JOHN HOLLAND

INLAND RAIL
ILLABO TO STOCKINBINGAL PROJECT

Groundwater Mitigation and Management Plan

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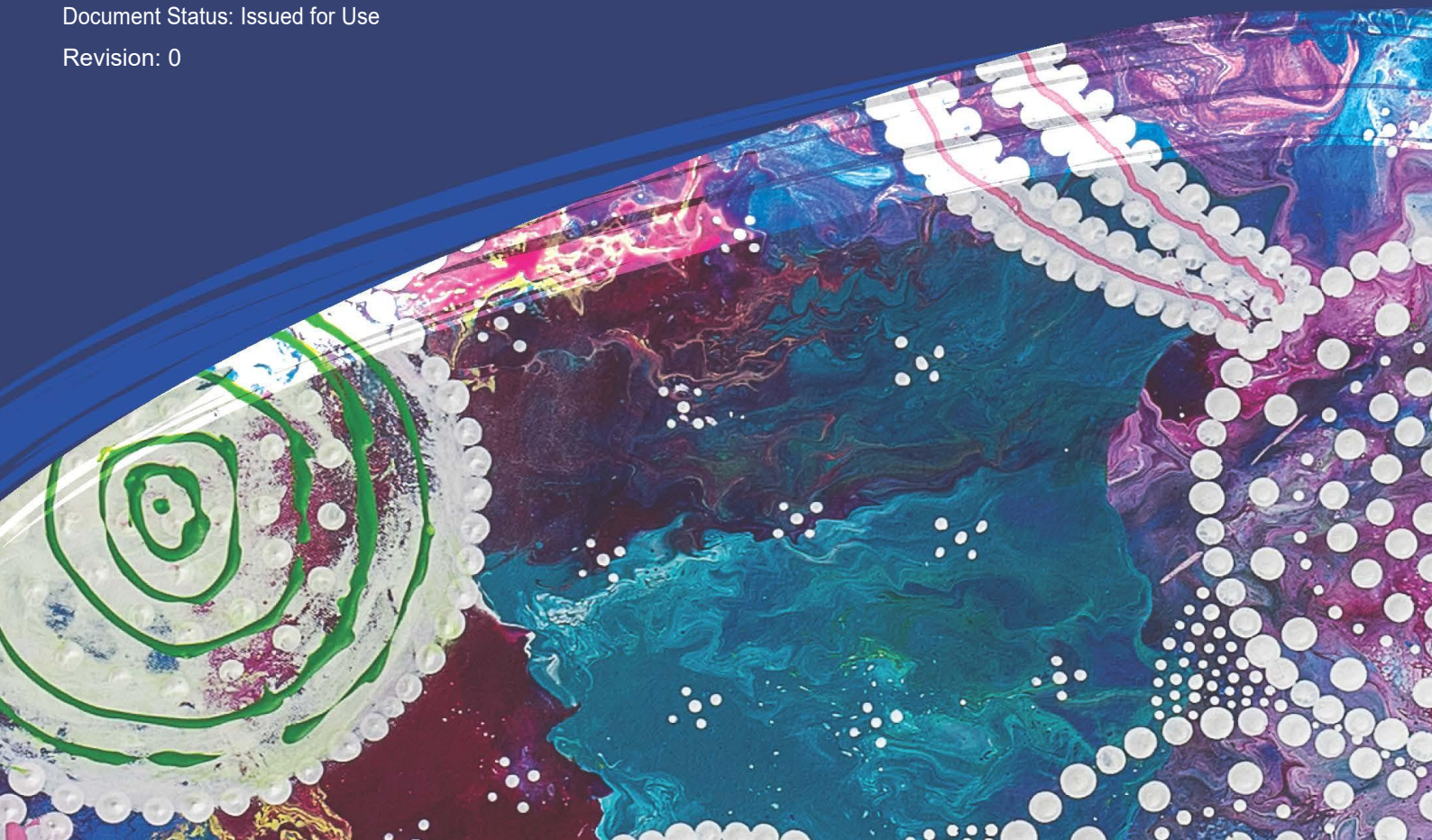

Document Control

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Signature **Date**	JOHN HOLLAND Document Number 5-0019-220-PMA-00-PL-0069 Revision 0 **Approved** Mr Daniel Lidbetter - John Holland Pty Ltd Oct 1, 2025, 5:37 PM GMT+10:00 This review has been completed using Aconex Workflow for the Inland Rail - Illabo to Stockinbingal (I2S) Project.	JOHN HOLLAND Document Number 5-0019-220-PMA-00-PL-0069 Revision 0 **Approved** Mr Andy Robertson - John Holland Pty Ltd Oct 2, 2025, 11:12 AM GMT+10:00 This review has been completed using Aconex Workflow for the Inland Rail - Illabo to Stockinbingal (I2S) Project.

Revision History

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1 Revisions and Distribution

1.1 Revisions

Draft issues of this document are identified as Revision A, B, C etc. Following acceptance by the document approver, the first finalised revision will be Revision 0. Subsequent revisions will have an increase of “1” in the revision number (1, 2, 3 etc.).

1.2 Distribution

The controlled master version of this document is available for distribution as appropriate and maintained on the document management system being used on the project. All circulated hard copies of this document are deemed to be uncontrolled.

Client’s Representative	Conrad Strachan
Project Director	Justin McCarthy
Environment and Sustainability Manager	Andy Robertson
Quality Manager	Rao Talada
Environmental Representative	Tim Elder
Project Personnel	Aconex Distribution

2 References, Definitions and Abbreviations

2.1 Compliance Roadmap

The following section provides a tabular representation of the Project approval requirements, as described in the Conditions of Approval (CSSI 9406) and the Updated Mitigation Measures (UMM's) and a reference link to detail how these requirements would be achieved during Project delivery.

It is noted that there are no groundwater specific Conditions in the Federal Approval (EPBC 2018/8233). A cross reference is also included to indicate where each requirement is addressed in this Groundwater Mitigation and Management Sub-Plan (GWMMP) or other Project management documentation.

Table 2-1 Conditions of Approval

Reference	Requirement	Applicable Section in this Plan
C22	The Soil and Water Management Sub-plan must include: (a) measures to avoid and minimise erosion and sedimentation impacts including to riparian, agricultural and forested land, and areas of high salinity and high erosion potential; (b) a draft water balance for the project; (c) information demonstrating that the required construction water resources are legally and physically available; (d) procedures and protocols for the appropriate supply, transport and storage of water across the CSSI; (e) mitigation measures to address construction water resource shortages that arise; (f) a protocol for avoiding, minimising and mitigating impacts in the event of interaction with groundwater; (g) a surface water monitoring framework as per Condition C29; (h) a dam dewatering protocol; and (i) a spill response procedure.	Soil & Water Management Plan Section 8
E77	The CSSI must be designed, constructed and operated to: a) ensure all drainage feature crossings (permanent and temporary watercourse crossings and stream diversions) new or modified surface water drainage (including cess drains), depressions are designed and constructed and maintained in accordance with Guidelines for controlled activities on waterfront land: riparian corridors (Department of Industry, 2018) and Policy and Guidelines for Fish Habitat Conservation and Management (Department of Primary Industries, 2013); b) locate all scour protection work associated with replacement culverts or the construction of new culverts within the rail corridor, or as agreed to by the relevant landowner in accordance with Condition E57;	Detailed Design Section 8

Reference	Requirement	Applicable Section in this Plan
	c) ensure that there is no permanent interception of, and/or connection with, groundwater; d) ensure all discharges from new or modified surface drainage (including cess drains) adjacent to the new and upgraded track are released at a controlled rate to prevent scour; and e) ensure that any recycled wastewater (including recycled/treated water) proposed for use by the CSSI, considers risks to human health or the receiving environment and meets the relevant standards.	
E80	In addition to the requirements of Condition E79, prior to construction, the Proponent must prepare a register (the Register) of all farm dams within 100m upstream and 500m downstream of the rail alignment. The Register must include: (a) property, location within property and owner; (b) approximate surface area, depth and volume; (c) alignment of dam inflow and outflow for 500m upstream and 100m downstream of the dam; (d) identification of all contour banks, drains or other water diverting structures that influence the water supply yield of existing farm dams; (e) catchment area feeding the dam; (f) identification of all surface water and groundwater sources supplying the dam; and (f) a map showing the items in (a) to (f) above	Farm Dam Register
E147	The Proponent, where liable, must rectify any property damage caused directly or indirectly (for example from vibration or from groundwater change) by the construction or operation at no cost to the owner. Alternatively the Proponent may pay compensation for the property damage as agreed with the property owner.	Section 8.11.2
E149	A Water Reuse Strategy must be prepared, which sets out options for the reuse of collected stormwater and groundwater during construction. The Water Reuse Strategy must include, but not be limited to: a) evaluation of reuse options; b) details of the preferred reuse option(s), including volumes of water to be reused, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required; c) measures to avoid misuse of recycled water as potable water; d) consideration of the public health risks from water recycling; and	Water Re-Use Strategy

Reference	Requirement	Applicable Section in this Plan
	e) a time frame for the implementation of the preferred reuse option(s). The Water Reuse Strategy must be prepared based on best practice and advice sought from relevant agencies, as required. The Strategy must be applied during construction and operation. Justification must be provided to the Planning Secretary if it is concluded that no reuse options prevail.	
E155	Detailed Site Investigations (DSI) must: a) be undertaken by a suitably qualified and experienced contaminated land consultant(s); b) be prepared in accordance with the relevant guidelines made or approved by the EPA under section 105 of the CLM Act; c) be undertaken before the commencement of work that would result in any disturbance of land identified as moderate to high risk areas of potential contamination in the relevant documents in Condition A1 or as updated by Condition E152; d) determine the nature and extent of contamination in soil, groundwater, surface water, ground gases and sediments (where applicable); e) consider whether contamination has the potential to pose an unacceptable risk to human health or the environment on or off-site; f) include recommendations for further investigations, remediation and/or management of contamination; g) be prepared in accordance with the land use criteria applicable to the final land use at the opening of the CSSI; h) be reviewed by the accredited Site Auditor with the intent of issuing Interim Audit Advice commenting on the adequacy of the report; and (i) be provided to the Planning Secretary upon request, along any associated Site Auditor's Advice.	Detailed Site Investigations Contaminated Land & Hazardous Materials Management Plan Section 8.8

Table 2-2 Updated Mitigation Measures

Reference	Requirement	Applicable Section in this Plan
HF-2 Construction water supply	Construction water supply options would continue to be explored during detailed design and would include: • ongoing consultation with Goldenfields Water (or an equivalent commercial water supply operator) to access the local reticulated network • investigation of options to utilise recycled water from sewage treatment plants • access to groundwater bores where it can be bought on-market • investigation into the use of farm dams for water harvesting and storage.	Detailed Design Water Re-Use Strategy Section 6
GW-1 Management of groundwater bores	Any bores that are decommissioned will be undertaken in accordance with the Minimum Construction Requirements for Water Bores in Australia— Edition 4 (NUDLC, 2020).	Detailed Design
GW- 2 Management of groundwater bores	Any existing groundwater bores that are destroyed during construction would be replaced subject to discussion with the registered owner	Detailed Design
GW- 3 Avoid and minimise groundwater seepage	Appropriate drainage measures would be installed at the base of cuts and along high-walls to manage groundwater seepage, in the unlikely event that they be encountered.	Detailed Design
GW- 4 Groundwater management	A groundwater mitigation and management plan (GWMMP) would be prepared as part of the CEMP. The GWMMP would comply with the proposal conditions of approval and be implemented to monitor the effectiveness of mitigation and management measures applied during the construction phase of the proposal. The GWMMP would at a minimum: • provide details of the groundwater monitoring network, frequency of monitoring, and test parameters be based on baseline studies developed for the proposal and establish baseline monitoring reports • contain procedures for the documentation and reporting of results • include requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction	This Plan Section 8

Reference	Requirement	Applicable Section in this Plan
GW- 5 Monitoring groundwater drawdown and quality	A groundwater monitoring program would be developed and implemented as part of the GWMMP to monitor potential groundwater impacts. The program would define the following: • monitoring parameters • monitoring locations • frequency and duration of monitoring. The monitoring program would include baseline monitoring to determine the water quality of groundwater from the proposed bore field bores.	Section 8.10
GW-6 Unforeseen water table penetration by earthworks	If excavations intersect the water table, potential impacts would be assessed by a hydrogeologist and adaptive management measures implemented as required.	Section 8 Section 9
GW-7	Drainage measures would be maintained where required to manage ongoing groundwater seepage during operation.	Detailed Design Section 8 Section 9
HF- 6 Sedimentation and erosion control	A soil and water management plan would be prepared and implemented as part of the CEMP. The plan would include measures, processes and responsibilities to minimise the potential for soil and water impacts (including impacts to groundwater and geomorphology) during construction	Soil & Water Management Plan Surface Water Monitoring Program Section 8
WQ- 3 Water Quality	A soil and water management plan would be prepared and implemented as part of the CEMP. The plan would include measures, processes and responsibilities to minimise the potential for soil and water impacts (including impacts to groundwater and geomorphology) during construction	Soil & Water Management Plan Surface Water Monitoring Program Section 8

2.2 Definitions and Abbreviations

Definitions and abbreviations to be applied to the Groundwater Mitigation and Management Plan are listed below.

Table 2-3 Definitions and Abbreviations

Term / Abbreviation	Definition / Expanded text
ARTC	Australian Rail Track Corporation
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
DPHI	Department of Planning, Housing and Infrastructure
Environmental Assessment Documentation	• Inland Rail – Illabo to Stockinbingal Environmental Impact Statement (ARTC 2022) • Illabo to Stockinbingal Project Response to Submissions (ARTC 2023) • Response to Submissions – Appendix E - Biodiversity Development Assessment Report version 12 (IRDJV, June 2024) • I2S – Mitigation Measures (Inland Rail, April 2024) • Illabo to Stockinbingal (SSI-9604) Additional and Appropriate Measures for Box Gum Woodland Impacts (Inland Rail, June 2024) • Technical and Approvals Consultancy Services: Illabo to Stockinbingal – Box Gum Woodland Gum Flat Rehabilitation Opportunity (IRDJV, June 2024)
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ER	Environmental Representative
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance.
IRPL	Inland Rail Pty Ltd
I2S	Illabo to Stockinbingal
JHG	John Holland Group
LGA	Local Government Area
Material Harm	is harm that: (a) involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or (b) results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment).
NSW	New South Wales
UMMs	Updated Mitigation Measures

Term / Abbreviation	Definition / Expanded text
Work	Any physical work for the purpose of the CSSI including construction and low impact work but not including operational maintenance work

3 Introduction

3.1 Context

This Groundwater Mitigation and Management Plan (GWMMP) forms part of the Construction Environmental Management Plan (CEMP) for the Inland Rail - Illabo to Stockinbingal Project (the Project).

This GWMMP has been prepared to address the groundwater requirements associated with Infrastructure Approval (CoA) (SSI-9406), the measures listed in the Environmental Impact Statement (EIS) as amended by the Submissions Report (known as Revised Mitigation Measures (UMMs)), EPBC Controlled Action Approval (EPBC Referral 2018/8233) and all applicable legislation, guidelines, standards and specifications.

Specifically, this GWMMP has been prepared to satisfy the NSW CoA and Updated Mitigation Measures (UMMs) in relation to the management of Groundwater during construction of the Project, particularly UMM GW-4 Groundwater Management.

3.2 Background

3.2.1 The Project

The Project is located in south-western New South Wales (NSW) in the Riverina region. Illabo is a small town located at the southern end of the alignment 16 kilometres (km) north-east of Junee in the Junee Local Government Area (LGA). Stockinbingal is situated at the northern end of the Project, approximately 20 km north-west of Cootamundra in the Cootamundra–Gundagai Regional LGA. The major towns surrounding the Project are Wagga Wagga, about 50 km to the south, Young to the north-east and Cootamundra to the east.

The Project comprises a new rail corridor that would connect Illabo to Stockinbingal. The alignment branches out from the existing rail line north-east of Illabo and travels north to join the Stockinbingal–Parkes Line west of Stockinbingal. The route will travel primarily through undeveloped land predominantly used for agriculture. The Project includes modifications to the tie-in points at Illabo and Stockinbingal to allow for trains to safely enter and exit the Illabo to Stockinbingal (I2S) section of Inland Rail. The alignment also crosses several local and private roads, watercourses and privately owned properties. Additionally, no major towns are located within the Project site between Illabo and Stockinbingal.

The Project will include a total extent of approximately 42.5 km, including 39 km of new, greenfield railway which will incorporate the following key features:

- single track standard gauge on a combination of existing ground level embankments and within cuttings
- new bridges and road overpasses
- crossing loop and maintenance siding
- new level crossings, stock crossings and upgrades to existing level crossings
- new major stormwater diversion and minor drainage works associated with installation and upgrades to culverts.

The Project will also include upgrades to approximately 3 km of existing track associated with tie-in works and construction of an additional 1.7 km of new track to maintain the existing rail network connections. Road upgrade works will also be undertaken to re-align approximately 1.4 km of Burley Griffin Way to provide a road-over-rail bridge at Stockinbingal. Re-alignment of Ironbong Road will also be completed to allow for safe sight lines. A temporary workforce accommodation camp will also be constructed to house the workforce for the duration of the Project. Key features of the Project are shown on Figure 3-2.

A detailed Project description is provided in Section 3 of the CEMP.

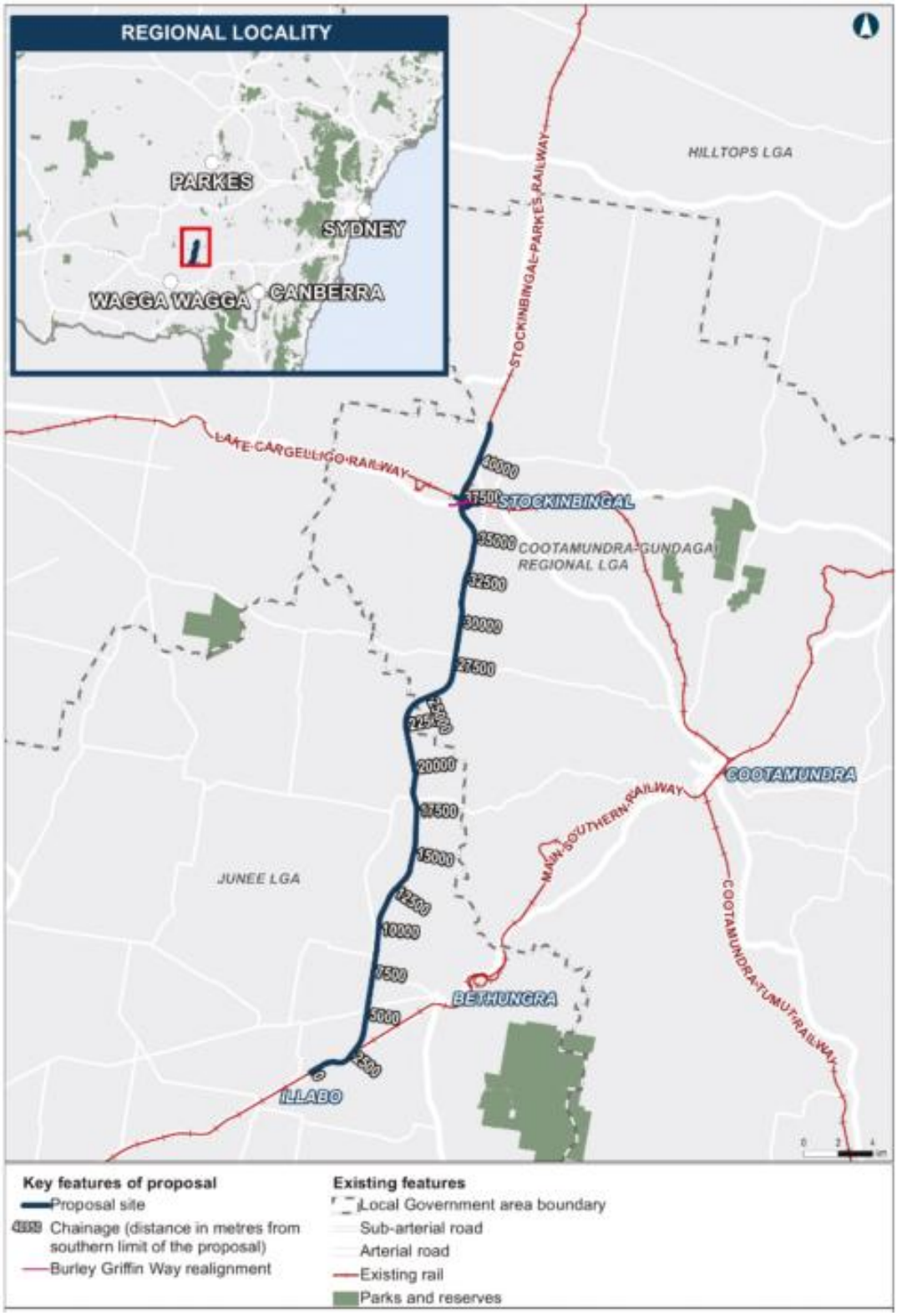


Figure 3-1 Project locality

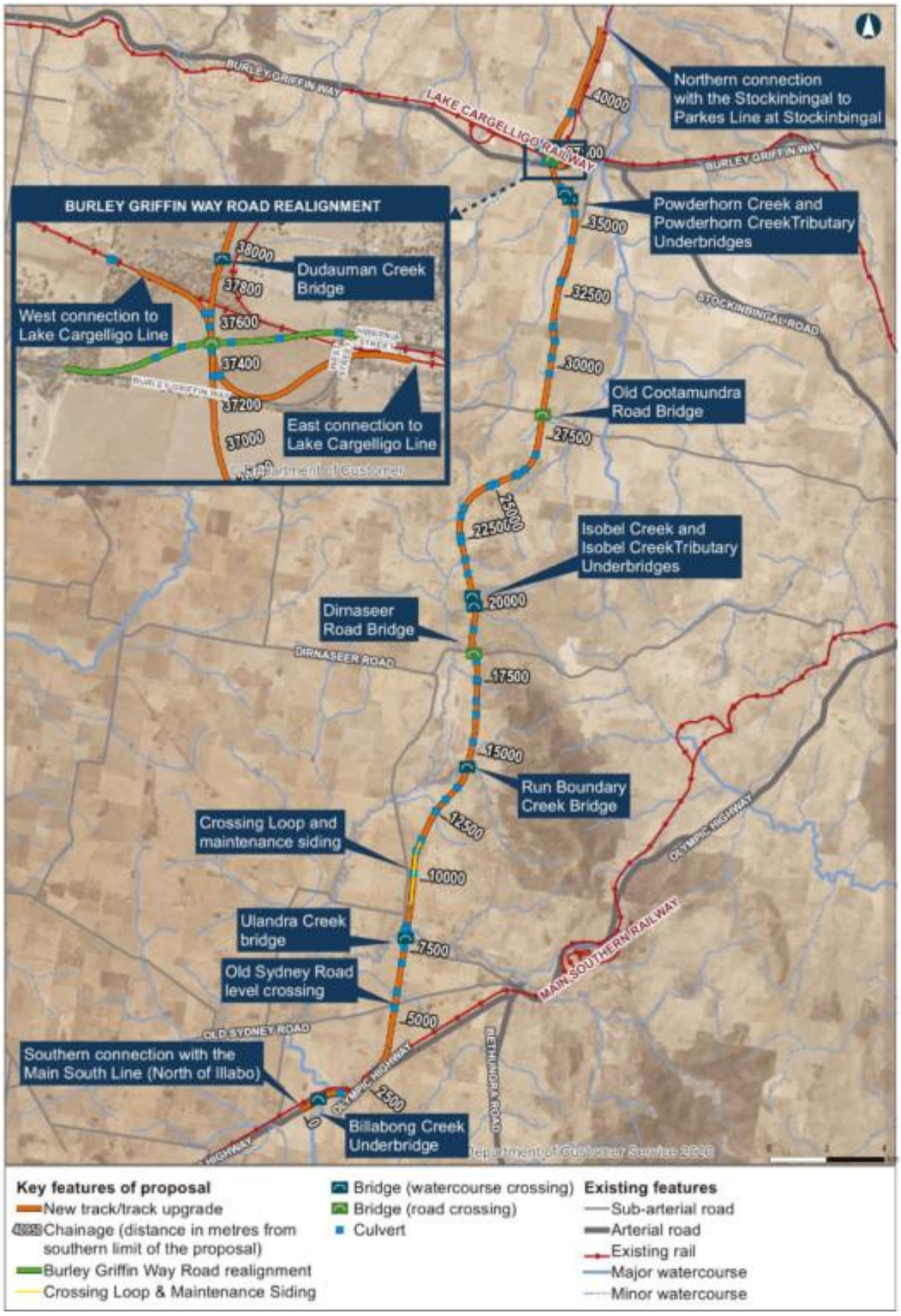


Figure 3-2 – Key Project features

3.2.2 Statutory Context

The Project was declared to be Critical State Significant Infrastructure (CSSI) in 2021, requiring approval under Division 5.2 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). In accordance with the Secretary's Environmental Assessment Requirements (SEARs) (dated 30 April 2021), an EIS was prepared by Australian Rail Track Corporation (ARTC) in August 2022. The EIS was exhibited by the Department of Planning, Housing and Infrastructure (DPHI) for a period of six (6) weeks, commencing on 14 September 2022 and concluding on 26 October 2022.

Following public exhibition of the EIS, ARTC prepared a Submissions Report to respond to submissions and describe Project design refinements.

Approval for the Project was granted on 4 September 2024 by the Minister for Planning (SSI-9406) and was subject to several CoAs.

The Project was determined to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Project received EPBC Controlled Action Approval from Department of Climate Change, Energy, the Environment and Water (DCCEEW) (EPBC Referral 2018/8233) on 28 October 2024.

3.3 Scope of the plan

This GWMMP is applicable to all activities during construction of the Project, including all areas where physical works will occur or areas that may otherwise be impacted by the construction works, and under the control of the contractor John Holland Group (JHG). All JHG staff and sub-contractors are required to comply with the requirements of this Plan and related Construction Environmental Management Plans over the full duration of the construction program.

The scope of this GWMMP is to describe how potential groundwater impacts will be managed during construction of the Project and includes:

- a description of Project construction activities
- environmental obligations attached to the Project
- legislation and external licences, permits and approvals required for the Project
- objectives, targets and performance criteria
- the existing environment in relation to groundwater
- potential groundwater impacts from the Project
- mitigation measures to manage groundwater impacts which will be implemented through the Project
- describes compliance management items including roles and responsibilities, training, monitoring and inspections, non-compliance protocols, incident response, auditing, reporting complaints management etc
- Describes review and improvement requirements for the Project.

Operational groundwater impacts and operational measures do not fall within the scope of this GWMMP and therefore are not included within the processes contained within this GWMMP. Operational groundwater considerations will be considered as part of the detailed design development and associated documentation (i.e. Operational Environmental Management Plan or existing operational management system).

3.4 Environmental Management Systems Overview

3.4.1 Environmental Management Systems

The Project Environmental Management System (EMS) is based on the ISO 14001 accredited JHG EMS, which itself forms part of the overall JHG Integrated Management System (IMS), tailored to satisfy Project-specific requirements. It provides a framework to ensure an integrated approach to meeting Project requirements and defines how the Project will minimise impacts to the environment. It comprises a combination of governance documentation, Project-specific management plans (including this GWMMP), procedures and tools.

The basis for the EMS is the concept of Plan-Do-Check-Act (PDCA), as shown in Figure 3-3.

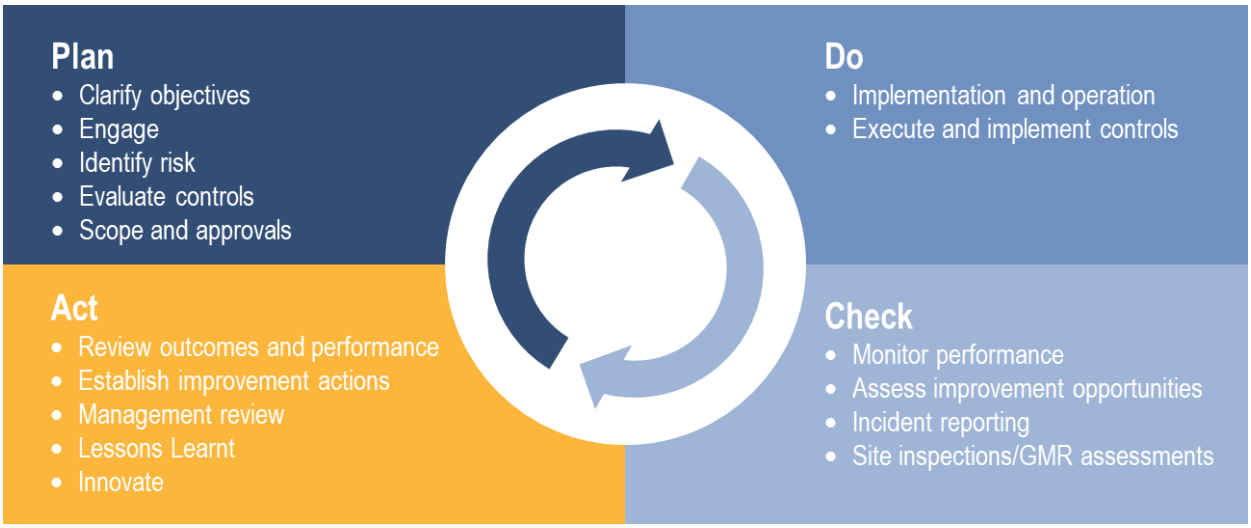


Figure 3-3 PDCA model

The PDCA model provides an iterative process to achieve continual improvement. As applied to the Project environmental processes, it can be briefly described as follows:

- **Plan**: Establish environmental objectives and processes necessary to deliver results in accordance with the JHG environmental policy.
- **Do**: Implement the environmental processes as planned.
- **Check**: Monitor and measure processes against the environmental policy, including its commitments, environmental objectives, and operating criteria, and report the results.
- **Act:** to continually improve the environmental processes.

The framework introduced in ISO14001 is integrated into a PDCA model within the EMS and in turn the Project CEMP and this GWMMP.

In accordance with the JHG Environmental Policy (refer to Appendix A5 of the CEMP), the Project will:

- Continually improve the EMS to enhance performance, through management review and CEMP and GWMMP revisions
- Maintain third party certification of the overarching EMS to ISO 14001 with independent verification of implementation and effectiveness.

The EMS provides structure to environmental management of the Project and covers areas such as training, record management, inspections, objectives, and policies. This GWMMP has been prepared as part of the EMS using JHG documentation as the basis for some documents (Figure 3-4 – EMS structure).

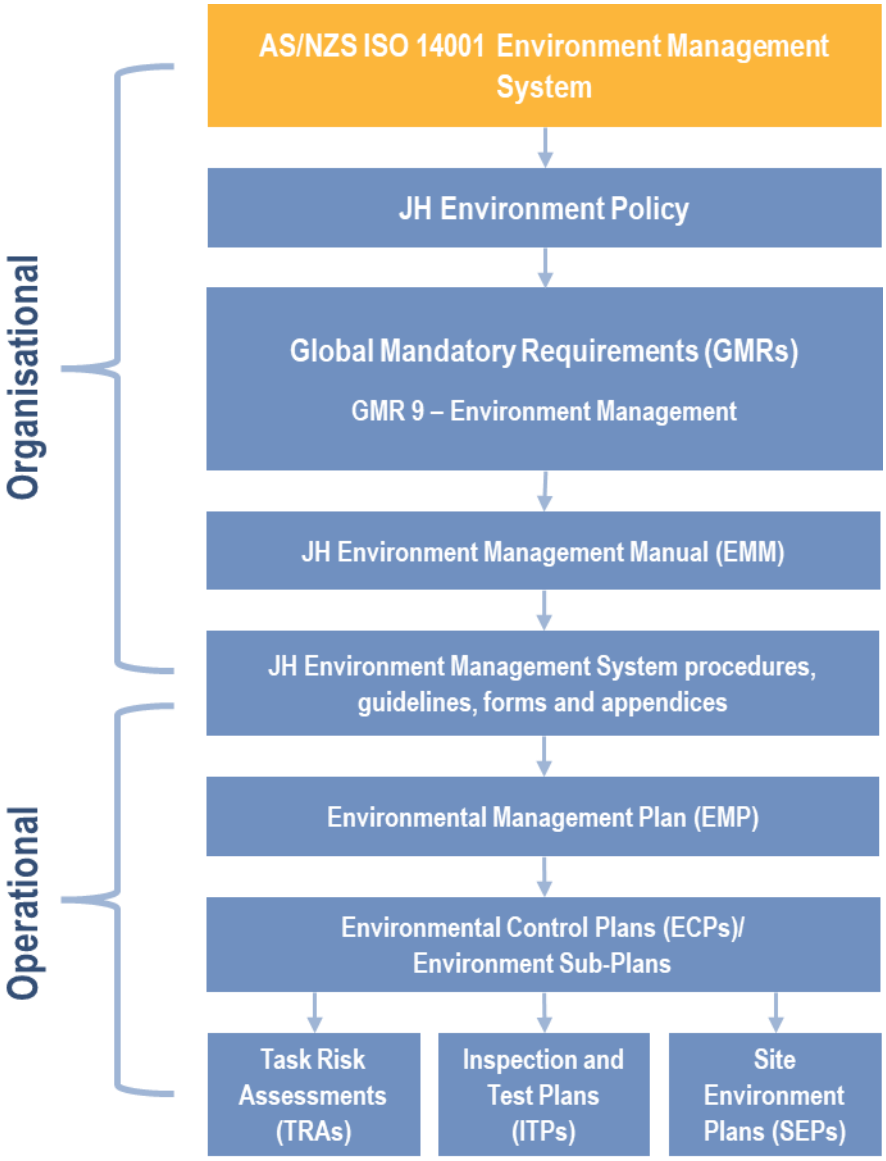


Figure 3-4 – EMS structure

The EMS contains policies, standards, manuals, plans, procedures, processes, and other documents that enable the Project to achieve its objectives through planned and controlled processes.

At a broad organisational level, the EMS contains policies, standards, manuals, plans, procedures, processes, and other documents that enable the Project to achieve its objectives through planned and controlled processes. JH will implement these organisational requirements through the development of specific documents (the operations identified above), these include:

1. An Environmental Management Plan (this Plan)
2. Environmental Sub Plans (the Management Plans required by CoA's and the UMMs)
3. Site Environmental Plans (SEPs) as defined in the CEMP.

It is noted that Task Risk Assessments (TRAs) and Inspection Test Plans (ITPs) are safety and quality equivalent documents to a Site Environmental Plan and do not form part of this Plan. An ITP or TRA prepared for specific construction activities will reference a SEP/s to ensure groundwater specific environmental controls are implemented in accordance with EMS and this Plan.

Other documents that will be developed and implemented throughout the Project that will be utilised to manage environmental risk that sit outside of the EMS framework described above, have been included in the CEMP in Section 5.2.

3.4.2 Global Mandatory Requirement

JHG's Global Mandatory Requirements (GMRs) outline the control strategies and minimum standards for managing, and where possible, eliminating key risks across the Project. These standards have been developed to:

- Minimise the impact of our activities on the environment and communities.
- Reduce our use of natural resources and energy, and the generation of waste.
- Be a reliable and trustworthy partner to our customers, dedicated to providing environmentally sustainable solutions throughout our diverse business.

The GMR's form part of the Project EMS and are to be used as tools in development of planning documents for management of environmental risks / impacts.

GMR's which are relevant to this GWMMP and will be implemented include GMR 9 – Environmental Management.

3.4.3 Plan preparation, endorsement and approval

This GWMMP has been prepared by John Holland, with input from the Project's specialist consultants (Douglas Partners).

The GWMMP has been prepared to satisfy the NSW CoA and Updated Mitigation Measures (UMMs) in relation to the management of Groundwater during construction of the Project, particularly UMM GW-4.

This Plan will be reviewed by the Inland Rail Pty Ltd (IRPL) Senior Environmental Advisor (or delegate) and the independent Environmental Representative (ER).

3.4.4 Interactions with other management plans and strategies

This GWMMP is also associated with the following documents which have been reviewed and incorporated into this GWMMP where applicable:

- Chapter 14 – Groundwater (from the EIS)
- Chapter 27 – Environmental Management and Mitigation (from the EIS)
- Tech Paper 6 – Groundwater Impact Assessment
- Appendix B – Revised Mitigation Measures (Response to Submissions- described throughout as the UMM's).

3.5 Consultation

There are no consultation requirements for the development of this Plan. Should there be any complaints, enquiries or feedback received by public or private stakeholders associated with groundwater management, these discussions and consultation will be managed in accordance with the Community Consultation Strategy (CCS) as per Condition B1 and B2 of the MCoA.

4 Purpose and Objectives

4.1 Purpose

The purpose of this GWMMP is to establish a set of best practice procedures to be undertaken by JHG for the management of groundwater during construction for the Project. As mentioned in Section 3, this GWMMP only provides the management of groundwater during construction. JHG is required to complete construction works for the Project in a manner that prevents impacts to groundwater resulting from construction activities (Condition C22(f), UMM GW-4) and in accordance with CoA E77 (c) ensure that there are no permanent interceptions and or connection with groundwater during construction and operation. The outcomes of construction are not anticipated to impact groundwater during the operation of the project.

4.2 Objectives

The key objective of this GWMMP is to prevent impacts to groundwater during construction of the Project. To aid in achieving this objective all CoA, UMMs and licence/permit requirements relevant to groundwater are described, scheduled and assigned responsibility as outlined in:

- Environmental Assessment Documentation
- Infrastructure Approval CoA (SSI 9406)
- Environment Protection Licence
- Inland Rail Specifications
- All relevant legislation and other requirements described in Section 2 and Section 5 of this Plan.

4.3 Targets

Targets for the management of groundwater during the Project have been established to enable compliance with relevant legislative requirements, CoA and environmental management measures. These targets and how they will be measured are outlined in the table below.

Target	Measurement Tool	Section
Compliance with the relevant legislative requirements and UMMs	Compliance Monitoring Real time loggers Quarterly monitoring	Section 8.10 Section 9
No pollution to the receiving environment as a result of interaction or disturbance of groundwater	Register of contaminated sites Australian Groundwater Explorer NSW Water Register Incident register	CLHMMP
No draw down of groundwater levels or changes to flow paths during construction due to construction related activities.	Real time loggers Quarterly monitoring	Section 8.4 Section 8.10 Section 9.1
No major changes in soil moisture content or groundwater table levels caused by construction activities	Real time loggers Quarterly monitoring	Section 8.4 Section 8.10

Target	Measurement Tool	Section
		Section 9.1
Contaminated materials appropriately identified, segregated and managed to ensure that there is no impact on groundwater inflows or degradation of groundwater quality.	Records pertaining to unexpected finds handling and unexpected finds register Quarterly monitoring Detailed Site Investigations (where required)	CLHMMP Section 8.10 Section 9.1
Ensure all relevant project personnel are informed via toolbox talks and the Project induction to enable the identification of groundwater.	Induction and training records	Section 9.2 Section 9.3
Ensure groundwater inflows from surface water are retained where possible to ensure effective recharge from infiltration.	Real time loggers Quarterly monitoring Implementation of ESCP's	Section 8.4 Section 8.10 Section 9.1

5 Environmental Requirements

5.1 Relevant Legislation and Guidelines

The primary legislation, guidelines and standards relevant to groundwater management are presented in Table 5-1. Also refer to Appendix A1 of the CEMP for a full register of legal requirements for the Project.

Table 5-1 Principal legislation and guidelines relevant to Groundwater Management

Legislation	• *Environmental Planning and Assessment Act 1979* (EP&A Act) • *Protection of the Environment Operations Act 1997* (POEO Act) • *Protection of the Environment Operations (General) Regulation 2022* • *Water Act 1912* • *Water Management Act 2000 (WM Act)* • *NSW Aquifer Interference Policy* (DPI-NSW Office of Water, 2012) • Relevant water sharing plans (Section 6.2.6)
Guidelines and Specifications	• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) • *Groundwater assessment toolbox for Major Projects in NSW* (NSW DPE, 2022) • *Guidelines for Groundwater Documentation for SSD/SSI Projects* (NSW DPE, 2022) • *Groundwater Sampling and Analysis – A Field Guide* (Geoscience Australia 2009)

5.2 Environment Protection Licence

The Project is subject to an Environment Protection Licence (EPL) as a Scheduled Activity for 'rail construction' (EPL No. 22021). EPLs require practical measures that could be taken to protect the environment from harm, including management of groundwater. Compliance with the obligations of the EPL assist in avoiding indirect impacts through pollution or other disturbances. The Project will be constructed so as to meet requirements identified in the EPL.

6 Existing Environment

6.1 Key Reference Documents

The following key reference documents were used to determine the existing environment in relation to soil and water management.

- EIS Chapter 12 – Hydrology and Flooding
- EIS Chapter 13 – Water Quality
- EIS Chapter 14 – Groundwater
- EIS Chapter 22 – Climate Change
- EIS Technical Paper 4 – Hydrology and Flooding
- EIS Technical Paper 4 – Water Quality Impact Assessment
- EIS Technical Paper 6 – Groundwater Impact Assessment (GIA)
- D7 Geotechnical and Hydrogeological Interpretative Report (GHIR), report reference:

6.2 Hydrogeological Context

6.2.1 Climate

The climate of the region is relatively dry and temperate with distinct cold winters, and warm to hot summers.

The closest Bureau of Meteorology (BoM) station is the Cootamundra Airport station (BoM Station 073142). This station is located about 60 km east of the rail alignment. Rainfall data recorded at this station show a mean annual rainfall of 623 mm (between 1996 and 2024). Highest rainfall typically occurs in November (63 mm on average) and the lowest in April (36 mm on average). Temperature ranges from maximum averages of 12°C in winter and 31°C in summer, minimum averages of 3 °C in winter and 16 °C in summer.

Climate data derived from the SILO dataset (QLD DES, 2025)[1] at the centre of the rail alignment (latitude -34.65, longitude 148.15) were also analysed to compare rainfall and evaporation data over the period 1990-2024. The SILO dataset is a specific gridded climate dataset that gives continuous daily weather and climate data at any point in Australia, derived from observed measurements and interpolation.

Figure 6-1 compares mean monthly rainfall to evaporation data from the SILO data drill between 1990 and 2024. Based on the SILO data, mean annual rainfall in the region is approximately 570 mm. Evaporation exceeds rainfall for most of the year, with annual pan evaporation averaging 1510 mm.

[1] Department of Environment, Science and Innovation (DES) 2025, SILO climate data, Queensland Government, accessed 18 June 2025, https://www.longpaddock.qld.gov.au/silo/.

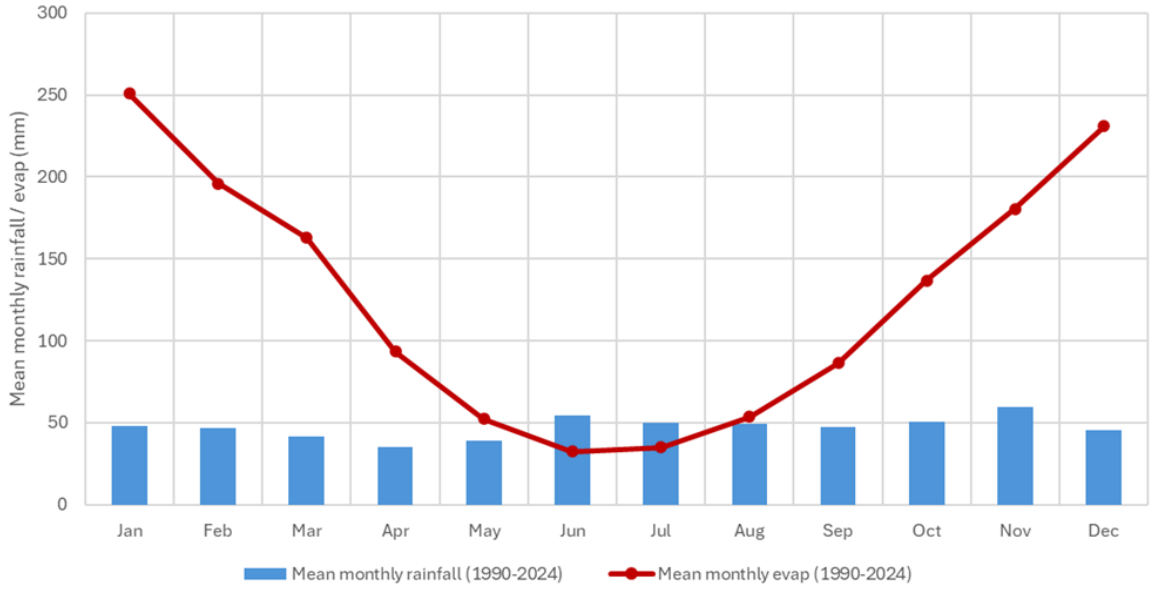


Figure 6-1: Mean Monthly Rainfall and Evaporation

Climate change is expected to affect the water cycle, including groundwater recharge, due to higher temperatures and more variable rainfall.

Chapter 22 of the EIS assessed potential impacts of climate change on various aspects of the project, including groundwater. While the EIS acknowledges the potential for climate change to impact groundwater resources, it does not provide detailed modelling or projections of groundwater level changes specific to the Project site.

The climate change scenarios (in line with the Representative Concentration Pathway "RCP" 8.5) assessed as part of the Climate Change Risk Assessment Framework for the project suggest an increased variability in rainfall and higher evaporation rates, with implications for reduced recharge and more intense rainfall events. This could result in temporary increase in groundwater levels above those recorded during groundwater investigations and monitoring, as well as the potential for long term rainfall averages to be below the recorded averages.

6.2.2 Broader Topography

The township of Stockinbingal has an elevation of 295 metres Australian Height Datum (AHD) and the south end of the Project site near Illabo has an elevation of 280 m AHD. The Project site is located on gently to moderately sloping terrain.

The broader topography of the southern portion of the Project generally slopes to the south and east. This transitions to higher ground in the central portion, with moderate undulations cut by Run Boundary Creek and Isobel Creek, north of Old Cootamundra Road, the Project passes through flat to gently sloping farmland, before passing through a low hillslope around Dudauman Creek.

6.2.3 Catchments and Surface Water Features

The I2S alignment spans two catchment areas:

- Southern Section (Illabo to Rail Kilometrage CH. 441500): This lies within the northern part of the Murrumbidgee catchment, which covers around 84 000 km² of southern NSW.
- Northern Section (Rail Kilometrage CH. 441500 to Stockinbingal): This falls within the southern part of the Lachlan catchment, which covers around 90 000 km².

The alignment crosses several minor watercourses and drainage lines, including (from Illabo to Stockinbingal):

- Billabong Creek;
- Ulandra Creek;
- Run Boundary Creek;
- Isobel Creek;
- Powder Horn Creek;
- Dudauman Creek; and
- Numerous minor unnamed tributaries and drainage lines.

These watercourses are intermittent and can be dry for extended periods but may support surface-groundwater interactions during seasonal flow events. Connectivity of the surface water bodies with shallow alluvial aquifers is likely to be localised and transient.

Farm dams are present in the area, and have been identified in the SWMP. These include:

- 14 farm dams located within the Project site; and,
- Multiple farm dams within the vicinity of the Project site.

As noted in the SWMP, the dams typically intercept overland flow, for water supply for stock, though not all dams have been visually assessed to date. These dams have the potential to provide recharge (via infiltration) to the underlying groundwater systems.

6.2.4 Geology

6.2.4.1 Geological Units

The Project alignment lies within the South Western Slopes bioregion of the Lachlan Fold Belt. Figure 6-2 Geological Sequence summarises the geological sequence of the Project site.

Figure 6-2 Geological Sequence

Age	Formation	Lithology
Quaternary	Unnamed, map symbol: Czs	Sand or gravel plains; some residual alluvium; local clay, calcrete, laterite, silcrete, silt and colluvium.
	Unnamed, map symbol: Qc	Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; minor alluvial and sand plain deposits; local calcrete and laterite.
Devonian	Combaning Formation	Siltstone, sandstone, shale, conglomerate and minor felsic volcanic rocks.
Silurian	Frampton Volcanics	Rhyolite, rhyodacite, dacite, quartz-feldspar sandstone, siltstone, volcaniclastic and polymictic conglomerate, numerous dykes, limestone.
Ordovician	Junawarra Volcanics	Andesite, andesitic agglomerate, latite, sedimentary rocks and minor dacite.

Source: GHIR (BG&E, 2025)

6.2.4.2 Structures

The alignment is located within the western limb of the eastern zone of the Lachlan Fold Belt, that is bounded by major regional structures:

- the Gilmore Fault Zone: a northwest-southeast trending thrust-fault that extends for several hundreds of kilometres from mid-NSW to southern Victoria (Stuart-Smith, 1991). It is located approximately 13 km to the west of the Project site.
- the Jugiong Shear Zone: located approximately 13 km east of the alignment.

Unidentified faults and areas of structural deformation have the potential to be present within the Project site. These structures have the potential to yield high groundwater inflows if intercepted during construction.

6.2.5 Hydrostratigraphic Units

Three main hydrostratigraphic units (HSUs) have been identified within the Project site:

- Shallow alluvial aquifers: Typically shallow and unconfined, these aquifers are associated with the alluvium in creek lines and are present in valley floors. They are recharged predominantly by surface water infiltration (watercourses and rainfall).
- Shallow fractured rock aquifers: Occur within the weathered and shallow fractured zones of the Palaeozoic bedrock. These are typically unconfined to semi-confined with variable yields, depending on the degree of fracturing and weathering. They are recharged predominantly by rainfall infiltration.
- Deep fractured rock aquifers: Occur within the deeper fractured zones of the Palaeozoic bedrock. These are typically semi-confined to confined with variable yields, depending on the degree of fracturing. They are thought to be directly recharged via infiltration through outcrop area and structural conduits, and indirectly via leakage from overlying formations.

From Rail Chainage 417.500 to 428.500 km, all three HSUs are present, with the alluvial aquifers associated with Billabong Creek watercourse, and the shallow fractured rock aquifer present at topographic high points associated with outcrops of the Combaning Formation and Junawarra Volcanics.

The shallow fractured rock aquifer is expected to be present between Rail Chainage 428.500 and 442.500 km through the central section of the alignment associated with the Frampton Volcanics.

Alluvial aquifers are expected to be present from Rail Chainage 442.500 to 460.000 km associated with the low-lying flood plains around Stockinbingal.

A summary of these units and their characteristics are provided in the table below.

Figure 6-3 Hydro stratigraphic Units (HSU) across the Rail Alignment

HSU	Geological Units	Estimated thickness where encountered (m)	Characteristics	Likely Locations
Alluvial aquifers	Quaternary Alluvium and Colluvium	0-20+	Unconfined to semi-confined aquifers. Mostly associated with drainage lines and low-lying plains.	Billabong Creek watercourse near Illabo. Low-lying plains near Stockinbingal.
Shallow fractured rock	Bedrock (Combaning Formation, Frampton Volcanics, Junawarra Volcanics)	0-15 (unconsolidated sediments and weathered rock)	Perched unconfined to semi- confined water within fractures, joints, bedding planes, faults, and cavities in the geological rock mass, as well as overlying unconsolidated sediments. Controlled by localised topographic influences and climatic conditions.	Topographic high points and along slopes of hills. Likely around the central section of the alignment associated with the Silurian volcanics.
Deep fractured rock	Bedrock (Combaning Formation, Frampton Volcanics, Junawarra Volcanics)	100+ (basement fractured rock)	Semi-confined to confined system within the fractured rock basement. Low primary porosity, highly localised groundwater flow controls due to the varying degree of structural deformation.	N/A

6.2.6 Groundwater Sources

With reference to the Water Sharing Plans (WSP); two relevant groundwater sources have been identified in the Project site:

- the Murray-Darling Basin Fractured Rock (Fractured Rock) aquifers, comprising the alluvial / colluvial aquifers outside the mapped Lachlan Alluvial aquifers, and shallow and deep Fractured Rock HSUs as described in Section 6.2.3.
- the Lachlan Unregulated and Alluvial (Lachlan Alluvial) aquifers.

The groundwater sources are classed as less productive alluvial and fractured rock aquifers based on the NSW Aquifer Interference Policy (DPI, 2012) (AIP).

6.2.7 Groundwater Receptors

6.2.7.1 Groundwater Users

A review of the WaterNSW database and EIS baseline data identified 55 licensed groundwater bores within in the Study Area.

Of these 55 bores, 24 are of unknown status and condition, 24 are no longer operational, and 7 are listed as operational. These bores are primarily used for (1) agricultural irrigation and stock watering; and (2) domestic supply for rural properties.

No registered bores were identified within the Project construction corridor, however six bores for exploration or monitoring (not classified as a sensitive receptor) were located within 100 m of the alignment.

6.2.7.2 Groundwater Dependent Ecosystems

The Bureau of Meteorology's groundwater dependent ecosystems (GDE) Atlas identifies potential GDEs in the broader region. Eight high-potential GDEs intersect the alignment:

- Four aquatic GDEs along some of main watercourses: Billabong, Ulandra, Ironbong and Dudauman Creeks; and
- Four terrestrial GDEs (flora species): Blakely's red gum, yellow box, western grey box and white cypress pine.

Some riparian vegetation along ephemeral creeks may also exhibit opportunistic use of shallow groundwater during wetter periods, though they are not considered obligate GDEs.

6.2.7.3 Surface Water

Given the ephemeral nature of the creeks at the site, surface flows for creeks and waterbodies are not considered to be reliant on groundwater discharge.

Farm dams in the vicinity are predominantly located on overland flow paths to opportunistically capture surface flows, though the condition and volume of these dams is not known. Given the hydrogeological model, it is considered unlikely that these dams are reliant on groundwater, unless they are registered dams.

6.3 Groundwater Monitoring and Testing

Groundwater monitoring and testing were conducted as part of the groundwater investigations for the EIS, and subsequent geotechnical investigations (GI). A summary of the results is provided in the following sections.

6.3.1 Groundwater Levels

A total of fifteen groundwater monitoring wells have been installed to date along the alignment. Four Groundwater Monitoring Events (GME) were conducted as part of the EIS investigations between January 2019 and April 2021.

One GME was conducted in June 2025 as part of the most recent GI at 6 of the existing monitoring wells. The remainder of the monitoring wells could not be accessed or located during the June 2025 GME.

An overview of the groundwater monitoring wells and level monitoring results is provided in **Table 6-1**

Table 6-1 Groundwater Monitoring Summary

Bore ID	Easting	Northing	GL (m AHD)	HSU	Design Element	Screen Depth (mbgl)	Screened Unit	Monitoring Period	GWL Range (mbgl) [2]	Comment on Groundwater Levels
2200_1_BH 201	571382	6149302	257.3	Lachlan alluvial	Billabong Creek Underbridge	8.14 - 20.14	Alluvial Soil	Jan 2019 – Apr 2021	7.3 – 8.2	Never dry in all four GMEs.
2200_1_BH 202	572979	6149825	289.8	Fractured rock (shallow)	Cut 3 (Max Cut Depth 5.1 m – Top of Rail at 284.4 m AHD)	7.86 - 13.86	Extremely Weathered Meta-Siltstone	Jan 2019 – Apr 2021	> 12 (dry)	Dry in four GMEs.
2200_1_BH 204	574319	6155023	284.5	Fractured rock (deep)	Ulandra Creek Underbridge	14.80 - 20.80	HW Meta Siltstone	Jan 2019 – Apr 2021; June 2025	10.4 - 14.6	Never dry in all five GMEs.
2200_1_BH 211	576936	6164824	345.0	Fractured rock (deep)	Dirnaseer Road Underbridge	17.20 - 20.20	HW Rhyolite	Jan 2019 – Apr 2021	> 20 (dry)	Temporary level recorded as 19.55 mbgl post drilling.
2200_1_BH 212	576950	6165203	379.5	Fractured rock (shallow and deep)	Cut 20 (Max Cut Depth 13.3 m -– Top of Rail at 252.8 m AHD)	8.85 - 26.85	SW Rhyolite	Jan 2019 – Apr 2021; June 2025	> 24 (dry)	Dry in all GMEs.

Bore ID	Easting	Northing	GL (m AHD)	HSU	Design Element	Screen Depth (mbgl)	Screened Unit	Monitoring Period	GWL Range (mbgl) [2]	Comment on Groundwater Levels
2200_1_BH213	576994	6165779	350.3	Fractured rock (deep)	Cut 22 (Max Cut Depth 9.8 m – Top of Rail at 354.3 m AHD)	14.30 - 26.30	MW Rhyolite	Jan 2019 – May 2019	8.2 - 8.8	Temporary level recorded as 20.48 mbgl post drilling.
2200_1_BH215	576830	6167308	376.1	Fractured rock (shallow and deep)	Cut 24 (Max Cut Depth 11.3 m – Top of Rail at 362.4 m AHD)	9.70 - 18.70	SW Rhyolite	Jan 2019 – May 2019	14.6 - 15.7	Dry in one GME.
2200_1_BH217	579142	6173054	346.5	Fractured rock (deep)	Old Cootamundra Road Underbridge	14.36 - 20.36	HW Meta Sediment	Jan 2019 – Apr 2021; June 2025	1.5 - 2.9	Never dry.
2200_1_BH219	579574	6182102	303.8	Fractured rock (shallow)	Burley Griffin Way Overbridge	11.97 - 20.97	Alluvial Soil	Jan 2019 – Apr 2021; June 2025	> 20 (dry)	Dry in all GMEs.
2200_1_BH220	579548	6182537	303.5	Fractured rock (shallow)	Dudauman Creek Underbridge	8.95 - 20.95	Extremely Weathered Meta Sandstone	Jan 2019 – Apr 2021; June 2025	> 20 (dry)	Dry in all GMEs.

Bore ID	Eastin g	Northin g	GL (m AHD)	HSU	Design Element	Screen Depth (mbgl)	Screened Unit	Monitoring Period	GWL Range (mbgl) [2]	Comment on Groundwater Levels
220_3_BH0 54	57675 6	616486 9	350.0	Fractured rock (shallow and deep)	Dirnaseer Road Underbridge	11.20 - 29.20	HW Rhyolite	Feb 2021 – Apr 2021	25.0 - 25.2	Never dry.
220-04- BH4000	57130 4	614928 5	264.3	Lachlan alluvial	Billabong Creek Underbridge	9.00 - 15.00	Alluvial Soil	Nil	Unclear from log [1]	
220-04- BH4301	57261 0	614952 9	282.3	Fractured rock (shallow and deep)	Cut 3 (Max Cut Depth 5.1 m – Top of Rail at 284.4 m AHD)	10.80 - 19.80	HW Meta-Siltstone	Nil	Unclear from log [1]	Probably dry.
220-04- BH4304A	57639 0	616045 4	325.3	Fractured rock (shallow)	Cut 12 (Max Cut Depth 6.5 m – Top of Rail at 313.7 m AHD)	8.30 - 14.30	MW Dacite	Nil	Unclear from log [1]	Dry in one GME in June 2025.
220-04- BH4319A	57565 9	615958 7	319.8	Fractured rock (shallow)	Cut 13 (Max Cut Depth 5.1 m – Top of Rail at 314.1 m AHD)	8.50 - 14.50	SW Dacite	Nil prior to 2025 One GME in June 2025	> 14.5 (dry)	Probably dry.

Notes: Test locations in bold were located and accessible for the 2025 GME.

[1]: Standing water levels are not clearly provided in Macquarie Geotech GFR (2024)

[2]: mbgl: metres below ground level

It should be noted that no groundwater level data was collected between 2021 and 2025. Therefore, long-term trends have not been included in this plan. In addition, latest measurements date from 2021 in 9 of the 15 monitoring wells; meaning that current groundwater elevations are also not available at these locations.

Based on available information, groundwater levels across the Project site are shallow to moderately deep, with standing water levels ranging from 2 m to more than 25 m below ground level depending on topography and hydrogeological conditions. In upland areas, groundwater has been found to be relatively deep, usually 10 to 30 m below ground level; whereas in lowland areas like Stockinbingal floodplain, shallower depths (less than 10 m, and typically more than 5 m) have been observed.

6.3.2 Hydraulic Conductivity

Hydraulic conductivity testing (slug tests and pumping recovery tests) was undertaken in three monitoring wells (2200_1_BH213, 2200_1_BH215 and 220_3_BH054) as part of the Groundwater Impact Assessment (WSP, 2022). Interpreted hydraulic conductivity (K) results are shown in **Table 6-2**.

Table 6-2 Interpreted K Values

Well ID	Screened lithology	Interpreted K (m/day)
BH213	Fractured Rock	7.2
BH215	Fractured Rock	1.5×10^{-4}
BH054	Fractured Rock	1.0×10^{-2}
Geometric mean		**2.2×10^{-2}**

Analysed K values for the deeper fractured rock aquifer range over six orders of magnitude. Lower K values are considered to represent bulk rock that does not intersect major water bearing zones associated with faults or folding. The higher K value obtained at 2200_1_BH213 is likely related to water bearing fracture or fault zones and may reflect local conditions at BH213. Based on literature values (Domenico and Schwartz, 1990), fractured rock hydraulic conductivities can vary greatly, typically between 10^{-5} to 10 m/day.

6.3.3 Groundwater Quality

Groundwater quality monitoring was undertaken as part of the EIS. Four monitoring events were conducted at 3-monthly intervals to capture seasonal variations.

Results were compared to the default guideline values (DGV) defined in the Australian and New Zealand guidelines (ANZG) for fresh and marine water quality. The 95% level of protection for fresh waters was adopted as the area is considered to be a moderately disturbed, upland river, ecosystem, due to the dominant agricultural land use practices.

Key findings are summarised as follows:

- Groundwater within the Project site is generally slightly brackish to brackish, with electrical conductivities (EC) ranging from approximately 1,400 to 7,400 µS/cm.
- Groundwater pH is generally neutral (ranging from 6.5 to 7.5).
- Groundwater type in the alluvium (BH201) is Na-Cl-HC03 dominant.
- Groundwater in the fractured rocks systems (BH222) consist of Na-Cl and Na-Mg-Cl-SO4 dominant water types.

- Some dissolved metal concentrations exceeded the default guideline values (DGVs) of the 95% protection level for freshwater aquatic ecosystems (ANZG, 2018 and ANZECC, 2000) adopted in the GIA:
- Copper sporadically exceeded the DGV in 2200_1_BH201 (alluvium).
- Aluminium sporadically exceeded the DVG in 220_3_BH054 (fractured rock).
- The Cadmium DVG was exceeded on one occasion in BH213 and 220_3_BH054 (fractured rock).
- The Copper DVG was exceeded on one or multiple occasion(s) in 220_3_BH204, 2200_1_BH213, 2200_1_BH215, 2200_1_BH217 and 220_3_BH054 (fractured rock).
- The Nickel DVG was exceeded on one occasion in 2200_1_BH215 and 220_3_BH054 (fractured rock).
- The Zinc DVG was exceeded on one or multiple occasion(s) in 220_3_BH204, 2200_1_BH215, 2200_1_BH217 and 220_3_BH054 (fractured rock).
- The EIS desktop study did not identify any known widespread contamination plumes or acid groundwater. The risk of groundwater contamination within the Project site was noted as low.

6.4 Conceptual Hydrogeological Model

From the perspective of groundwater management, key features of the conceptual hydrogeological model are summarised in Table 6-3.

Table 6-3: Conceptual Hydrogeological Model

Unit	Stratigraphy	Aquifer condition	Saturation	Comment
1A	Alluvial/Colluvial soils	Vadose zone	Unsaturated	Seepage through excavations may occur due to surface water or rain water infiltrating through these soils. Inflows (if any) are likely to be low, ephemeral and weather-dependent.
1B	Alluvial/Colluvial soils	Unconfined, possibly perched, groundwater table (HSU Alluvial aquifer)	Saturated	These aquifers may be local and/or ephemeral (i.e. weather or season-dependent). May be associated with surface GDEs and flow in watercourses.
2A	Residual soils and upper rock	Vadose zone	Unsaturated	Seepage through excavations may occur due to surface water or rain water infiltrating through these materials. Inflows (if any) are likely to be low, ephemeral and weather-dependent. Within rock, flow would predominantly occur through defects.
2B	Residual soils and upper rock	Typically unconfined to semi-confined, possibly perched, groundwater table (HSU Shallow fractured rock)	Saturated	These aquifers may be local, perched and ephemeral, and may be weather or season-dependent. Within rock, flow would predominantly occur as seepage through soils and defects. Based on the observed depths to groundwater, this unit is unlikely to support surface GDEs.

Unit	Stratigraphy	Aquifer condition	Saturation	Comment
2C	Fractured Rock	Semi-confined to confined (HSU deep fractured rock)		Flow predominantly through defects in the rock. The GIA indicates that water bearing fractured zones (WBFZ) are present from 15 m to more than 50 m below ground level. Potentiometric surfaces are shallower than the WBFZs due to confining pressures and were observed to rise up to about 2 m below ground surface (BH217).

Recharge and discharge mechanisms are presented in Table 6-4.

Table 6-4: Conceptual model components - based on EIS Chapter 14

Mechanism	Parameter	Conceptual model unit(s)	Comment
Recharge	**Rainfall**	1A/1B	2.5% infiltration factor from rainfall data obtained from Eurongilly meteorology station (BoM Station 73124).
		2A/2B	1.0% infiltration factor from rainfall data obtained from Eurongilly (BOM Station 73124).
	Stream flow	1A/1B	The streams within the catchment are ephemeral and dry (no flow) throughout most of the year.
		2A/2B	Negligible contribution assumed from streams.
	Irrigation	1A/2A	The catchment area is subject to irrigation (dryland crops). Irrigation will recharge the underlying groundwater units.

Mechanism	Parameter	Conceptual model unit(s)	Comment
Discharge	Evapotranspiration (ET)	1A	Shallow groundwater in the alluvium would be subject to evapotranspiration. Vegetation may access shallow groundwater present in the vadose zone.
		2A	Shallow perched aquifers (if any) would be subject to evapotranspiration.
	Extraction	1B	Negligible volume assumed due to the identification of only one registered bore user, listed for household and domestic.
		2B/2C	Several bores registered for stock and domestic usage. No bores are however located within 100 m of the alignment.
	Baseflow contribution	1B / 2B	The Project site is located within the upper bounds of the regional catchment with negligible baseflow contribution. The streams within the Project site have been observed to be ephemeral and dry throughout most of the year, suggesting limited baseflow contribution.

7 Groundwater Aspects and Impacts

7.1 Relevant Construction Activities

Key aspects of the Project that could result in adverse impacts to soil and water include:

- Bulk earthworks (cut and fill)
- Construction of culverts, bridges and drainage works
- Extraction of groundwater (not proposed) and surface water from watercourses
- Vegetation clearing and topsoil stripping
- Stockpiling of material/spoil
- Dewatering works (if any)
- Discharge from sediment basins, farm dams and other construction sources
- Compound operation including fuel and chemical storage, refuelling and chemical handling.

Refer also to the Aspects and Impacts Register included in Appendix A2 of the CEMP. In line with the Water Re-Use Strategy prepared for the Project, no water withdrawal is proposed for use in construction. Should this approach change as part of the review and implementation of the Water Re-Use Strategy and groundwater will be used during construction, this Plan will be updated in accordance with Section 10.

7.2 Impacts

Chapter 14, Section 14.4 of the EIS identified activities that could affect groundwater regimes and receptors during construction of the Project, these include:

- **Dewatering-** No groundwater 'take' for use as construction water supply is proposed. However, groundwater dewatering may occur during construction if excavations (cuts) or piling for bridge foundations intersect with the groundwater table and removal of this water within an excavation is required (i.e. no proposed draw down of groundwater or extraction from bores/wells as part of the Project).
- **Salinity-** Changes to groundwater (and surface water) flow patterns located in areas with saline land would have a higher likelihood and risk of mobilising salts and impacting groundwater quality downgradient. This could cause adverse effects to GDEs where present.
- **Settlement-** this can occur due to changes in soil moisture as a result of groundwater take. As cuts are not anticipated to intersect the regional groundwater table, the risk to settlement is low.
- **Contamination-** Construction of the proposal includes the storage of hazardous materials and chemicals. These substances, including waste-water discharge, can potentially interact with the groundwater through surface infiltration. The impact from hazardous chemicals (e.g. fuel) that may leach through surface infiltration during construction may be significant depending on the quantity and type of contaminate involved.
- **Groundwater discharge-** Changes to surface infiltration (groundwater recharge), evaporation or evapotranspiration due to alteration of the existing sealed surfaces, vegetation coverage or topography can either increase or reduce groundwater availability temporarily or permanently.

A breakdown of the potential impact locations identified in the assessment undertaken as part of the EIS has been included as Figure 7-1 below. Figure 7-1 provides a breakdown of the indicative cut and fill levels and associated groundwater levels identified as part of the samples collected at depth from the EIS assessment.

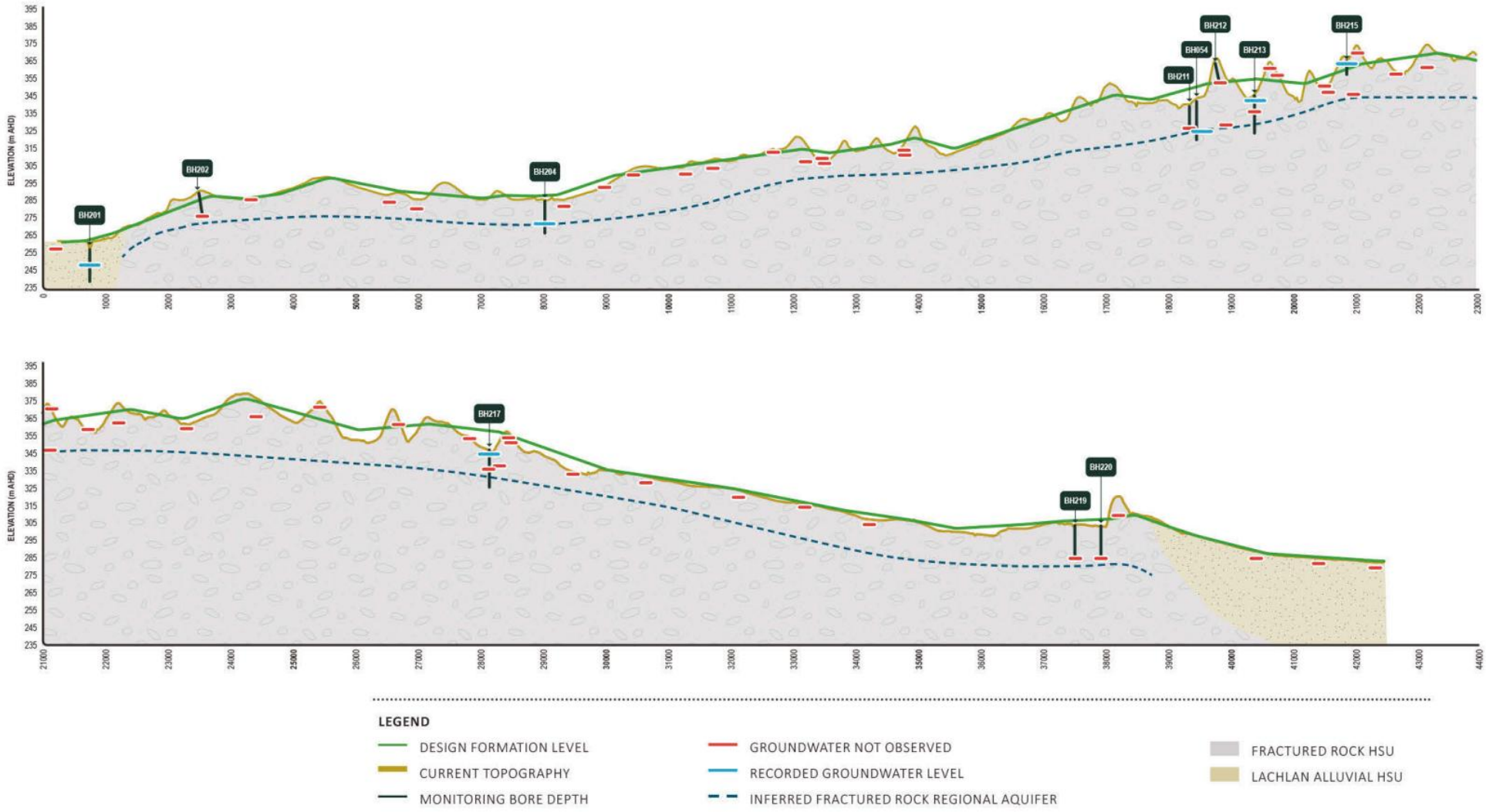


Figure 7-1 identified groundwater depth vs cut and fill profile (Project EIS)

Potential impacts attributable to construction are summarised in Table 7-1 and also detailed in Section 6.3 of the CEMP.

Table 7-1: Potential groundwater impacts associated with the Project

Risk	Impact pathway	Considerations	Risk rating
Dewatering / groundwater 'take'	• Excavations (i.e., cuts and bridge piling) directly intercepting groundwater resulting in drawdown and groundwater 'take' (only where inflows are encountered during excavations) • Use of groundwater for construction water supply resulting in drawdown (not proposed by the Project) • Lower groundwater levels reducing the availability of groundwater to nearby sensitive receptors such as GDEs or nearby users of groundwater	• Based on groundwater data collected for the EIS and subsequent geotechnical investigations, the GHIR (BG&E, 2025) concluded that excavations for construction works (cuts) are expected to generally remain above the groundwater table. Incidental groundwater 'take' is therefore not expected. Should ongoing GI identify that some cuts will intersect the water table, this GWMMP will be revised accordingly. • Deep piling for bridge foundations could intersect groundwater. However, groundwater 'take' would be negligible using appropriate mitigation measures, such as a tremie system. • Minor seepage through the unsaturated zone (Units 1A and 2A defined in the conceptual model – Section 6.4) could occur following rainfall events. These inflows are likely to be minimal and readily captured by the proposed cess drains. • No groundwater 'take' for use as construction water supply is proposed.	Low
Salinity	• Changes to groundwater flow paths from diversions, level changes, or altered infiltration may mobilise salts and affect water quality. • Mobilisation of salts may lead to increased groundwater salinity, potentially impacting sensitive receptors and proposed concrete and steel structures.	• Flow pattern changes may increase salt mobilisation and affect groundwater quality. GDEs could be impacted if present. • Realignments aim to minimise flow disruptions. • Most watercourse crossings are designed as pipe and box culverts with negligible to low impact on groundwater levels, flow paths, and salinity. • Bridge piling has low risk to groundwater salinity as it would	Low

Risk	Impact pathway	Considerations	Risk rating
		result in localised and limited modification of groundwater levels.	
Settlement	• Changes in soil moisture content, including those resulting from groundwater take, may lead to compression or settlement of soil.	• Excavations are not expected to intersect the regional groundwater table. Dewatering is not expecting as a result of the Project. Therefore, drawdown-induced settlement impacts are expected to be negligible.	Low
Contamination	• Potential to introduce surface contaminants to surface water runoff. Leachate could occur and impact the quality of the underlying groundwater. • Movement of potentially existing contamination plumes within the groundwater environment.	• Leaks/spills can occur from storage, transport, use and handling of chemicals, heavy metals, oils, and petroleum hydrocarbons during the use and operation of machinery. • No existing contamination plumes are expected to be present within the Project site.	Significant if not mitigated
Recharge	• Risk of altered catchment recharge and evapotranspiration due to the introduction of additional sealed (impervious) surfaces, changes in vegetation and ongoing seepage from cuts.	• The Project is expected to cause only minor changes to these parameters during construction. • Any resulting change in recharge is expected to be negligible at the catchment scale.	Negligible

8 Groundwater Mitigation and Management Measures

8.1 Overview

The mitigation measures to manage impacts to groundwater proposed in the EIS are outlined in Table 8-1. The following sections detail how these measures will be addressed and implemented.

Table 8-1: Groundwater mitigation and management measures (EIS)

Ref	Impact	Mitigation measures	Timing	Evidence
GW-1	Management of groundwater bores	Any bores that are decommissioned will be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia—Edition 4* (NUDLC, 2020).	Detailed design / pre-construction	Hydrogeologist Reports
GW-2	Management of groundwater bores	Any existing groundwater bores that are destroyed during construction would be replaced subject to discussion with the registered owner.	Detailed design / pre-construction	Individual Property Management Plans
GW-3	Avoid or minimise groundwater seepage	Appropriate drainage measures would be installed at the base of cuts and along high-walls to manage groundwater seepage, in the unlikely event that they be encountered.	Detailed design / pre-construction	IFC drawings ESCP
GW-4	Groundwater management	A groundwater mitigation and management plan (GWMMP) would be prepared as part of the CEMP. The GWMMP would comply with the proposal conditions of approval and be implemented to monitor the effectiveness of mitigation and management measures applied during the construction phase of the proposal. The GWMMP would at a minimum: • Provide details of the groundwater monitoring network, frequency of monitoring, and test parameters • Be based on baseline studies developed for the proposal and establish baseline monitoring reports • Contain procedures for the documentation and reporting of results • Include requirements for training, inspections, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction.	Construction	This Plan Quarterly Monitoring Reports
GW-5	Monitoring groundwater drawdown and quality	A groundwater monitoring program would be developed and implemented as part of the GWMMP to monitor potential groundwater impacts. The program would define: • Monitoring parameters • Monitoring locations	Construction	This Plan Quarterly Monitoring Reports

Ref	Impact	Mitigation measures	Timing	Evidence
		• Frequency and duration of monitoring The monitoring program would include baseline monitoring to determine the water quality of groundwater from the proposed bore field bores.		
GW-6	Unforeseen water table penetration by earthworks	If excavations intersect the water table, potential impacts would be assessed by a hydrogeologist and adaptive management measures implemented as required.	Construction	Hydrogeologist Reports Updates to this Plan
GW-7	Management of groundwater seepage	Drainage measures would be maintained where required to manage ongoing groundwater seepage during operation.	Operation	ESCP SEP

8.2 Validation of Conceptual Model

Geotechnical and groundwater investigation is currently being undertaken to inform the detailed design of the Project. Additional groundwater monitoring bores have been and will be installed to refine the conceptual hydrogeological understanding of the Project site and confirm predicted impacts.

If required, this GWMMP will be amended to address unforeseen conditions such as interception of the groundwater table by the proposed excavations.

8.3 Groundwater Seepage Controls

Based on the groundwater data collected for the EIS and conclusions of the GIA, the Project is not anticipated to intercept the groundwater table. Very minor seepage could however occur through the unsaturated zone following rainfall events.

The proposed design comprising two cess drains on each side of the railway to capture, divert and manage any runoff and minor groundwater seepage.

Should unexpected conditions be encountered (i.e., deep cuts intercepting the groundwater table or large in-flows that were not anticipated), the following actions will be undertaken:

- Works will cease in the affected location
- Notification and incident classification of the event will be undertaken in accordance with Section 8.1 of the CEMP
- JHG will contact the Project groundwater subject matter expert (SME) to seek guidance on whether further action is required (i.e. monitoring and response measures as outlined in Section 8.10 and Section 8.11 of this Plan).

8.4 Dewatering

Where required, additional measures such as drainage blankets would be incorporated into the design to prevent subgrade saturation and to manage potential groundwater ingress. The validation of the conceptual model (Section8.2) would confirm whether additional seepage control measures are required based on the results of the ongoing geotechnical and groundwater investigation.

Dewatering is not proposed via wells or bores as part of this Project, nor is it anticipated to intercept the groundwater table. In the unlikely event that groundwater interaction occurs and dewatering is required, it will be undertaken in accordance with the Dewatering Procedure provided in Appendix D of the SWMP.

8.5 Water Storage and Treatment

Sediment basins, low points, sumps or tanks are expected to be used to manage unforeseen incidental groundwater ‘take’ during construction, in accordance with the SWMP.

8.6 Groundwater Re-use or Disposal

Groundwater interception is not expected. Therefore, opportunities for groundwater re-use are likely to be limited unless unexpected conditions are encountered.

If so, re-use is desirable to reduce the consumption of potable water on the project. Groundwater re-use is considered in the context of the greater project, in the Water Re-use Strategy document.

If encountered, options for groundwater management include the following (in order of priority):

- Onsite re-use, with dust suppression being the preferred re-use option

- Discharge to land – to infiltrate into the ground within the Project site (e.g. via infiltration basins)
- Discharge to water bodies
- Offsite disposal

Further detail is provided in the Water Re-use Strategy document.

8.7 Replacement of third-party water bores

It should be noted that no water supply bores are registered within 100 m in the vicinity of the alignment. However, unregistered bores or newly installed (not yet registered) could be present. If water bores are identified along the alignment, dataloggers should be installed (subject to access permission) to monitor water level changes over time.

Should any third-party water bores be damaged during construction or experienced drawdown impacts greater than 2 m (as per threshold set out in the AIP), the bores must be replaced or compensated, subject to discussion with the affected landholders.

All water bores should be installed in accordance with the minimum construction requirements for water bores in Australia (NUDLC, 4th Edition, 2020).

8.8 Contaminated Land Management

Measures for the handling, treatment and management of hazardous and contaminated soils and materials, including measure to manage asbestos finds, are documented in the CLHMMP.

8.9 Acid Sulphate Soils Management

Measures to manage actual acid sulphate soils (ASS) are documented in the CLHMMP.

8.10 Groundwater monitoring program

8.10.1 Baseline Monitoring

Baseline groundwater monitoring data were collected for the EIS (Chapter 14 and Technical Paper 6) and are summarised in Section 5.5.

Additional baseline data is being obtained by JHG as part of the ongoing geotechnical investigation for the detailed design. The monitoring program may be updated based on these additional baseline data.

8.10.2 Monitoring Network

Groundwater monitoring locations have been selected based on the locations of potentially groundwater interfering activities (i.e., the deepest cuts and bridges), and sensitive receptors (mainly watercourses).

Based on the existing available monitoring points being used for the geotechnical investigation and those captured in the EIS assessment, a suite of monitoring locations available for construction monitoring as part of this Plan are detailed in Table 6-3 and shown in

Figure **3-1**. It is noted that monitoring at each well will be subject to land conditions and access.

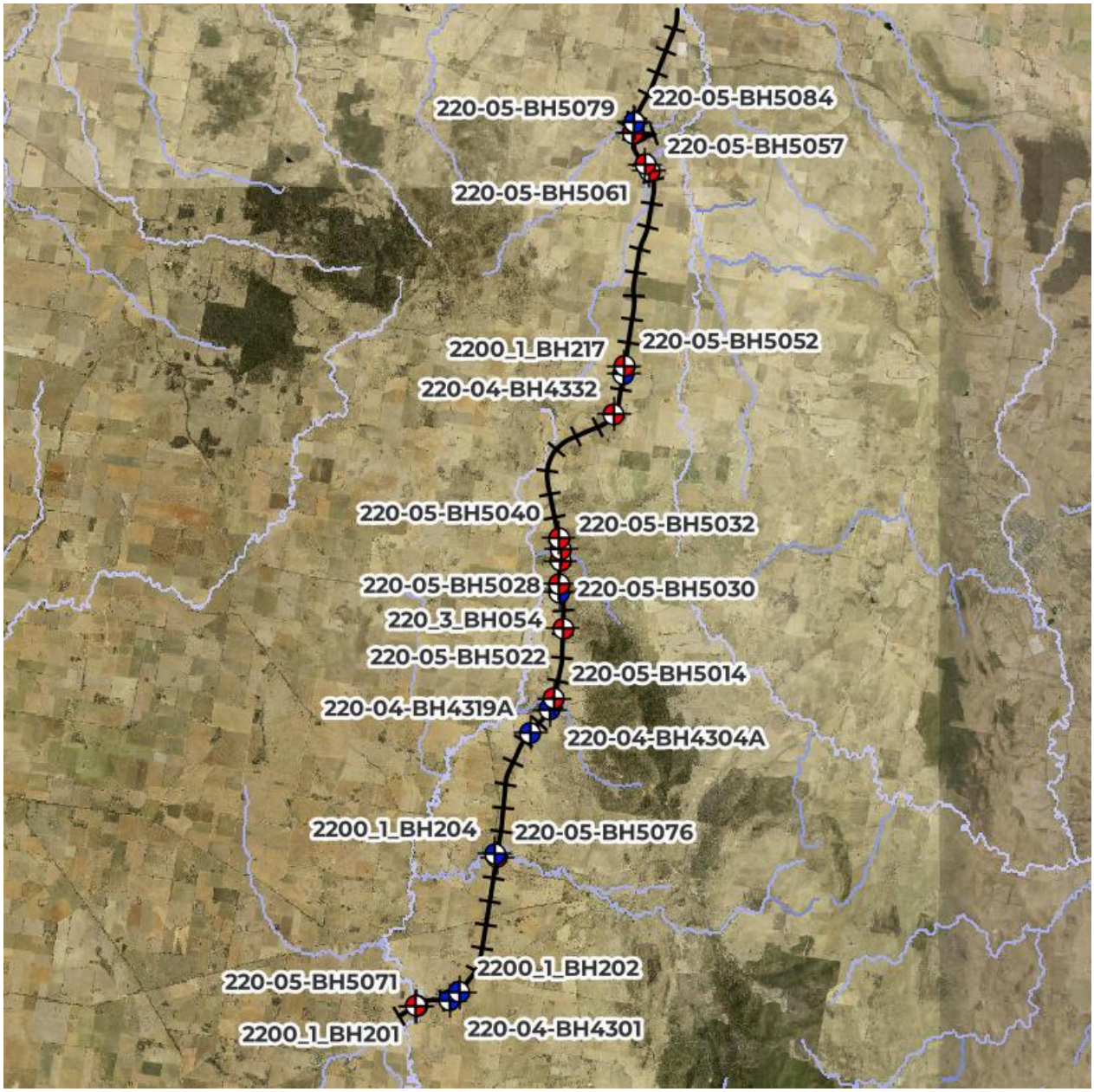
Monitoring locations will be reviewed throughout construction and as additional groundwater data become available. Locations may be modified or removed should unexpected conditions be encountered or Project design change. Any changes to the monitoring network will require approval from the ER (as an amendment to this Plan) and should be undertaken in accordance with the EPL where required.

Figure 8-1 shows that watercourses are adequately covered by the monitoring network.

Table 8-2: Project Groundwater Monitoring Locations – during construction

Bore ID	Easting	Northing	Status	Depth (m)	Targeted HSU
2200_1_BH201	571382	6149302	Existing	20	Lachlan alluvial
220-05-BH5071	571335	6149306	Proposed	20	Lachlan alluvial
220-04-BH4301	572610	6149529	Existing	20	Fractured rock (shallow and deep)
2200_1_BH202	572979	6149825	Existing	14	Fractured rock (shallow)
220-05-BH5076	574393	6154900	Proposed	20	Fractured rock (deep)
2200_1_BH204	574319	6155023	Existing	21	Fractured rock (deep)
220-04-BH4319A	575659	6159587	Existing	14	Fractured rock (shallow)
220-04-BH4304A	576390	6160454	Existing	14	Fractured rock (shallow)
220-05-BH5014	576542	6160858	Proposed	20	Lachlan alluvial
220-05-BH5022	576870	6163502	Proposed	12	Fractured rock (shallow)
220_3_BH054	576756	6164869	Existing	29	Fractured rock (shallow and deep)
220-05-BH5028	576710	6165174	Proposed	20	Fractured rock (shallow and deep)
220-05-BH5030	576768	6166029	Proposed	20	Fractured rock (deep)
220-05-BH5032	576798	6166479	Proposed	20	Fractured rock (deep)
220-05-BH5040	576717	6166889	Proposed	20	Fractured rock (deep)
220-04-BH4332	578792	6171552	Proposed	16	Fractured rock (shallow)
2200_1_BH217	579142	6173054	Existing	20	Fractured rock (deep)
220-05-BH5052	579190	6173353	Proposed	15	Fractured rock (shallow)
220-05-BH5057	580123	6180703	Proposed	30	Fractured rock (deep)
220-05-BH5061	579950	6180932	Proposed	30	Fractured rock (deep)
2200_1_BH219	579574	6182102	Existing	21	Fractured rock (shallow)
220-05-BH5079	579498	6182105	Proposed	20	Fractured rock (shallow and deep)
220-05-BH5084	579557	6182496	Proposed	20	Fractured rock (shallow and deep)
2200_1_BH220	579548	6182537	Existing	21	Fractured rock (shallow)

Figure 8-1: Proposed groundwater monitoring locations for construction – existing (blue) and proposed (red) monitoring bores



8.10.3 Groundwater Monitoring Coverage

Table 8-3 outlines the construction elements that may require groundwater monitoring (i.e., deep cuts and bridges) and the corresponding proposed monitoring network in their vicinity. For the purpose of this plan, cuts deeper than 8 metres were classified as deep. The proposed monitoring network provides adequate coverage for all identified deep cuts and bridge structures.

Table 8-3: Project Groundwater Monitoring Locations – during construction

Element ID	Critical Chainage (m)	Cut Length (m)	Max Cut/Piling Depth (m)	Monitoring network
Cut 1	417829	62	0.5	Not required
Cut 2	419347	265	1.3	Not required
Cut 3	420020	797	6.1	Not required
Cut 4	421810	750	1.9	Not required
Cut 6	423950	650	7.3	Not required
Cut 7	424780	242	2.9	Not required
Cut 8	427080	570	2.9	Not required
Cut 9	427890	210	1.7	Not required
Cut 10	428270	282	1.4	Not required
Cut 11	428720	254	1.8	Not required
Cut 12	429600	775	8.2	Not required
Cut 13	430360	180	5.5	Not required
Cut 14	430870	177	4.6	Not required
Cut 15	431490	234	7.0	220-04-BH4304A
Cut 16	433200	280	3.5	Not required
Cut 17	433610	105	1.8	Not required
Cut 18	434120	250	5.6	Not required
Cut 19	434610	352	6.9	220-05-BH5022
Cut 20	436330	302	13.5	220_3_BH054 220-05-BH5028
Cut 21	436580	60	1.4	Not required
Cut 22	437180	295	10.2	220-05-BH5032
Cut 23	437810	155	6.1	Not required
Cut 24	438570	503	11.1	2200_1_BH215
Cut 25		205	2.8	Not required
Cut 26	438970	380	7.3	Not required
Cut 27	439700	250	3.7	Not required
Cut 28	440440	705	4.5	Not required
Cut 29	441590	497	10.8	220-04-BH4332
Cut 30	442940	292	11.4	220-04-BH4332

Element ID	Critical Chainage (m)	Cut Length (m)	Max Cut/Piling Depth (m)	Monitoring network
Cut 31	444100	510	4.7	Not required
Cut 32	444660	138	2.3	Not required
Cut 33	445940	168	1.2	Not required
Cut 34	447639	394	1.0	Not required
Cut 35	447960	425	0.8	Not required
Cut 36	449460	133	0.4	Not required
Cut 37	450920	26	0.4	Not required
Cut 38	451310	340	1.6	Not required
Cut 39	452450	170	0.8	Not required
Cut 40	454710	1025	14.0	2200_1_BH220 220-05-BH5084
Billabong Creek Underbridge	418221	NA	Abutment 1&2: 14m Pier 1&2: 19.5m Pier 3: 20m	BH201
Ulandra Creek Underbridge	425410	NA	Abutment 1: 14.3m Abutment 2: 17m Pier 1: 14.5m	BH5071
Run Boundary Creek Underbridge	431936	NA	Abutment 1&2: 6.8m Pier 1: 5.7m	BH204
Dirnaseer Road Underbridge	435949	NA	Abutment 1&2: 7.0m Pier 1: 9.5m	BH5076
Isobel Creek Underbridge	437621	NA	Abutment 1: 21.1m Abutment 2: 20.3m Pier 1&2: 15.1m	BH5014
Isobel Creek Tributary Underbridge	437970	NA	Abutment 1: 21.1m Abutment 2: 20.3m Pier 1&2: 15.1m	BH054
Old Cootamundra Road Underbridge	445749	NA	Abutment 1 & 2: 13.5m Pier 1: 18m	BH5032
Powder Horn Creek Underbridge	453412	NA	Abutment 1: 14m Abutment 2: 12.7m Pier 1: 15.9m Pier 2: 15.3m	BH5040

Element ID	Critical Chainage (m)	Cut Length (m)	Max Cut/Piling Depth (m)	Monitoring network
Billabong Creek Underbridge	418221	NA	Abutment A&B: 25m	BH5052

8.10.4 Monitoring Frequency

Groundwater level and basic water quality will be monitored throughout construction. Given the length of the alignment and staged approach of work, the monitoring frequency and program will be structured in the following manner:

1. Where construction works are being undertaken (ground excavations and in-fill), monitoring will occur at the closest available monitoring well.

2. Where a bore is no longer able to be sampled, the construction team will review available wells in the vicinity of the work and attempt to undertake monitoring within 1 km (using the wells identified in Table 8-3 above) of a proposed monitoring location

3. Once construction activities (ground excavations and in-fill) have been completed, monitoring requirements for this construction footprint will be reviewed and amended as required.

The JHG environment team will review these locations and the requirements to undertake this monitoring frequency and locations on a regular basis. JHG may reduce or cease the monitoring durations and locations outlined in this Plan where analysis by the groundwater SME considers the value of this data to be of no further benefit or that the scope of work has been considered and that no groundwater impacts have been identified or potentially caused by construction activities.

Table 8-4: Recommended monitoring frequencies

Monitoring Type	Frequency	Analytes	Location
Groundwater level	Continuous (datalogger) + Quarterly manual	Level	Monitoring wells
Basic water quality	Quarterly	See Table 8-5	Monitoring wells
Event-triggered samples	As needed following: • Surface and/or groundwater trigger exceedances • Abrupt changes in groundwater levels • Any issues that have the potential to impact groundwater, e.g., spills, leaks, etc • Unforeseen interception of groundwater	Level + all water quality	Where necessary

8.10.5 Monitoring Methodology

8.10.5.1 Level

Groundwater level monitoring will be conducted using automated dataloggers installed at the locations identified in Table 8-3. Logger data will be downloaded in line with the wells that are utilised as per the frequency described in Section 8.10.4 on a quarterly basis. During each data download event, manual groundwater level measurements using a water level (dip) meter should also be collected to verify the accuracy of the logger readings, care will be taken to note this reading as top of casing or from ground level.

8.10.5.2 Groundwater quality

The recommended methodology for groundwater quality testing is as follows:

- Collection of water samples and quality control samples from the monitoring bores;
- Measurement of general groundwater physical parameters (EC, pH and temperature) using a calibrated water quality meter;
- Analysis of the samples by a NATA accredited laboratory for the analytes presented below; and
- Review and update of this water quality testing methodology as required.

Water quality sampling should be conducted in accordance with Geoscience Australia's Groundwater Sampling and Analysis – A Field Guide (Geoscience Australia, 2009).

Quality assurance / quality control (QA / QC) procedures should be used to establish accurate, reliable and precise results. QA / QC procedures should include calibration of equipment, analyses of samples within holding times, keeping samples chilled and wearing gloves during sampling.

Table 8-5: Proposed suite of analytes for water quality monitoring

Category	Analytes
Field parameters	T, EC, pH, turbidity
Physical properties	TDS, TSS
Major ions	Calcium, magnesium, sodium, potassium, chloride, sulphate and alkalinity (total, carbonate and bicarbonate)
Metals (dissolved)	Arsenic, aluminium, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead and zinc
Nutrients	Total nitrogen, total Kjeldahl nitrogen, nitrite, nitrate, ammonia, total phosphorus and reactive phosphorus
Pollutants	TRH / TPH, BTEX, phenols, PAH, VOC, oil and grease, OCP, OPP, PCB

Notes: EC: electrical conductivity | TDS: total dissolved solids | TSS: total suspended solids
TRH: total recoverable hydrocarbons | TPH: total petroleum hydrocarbons
BTEX: benzene, toluene, ethylbenzene and xylenes
PAH: polycyclic aromatic hydrocarbons
VOC: volatile organic compounds
OCP: organochlorine pesticides | OPP: organophosphate pesticides
PCB: polychlorinated biphenyl

8.11 Trigger Response

8.11.1 Trigger Levels

8.11.1.1 Groundwater levels

Proposed groundwater level triggers for which management action would be initiated are as follows:

- A variation in groundwater level exceeding 20% from the baseline range for a particular well
- A decline of more than 2 m from the baseline average groundwater level for a particular well
- The emergence of a long-term declining trend in any monitoring bore that cannot be attributed to climatic variations.

Should any of these trigger conditions be exceeded, management actions will be undertaken in accordance with the Trigger Action Response Plan (TARP) presented in Section 8.11.2.

8.11.1.2 Groundwater quality

Groundwater quality results will be compared to the trigger values presented in Table 6-2 and Table 6-3. The criteria were selected based on the baseline monitoring data and the ANZG (2018) guidelines for slightly to moderately disturbed freshwater ecosystems (95% species protection level and 99% for bioaccumulative pollutants).

Proposed trigger values are shown in Table 8-6 and Table 8-7. These trigger values will be reviewed and updated if required as the Project progresses and new data become available.

Table 8-6: Groundwater Quality Trigger Values (Physical)

Water Quality Indicator	Units	Trigger Value / Criteria
pH	pH units	6.5 – 8.5
Electrical conductivity	µS/cm	Baseline value + 30%
Oils, petroleum and hydrocarbons, pesticides	N/A	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour.

Table 8-7: Groundwater Quality Trigger Values (Chemical)

Water Quality Indicator[1]	Units	Rationale	Trigger Value / Criteria
Total Nitrogen	mg/L	Freshwater aquatic ecosystems	2.4
Aluminium (pH>6.5)	ug/L	Freshwater aquatic ecosystems	55
Arsenic (III)	ug/L	Freshwater aquatic ecosystems	24
Cadmium	ug/L	Freshwater aquatic ecosystems	0.2
Chromium	ug/L	Freshwater aquatic ecosystems (marine)	27
Copper	ug/L	Baseline data[1]	20
Iron	mg/L	Irrigation (draft)(long-term value)[2]	0.2
Lead	ug/L	Freshwater aquatic ecosystems	3.4
Magnesium	mg/L	Livestock[2]	500
Mercury	ug/L	Freshwater aquatic ecosystems	0.6
Nickel	ug/L	Baseline data[1]	20
Zinc	ug/L	Baseline data[1]	20
Ammonia	ug/L	Freshwater aquatic ecosystems	900
Nitrate	mg/L	Livestock[2]	1,500
Benzene	ug/L	Freshwater aquatic ecosystems	950
Tolulene	ug/L	Freshwater aquatic ecosystems	180
Ethylbenzene	ug/L	Freshwater aquatic ecosystems	80
o-xylene	ug/L	Freshwater aquatic ecosystems	350
1,2,4-trichlorobenzene	ug/L	Freshwater aquatic ecosystems	170
Oils, petroleum and hydrocarbons, pesticides	N/A	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour.	

1 Where the background concentration exceeds the ANZG guideline values, the trigger value was selected based on baseline data.
2 In the absence of guideline value for freshwater ecosystems, other guidelines were used.

8.11.2 Trigger action response plan (TARP)

The primary objective of the TARP is to provide an early indication of potential impacts to receptors and initiate a management response. The TARP is based on the trigger levels defined in Section 8.11.1. It includes a list of management actions to be implemented when trigger levels are exceeded.

The proposed TARP is presented in Table 8-8.

Table 8-8: Proposed TARP

Alert level	Exceedances / trend	Additional assessment	Action / Response
Level 0 - Normal	No exceedances	Continue monitoring as usual	Nil
Level 1 – Low	Single exceedance	Re-measure (sample or level) to confirm exceedance. If exceedance confirmed: - Investigate potential causes (e.g. dewatering, rainfall, leaks). - Review construction activity. - Increase monitoring frequency to monthly.	- If caused by Project (e.g., spills), remediate, cease impacting activity if possible and notify the regulators if necessary (e.g., spill identified). - If unidentified cause, flag as risk and continue monitoring at increased frequency.
Level 2 - Moderate	Three consecutive exceedances Medium term trends	- Conduct targeted sampling - Conduct hydrogeological assessment and assess whether exceedances are due to natural variations and/or background conditions - Review groundwater conceptual model and mitigation measures	- Implement contingency response plan - Notify relevant authorities (e.g., DCCEEW, EPA) if necessary - Review and update monitoring plan and trigger levels if necessary
Level 3 - High	Continuous exceedances Long term trends confirmed and not attributed to natural variations	- Detailed assessment that may include field investigations to assess cause of exceedances and extent of impact. - Specialist to review and prepare tailored remediation plan	- Cease relevant construction activity if needed - Implement emergency controls (e.g. containment, bunding) - Notify regulators (EPA, DCCEEW, landholders) - Remediation plan to be prepared and implemented

9 Compliance Management

9.1 Water access licences (WAL), Approvals and exemptions

9.1.1 Approval for groundwater take

Based on the Groundwater Impact Assessment, no significant groundwater take is expected and no active groundwater withdrawal is proposed (from bores or wells) for use during construction. Given the exemptions in place for minor interception of groundwater as well as the construction methodology for water use outlined in the Water Re-use Strategy, no permits or licenses for groundwater extraction are anticipated during construction.

The condition E77c of the Instrument of Approval requires that the CSSI be designed, constructed and operated to: “ensure that there is no permanent interception of, and/or connection with, groundwater.”

The groundwater impact assessment notes, however, that groundwater take is possible in cuts and temporary excavations at the site.

While dewatering arising from temporary excavations (e.g. footing excavations) is considered to meet the condition, if a rail cutting intercepts the permanent groundwater table, then the condition would be breached. Noting that investigation of groundwater levels is ongoing – if groundwater is encountered in cuts, condition E77c would require a change in conditions and management measures (e.g. drainage blankets). If this occurs, the process outlined in Section 8.3 will be followed.

9.1.2 Water Access Licences (WAL) for groundwater take

The following exemptions from requirements for a water access licence (WAL), and relevant conditions, would appear to apply under the Water Management (General) Regulation 2018:

- Under Clause 21(1), with reference to Schedule 4, Clause 3 – exemption for construction and maintenance of rail infrastructure by transport authorities (subject to the environmental impact being considered by the transport authority in accordance with Section 5.5 of the *Environmental Planning and Assessment Act 1979.*
- The above exemption is subject to Clause 21(6) – that taking of water is subject to the condition that the person claiming the exemption must –
    - record water taken for which the exemption is claimed
    - make the record not later than 24h after water is taken; and,
    - make the record in an approved form and manner; and,
    - keep the record for a period of 5 years; and,
    - give the record to the minister in an approved form and manner;
    - not later than 28 days after the end of the water year in which the water was taken; or,
    - if the Minister directs the person in writing to give the record to the minister on an earlier date, by that date.

Noting that under Schedule 4, clause 7 – the maximum volume of groundwater that may be taken from a groundwater source under the exemption by all aquifer interference activities carried out in connection with an authorised project is 3ML in a water year.

Accordingly, appropriate records will need to be maintained of all groundwater dewatering volumes, in order to meet the terms of the exemption.

The exemption is limited to take that is authorised (i.e., subject to the approval) which at the time of writing excludes any take arising from permanent interception of groundwater (per E77c).

It is noted that this is based on the Water Management (General) Regulation 2018, which is scheduled to be repealed on 1 September. The exemption should be re-evaluated after repeal, in light of any replacement.

9.2 Training

All employees, sub-contractors and visitors will receive a Project induction prior to commencing work on site. The induction will include details on the following:

- Requirements of this GWMMP
- Relevant legislation and guidelines
- Location of sensitive receivers
- Complaints reporting and recording
- How to implement groundwater management measures
- Specific responsibilities to minimise groundwater impacts on the community associated with construction activities.

Additional daily and task-specific training and awareness material may be delivered to relevant staff and workforce, in the form of toolbox talks and pre-start meetings, to ensure that where detailed information is required, it is accessible to all involved with the Project. Toolbox and prestart meetings will be used, as required, to highlight any specific issues that arise on-site and posters will be used to further educate employees and sub-contractors, particularly immediately prior to clearing works.

9.3 Monitoring and inspections

Table 9-1 details the inspections related to groundwater management required to be undertaken during for the Project. A full list of inspections is provided in Section 9.1 of the CEMP. The frequency of these inspections may be increased to reflect the risk associated with potential impacts during adverse weather conditions or during specific construction activities.

Table 9-1 Groundwater inspections

Inspection	Frequency	Responsibility	Record
Visual surveillance for groundwater seepage at excavations (cuts)	Daily	JHG Environment and Sustainability Manager JHG Site Supervisor	Weekly inspection Daily diary
Inspection of dust controls to ensure effective implementation	Daily	JHG Environment and Sustainability Manager JHG Site Supervisor	Weekly inspection Daily diary
Investigation in response to non-vexatious complaints, or authorised agency request, regarding exceedance of air emissions	As required	JHG Environment and Sustainability Manager JHG Site Supervisor	Incident report Complaints register
Haul road integrity (clean, no potholes etc)	Daily	JHG Environment and Sustainability Manager JHG Site Supervisor	Weekly inspection Daily diary
Plant / equipment inspections including maintenance and emissions	As required, prior to use	JHG Plant Manager JHG Site Supervisor	Weekly inspection Daily diary
No detectable offensive odours or gases (e.g. inspection of potential odour sources including freshly disturbed areas, open stockpiles, portable toilets, waste skips, etc)	Daily	JHG Plant Manager JHG Site Supervisor	Weekly inspection Daily diary

Inspection	Frequency	Responsibility	Record
Weather forecast (e.g. rainfall and wind) will be checked to allow for proactive dust management actions to be implemented	Daily	JHG Environment and Sustainability Manager JHG Site Supervisor	Weekly inspection Daily diary

Site inspections will be recorded (along with actions and issues observed) and actioned appropriately within agreed timeframes. These inspections will be recorded as part of the Weekly Environmental Inspection Checklist. Additional requirements and responsibilities in relation to inspections are documented in the CEMP.

Weekly and other routine inspections by the Inland Rail Environment and Sustainability Manager (or delegate), and the fortnightly inspections undertaken by the ER will also occur throughout construction. Detail on the nature and frequency of these inspections are documented in the CEMP.

All relevant equipment will be maintained and appropriately calibrated.

9.4 Non-Compliance and Non-Conformance

Non-compliances and non-conformances, including those related to groundwater management, are detailed in Section 9.3 of the CEMP. This includes the definitions of non-compliance and non-conformance, corrective and preventative actions, communication of corrective and preventative actions to staff and non-conformance close-out.

9.5 Incident Response

Incident management, including groundwater management, are detailed in Section 8 of the CEMP. This includes incident classification, notification and reporting including to external authorities, incident investigation and closeout.

9.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licenses and guidelines. Audit requirements are detailed in Section 9.4 of the CEMP.

9.7 Reporting

Reporting requirements relevant to the management of groundwater are identified in Table 9-2. Requirements and responsibilities for reporting are further described in Section 9.5 of the CEMP.

Accurate records will be maintained substantiating all construction activities associated with the Project or relevant to the CoA, including measures taken to implement this GWMMP. Records will be made available to IRPL, the ER, EPA and DPHI upon request, within the timeframe nominated in the request.

Table 9-2 Reporting requirements relevant to this plan

Item	Frequency	Standards	External reporting	Responsibility
Monthly Environmental Report	Monthly	Reporting as required by Inland Rail	N/A	JHG Environment and Sustainability Manager

Item	Frequency	Standards	External reporting	Responsibility
Incident and non-compliance reports	At each occurrence	Reporting of incidents and non-compliances in accordance with CoA, EPL, Pollution Incident Response Management Plan.	Appropriate authority dependant on nature of the incident (e.g. EPA, DPHI) (see further detail in the CEMP)	JHG Environment and Sustainability Manager
Complaint register	Daily (ER, EPA) as received DPHI as requested	Reporting of complaints, in accordance with the CoA, EPL through the complaints register, to the ER and EPA for any complaints received (on the day they are received). Communication, notification and complaints handling requirements regarding groundwater matters will be managed through the Complaints Management System.	ER (NSW CoA A27) EPA (in accordance with EPL conditions) DPHI (as requested by the Planning Secretary)	JHG Environment and Sustainability Manager JHG Stakeholder and Engagement Manager
EPL Annual Return	Annually	EPL Annual Return	EPA	JHG Environment and Sustainability Manager
Equipment calibration records	As required	Manufacturers specifications	-	JHG Environment and Sustainability Manager

9.8 Complaints Management

Section 7.6 of the CEMP details communication and complaints management processes and procedures. The Community Consultation Strategy (CCS) identifies key stakeholder groups that will be consulted and engaged with during the Project and outlines the communication tools that will be used to consult and engage with these groups. During construction, any comments, feedback or complaints relating to groundwater management issues will be addressed through the Complaints Management System. The Complaints Management System includes a complaints register within the stakeholder database.

10 Review and Improvement

10.1 Continuous improvement

Continuous improvement of this GWMMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives, and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

The Project Environment Manager (or delegate) is responsible for ensuring stage-specific environmental risks are identified and included in the Project risk register and appropriate mitigation measures implemented throughout the construction, as part of the continuous improvement process. The process for ongoing risk identification and management during construction is outlined in the CEMP

10.2 GWMMP update and amendment

The processes described in the CEMP may result in the need to update or revise this Plan. Only the JHG Environment and Sustainability Manager (or delegate) has the authority to approve changes to the requirements of this GWMMP. Minor amendments to the GWMMP may be approved by the ER (at Plannings discretion) in accordance with the CEMP and are to be implemented for the duration of construction and for any longer period set out in the monitoring programs or specified by the Planning Secretary, whichever is the greater. Amendments not considered minor by the ER require approval by the Planning Secretary.

A copy of the updated GWMMP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure detailed in the CEMP.