Water Monitoring and Management Plan 2025

MAHALO NORTH PL1128

PREPARED FOR COMET RIDGE

Water Monitoring and Management Plan, 2025

Comet Ridge Mahalo North, PL1128

Document Control

Revision History

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Abbreviations

Abbreviation	Description
AEP	Annual Exceedance Probability
AGST	Above Ground Storage Tanks
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ATP	Authority to Prospect
BAP	Baseline Assessment Plan
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CLR	Contaminated Land Register
CSG	Coal Seam Gas
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	Department of Environment and Heritage Protection (Queensland), now named DETSI
DETSI	Department of Environment, Tourism, Science and Innovation (Queensland)
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EA	Environmental Authority
EC	Electrical Conductivity
EMR	Environmental Management Register
EMS	Environmental Management Systems
EP Act	Environmental Protection Act 1994 (Queensland)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EPP Water	Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (Queensland)
ERA	Environmentally Relevant Activity
ET	Evapotranspiration
EV	Environmental Value
GCF	Gas Compression Facility
GDE	Groundwater Dependent Ecosystem
IESC	Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development formerly the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development
LOR	Limit of Reporting
MODFLOW	Modular Finite-Difference Groundwater Flow Model
MNES	Matters of National Environmental Significance
NDVI	Normalized Difference Vegetation Index
NEPM	National Environment Protection Measure
PAH	Polycyclic Aromatic Hydrocarbons
P&G Act	Petroleum and Gas (Production and Safety) Act 2004 (Queensland)
PL	Petroleum Lease
PLA	Petroleum Lease Application
PTDLs	Pressure Transducer Data Loggers
PWST	Produced Water Storage Tank
RO	Reverse Osmosis
SCA	Strategic Cropping Area

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Abbreviation	Description
SCADA	Supervisory Control and Data Acquisition
SSGVs	Site-Specific Guideline Values
SWL	Standing Water Level
TARP	Trigger Action Response Plan
TDS	Total Dissolved Solids
VWPs	Vibrating Wire Piezometers
WMMP	Water Monitoring and Management Plan
WTP	Wastewater Treatment Plant
WQO	Water Quality Objective

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1. Introduction

Comet Ridge Mahalo North Pty Ltd (Comet Ridge) is proposing to develop the Mahalo North Coal Seam Gas (CSG) Project (The Project), a greenfield gas development located in the northern section of the Bowen Basin, approximately 45 km north of Rolleston in Central Queensland.

The Project is situated within Petroleum Lease (PL) 1128.

1.1 Purpose and Scope

This Water Monitoring and Management Plan (WMMP) outlines the strategies, infrastructure, monitoring programs, assessment criteria and mitigation measures that will guide the responsible and scientifically robust management of water resources for the Project.

The WMMP has been developed in accordance with:

- Conditions of the Environmental Authority (EA) No. P-EA-100522021;
- Requirements of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act); and
- Information Guidelines for Proponents Preparing Coal Seam Gas and Large Coal Mining Development Proposals (IESC, 2024).

The WMMP ensures that water-related Environmental Values (EVs)— associated with groundwater, surface water, and Groundwater-Dependent Ecosystems (GDEs)—are protected across all phases of project development and operation. Specifically, the WMMP is designed to collect multiple lines of evidence to support:

- The establishment of baseline datasets to inform the development of Site-Specific Guideline Values (SSGVs);
- The characterisation of aquifer interconnectivity;
- The identification of surface water–groundwater interactions; and
- The implementation of a transparent and risk-based monitoring and management framework.

This version of the WMMP supersedes the previous Groundwater Monitoring Program prepared by RDM Hydro (dated 14 November 2024). It incorporates detailed responses to feedback from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) and addresses key recommendations from the IESC, as outlined in Advice Reference IESC 2025-153.

2. Project Overview

In October 2019, Comet Ridge was appointed as the preferred tender for the gas acreage PLR 2019-1-2 by the Queensland Government, and the block has since been given the ATP 2048 for the project now referred to as the Mahalo North Coal Seam Gas (CSG) Project.

Gas produced from this Project is for domestic use only.

The Project represents a strategically significant resource development for Comet Ridge and the region. It targets the Bandanna Formation coal seams and has been designed to minimise surface disturbance while achieving commercial gas extraction through staged production.

The proposed development includes:

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- 34 vertical CSG production wells.
- 34 lateral wells, drilled directionally to intersect productive coal seams within the Bandanna Formation.
- Water and gas gathering infrastructure, including buried flowlines.
- Access tracks.
- A central Gas Compression Facility (GCF) to manage produced gas and associated water.
- Supporting facilities including produced water storage tanks, a Water Treatment Plant (WTP) for Reverse Osmosis (RO) treatment of brackish water, brine storage infrastructure, and stormwater containment measures.

Key project details are summarised in Table 1. Figure 1 shows the production well layout and the proposed drilling schedule.

Table 1 – Project Overview

Project Overview	
Project Name:	Mahalo North CSG Project
Location:	ATP2048, ~45 km north of Rolleston, Central Queensland
Lease area	PL1128 14,100 ha
Project Infrastructure:	• 34 vertical wells; • 34 lateral wells (no hydraulic fracture stimulation); • GCF; • Water Treatment Plant (WTP) with RO; • Produced Water Storage Tanks (PWSTs), brine storage tanks, and RO permeate tanks; and • Gathering pipelines and associated access infrastructure.
Production Method:	Dewatering only (no hydraulic fracture stimulation)
Project duration	~ 30 years (staged approach)
Maximum disturbance:	180 ha (1.2% of entire PL area)

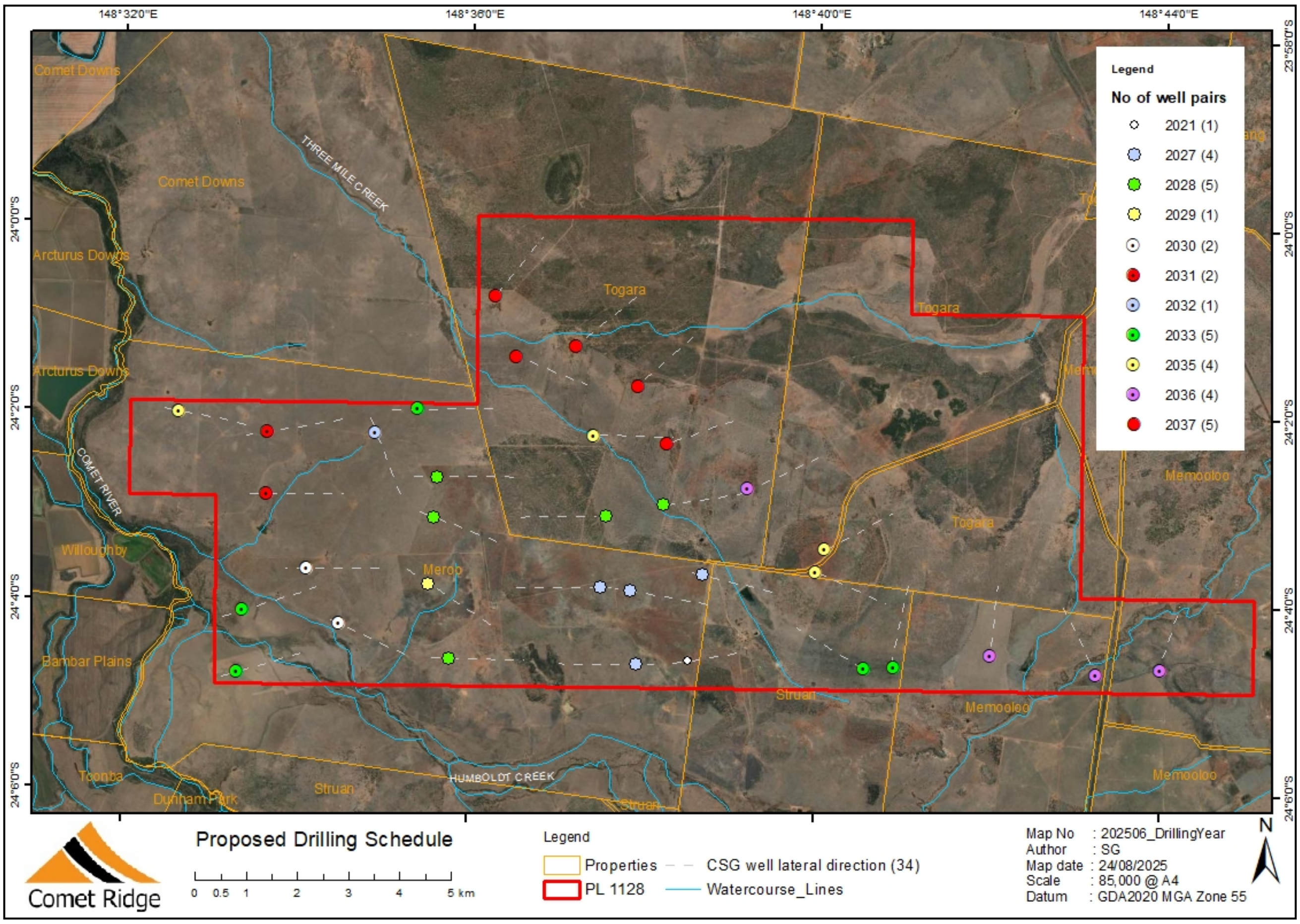

Figure 1 – Project Overview and Development Plan

3. Regulatory and Policy Context

To support the Project's planning and implementation, the applicable legislation, guidelines, and regulatory instruments have been summarised and aligned with key project activities, as presented in Tables 2 and 3 below.

Table 2 – Queensland State Legislation and Guidelines

Legislation / Policy	Context of Application
Environmental Protection Act 1994 (Qld)	Regulates environmental harm, outlines conditions in the Environmental Authority (EA) No. P-EA-100522021, conditions WS7 to WS9 include groundwater, surface water, waste, and land disturbance management.
Water Act 2000 (Qld)	Govern underground water rights, baseline assessments, and make-good obligations for affected landholders. Applies to groundwater take associated with CSG activities.
Vegetation Management Act 1999 (Qld)	Governs clearing of native vegetation, especially along drainage lines and in areas with potential GDEs.

Legislation / Policy	Context of Application
Petroleum and Gas (Production and Safety) Act 2004 (Qld)	Authorises petroleum exploration and production; includes provisions for produced water management and safety of infrastructure (e.g., wells, pipelines).
Environmental Protection Regulation 2019 (Qld)	Defines notifiable activities, Environmentally Relevant Activities (ERAs), water quality standards, and monitoring requirements under the EP Act.
Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (Qld)	Identifies EVs and Water Quality Objectives (WQOs) for Queensland waterways. The Comet River Sub-Basin WQOs apply to the Project.
Nature Conservation Act 1992 (Qld)	Applies to species and ecological communities of conservation significance that may rely on groundwater or be impacted by CSG operations.
Strategic Cropping Land Act 2011 / Planning Act 2016 (Qld)	Manages impacts on strategic cropping areas (SCA), with relevance to land access and project design (e.g., pipeline routes, infrastructure siting).
Contaminated Land Act 1991 (Qld) (EMR/CLR)	Identifies land that may be listed on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) due to CSG activities.
End of Waste Code: Associated Water (Irrigation) (DES, 2019)	Governs beneficial reuse of treated produced water under strict quality criteria, especially for irrigation or dust suppression.

Table 3 – Commonwealth Legislation and Guidelines

Legislation / Policy	Context of Application
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	The project is subject to EPBC Act referral due to potential impacts on water resources and Matters of National Environmental Significance (MNES), including threatened species and ecological communities.
Water Trigger (EPBC Amendment)	Requires detailed groundwater modelling, impact assessments, and IESC advice where a CSG project may significantly affect water resources.
IESC Information Guidelines 2024	Sets technical standards for impact assessments, hydrogeological models, monitoring design, uncertainty analysis, and cumulative impact considerations.

4. Physical Setting

This section provides a summary of the physical setting of the Project area. A detailed description of the physiography, drainage patterns, geology, and hydrogeology is available in the supporting Appendix G - (Epic 2025).

4.1 Climate

The Project is located in Central Queensland’s semi-arid subtropical zone. The region experiences hot summers and mild, dry winters, with seasonal variability in rainfall. Long-term climate data from the Bureau of Meteorology (BOM) Rolleston (Station ID: 035096) indicate:

- Annual Rainfall: ~610 mm, with highest rainfall typically between December and February.
- Annual Evaporation: ~2,070 mm, indicating a strong net evaporative deficit.
- Temperature Range: Summer maxima often exceed 35°C, while winter minima can fall below 5°C.
- Rainfall Intensity: Extreme daily rainfall events can exceed 50 mm.

The pronounced seasonal variability, particularly high summer rainfall and prolonged dry periods, plays a critical role in defining aquifer recharge rates, potential evapotranspiration losses, stormwater runoff dynamics and operational management of water storages.

4.2 Topography and Drainage

The project area lies across gently to moderately undulating terrain, characterised by a complex mosaic of ridgelines, shallow depressions, and ephemeral drainage features, which drain to the west and southwest, feeding into the Comet River, located >1,000m west of the PL (refer to Figure 2).

Ground elevations range from approximately 180 mAHD in the southern floodplain areas to more than 245 mAHD along the northeastern and central highlands, as verified through 0.5 m interval LiDAR-based contour mapping, obtained in October 2023 (refer to Figure 2).

Key Terrain Characteristics:

- High Elevation Zones: Prominent ridgelines exceeding 235 mAHD are located in the northeast (Togara Station) and along the central uplands, forming natural drainage divides that influence surface flow direction and subsurface hydraulic gradients.
- Mid-Slope Catchments: Sloping lands (~200–230 mAHD) dominate much of the central project area, facilitating shallow overland flow during high-intensity storm events.
- Low-Lying Drainage Basins: Local depressions and swales, particularly toward the southwest near Struan and southern Meroo Downs, reach elevations as low as ~180 mAHD, corresponding with flood-prone areas and watercourse confluences.
- Surface Watercourses:
    - The southwest project area is traversed by Humboldt Creek, a seasonally flowing drainage line that integrates runoff from several ephemeral gullies originating from higher ridges.
    - The Comet River flows northward just west of the Project's western boundary. The Comet River generally flows year-round with varying degrees of flow. The Project is situated near the eastern edge of the Comet River's floodplain, which extends west approximately 6.5 km.
- Flood-Influenced Zones: Flood modelling indicates 1% Annual Exceedance Probability (AEP) flood extents are largely confined to the Humboldt Creek corridor and its alluvial fringes. These areas show potential for short-duration inundation but are limited in spatial extent.

Drainage Behaviour:

- Drainage Direction: Predominantly southwest oriented, aligning with regional topographic and hydraulic gradients.
- Drainage Density: Low to moderate, reflecting the low-relief nature of the terrain and the dominance of overland flow during convective summer storm events.
- Flood Mitigation Considerations: the GCF is sited outside the 1% AEP floodplain. However, site-specific hydrological modelling has identified the need for strategic infrastructure design to manage:
    - Sheet flow accumulation
    - Erosion and sediment transport
    - Potential overland ponding near infrastructure platforms.

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This refined understanding of the site's topographic setting underpins both the stormwater infrastructure design and the risk-based approach to surface water quality monitoring presented later in this plan.

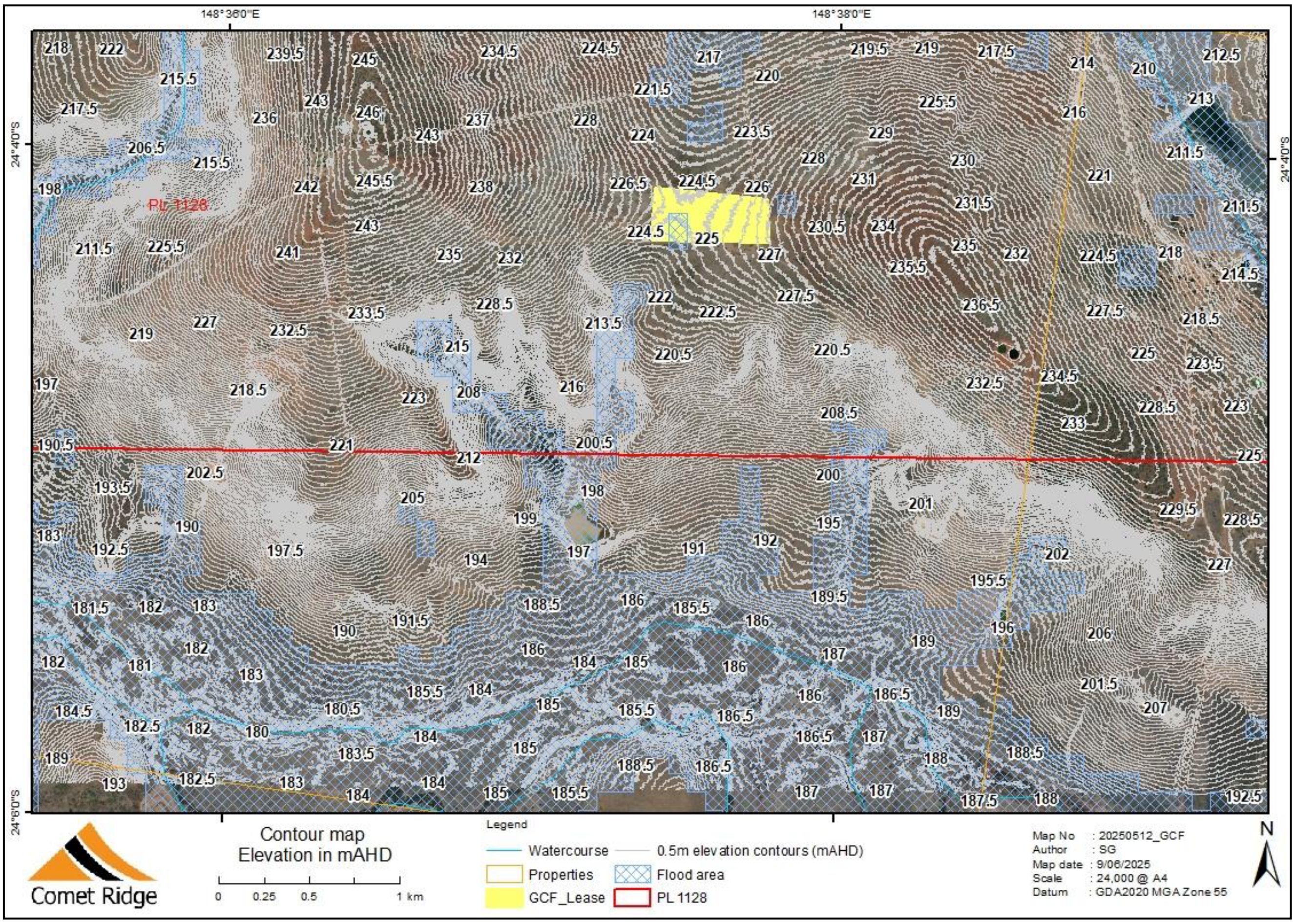

Figure 2 – Contours and Flood Map

4.3 Geology and Hydrogeology

The geological profile underlying the project area includes multiple hydrostratigraphic units relevant to groundwater flow and potential interconnectivity (refer to Table 4), including:

- **Bandanna Formation (Target Reservoir)**

The Bandanna Formation consists of interbedded coal seams, mudstone, and sandstone, encountered at ~330–380 m Below Ground Level (BGL). It is the primary reservoir for CSG production, with very low hydraulic conductivity ($<1\times10^{-7}$ m/s).

- **Rewan Formation (Overlying Aquitard)**

The Rewan Formation lies directly above the Bandanna Formation and serves as a regionally extensive confining aquitard. Composed predominantly of fine-grained mudstone and siltstone, this unit exhibits extremely low vertical permeability, effectively inhibiting hydraulic connectivity between the Bandanna coal seams and overlying aquifers such as the Tertiary Basalt and Quaternary Alluvium across much of the PL.

However, where the Rewan Formation subcrops in the eastern portion of the PL, the unit thins and pinches out. In this area, the unit likely exhibits a weathered profile with a higher relative hydraulic conductivity compared to the unweathered Rewan Formation, which is greater than 200 m thick across the majority of the PLA.

As the principal confining unit in the hydrostratigraphic sequence, the Rewan Formation plays a critical role in limiting vertical fluid migration and maintaining the hydraulic separation between deep gas-bearing formations and shallow water resources (refer to Figure 3).

- **Tertiary Basalt (Discontinuous Aquifer)**

Present in laterally discontinuous, isolated pockets, the Tertiary Basalt comprises weathered and fractured volcanic flows with moderate yields in areas of structural enhancement. The basalt is incised into a broad blanket of generally low permeability Tertiary sediments. The Tertiary sediments generally do not host groundwater. The basalt aquifer acts as the primary water source for stock and domestic supply across Meroo Downs, Togara Station, and Struan, with saturated thicknesses depending on local structural and weathering conditions (refer to Figure 4).

- **Quaternary Alluvium (Shallow Aquifer)**

Alluvial sediments, comprised of lenticular deposits of sand, silt and clay are associated with the Comet River, Humboldt Creek and Rockland Creek. The Comet River floodplain does not extend within the PL boundary and the river is close to the channel boundary, with limited alluvial sediment present in the southwest at the confluence of the Comet River and Humboldt Creek. The extent of alluvium is limited to the stream channels in the ephemeral Humboldt and Rockland Creeks. Quaternary Alluvium is shown in Figure 5.

The alluvial sediments west of the Comet River are likely to host groundwater, which is exploited by local users as a water supply. The alluvial sediments of the ephemeral streams are unlikely to be permanently saturated, rather they likely host groundwater for a brief period after significant rain events and stream flow. The streams are likely to be a groundwater recharge zone and do not receive groundwater discharge except briefly following periods of very high rainfall.

Table 4 – Summary of Hydrostratigraphic Units

Unit Name	Type	Lithology	Role / Function	Hydraulic Conductivity (m/s)
Bandanna Formation	Target Reservoir	Coal seams, carbonaceous mudstone	CSG production zone	$<1\times10^{-7}$
Rewan Formation	Regional Aquitard	Mudstone, siltstone	Confining layer, limits vertical flow	$<1\times10^{-8}$
Tertiary Basalt	Discontinuous Aquifer	Fractured basalt flows	Primary aquifer for stock/domestic bores in project area	Variable (fracture-controlled)
Quaternary Alluvium	Shallow Aquifer	Sand, gravel, clay	Limited extent within the project area; not used as water supply; environmental relevance	Moderate ($\sim10^{-5}$ to 10^{-6} where present)

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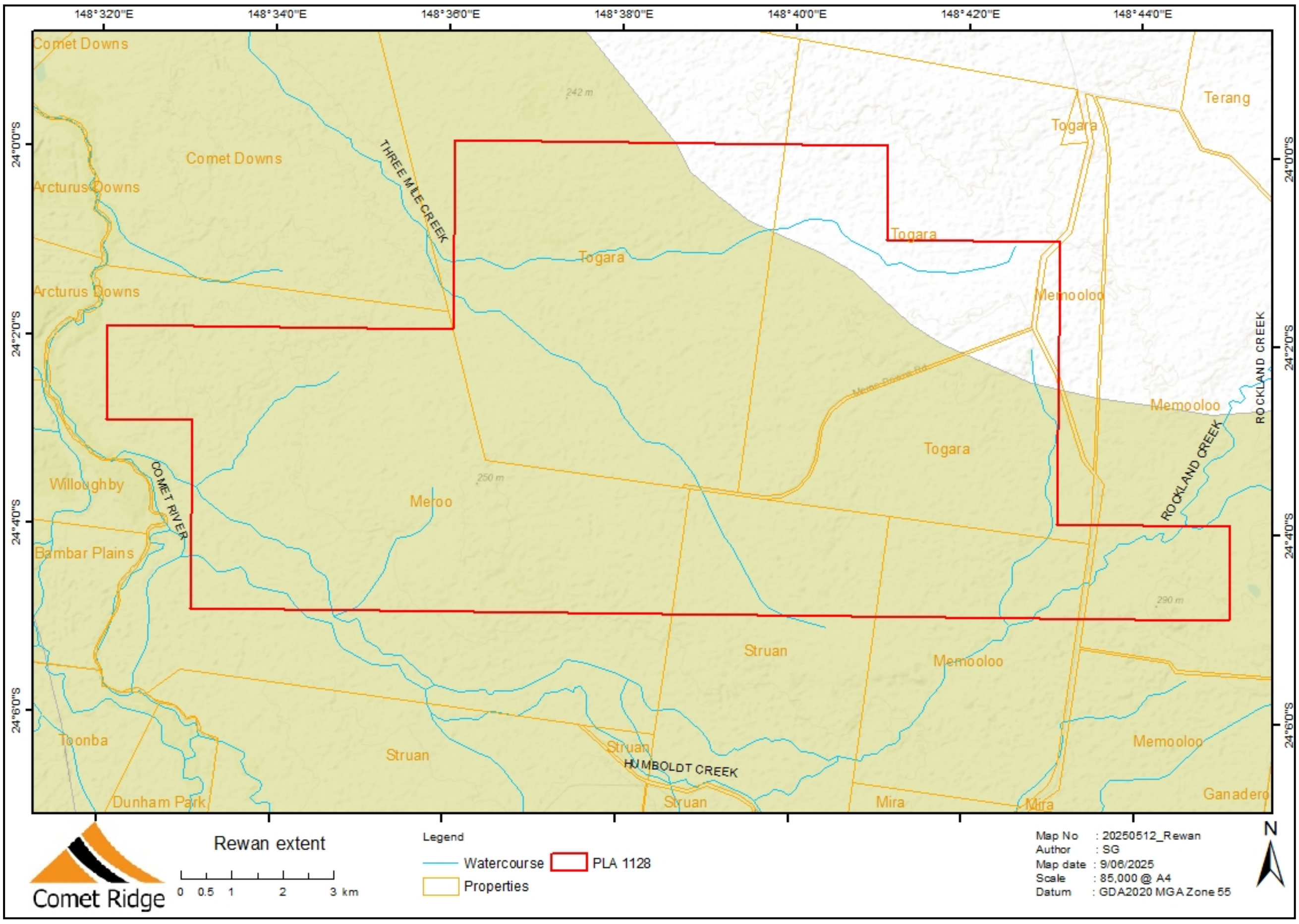

Figure 3 – Rewan Formation distribution within the Mahalo North project

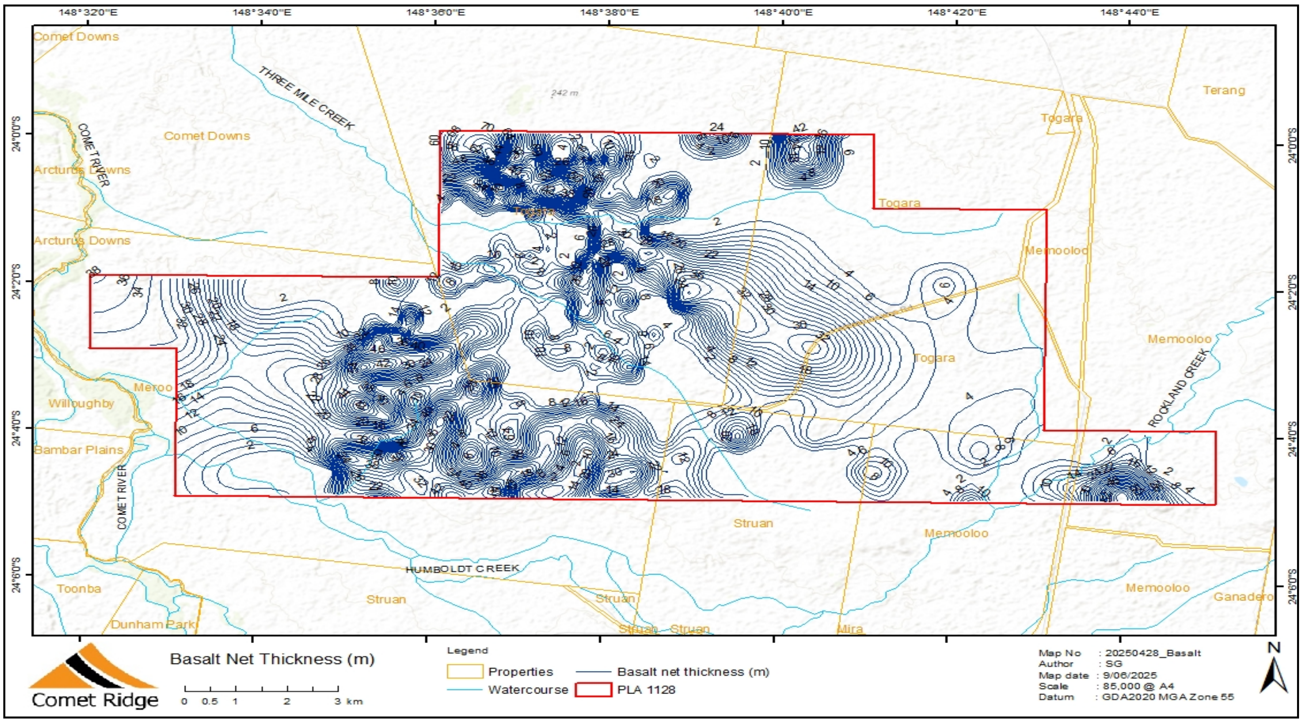

Figure 4 – Tertiary Basalt Distribution within the Mahalo North Project

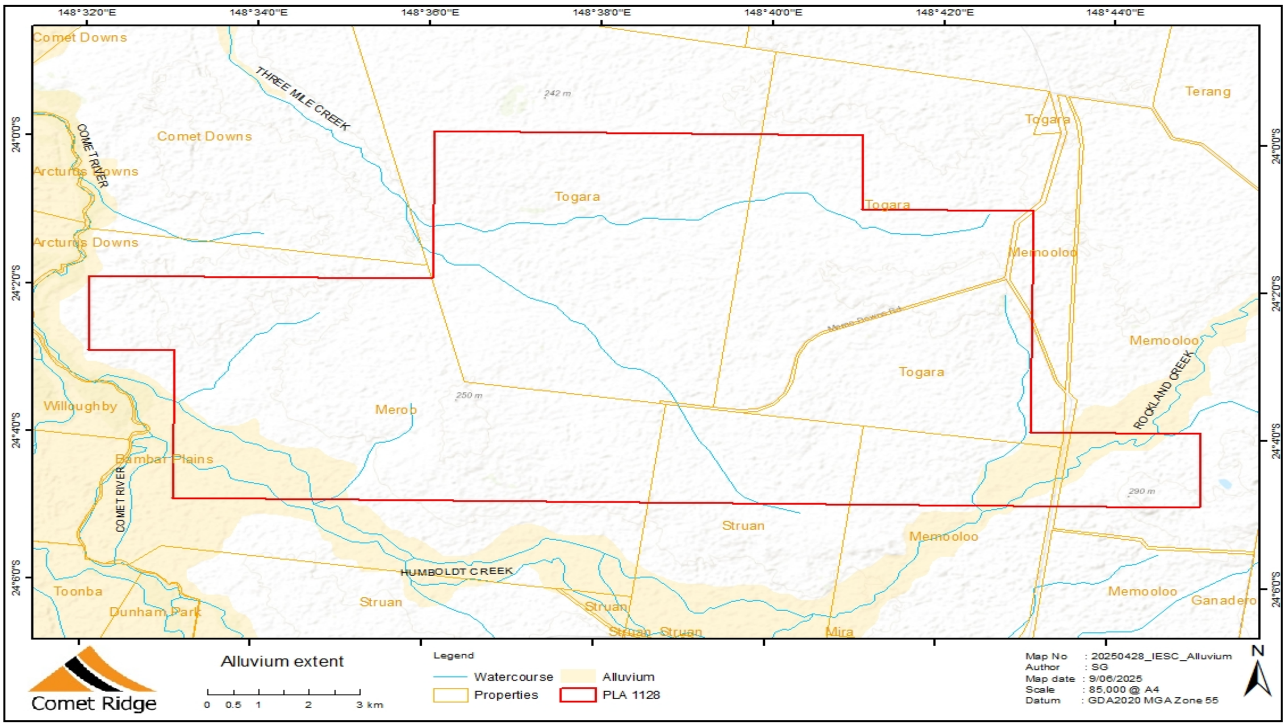

Figure 5 – Alluvium Distribution within the Mahalo North Project

4.4 Surrounding Land Use

The Project is situated within a region of Central Queensland characterised by diverse land uses, including extensive pastoral activities and a variety of industrial and resource development activities, summarised in Table 5 below.

Table 5 – Summary of Surrounding Land Use

Land Use/ Activity	Description	Reference Information
Coal Mining	The Project is located within the Bowen Basin, an active coal-producing region with nearby open-cut and underground coal operations.	QLD Department of Regional Development, Manufacturing and Water, Bowen Basin Geology and Mines Database (2021)
Other CSG Tenures	The Project is situated near several existing and proposed CSG tenures, including adjacent PLs that form part of a larger gas development hub in the region. Additional CSG tenures are located to the west, south and east of the Project area.	Public searches for resource authorities (Business Queensland)
Irrigated Agriculture	Downstream in the Comet River catchment, some irrigated cotton and forage cropping depend on surface water diversions and pumping directly from the Comet River.	Fitzroy Basin Water Resource Plan (Department of Regional Development, Manufacturing and Water, 2021); Queensland Land Use Mapping Program (QLUMP 2023)
Dry Land Cropping	Broadacre cropping (e.g., sorghum, wheat, chickpeas) is practiced on suitable soils in the region, primarily reliant on seasonal rainfall and generally located adjacent to rivers and streams on the floodplains.	ABARES Land Use Survey Data (2021); Queensland Land Use Mapping Program (QLUMP 2023)
Extensive cattle breeding , grazing and feedlots	Widespread across the region, using large landholdings for low-intensity grazing. Pasture condition varies with seasonal rainfall and land management.	Queensland Land Use Mapping Program (QLUMP 2023)
Linear Infrastructure	Includes Ergon powerlines and associated easements, coal train lines, rural roads.	Queensland Spatial Catalogue (QSpatial, 2024); Ergon Energy Network Plans; Aurizon Rail Corridor Data

4.5 Overlapping Tenure and Adjacent Projects

The Project overlaps with and is adjacent to several other resource tenures and mining leases shown in Figure 6, as of May 2025.

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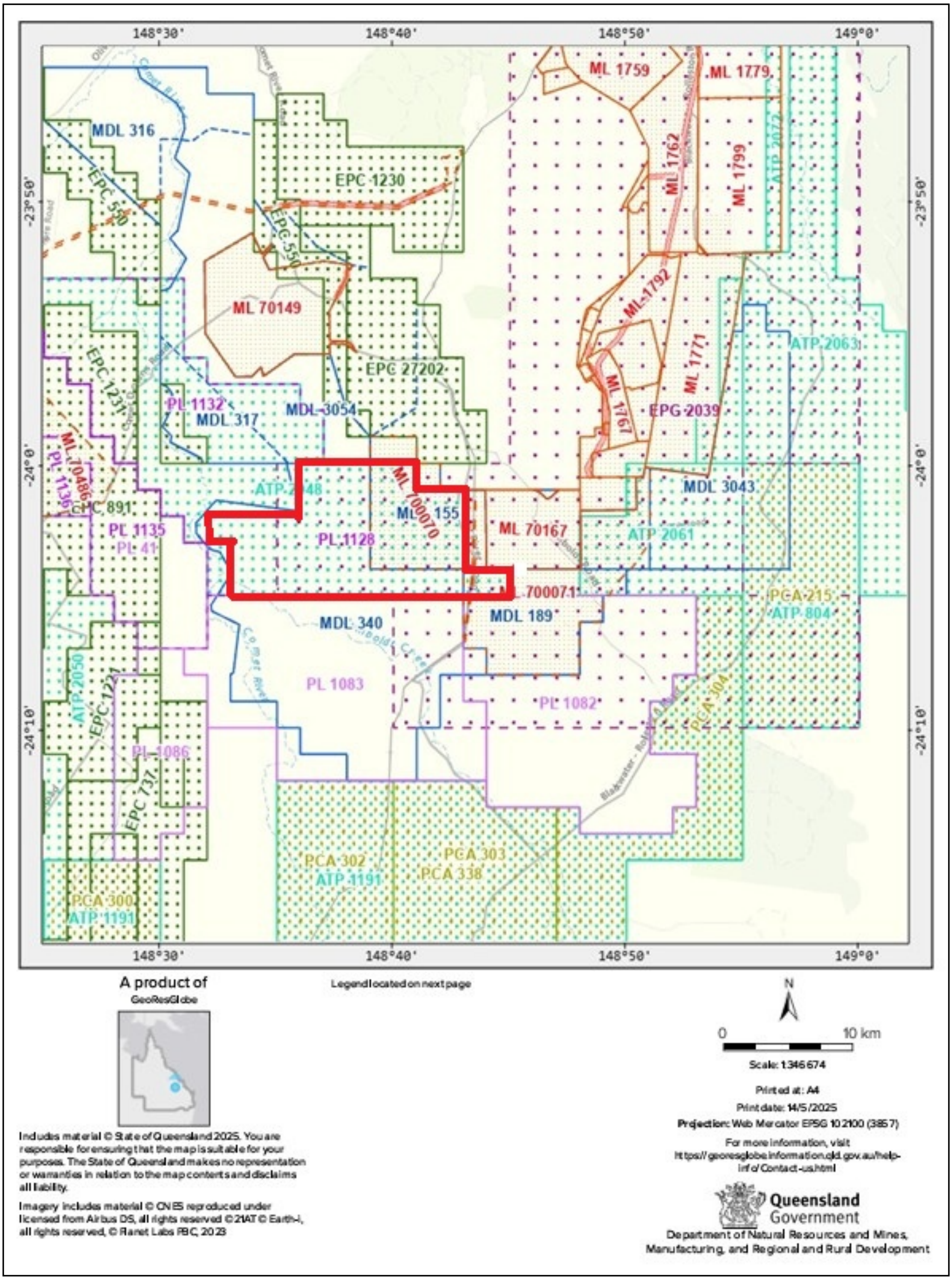

Figure 6 – Overlapping Tenures and Adjacent Projects

4.6 Pastoral Properties within PL1128

The Project encompasses four (4) large pastoral properties primarily used for extensive cattle grazing (refer to Table 6 below). These properties contribute to the regional beef industry and feature a mix of improved pasture, native vegetation, and ephemeral waterways.

Table 6 – Summary of Key Properties within PL1128

Property Name	General Location within PL1128	Primary Land Use	Notes
Togara Station	Northern sector	Extensive cattle grazing	Includes broadacre blade-ploughed paddocks, sown to Buffel grass *(Cenchrus ciliaris)*
Meroo Downs	South and Southwestern lease area	Rotational grazing, pasture improvement, dryland cropping	Hosts Mahalo North pilot well (MN-1), Extensively cleared paddocks sown to Buffel grass following blade ploughing.
Memooloo	East of Struan southeast of Togara	Livestock management across native and improved pasture	Mostly native pasture with improved pasture for grazing.
Struan	Southern Central area	High intensity cattle grazing and Droughtmaster bull stud	Extensively cleared and developed; Buffel grass dominant.

5. Environmental Impact Assessment

This section provides an assessment of potential impacts from the Project on water-related EVs, consistent with the IESC Information Guidelines (2024), the EPBC Act 1999, and Queensland's Water Act 2000.

The assessment is underpinned by a site-specific conceptual model that incorporates geological, hydrogeological, and ecological processes, and their interrelationships, refer to Appendix O (Epic 2025).

A structured cause–effect pathway approach is used to evaluate the potential impacts associated with CSG development activities.

The impact assessment framework is structured to:

- Identify key EVs and sensitive receptors;
- Describe potential CSG-related impacts;
- Establish clear cause–effect pathways linking project activities to potential environmental impacts;
- Integrate site-specific geological and hydrogeological data with ecological indicators to develop a conceptual and predictive model of system interactions; and
- Account for spatial and seasonal variability, including the role of faults, recharge zones, and climatic drivers in modulating aquifer connectivity and ecosystem resilience.

This structured approach ensures that impact predictions are scientifically robust, regulator-aligned, and responsive to dynamic environmental conditions throughout the life of the project.

5.1 Sensitive Receptors

The key water-related receptors identified include:

Groundwater systems

Aquifers including Bandanna Formation (target formation), Rewan Formation (aquitard), Tertiary fractured rock aquifer, and Quaternary Alluvium.

- Quaternary Alluvium represents the shallowest aquifer in the area. It is unconfined and recharged primarily through rainfall and surface runoff. The aquifer is susceptible to surface-derived contaminants, including hydrocarbons, nutrients, or high-salinity water mobilised during CSG operations. As previously discussed, this aquifer is not used for stock water purposes.
- Beneath the alluvium lies the Tertiary Basalt, a semi-confined fractured rock aquifer. While its permeability is generally moderate, it is highly variable depending on the degree of fracturing and weathering.
- The Rewan Formation serves a critical role as a regional aquitard. It is characterised by low permeability and acts as the primary confining layer that separates shallow aquifers from the underlying Bandanna Formation

Third-party groundwater users

- Landholders' bores within the area are advanced in the Tertiary Basalt aquifer, particularly on Togara Station and Meroo Downs, where groundwater is extracted primarily for stock watering. They are legally protected under the Water Act 2000 (Qld), and any observed changes in bore functionality or water quality must be assessed in accordance with make-good provisions.

Surface water features

Surface water systems in or adjacent to the Project area that are considered sensitive environmental receptors include:

- The Comet River, a semi-permanent and regionally significant watercourse that serves as the primary downstream compliance receptor. It is listed under the Comet River Sub-basin WQOs (DEHP, 2011) and supports multiple EVs, including aquatic ecosystems, agriculture, and cultural values. The Comet River is entirely outside the PL area.
- Humboldt Creek is an ephemeral stream, its flow is highly seasonal and sensitive to changes in rainfall, runoff, and sediment load. It is particularly vulnerable to surface spills, stormwater discharges, and increased sedimentation during construction and operation. Humboldt Creek is approximately 73km in length, of which 2.5km is within the PL boundary.
- Rockland Creek, a third-order ephemeral stream in the southeast of the Project area, supports episodic flows and temporary aquatic habitat following rainfall. Although fresh, water quality is highly turbid during runoff, and the creek functions primarily as a recharge zone rather than a baseflow system. It provides moderate ecological value as a regional fish passage corridor and has been included in the monitoring network as a sensitive local receptor. Rockland Creek is approximately 51km in length, of which 3.5km is within the PL boundary.

Groundwater-Dependent Ecosystems (GDEs)

Riparian vegetation and potential refugial pools supporting *Elseya albagula* (white-throated snapping turtle), other EPBC-listed fauna, and potential subterranean GDEs (e.g., stygofauna in basalt and alluvial aquifers).

5.2 Potential Impacts

Potential project-induced impacts include:

- **Aquifer depressurisation**:
  - Pressure reduction in the Bandanna Formation may propagate through faults or discontinuous aquitards, affecting overlying aquifers.

- **Surface water changes**:
  - Altered baseflow regimes in ephemeral creeks due to drawdown-induced reduction in shallow aquifer discharge.

- **GDEs stress**:
  - Reduction in water availability or quality may affect terrestrial and aquatic ecosystems reliant on shallow groundwater.

- **Water quality degradation**:
  - Mobilisation of contaminants from deep formations.
  - Changes in water quality through discharge, runoff, or inter-aquifer flows, spills, seepage, or overtopping of storage infrastructure

5.3 Pathways

These pathways serve as the foundation for the conceptual hydrogeological model and are used to design the monitoring network, set performance objectives, and identify contingency measures.

The key potential pathways for impacts to water resources from the project are:

- **Vertical hydraulic connectivity** due to geological features such as faults, poorly sealed wells, or compromised well integrity;
- **Subsurface leakage or seepage** from CSG infrastructure such as ponds, pipelines, or storage tanks;
- **Mobilisation via aquifer depressurisation** and changes to hydraulic gradients resulting from gas extraction; and
- **Surface discharge or stormwater runoff**, where contaminants are transported to ephemeral streams or river systems (e.g., Humboldt Creek, Comet River).

5.4 Impact Pathway Identification

The Project involves several activities that could introduce pressures to the hydrogeological environment. These pressures may generate stressors that affect sensitive receptors—such as aquifers, surface water systems, soil, and ecosystems—through various impact mechanisms.

The impact pathway framework used in this plan applies the following structure:

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Pressure (Activity) → Stressor/Change → Receptor → Potential Impact

Impact pathways are summarised in Table 7.

Table 7 – Identified Impact Pathways

Pressure (Activity)	Stressor / Change	Receptor/s	Potential Impact/s
Operational dewatering	Depressurisation of Bandanna Formation	• Rewan Formation • Tertiary Sediments and Basalt • Quaternary Alluvium • Comet River and streams • Aquatic ecosystems • GDEs.	• Groundwater drawdown • Altered inter-aquifer pressure gradients • Groundwater quality changes from aquifer interconnectivity • Reduction in baseflow • Potential vegetation stress.
Produced water extraction and handling	Produced water seepage or spill events	• Soil • Shallow aquifer • Surface water.	• Salt accumulation • Reduced surface water and groundwater quality.
RO treatment and brine storage	Concentrated brine, elevated salts and metals	• Soil • Shallow aquifers • Root zones.	• Salinisation • Mobilisation of metals • Long-term degradation of soil and water quality.
Stormwater runoff from CGF infrastructure	Increased sediment load, hydrocarbon/nutrient transport	• Humboldt Creek • Ephemeral gullies.	• Water quality degradation • Riparian habitat loss • Sedimentation impacts • Algal blooms.
Site clearing and vehicle access	Soil compaction, loss of ground cover	• Overland flow paths • Ephemeral creeks.	• Increased erosion and turbidity • Altered drainage behaviour.
Road and trench construction	Drainage redirection; potential flow obstruction	• Humboldt Creek • Floodplain hydrology.	• Modified flow regime • Flooding or drying of sensitive habitats.

6. Analytical Plan Rationale

The Bandanna Formation—targeted for CSG extraction by the Project — contains groundwater with moderate to high salinity, typically ranging from 5,000 to 10,000 mg/L Total Dissolved Solids (TDS). This groundwater is characterised by a sodium-chloride (Na-Cl) hydrochemical signature and is generally near-neutral to slightly alkaline (average pH ~7.9).

These characteristics are supported by regional groundwater datasets from the research paper *Using geochemical and geophysical data to characterise inter-aquifer connectivity and impacts on shallow aquifers and groundwater dependent ecosystems*. (Science Direct,2024) and Geoscience Queensland hydrochemistry compilations (Geological Survey of Queensland, 2020).

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Naturally occurring concentrations of trace elements are present in Bandanna Formation groundwater. Based on regional hydrogeochemical studies (GISERA Report EP155808, 2015), the following elements are commonly detected and may pose a risk to EVs if mobilised to shallow aquifers or surface water bodies:

- Boron (B)
- Barium (Ba)
- Strontium (Sr)
- Manganese (Mn)
- Iron (Fe)
- Lithium (Li)
- Fluoride (F).

These analytes are considered critical for baseline and operational monitoring because they:

- Act as geochemical tracers of deep groundwater (e.g., from the Bandanna Formation);
- Indicate possible vertical leakage or inter-aquifer connectivity where they appear in overlying aquifers (Science Direct 2024)
- Support identification of infrastructure leakage or seepage (e.g., from produced water storage) (APPEA, 2017); and
- Aid in the source attribution of anomalous surface water chemistry (e.g., via aquifer interflow or stormwater mobilisation during rainfall events).

To support impact assessment and compliance monitoring, elements summarised in Table 8 are included in baseline and operational water quality monitoring programs.

Table 8 – Release of Contaminants, Inorganic Elements

Metal/Element	WQO (DEHP 2011)/ANZG(2018)	NEPM 2013	CSG Indicator
Arsenic (As)	✅	✅	❌
Cadmium (Cd)	✅	✅	❌
Chromium (Cr VI)	✅	✅	❌
Copper (Cu)	✅	✅	❌
Lead (Pb)	✅	✅	❌
Nickel (Ni)	✅	✅	❌
Selenium (Se)	✅	✅	❌
Zinc (Zn)	✅	✅	❌
Cobalt (Co)	✅	✅	❌
Iron (Fe)	✅	❌	❌
Manganese (Mn)	✅	❌	❌
Boron (B)	❌	❌	✅
Barium (Ba)	❌	❌	✅
Strontium (Sr)	❌	❌	✅
Lithium (Li)	❌	❌	✅
Fluoride (F)	❌	❌	✅
Uranium (U)	❌ (ADWG/ANZG)	✅	❌

The Project proposes to adopt a harmonised suite of metals across groundwater and surface water monitoring to ensure early detection of any accidental release of CSG produced water. This harmonisation provides consistency in monitoring, supports spill and seepage detection, and strengthens confidence in environmental protection.

Studies including GISERA Report EP155808 (2015) and regional assessments by Geoscience Australia have documented the occasional presence of organic contaminants in coal seam formation water. Although typically at low concentrations, these compounds may be mobilised during gas extraction, produced water handling, or unintentional release, and pose risks to aquatic ecosystems and human health. Table 8 has the list of analytes that will be in the monitoring program.

Monitoring will adopt a risk-based, site-specific approach consistent with ANZG (2018) water quality guidelines and the NEPM (2013) Schedule B framework.

7. Assessment Criteria

To support the environmental management, a suite of assessment criteria has been defined to guide monitoring, trigger investigations, and inform adaptive management responses. These criteria are directly linked to the EVs identified for the Project and are developed using a combination of baseline data, statutory water quality objectives, and national guideline values.

7.1 Environmental Values

The EVs define both environmental and community's uses and values for local water resources. These underpin the monitoring and impact assessment framework and have been determined in accordance with:

- Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water);
- Fitzroy Basin Environmental Values and Water Quality Objectives – Basin 130 (DEHP, 2011);
- EPBC Act 1999 – Significant Impact Guidelines; and
- IESC Information Guidelines (2024), including Chapter 5 – Water Resources and the Explanatory Note on Site-specific Guideline Values (2023).

The key EVs relevant to The Project are summarised in Table 9, and include:

- Aquatic ecosystem protection – Slightly to moderately disturbed systems that support biodiversity and ecological functions;
- Agricultural water use – Stock watering and limited irrigation;
- Recreational use – Primary and secondary contact activities (e.g., swimming, fishing);
- Cultural and spiritual values – Recognising Traditional Owner connection to land and water; and
- Industrial use and visual amenity – Non-potable use and maintenance of aesthetic water quality.

Table 9 – Correlation between EVs and water source

Key EVs	Water Source
Aquatic ecosystem protection – Slightly to moderately disturbed systems that support biodiversity and ecological functions;	Groundwater Surface water

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Key EVs	Water Source
Agricultural water use – Stock watering and limited irrigation;	Groundwater limited to Basalt
Recreational use – Primary and secondary contact activities (e.g., swimming, fishing);	Surface water
Cultural and spiritual values – Recognising Traditional Owner connection to land and water;	Groundwater Surface water
Industrial use and visual amenity – Non-potable use and maintenance of aesthetic water quality.	Surface water

7.2 Default Criteria for Water Quality

Where default water quality criteria exist, and baseline data meets these criteria, these values will be adopted for assessing operational monitoring data against to determine whether potential impacts to the environment are occurring. The following hierarchy for identifying default water quality criteria will be applied:

1. WQOs for the Comet River Sub-basin (DEHP, 2011), as published in the Comet River Sub-basin Environmental Values and Water Quality Objectives, Basin No. 130 (part), including all waters of the Comet River Sub-basin, September 2011. These waters fall within the broader Fitzroy Basin (basin 130).
2. Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) default guideline values (DGVs); Chapter 3 — Aquatic ecosystems, Trigger values for toxicants at alternative levels of protection values applying to typical slightly–moderately disturbed systems, Table 3.4.2.
3. NEPM (2013) values and effect-based thresholds, where relevant.

The criteria have been used in the order of hierarchy as listed above, such that in the absence of any guideline values, the subsequent criteria were used to fill in missing values, with the most conservative values being adopted. Table 10 summarises the identified parameters and default criteria relevant to the Project. For some parameters there are no applicable default criteria thus site-specific values will need to be derived. These are indicated by 'site-specific' in the source column. Applicable values for each parameter in Table 10 will be identified at the time of baseline data analysis. Baseline data will be compared with these default values to determine if site-specific guideline values will need to be derived as outlined in Section 7.3.

These criteria are applied to both groundwater and surface water receptors and form the basis of event-based and trend-based monitoring evaluation.

Table 10 – Default Water Quality Criteria for Groundwater (GW) and Surface water (SW)

Category	Parameter	Source
Dissolved Gases	Methane	GW - Site-specific baseline monitoring
Field Parameters	Dissolved Oxygen (DO)	SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
	Electrical Conductivity (EC)	GW - WQO (DEHP 2011) Zone 35 80^{th} shallow <30 m, and deep >30 m SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
	SWL	GW - Water Act 2000

Category	Parameter	Source
	Turbidity	SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
	pH	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m. SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
Major Ions	Calcium (Ca)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - Site-specific baseline monitoring
	Chloride (Cl)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - Site-specific baseline monitoring
	Fluoride (F)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - ANZG (2018) slightly–moderately disturbed, 95% protection
	Magnesium (Mg)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - Site-specific baseline monitoring
	Sodium (Na)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - Site-specific baseline monitoring
	Sulfate (SO_4)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
Metals Total and Dissolved	Arsenic (As III)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Barium (Ba)	CSG Risk Indicator Site-specific baseline monitoring
	Boron (B)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Cadmium (Cd)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Chromium (Cr III)	ANZG (2018)
	Cobalt (Co)	ANZG (2018)
	Copper (Cu)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Iron (Fe)	GW - WQO (DEHP 2011) Zone 35 80th shallow <30 m, and deep >30 m SW - Site-specific baseline monitoring
	Lead (Pb)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Lithium (Li)	CSG Risk Indicator. Site-specific baseline monitoring
	Manganese (Mn)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Nickel (Ni)	ANZG (2018) slightly–moderately disturbed, 95% protection
	Selenium (Se)	ANZG (2018) 99% level of protection
	Strontium (Sr)	CSG Risk Indicator Site-specific baseline monitoring
	Uranium (U)	ANZG (2018)
	Zinc (Zn)	ANZG (2018) slightly–moderately disturbed, 95% protection
Nutrients	Ammonia	GW - ANZG (2018) slightly–moderately disturbed, 95% protection

Category	Parameter	Source
		SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
	Nitrate	ANZG (2018) slightly–moderately disturbed Values as listed apply to nitrate in soft water (< 30 mg/L CaCO3), moderately hard water (30–150 mg/L CaCO3) and hard water (> 150 mg/L CaCO3), respectively.), 95% protection
	Total Nitrogen (TN)	SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
	Total Phosphorus (TP)	SW - WQO (DEHP 2011). Comet River Sub-basin waters Aquatic ecosystem—moderately disturbed
Organics	BTEX	ANZG (2018) Site-specific baseline monitoring
	PAHs	ANZG (2018) Site-specific baseline monitoring
	Phenolic compounds	ANZG (2018) Site-specific baseline monitoring

7.3 Site-Specific Guideline Values (SSGVs) Development Framework

To determine if SSGVs are needed for The Project, the following framework consistent with the IESC Explanatory Note on SSGVs (2019) and the ANZG (2018) Water Quality Guidelines will be applied. This framework ensures that SSGVs are applied selectively, using a robust, transparent process consistent with national guidance. The framework adopts a tiered approach. The first step is to determine which sites and parameters require SSGVs:

1. Measure Baseline Data
   - A statistically robust baseline dataset is collected.
2. Determine if default criteria are met by baseline data
   - Compare baseline data with the default limits identified in Table 10. Where baseline data:
     - meet default limits adopt these
     - exceed default limits derive SSGVs.

All applicable default limits and SSGVs will be embedded within the project's Trigger–Action–Response Plans (TARPs) (refer to Section 9) and reviewed periodically in line with risk-based monitoring outcomes and evolving baseline understanding.

7.3.1 Derivation Process for SSGVs

- SSGVs will only be derived for parameters where existing default guideline values (ANZG 2018 DGVs) or published Water Quality Objectives (WQOs; DEHP 2011) are not met under baseline conditions, or where background levels differ significantly from the regional context.
- Parameters meeting DGVs or WQOs will continue to be assessed against those values, and no SSGVs will be required.
- This ensures a risk-based application of SSGVs, avoiding unnecessary derivation while focusing on parameters with site-specific exceedances.

The process for SSGV derivation follows the IESC Explanatory Note (2019) and ANZG (2018), which recommend a structured, transparent approach:

1. **Baseline dataset requirements**
    - A minimum of 12 months of monitoring covering both wet and dry seasons with 24 months of monitoring data preferred.
    - At least 6 independent observations per parameter.
    - For example, for Electrical Conductivity (EC), values must be collected across both high-flow and low-flow events to capture natural salinity variability.

2. **Statistical approach**
    - Reference condition approach (ANZG 2018): If background values consistently exceed the DGV, the SSGV will be set at the 80th or 95th percentile of the baseline dataset, depending on the environmental value being protected and the relevant ecological thresholds (see below point 3).
        - *Example*: If ANZG DGV for chloride is 250 mg/L, but baseline monitoring shows natural levels between 200–400 mg/L, the SSGV may be set at the 95th percentile of site data (e.g., 380 mg/L) to reflect natural conditions while ensuring protection.
    - **Outlier management**: Outliers will be assessed using robust statistical methods (e.g., Grubbs' test) to ensure SSGVs reflect natural variability, not anomalous events.

3. **Cross-checks and ecological thresholds**
    - Derived SSGVs will be validated against **ecotoxicological thresholds** to ensure EV protection.

    Example: If baseline TN levels are elevated (e.g., 0.8–1.2 mg/L) compared with the ANZG DGV (0.5 mg/L), a site-specific value may be derived using the **80th percentile of baseline data** (e.g., 1.1 mg/L). However, this SSGV must remain **below effect-based thresholds** (e.g., levels associated with algal bloom risk, typically ~1.2–1.5 mg/L in freshwater), ensuring that ecological protection is not compromised.

7.3.2 Finalisation and Submission of SSGVs

- Once sufficient baseline data are available (after baseline data collection is completed), SSGVs will be calculated and **lodged with the Department within three months** of dataset finalisation.
    - For surface water this is expected to be Q3 2027.
    - For groundwater this is expected to be Q3 2028.
- A list of sites and parameters that do not require SSGVs to be derived will also be submitted at this time to the Department. The list will identify what WQO or DGV is applicable to each site and parameter.
- All baseline data collected to inform derivation of SSGVs (including for sites and parameters where it was determined that SSGVs were not required) will also be lodged with the Department at this time. This ensures a streamlined process whereby updated values can be provided without requiring formal amendment/approval of the Plan.

7.3.3 Integration into Management

- All SSGVs will be embedded within the Project's Trigger–Action–Response Plan (TARP) (refer to Section 9), ensuring they directly inform compliance monitoring and management responses.
- SSGVs will be finalised when baseline data collection is complete with no further changes made under this process. If changes to SSGVs are required after this time the Department will be consulted, and a revised management plan will be submitted for consideration.

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7.3.4 Decision-tree

The decision tree is summarised in Figure 7 below. The steps can be described as:

1. Check if baseline meets **ANZG DGVs / WQOs** → apply defaults.
2. If exceedances or differences exist → derive **SSGVs** using IESC/ANZG methods.
3. Validate against ecological/effect-based criteria → integrate into **TARP**.

7.3.5 Worked Examples of SSGV Derivation

Example 1 – Nutrients (Total Nitrogen, TN)

If baseline TN levels are elevated (e.g., 0.8–1.2 mg/L) compared with the ANZG DGV (0.5 mg/L), a site-specific value may be derived using the **80th percentile of baseline data** (e.g., 1.1 mg/L). However, this SSGV must remain **below effect-based thresholds** (e.g., levels associated with algal bloom risk, typically ~1.2–1.5 mg/L in freshwater), ensuring that ecological protection is not compromised.

Example 2 – Salinity (Electrical Conductivity, EC)

ANZG DGV for freshwater is 250 µS/cm. Baseline monitoring in Rockland Creek shows EC ranging from 200–400 µS/cm, reflecting natural catchment geology. An SSGV could be set at the **95th percentile of baseline data (e.g., 380 µS/cm)**. This acknowledges natural salinity patterns while still protecting against increases that would signal project-related impacts.

Example 3 – Acidity/Alkalinity (pH)

The ANZG DGV for pH is 6.5–8.5. In a naturally acidic basalt aquifer, baseline pH values consistently range from 6.0–6.3. An SSGV may be set at the **20th percentile of baseline data (e.g., 6.1)** to reflect natural conditions. This adjustment remains protective provided it does not fall below tolerance limits for sensitive aquatic species, as required by ANZG (2018).

Example 4 – Metals (Manganese, Mn)

ANZG (2018) sets a DGV for Mn at 1,900 µg/L (95% protection, freshwater). Baseline data from project bores show natural concentrations ranging from 1,200–2,100 µg/L, with exceedances linked to geological background levels. An SSGV may be set at the **95th percentile of baseline values (e.g., 2,000 µg/L)**, recognising natural variability while ensuring levels remain below effect-based toxicity thresholds from international literature.

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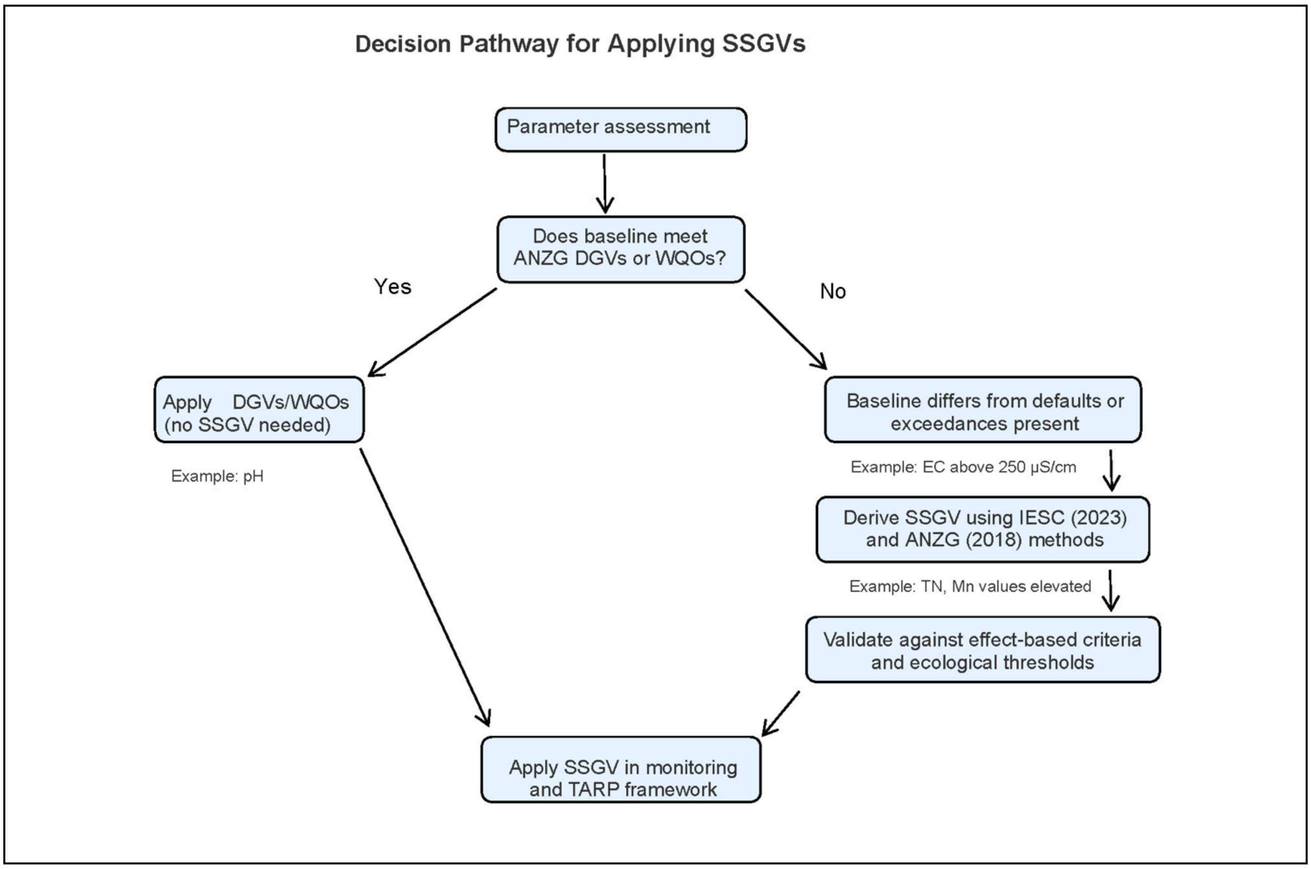

Figure 7 – Decision Pathway for Applying SSGVs

8. Monitoring and Management

This section outlines the groundwater and surface water monitoring and management strategy for the Project. The strategy has been developed to be scientifically robust, risk-responsive, and adaptive to changing conditions over the life of the project.

The monitoring program is designed to protect water-related EVs by achieving the following:

- Establish robust baseline conditions for surface water and groundwater systems;
- Identify long-term trends and capture seasonal and spatial variability;
- Enable early detection of exceedances against assessment criteria or thresholds; and
- Support event-based responses, particularly during high-risk periods such as extreme rainfall events or operational upscaling.

A central component of the strategy involves the identification of hydraulic head and geochemical indicators characteristic of deep formation water (e.g., Bandanna Formation) and hydraulic head within each hydrostratigraphic unit (between shallow alluvium and deeper confined units). These indicators will support the assessment of potential vertical connectivity or contaminant migration pathways. The groundwater and surface water monitoring strategy for the Project is supported by the outcomes of the Rewan Connectivity Plan (RCP) (Appendix M (Epic, 2025)). The RCP was prepared in response to IESC advice to demonstrate the hydraulic role of the Rewan Formation as a regional aquitard between the shallow aquifers (Quaternary Alluvium, Tertiary Basalt) and the deeper Bandanna Formation coal seams.

The RCP will be implemented following EPBC Act approval of the Project. The scope of the RCP includes:

- Ground-based geophysical investigations to determine the optimum locations for nested monitoring bores (see Section 8.5.6 of this plan);
- Drilling and construction of the nested monitoring bores at 4 (four) locations as per Table 15 and Figure 11 (see Section 8.5 of this plan);
- Detailed logging of the properties of the Rewan Formation during monitoring bore construction;
- Collection of core samples for permeability analysis where possible during construction of monitoring bores;
- Hydrochemical and isotopic analysis of groundwater samples from each of the target aquifers, where possible, collected during construction of monitoring bores;
- Slug testing and permeability testing of shallow monitoring bores shortly after monitoring bore construction;
- Ongoing monitoring of piezometric head from monitoring bores (as outlined in Section 8.5 of this plan); and
- Integration of the new data into an updated conceptual model.

The RCP will provide multiple lines of evidence designed to assess whether preferential pathways (e.g., faults, fractures, weathered zones) could enable vertical connectivity or contaminant migration through the Rewan.

8.1 Monitoring Network Overview and Sampling Program Summary

The monitoring network consists of several strategically located monitoring points across the PL, designed to provide representative coverage of key receptors and flow paths. It includes:

- Landholder bore monitoring – for receptor-level monitoring and stakeholder assurance;
- Groundwater monitoring – including existing and planned installations across different hydro stratigraphic units;
- GDE monitoring – to assess groundwater availability and ecological dependencies in riparian or sensitive areas; and
- Surface water monitoring – focusing on ephemeral creeks and drainage lines near the GCF, particularly Humboldt Creek.

Each location has been selected based on hydrogeological mapping, groundwater flow modelling, receptor sensitivity, and proximity to CSG infrastructure. Together, the network captures both natural environmental variability and project-induced pressures, supporting a holistic water monitoring and management framework.

The spatial layout of the existing and proposed monitoring locations is shown in Figure 8 with a summary of the monitoring program provided in Table 11.

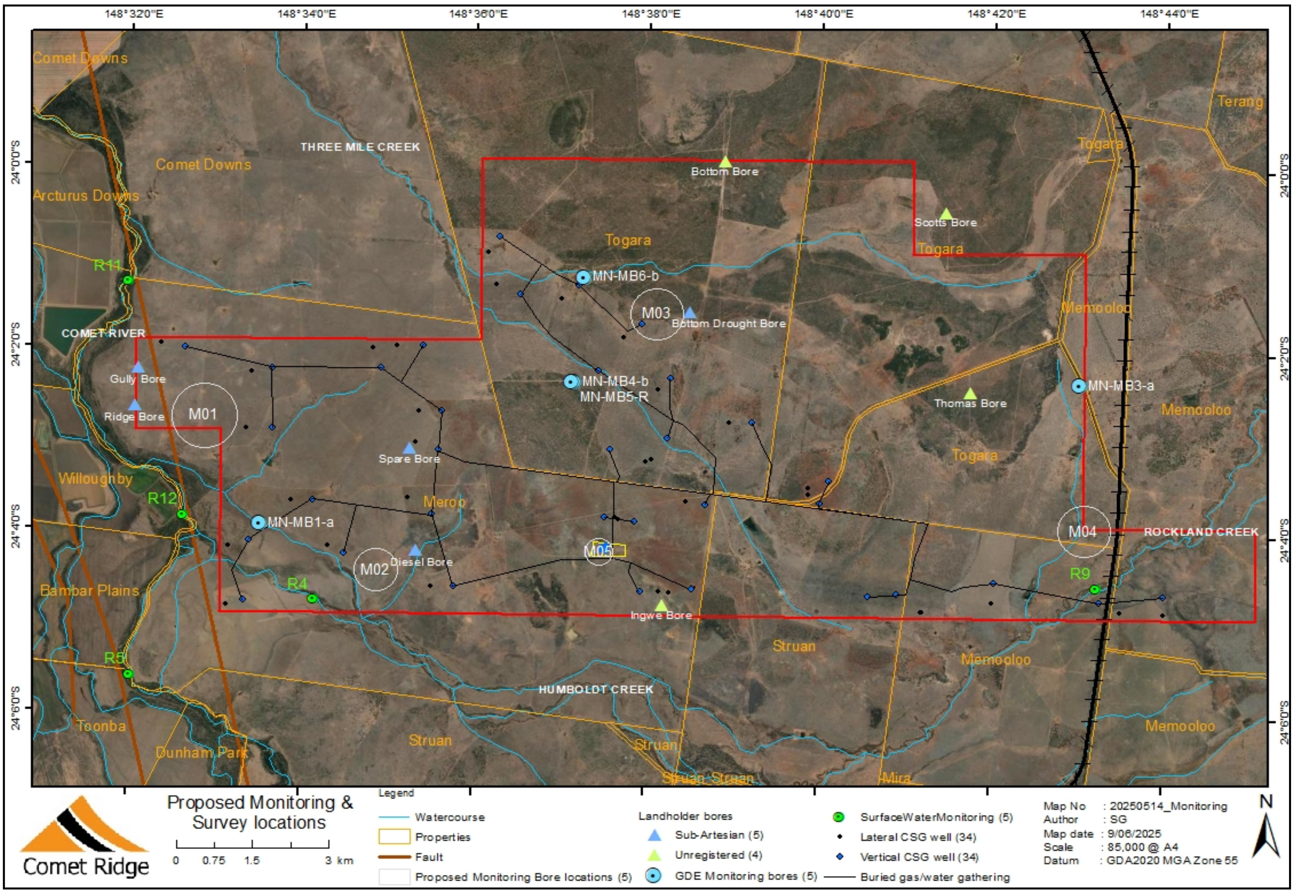

Figure 8 – Existing and Proposed Water Monitoring Locations

Table 11 – Monitoring Program Summary

Monitoring	Number	Description Monitoring Locations	Baseline Sampling Frequency	Operations Sampling Frequency
Landholder bores	9	All the bores are installed in the tertiary basalt and used for stock watering	Annually	Annually
Groundwater monitoring - Aquifer interconnectivity assessment	14	Clustered bores installed to target each hydrogeological feature of the site	Quarterly	Biannually *
GDEs monitoring bores	5	Bores installed in the alluvium and nearby the location of potential terrestrial GDEs	Monthly	Ongoing monitoring to focus on the GW/SW interaction and riparian components (#)

Monitoring	Number	Description Monitoring Locations	Baseline Sampling Frequency	Operations Sampling Frequency
(#) Riparian vegetation/ permanent pools	5	• R5 • R12 • R11 • R4 • R9	Annually	Annually, using remotely sensed satellite imagery, and utilising NDVI to compare potential changes over time.
(#) Groundwater/ surface water interaction evaluation	4	Part of the clustered bores, installed close to ephemeral waterways to target alluvium.	Quarterly	Biannually *
Surface water	4	• R11 • R4 • R9 • R5	Quarterly	Biannually *
Stormwater	3	• 3 groundwater monitoring bores: ○ 2 seepage bores; and ○ 1 bore advanced in the Basalt • Surface Water Catchment Dam	-	• Event-based (post-rainfall >25 mm over 24 hours). • Quarterly check for presence of seepage water and sampling Surface Water Catchment Dam.

*April (end of wet season), and September (end of dry season)

8.2 Adaptive Management Approach

While this WMMP reflects the current best understanding of the site's hydrogeological setting and regulatory context, it is designed as a dynamic tool. Updates may occur throughout the operational lifecycle to reflect:

- Improved site-specific hydrochemical and pressure data;
- Changes in regulatory expectations;
- Observations from baseline or operational monitoring; and
- Technological advancements in sampling or analysis.

Potential refinements may include adjustments to monitoring frequency, scope of analytes, or threshold values, in consultation with regulators as required. However, the core principles of the plan remain constant including:

1. early risk identification;
2. environmental protection;
3. transparent reporting; and
4. compliance with legal and approval conditions.

This adaptive but accountable structure supports responsiveness without compromising rigour. It ensures scientific integrity across the life of the project while maintaining alignment with community expectations and regulatory best practices.

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8.3 Landholder Bores

8.3.1 Rationale

Landholder bores are routinely monitored to assess potential groundwater impacts associated with petroleum activities within the tenure area. These assessments form the foundation of compliance with Queensland's underground water management framework:

- Baseline Assessments are undertaken prior to gas production to establish a benchmark dataset for each registered bore, including water quality, standing water level (SWL), and bore construction details. These data are critical for predictive groundwater modelling, impact attribution, and compliance with make-good obligations under Chapter 3 of the *Water Act 2000* (Qld).
- Bore Condition Assessments, conducted during and after operations, re-evaluate the structural integrity, yield, and performance of landholder bores. These assessments ensure that monitoring results remain reliable and that any degradation in bore condition is identified and addressed early.

Together, these assessments:

- Provide the evidence base for potential "make good" agreements under the *Water Act 2000*;
- Support early detection of project-related drawdown or contamination; and
- Inform updates to hydrogeological models and risk assessments.

8.3.2 Relevant Legislation

Under the Petroleum and Gas (Production and Safety) Act 2004 and the Petroleum Act 1923 (collectively referred to as the P&G Acts), tenure holders are granted an "underground water right", which permits unavoidable interference with groundwater during petroleum resource activities, including gas production.

However, this right is conditional and governed by the Water Act 2000 (Qld), which establishes the "Underground Water Management Framework". This framework mandates proactive and ongoing obligations to assess, monitor, and manage the impacts of resource activities on groundwater systems and landholder bores.

The Underground Water Management Framework obliges tenure holders to:

- Submit a BAP (Section 396), detailing bore locations, assessment timeframes, and sampling methodology;
- Conduct baseline assessments of all bores that may be affected by petroleum activities (Section 395), to establish pre-development water quality and level benchmarks; and
- Monitor groundwater condition during operations (Section 376) and enter into *make-good agreements* with landholders if a bore is materially impacted by resource activity (Section 407).

These requirements are operationalised through:

- Baseline Assessment Guideline (ESR/2016/1999, Version 3.04);
- BAP Guideline (ESR/2016/2004); and
- Bore Assessments Guideline (ESR/2016/2005).

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8.3.3. Alignment with IESC Recommendations

The landholder bore monitoring program is aligned with the IESC Information Guidelines (2024) for coal seam gas developments, which emphasise the early characterisation and ongoing protection of groundwater receptors.

Key areas of alignment include:

- Baseline and Operational Monitoring: The program includes both pre-development and operational bore assessments, consistent with IESC expectations for identifying pre-disturbance conditions and detecting long-term impacts.
- Receptor-Specific Approach: The selection of landholder bores as monitoring locations reflects IESC guidance to focus on sensitive receptors (e.g., stock watering bores in Tertiary Basalt aquifers) that are potentially at risk from project-related drawdown or water quality changes.
- Comprehensive Analytical Suite: The analytical plan incorporates all key parameter groups identified in the IESC guidelines, including field parameters, major ions, nutrients, dissolved metals, hydrocarbons, and gases, supporting risk detection and source attribution.
- Use of Guideline Values: Monitoring results are compared against site-specific or default guideline values as outlined in the ANZG (2018) and the Baseline Assessment Guideline (ESR/2016/1999), ensuring alignment with IESC-recommended evaluation methods.
- Risk-Based Monitoring and Compliance: The monitoring supports the Water Act 2000 (Qld) obligations under the Underground Water Management Framework, including make-good provisions. This risk-based and legally compliant framework is consistent with IESC expectations for adaptive management.

This dual-layered approach—integrating both *baseline assessments* and ongoing *bore assessments*—ensures that groundwater impacts are identified early, managed appropriately, and remain scientifically defensible and regulatory compliant throughout the life of the project.

8.3.4. Monitoring

Comet Ridge will fulfil monitoring requirements for landholder bores as required by the relevant Queensland legislation outlined above.

8.4 Groundwater Dependent Ecosystems

8.4.1 Rationale

GDEs are ecological communities that require access to groundwater to sustain key functions, particularly during dry periods. Their accurate identification and assessment are essential for ensuring protection under both Queensland and Commonwealth environmental frameworks, including the Environmental Protection Act 1994 (Qld) and the Environment Protection and Biodiversity Conservation Act 1999 (Cth).

8.4.2 Relevant Legislation

The assessment and protection of GDEs aligns with obligations under the Environmental Protection Act 1994 (Qld), the Environmental Protection (Water and Wetland Biodiversity) Policy 2019, and national frameworks such as the EPBC Act 1999 (Cth).

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8.4.3 Alignment with IESC Requirements

The GDE assessment program aligns with the IESC Information Guidelines (2024), which recommend early identification of water-dependent ecosystems and site-specific investigations to confirm risk potential.

Key areas of alignment include:

- Multi-Stage Assessment: The program integrates a desktop review, field-based validation (2024), and a seasonal reassessment (2025), as recommended by IESC for robust characterisation of GDE presence and function.
- Site-Specific Monitoring: Installation of five shallow bores in potential GDE zones supports IESC guidance to ground-truth modelled risks and improve understanding of local hydrogeological conditions.
- Hydroecological Indicators: The monitoring incorporates vegetation, soil, and groundwater data to distinguish between opportunistic and obligate groundwater use, in line with IESC expectations for defensible GDE classification.
- Adaptive Monitoring Approach: The follow-up assessment in August 2025 reflects IESC advice to capture seasonal variability and provides a pathway for scaling monitoring intensity based on verified risk.

8.4.4 Baseline Assessments

To assess potential impact of groundwater drawdown on terrestrial GDEs, a preliminary desktop assessment was undertaken in August 2022 and was revised in March 2023 using the Queensland GDE Atlas and the EPBC Act Protected Matters Search Tool. This review did not identify any mapped GDEs within the Project area. However, due to recognised limitations in the spatial resolution and completeness of regional GDE mapping in regional Queensland, the desktop findings were not considered sufficient to rule out the presence of unmapped or diffuse GDEs systems.

To address this data gap, a GDEs field verification program was undertaken in August 2022 (dry season) and March 2023 (wet season). The study concluded that no surface expression GDEs were encountered within the Project area, nor are they considered likely to occur (refer to Appendix D (Epic, 2025)).

A request for information (RFI) issued by the DCCEEW identified several areas where additional information was required, before an assessment of the Projects impacts could be made. In response to the RFI, a field study was conducted in August 2024 (refer to Appendix E (Epic, 2025)).

The field verification program comprised:

- Targeted field inspections of riparian zones and alluvial settings with elevated GDE potential;
- Vegetation surveys to identify phreatophytic species indicative of groundwater access;
- Soil investigations to detect saturation indicators or rooting depth profiles suggestive of groundwater use; and
- Utilisation of multiple lines of evidence, including pre-dawn leaf water potentials, soil moisture potentials, and analysis of stable isotope trends.

No formally listed or high-value GDEs were confirmed within the Project boundary.

Following further consultation with DCCEEW under the EPBC Act process, five (5) shallow monitoring bores were installed in August 2024 across Meroo Downs and Togara Station (refer to Table 12). These bores were strategically positioned based on remote sensing and a multi-criteria analysis (refer to Appendix G (Epic, 2025)) to target areas with elevated potential for GDEs. The objective was to monitor depth to water and support ongoing GDE risk screening. This initiative aimed to respond to regulator feedback highlighting the need for enhanced hydrogeological data coverage in environmentally sensitive areas.

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In line with subsequent advice from the IESC, a follow-up GDEs field assessment was undertaken in August 2025—timed to coincide with the end of the dry season and to align seasonally with the 2024 baseline survey.

The results of 12 months of GDE bore monitoring, together with the follow-up assessment undertaken in August 2025, (refer to Appendix P (Epic, 2025) indicate that there are no likely groundwater dependencies. These findings are consistent with the outcomes of the earlier field survey documented in Appendix E (Epic, 2025)

Groundwater samples were collected from the monitoring network outlined in Table 12 on a monthly base (approximately every four weeks) since August 2024. Data collected from field validation and bore monitoring confirmed:

- No sustained surface expression of groundwater at the identified sites;
- Vegetation and soil characteristics consistent with opportunistic use of shallow water during wet periods rather than obligate groundwater dependency;
- Depth to water tables inconsistent with the persistence of obligate GDEs; and
- Water quality parameters (e.g., salinity, nutrient levels) outside the optimal range for GDEs health.

8.4.5 Baseline Monitoring Locations

The GDEs baseline monitoring locations are shown on Figure 9. This includes fifteen (15) sites included in the field assessment as considered to represent potential GDEs and shallow groundwater monitoring bore's locations.

Table 12 summarise the information of the sampling locations selected to assesses the potential impacts of groundwater extraction on native vegetation, including bore locations. Table 13 summarise the baseline analytical plan.

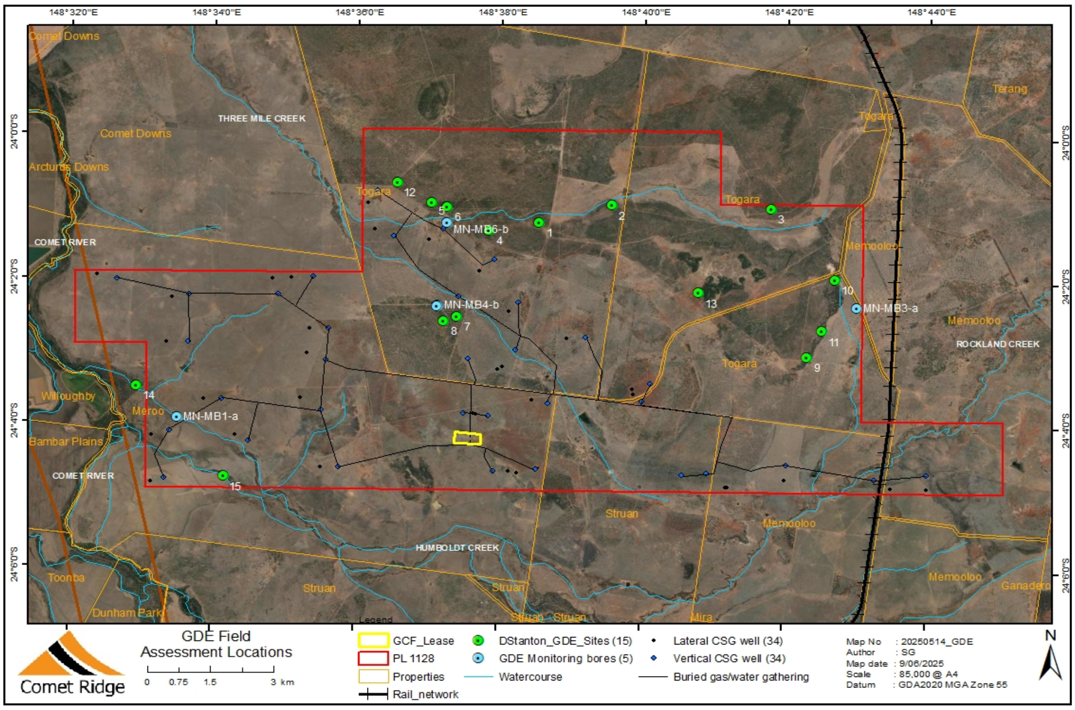

Figure 9 – GDEs Monitoring Locations

Table 12 – Baseline GDEs Shallow Groundwater Monitoring Network

Property	Bore ID	Easting	Northing	Depth (m)	Screened Interval (m bgl)
Meroo Downs	MN-MB1-A	658464.7	7337611.6	17.0	10.1 – 16.1
Togara Station	MN-MB3-A	674586.1	7340392.6	25.1	18.3 – 24.3
Togara Station	MN-MB4-B	664644.0	7340479.9	20.0	16.0 – 19.0
Togara Station	MN-MB5-R	664636.8	7340479.7	34.1	27.1 – 33.1
Togara Station	MN-MB6-B	664873.2	7342602.8	30.0	23.0 – 29.0

8.4.6 Baseline Analytical Plan

The analytical plan for the baseline GDEs shallow groundwater monitoring covered a comprehensive suite of physical and chemical parameters to assess groundwater quality and chemistry. The parameters are grouped and summarised in Table 13 below.

Table 13 – GDEs Shallow Groundwater Baseline Analytical Plan

Monitoring Locations	Parameter Group	Analytes
MN-MB1-A MN-MB3-A MN-MB4-B MN-MB5-R MN-MB6-B	Field Parameters	pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Oxidation-Reduction Potential (Redox), Temperature, Standing Water Level (SWL)
	Major Ions	Bicarbonate (HCO_3); Calcium (Ca); Carbonate (CO_3); Chloride (Cl); Fluoride (F); Magnesium (Mg); Potassium (K); Sodium (Na); Sulfate (SO_4)
	Nutrients	Ammonia (NH_3); Nitrate (NO_3); Nitrite (NO_2); Reactive Phosphorus (TP); Total Nitrogen (TN)
	Total Metals	Arsenic (As); Barium (Ba); Beryllium (Be); Boron (B); Cadmium (Cd); Chromium (Cr); Cobalt (Co); Copper (Cu); Lead (Pb); Manganese (Mn); Mercury (Hg); Nickel (Ni); Selenium (Se); Vanadium (V); Zinc (Zn)
	Dissolved Metals	Antimony (Sb); Arsenic (As); Barium (Ba); Beryllium (Be); Boron (B); Cadmium (Cd); Chromium (Cr); Cobalt (Co); Copper (Cu); Lead (Pb); Lithium (Li); Manganese (Mn); Mercury (Hg); Molybdenum (Mo); Nickel (Ni); Selenium (Se); Strontium (Sr); Vanadium (V); Zinc (Zn)
	Hydrocarbons	BTEX (Benzene, Toluene, Ethylbenzene, Xylene), Polycyclic Aromatic Hydrocarbons (PAHs)
	Dissolved Gases	Methane (CH_4)

Monthly groundwater monitoring of the five shallow GDEs observation bores ceased after September 2025. The data collected was used to confirm groundwater stability and will be used to inform any future contingency planning, should risk profiles change during operations.

8.4.7 Operations Monitoring

Operations monitoring has been designed to provide an integrated assessment of ecosystem condition and groundwater–surface water dynamics during the life of the Project. This program combines remote sensing techniques with on-ground hydrogeological investigations to establish multiple, independent lines of evidence that can detect potential changes in environmental values.

Remotely Sensed Normalized Difference Vegetation Index (NDVI)

NDVI provides a spatially consistent, repeatable measure of vegetation condition and stress through time. Applied to riparian corridors and phreatophytic communities, it functions as an early-warning indicator of changes potentially linked to groundwater availability.

Rationale

NDVI anomalies can signal potential groundwater-related change (drawdown, quality shifts) ahead of field-observable impacts. Integrating NDVI with groundwater levels/quality, rainfall and land-use enables early, proportionate management actions via the TARP.

Relevant Legislation

- **Environmental Protection Act 1994 (Qld)** — general environmental duty; monitoring and response to avoid environmental harm.
- **Water Act 2000 (Qld)** — make-good obligations, bore impact assessment; supports use of evidence (incl. NDVI) in impact attribution.
- **Environmental Protection and Biodiversity Conservation Act 1999 (Cth)** — protection of MNES; use NDVI to support detection/assessment of GDE and listed ecological community stress.
- **Environmental Authorities (EA) conditions** — monitoring, trigger/response, reporting; NDVI can evidence compliance and adaptive management.

Alignment with IESC Requirements

This program aligns with IESC Information Guidelines (2024) by:

- Using multiple lines of evidence (remote sensing + hydrogeology + ecology).
- Establishing seasonal baselines, quantifying uncertainty, and applying transparent triggers.
- Supporting cumulative impact assessment through regional NDVI context and comparison with OGIA modelling.

Approach

- **Examples of Datasets:** Surface-reflectance Sentinel-2 (10m, 5-day revisit) and Landsat (30 m) with cloud/shadow masking, or MODIS (MOD13Q1, 250m, 16-day composites).
- **Processing:** Atmospheric correction → NDVI → mosaicking & gap-fill → aggregation to monitoring units (riparian buffers, mapped GDE polygons, receptor transects).
- **Baselines & Trends:** annual baseline; anomaly detection via percentile bands
- **Attribution:** Interpret alongside rainfall/ET, fire history, grazing/land-use, and groundwater head/quality to distinguish climate vs. groundwater signal.

Reference Assessments

- **Initial NDVI capture:** at end of dry season (September), record reference (baseline) assessment
- **Reference Assessment**
    - <0: not vegetated
    - 0-0.2: bare soil, rock, sparse vegetation; minimal photosynthetic activity
    - 0.2-0.4: spare vegetation, stressed grass, early regrowth or degraded area
    - 0.4-0.6: moderate vegetation cover, typical healthy pastures, crops under normal conditions

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  - 0.6-0.7+: dense, healthy vegetation, optimal canopy cover, vigorous growth
- **Validation:** Field photos, canopy condition scores, leaf-water potential (where feasible) at sentinel plots; cross-check with groundwater levels/EC.

Anomaly Calculations and interpretations

- NDVI = NDVI current – NDVI previous

- NDVI% = $\frac{\text{NDVI current – NDVI previous}}{\text{NDVI previous}}$ X 100

- ≥ +20%: very lush vegetation, above normal conditions
- +10% to +20%; slightly above normal growth
- -10% to +10%: normal vegetation, no significant stress
- -10% to -20%: slightly below normal, minor stress
- -20% to -40%: noticeable stress, vegetation below average
- ≤ -40%: extreme stress, severe vegetation loss

Operational Monitoring

Operational monitoring will follow the data processing approach outlined above with results compared to the previous assessment results and the following trigger used to detect change:

- NDVI% ≤ -40% indicating stress at levels greater than typically expected due to natural climatic variations

Monitoring Locations

Figure 8 identifies the locations and Table 14 discusses the locations in more detail.

Table 14 – NDVI monitoring units tied to receptors and hydrogeology

ID	Receptor / Area	Type	Rationale	Buffer/Unit
R5	Upstream riparian reach (Comet River)	Control	Hydrologic & land-use analogue; no project influence	50m buffer /500m reach
R12	Mid-stream riparian reach (Comet River)	Impact	Hydrologic & land-use analogue; minimal project influence	50 m buffer / 500m reach
R11	Downstream riparian reach (Comet River)	Impact	Hydrologic & land-use analogue; minimal project influence	50m buffer / 500m reach
R4	Mid-stream riparian reach (Humboldt creek)	Impact	Most sensitive to project drawdown	50m buffer / 500m reach
R9	Mid-stream riparian reach (Rockland Creek)	Control	Hydrologic & land-use analogue; no project influence	50m buffer / 500m reach

Surface Water/Groundwater Interaction Study

In parallel, the Surface Water/Groundwater Interaction Study, supported by the nested bore monitoring network, provides critical hydrogeological context. This study evaluates the degree of hydraulic connectivity between

shallow aquifers and surface water systems, allowing potential ecological responses observed in vegetation to be cross-referenced with measured groundwater conditions.
Together, these complementary approaches strengthen the monitoring framework by linking vegetation health indicators with hydrogeological processes, ensuring that any potential impacts are detected early and assessed in a scientifically robust manner.

8.4.8 Assessment Criteria

Monitoring data will be evaluated against baseline conditions, model predictions, and expected pressure responses. Triggers for further review and potential activation of contingency plans/TARPs (refer to Section 9) include:

- Declining water level trends inconsistent with climatic conditions and model predictions.
- Anomalous changes in water chemistry inconsistent with natural variability; and
- Changes to ecosystem condition (refer to Section 9.3).

8.5 Groundwater Monitoring - Aquifer Interconnectivity Assessment

8.5.1 Rationale

The hydrogeological assessment for the Project suggests limited vertical hydraulic connectivity between the Bandanna Formation (the target coal seam gas reservoir) and the overlying aquifers, including the Tertiary Basalt and Quaternary Alluvium. The intervening Rewan Formation is interpreted as a regionally extensive aquitard with low permeability, functioning as a primary confining unit that restricts vertical groundwater flow between deeper and shallower systems.

The current evidence and sensitivity modelling presented in the site-specific MODFLOW-USG model supports the assumption of low to negligible vertical flux between the coal seams and shallow aquifers. However, data collected during baseline monitoring and early production phases will be critical to verifying this assumption and managing regulatory risk.

8.5.2 Relevant Legislation

This monitoring program is developed under the Water Act 2000 (Qld) and aligns with:

- IESC Information Guidelines (2024);
- Water Monitoring and Management Plans (WMMP) requirements;
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019; and
- EPBC Act 1999 (Cth) significant impact considerations.

8.5.3 Alignment with IESC Recommendations

The IESC has specifically recommended that multi-level nested monitoring bores be used to evaluate the vertical hydraulic gradient across the Bandanna, Rewan, and shallow formations to detect potential leakage.

8.5.4 Monitoring Bore Design and Strategy

To directly assess potential vertical leakage associated with CSG production-induced pressure gradients, a series of up to four (4) nested bore clusters (M1 to M4) will be installed at strategically selected locations (refer to Figure 10 for the nested bores design and Figures 11 to 15 for the location), initially as part of the RCP, with monitoring to continue throughout the operational stage of the Project. Each cluster will monitor hydraulic conditions across the following hydrostratigraphic units:

- Bandanna Formation – target coal seam for CSG production
- Rewan Formation – confining aquitard
- Tertiary Basalt/Sediments – potentially semi-confined, fractured aquifer
- Quaternary Alluvium – shallow unconfined aquifer associated with stream valleys.

Each bore within a cluster will be screened in a specific unit to enable depth-discrete monitoring of pressure and water quality, reducing the risk of cross-contamination and enabling clear interpretation of vertical gradients.

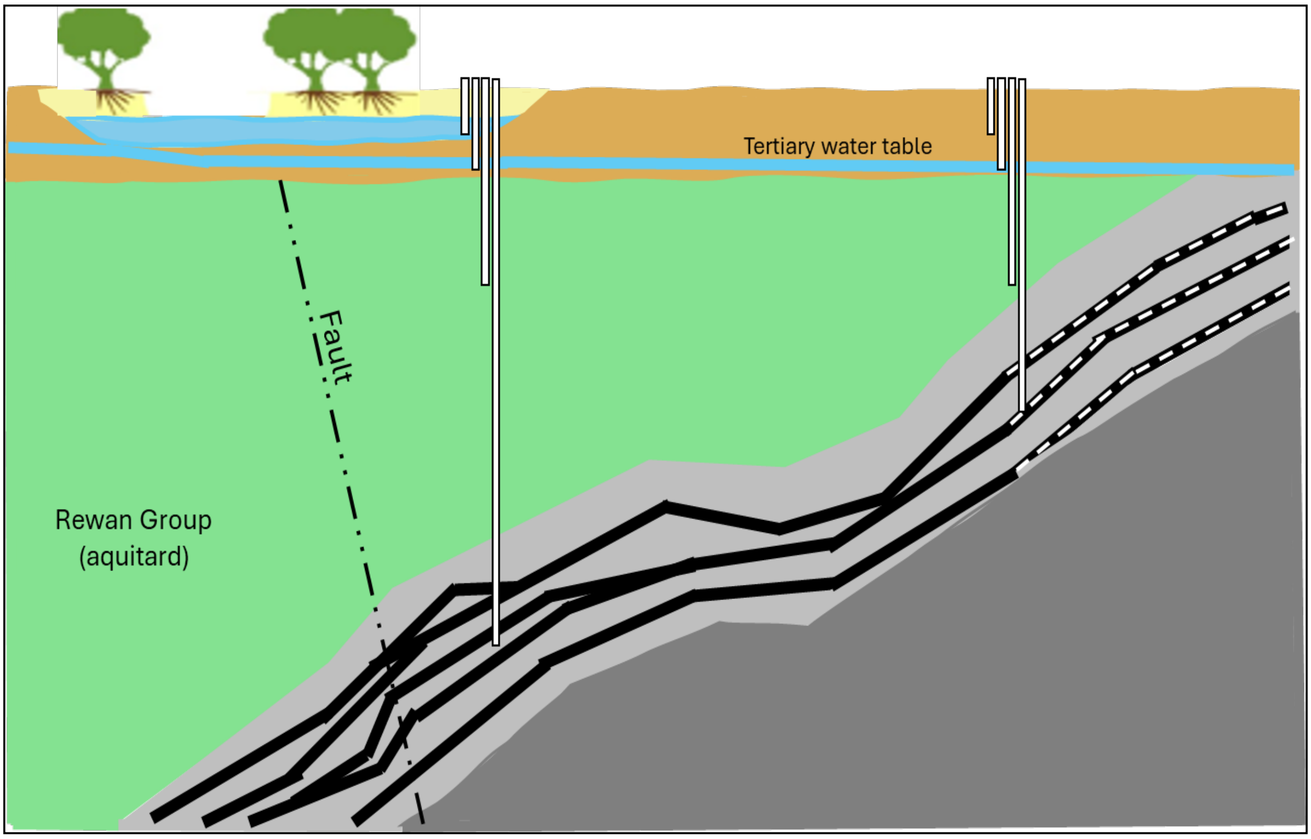

Figure 10 – Nested Bores Design and Strategy

8.5.5 Well Construction and Risk Mitigation

To mitigate cross-aquifer flow and potential gas migration risks:

- Grouted completions will be implemented for the Rewan and Bandanna bores using VWPs.
- Bore designs will comply with "Minimum Construction Requirements for Water Bores in Australia (2020)".
- All installations will follow strict drilling and well integrity protocols to prevent unintended connectivity.

8.5.6 Bore Siting and Geophysical Support

Monitoring bore locations will be refined and confirmed using Electrical Resistivity Tomography (ERT) to improve the confidence in intersecting the intended hydrostratigraphic units. This geophysical data will guide precise siting of the bore clusters to ensure that each unit—Alluvium, Tertiary Basalt/sediments, Rewan

Formation, and Bandanna Formation—is appropriately monitored for hydrogeological and geochemical assessments. By integrating ERT prior to drilling, the program aims to reduce uncertainty in bore stratigraphy and ensure alignment with the project's aquifer interconnectivity and impact assessment objectives.

8.5.7 Lines of Evidence for Interconnectivity Assessment

A multiple-lines-of-evidence approach will be employed, including:

- Hydraulic Head Monitoring
    1. Bores will be equipped with Pressure Transducer Data Loggers (PTDLs) or Vibrating Wire Piezometers (VWPs) to record continuous groundwater pressure data.
    2. Focus will be placed on identifying pressure differentials between units and assessing temporal drawdown responses during CSG production.
- Isotopic Tracing
    1. Environmental isotopes will be used to identify recharge sources, residence times, and potential inter-aquifer mixing.
- Hydro geochemistry
    1. Groundwater samples will be analysed for major ions, trace metals, and geochemical indicators.
    2. The goal is to establish baseline water chemistry for each hydro stratigraphic unit and identify any shifts that might indicate vertical mixing or leakage.

8.5.8 Proposed Monitoring Locations

The four bore clusters (M1 to M4) are sited to intercept varying geological conditions across the Project area. Figure 11 shows the monitoring location overview, with Figures 12 to 15 providing site specific details. Table 15 includes the unique monitoring bore IDs. Location considerations were:

- M01 is located on the western edge of the PL boundary, near the Comet River and Arcturus Fault, also near existing landholder bores for data integration. Initial studies show there is no alluvium or Tertiary/basalts at this location, so the targeted formations here are the Rewan and Bandanna.
- M02 is located at the southern margin of the PL, near Humboldt Creek and a potential recharge zone. It is near the Mahalo North Pilot (MN01) and is positioned to capture any potential early-stage pressure responses from production.
- M03 is in the central-north of the PL, a higher elevation area with thin, weathered Rewan near the formation subcrop, positioned near proposed CSG wells and surface drainage.
- M04 is located at the eastern section of the PL, near Rockland Creek; targets preserved stratigraphy and wider basalt extent; away from identified faults.

Table 15 – Bore Clusters Locations

Monitoring Cluster	Monitoring bore ID	Targeted Formations	Geological Considerations	Purpose/ Monitoring Objective
M01	M01-3	Rewan	Downgradient of fault zone	Baseline monitoring, Rewan connectivity and fault-related connectivity.
	M01-4	Bandanna		
M02	M02-1	Alluvium	Transition zone; fault-crossing with potential vertical leakage.	Surface water/groundwater interaction, early-stage pressure responses from production.
	M02-2	Tertiary		
	M02-3	Rewan		
	M02-4	Bandanna		
M03	M03-1	Alluvium		

Monitoring Cluster	Monitoring bore ID	Targeted Formations	Geological Considerations	Purpose/ Monitoring Objective
	M03-2	Tertiary/Basalt	Presence of saturated alluvium. Subcrop and weathering of Rewan; production drawdown influence	Interconnectivity between aquifers through the thinner, weathered Rewan formation. sensitive receptor check; verify predicted drawdown propagation.
	M03-3	Rewan		
	M03-4	Bandanna		
M04	M04-1	Alluvium	Subcrop and weathering of Rewan; end of hydraulic gradient; intersects floodplain.	Surface water/groundwater interactions, long-term impact tracking near ecologically sensitive areas.
	M04-2	Tertiary sediments or basalt (if present)		
	M04-3	Rewan		
	M04-4	Bandanna		

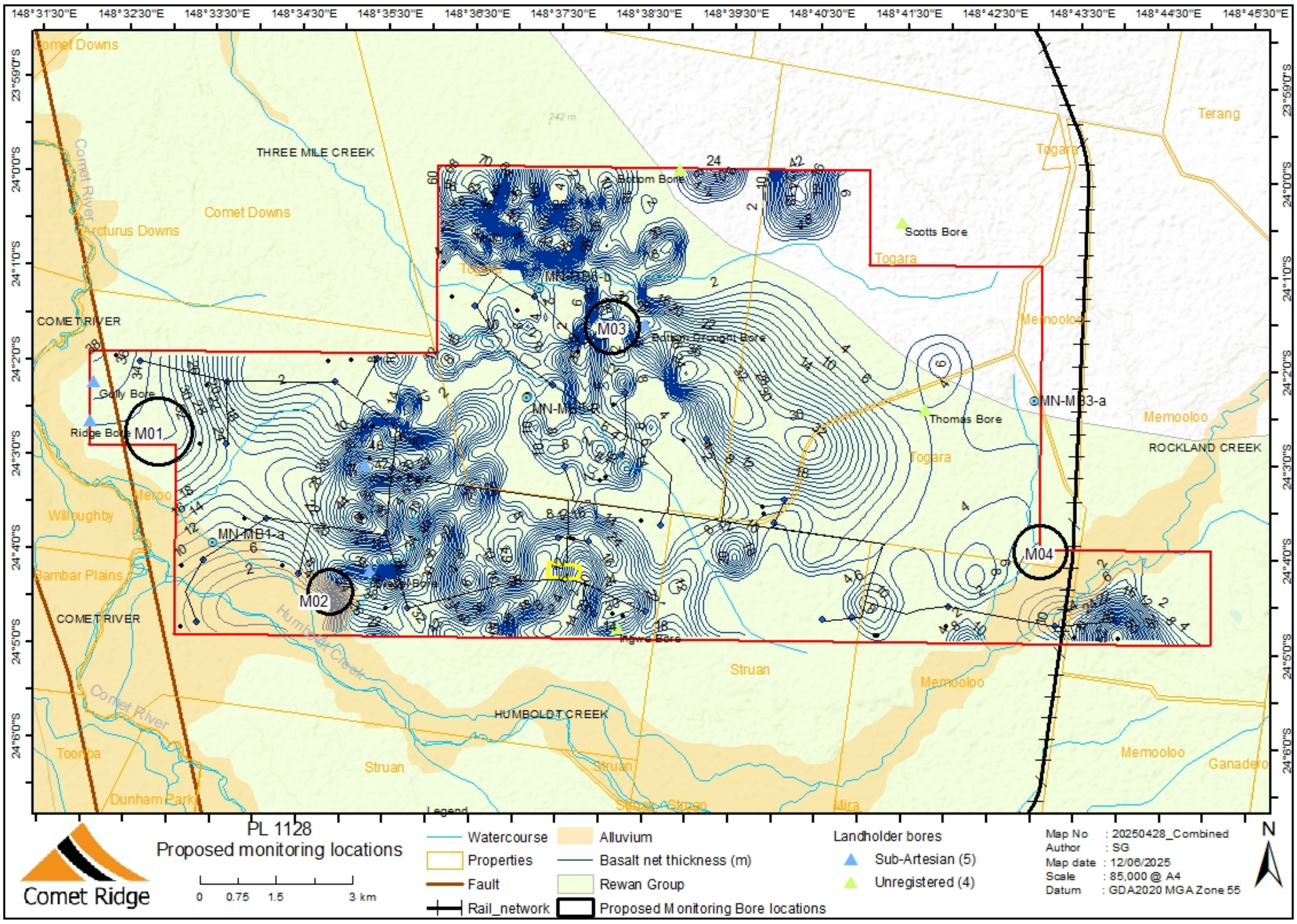

Figure 11 – Aquifer Interconnectivity Monitoring Locations

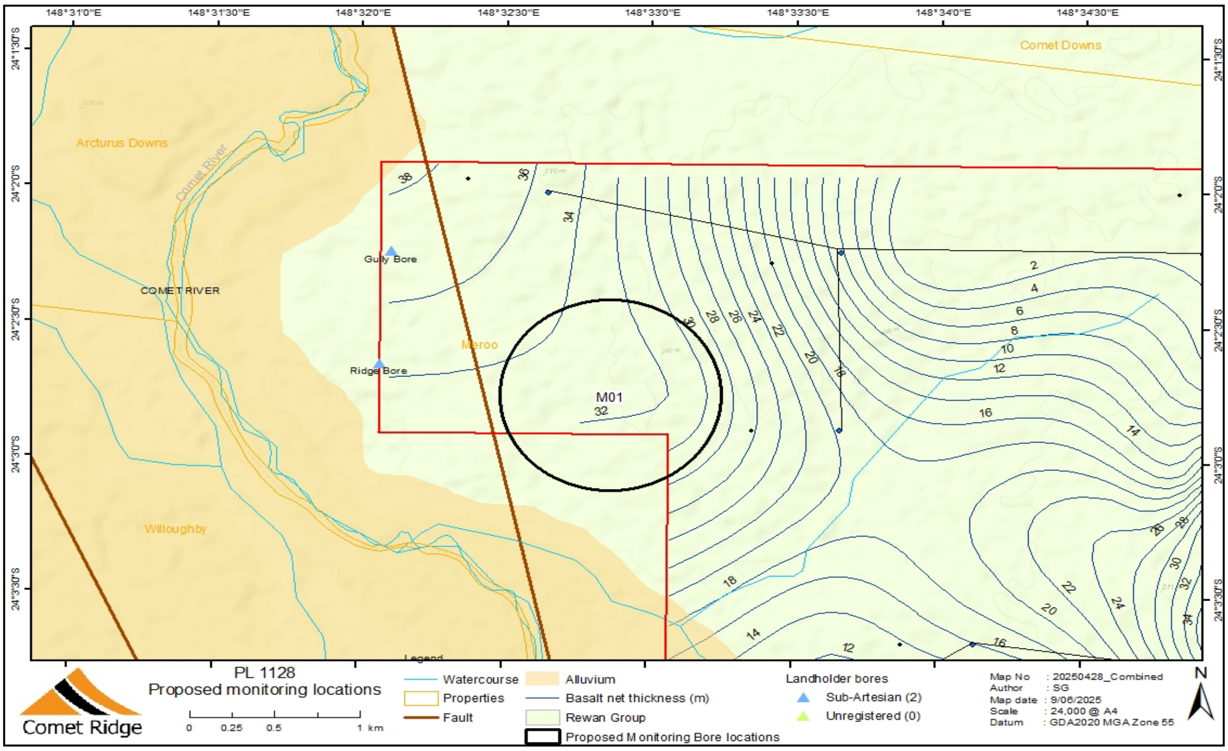

Figure 12 – Aquifer Interconnectivity Cluster M01

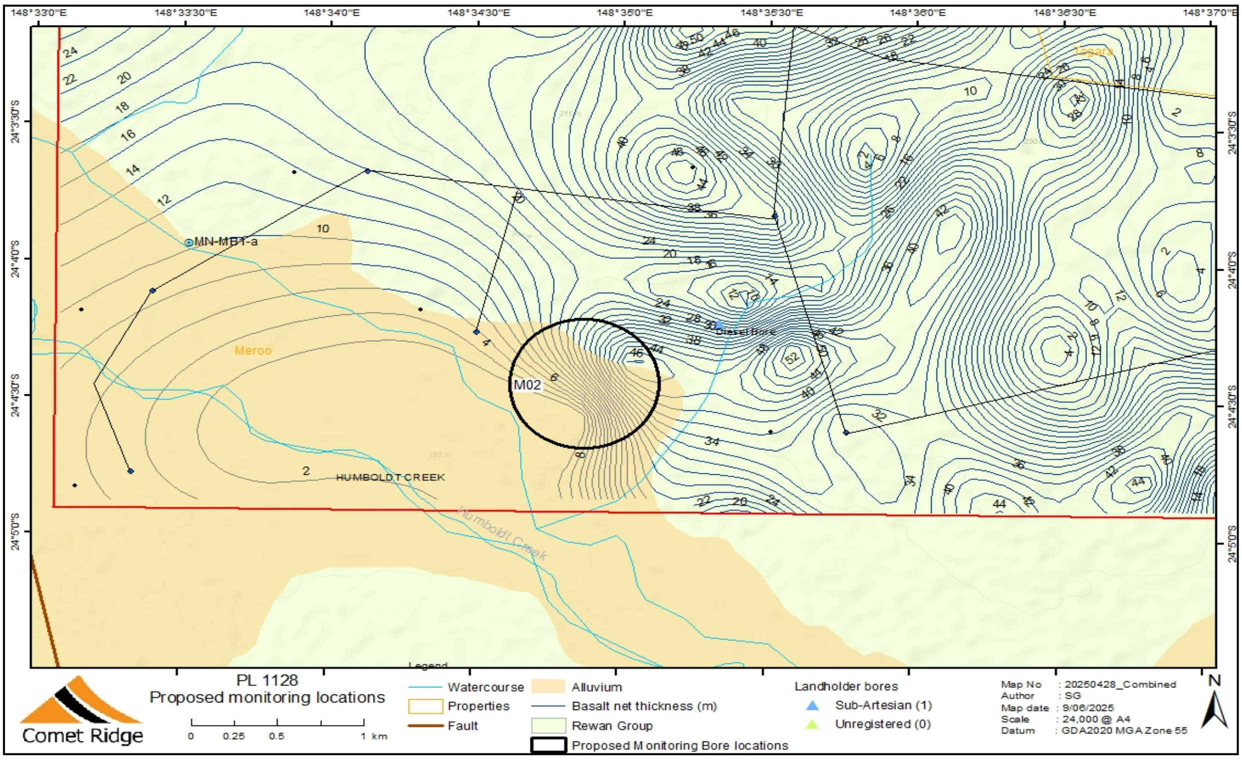

Figure 13 – Aquifer Interconnectivity Cluster M02

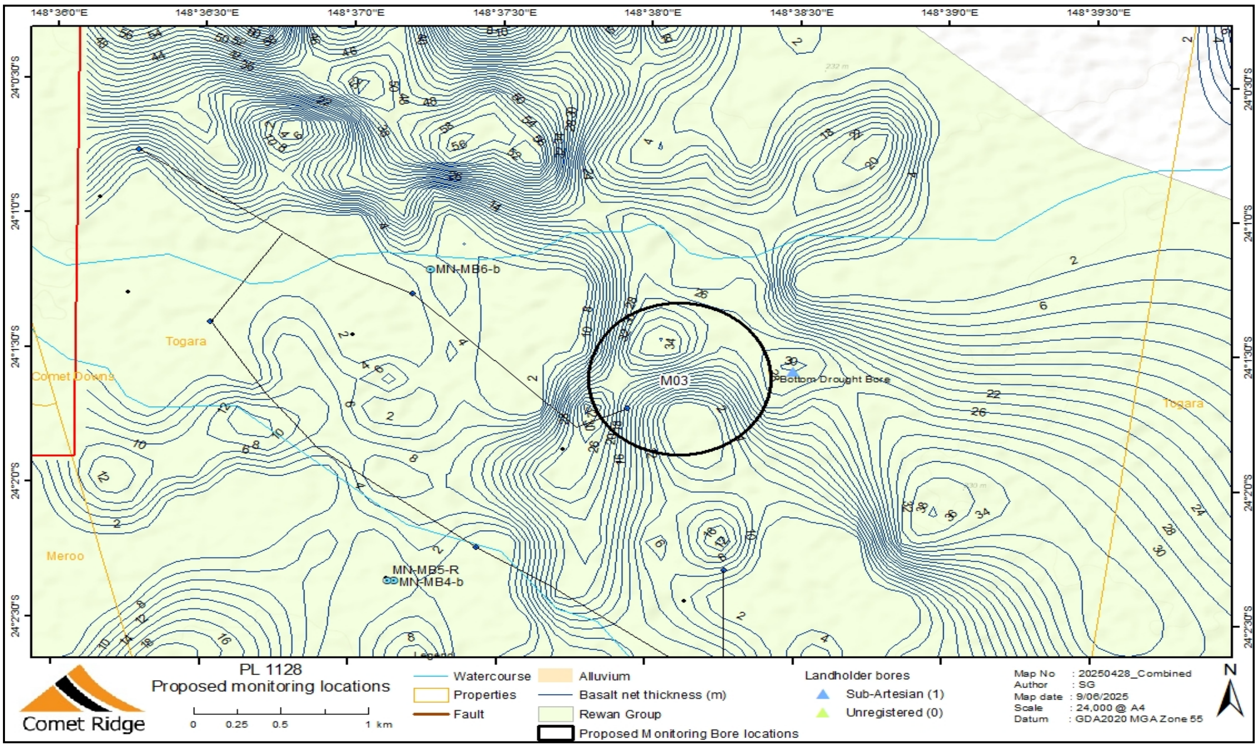

Figure 14 – Aquifer Interconnectivity Cluster M03

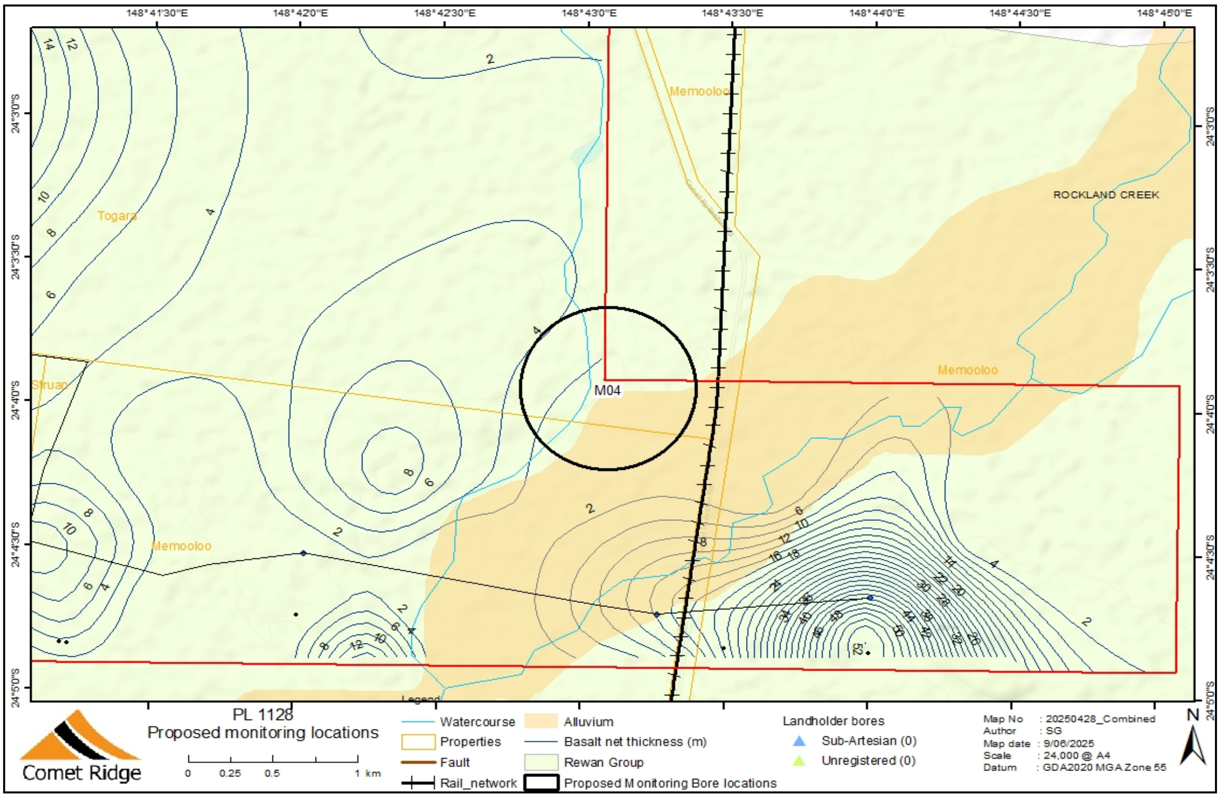

Figure 15 – Aquifer Interconnectivity Cluster M04

8.5.9 Baseline Sampling

Following installation of the four nested bore clusters, expected in early 2026, the RCP and baseline sampling will be completed. Baseline sampling will occur for approximately 2 years and is expected to be completed by early to mid-2028. Baseline sampling will be completed no later than 12 months after production well construction. While the first production wells will be constructed late in the baseline sampling period; the initial production wells have been located as distant from the monitoring bores as possible considering the planned production schedule and field development requirements. This will allow baseline data collection at the monitoring bores to be completed before any potential impacts to groundwater from production could feasibly occur at the monitoring bore locations given the hydraulic properties of the relevant hydrostratigraphic layers.

8.5.10 Operational Integration and Sampling

Water quality samples to characterise the Rewan and Bandanna will be collected during bore installation (where feasible). Once VWPs are completed in the Bandanna and Rewan formations no further water quality samples will be able to be collected at these locations, however, samples from the Bandanna will be collected periodically during the operational phase from nearby gas production wells, where feasible.

Water quality samples will be collected from alluvium and Tertiary sediments/basalt monitoring sites quarterly during the baseline data collection period then biannually throughout operations.

8.5.11 Analytical Plan

To evaluate connectivity between coal seams and overlying aquifers the 4 multi-level nested monitoring bore clusters (Bandanna, Rewan, Tertiary, Alluvium) will be analysed for the parameters outlined in Table 16 below.

Table 16 – Aquifer Interconnectivity Analytical Plan

Parameter Group	Analytes	M1	M2	M3	M4
Field Parameters	pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Oxidation-Reduction Potential (Redox), Temperature, Standing Water Level (SWL)	✓	✓	✓	✓
Major Ions	Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Sulfate (SO_4), Bicarbonate (HCO_3), Carbonate (CO_3)	✓	✓	✓	✓
Nutrients	Total Nitrogen (TN), Nitrate (NO_3), Nitrite (NO_2), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP)	✓	✓	✓	✓
Total and Dissolved Metals	Aluminium (Al), Arsenic (As), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Uranium (U), Vanadium (V), Zinc (Zn)	✓	✓	✓	✓
CSG Indicators	Barium (Ba), Boron (B), Fluoride (F), Lithium (Li), Strontium (Sr), dissolved methane	✓	✓	✓	✓
Organics	BTEX, PAHs, Phenolic compounds	✓	✓	✓	✓

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8.5.12 Assessment Criteria

Monitoring data will be evaluated against baseline conditions, model predictions, and expected pressure responses. Triggers for further review and potential activation of contingency plans/TARPs (refer to Section 9) include:

- Changed head gradients between the Bandanna and overlying units;
- Declining water level trends inconsistent with climatic conditions and model predictions; and
- Anomalous changes in water chemistry inconsistent with natural variability (refer to Section 9.3).

8.6 Surface Water/Groundwater (SW/GW) Interaction Evaluation

8.6.1 Rationale

The Project area includes several ephemeral surface water systems—namely the Comet River, Humboldt Creek, and Rockland Creek—which only flow in response to substantial or prolonged rainfall.

These watercourses are not perennial and, due to their intermittent nature, are more likely to recharge underlying aquifers than to receive sustained baseflow contributions. However, in areas where hydraulically connected shallow alluvial aquifers are present, localised discharge to these streams may occur.

Understanding the direction and magnitude of flow between surface water and shallow groundwater systems is essential for identifying potential impacts from CSG operations, particularly where depressurisation of the Bandanna Formation may propagate through hydraulically connected shallow groundwater systems.

The aquifer interconnectivity study will determine the likelihood of this connectivity.
The objective of this monitoring program is to develop an evidence-based understanding of:

- The direction and magnitude of hydraulic gradients between surface water and shallow groundwater;
- The extent to which surface flows recharge groundwater systems (e.g., losing streams, gaining streams) or have bidirectional flow dynamics under varying seasonal and hydraulic conditions; and
- The influence of seasonal variability and project-related drawdown on SW/GW dynamics.

Data collection and analysis focuses on measurement of hydraulic head gradients between the monitored watercourses and alluvial groundwater (where and if present) and to a lesser degree the hydrogeochemistry of the alluvial system(s). Differences in hydraulic head and hydrogeochemistry will inform if groundwater is discharging into the watercourse, or vice versa. Recharge estimates will also inform the SW/GW dynamics.

To meet these objectives, the program will:

- Utilises the multi-level nested monitoring bores installed as part of the RCP to evaluate the vertical hydraulic gradient across the Bandanna, Rewan, and shallow formations to detect connectivity or potential leakage;
- Correlate monitoring data from shallow groundwater monitoring bores near existing surface water monitoring sites to identify and characterise the hydraulic relationship;
- Measure groundwater levels and compare to surface water elevation at each site to assess potential flow direction;
- Undertake routine major ion analyses and one-off stable isotope sampling to characterise hydrochemical differences between surface and groundwater; and
- Estimate recharge volumes based on water balance and hydraulic data.

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The ephemeral Humboldt Creek and Rockland Creek do not have flow gauging stations. Because of this, monitoring will comprise shallow current surface water monitoring locations and groundwater monitoring in the bore nests. The hydraulic head of groundwater will be compared to the elevation of water in the creek to ascertain if groundwater is discharging to the creek or vice versa.
Groundwater monitoring data will also be compared to the Comet River stage height, but this comparison will be semiquantitative, given the distance of the upstream gauging station (>20 km) and the lack of alluvial deposits present in the PL boundaries.

Geochemical analyses will comprise major ions on a routine basis with stable isotopes analysed during the first monitoring event only. Stable isotopes will not be sampled routinely because groundwater flow paths are likely to be very short due to the limited extent of alluvial sediments and the depth of the Tertiary water table. However, if monitoring data suggest that groundwater from multiple sources is mixed with the stream water, then additional analyses would be implemented as part of the investigation and assessment process.

8.6.2 Relevant Legislation

This evaluation is designed to address obligations under the following regulatory frameworks:

- Environmental Protection Act 1994 (QLD) and the Environmental Protection (Water) Policy 2019, including compliance with WQOs for the Comet River sub-basin (DEHP, 2011); and
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999), including identification of Matters of National Environmental Significance (MNES) such as GDEs and listed threatened ecological communities.

8.6.3 Alignment with IESC Recommendations

This surface water–groundwater (SW–GW) monitoring program has been developed in accordance with the IESC Information Guidelines (2024). It is designed to inform the project's conceptual hydrogeological model and provide the evidence base necessary to assess and manage potential impacts on sensitive receptors.

Specifically, the program aligns with the IESC's recommended principles by:

- Applying a multiple-lines-of-evidence approach to evaluate hydraulic connectivity between surface water features and shallow aquifers;
- Characterising seasonal variability in recharge–discharge dynamics and surface water features – aquifer interactions;
- Assessing changes in flow regimes associated with potential depressurisation of the Bandanna Formation;
- Quantifying baseflow contributions and recharge pathways, particularly for ephemeral systems such as Humboldt and Rockland Creeks;
- Utilising isotopic tracers and geochemical signatures (e.g., major ions, stable isotopes) to distinguish between formation water, alluvial groundwater, and surface water sources; and
- Incorporating field-derived monitoring data into the site's conceptual hydrogeological models to evaluate potential impact scenarios under both baseline and operational conditions.

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8.6.4 Lines of Evidence

Hydraulic Head Monitoring

- Standing Water Level (SWL) measurements of shallow and intermediate aquifer bores using manual dippers.
- Correlation with creek stage height and rainfall events to detect lagged recharge/discharge responses.

Water Chemistry and Isotope Analysis

- Major ions, stable isotopes, and trace elements will be assessed to delineate mixing zones, recharge sources, and identify any anomalous chemistry indicative of connectivity to deeper formation water.

8.6.5 Monitoring Locations

To identify and monitor for interactions between firstly, surface water and shallow groundwater, and secondly, between shallow groundwater and deeper aquifers, the SW-GW monitoring program will monitor both surface water elevations and groundwater levels across multiple sites (refer to Table 17), including:

- M01 – nested bores with VWPs in the Rewan Formation (M01-3) and Bandanna Formation (M01-4).
- M02 – nested bores targeting Alluvium (M02-1) and Tertiary sediments/basalt (M02-2) with VWPs in the Rewan Formation (M02-3) and Bandanna Formation (M02-4).
- M03 – nested bores targeting Alluvium (M03-1) with VWPs in the Rewan Formation (M03-3) and Bandanna Formation (M03-4).
- M04 – nested bores targeting Alluvium (M04-1), Basalts if present (M04-2), with VWPs in the Rewan Formation (M04-3) and Bandanna Formation (M04-4).
- R4 – surface water monitoring location on Humboldt Creek adjacent the PL.
- R5 – surface water monitoring location on Comet River upstream of the PL.
- R9 - surface water monitoring location on Rockland Creek adjacent the PL.
- R11 - surface water monitoring location on Comet River downstream of the PL.

8.6.6 Analytical Plan

Table 17 – GW/SW Interaction Analytical Plan

Parameter Group	Analytes	M01	M02	M03	M04	R11	R4	R9	R5
Field Parameters	pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Oxidation-Reduction Potential (Redox), Temperature, Standing Water Level (SWL)	✓	✓	✓	✓	✓	✓	✓	✓
Major Ions	Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Sulfate (SO_4), Bicarbonate (HCO_3), Carbonate (CO_3)	✓	✓	✓	✓	✓	✓	✓	✓
Nutrients	Total Nitrogen (TN), Nitrate (NO_3), Nitrite (NO_2),	✓	✓	✓	✓	✓	✓	✓	✓

Parameter Group	Analytes	M01	M02	M03	M04	R11	R4	R9	R5
	Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP)								
Total and Dissolved Metals	Aluminium (Al), Arsenic (As), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Uranium (U), Vanadium (V), Zinc (Zn)	✓	✓	✓	✓	✓	✓	✓	✓
CSG Indicators	Barium (Ba), Boron (B), Fluoride (F), Lithium (Li), Strontium (Sr), dissolved methane	✓	✓	✓	✓	✓	✓	✓	✓
Organics	BTEX, PAHs, Phenolic compounds	✓	✓	✓	✓	✓	✓	✓	✓

8.6.7 Assessment Criteria

Monitoring data will be evaluated against baseline conditions, model predictions, and expected pressure responses.

Triggers for further review and potential activation of contingency plans/TARPs (see Section 9) include:

- Declining water table head in shallow aquifers;
- Decreased vertical head gradient between Bandanna Formation and overlying units; and
- Anomalous changes in water chemistry inconsistent with natural variability (refer to Section 9.3).

8.7 Surface Water Monitoring

8.7.1 Rationale

Surface water monitoring is a critical component ensuring early identification of water quality risks from resource activities.

The Project tenement encompasses several surface water features that differ in hydrology, ecological value, and sensitivity to potential impacts from coal seam gas (CSG) activities, key surface water receptors are summarised in Table 18, and include:

- Comet River,
- Humboldt Creek, and
- Rockland Creek.

These watercourses act as receptors for potential surface runoff, sediment transport, and contaminant mobilisation, particularly during the construction and production phases. Monitoring is necessary to track any degradation in water quality related to stormwater flows, chemical storage, or CSG water handling.

These systems support aquatic ecosystems and are particularly vulnerable to increases in sediment, nutrient, and hydrocarbon loads during high-flow events.

Table 18 – Summary of Key Surface Water Monitoring Receptors

Receptor	Hydrological Type	Key Characteristics
Comet River	Permanent stream	Regionally significant watercourse along the western boundary of PL1128; primary downstream receptor for surface discharges; covered by Comet River WQOs; long-term baseline monitoring confirms flow reliability.
Humboldt Creek	Ephemeral stream	Located in the southwest of the project area. Important for assessing event-based mobilization of contaminants.
Rockland Creek	Ephemeral Stream	Located in the southeastern portion of PL1128. May interact with basalt and alluvial systems.

8.7.2 Relevant Legislation

The monitoring program supports compliance with Environmental Authority (EA) conditions and EPBC Act 1999 requirements including:

- Environmental Protection Act 1994 (Qld);
- Water Act 2000 (Qld);
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019;
- Comet River Sub-Basin WQOs (DEHP, 2011); and
- ANZG (2018) Water Quality Guidelines for Ecosystem Protection.

8.7.3 Alignment with IESC Recommendations

The surface water monitoring program has been developed in alignment with the IESC Information Guidelines (2024) for coal seam gas (CSG) developments, ensuring scientific robustness and regulatory compliance.

Key elements of alignment include:
- Receptor-Based Network: Monitoring locations target key hydrological receptors (Comet River, Humboldt Creek, Rockland Creek) based on ecological value, flow regime, and proximity to infrastructure—consistent with IESC recommendations.
- Use of Baseline Data: Historical data informs site-specific WQOs and supports defensible impact assessments, as required by the IESC.
- Hydrological Variability: Inclusion of both permanent and ephemeral systems addresses IESC guidance on flow regime sensitivity and episodic contaminant transport.
- Comprehensive Analytical Suite: The monitoring includes field parameters, nutrients, major ions, metals (total and dissolved), CSG indicator elements (e.g., Li, Sr, F), and organics (BTEX, PAHs), supporting early detection and source attribution.
- Guideline Consistency: The program is aligned with ANZG (2018), Comet River WQOs (DEHP 2011), the EPBC Act 1999, EP Act, and EA conditions.
- Adaptive Design: Provision for future expansion enables adaptive management in response to new data or IESC feedback.

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8.7.4 Baseline Surface Water Monitoring Locations

Historical surface water quality monitoring has been undertaken since early project scoping phases, encompassing multiple sites across the Comet River and ephemeral streams within or near PL1128 as outlined in Table 19. This data establishes the pre-development condition of aquatic environments and supports the derivation of site-specific WQOs (refer Appendix D (Epic, 2025)).

Table 19 – Baseline Surface Water Monitoring Locations

Site ID	Watercourse	Rationale for Baseline Selection	Operational monitoring status rationale
R1	Unnamed tributary of the Comet River	Established for upstream background quality.	Not retained, outside southern PL boundary, minor drainage feature that only captures flow from a small part of the Project site.
R2	Unnamed tributary of the Comet River	Used in early baseline characterisation.	Not retained, outside southern PL boundary, drainage feature that only captures flow from a small part of the Project site.
R3	Unnamed drainage line	Used in early baseline characterisation.	Not retained, removed due to duplication with downstream accessible points (R4).
R4	Humboldt Creek	Used in baseline characterisation.	Retained, shallow alluvial connection noted, captures runoff from southwest parts of the site.
R5	Comet River	Intermittently monitored, upstream location on receiving waterway.	Retained, identified via GIS as potential runoff conduit.
R6	Comet River	Used in early baseline characterisation.	Not retained, outside of PL boundary, duplicative with R5.
R7–R8	Unnamed tributaries of Comet River and Three Mile Creek	Used in early baseline characterisation.	Not retained due to lack of persistent flow, drainage features that only capture flows from a small part of the Project site.
R9	Rockland Creek	Located in a permanent water hole on Rockland Creek.	Retained as site is a permanent water hole on Rockland Creek near the upstream extent of the site that can be used to indicate water quality entering the site.
R10	Humboldt Creek	Historical downstream compliance site.	Not retained, outside PL, duplicative with R4.
R11	Comet River	Primary downstream receptor outside of tenure.	Retained as representative of the major downstream receptor, aligned with WQOs for Comet River.

8.7.5 Operation Surface Water Monitoring Locations

The baseline surface water monitoring network was streamlined for operational monitoring with sites selected based on their representativeness of the key hydrological receptors, ability to detect potential impacts from the Project and site safety and accessibility. The operational monitoring network targets key hydrological receptors, including the Comet River up stream (R5) and downstream (R11), Humboldt Creek (R4), and Rockland Creek (R9) as outlined in Table 20.

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Table 20 – Summary of Surface Water Monitoring Locations

Site ID	Watercourse	Hydrological Type	Monitoring Status
R5	Comet River	Permanent	Active – up stream compliance point with good access
R11			Active – downstream compliance point with good access
R4	Humboldt Creek	Ephemeral	Active – sensitive receptor near infrastructure
R9	Rockland Creek	Ephemeral	Active – located in a permanent water hole on Rockland Creek

Figure 8 shows the locations of the surface water monitoring locations in relation to the development area, drainage lines, and surrounding infrastructure.

8.7.6 Analytical Plan

The locations outlined in Table 20 will be analysed according to the analytical plan outlined in Table 21.

Table 21 – Analytical Plan Surface Water Monitoring

Parameter Group	Analytes	R11	R4	R9	R5
Field Parameters	pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Oxidation-Reduction Potential (Redox), Temperature, Standing Water Level (SWL), turbidity	✓	✓	✓	✓
Major Ions	Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Sulfate (SO_4), Bicarbonate (HCO_3), Carbonate (CO_3)	✓	✓	✓	✓
Nutrients	Total Nitrogen (TN), Nitrate (NO_3), Nitrite (NO_2), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP)	✓	✓	✓	✓
Total and Dissolved Metals	Aluminium (Al), Arsenic (As), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Uranium (U), Vanadium (V), Zinc (Zn)	✓	✓	✓	✓
CSG Indicators	Barium (Ba), Boron (B), Fluoride (F), Lithium (Li), Strontium (Sr),	✓	✓	✓	✓
Organics	BTEX, PAHs, Phenolic compounds	✓	✓	✓	✓

8.7.7 Assessment Criteria

Monitoring data will be evaluated against baseline water quality and condition observations during baseline data collection.
Triggers for further review and potential activation of contingency plans/TARPs (see Section 9) include:

- Unauthorised discharges (e.g., sediment plumes, oily sheens);
- Ecological impacts (e.g., fauna mortality, algal blooms); and
- Anomalous changes in water chemistry inconsistent with natural variability (refer to Section 9.2).

8.8 Stormwater Monitoring and Management Program

8.8.1 Rationale

The Mahalo North GCF will manage produced CSG water extracted from surrounding wells and conveyed to the site via underground pipelines. Produced water will be temporarily stored and treated on-site before reuse or disposal.

The Key Infrastructure present within the GCF footprint includes:

- Above-Ground Storage Tanks (AGSTs) for:
    - Produced Water (raw);
    - RO Permeate (treated water for potential reuse); and
    - Brine Concentrate.
- RO Treatment Plant to separate the brine and permeate from CSG produced water

Given the site's location in the Comet River sub-basin, where ephemeral streams and overland flow pathways intersect with project infrastructure, robust stormwater management is essential to:

- Prevent uncontrolled discharges during rainfall events;
- Protect sensitive receptors such as Humboldt Creek, the Comet River, and surrounding GDEs;
- Mitigate contaminant mobilisation and sediment runoff; and
- Ensure compliance with Environmental Authority (EA) conditions and national environmental guidelines.

8.8.2 Relevant Legislation

Stormwater controls have been designed in accordance with:

- Environmental Protection Act 1994 (Qld);
- Environmental Protection (Water) Policy 2019;
- EPBC Act 1999 (if discharge risks to aquatic ecosystems are triggered);
- ANZG (2018) Water Quality Guidelines;
- Queensland Urban Drainage Manual (QUDM, 2017);
- CSG Water Management Policy (DES, 2012; revised 2021);
- Comet River Sub-basin WQOs (DEHP, 2011); and
- IESC Information Guidelines (2024).

8.8.3 Alignment with IESC Recommendations

The stormwater management strategy addresses IESC Advice (2025-153), which identified overtopping, spills, and seepage from water storages as key risks to EPBC Act–listed species and surface water quality.

The Project's approach includes:

- Bunded and engineered storages with high freeboard thresholds and level alarms to mitigate overtopping risk.
- Event-based contingency actions triggered by rainfall forecasts, tank levels, or observed overflows.
- Dedicated seepage monitoring bores to detect early signs of leakage or mobilisation of contaminants.
- Siting of key infrastructure outside the 1% AEP floodplain based on flood modelling and topographic analysis.

- Adaptive design and response measures including RO plant shutdown, inter-tank transfer, and offsite disposal where required.
- Compliance with EA and EPBC Act notification and reporting requirements for any exceedance or discharge events.

8.8.4 Design Measures

A suite of engineered controls and operational safeguards have been integrated into the facility design to manage stormwater, prevent environmental harm, and ensure regulatory compliance. These measures are informed by hydrological modelling, industry best practices, and relevant guidelines (QLD State Planning Policy, ANZG 2018, and IESC Information Guidelines 2024).

1. Capture Basin and Hydrological Control

- A capture basin with an approximate capacity of $325m^3$ to $495m^3$ has been designed to manage runoff from rainfall events up to 25mm in 24-hours. Noting that this threshold captures approximately 95% of daily rainfall events based on the historical 125 years dataset. It is also consistent with the proposed water quality monitoring trigger. The basin provides temporary containment of site runoff.
- The basin includes a low flow piped outlet and emergency spillway, ensuring resilience under high rainfall conditions. The piped outlet from the capture basin would have a valve to enable water to be held within the basin for treatment or redirection (e.g., to produced water tank for treatment using RO plant) in the case of a contaminated discharge event.

2. Clean and Dirty Water Separation

- Swales and diversion bunds are installed to direct uncontaminated overland flow away from operational areas and direct potentially contaminated water toward the capture basin. This separation reduces the volume of water being directed to the capture basin and therefore lowers the risk of cross-contamination.
- The operational phase has site grading and bunds and swales to ensure that all runoff from the tanks and RO plant and associated infrastructure would be directed to the capture basin.
- All drainage infrastructure is graded to promote positive flow, preventing ponding and minimising mosquito breeding or standing water hazards.

3. Tank Design and Secondary Containment

- All above-ground storage (produced water, permeate and brine) tanks are constructed with corrosion-resistant materials, and all tanks are to have two liners (primary and secondary) with interstitial leak detection. Each tank has a minimum 0.3 m freeboard above its maximum operating volume to accommodate rainfall inputs and provide 2–3 days' operational buffer, allowing for reactive management under abnormal operating or weather conditions.
- The system will enable recirculation between tanks to manage inflow surges and maintain operational levels.
- Sufficient space is provided to install additional tanks if volumes exceed expected rates.
- In the unlikely event that onsite containment is exceeded, tankering of excess water offsite is available as a contingency.
- Production processes can be paused during high rainfall events or when tank storage capacity is nearing its limit. This safeguard prevents excess inflow to the water management system and reduces the risk of containment system exceedance. Production restart is only permitted once sufficient storage capacity is restored.

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4. Instrumentation, Monitoring and Alarms

- Tanks are equipped with digital level sensors and telemetry-connected alarms to provide real-time alerts for rising water levels, potential overflows, or equipment failures.
- The telemetry system is integrated into the site's Supervisory Control and Data Acquisition (SCADA) network, ensuring remote monitoring and rapid response capability by operators. The alarms would be set with multiple levels (i.e. 1m to overtopping, 0.5m to overtopping, and maximum operational level being 0.3m till overtopping) to ensure that personnel are aware as the levels within the tanks are reaching capacity.

5. Emergency Spill Management and Isolation

- The site includes spill containment kits and shutoff valves at key transfer points to isolate infrastructure and contain any accidental releases.

6. Erosion and Sediment Control

- Exposed soil areas are stabilised using temporary erosion controls (e.g., geotextiles, mulch) and permanent vegetation cover where feasible.
- Sediment fences, check dams, and sediment traps are installed during construction and maintained during operations to reduce turbidity and total suspended solids (TSS) in runoff.
- The capture basin is to be installed as a sediment dam during the construction phase.

7. Operational Readiness and Maintenance

- Standard operating procedures (SOPs) outline inspection, maintenance, and emergency response protocols for all stormwater infrastructure.
- Routine inspections are conducted before and after rainfall events to verify infrastructure integrity, sediment build-up, and bund condition.

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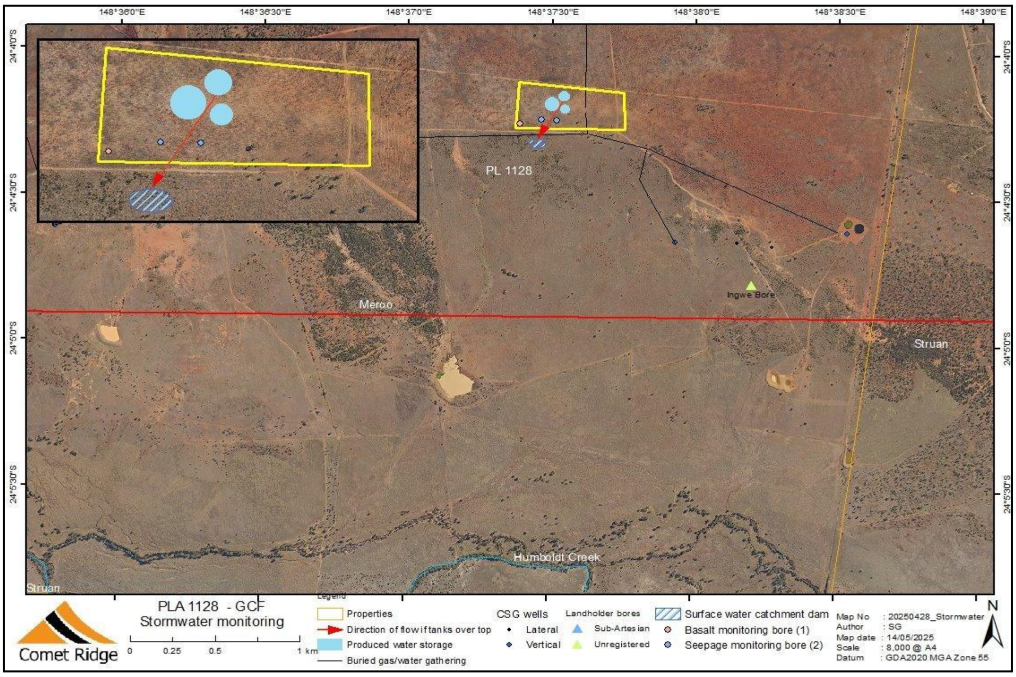

Figure 16 – Stormwater Monitoring Locations

8.8.5 Proposed Monitoring Infrastructure

The locations of the proposed stormwater monitoring infrastructure are showed in Figure 16 and summarised in Table 22.

Table 22 – Monitoring Locations for Stormwater Monitoring

Site ID	Description	Locations	Rationale
GCF-P1	Catchment pond	Surface Water Catchment Dam	• Positioned strategically to intercept runoff from GCF infrastructure. • Monitored during both baseline and operational phases to assess overflow water quality.
GCF-S1 & GCF-S2	Seepage monitoring bores	Located adjacent to tanks	Detect infiltration or leakage into shallow soils and groundwater.
GCF-B1	Basalt monitoring bore	Positioned west of the facility	Detect any downstream groundwater quality impacts in the Tertiary Basalt aquifer.

8.8.6 Operational monitoring

Operational monitoring for stormwater will be rain event based as per Table 23 below. Rainfall will be measured onsite with an automated and telemetered rain gauge.

Table 23 – Event based sampling for Stormwater Monitoring

Threshold	Trigger	Actions
>25 mm/24 hrs	Design capacity for catchment pond exceeded.	Sample runoff at key discharge points during the event. Conduct visual inspections for sedimentation. Field parameters GCF-P1 only. Any exceedances of field parameters (defined by DGVs in Table 10) trigger laboratory analysis.
≥121 mm for a 24-hour event.	Minor event ARI 1 in 5 years AEP 20%	Field parameters at GCF-P1; GCF-S1/S2; GCF-B1. If seepage indicated by field parameter results laboratory analysis also undertaken.
≥129.5 mm for a 24-hour event.	Major event ARI 1 in 10 years AEP 10%	Field parameters and laboratory sampling at GCF-P1; GCF-S1/S2; GCF-B1

8.8.7 Analytical Plan

The locations identified in Table 22 will be monitored on an event basis as outlined in Table 23 for the parameters listed in Table 24 which are targeted to detecting seepage or leakage from the stormwater management system or water storages at the GCF.

Table 24 – Analytical Plan for Stormwater Monitoring

Parameter Group	Analytes	GCF-P1	GCF-S1	GCF-S2	GCF-B1
Field Parameters	pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Oxidation-Reduction Potential (Redox), Temperature, Standing Water Level (SWL), Turbidity.	✓	✓	✓	✓
Nutrients	Total Nitrogen (TN), Nitrate (NO_3), Nitrite (NO_2), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP)	✓	✓	✓	✓
CSG Indicators	Barium (Ba), Boron (B), Fluoride (F), Lithium (Li), Strontium (Sr)	✓	✓	✓	✓

8.8.8 Assessment Criteria

Monitoring data will be evaluated against the relevant water quality parameters outlined in Table 10 (refer to Section 7), depending on the required event-based analysis outlined in Table 23. Triggers for further review and potential activation of contingency plans/TARPs (see Section 9) include:

- Produced water storages exceeding 90% capacity;

- Unauthorised discharges (e.g., sediment plumes, oily sheens); and
- Seepage detected (refer to Section 9.3).

9. Contingency Plan

The Contingency Plan outlines a structured, risk-based framework to respond proactively to potential water-related impacts associated with the Project as detected during operational monitoring. It integrates adaptive management principles and reflects site-specific hydrogeological, geochemical, and ecological conditions.

It supports the overarching WMMP by defining clear triggers which initiate various response actions and mitigation measures to safeguard the identified EVs for the Project area.

The contingency plan has been developed in alignment with the requirements of the EA, the EPBC Act 1999, and the IESC Information Guidelines (2024).

9.1 Trigger–Action–Response Plan (TARP)

The contingency plan consists of a TARP for each monitoring program (see Tables 25-29). The TARPs provide a proactive framework for identifying and responding to deviations from baseline or expected environmental performance.

The TARPs support early detection of potential environmental impacts, particularly in groundwater and surface water systems, associated with CSG activities.

Triggers (values or events) serve as early warning thresholds within the monitoring framework. While not compliance limits, they are designed to initiate further assessment, validation, or management action when exceeded. Their purpose is to detect and address deviations from baseline or expected conditions before significant environmental harm occurs.

Once operational monitoring commences data will be reviewed as collected against triggers, and TARPs activated if triggers are exceeded. The operational monitoring programs outlined in Section 8 will commence at different times as the potential for impacts from the project to specific water resources varies temporally and baseline data collection periods are different as a result. Expected timings of operational monitoring commencement and review against all triggers outlined in Tables 25-29 are:

- GDEs monitoring (Section 8.4) – approximately Q3 2028 or following completion of groundwater baseline monitoring. Groundwater baseline monitoring will be completed no later than 12 months after construction of the first production bore.
- Groundwater monitoring – Aquifer interconnectivity (Section 8.5) – approximately Q3 2028 or following completion of groundwater baseline monitoring. Groundwater baseline monitoring will be completed no later than 12 months after construction of the first production bore.
- Surface water/groundwater (SW/GW) Interaction monitoring (Section 8.6) – approximately Q3 2028 or following completion of groundwater baseline monitoring. Groundwater baseline monitoring will be completed no later than 12 months after construction of the first production bore.
- Surface water monitoring (Section 8.7) – approximately Q3 2027 following completion of surface water baseline monitoring which will occur prior to the commencement of infrastructure development.
- Stormwater monitoring and management program (Section 8.8) – approximately Q3 2027 to coincide with commencement of infrastructure development.

Components of the monitoring programs may commence earlier than the timings outlined above if relevant baseline monitoring is available.

9.2 Trigger Values

9.2.1 Water quality

Quantitative trigger values derived from the baseline dataset will be used in conjunction with trigger events in the TARPs for this project. The trigger values are designed to provide an early warning of potential impacts enabling timely response to prevent environmental impact. The approach is based on the Department of Environment and Science (DES 2021) methodology with consideration of the operational monitoring frequency. A multi trigger approach will be used with a trigger designed to identify gradual changes over time and another trigger designed to identify rapid changes.

In determining the trigger values from the baseline dataset, the following processes will be followed where applicable:

- where metal DGVs require modifiers (e.g., hardness, pH, DOC, salinity), adjust to site conditions at time of sampling (refer to Table 10 and Section 7.3 of this plan) as per ANZG guidance.
- for metals dissolved concentrations (0.45 µm filtered) will be used to represent the bioavailable metals.
- where non-detects (values below the limit of reporting – LOR) occur a value equal to half the LOR will be substituted in statistical calculations if non-detects make up no more than 15% of the baseline dataset, otherwise non-detects will be excluded from the dataset used for statistical calculations.
- outliers will be identified using appropriate statistical techniques (see DES 2021) and excluded from the dataset used for statistical calculations.

Trigger values will be based on whichever of these is applicable for the specific parameter:

- exceeding an upper value where a maximum concentration is of concern e.g., a toxicant; or
- being below a minimum value where a minimum concentration is of concern e.g., DO in groundwater; or
- being outside of the value range where parameters are required to occur within a range of values e.g., pH.

The triggers will be calculated for each monitored water resource and parameter as follows:

- Trigger A – to identify gradual changes over time.
    - Trigger A will be:
        - the 80th percentile for an upper value, the 20th percentile for a lower value, or the 20th to 80th percentile for a value range, of the baseline data.
        - the exception will be when a SSGV has been derived which relates to the 20th or 80th percentile. In this case Trigger A will need to be set at a more conservative percentile value e.g., 25th and 75th percentiles.
    - Exceedance of Trigger A will occur when the rolling median of the 3 most recent independent monitoring observations is:
        - greater than the Trigger A value where an upper value applies; or
        - less than the Trigger A value where a lower value applies; or
        - outside of the range of Trigger A values where a value range applies.
- Trigger B – to identify rapid changes.
    - Trigger B will be the most conservative of:
        - the WQO; or
        - the DGV; or
        - the SSGV; or

        - the 5th and 95th percentile values of the baseline dataset.
    - Exceedance of Trigger B will occur when two consecutive independent monitoring observations exceed the applicable WQO/DGV/SSGV/95th percentile value or range.

Exceedance of Trigger A or B would initiate a QC/QA check of monitoring data and if needed, resampling to confirm the exceedance. If an exceedance is confirmed, then the relevant TARP would be initiated.

Quantitative triggers will be tracked during operational monitoring using time-series plots with Trigger A and B levels marked (see Figure 17 for an example). Plots will be updated as data is collected to allow visualisation of trends and tracking of trigger exceedances. The plots will be parameter- and location-specific, ensuring targeted and responsive management of emerging trends.

9.2.2 Additional groundwater triggers

There will be site and hydrogeological unit-specific groundwater triggers for initiating TARPs, that are an exceedance of trigger thresholds;

- >10% deviation from baseline SWL,
- detection of hydrocarbons or
- CSG indicator element.

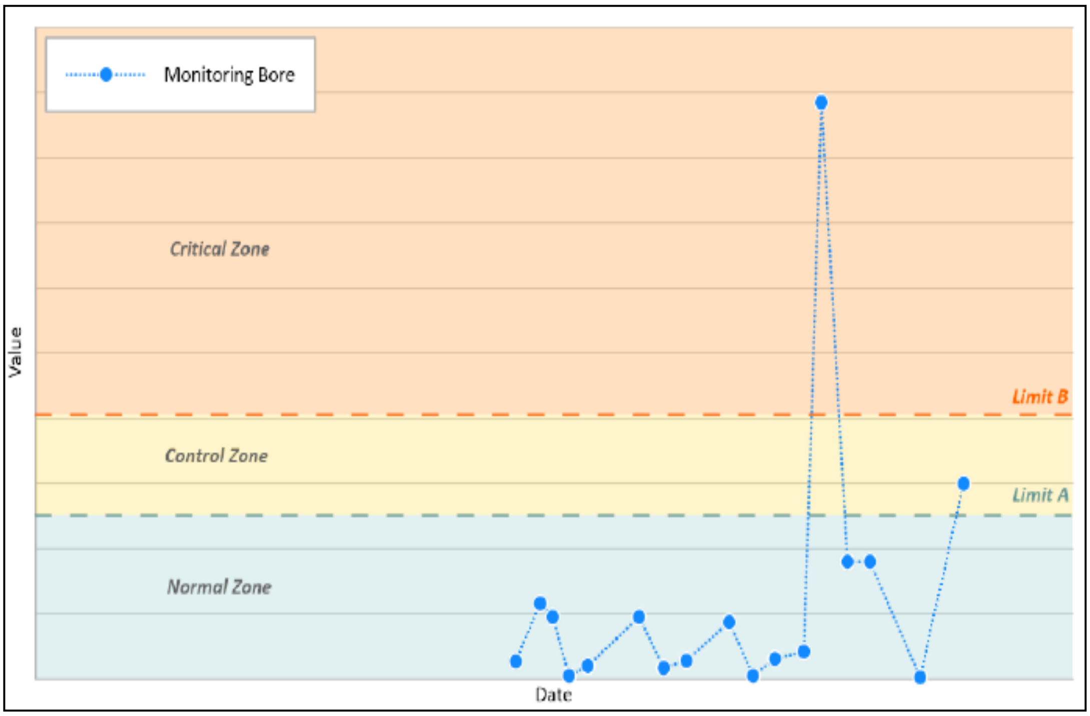

Figure 17 Example Control Chart

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9.3 Mitigation Response

Table 25 – Groundwater Dependent Ecosystems TARP

Trigger Event	Action	Response / Mitigation	Reporting Requirement
NDVI falls below the 20th percentile for ≥2 consecutive monitoring periods	• Initiate field inspections at mapped GDE receptors • Increase groundwater sampling frequency at linked bores • Validate NDVI with field photos/canopy scoring.	• Correlate with groundwater levels/EC and recent rainfall • If groundwater-linked and project-related, adjust extraction regime (rate/roster/zone), implement temporary reduction in take • Schedule targeted eco-assessment.	Report to the relevant Statutory Authorities.
Visible change (sheen, turbidity plume, algal bloom, sudden browning) in surface water at a potential GDE location	• Field inspection same/next day • Collect surface water and groundwater samples • Deploy spill response if needed.	• Isolate source • Verify infrastructure integrity • Implement containment and clean-up • Increase short-term monitoring until metrics recover.	
Groundwater level trigger exceeded in shallow groundwater	• Verify with repeat gauging • Review OGIA and site-specific model predictions • Run attribution check to identify cause.	• If project-related stage down pumping; revise operating roster • Recalibrate model if persistent and update impact predictions • Prepare and implement additional mitigation options if receptors at risk.	
Water quality trigger exceedance in shallow groundwater	• Resample to confirm • Expand analyte suite if needed to determine cause • Inspect upgradient sources • Review hydrogeological data to check for indications of interaquifer connectivity.	• Source control (repair leaks, improve separators) • Treat/contain • Increase monitoring cadence until 3 consecutive compliant rounds. • If potential interaquifer connectivity identified initiate the Groundwater Monitoring – Aquifer Interconnectivity Assessment TARP.	

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Trigger Event	Action	Response / Mitigation	Reporting Requirement
Fauna/fish kill or ecological distress observed	• Initiate emergency response • Notify internal HSE • Undertake rapid water quality screening • Initiate ecological triage.	• Contain any leaks and initiate mitigation (aeration, diversion, temporary barriers) • Commission independent ecological assessment • Adjust groundwater/surface operations contributing to stress.	
Cumulative impact indicator - regional NDVI decline coincident with regional drawdown	• Compare to control sites • Run regional NDVI vs rainfall analysis • Consult adjacent tenure data.	• Coordinate cross-tenure actions • Implement adaptive limits locally • Feed results into cumulative impact analysis and model scenarios.	
Confounders detected (fire scar, clearing, grazing pulse)	• Map disturbance • Exclude affected pixels/periods • Collect field notes.	• De-confound NDVI series • Defer trigger escalation if non-groundwater driver confirmed • Maintain watch status	
Unauthorised discharge or infrastructure failure affecting GDE suspected	• Inspect drains/valves • Confirm rainfall/flow • Isolate and shut-off.	• Repair/contain • Remediate affected area • Undertake short-interval monitoring until stable • Initiate the Stormwater TARP if unauthorised discharge event confirmed.	

Table 26 – Groundwater Monitoring – Aquifer Interconnectivity Assessment TARP

Trigger Event	Action	Response / Mitigation	Reporting Requirement
Groundwater quality trigger exceedance	• Resample to confirm. • Expand analyte suite if needed to determine cause • Inspect upgradient sources	• Increase monitoring cadence until 3 consecutive compliant rounds • If source is project-related, implement measures to contain source • If potential interaquifer connectivity identified modify pumping rates or	Report to the relevant Statutory Authorities

Trigger Event	Action	Response / Mitigation	Reporting Requirement
	• Review hydrogeological data to check for indications of interaquifer connectivity.	implement flow control measures to reduce risk of inter-aquifer contamination.	
Groundwater level trigger exceeded	• Verify with repeat gauging • Review OGIA and site-specific model predictions • Run attribution check to determine cause.	• If project-related stage down pumping; revise operating roster • Recalibrate model if persistent and update impact predictions • Prepare and implement additional mitigation options if receptors at risk.	Report to the relevant Statutory Authorities.
Observed change in groundwater levels or chemistry indicating potential aquifer interconnectivity (e.g., sudden rise/fall in water levels across multiple bores)	• Field investigation to confirm the change, checking borehole data and water chemistry across multiple monitoring wells.	• Review hydrogeological data (e.g., groundwater flow direction, transmissivity, and hydraulic conductivity) • Increase monitoring cadence targeting for signs of cross-contamination between aquifers (e.g., changes in pH, salinity, or contamination) • If project-related modify pumping rates or implement flow control measures to reduce risk of inter-aquifer contamination.	
Signs of contamination or pollutant movement from one aquifer to another (e.g., petroleum hydrocarbons, metals, or other CSG related pollutants detected in both shallow and deeper aquifers)	• Immediate resampling at key monitoring points, focusing on areas with suspected interconnectivity • Expand analyte suite if needed to determine cause.	• Isolate the source of contamination • Reduce pumping from affected aquifers, if applicable • Implement remediation (e.g., treatment of contaminated groundwater, installing barriers to contain pollutants) • Increase frequency of monitoring to track contaminant movement and	

Trigger Event	Action	Response / Mitigation	Reporting Requirement
		ensure containment measures are effective.	
Unexpected water quality changes in monitoring wells, such as increased salinity, changed water composition, or hydrocarbons that could indicate a connection between aquifers.	• Immediate review of groundwater data from monitoring wells, and field assessment of possible leakage or flow between aquifers • Expand analyte suite if needed to determine cause.	• Evaluate vertical flow potential by inspecting well construction integrity and geological features (e.g., confining layers) • If project-related adjust pumping • Consider installing additional barriers (e.g., grout seals or impermeable layers) to prevent future interconnection.	
Detection of significant changes from baseline in water chemistry or pressure between shallow and deeper aquifers	• Detailed aquifer assessment using advanced techniques such as geophysical surveys or aquifer testing (e.g., slug tests or pumping tests) • Expand analyte suite if needed to determine cause.	• Reassess aquifer boundaries and flow patterns and install additional monitoring wells if needed to better understand the interaction between layers • If potential interaquifer connectivity identified modify pumping rates or implement flow control measures to reduce risk of inter-aquifer contamination • Consider reinforcing well casings to reduce any potential vertical flow between aquifers if isolated to a specific bore.	
Aquifer interconnectivity suspected due to regional activity or geotechnical shifts	• Seismic and geotechnical assessment to investigate the potential for new fractures or faults connecting aquifers.	• Conduct a detailed geological survey to detect any new fractures or connections between aquifers • Reassess groundwater flow models to account for any structural changes in the aquifer system	

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Trigger Event	Action	Response / Mitigation	Reporting Requirement
		• Modify operational activities to reduce the risk of cross-contamination or fluid migration between aquifers.	

Table 27 – Surface Water/Groundwater Interaction Evaluation TARP

Trigger Event	Action	Response / Mitigation	Reporting Requirement
Change in groundwater quality that could impact surface water quality (e.g., exceedance of water quality triggers in surficial aquifers)	• Confirm exceedance with resampling • Expand analyte suite if needed to determine cause.	• Perform site investigation to confirm potential interaction • If source is project-related, implement measures to contain source • Prepare and implement additional mitigation options if receptors at risk.	Report to the relevant Statutory Authorities.
Hydrological changes observed in surface water systems (e.g., sudden flow decrease)	• Measure water levels and flow rates at both surface water and groundwater monitoring points.	• Evaluate changes to the surface water flow and groundwater level to determine source of hydrological change • Implement water diversion or storage solutions to prevent excessive contamination or sedimentation • Adjust groundwater/surface water operations contributing to stress.	
Change in surface water that could impact groundwater quality (e.g., exceedance of water quality limits in surface water that recharges groundwater)	• Conduct additional sampling of both surface water and groundwater at key locations • Expand analyte suite if needed to determine cause	• Increase monitoring frequency of both groundwater and surface water sites • If source is project-related, implement measures to contain source • Implement remediation actions such as treatment, pumping, or storage to prevent contaminants from entering the environment.	

Trigger Event	Action	Response / Mitigation	Reporting Requirement
Observed or suspected leakage or cross-contamination between surface water and groundwater systems	• Perform hydrogeological assessment to verify connectivity and evaluate the extent of contamination.	• If aquifer interconnectivity is confirmed, consider increased isolation measures (e.g., installing barriers or rerouting flows) • Isolate the source of contamination and take corrective actions to prevent further degradation.	

Table 28 – Surface Water TARP

Trigger Event	Action	Response / Mitigation	Reporting Requirement
Exceedance of water quality triggers	• Confirm exceedance with resampling • Expand analyte suite if needed to determine cause • Deploy spill response if needed.	• Investigate potential source • Initiate source control (repair leaks, improve separators) if needed • increase monitoring cadence until 3 consecutive compliant rounds.	Include in EA Annual Monitoring report.
Visible change (sheen, turbidity plume, algal bloom, sudden browning) in surface water	• Field inspection same/next day • Collect surface water samples • Deploy spill response if needed.	• Isolate source • verify infrastructure integrity • Implement containment and clean-up • Increase short-term monitoring until metrics recover.	As per notification requirements in the EA.
Fish kill or ecological impact observed	• Initiate emergency response • Notify internal HSE • Undertake rapid water quality screening • Initiate ecological triage.	• Contain any leaks and initiate mitigation (aeration, diversion, temporary barriers) • Commission independent ecological assessment • Adjust groundwater/surface operations contributing to stress.	As per notification requirements in the EA.

Trigger Event	Action	Response / Mitigation	Reporting Requirement
Unauthorised discharge suspected	• Inspect drains/valves • Confirm rainfall/flow • Isolate and shut off.	• Repair/contain • Remediate affected area • Undertake short-interval monitoring until stable • Implement the Stormwater TARP if unauthorised discharge event confirmed.	Trigger incident report as per EA and EPBC conditions.

Table 29 – Stormwater TARP

Monitoring Component	Trigger Level	Action	Response / Mitigation	Reporting
Brine/CSG Produced Water Storage Capacity	Tank level >90% or forecast rainfall exceeds freeboard limit	• Activate alarms • Inspect system.	• Recirculate brine between tanks; or • Initiate inter-tank transfer to manage volume; or • Initiate trucking of brine to offsite disposal with licensed waste contractor.	• Internal incident register • Include in quarterly SWMP.
RO Plant Operation	Forecast high rainfall event or loss of containment capacity	• Pre-emptive system checks and standby.	• Temporarily shut down RO plant to prevent overflow or process disruptions.	Log in operational records.
Basin Freeboard or Overflow	Freeboard <0.3 m or discharge observed beyond design limits	• Site inspection • Confirm rainfall data.	• Implement containment • Assess infrastructure for maintenance or upgrade needs.	Notify as per EA requirements.
Contaminated Stormwater Detection	• Presence of water in seepage bores and lab exceedance or	• Identify the cause (spill, leak, overflow)	• • Implement remediation (e.g., treatment of contaminated	As per EA reporting requirements.

Monitoring Component	Trigger Level	Action	Response / Mitigation	Reporting
	• Visual evidence of contamination in the dam (e.g., sheen, odour, turbidity), and lab exceedance.	• Expand analyte suite if needed to determine cause • Collect a sample from the associated basalt monitoring bore.	groundwater, installing barriers to contain pollutants) • Increase frequency of monitoring to track contaminant movement and ensure containment measures are effective.	
Unauthorised Discharge Event	Any flow outside containment system or bund	• Site inspection • Check control system	• Identify failure point (e.g., overtopping, valve release) • Rectify cause • Conduct site clean-up.	Trigger incident report as per EA and EPBC conditions.

10. Cumulative Impact Monitoring and Management

The Project is located within the Bowen Basin, a region subject to intensive and overlapping resource development activities. These include coal mining, coal seam gas (CSG) production, irrigated agriculture, and associated infrastructure development. Individually and collectively, these activities have the potential to affect surface water and groundwater systems through additive, synergistic, or antagonistic interactions—impacts that may not be apparent when assessed in isolation.

10.1 Regional Activities

Key activities occurring across the region that may cause cumulative impacts to water resources include:

- Nearby coal mining operations;
- Overlapping Coal tenure company exploration activities (for example, seismic surveys or drilling of their own groundwater monitoring bores);
- Adjacent CSG development;
- Agricultural activities such as cotton and dryland cropping near the Comet River;
- Grazing on nearby properties;
- Landholder vegetation clearing, either by blade ploughing or application of herbicides (ie: Grasslands), or pasture burn off;
- Landholders digging new overland flow stock dams;
- Landholders drilling additional stock water bores, or bringing 'online' existing stock bores, that may not have been utilised for a number of years;
- Landholders clearing land for building of cattle yards or new accommodations or sheds;
- Train railway network and easement;
- Power line network and easement;
- Land clearing and vegetation loss from infrastructure corridors; and
- Potential impacts from climate change (e.g., increased evapotranspiration, reduced recharge).

Table 30 summarises these activities, the cumulative impact pathways that they contribute to and the water receptors potentially impacted.

10.2 Focus Areas of Cumulative Impact

The main ways in which the project could add to existing cumulative impacts include:

- Drawdown in shared aquifers (Bandanna Formation, Basalt and other Tertiary water-bearing sediments, Alluvium).
- Surface water degradation due to runoff from industrial areas, erosion during construction or spills/leaks from water management infrastructure.
- Impacts to GDEs due to changes in flow regimes, water quality, and vegetation clearance.
- Contributing to the possible exceedance of hydrological or ecological thresholds, with the potential to trigger tipping points or long-term ecosystem degradation.

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Table 30 – Regional Activities and Interacting Pathways

Land Use/Activity	Cumulative Risk Pathways	Water Receptors Affected
Coal mining	Groundwater depressurisation, aquifer interference, spoil runoff, seepage to groundwater from mine waste storage	Bandanna, Basalt, Alluvium
Other CSG	Groundwater depressurisation, field-scale aquifer drawdown, seepage from produced water and/or brine storage infrastructure	Bandanna, Alluvium
Mineral Development	Shared infrastructure, potential future extraction	Bandanna, Basalt, Alluvium
Irrigated agriculture	Surface water extraction, reduced stream baseflow and alluvial aquifer drawdown, runoff of nutrients and salts	Comet River, aquatic ecosystems, GDEs, alluvial aquifers
Grazing (extensive)	Groundwater abstraction, land access, runoff of nutrients, salts and animal waste, degradation of stream banks from cattle access	Aquatic ecosystems, GDEs, Shallow aquifers (Basalt/Alluvium)
Infrastructure corridors	Soil compaction, sediment transport, drainage alteration	Ephemeral surface water & floodplains

10.3 Cumulative Impact Monitoring and Management

Monitoring for cumulative impacts will occur as part of monitoring for project specific impacts. Through the monitoring and management actions outlined in Sections 8 and 9 of this plan, if a TARP (Section 9) is actioned, the investigation will determine the nature of the impact (if cumulative, project specific, or another cause), and the appropriate response will be determined. When a cumulative impact is identified, Comet Ridge will work to limit its contribution to the cumulative impact and where feasible will explore options to work with others to monitor and manage the cumulative impact.

11. WMMP Review and Update

This plan is a living document designed to accommodate evolving site conditions, operational changes, monitoring results, and regulatory requirements.
By embedding adaptive management principles, the plan ensures that Comet Ridge remains responsive to environmental risks, regulatory expectations, and stakeholder concerns. Continuous improvement, data integration, and scientific defensibility underpin the long-term protection of water resources.

In line with best-practice environmental management and the principles outlined in the IESC Information Guidelines (2024), this section outlines the procedures for periodic review, update and plan revision responsibilities.

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11.1 Review Frequency

An initial review of the hydrogeological conceptualisation and site-specific groundwater model will be undertaken within 12 months of completion of groundwater baseline data collection by suitably qualified experts in hydrogeology and modelling. This review will:

- incorporate the results of the RCP and the baseline data;
- identify if any updates to the initial hydrogeological conceptualisation are needed;
- determine if interaquifer connectivity is likely;
- include recalibration of the site-specific groundwater model and comparison of model predictions with the current OGIA model prediction; and
- clearly identify any changes in impact predictions and how the changes could affect the management plan.

The results of the initial review will be provided to the Department upon completion.

After the initial review, regular, formal reviews of the WMMP will be undertaken at the following intervals:

- Annually – as part of the Annual Environmental Report (AER) submitted to the Department of Environment, Tourism, Science and Innovation (DETSI);
- Biannually – for cumulative impact review in alignment with OGIA model updates; and
- Trigger-Based Reviews – initiated if monitoring data, regulatory feedback, or operational changes indicate that current monitoring or mitigation measures may no longer be adequate (this could include the site specific MODFLOW model recalibration).

11.2 Review Triggers

In the instance where a review trigger is initiated the relevant regulators will be contacted and consulted. Updates to the WMMP may be required if any of the following occur:

- Exceedance of trigger thresholds (e.g., >10% deviation from baseline SWL, WQO exceedance, detection of hydrocarbons or CSG indicator elements).
- Detection of aquifer interconnectivity inconsistent with the conceptual model.
- Changes to project infrastructure or operational scope (e.g., new production areas, expanded water treatment capacity).
- Significant stakeholder or landholder feedback (e.g., bore complaints or make-good claims).
- Amendments to regulatory conditions, including EA revisions, EPBC approval modifications, or updates to applicable guidelines (e.g., ANZG, IESC).
- Emergence of new data or EVs, such as confirmed GDEs or revised water quality objectives.

11.3 Update Procedure

Plan updates will follow a structured and auditable process:

- Data Review – Evaluate monitoring results against baseline conditions, model predictions, and trigger values.
- Gap Analysis – Identify inconsistencies, risks, or emerging trends that warrant management response or plan modification.

- Stakeholder Engagement – Where appropriate, consult with regulatory agencies (e.g., DETSI, DCCEEW), landholders, or technical specialists.
- Plan Revision – Update relevant sections (e.g., analytical plans, TARP tables, bore networks) and document rationale for changes.
- Version Control – Apply a new revision number and maintain a detailed change history in the document control register.
- Re-Submission – Provide the revised WMMP to DETSI and/or DCCEEW where updates are material or required under the EA or EPBC Act.
- Updated plans will be implemented after appropriate approvals are obtained.

11.4 Version Management and Responsibilities

Comet Ridge will assign responsibility for WMMP management to the Project Environmental Manager (or equivalent delegate), who will:

- Coordinate internal and external technical reviews;
- Ensure alignment with groundwater modelling and other environmental management plans (e.g., Biodiversity Management Plan, Stormwater Plan);
- Maintain version control and register of changes; and
- Ensure all staff and contractors are aware of any changes relevant to their roles.

The updated WMMP and associated monitoring datasets will be made available upon request to regulators and affected stakeholders, consistent with transparency principles.

11.5 Integration with Broader Environmental Management

Revisions to this WMMP will be coordinated with updates to other environmental plans and approvals to ensure consistency across the broader Environmental Management System (EMS). This includes:

- Stormwater and Erosion Control Plans;
- GDEs and Biodiversity Monitoring Programs; and
- Annual Environmental Return (EA Condition compliance).

12. Limitation

Terra Sana Consultants Pty Ltd (TSC) has prepared this report for the sole use of the Client. The report has been prepared in accordance to the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. The methodology adopted to sources of information used by TSC includes interview(s), review of documentation, inspection, sampling or other means of investigation. TSC has made no independent verification of the information supplied by the Client's representative and assumes no responsibility for any inaccuracies or omissions. This report is based on the conditions encountered and information reviewed at the time of preparations. TSC disclaims responsibility for any changes that may have occurred after this time. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Any changes in regulations or scientific understanding could impact

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on our conclusions and recommendations. TSC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document. Note: Section 9 of this report has been modified from its original version following advice from a DCCEEW representative.

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