo 2025).

Within the fractured rock aquifer system of the Andover Intrusion, recharge is further constrained by the crystalline nature of the host rocks. Productive bores (yielding between about 1.0 and 1.5 L/s) are generally located in valleys where structural features intersect the surface, indicating that fracture-controlled pathways in topographic lows are the primary zones of effective recharge and groundwater storage (AquaGeo 2025).

The construction and operation of Harding Dam in 1984 have significantly modified the recharge regime in the lower Harding River and adjacent alluvial aquifers. Pre-dam flows provided more frequent opportunities for streambed infiltration and bank storage, whereas regulated releases now result in reduced flow frequency and volume downstream, thereby diminishing natural recharge to the alluvial systems that fringe the Andover area (Water and Rivers Commission 1999; Western Australian Water Corporation & Department of Water, WRP 15 and Water Corporation 2025). This reduction in recharge has been linked to increasing groundwater salinity in downstream borefields and coastal aquifers, reflecting longer residence times and greater evaporative concentration (Haig 2009; AquaGeo 2025).

Groundwater discharge in the study area occurs predominantly through evapotranspiration and outflow to the sea, rather than via well-defined baseflow to streams. Along major drainage lines such as the Harding River and East Harding River, riparian vegetation communities containing phreatophytic species (e.g. *Melaleuca argentea*, *Eucalyptus camaldulensis*, *Sesbania formosa*, *Eucalyptus victrix*) access shallow groundwater or bank-stored moisture following flood events, representing a key biological discharge mechanism (Biologic Environmental Survey 2025a; AquaGeo 2025). Toward the coastal margin and tidal flats north of Roebourne, groundwater discharge is mainly to the marine system, where the shallow saline groundwater table is subject to tidal mixing and evaporation over estuarine and supratidal surfaces (Haig 2009; AquaGeo 2025).

A conceptual cross-section (Figure 4.1) was developed to illustrate the interaction between surface water and groundwater across the proposed pit and the Harding River. The section indicates that the Harding River behaves as a losing stream, providing recharge to the groundwater system during high rainfall events and periods when substantial releases occur from Harding Dam. Riparian vegetation is present along both banks of the river, suggesting a high potential for groundwater dependency in these communities.

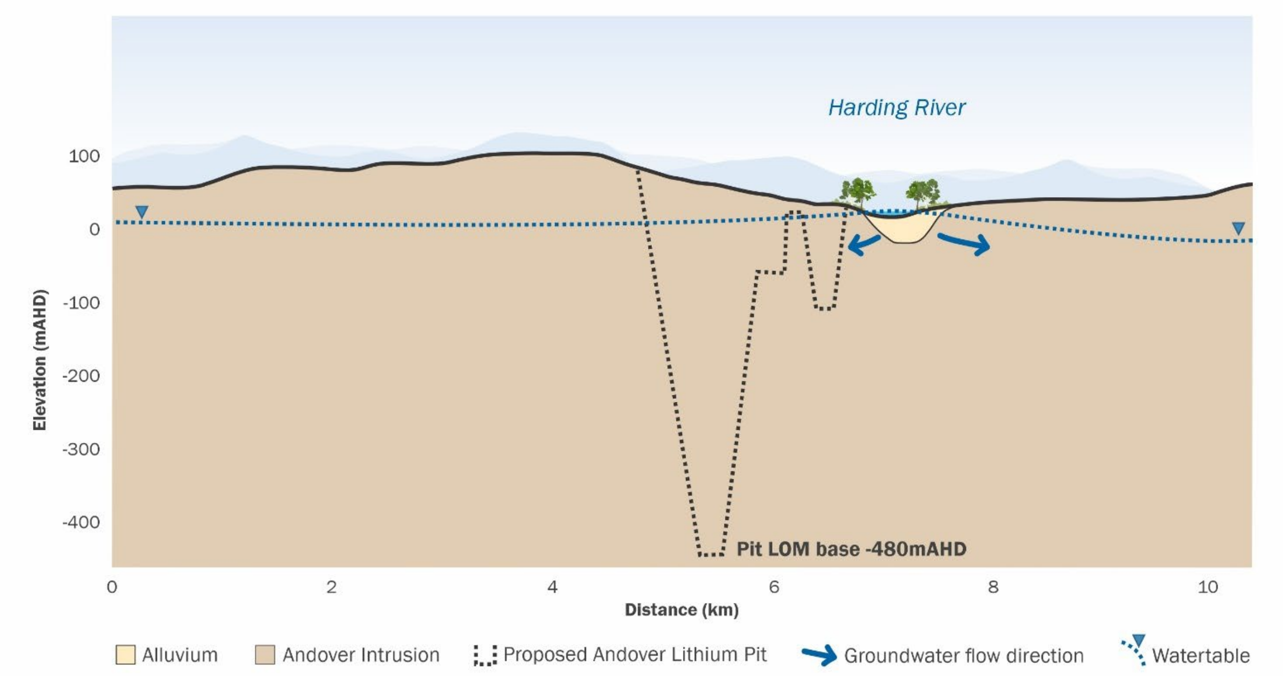


Figure 4.1 Conceptual surface water and groundwater interaction relative to Harding River and proposed pit

4.5 Groundwater occurrence

The interpreted pre-mining groundwater gradient is from the elevated basement and Andover Intrusion area in the south-west and central parts of the project area toward the lower lying Harding River corridor and, further downstream, toward the coastal plain and tidal flats in the north and north-east. Within the Andover Intrusion, gradients steepen locally along valleys and fracture zones, where shallow water bearing structures focus flow toward drainage lines.

In the coastal and tidal flat areas, groundwater levels lie close to sea level and the gradient becomes very low and planar, controlled largely by marine water level and tidal influence rather than inland recharge. Overall, the system is characterised by low regional gradients, structurally focused flow paths, and minimal cross-boundary flow where low-permeability units and shear zones compartmentalise the groundwater system.

4.5.1 Sensitive features

The project area includes several sensitive features that require consideration in groundwater management. Riparian vegetation communities along the Harding River and its tributaries represent the primary potential groundwater-dependent ecosystems (pGDEs), see Figure 2.7. These communities include species such as *Melaleuca argentea*, *Eucalyptus camaldulensis*, *Sesbania formosa*, and *Eucalyptus victrix*, which rely on shallow groundwater or bank-stored soil moisture following flood events. Mapping from the Biologic Environmental Survey (2025a) identified one vegetation unit with high groundwater dependence potential and several others rated moderate or low, consistent with the episodic nature of groundwater access in this arid environment. In addition to ecological receptors, multiple artefacts and culturally significant sites have been recorded within the study area (Figure 2.6). These locations are considered sensitive due to their heritage and environmental values and are included in the avoidance layer to ensure they are protected during project activities.

5 Analytical model

5.1 Dewatering assessment

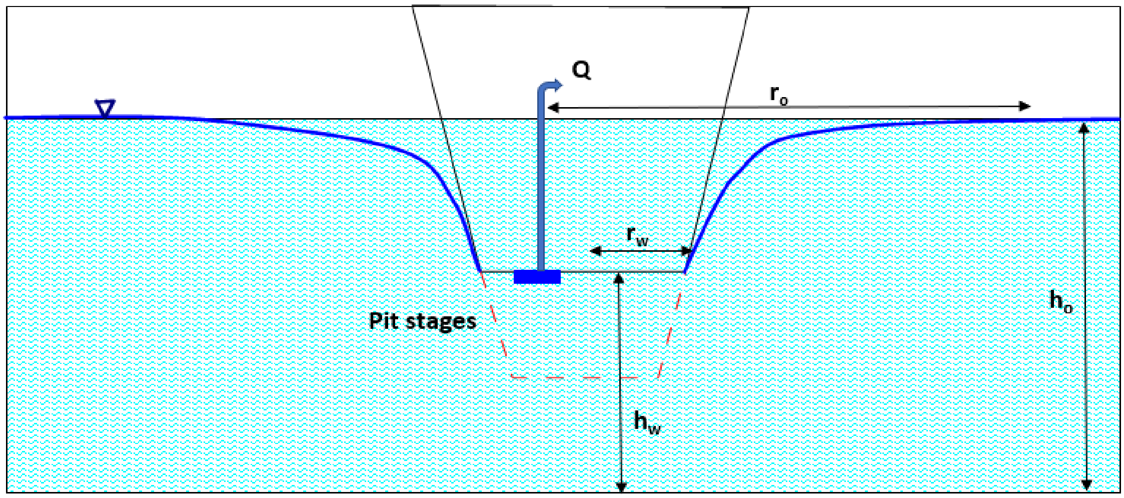
Dewatering will become necessary once mining activities intersect the weathered geological profile below the watertable. The 20-year life-of-mine (LOM) schedule was provided in the form of .dxf files, representing pit stages at four-year intervals. An analytical approach was adopted as a practical method for estimating potential dewatering requirements.

The assessment utilised the Thiem–Dupuit equation (Kruseman and de Ridder, 1994) to estimate mine inflows for each four-year interval. This method assumes that steady-state inflow rates offer a reasonable approximation of dewatering demands at each depth. However, it may underestimate actual inflows in cases of rapid mine development or where the rock mass demonstrates considerable heterogeneity.

Due to the limited availability of hydrogeological data and testing, the inflow estimates derived from this model should be regarded as semi-quantitative and indicative only.

A graphical representation of the analytical assumptions is provided in Figure 5.1.

$$Q = \pi . k.(h_o^2 - h_w^2)/\ln(r_o/r_w)$$



Notes: Q = outflow from large diameter sump or pit (m3/day); k = hydraulic conductivity (m/day); Sy = specific yield

h_o = height of SWL above base of aquifer (m); h_w = height of depressed water level in pit (m); r_w = radius of sump or pit floor (m)

r_o = radius of maximum extent of cone of drawdown given by (Sqrt (2.25* k* ho* t / Sy)) (m); t = time since pumping started (days).

Figure 5.1 Estimation of mine void inflow rates using the Thiem – Dupuit equation

Assumptions used within the base case calculations include:

- the pre-mining watertable elevation at the pit is 10 m AHD, based on the conceptual contours developed in section 3.3.1
- the height of the dewatered water level above datum, h_w, given by the bench elevation for each four year period
- the time, t, for each step was taken from the number of days in the corresponding end of each period
- the radius of the pit (r_w) was estimated based on the approximations of the largest length (a) and width (b) at the end of each period, calculated as:

$$r_w = \sqrt{(ab/\pi)};$$

- the initial saturated thickness (h_0) was estimated by subtracting a reference depth of 10 m below the bench elevation from the pre-mining water table level for each period. For example, at the end of the 20-year period, the bench elevation is -480 m AHD; thus, h_0 would be calculated as 490 m
- the hydraulic conductivity and specific yield were assumed given expert knowledge and by trying multiple combinations to avoid convergence issues.

5.2 Results

The dewatering volumes and associated drawdown extents (expressed as the predicted radius of influence) were estimated across a 20-year mining period using a range of specific yield and hydraulic conductivity values (Table 5.1). These parameters are critical in understanding the groundwater response to mine dewatering and the extent of aquifer drawdown.

The results demonstrate a strong sensitivity of both the radius of influence and dewatering volumes to variations in hydraulic conductivity, while specific yield exerts a more moderate influence. Among the two variables, hydraulic conductivity is the most influential, particularly with respect to the estimated dewatering volumes.

For instance, when specific yield is held constant at 0.001, increasing the hydraulic conductivity from 0.0001 m/d to 0.01 m/d reduces the predicted radius of influence significantly (from ~9,000 m to ~900 m at year 20), while increasing the estimated dewatering volume from 0.39 L/s to 19.58 L/s. This indicates that even modest increases in hydraulic conductivity can dramatically affect pumping requirements.

Conversely, variations in specific yield have a more gradual effect on both the radius of influence and dewatering rates. For example, increasing specific yield from 0.001 to 0.05 at a constant hydraulic conductivity of 0.01 m/d increases the radius of influence from ~900 m to ~6,400 m at year 20, but the dewatering volumes rise only slightly, from 0.8 L/s to 0.5 L/s.

Considering these sensitivities, a plausible maximum scenario is represented by a specific yield of 0.001 and a hydraulic conductivity of 0.01 m/d. Under this scenario, the predicted radius of influence at year 20 is approximately 905 m, and the corresponding dewatering rate is 19.6 L/s. This combination reflects a realistic balance between aquifer transmissivity and storage, especially in fractured rock environments with limited porosity.

Table 5.1 Predicted range in drawdown extension and dewatering

Specific yield	K (m/d)	Predicted radius of influence (m)					Predicted dewatering (L/s)				
		4 years	8 years	12 years	16 years	20 years	4 years	8 years	12 years	16 years	20 years
0.001	0.0001	4,011	5,703	6,997	8,087	9,046	0.1	0.2	0.3	0.3	0.4
0.001	0.001	1,268	1,803	2,213	2,557	2,861	0.1	0.3	0.5	0.6	0.8
0.001	0.01	401	570	700	809	905	0.3	0.8	2.2	4.8	19.6
0.01	0.0001	12,684	18,034	22,127	25,573	28,606	0.1	0.1	0.2	0.2	0.3
0.01	0.001	4,011	5,703	6,997	8,087	9,046	0.1	0.2	0.3	0.3	0.4
0.01	0.01	1,268	1,803	2,213	2,557	2,861	0.1	0.3	0.5	0.6	0.8
0.05	0.0001	28,362	40,326	49,477	57,182	63,966	0.0	0.1	0.1	0.2	0.2
0.05	0.001	8,969	12,752	15,646	18,083	20,228	0.1	0.1	0.2	0.3	0.3
0.05	0.01	2,836	4,033	4,948	5,718	6,397	0.1	0.2	0.3	0.4	0.5

6 Conclusion and recommendations

6.1 Conclusions

- The hydrogeological assessment for the Andover Lithium Project indicates that groundwater occurrence within the project area is highly constrained by the geological and climatic setting. The fractured rock aquifer system of the Andover Intrusion exhibits very low transmissivity and storage, with groundwater largely restricted to shallow fracture zones and structurally controlled corridors. Away from these zones, the intrusion and surrounding basement units function predominantly as aquitards. Productive bores yield only modest rates (approximately 1.0 - 1.5 L/s), confirming the limited potential for groundwater abstraction.

- Recharge across the project area is episodic and strongly event-driven, occurring primarily during high-intensity rainfall and cyclone events. The construction and operation of Harding Dam have further reduced downstream flows, diminishing natural recharge opportunities in the lower Harding River corridor. Consequently, groundwater systems are hydraulically subdued, with gradients following topography and minimal connectivity between uplands and surface water features outside alluvial corridors.

- Groundwater-dependent ecosystems (GDEs) are limited to riparian vegetation along major drainage lines, with no high-certainty aquatic or terrestrial GDEs identified within the project footprint. Sensitive receptors include these riparian communities and culturally significant sites mapped within the avoidance layer.

- Analytical modelling using the Thiem–Dupuit equation suggests that dewatering requirements will increase as mining progresses below the water table. The maximum () predicted inflows at the end of the 20-year life-of-mine are approximately 19.6 L/s, with a radius of influence of ~905 m given K ≈ 0.01 m/d, Sy ≈ 0.001 and a homogenous and isotropic porous media equivalent assumption. These estimates are semi-quantitative due to limited hydrogeological data and should be refined through additional testing and monitoring

6.2 Recommendations

- Monitoring and Data Collection:
  - Implement a comprehensive groundwater monitoring program, including level and salinity triggers near potential GDEs and sensitive receptors.
  - Expand the monitoring network to improve spatial coverage and capture temporal variability, particularly following major rainfall events.
- Adaptive Management:
  - Establish contingency measures for rapid response to unexpected drawdown or salinity changes.
- Further Investigations:
  - Conduct additional aquifer testing and hydrochemical sampling to refine hydraulic parameters and improve predictive modelling.
  - Undertake targeted stygofauna and ecological surveys to address knowledge gaps and meet regulatory requirements.

- Dewatering Strategy:
  - Develop a numerical groundwater model incorporating the conceptual understanding provided herein and a robust mathematical framework. This model will be calibrated and applied to assess potential impacts throughout the mining phase and into the post-closure period.
  - Progressively update dewatering estimates as new data become available, ensuring alignment with mine scheduling and environmental commitments.
  - Consider staged pumping and water reuse strategies to minimise environmental impacts and optimise water management.

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Appendix A

Groundwater monitoring network

EMM creating opportunities

A.1 Groundwater monitoring network details

Table A.1 Monitoring network details

Well ID	Bore Type	Monitored period		Well coordinates					Est. Depth (m)	Depth of Pilot Hole (mbgl)	Reamed Depth (mbgl)	Cased Depth (m)	Casing Diam. (DN)	Blank Casing Interval (mbgl)		Screened casing interval (mbgl)		Top of Casing (TOC) RL	Airlift Yield (L/s)
		From	To	Number of days	Easting	Northing	Ground RL	Top of casing RL						Start	Finish	Start	Finish		
AND-MB-008	Monitoring	13-Nov-24	13-Nov-24	1	518,035	7,697,741	25.05	25.42	120	84	-	84	100	1st: 0-18m	2nd: 24-78m	1st: 18-24m	2nd: 78-84m	0.37	0.2
AND-MB-009	Monitoring	13-Nov-24	19-Jul-25	224	518,416	7,698,663	23.67	24.00	120	100	-	96	100	1st: 0-24m	2nd: 30-90m	1st: 24-30m	2nd: 90-96m	0.45	dry
AND-MB-010	Monitoring	21-Feb-25	20-Jul-25	150	516,506	7,696,237	34.51	34.73	120	82	-	78	100	0	72	72	78	0.34	dry
AND-MB-011	Monitoring	15-Nov-24	20-Jul-25	227	517,361	7,697,035	19.58	19.90	120	120	-	108	100	1st: 0-12m	2nd: 18-102m	1st: 12-18m	2nd: 102-108m	0.33	1.0
AND-MB-012	Monitoring	11-Nov-24	11-Nov-24	1	519,290	7,701,290	12.27	12.77	30	30	-	30	100	0	24	24	30	0.58	0.6
AND-MB-013	Monitoring	11-Nov-24	18-Jul-25	149	521,616	7,700,696	14.31	14.59	30	30	-	30	100	0	24	24	30	0.38	0.2
AND-MB-014	Monitoring	22-Feb-25	19-Jul-25	148	522,961	7,700,617	9.04	9.32	30	24	-	24	100	0	18	18	24	0.40	0.8
AND-MB-015	Monitoring	13-Nov-24	19-Jul-25	149	524,622	7,698,814	11.22	11.60	30	30	-	30	100	0	24	24	30	0.45	0.1
AND-MB-016	Monitoring	22-Feb-25	19-Jul-25	148	526,966	7,694,489	15.08	15.54	30	30	-	30	100	0	24	24	30	0.54	<0.1
AND-MB-017	Monitoring	21-Feb-25	20-Jul-25	150	511,938	7,704,314	22.25	22.83	80	72	-	72	100	1st: 30-36m	2nd: 66-72m	1st: 0-30m	2nd: 36-66m	0.65	2.5
AND-MB-019	Monitoring	21-Feb-25	17-Oct-25	239	515,071	7,699,949	13.58	13.91	80	30	-	28	100	1st:0-10m	2nd: 16-22m	1st 10-16m	2nd: 22-28m	0.65	1.0
AND-MB-022	Monitoring	22-Feb-25	17-Oct-25	238	519,822	7,696,473	23.52	24.03	80	80	-	78	100	1st: 0-36m	2nd: 36-72m	1st:30-36m	2nd: 72-28m		1.0
AND-PB-009	Production	13-Nov-24	13-Nov-24	1	518,422	7,698,660	23.67	23.98	120	120	42	40	150	1st: 0-22m	2nd: 34-40m	22	34	0.43	1.5
AND-PB-011	Production	15-Nov-24	15-Nov-24	1	517,357	7,697,040	19.49	19.70	120	120	30	30	150	1st: 0-12m	2nd: 24-30m	12	24	0.35	1.0
WPWS 16-05	Monitoring	06-Apr-24	19-Jul-25	470	517420	7693936	24.277	23.572	-	-	-	-	-	-	-	8.4-14.4m		-	-
WPWS 17-05	Monitoring	17-Jul-24	18-Jul-25	367	517874	7693420	24.302	25.085	-	-	-	-	-	-	-	5.4-17.4m		-	-
Windmill Well	Monitoring	05-Apr-24	18-Sep-24	167	524287	7696110	15.731	15.987	-	-	-	-	-	-	-	-	-	-	-
Deception Well	Monitoring	17-Jul-24	19-Jul-25	368	526750	7693980	11.328	11.478	-	-	-	-	-	-	-	-	-	-	-
Biscuit Bore	Monitoring	18-Jul-24	18-Sep-24	63	523736	7691887	19.535	20.095	-	-	-	-	-	-	-	-	-	-	-
Native Hill Well	Monitoring	17-Jul-24	19-Jul-25	368	522215	7694326	19.849	19.461	-	-	-	-	-	-	-	-	-	-	-

Appendix B
Water quality results

creating opportunities

B.1 Groundwater quality

Table B.1 Groundwater chemistry - 2024

Sample Description	Units	Detection limit	Deception Well	Biscuit Bore	Native Hill Well	AND-MB17	Windmill Well	AND-MB16	AND-MB15	AND-MB14	AND-MB13	AND-MB12	AND-PB11	AND-MB11	AND-MB10	AND-MB08	AND-PB09	AND-MB09
Phosphorus	mg/L	0.05	0.077	0.13	-	-	-	-	-	-	0.16	<0.050	-	-	<0.050	-	<0.050	-
Phosphorus	mg/L	0.05	0.069	0.094	0.11	<0.050	1.8	0.58	<0.050	<0.050	0.37	0.15	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silicon	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica	mg/L	0.2	53	52	52	35	23	34	61	77	34	40	74	82	61	59	70	12
Aluminium	µg/L	10	<10	<10	<10	27	<10	33	<20	<10	<50	15	<10	<10	13	<10	<10	84
Antimony	µg/L	1	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	µg/L	1	1	6.4	4.8	17	5.4	1.2	2.3	93	<5.0	6	30	40	250	5.6	3.4	<1.0
Barium	µg/L	1	170	120	120	93	94	400	150	85	370	130	170	150	340	110	73	190
Beryllium	µg/L	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<0.50	<2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron	µg/L	20	740	600	650	220	930	210	820	1,300	2,300	1,000	880	1,000	540	550	510	370
Cadmium	µg/L	0.1	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	0.34	<0.10	<0.50	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Caesium	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	130	26	63	<1.0	4.5	5.8	47	7.5	2.1	1.1
Chromium	µg/L	1	<1.0	<1.0	1.9	<1.0	<1.0	<1.0	<2.0	1.2	<5.0	800	<1.0	1.7	<1.0	49	12	<1.0
Cobalt	µg/L	1	<1.0	<1.0	<1.0	1	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	1.8	13	<1.0
Copper	µg/L	1	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	4.2	<1.0	<5.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	µg/L	10	<10	<10	<10	<10	<10	37	<20	<10	<50	<10	94	<10	46	<10	<10	<10
Lanthanum	µg/L	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<0.50	<2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lead	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	µg/L	1	10	13	6.6	6.1	5.5	6.9	74	190	120	25	77	76	490	86	85	62
Manganese	µg/L	1	2.5	1.8	<1.0	24	17	1300	19	19	1600	<1.0	120	2.4	360	23	72	320
Molybdenum	µg/L	1	3.5	2.5	3.5	3.7	1.9	<1.0	6.9	8.4	<5.0	69	2.5	3.7	1.6	1.2	<1.0	1.4
Nickel	µg/L	1	1.1	<1.0	<1.0	25	1	<1.0	15	3.2	<5.0	540	<1.0	4.6	3.2	20	16	<1.0
Rubidium	µg/L	1	1.2	1.1	<1.0	1.2	6.5	2.9	170	76	210	2.9	11	13	42	24	2.6	7.2
Selenium	µg/L	1	2.2	2.4	4.3	<1.0	<1.0	<1.0	2.6	11	16	3.3	2.3	4	<1.0	5.6	1.9	4.6
Silver	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium	µg/L	1	2400	1300	640	710	920	660	6000	3000	8700	470	1800	2000	530	690	660	250
Thallium	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.9	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thorium	µg/L	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	4.9	1.4	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.9	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Titanium	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tungsten	µg/L	10	<10	<10	<10	<10	<10	<10	<20	<10	<50	<10	<10	<10	<10	<10	<10	<10
Uranium	µg/L	1	26	35	4.7	1.4	1.5	10	6.4	5.3	16	8.2	8.5	11	1.8	2	1.1	<1.0
Vanadium	µg/L	1	12	17	39	9.8	3.3	<1.0	4.5	4.4	<5.0	52	5.9	40	<1.0	5.8	12	<1.0
Zinc	µg/L	1	36	32	10	30	8	<1.0	12	1.6	<5.0	7.6	<1.0	<1.0	<1.0	1.7	11	<1.0
pH	pH units		7.6	7.5	8	7.4	8.2	7.4	7.4	8.1	7.4	8	7.5	7.4	8.7	7.5	7.5	8.3
Electrical Conductivity	µS/cm	2	2,500	1,700	2,200	1,000	2,500	1,200	21,000	13,000	59,000	5,100	3,400	3,600	1,400	2,000	1,600	1,400
Total Dissolved Solids	mg/L	5	1,300	940	1,200	580	1,300	620	11,000	7,900	35,000	2,800	1,700	1,800	750	1,000	880	800
Bicarbonate Alkalinity as $CaCO_3$	mg/L as $CaCO_3$	5	370	310	330	380	590	340	310	330	470	650	370	380	330	480	600	360
Carbonate Alkalinity as $CaCO_3$	mg/L as $CaCO_3$	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	49	<5.0	<5.0	<5.0
Hydroxide OH- as $CaCO_3$	mg/L as $CaCO_3$	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Sample Description	Units	Detection limit	Deception Well	Biscuit Bore	Native Hill Well	AND-MB17	Windmill Well	AND-MB16	AND-MB15	AND-MB14	AND-MB13	AND-MB12	AND-PB11	AND-MB11	AND-MB10	AND-MB08	AND-PB09	AND-MB09
Total Alkalinity as $CaCO_3$	mg/L as $CaCO_3$	5	370	310	330	380	590	340	310	330	470	650	370	380	380	480	600	360
Chloride	mg/L	1	550	340	490	110	470	170	6,700	4,000	19,000	1,200	830	880	210	350	180	240
Sulphate	mg/L	1	83	58	96	20	39	1.4	370	300	1,500	66	130	140	54	61	39	46
Calcium	mg/L	0.5	110	47	45	80	80	65	370	83	450	34	73	77	47	36	33	19
Magnesium	mg/L	0.5	66	46	51	44	120	33	640	420	1200	66	120	140	89	120	100	80
Potassium	mg/L	0.5	0.95	2.6	0.93	1.4	13	5.6	11	14	140	7	1.8	1.5	3.9	1.2	<0.50	4.9
Sodium	mg/L	0.5	240	170	240	54	220	88	2400	1,700	10,000	830	330	360	130	150	120	120
Hardness (calc) $CaCO_3$	mg/L	3	550	310	320	380	670	300	3,500	1,900	6,000	360	680	760	490	580	510	380
Fluoride	mg/L	0.1	0.9	0.61	0.82	0.72	0.29	0.23	0.35	1.1	1.8	0.44	0.43	1.1	0.78	0.7	0.37	0.22
Dissolved Organic Carbon	mg/L	1	<1.0	-	-	-	-	-	-	-	-	-	1.7	-	-	-	-	34
Ammonia as N	mg/L	0.005	0.02	0.0096	-	-	-	-	-	0.018	-	<0.0050	0.036	-	-	0.018	-	0.014
Nitrate as N	mg/L	0.005	2.4	4.7	-	-	-	-	-	<0.0050	-	0.39	0.0067	-	-	2.4	-	<0.0050
Nitrate as NO_3 by calculation	mg/L	0.02	11	21	-	-	-	-	-	<0.020	-	1.7	0.03	-	-	11	-	<0.020
Nitrite as N	mg/L	0.005	0.01	<0.0050	-	-	-	-	-	<0.0050	-	0.045	<0.0050	-	-	0.0066	-	<0.0050
Nitrite as NO_2 by calculation	mg/L	0.02	0.034	<0.020	-	-	-	-	-	<0.020	-	0.15	<0.020	-	-	0.022	-	<0.020
NOx as N	mg/L	0.005	2.4	4.7	-	-	-	-	-	<0.0050	-	0.44	0.011	-	-	2.4	-	<0.0050
TKN as N by calculation	mg/L	0.1	0.43	1.8	-	-	-	-	-	0.37	-	2.3	0.12	-	-	0.8	-	<0.10
Organic Nitrogen by calc	mg/L	0.1	0.41	1.8	-	-	-	-	-	0.35	-	2.3	<0.10	-	-	0.79	-	<0.10
Total Nitrogen	mg/L	0.1	2.8	6.5	-	-	-	-	-	0.37	-	2.7	0.13	-	-	3.2	-	<0.10
Phosphate	mg/L	0.005	0.065	0.11	-	-	-	-	-	0.0061	-	0.13	0.012	-	-	0.029	-	0.013

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