Compliance Report

Ensham Life of Mine Extension Project
EPBC 2020/8669

30 June 2023 – 30 June 2024

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1.0 Document Details

Document Title: Compliance Report: Ensham Life of Mine Extension Project – EPBC 2020/8669 – 2023/2024

File Name: Compliance Report - 2023.2024 - Ensham Life of Mine Extension Project, Queensland (EPBC 2020.8669)

1.1 Document status and review

Table 1 – Document Authorisation

Edition	Comments	Author/s	Authorised by	Date
V1	Original document.	Alana Connolly Tayla Carins	Matthew Lumb 1B64FD5EE34FC85FA373BCE86499ACCD readysign	**28/08/2024**

2.0 Introduction

Ensham Mine is located about 40 kilometres east of Emerald, near the township of Comet in Central Queensland. Ensham Mine is an underground bord and pillar coal mine extracting quality thermal coal from the Aries/Castor seams. Whilst originally commencing operations as an open cut coal mine in 1993, Ensham's mining operations are now solely underground with the surface operations being focussed on the rehabilitation of the historical mine pits and disturbance. Producing around 5 million tonnes per annum, Ensham's coal is railed to the Port of Gladstone and sold to various domestic and international customers.

3.0 Purpose of this report

In accordance with Condition 26 of EPBC Act Approval 2020/8669, the approval holder must prepare a compliance report for each 12-month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the minister. This compliance report has been prepared in accordance with the *Annual Compliance Report Guidelines,* Commonwealth of Australia 2014 – as required by EPBC 2020/8669 Condition 27.

4.0 Description of Activities

Table 2 – Project Description

Item	Description
EPBC Number	EPBC 2020/8669
Project Name	Ensham Life of Mine Extension Project
Approval Holder and ACN*	Bligh Coal Limited ACN: 010 186 393 Idemitsu Australia Pty Ltd ACN: 010 236 272 Bowen Investment (Australia) Pty Ltd ACN: 002 806 831
Approved Action	To extend the operation of the underground board and pillar working of Ensham Mine and to decommission the coal mine, located approximately 35 km east of Emerald in Queensland.
Location of the Project	Emerald, Queensland.
Report Author	See Declaration of Accuracy (Section 1.0).
Reporting Period	30 June 2023 to 30 June 2024
Date of Report	28 August 2024

**Transfer of Approval Holder is progress with the department to transfer to Sungela Pty Ltd (ACN: 665 234 739) and Bowen Investment (Australia) Pty Ltd (ACN: 002 806 831).*

5.0 Definitions

Table 1 provides details of the status of compliance with the conditions of the EPBC Act approval notice (EPBC 2020/8669). The following designations have been used to record findings in this compliance report:

Table 3 - Compliance Definitions

Status	Description
Compliant	'Compliance' is achieved when all the requirements of a condition have been met, including the implementation of management plans or other measures required by those conditions.
Non-compliant	A designation of 'non-compliance' should be given where the requirements of a condition or elements of a condition, including the implementation of management plans and other measures, have not been met.
Not applicable	A designation of 'not applicable 'should be given where the requirements of a condition or elements of a condition fall outside of the scope of the current reporting period. For example, a condition which applies to an activity that has not yet commenced.

These definitions are consistent with Section 3.7 of the Annual Compliance Report Guidelines.

6.0 EPBC Approval Conditions and Compliance Table

Table 4 - EPBC Approval Conditions and Compliance Table

Condition Number	Condition	Status	Evidence
Part A – Conditions specific to the Action			
Maximum Clearance Limits			
1	The approval holder must not **clear** outside of the **project area.**	Compliant	The approved action did not require nor undertake clearance outside of the project area.
2	The approval holder must not **clear** any habitat for **protected matters.**	Compliant	The approved action did not require, no undertake clearance of any habitat for protected matters.
Groundwater Dependent Ecosystems (GDEs)			
3	To minimise **harm** to **protected matters**, within 12 months of the date of this approval, the approval holder must submit to the **department**, for the **Minister's** written approval, a GDE Monitoring and Management Plan (GDEMMP). The approval holder must implement the approved GDEMMP from when it is approved until the expiry date of this approval.	Compliant	The approval holder developed the Groundwater Dependant Ecosystem Monitoring and Management Plan (GDEMMP), dated May 2024. The GDEMMP was submitted to the Minister via email on 27 June 2024. This Plan is pending approval. See Appendix A– Confirmation of Receival.
4	If the GDEMMP has not been approved by the Minister in writing within 15 months of this approval, and the Minister notifies the approval holder that the GDEMMP is not suitable for approval, the Minister may, at least two months after so notifying the approval holder, approve a version of the GDEMMP prepared or revised by the department. The	Not applicable	*Note only.*

	approval holder must implement the GDEMMP as approved by the Minister in writing, from when it is approved until the expiry date of this approval.		
5	The outcome of implementing the GDEMMP must be that all GDEs potentially impacted by the Action are identified and any impacts are avoided, mitigated or residual impacts are offset in accordance with the Environmental Offsets Policy. The GDEMMP must be consistent with the Environmental Management Plan Guidelines and include the following to the satisfaction of the Minister:	Compliant	The Groundwater Dependant Ecosystem Monitoring and Management Plan was developed consistent to the Environmental Management Plan Guidelines. There is no indication there are aquatic or terrestrial GDE's within the project area. See Appendix B – Groundwater Dependant Ecosystem Monitoring and Management Plan (GDEMMP), Section 3.
5 (a)	The details and results of a GDE field assessment of the project area.	Compliant	Three seasonal flora surveys were conducted in 2019 and 2020. Details and results of these surveys are detailed in Appendix XX, GDEMMP, Section 3.4.
5 (b)	If any riparian vegetation or Brigalow on alluvial plains within the project area is found to not be groundwater dependent, the evidence used to draw this conclusion.	Compliant	Riparian vegetation and Brigalow on alluvial plains in the project area is not found to be groundwater dependant. This conclusion and supporting evidence is summarised in Appendix B, GDEMMP, Section 3.5 and Section 3 (wholly), respectively.
5 (c)	If any riparian vegetation or Brigalow on alluvial plains is determined likely to be groundwater dependent, a description and map/s to clearly define the location and boundaries of GDEs and where they include habitat for protected matters.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant.

			No action required.
5 (d)	If any riparian vegetation or Brigalow on alluvial plains is determined likely to be groundwater dependent, the proposed methodology and timing for the monitoring and detection of any impacts to GDEs as a result of the Action, including collecting baseline data and specifying associated:	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
5 (d)i)	Trigger values that, if reached, the approval holder commits to investigate the cause of and take effective corrective actions to bring values below the trigger, and	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
5 (d)ii)	Limits that, if exceeded, the approval holder commits to provide environmental offsets to compensate for likely residual impacts to GDEs as a result of the Action in accordance with condition 9.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
5 (e)	Details of the investigations and corrective actions that will be taken if trigger values are reached.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
6	If, at any time during the period for which the approval has effect, the approval holder detects that any trigger value specified in the approved GDEMMP has been reached or any limit specified in the approved GDEMMP exceeded, the approval holder must notify the department in writing within 10 business days of the detection.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
7	Within 14 business days of detecting the reaching or exceeding of a trigger value or limit that must be notified under condition 6, the approval holder must commence an	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant.

	investigation to determine if the reaching of a trigger value or exceedance of a limit is a result of the Action.		*No action required.*
8	The approval holder must, within 60 business days of a detection that must be notified under condition 6, complete and submit to the department a report of the investigation required under condition 7. Unless evidence can be provided, to the Minister's satisfaction, that the reaching of a trigger value is not attributable to the Action, the approval holder must implement the corrective actions in accordance with the commitments made in the approved GDEMMP to halt and prevent further harm to protected matters.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
9	If a limit specified in the approved GDEMMP is exceeded the approval holder must, within 12 months from the detection of the exceedance, submit an Offset Management Plan to address residual harm to protected matters to the department for the Minister's written approval. The Offset Management Plan must be consistent with the Environmental Management Plan Guidelines and the Environmental Offsets Policy and contain the information and commitments specified in Attachment 4. The approval holder must implement the approved Offset Management Plan from when it is approved by the Minister in writing until the expiry date of this approval.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*
10	If an Offset Management Plan is required under condition 9 and an Offset Management Plan has not been approved by the Minister in writing within 4 months of its first submission to the department and the Minister notifies the approval holder that the Offset Management Plan is not suitable for approval, the Minister may, at least two months after so notifying the approval holder, approve a version of the Offset Management Plan prepared or revised by the department. The approval holder must implement the Offset Management Plan as approved by the Minister in writing.	Not applicable	No riparian vegetation or Brigalow on alluvial plains was found to be groundwater dependant. *No action required.*

Subsidence Monitoring and Management Plan (SMMP)			
11	To manage potential impacts on protected matters, the approval holder must, within 12 months of the date of this approval, submit to the department for the Minister's written approval a Subsidence Management and Monitoring Plan (SMMP) developed by a suitably qualified expert. The SMMP must reliably predict subsidence caused by the Action that may cause harm to protected matters arising from the Action. The SMMP must:	Compliant	To meet the requirements of this condition, the approval holder prepared the The approval holder developed a Subsidence Management Plan (SMP), dated 11 June 2024. The SMP was submitted to the Minister via email on 27 June 2024. This Plan is pending approval. See Appendix A – Confirmation of Receival.
11 (a)	Specify trigger values that will provide early warning of potential subsidence that may cause harm to protected matters.	Compliant	A subsidence trigger value of 500 mm has been selected for Ensham Mine. The literature review identified that Brigalow has not been impacted by subsidence movements up to 3m. See Appendix C, EIMP.06.00.06 Subsidence Management Plan (SMP), Section 5.2.1.
11 (b)	Specify a program and network of monitoring capable of prompt detection of any specified trigger value so as to prevent harm to protected matters.	Compliant	A Brigalow monitoring program, including a pre-activity baseline condition assessment and Brigalow TEC subsidence impact monitoring, was developed. See Appendix C, SMP, Section 5.3.
11 (c)	Specify procedures for prompt notification to the department and details of investigation that will be undertaken if	Compliant	The notification, investigation and reporting procedure is outlined in the SMP.

	monitoring detects a specified trigger value being reached or exceeded.		See Appendix C, SMP, Section 5.4.
11 (d)	Specify corrective actions to be undertaken to stop the cause of the trigger value being reached or exceeded and bring values under the trigger level.	Compliant	Specified in the SMP are corrective actions and management measures for: Routine operations; Trigger exceedance, no TEC impacted; Trigger exceedance, TEC impacted; and Non-routine situations. See Appendix C, SMP, Section 5.5.
11 (e)	Specify procedures to determine the potential extent and severity of actual and potential harm to protected matters.	Compliant	Monitoring methods and procedures used to identify impacts to the Brigalow TEC are described in the SMP. See Appendix C, SMP, Section 5.3.
11 (f)	Specify procedures to promptly report to the department the findings of investigations into the cause of any trigger value being reached or exceeded and the extent of any harm of subsidence on protected matters.	Compliant	The SMP addresses the process for notifying the Department upon exceedance of trigger thresholds and upon finalisation of any required investigations. See Appendix C, SMP, Section 5.4.1 & 5.4.2.
11 (g)	Specify procedures to promptly remediate harm to protected matters where this can reliably be achieved.	Compliant	Corrective actions are outlined in the SMP. See Appendix C, SMP, Section 5.5.
11 (h)	Make firm, clear commitments and specify procedures and timeframes to provide an offset consistent with the Environmental Offsets Policy for any harm to protected matters which has resulted from, or is likely to result from	Compliant	Ensham has committed to developing an Offset Management Plan within 12 months of a trigger threshold exceedance caused by mining activities. The

	subsidence including submitting an Offset Management Plan for the Minister's written approval, which contains the information and commitments specified in Attachment 4.		Offset Management Plan requirement is detailed further in the SMP. See Appendix C, SMP, Section 5.4.3.
11 (i)	Specify control measures for routine operations to minimise likelihood of harm to protected matters.	Compliant	The SMP details preventative actions to be incorporated into routine mining operations. See Appendix C, SMP, Section 5.5.1.
11 (j)	Specify contingency plans and emergency procedures for non-routine situations.	Compliant	The SMP details corrective actions to be taken during non-routine situations, inclusive of reporting. See Appendix C, SMP, Section 5.5.2.
11 (k)	Specify procedures for periodic review of environmental performance and continual improvement.	Compliant	The SMP is subject to review every 2 years at minimum, or as triggered by: Change to licence conditions and/or reporting requirements; Significant change to current mine plan/operations; or An investigation report recommendation. See Appendix C, SMP, Section 9
12	If the SMMP has not been approved by the Minister in writing within 16 months of this approval decision, and the Minister notifies the approval holder that the SSMP is not suitable for approval, the Minister may, at least two months after so notifying the approval holder, approve a version of the SMMP prepared or revised by the department. The approval holder must implement the approved SMMP as approved by the	Not applicable	*Note only.*

	Minister in writing from when it is approved until the expiry date of this approval.		
13	If an Offset Management Plan is required in accordance with the approved SMMP for any harm to protected matters which has resulted from, or is likely to result from, the Action but has not been approved by the Minister in writing within 4 months of when the submission of an Offset Management Plan is required in accordance with the approved SMMP, and the Minister notifies the approval holder that the Offset Management Plan is not suitable for approval, the Minister may, at least two months after so notifying the approval holder, approve a version of the Offset Management Plan prepared or revised by the department. The approval holder must implement the approved Offset Management Plan as approved by the Minister in writing, from when it is approved by the Minister in writing until the expiry date of this approval.	Not applicable	The approval holder has not triggered the requirement to develop or submit an Offset Management Plan during the reporting period. *Note only.*
Part B – Administrative conditions			
Revision of Action Management Plans			
14	The approval holder may, at any time, apply to the Minister for a variation to an action management plan approved by the Minister, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised action management plan (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management plan.	Not applicable	No managements plans were required to be varied or submitted during the reporting period.
Submission and Publication of Plans			
15	The approval holder must submit all plans required by these conditions electronically to the department.	Compliant	The GDEMMP required by Condition 3 and the SMP required by Condition 11 were submitted electronically to the department on 27 June 2024.

			See Appendix A– Confirmation of Receival.
16	Unless otherwise agreed to in writing by the Minister, the approval holder must publish each plan on the website within 15 business days of the date the plan is approved by the Minister in writing.	Not applicable	No plans were approved by the minister in the reporting period.
17	The approval holder must keep all published plans required by these conditions on the website until the expiry date of this approval.	Not applicable	No approved plans are currently published on the website.
18	The approval holder is required to exclude or redact sensitive ecological data from plans published on the website or otherwise provided to a member of the public. If sensitive ecological data is excluded or redacted from a plan, the approval holder must notify the department in writing what exclusions and redactions have been made in the version published on the website.	Not applicable	No approved plans are currently published on the website.
Notification of Date of Commencement of the Action			
19	The approval holder must notify the department electronically of the date of commencement of the Action, within 5 business days following commencement of the Action.	Compliant	The approved action commenced on 11 August 2023. The department was notified via email on 11 August 2023. See Appendix D– Notification of Commencement of the Action.
20	If the commencement of the Action does not occur within 5 years from the date of this approval, then the approval holder must not commence the Action without the prior written agreement of the Minister.	Not applicable	Commencement of the approved action occurred on 11 August 2023, 42 days from the date of the EPBC 2020/8669 approval was granted.

Compliance Records			
21	The approval holder must maintain accurate and complete compliance records	Compliant	All records relevant to this compliance report are stored within Ensham's internal file network or online data management platform.
22	If the department makes a request in writing, the approval holder must provide electronic copies of compliance records to the department within the timeframe specified in the request. Note: Compliance records may be subject to audit by the department, or by an independent auditor in accordance with section 458 of the EPBC Act, and/or be used to verify compliance with the conditions. Summaries of the results of an audit may be published on the department's website or through the general media	Not applicable	The department has not made a written request to the approval holder for provision of compliance records within the reporting period.
23	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Guidelines for biological survey and mapped data, Commonwealth of Australia 2018.	Not applicable	No monitoring, surveys or mapping were undertaken during the reporting period. *Note only.*
24	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Guide to providing maps and boundary data for EPBC Act projects, Commonwealth of Australia 2021, or as otherwise specified by the Minister in writing.	Not applicable	No monitoring, surveys or mapping were undertaken during the reporting period. *Note only.*
25	The approval holder must submit all monitoring data (including sensitive ecological data), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the department in accordance with the requirements of the relevant plan.	Not applicable	No monitoring, surveys or mapping were undertaken during the reporting period. *Note only.*

Annual Compliance Reporting			
26	The approval holder must prepare a compliance report for each 12-month period following the date of this approval decision, or as otherwise agreed to in writing by the Minister.	Compliant	This Compliance Report dated 28 August 2024 has been prepared for the 2023/24 reporting period.
27	Each compliance report must be consistent with the Annual Compliance Report Guidelines, Commonwealth of Australia 2014.	Compliant	This Compliance Report has been developed in accordance with the Annual Compliance Report Guidelines, Commonwealth of Australia 2014.
28	Each compliance report must include:		
28 (a)	Accurate and complete details of compliance and any non-compliance with the conditions and the plans, and any incidents.	Compliant	Refer to Section 6.0 of this report.
28 (b)	One or more shapefile showing all clearing of protected matters, and/or their habitat, undertaken within the 12-month period at the end of which that compliance report is prepared.	Compliant	No clearing of protected matter or their habitat occurred within the reporting period. No shapefiles have been provided.
28 (c)	A schedule of all plans in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.	Compliant	Refer to Section 1.0 of this report.
29	The approval holder must:		
29 (a)	Publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is required	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669. This report must be published by 29 August 2024. *Note only.*

29 (b)	Notify the department electronically, within 5 business days of the date of publication that a compliance report has been published on the website.	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669. No compliance reports were published within the reporting period. *Note only.*
29 (c)	Provide the weblink for the compliance report in the notification to the department	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669. No compliance reports were published within the reporting period. *Note only.*
29 (d)	Keep all published compliance reports required by these conditions on the website until the expiry date of this approval	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669. No compliance reports were published within the reporting period. *Note only.*
29 (e)	Exclude or redact sensitive ecological data from compliance reports published on the website or otherwise provided to a member of the public	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669. No compliance reports were published within the reporting period. *Note only.*
29 (f)	If sensitive ecological data is excluded or redacted from the published version, submit the full compliance report to the	Not applicable	This report is the first Annual Compliance Report required under EPBC Approval 2020/8669.

	department within 5 business days of its publication on the website and notify the department in writing what exclusions and redactions have been made in the version published on the website. Note: Compliance reports may be published on the department's website.		No compliance reports were published within the reporting period. *Note only.*
Reporting Non-Compliance			
30	The approval holder must notify the department electronically, within 2 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a plan.	Not applicable	No incidents, potential non-compliance or actual non-compliance occurred in the reporting period.
31	The approval holder must specify in the notification:		
31 (a)	Any condition or commitment made in a plan which has been or may have been breached.	Not applicable	*Note only.*
31 (b)	A short description of the incident and/or potential non-compliance and/or actual non-compliance.	Not applicable	*Note only.*
31 (c)	The location (including co-ordinates), date and time of the incident and/or potential non-compliance and/or actual non-compliance. Note: If the exact information cannot be provided, the approval holder must provide the best information available.	Not applicable	*Note only.*
32	The approval holder must provide to the department in writing, within 12 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance, the details of that incident and/or potential non-compliance and/or actual non-compliance with the conditions	Not applicable	*Note only.*

	or commitments made in a plan. The approval holder must specify:		
32 (a)	Any corrective action or investigation which the approval holder has already taken.	Not applicable	*Note only.*
32 (b)	The potential impacts of the incident and/or non-compliance.	Not applicable	*Note only.*
32 (c)	The method and timing of any corrective action that will be undertaken by the approval holder.	Not applicable	*Note only.*
Independent Audit			
33	The approval holder must ensure that an independent audit of compliance with the conditions is conducted for every five-year period following the commencement of the Action until this approval expires, unless otherwise specified in writing by the Minister.	Not applicable	*Note only.* The 5-year period for the independent audit is 11/08/2023 to 11/08/2028.
34	For each independent audit, the approval holder must:		
34 (a)	Provide the name and qualifications of the nominated independent auditor, the draft audit criteria, and proposed timeframe for submitting the audit report to the department prior to commencing the independent audit.	Not applicable	*Note only.*
34 (b)	Only commence the independent audit once the nominated independent auditor, audit criteria and timeframe for submitting the audit report have been approved in writing by the department.	Not applicable	*Note only.*
34 (c)	Submit the audit report to the department for approval within the timeframe specified and approved in writing by the department.	Not applicable	*Note only.*

34 (d)	Publish each audit report on the website within 15 business days of the date of the department's approval of the audit report.	Not applicable	*Note only.*
34 (e)	Keep every audit report published on the website until this approval expires.	Not applicable	*Note only.*
35	Each audit report must report for the five-year period preceding that audit report.	Not applicable	*Note only.*
36	Each audit report must be completed to the satisfaction of the Minister and be consistent with the Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines, Commonwealth of Australia 2019.	Not applicable	*Note only.*
Completion of the Action			
37	The approval holder must notify the department electronically 60 business days prior to the expiry date of this approval, that the approval is due to expire.	Not applicable	*Note only.* Notification must be submitted by 1 November 2045.
38	Within 20 business days after the completion of the Action, and, in any event, before this approval expires, the approval holder must notify the department electronically of the date of completion of the Action and provide completion data. The approval holder must submit any spatial data that comprises completion data as a shapefile.	Not applicable	*Note only.*

7.0 Correcting non-compliances

No non-compliances occurred within this reporting period.

8.0 New Environmental Risks

No new environmental risks have been identified during this reporting period.

9.0 Schedule of Plans

The below Schedule of Plans outlines all documents in existence relevant to this approval.

Name	Purpose	Version	Dated	Comments
Groundwater Dependent Ecosystem Monitoring and Management Plan (GDEMMP)	Comply with Condition 5. Identify all GDE's potentially impacted by the Action and manage impacts where required.	V1	30/05/2024	Submitted for ministerial approval on 27 June 2024 – not yet approved.
EIMP.06.00.06 Subsidence Management Plan (SMP)	Comply with Condition 11. Detail subsidence likely caused by the Action and specify trigger values and actions to prevent or mitigate harm to protected matters.	V6	27/06/2024	Submitted for ministerial approval on 27 June 2024 – not yet approved.

10.0 Declaration of accuracy

In making this declaration, I am aware that sections 490 and 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed 

Full name *(printed)* TAYLA CARINS

Position *(printed)* ENVIRONMENTAL SUPERINTENDENT

Organisation *(printed)* ENSHAM RESOURCES PTY LTD

ABN/ACN 23011048678

Date 28 / 08 / 2024

11.0 Appendices

Appendix A - Confirmation of Receival

Tayla Carins

From: Post Approval <PostApproval@dcceew.gov.au>
Sent: Monday, 1 July 2024 9:07 AM
To: Tayla Carins
Subject: RE: EPBC 2020/8669 - Ensham Resources - Management Plan Submission [SEC=OFFICIAL]

Categories: INX_InForm

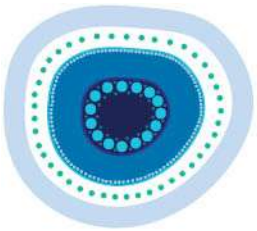
Hi Tayla,

Thank you for the submission of the GDEMMP and SMP for EPBC 2020/8669.

I have forwarded the plans to the Director of the Water Resources Regulatory Support section Derek Yates, who should be in contact soon.

Regards, Max.

Max Stratton
Environment Impact Assessment Officer
Nature Positive Regulation Division| Environment Assessments (Vic, Tas) and Post Approvals| Post Approvals Section
Ngunnawal Country, John Gorton Building, King Edward Terrace, Parkes ACT 2600 Australia, GPO Box 3090
Department of Climate Change, Energy, the Environment and Water
Contact: max.stratton@dcceew.gov.au
DCCEEW.gov.au | ABN 63 573 932 849



Acknowledgement of Country

Our department recognises the First Peoples of this nation and their ongoing connection to culture and country. We acknowledge Aboriginal and Torres Strait Islander Peoples as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, present and emerging.

From: Tayla Carins <tayla.Carins@ensham.com.au>
Sent: Thursday, June 27, 2024 6:21 PM
To: EPBC Monitoring <epbcmonitoring@dcceew.gov.au>; Post Approval <PostApproval@dcceew.gov.au>
Cc: Dave Meyers <Dave.Meyers@ensham.com.au>
Subject: EPBC 2020/8669 - Ensham Resources - Management Plan Submission

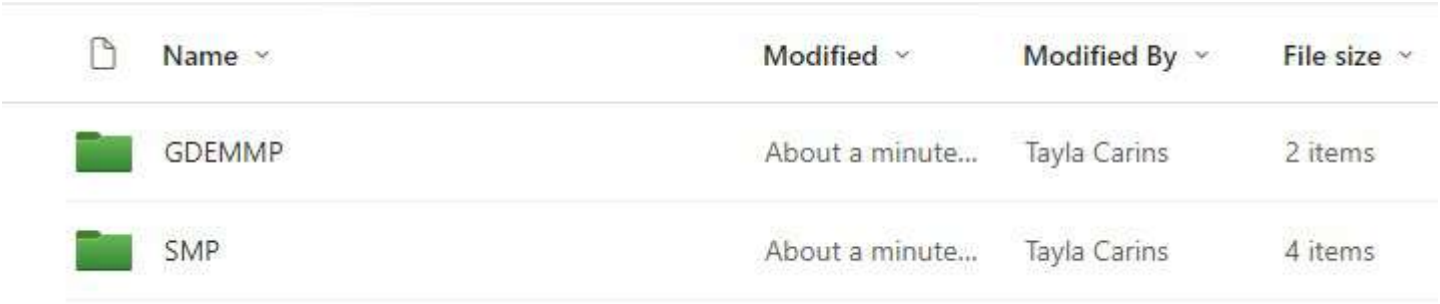
Good Afternoon,

As required by EPBC 2020/8669, Ensham are required to submit two Monitoring and Management Plans within 12 months of approval, due 30 June 2024.
Ensham have prepared the following plans for the Ministers review and approval:

Condition 3 - Groundwater Dependent Ecosystem Management and Monitoring Plan
Condition 11 - Subsidence Monitoring and Management Plan

The above plans, covering letters and supporting documents are attached in the following link.

Can the department please confirm successful receipt of the 6 submitted documents?



My contact details are below should you require any further information or assistance.

Best regards,

Ensham RESOURCES

Tayla** (Grant) **Carins
Environmental Superintendent
T: (07) 4987 3614
M: 0409 182 169
E: Tayla.Carins@ensham.com.au

of, or any reliance on, this email or attachments. If you have received this e-mail as part of a valid mailing list and no longer want to receive a message such as this one, advise the sender by return e-mail accordingly. This notice should not be deleted or altered ------

Appendix B - Groundwater Dependent Ecosystem Monitoring and Management Plan (GDEMMP)

Ensham Resources Pty Ltd

Groundwater Dependent Ecosystem Management and Monitoring Plan

Ensham Mine

May 2024

Question today
Imagine tomorrow
Create for the future

Groundwater Dependent Ecosystem Management and Monitoring Plan
Ensham Mine

Ensham Resources Pty Ltd

WSP
Level 12, 900 Ann Street
Fortitude Valley QLD 4006
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Brisbane QLD 4001

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Rev	Date	Details
A	02/05/2024	Draft for client review and comment
B	30/05/2024	Final

	Name	Date	Signature
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Reviewed by:	Rob Harrison	30/05/2024	
Approved by:	Rob Harrison	30/05/2024	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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1 Introduction

1.1 Background

Ensham Resources Pty Ltd (Ensham), has engaged suitably qualified ecologists to prepare this Groundwater Dependent Ecosystem Monitoring and Management Plan (GDEMMP) for Ensham Mine. The Ensham Mine is an open-cut and underground coal mine located approximately 35 kilometres east of Emerald, and it is proposed to extend underground operations into zones 1, 2 and 3 (Figure 1.1), which is the subject of an Environmental Authority Amendment application. The preparation of a GDEMMP and terrestrial Groundwater Dependent Ecosystem (GDE) monitoring methodology is in response to Condition 5 of the EPBC Approval (2020/8669) for the Ensham Life of Mine Extension (the Project).

Condition 5 of the EPBC Approval (2020/8669) outlines the following requirements for the GDEMMP and development and implementation of a potential terrestrial GDE monitoring program:

> *Condition 5:*
>
> *The outcome of implementing the GDEMMP must be that all GDEs potentially impacted by the Action are identified and any impacts are avoided, mitigated or residual impacts are offset in accordance with the Environmental Offsets Policy. The GDEMMP must be consistent with the Environmental Management Plan Guidelines and include the following to the satisfaction of the Minister:*
>
> *a) the details and results of a GDE field assessment of the project area.*
>
> *b) if any riparian vegetation or Brigalow on alluvial plains within the project area is found to not be groundwater dependent, the evidence used to draw this conclusion.*
>
> *c) if any riparian vegetation or Brigalow on alluvial plains is determined likely to be groundwater dependent, a description and map/s to clearly define the location and boundaries of GDEs and where they include habitat for protected matters.*
>
> *d) if any riparian vegetation or Brigalow on alluvial plains is determined likely to be groundwater dependent, the proposed methodology and timing for the monitoring and detection of any impacts to GDEs as a result of the Action, including collecting baseline data and specifying associated:*
>
> > *i) trigger values that, if reached, the approval holder commits to investigate the cause of and take effective corrective actions to bring values below the trigger, and*
> >
> > *ii) limits that, if exceeded, the approval holder commits to provide environmental offsets to compensate for likely residual impacts to GDEs as a result of the Action in accordance with condition 9.*
>
> *e) details of the investigations and corrective actions that will be taken if trigger values are reached.*

1.2 Study purpose

The purpose of the GDEMMP is to:

- Identify field verified regional ecosystems that may be potential GDEs dependant on the subsurface presence of groundwater (subsurface GDEs), within the modelled areas of potential groundwater drawdown associated with mining operations.
- Evaluate the potential groundwater drawdown impacts to threatened ecological communities (TECs) (e.g. Brigalow) listed as Matters of National Environmental Significance (MNES) under the EPBC Act, which may be potential GDEs.

1.3 Areas of investigation

The primary area of interest for assessment was 2,737 ha of land within three zones into which underground operations expansion is proposed, or has commenced:

- Zone 1 (proposed)
  - Lot A AP7202
  - Lot 2 CP911010
  - Lot 8 TT345
  - Lot 7 TT309
  - Lot 6 TT309
- Zone 2 (approved and commenced)
  - Lot 31 CP864573
  - Lot 32 RP908643
- Zone 3 (approved, not yet commenced)
  - Lot 30 CP864574
  - Lot 33 RP864576

The areas of investigation and assessment discussed within this report for the Project, include:

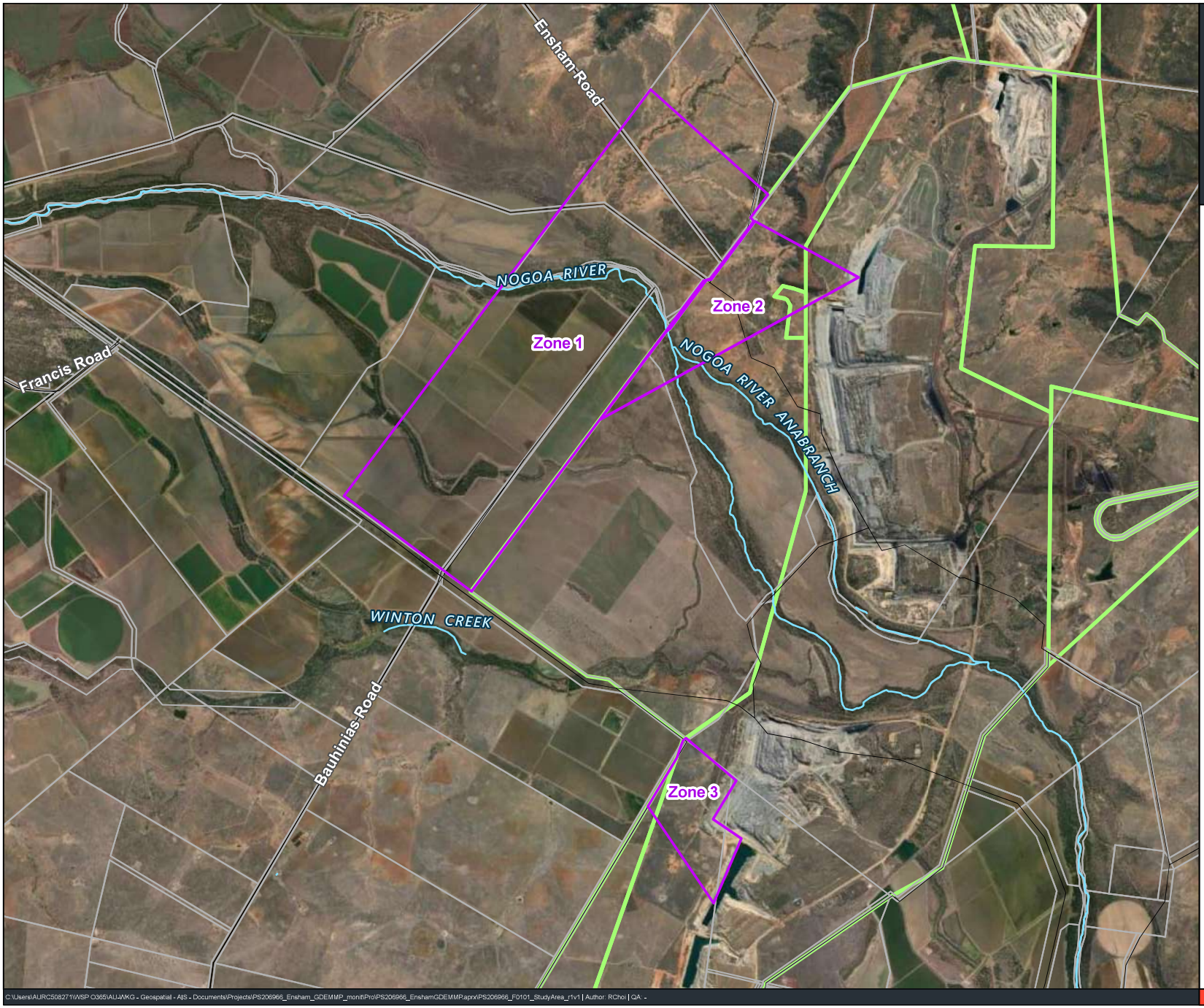
- *Mine Expansion Area* – the extent of the expansion (zone 1, 2 and 3).
- *Study Area* – the extent of the Mine Expansion Area and additional areas within the Ensham mining leases where flora and hydrological surveys have been conducted.
- *Locality* – the extent of 20 km radius of the Study Area.

The areas of investigation are illustrated in Figure 1.1.

1.4 Study limitations

The GDE study and assessment presented herein has involved a desktop assessment only, which has relied on publicly available information and data and reports prepared by various consultancies for Ensham. It assumes these sources of information contain correct and scientifically robust analytical information and data, to enable the assessment of potential impacts upon GDEs, which may or may not result from modelled groundwater drawdown.

This study has also evaluated the influence of water releases from Fairbairn Dam for the purpose of crop irrigation that occurs on agricultural land associated with an alluvial floodplain, which is immediately adjacent to mining operations, and how the irrigated water recharges the shallow alluvial aquifer within the Quaternary aged alluvium.



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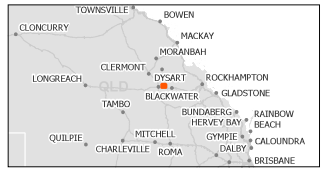
Ensham GDEMMP

Figure 1.1
Study Area

Legend

- Watercourse
- Roads
- Mine Expansion Area
- Mining Lease
- Land Parcels



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Data sources: DELWP, Geoscience Australia
World Imagery: Earthstar Geographics

2 Environmental context

2.1 Climate

Ensham is in the Central Highlands region of Queensland in the Brigalow Belt bioregion, which is characterised by hot summers and mild winters. Meteorological data is available from the Emerald airport station (35264; BoM, 2024) from 1992 to 2024, which is approximately 35 km southwest of Ensham.

The Emerald region typically experiences short, intense rainfall events that occur primarily from November to April (the wet season), with comparatively less precipitation during the dry season (May to October) (BoM, 2024; refer Figure 2.1Error! Reference source not found.). Mean annual rainfall between 1992 and 2024 was 558 mm, average dry season rainfall was 159 mm and average wet season rainfall was 380 mm.

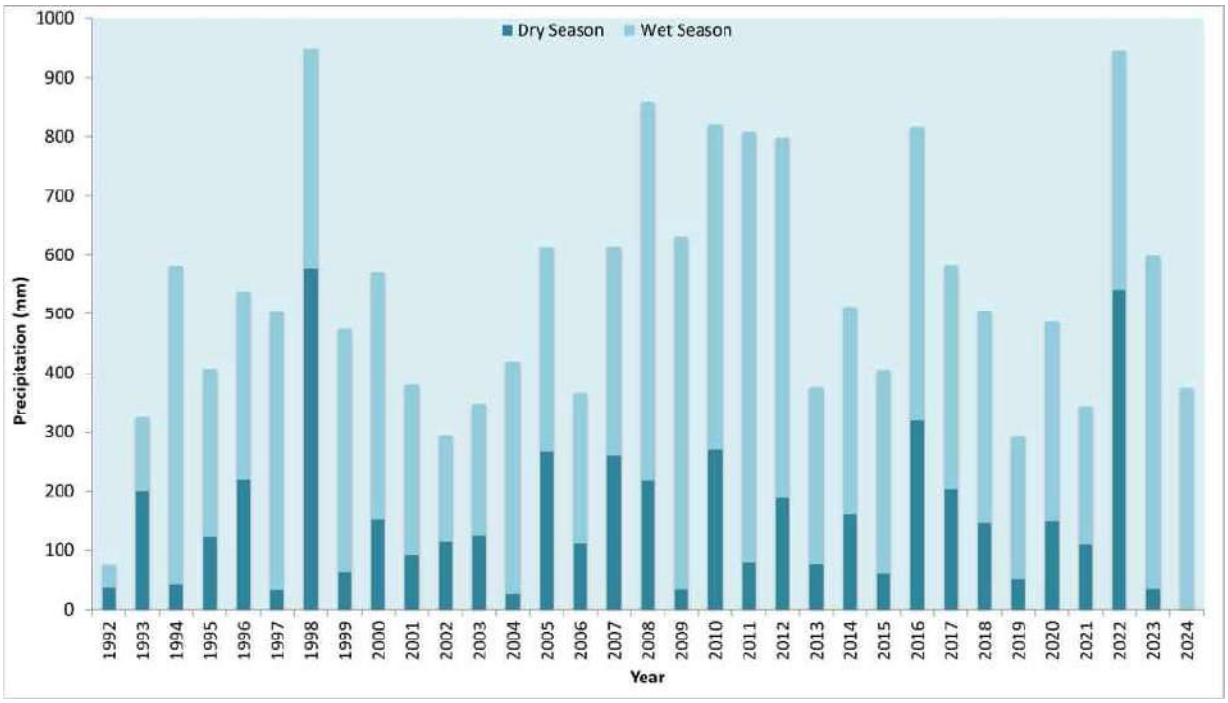


Figure 2.1 Annual precipitation (1992–2024) divided between wet and dry season records from the Emerald Airport weather station (BoM, 2024)

2.2 Geology

Geology features of the Study Area are described using the current Queensland Government online mapping resource (Queensland Globe, 2024).

The general landscape of Ensham is approximately 150 m above sea level (ASL) and characterised by gently undulating plains with some rocky hills with elevations up to 250 m. There are four separate surface geologies:

- The predominant surface geology in the Study Area is an alluvial flood plain with stratified units from the Quaternary, including clay, silt, sand and gravel.
- To the north of zone 1 and 2 there is stratified sedimentary rocks from the Eocene, with deeply weathered claystone, siltstone, sandstone, gravel, lignite, oil shale and interbedded basalt.

- There is a small section in the north-east corner of zone 2 with stratified ferricrete from the Tertiary which is characterised by duricrusted paleosols at the top of deep weathering profiles.
- In the centre of zone 1 and 2 there is a section of arenite-mudrock from the early/middle Triassic containing sandstones, mudstone and conglomerate.

2.3 Hydrogeological setting

There are two groundwater bearing units within the Study Area, the Quaternary aged alluvium, and the Permian aged Rangal Coal Measures, which are separated by a low permeability unit, the Rewan Group (SLR, 2024).

The Quaternary aged alluvium groundwater aquifer level is shallow (on average 13.8 m below ground level) and is comprised of sequences of less permeable clay, silt, and sand, underlain by more permeable sand and gravel (SLR, 2022a). It is likely the less permeable layers isolate the alluvium from the Nogoa River. The shallow alluvial aquifer is highly saline and unsuitable for stock watering and irrigation, which also indicates the aquifer is not connected to the Nogoa River, which has freshwater (discussed further in Section 3.2 and 3.3). The shallow alluvial aquifer has low water levels and may not be continuously saturated and rather form lenses of highly saline, stagnant water, as indicated by periodically dry bores.

2.4 Receiving waters

Watercourse features of the Study Area are described using the current Queensland Government online mapping resource (Queensland Globe, 2024).

The Nogoa River is a stream order 8 major watercourse that transects the Study Area, flowing from west to east, and continues south-east for approximately 20 km before its confluence with the Comet River to form the Mackenzie River. The Nogoa River briefly splits into two river channels within the Study Area before re-converging again into the one. The main channel flows the southern route. There are several ephemeral watercourses, including Mosquito Creek, stream order 4, which originates beyond the north-western boundary of zone 1 and flows into the Nogoa River in zone 1, and several small unnamed watercourses that drain to Mosquito Creek and the Nogoa River.

The Nogoa River is naturally ephemeral yet is anthropogenically managed for consistent low flow through releases from Fairbairn Dam, located ~60 km from the Study Area, for stock watering and agricultural crop irrigation.

2.5 Connectivity

Connectivity has been assessed using the Biodiversity Planning Assessment using Queensland Government online mapping resource (Queensland Spatial, 2024).

The Project Footprint contains 537.9 ha of state significant habitat and 164.8 ha of regionally significant habitat, which are predominantly along watercourses and represented by remnant vegetation. The watercourses and fringing vegetation provide habitat and a functional riparian wildlife corridor for the movement and dispersal of aquatic and terrestrial fauna species. It provides a safe refuge for and maintains genetic flow and diversity, which is particularly important for threatened fauna species. The waterway and transient fauna also enable the dispersal of flora seeds and pollen. The state and regionally significant habitats are connected to large tracts of state significant habitat that continues northward of the Project footprint.

2.6 Land use

Land use of the locality is described using the current Queensland Government online mapping resource (Queensland Globe, 2024).

The majority of the Study Area and the locality has been historically cleared for grazing and agricultural crop production, which has been occurring prior to the mine development and continues to currently occur.

2.7 Groundwater dependent ecosystems

Groundwater dependant ecosystems are defined as aquatic and terrestrial ecosystems reliant on groundwater for some, or all of their water requirements to survive, which can be influenced by variations in groundwater level and groundwater water quality. Groundwater dependant ecosystems are classified into three broad types (DESI, 2013):

1. Aquatic / surface expression GDEs: aquatic ecosystems dependent on the subsurface presence of groundwater.
2. Terrestrial GDEs: terrestrial ecosystems dependent on the subsurface expression of groundwater from shallow aquifers.
3. Subterranean GDEs: aquatic ecosystems within deeper aquifer and cave ecosystems.

Aquatic and terrestrial GDE's (low confidence) have been mapped within the Mine Expansion Area (Queensland Spatial, 2024).

Groundwater dependant ecosystems rely on groundwater presence to sustain their functionality and composition (Foster et al. 2005 and Murray et al. 2003). Alterations in groundwater levels can induce noticeable changes in GDEs, as evidenced through observable shifts in vegetation. These alterations include stunted or absent growth and dieback due to limited availability of water for transpiration and limit the effective recruitment of seedlings from adult trees.

Predicting the impacts of groundwater drawdown on vegetation communities is difficult as the critical groundwater depth threshold is unknown, as too the depth of roots of flora species that can be groundwater dependant (e.g. *Eucalyptus camaldulensis* and *E. tereticornis*). Ecological responses may exhibit either linear patterns, wherein a tree's health deteriorates proportionally with changes in groundwater depth, or threshold responses, where tree health remains relatively stable until groundwater depth plunges below the critical threshold (Kath et al., 2014).

The response to drawdown is likely contingent upon tree size, with younger trees possessing shallow roots exhibiting distinct requirements, thresholds, and responses compared to larger trees (Kath et al., 2014). Smaller trees typically have less interactions with groundwater and may not exhibit discernible responses to dewatering.

In regions characterised by highly intermittent watercourse flows, groundwater serves a vital water source for groundwater dependent species and vegetation. Consequently, the structure of riparian vegetation communities along ephemeral watercourses may be attributed to, or at least partly dependent upon, groundwater for long-term survival and persistence.

3 Desktop findings

3.1 Literature review

The following reports have been prepared for Ensham to support approval applications in relation to the Project and have been reviewed as part of the desktop assessment:

- Ensham Groundwater Monitoring – Groundwater Monitoring and Management Plan Report (SLR, 2024) (Appendix A)
- Ensham Life of Mine Extension Project – Zone 1: Groundwater Impact Assessment (SLR, 2022a) (Appendix B)
- Ensham Life of Mine Extension Project – Zones 2 and 3: Groundwater Impact Assessment (SLR, 2022b) (Appendix C)
- Ensham Life of Mine Extension Project: Flora Technical Report (AECOM, 2020) (Appendix D).

3.2 Groundwater Monitoring and Management Plan Report (SLR, 2024)

The Groundwater Monitoring and Management Plan (GMMP) was prepared to satisfy groundwater management conditions I14 and I15 from Environmental Authority (EA) EPML00732813 for Ensham Mine. A conceptual hydrological model described within the report represents the current understanding of the groundwater environment at Ensham Mine.

A progressive groundwater monitoring network has been progressively installed at Ensham since the 1990's. The bore network comprises 39 bores located within Ensham and adjacent agricultural land, and they include alluvial, inactive, private landholder (agriculture), regional and residual void monitoring bores. As the potential GDE's occur above the Quaternary aged alluvium (land zone 3, see section 3.4.1) associated with the Nogoa River floodplain, only the Nogoa River Alluvium bores have been interrogated by this GDE assessment (Table 3.1 and Figure 3.1).

Table 3.1 Alluvial monitoring bores for Ensham

Bore name	Longitude	Latitude	Within predicted groundwater drawdown impact zones for the relevant shallow alluvial aquifers
13020166	148.326758	-23.440642	No
13020169	148.451700	-23.439110	No
13020173	148.429450	-23.466970	No
EC01	148.468940	-23.475640	No
EC03	148.472130	-23.480240	No
EC07	148.478420	-23.487410	No
EC09A	148.482180	-23.489560	Yes
EC11	148.483800	-23.492360	Yes
EC13	148.483850	-23.496120	Yes
EC14	148.485420	-23.497210	Yes
EC24	148.46562	-23.45621	No

Bore name	Longitude	Latitude	Within predicted groundwater drawdown impact zones for the relevant shallow alluvial aquifers
EC25	148.50678	-23.48696	No
Field 5	148.50532	-23.51853	Yes
GW01	148.507470	-23.499080	Yes
RB7a	148.447320	-23.437070	No
Twin (Bore 5)	148.38392	-23.48989	No

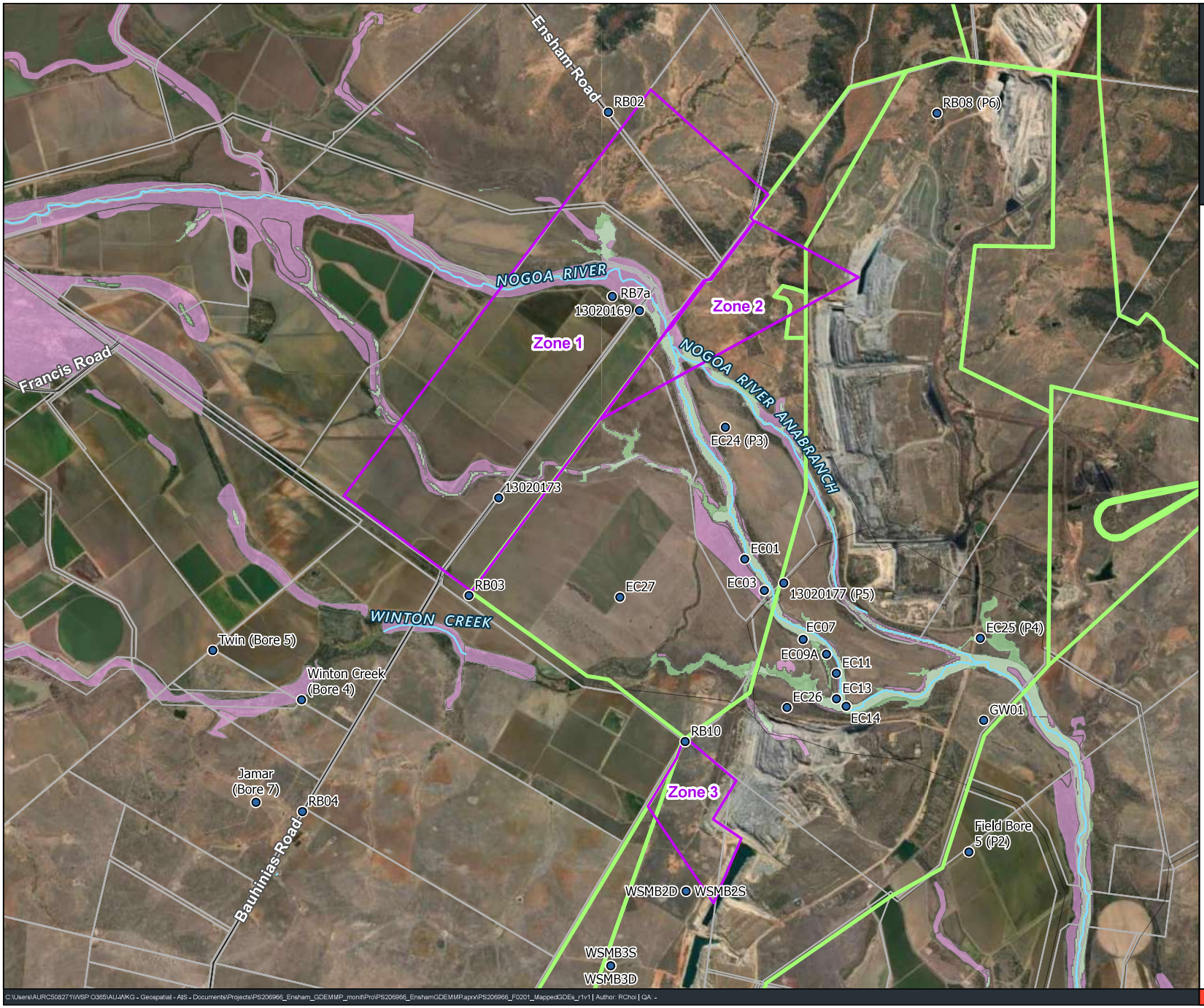
3.2.1 Groundwater levels

The GMMP separates the Nogoa River alluvium bores into two categories:

- Western bores: 13020166, 13020169, 13020173, RB7a, and basal alluvium Twin (Bore 5). These are in the western section and are the most upstream monitoring points in the groundwater monitoring network. Water levels here range between 155 and 146 m AHD (Australian Height Datum).
- Eastern bores: EC01, EC03, EC07, EC09a, EC11, EC13, EC14, GW01, GW01, EC24, EC25, and Field 5. These are in the eastern section of the groundwater monitoring network, which is primarily within the central area of mining operations. Water levels here range between 145 and 136 m AHD.

On average, the alluvium groundwater level is 13.8 m below ground surface level.

Cumulative rainfall departure (CRD) reflects rainfall trends and is a parameter used to assess the nature of groundwater level changes. Positive gradients indicate wetter than normal climatic conditions, and conversely, negative gradients indicate drier than normal climatic conditions.



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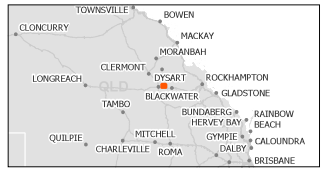
Ensham GDEMMP

Figure 3.1 Location of bores and mapped GDE's

Legend

- Bores
- Watercourse
- Roads
- Mine Expansion Area
- Mining Lease
- Land Parcels
- Derived Surfacre GDE - low confidence
- Derived Terrestrial GDE - low confidence



Coordinate system: GDA 1994 MGA Zone 55
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1:60,000 Date: 18/04/2024

Data sources: DELWP, Geoscience Australia
World Imagery: Earthstar Geographics

3.2.1.1 Western bores

One of the western groundwater monitoring bores, the Twin bore site, is approximately 7 km west of the mine and has the highest groundwater levels of the alluvial aquifer. Between 2006 and 2018 groundwater levels increased, regardless of climatic trends (Figure 3.2), which is theorised to be due to agricultural irrigation recharging the shallow alluvial aquifer. Since 2018 groundwater levels have been in line with general climatic trends and are trending towards baseline conditions, which may reflect a reduction of recharge related to decreased irrigation, more so than climatic rainfall variables.

Figure 3.2 Hydrograph for Twin (bore 5), the upstream basal alluvium bore (SLR, 2024)

Water level for the other western bores largely reflect climatic trends (Figure 3.3). The groundwater level at these bores has been relatively stable, with a strong correlation between groundwater levels and CRD, as demonstrated through increasing water levels in response to wetter than average climatic conditions over the 2022/2023 cusp, and subsequent decline as the wetter weather decreased.

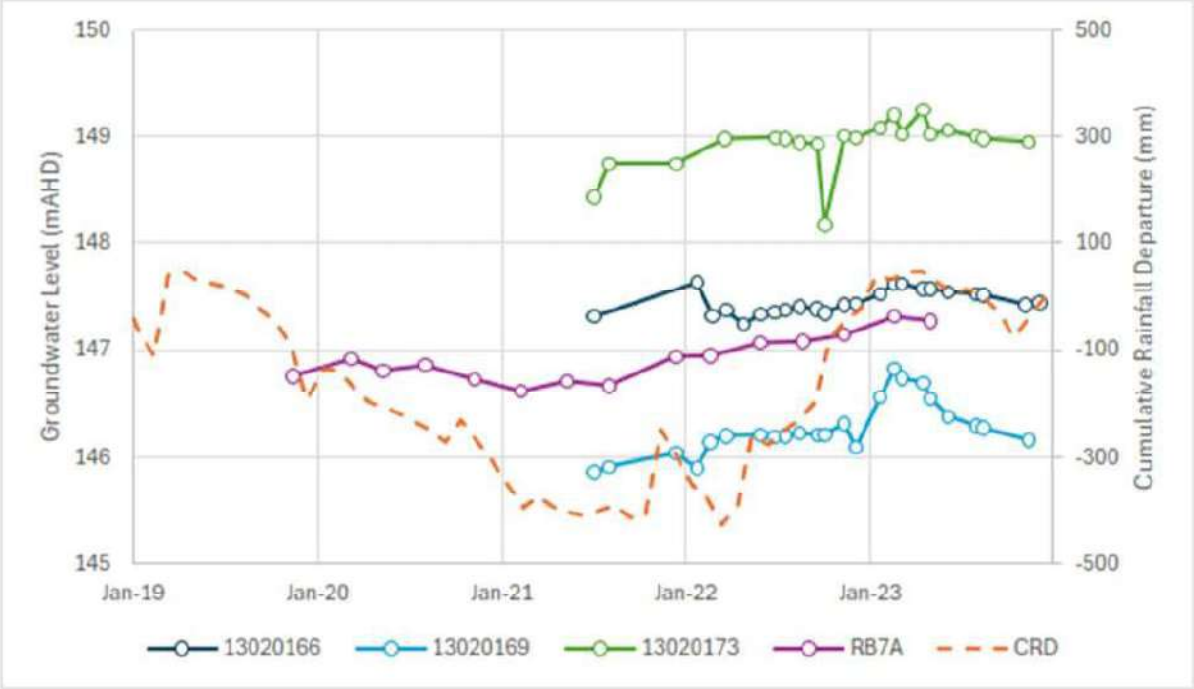

Figure 3.3 Hydrograph of western, upstream Nogoa River alluvial bores (SLR, 2024)

3.2.1.2 Eastern bores

In the eastern section of the alluvial monitoring network, the eastern monitoring bores are situated downstream and at lower elevations within the catchment area. These alluvial bores include the EC monitoring bore series, as well as the GW01 and Field 5 bore. The EC monitoring bore series is positioned near the Nogoa River and its anabranch, typically where the Rangal Coal measures sub-crops into the overlying alluvium. Meanwhile, the GW01 and Field 5 bores are situated further downstream, to the east of the sub-crop and current mining operations.

Hydrographs depicted in Figure 3.4 illustrate the water levels recorded in the eastern monitoring bores. Similar to the western boreholes, these downstream bores exhibit some sensitivity to climatic variations, with trends in CRD closely correlated with groundwater levels prior to 2011. However, most boreholes have remained relatively stable despite prolonged periods of drier-than-average conditions.

The potential impact of mining activities, if any, may have been obscured by a significant rainfall event at the onset of 2011, causing a sharp increase in water levels across the alluvium monitoring bore network. Subsequent monitoring efforts have revealed no discernible influence of mining extraction since then. Although water levels initially returned to near baseline levels following the flooding event, they continued to remain elevated despite the prevailing drier climatic conditions from 2014 to 2019. The persistent groundwater level during a prolonged dry period can likely be attributed to crop irrigation associated with agricultural land use.

The rising water levels within the EC monitoring bore series have been attributed to upstream irrigation, particularly in proximity to EC01 and EC03, with bores closest to the irrigation area experiencing the most substantial increase in water level over time. Monitoring bores farther from this recharge area demonstrate a greater response to climatic influences, particularly evident during the significant rainfall events of early 2022.

The lack of groundwater level decline amidst generally drier climatic conditions, coupled with the commencement and advancement of mining operations, indicates hydraulic disconnect or impediment between the Nogoa River Alluvium and the Rangal Coal Measures. Notably, no groundwater level drawdown attributable to mining activities has been observed in the alluvium. Instead, it is evident that increases to groundwater levels, which are inconsistent with CRD and

prevailing climatic conditions (rainfall) and modelled groundwater drawdown from mining operations, can be attributed to crop irrigation practices recharging the shallow alluvial aquifer.

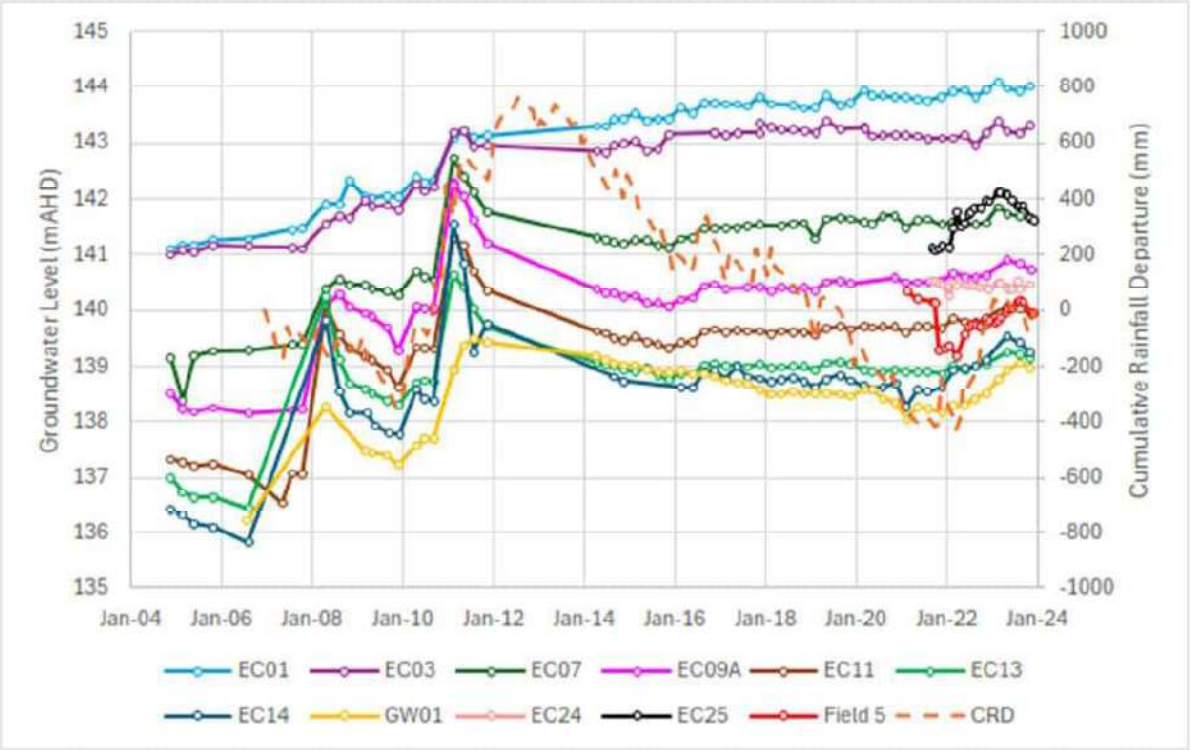

Figure 3.4 Hydrograph of eastern alluvial bores (SLR, 2024)

3.2.2 Drawdown mapping

No drawdown of groundwater has been observed in the alluvium.

3.2.3 Groundwater quality

The groundwater quality of the shallow alluvial aquifer is moderately to highly saline, with neutral to moderately alkaline pH and sodium-chloride water. The high rainfall and flooding events during 2011 resulted in increased salinity in the alluvial aquifer system due to the flushing of precipitated salts, which is now declining to baseline levels for most monitoring bores. However, at monitoring bore 13020166 there is a trend of increasing electrical conductivity, and as this is upstream of Ensham it can most likely be attributed to influences associated with agricultural crop irrigation.

Monitoring bores 13020169, GW01 and EC07 exhibit an upward trending pH, which is correlated with decreasing EC trends at these locations, likely due to calcite precipitation. These chemical trends are not considered related to mining operations as they are located upstream of mining and are likely to be due to both natural processes and influences beyond the Study Area.

Additional interaction with agricultural activities (irrigation) is evidenced by the substantial influx of high bicarbonate and low pH recharge originating from agricultural runoff and infiltration into the shallow alluvial aquifer, both within and outside the monitoring area.

3.2.4 Aquifer connection

The Nogoa River is partially isolated from the shallow alluvial aquifer, due to shallow silts and clays which divide the surface water areas from the basal gravel layers that comprise the lower areas of the groundwater aquifer. Groundwater

and surface water interactions may only occur during periods of intense irrigation, when the basal clay is absent, or the basal sands are exposed within the river. This is further supported by the differences in salinity and groundwater level observations, which specifically demonstrate no correlation between groundwater level and distance to the Nogoa River.

Figure 3.5 illustrates a conceptual cross section of the alluvium and underlying rock mass.

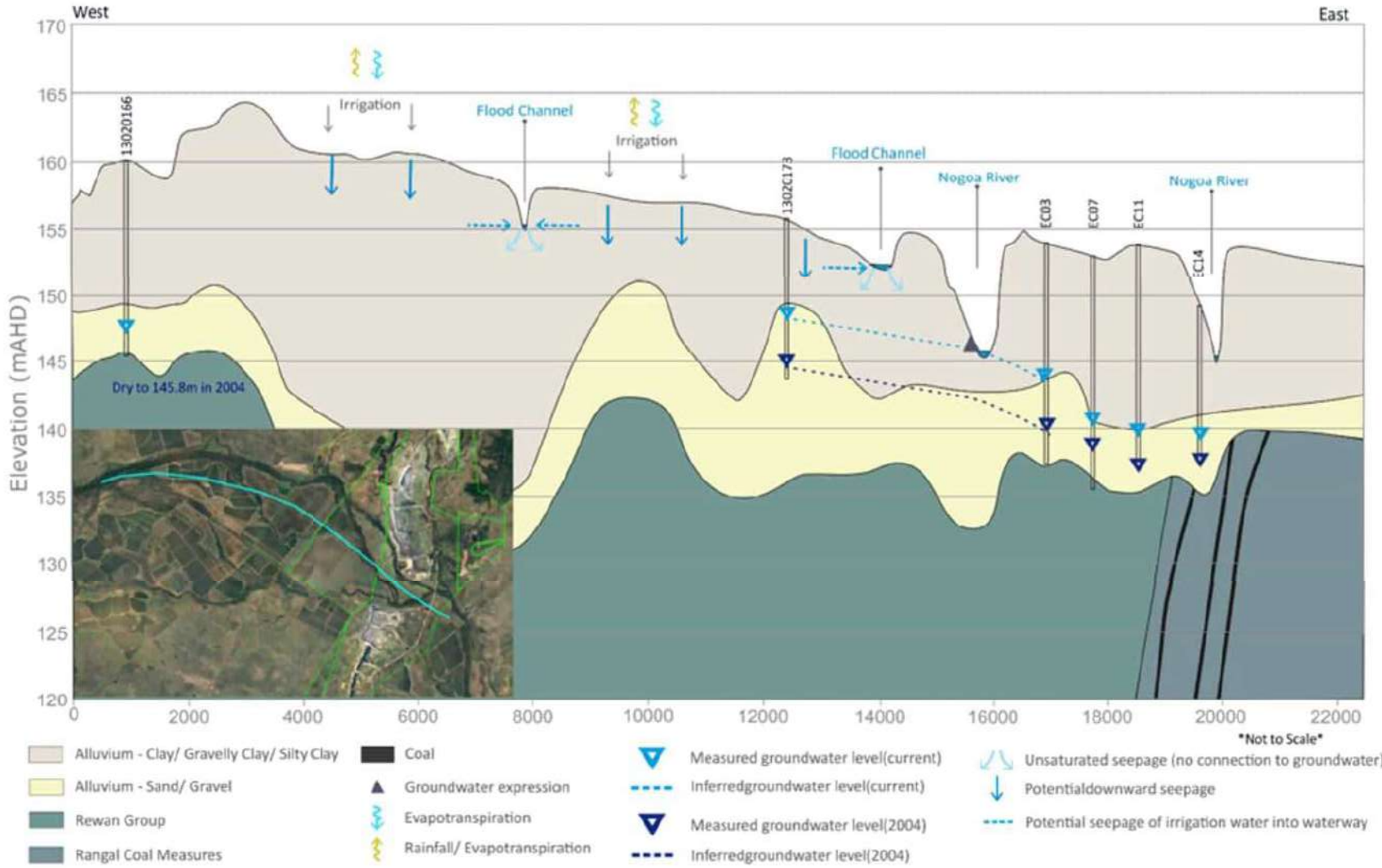

Figure 3.5 Conceptual cross section through Nogoa River alluvium and Quaternary sediments (SLR, 2024)

3.3 Zone 1: Groundwater Impact Assessment (SLR, 2022a) and Zones 2 and 3: Groundwater Impact Assessment (SLR, 2022b)

These two reports are essentially the same, as assessment of Zone 1 and Zone 2 utilise the same groundwater monitoring bores and were developed to assess potential impacts upon groundwater associated with the mine development (potential groundwater drawdown) and are thus combined herein.

3.3.1 Groundwater levels, flow, recharge and discharge

This section discussed the hydrogeological unit pertinent to the Project, describing groundwater hydrology (including groundwater occurrence, hydraulic gradients, recharge, and discharge), hydraulic characteristics, groundwater quality, and groundwater utilization and administration.

3.3.1.1 Upstream bores

This assessment incorporated analysis of monitoring bores upstream of the Study Area, operated by the Queensland Government. These bores were deemed to represent the natural interaction of the Nogoa River floodplain's alluvial aquifer and the Nogoa River, particularly prior to 2000 when there was an absence of agricultural and mining activities in the area.

The upstream bores exhibited a general disconnect to three flood events that happened prior to 2000, and the bore closest to the river, 13020163, remained dry for that period (Figure 3.6). The bore second closest to the river, 13020164 has only exhibited a response to flooding once, to the major flood in 2008 where the water level rose by approximately one metre. Monitoring for many bores ceased in 2008, with one more round occurring in 2018. During this period the water level at all bores had increased two metres, except for 13020164 which increased by four metres. These increases are likely due to agricultural irrigation commencing and continuing.

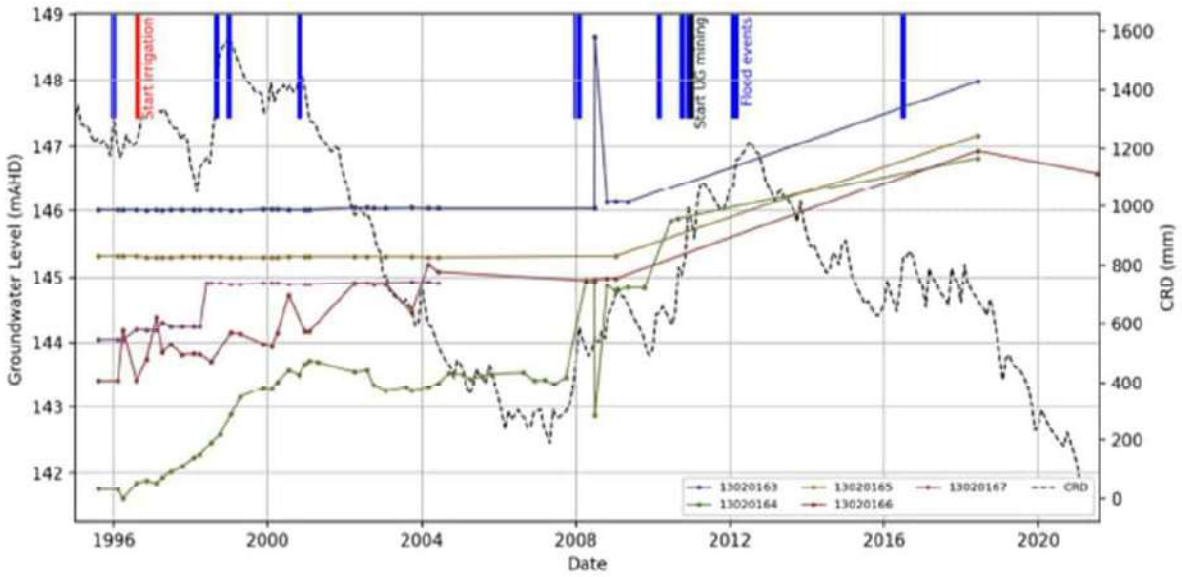

Figure 3.6 Hydrographs for upstream bores (SLR, 2022a)

3.3.1.2 Zone 1 and 2 bores

The monitoring bore closest to the river, 13020169, did not exhibit a response to periods of high rainfall, in 1996, 1998 and 1999 (Figure 3.7). There was a minor response observed from the 2008 flood event, with water level rising by approximately 0.5 m. However, this response aligns with the overall upward trend witnessed across all monitoring boreholes.

This trend commenced around 2000, coinciding with a period of severe drought and an absence of flood events, as indicated by rainfall monitoring data. Since 1996, water levels in these bores have risen by approximately five to six meters, exceeding those recorded in upstream boreholes by up to four meters. Groundwater measurements taken from 2021 onwards in accessible monitoring bores indicate a sustained and continually upward trend. With no other identified sources that could have influenced groundwater during this period, it was concluded that irrigation activities were responsible for the increased water levels in the shallow alluvial aquifer associated with the Nogoa River's alluvium deposits.

An additional observation is that groundwater levels tend to be higher farther away from the Nogoa River, suggesting a gradient towards the river. Typically, if the river were the primary source of groundwater, groundwater levels would be expected to be higher closer to the river.

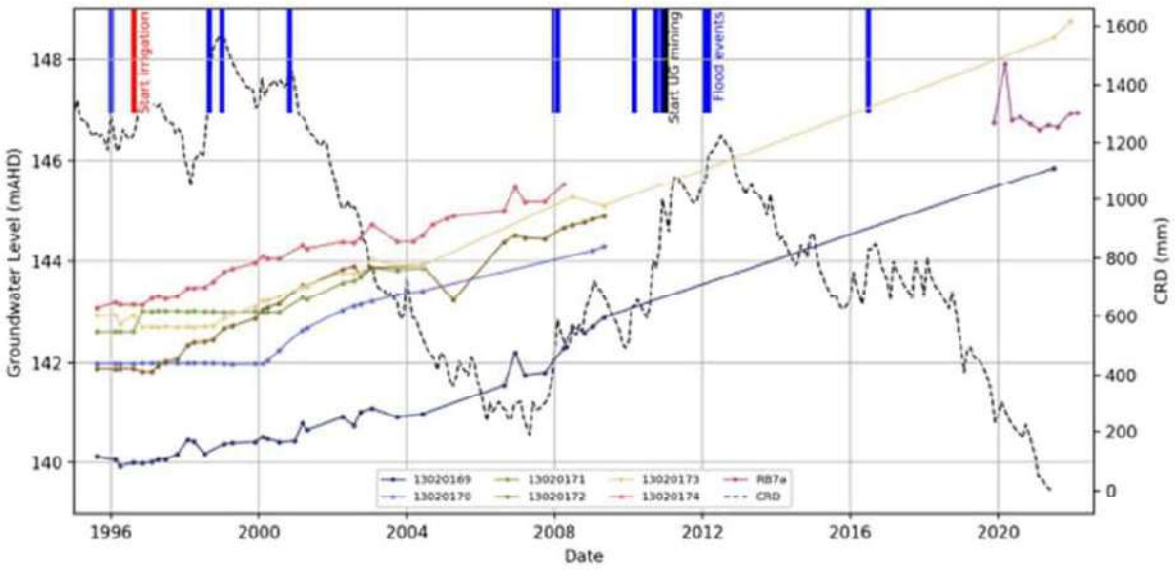

Figure 3.7 Hydrograph of bores near/in Zone 1 and 2 (SLR, 2022a)

3.3.1.3 EC monitoring bore series

The EC monitoring bore series is situated within the Nogoa River alluvium, near or within the sub-crop of the Rangal Coal measures. Unlike the bores discussed above, the EC monitoring bore series exhibit a distinct response to flooding and climate conditions (Figure 3.8). Specifically, bores EC07 to EC14 respond to flooding in the Nogoa River and/or rainfall, as evidenced by the CRD data. Over time, water levels in these bores show a decreasing trend, which contrasts with the constantly increasing trend observed in bores EC01 and EC03. Bores EC01 and EC03, which are closest to the irrigation area, do not display a decrease in water levels over time. It has been interpreted that the upstream rise in alluvial groundwater levels has moved towards EC01 and EC03, indicating that agricultural irrigation influences the groundwater levels within the shallow alluvial aquifer, via recharging the aquifer with water releases from Fairbairn Dam.

No EC monitoring bores showed a response to the commencement of underground mining, whereby groundwater drawdown from mining could be evidenced.

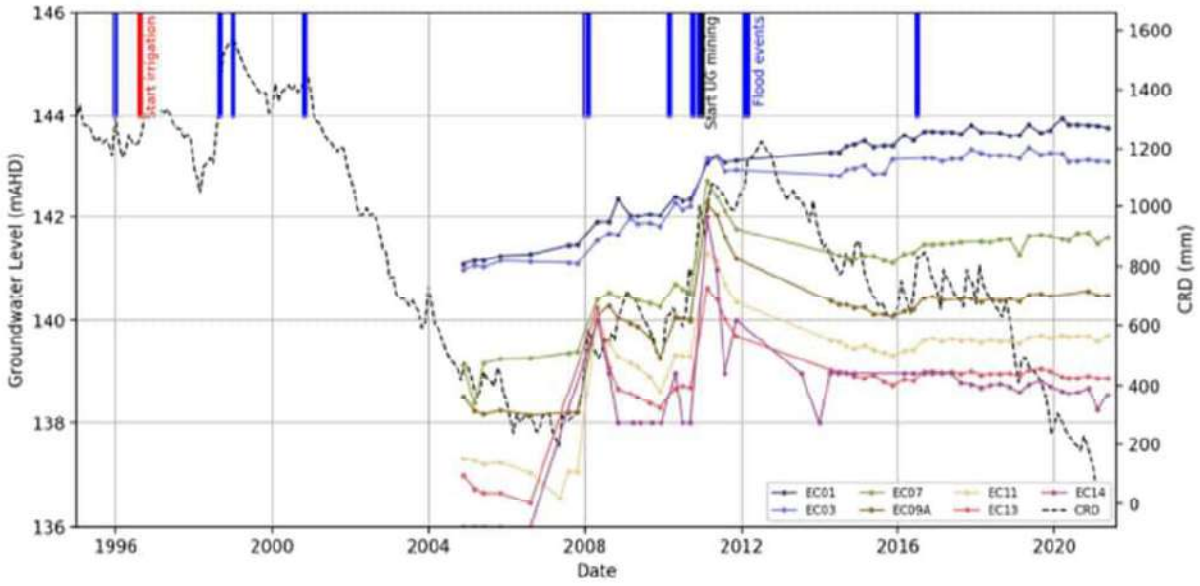

Figure 3.8 Hydrograph of the EC bores (SLR, 2022a)

3.3.1.4 Groundwater flow

There is limited hydraulic connection between the coal seam groundwater and the shallow alluvial aquifer associated with the Nogoa River's alluvium, with the Rewan Group acting as a flow barrier.

Groundwater movement within the alluvial deposits conforms to the topographical slopes, generally flowing from the northwest to the southeast across the Study Area. The flow direction of groundwater within the alluvium mirrors the course of the Nogoa River, trending from northwest to southeast. The shallow alluvial aquifer may not be consistently saturated and the contours offer the most accurate representation. However, there is a possibility of disconnected zones and stagnant lenses within the groundwater system, as indicated by dry monitoring bores.

3.3.1.5 Interaction with surface water

The saturated water level of the alluvium is approximately 140 m AHD, and the riverbed is approximately 147 m AHD. The groundwater level of the alluvium is, on average, 13.8 m below ground level. There have been numerous investigations, which have conceptualised the groundwater interaction with surface water. All investigations have concluded there is limited, and potentially no, interaction between the two water features (groundwater and surface water) (Figure 3.9).

There are silts and clays at the upper part of the alluvium with poor permeability and the groundwater occurrence in the alluvium is highly variable, with some bores documented as being repeatedly dry. If the alluvium was connected to the river, the water quality parameters should be expected to be similar. However, when the alluvial monitoring bores started to refill after extended dry periods, the water was saline whilst the Nogoa River is fresh.

Additionally, the bores further away from Nogoa River tend to have higher groundwater levels, which is contradictory of what would be expected if there was hydraulic connectivity, whereby groundwater levels would be higher closer to the river and the river would naturally lose stream. It is conceptualised, the alluvium during the wet season is recharged primarily through irrigation, with limited amounts of downward seepage from rainfall.

The most likely explanation for the steady long-term increase in groundwater levels is agricultural irrigation of water releases from Fairbairn Dam upstream of Zone 1. In July 2019 it was clearly determined that groundwater was flowing into the river, and again was most likely due to irrigation upstream of the Study Area increasing the standing water level of the alluvium.

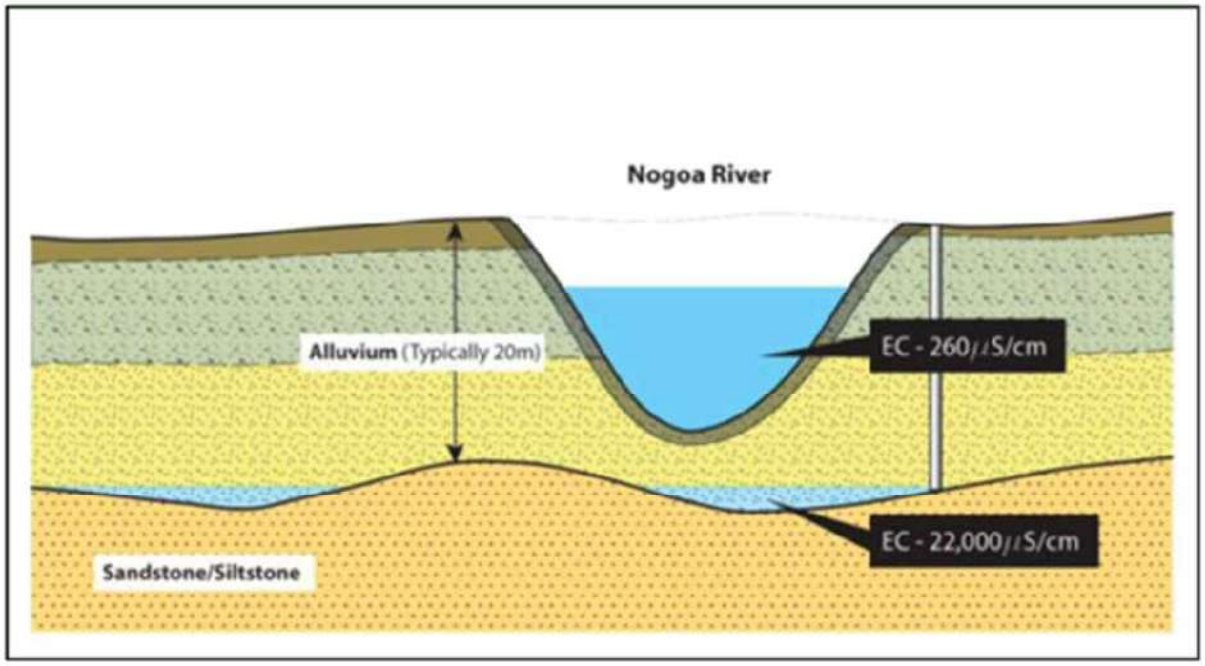

Figure 3.9 Conceptual cross section through the Nogoa River and quaternary sediments (SLR, 2022a and SLR, 2022b)

3.3.2 *Groundwater water quality*

Electrical conductivity (EC) is a measurement of salinity levels in water, and the water within the alluvium is highly saline, as demonstrated by over 350 monitoring observations (Table 3.2). Historical data indicates that high electrical conductivity (EC) in the alluvium is natural, as EC was high prior to the commencement of mining (late 1990s and early 2000s). It is likely that the alluvium is highly saline due to slow infiltration recharge from rainfall and evapotranspiration, and the evidential lack of influx from the Nogoa River.

Table 3.2 Electrical Conductivity summary statistics (SLR, 2022a and SLR, 2022b)

Parameter	Number of observations	20th percentile (µS/cm)	Median (µS/cm)	80th percentile (µS/cm)
Field EC	353	3,208	11,590	20,040
EC Lab	668	2,124	6,150	19,360

After a main recharge event in late 2010 the EC at bores had begun to increase, with varying times of onset. At the furthest upstream bore from the mine (where EC data is available, EC07), salinity began increasing in 2013, and at EC13, which is downstream of the mine, EC began increasing around 2016. The trend of increase beginning upstream then downstream indicates the increase is not mining related.

The 80th percentile value for EC for EC01, EC03, EC05, EC07, EC09A, EC11 and EC13 is above the 80th percentile of water quality objectives for electrical conductivity for the region (15,495 µS/cm), which indicate groundwater from the alluvium at these bores is not suitable for aquatic ecosystems. Groundwater quality parameters support the conclusion that the Nogoa River is separated from the alluvium, as demonstrated through high salinity within the alluvium in contrast to the freshwater in the river.

3.3.3 Groundwater dependent ecosystems

The ecological survey (AECOM, 2020) identified three Regional Ecosystems within the terrestrial GDE mapping, though there was a lack of wetland flora indicator species, evidence of water stress and high availability of preferential freshwater surface flows, which confirmed it is unlikely these communities rely on groundwater to persist.

Within a 10 km radius of the Survey Area, there are no identified aquatic GDE seeps with known or high confidence, nor are there any subterranean GDE seeps. The primary channel of the Nogoa River and its anabranches are categorised as low confidence aquatic GDE seeps. Aquatic and terrestrial GDE seeps denote ecosystems dependent on surface water closely linked with groundwater. As detailed previously, there is documented evidence that there is no hydraulic connectivity between the alluvium and the Nogoa River.

There are no potential GDE's mapped in Zone 3.

3.3.4 Groundwater modelling predictions

The groundwater model primarily presents its predictions as incremental impacts, meaning it compares the results of three cases, a Null run (no mining post January 2022), current underground operations (ending mining in 2028) and modelling of the proposed mine expansion (ending mining in 2037).

The model is likely an overestimation, as the model does not account for active management measures to reduce inflows after mining has passed through an area, thus predicting larger drawdown, resulting in a conservative impact assessment.

Lower inflows are expected when mining remains in an area for a longer period of time and can be higher when going into new areas, as no previous dewatering has occurred. Mine dewatering, both directly and indirectly through induced flow, leads to a reduction in water levels in the surrounding groundwater units.

The scope of the area impacted by modelled mine dewatering, resulting in decreased water levels, is contingent upon the hydraulic characteristics of the aquifers / aquitards. In a confined aquifer, this area is termed the zone of depressurisation, whereas in an unconfined aquifer, it is referred to as the zone of drawdown within the water table. The most significant depressurisation and drawdown of groundwater levels occur at the coal-face of the mine workings, gradually diminishing with distance from the mine.

Predictive groundwater modelling demonstrates the rate of inflow for the proposed mine expansion is similar to existing operations, and the incremental alluvial flux is negligible, with no evidential predicted reduction in baseflow in the Nogoa River.

There is a predicted maximum incremental groundwater drawdown of 1 m in the target coal seams associated with the Project at end of mining, which is expected to extend up to 15 km west. The drawdown resulting from mine dewatering is not causing wide-spread drawdown in the alluvium, as there is limited hydraulic connection between the alluvium groundwater and the Rangal Coal measures.

The model shows a downward trend of recharge in the alluvium south-west of the Mine Expansion Area (Figure 3.10) from 2030, due to reduction in loss from the alluvium into the lower strata, with a maximum decrease of 0.5 ML/day in 2036 before recovery commences. The long-term average alluvial extraction, calculated using annual climate inputs, is approximately 0.9 ML/day for the Project. In contrast, the null model (where there is no change) indicates a slightly lower extraction rate of around 0.8 ML/day, resulting in a difference of 0.1 ML/day between the two, which is considered negligible and of no tangible significance to the groundwater aquifer.

The Nogoa River alluvium is predicted to fully recover post-mining.

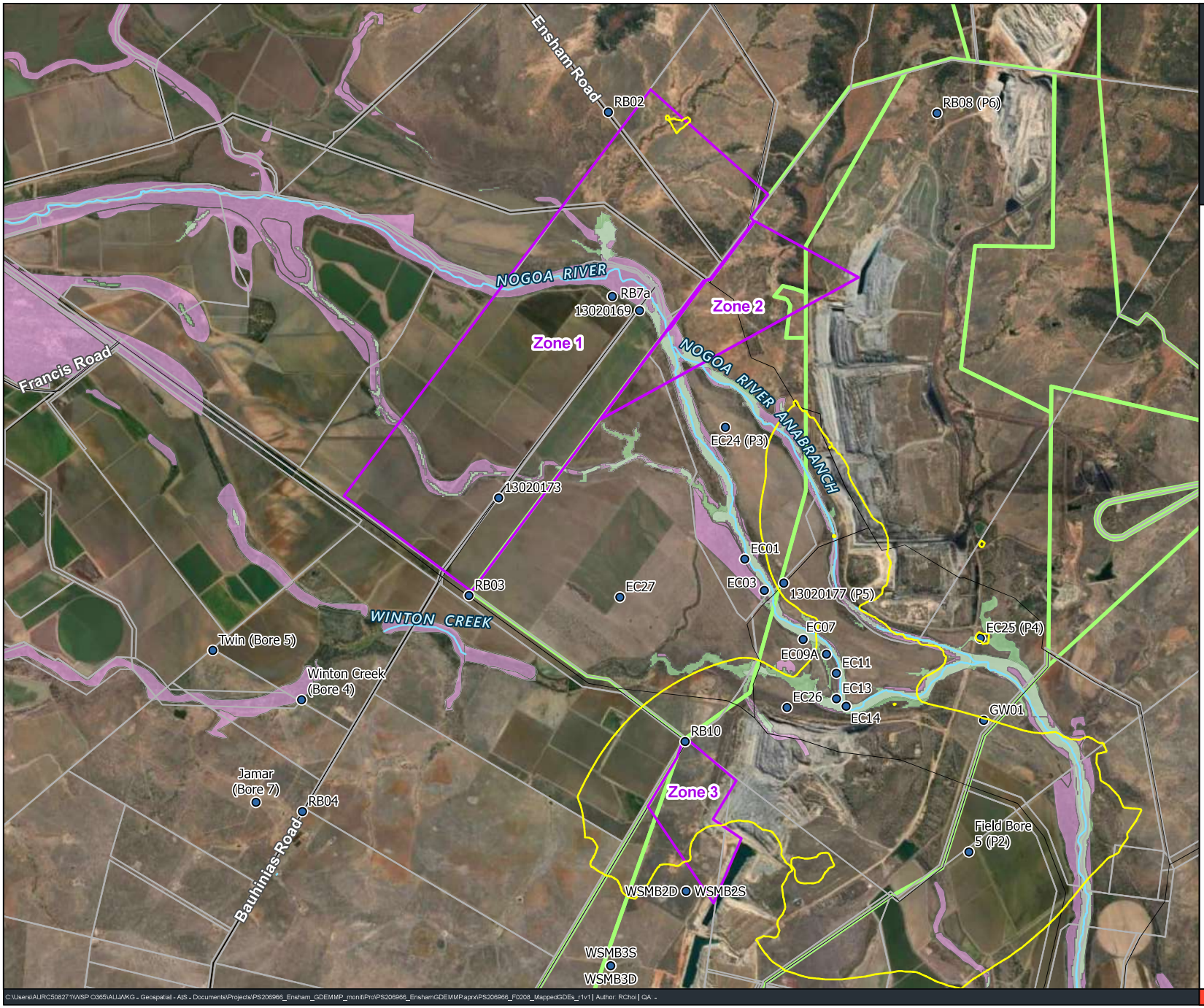

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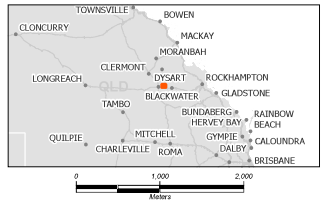
Figure 3.10 Location of impacts to Nogoa River alluvium

Legend

- Bores
- Watercourse
- Roads
- Maximum Incremental drawdown
- Mine Expansion Area
- Mining Lease
- Land Parcels
- Derived Surfacre GDE - low confidence
- Derived Terrestrial GDE - low confidence



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3

1:60,000 Date: 18/04/2024

Data sources: DELWP, Geoscience Australia
World Imagery: Earthstar Geographics

3.3.5 Potential impacts

The 0.5 m contour of the Project's incremental maximum drawdown intersects parts of the low confidence aquatic and terrestrial GDEs outside of the Mine Development Area yet being within the mining lease (south-west of Zone 2, see Figure 3.1).

Due to the conservative approach in drawdown calculations, the model predicts an incremental drawdown curve. However, upon reviewing hydrographs within the drawdown contour, it becomes evident the groundwater system will not experience additional drawdown due to the Project. For instance, in the hydrograph example for EC11 in Figure 3.11, the maximum incremental drawdown (the maximum difference between the light blue and dark blue lines) is around 1 m, as predicted to occur in 2070 (noting that mining is proposed to conclude in 2037 and that drawdown continues post-works).

In terms of the three scenarios (graphical lines for Null run, Existing operations, and Project), water level predictions remain consistent up to 2038. Subsequently, the water level for the Null run indicates a faster recovery, resulting in a difference between water levels resembling drawdown, although in real terms, the water levels are gradually increasing. Groundwater availability in the alluvium increases across all scenarios, indicating no actual additional drawdown forecasted from mining, and all scenarios ultimately recover to the same final levels. Thus, impacts on any potential low confidence GDE's are negligible as the drawdowns in the shallow alluvial aquifer are a typical delay in groundwater recovery and not a reduction in water levels.

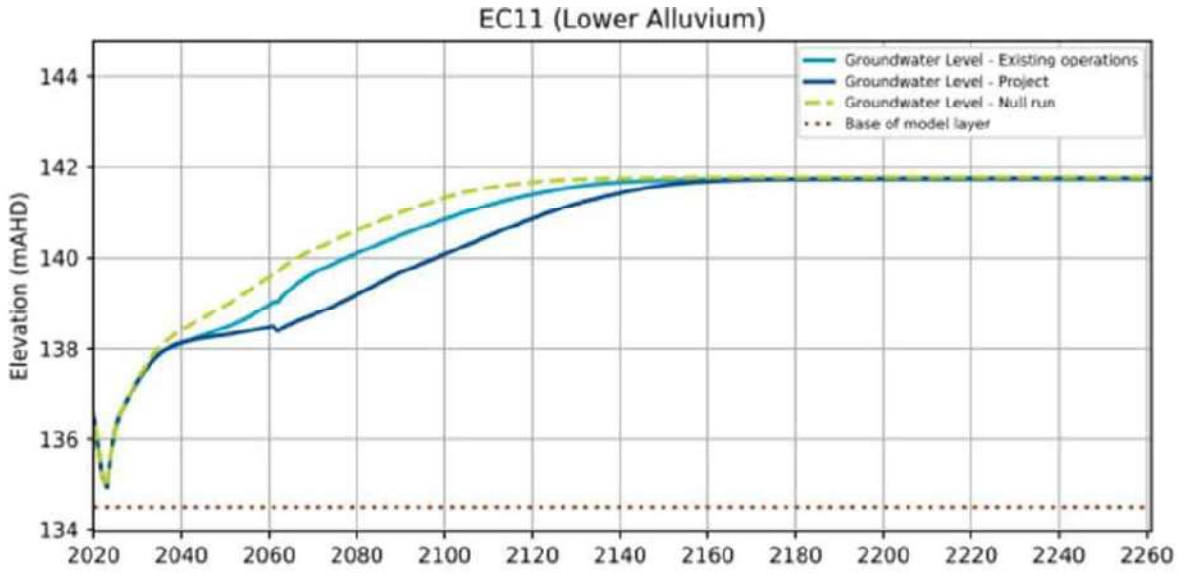


Figure 3.11 Recovery curve of EC11, an alluvial bore (SLR, 2022a)

3.4 Flora Technical Report (AECOM, 2020)

Three seasonal flora surveys were conducted in zones 1, 2 and 3 in May 2019, October 2019 and January 2020. The surveys consisted of field verification (ground truthing) the presence and extent of regulated vegetation (regional ecosystems), EPBC Act listed threatened ecological communities (TEC's), GDE's and threatened flora habitat.

3.4.1 Regulated vegetation (regional ecosystems)

Five regional ecosystems have been field verified as occupying 450.2 ha within the Mine Expansion Area (Table 3.3 and Figure 3.12). The remaining 1,774.6 ha is non-remnant woodland and pastures, agricultural land, mine rehabilitation and regrowth vegetation. The vegetation outside of the Mine Expansion Area, though within the Ensham mining lease, was not field verified as part of the AECOM survey and report.

Table 3.3 Regional ecosystems field verified as occurring within the Project Footprint

RE	Regional ecosystem description	VM Act Status	Area (ha)
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Endangered	63.7
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	Of concern	169.4
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least concern	52.3
11.7.1	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust	Least concern	127.7
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	Least concern	37.1
Total regulated vegetation			450.2
Non-remnant			1,774.6
Total Project area			2,224.8

3.4.2 Threatened ecological communities

The Brigalow (*Acacia harpophylla*) dominant and co-dominant TEC (Brigalow TEC) has been field verified as occurring within the Mine Expansion Area. The Brigalow TEC is analogous with RE 11.3.1, although the listing advice requires the vegetation meets key diagnostic criteria and condition thresholds to be considered the TEC. The primary criteria and thresholds are that the patch is 0.5 ha or larger, and exotic perennial vegetation does not exceed 50% of the patch. Within the Mine Expansion Area, 72% of RE 11.3.1 met the Brigalow TEC key diagnostics.

3.4.3 Groundwater dependent ecosystems

3.4.3.1 Vegetation with potential to be terrestrial GDE's

The field verified regional ecosystems (RE) that occur within the Mine Expansion Area, which have been state mapped as low-confidence derived GDE's, include:

- RE 11.3.1: *Acacia harpophylla* open forest on alluvial plains
- RE 11.3.3: *Eucalyptus coolabah* woodland on alluvial plains, and
- RE 11.3.25: *E. camaldulensis* woodland fringing drainage lines.

The *Acacia harpophylla* (Brigalow) forest is located along an unnamed watercourse within zone 1 and in small linear strips along the Nogoa River. It is comprised of remnant and high-value regrowth with a canopy range from 6 m to 7 m, with some emergent *Acacia harpophylla* (Brigalow) and *Eucalyptus coolabah* (Coolabah) reaching up to 14 m. *Terminalia oblongata* (Yellowwood) and *Lysiphyllum carronii* (Red bauhinia) are common in the canopy. Due to extensive historical clearing in the surrounding areas this community was in poor / moderate condition.

The remnant *Eucalyptus coolabah* (Coolabah) woodland is located along the Nogoa River, Mosquito Creek and a southern unnamed tributary. The canopy reaches 21 m and is generally mid-dense, though during the post-dry season surveys the condition of the canopy foliage was reduced, indicating water stress.

The remnant *Eucalyptus camaldulensis* (River red gum) woodland within the potential GDE mapping is located along the Nogoa River, fringing stream banks adjacent to where the channel typically held water during the surveys. The canopy reaches 22 m and *Casuarina cunninghamiana* (River she-oak) and *Eucalyptus coolabah* (Coolabah) are common. The community had good growth and coverage and was determined to be in good condition.

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Figure 3.12
Field Verified Vegetation Communities

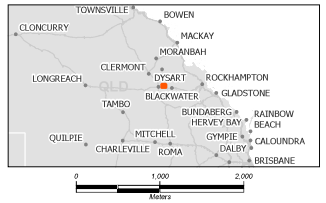
Legend

- Bores
- Watercourse
- Roads
- Maximum Incremental drawdown
- Mine Expansion Area
- Mining Lease
- Land Parcels
- Derived Surface GDE - low confidence
- Derived Terrestrial GDE - low confidence
- Brigalow TEC

Regional ecosystems

RE

- 11.3.1
- 11.3.25
- 11.3.3
- 11.7.1
- 11.7.2



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3

1:60,000 Date: 18/04/2024

Data sources: DELWP, Geoscience Australia
World Imagery: Earthstar Geographics

3.4.3.2 Wetland indicator species

Seven wetland indicator species were recorded, which can indicate, though does not confirm, groundwater dependence, including:

- *Casuarina cunninghamiana* (River she-oak)
- *Marsilea hirsuta* (Nardoo)
- *Eucalyptus camaldulensis* (River red gum)
- *Melaleuca trichostachya* (Flax-leaf paperbark)
- *Ischaemum australe* (Large bluegrass)
- *Duma florulenta* (Lignum), and
- *Eremophila bignoniiflora* (Dogwood).

Most of the wetland indicator species occurred within RE 11.3.25, with *Eucalyptus camaldulensis* (River red gum) the most common species. *Duma florulenta* (Lignum) and *Marsilea hirsuta* (Nardoo) were recorded within RE 11.3.3, and no wetland indicator species were recorded within RE 11.3.1.

3.4.3.3 Likelihood of GDE's within the Mine Development Area

Acacia harpophylla (Brigalow) has a shallow horizontal root system concentrated in the upper soil profile, enabling the species to draw resources from a substantial, shallow area around the plant, and is thus highly unlikely to be dependent on access to groundwater for long-term survival.

Eucalyptus coolabah (Coolabah) exhibited signs of water stress during the surveys that occurred post-dry season, indicating that the community is not accessing permanent groundwater. Additionally, the alluvium groundwater has a higher saline content and thin, discontinuous saturation zones, which limit the use and reliance of flora upon any potential GDE present.

The *Eucalyptus camaldulensis* (River red gum) woodlands were dominated by wetland indicator species and were in good condition. *Eucalyptus camaldulensis* (River red gum) is a common species along Australian watercourses that can develop vertical roots to depths greater than 10 m and is not tolerant of long-term drought or salinity. Whilst *Eucalyptus camaldulensis* (River red gum) has the ability to access and utilise groundwater, the alluvium groundwater within the Study Area is not suitable due to the high salinity content and thin, discontinuous saturation zones. It is likely the health of the community is attributed to the Nogoa River which has permanent water due to water releases from Fairbairn Dam for irrigation, which reduces the need and reliance upon permanent groundwater.

It should be noted the only the regional ecosystems within the Mine Expansion Area were field verified by AECOM, and the area of drawdown that intersects derived GDE's is outside of the Mine Expansion Area, although within the mining lease (Figure 3.12). The state mapping indicates that the regional ecosystems within the potential drawdown area are the same, though would need to be field verified if monitoring is undertaken, to confirm regional ecosystem presence and extent.

3.5 Summary

The combination of groundwater data and flora surveys determine that there are no aquatic or terrestrial GDE's within the Study Area and Mine Development Area.

There is evidence that the shallow alluvial aquifer within the Nogoa River alluvium is not connected to the Nogoa River, via highly differential saline levels and a groundwater gradient that is higher further away from the river, instead of lower gradient. This separation is due to shallow silts and clays which divide the surface water areas from the basal gravel layers that comprise the lower areas of the aquifer. The Nogoa River is a freshwater river that has permanent flow, which is anthropogenically controlled via releases from Fairbairn Dam.

The shallow alluvial aquifer within the Nogoa River alluvium has low groundwater levels that are not continuously saturated and rather form lenses of highly saline, stagnant water, as indicated by periodically dry groundwater monitoring

bores. When the bores recharge following periods of being dry, the water was saline, which could be attributed to a combination of naturally saline groundwater and possibly recharge from irrigation. If the shallow alluvial aquifer and river were connected, it would be expected the bores would not dry whilst there was flow in the river and water chemistry would be similar; thus, there is no recharge of the alluvium from the river.

The hydraulic disconnect results in no dilution of the highly saline water within the shallow alluvial aquifer, which is so saline that it is unsuitable for stock watering and irrigation. Seven bores are above the 80th percentile of water quality objectives for electrical conductivity for the region (15,495 µS/cm). These bores (EC01, EC03, EC07, EC05, EC09A, EC11 and EC13) are either within 200 m of the incremental maximum drawdown of the alluvium or within it. Aquatic and terrestrial GDE seeps denote ecosystems that depend on surface water closely linked with groundwater. As detailed, there is evidence that there is no hydraulic connectivity between the shallow alluvial aquifer and Nogoa River.

There is evidence that irrigation above the Study Area is increasing the water level of the shallow alluvial aquifer and altered chemistry. There has been a substantial influx of high bicarbonate and low pH recharge originating from agricultural runoff and infiltration of irrigated water. Monitoring bores closest to the irrigation area have been steadily increasing, regardless of climatic conditions. There is potential for increasing, highly saline groundwater to have negative impacts on the flora communities, if it gets closer to the ground surface and encroaches on root zones, and on the aquatic community, if it starts to seep into the Nogoa River.

There are no known GDE's within a 10km radius, only low-confidence derived GDE's. Aquatic GDE's require groundwater present at the surface, and as the groundwater level is, on average, 13.8 m below ground level, this is not possible. The flora present within the Mine Expansion Area are does not indicate any reliance on subsurface groundwater (terrestrial GDE's), regardless of whether that groundwater is suitable.

Acacia harpophylla (Brigalow; dominant species of RE 11.3.1 and Brigalow TEC), which has a shallow, lateral root system that is concentrated in the upper soil profile and is a shallow-rooted species (Johnson et al, 2016). Brigalow's shallow rooting habitat is evident through the tendency of mature trees to fall because of disturbance to the upper soil profile, which exposes the lateral root system with little evidence of deeper sinking roots. It is therefore unlikely this vegetation community is reliant on the groundwater, which is on average 13.8 m below ground level, discontinuous and highly saline.

Eucalyptus coolabah (Coolabah; dominant species of RE 11.3.3) is a species that can utilise groundwater and is tolerant of slightly saline sites (2,000-4,000 µS/cm; Government of Western Australia, 2023). However, surrounding and within the areas mapped as derived GDE's, which also intersect the incremental maximum drawdown of the shallow alluvial aquifer, the salinity of the groundwater exceeds 15,495 µS/cm. Additionally, during the flora surveys conducted post-dry season, there was signs of water stress among the *Eucalyptus coolabah* canopy, further indicating this vegetation community is not interacting with the groundwater present in the alluvium.

Eucalyptus camaldulensis (River red gum; dominant species of RE 11.3.25) is a species that can utilise groundwater and is tolerant of moderately saline sites (4,000-8,000 µS/cm; Government of Western Australia, 2023). However, surrounding and within the areas mapped as derived GDE's, which also intersect the incremental maximum groundwater drawdown of the alluvium, the salinity of the groundwater exceeds 15,495 µS/cm.

In summary, it is therefore likely the vegetation communities along the Nogoa River would access the high availability of preferred, permanent freshwater surface flows from the river and regulated water releases from Fairbairn Dam and would show signs of poor health, and likely senesce, if there was interaction with the highly saline groundwater within the alluvium.

Regardless, if there were GDE's present, the groundwater model for the mine expansion determined that the inflow and incremental alluvial flux predicted changes, are negligible and there is no predicted reduction of baseflow in the Nogoa River. The predicted reduction in loss from the alluvium into the lower strata reaches an incremental maximum drawdown of 0.5 m, which is temporary and was determined to be a negligible reduction. Additionally, the alluvium is separated from the Rangal Coal Measures groundwater unit, and thus drawdown in the coal seam aquifer would also not affect any present GDE's.

4 Mitigation and management

Ensham's existing EA requires monitoring of groundwater, as summarised below. There are no GDE's present, therefore additional mitigation or management is not required, and no further actions are proposed.

4.1 Groundwater trigger levels

Drawdown trigger levels have been established within the GMMP (SLR, 2024) to provide an early warning of potential impacts. If a drawdown trigger level is exceeded, Ensham will conduct an investigation into the potential for environmental harm. If the investigation indicates potential for environmental harm, a suitably qualified person will develop an action plan to mitigate the potential harm.

4.2 Data management and reporting

4.2.1 Groundwater level (SLR, 2022a and SLR, 2022b)

In accordance with the current EA the following will apply:

- The groundwater monitoring at all bores will be conducted on a quarterly basis or as defined in the EA.
- Data will be stored within the existing consolidated groundwater database.
- Quality assurance and quality control procedures, such as field sampling procedures and the use of NATA accredited laboratories, will continue to be in place to assess the accuracy of data entered into the database.

In accordance with the current EA, findings from the quarterly monitoring events will continue to be documented:

- The quarterly review will include identification of any groundwater quality trigger exceedances.
- Where a trigger exceedance is identified, the regulator will be notified within 28 days and an investigation into the potential for environmental harm will be completed. The groundwater database and factual quarterly documentation will be available for provision to the regulator upon request.
- Each year an annual review of groundwater level and water quality trends will be conducted by a suitably qualified person and provided to the regulator. The review will assess the change in groundwater level and quality over the year, compared to historical trends and impact assessment predictions. The annual review will discuss any groundwater trigger exceedances or where trends show potential for environmental harm.

5 Conclusion

There is no indication there are aquatic or terrestrial GDE's within the Study Area. It has been demonstrated there is no hydrological connectivity between the Nogoa River, Nogoa River alluvium and the coal seam groundwater. The Nogoa River alluvium is not consistently saturated and rather forms lenses of stagnant, highly saline water.

The vegetation along the Nogoa River is slightly to moderately tolerant of saline water. However, the salinity within the groundwater in the area of drawdown impact significantly exceeds the known tolerant range of dominant species. It is likely that the vegetation is accessing the permanent, freshwater of the Nogoa River, more so than water from the shallow alluvial aquifer and would show signs of poor health if the vegetation was interacting with the highly saline groundwater.

Regardless, if there were GDE's present within the Study Area, the modelled 0.5m incremental maximum drawdown of the shallow alluvial aquifer is temporary and determined to be a negligible impact.

Ensham currently monitors groundwater as per the existing EA requirements, and as there are no GDE's present additional mitigation or management is not required.

6 Limitations

This Report has been prepared by WSP on behalf of Ensham and in accordance with WSP's proposal and agreement with Ensham.

Even though attention has been paid to desktop and field-based identification of project risks, this Report is not able to comprehensively account for unknown risks not captured by this Report.

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This report has been prepared by WSP on behalf of Ensham for the purpose described in the contractual agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (Permitted Purpose).

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Appendix C - EIMP.06.00.06 Subsidence Management Plan (SMP)

ENVIRONMENTAL MANAGEMENT SYSTEM

EIMP.06.00.06
SUBSIDENCE MANAGEMENT PLAN
ENVIRONMENTAL IMPACT MANAGEMENT PLAN (EIMP)

APPROVAL

	Name	Position	Signature	Date
Document Owner	Dave Meyers	Manager HSECT		
SSE	Andy Mifflin	GM Operations		
Revision	6			

Contents

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1. INTRODUCTION

Ensham Mine (EM) is an opencut and underground bord and pillar coal mine located approximately 35 km east of Emerald along the Nogoa River in Central Queensland.

Ensham currently undertakes underground mining using continuous miner operations, whilst utilizing the existing access and supporting infrastructure located within the current Mining Leases. The open cut portion of the mine is transiting from mining to rehabilitation. Mining extracts a portion of the combined Aries/Castor seam plies, typically leaving the higher ash, uppermost plies in the roof of the underground roadways.

Ensham is required to manage potential impacts of subsidence from underground mining activities in accordance with conditions within the following approvals:

- Regional Interests Development Approval (RIDA RPI22/002 Ensham – Life of Mine Extension Zones 2 and 3)
- Progressive Rehabilitation Closure Plan schedule PRCP_EMPL00732813_V2 (and future revisions)
- Environmental Protection and Biodiversity Conservation Approval (EPBC 2020/3889 - Zones 1, 2 & 3)

1.1 SCOPE

This Plan addresses the monitoring and management of subsidence impacts from Ensham's underground mining operation. This includes the triggers for investigation of potential subsidence impacts, Specifications for LIDAR, guidance on inspections and photographic monitoring, groundwater monitoring. Mitigation and management measures are also included.

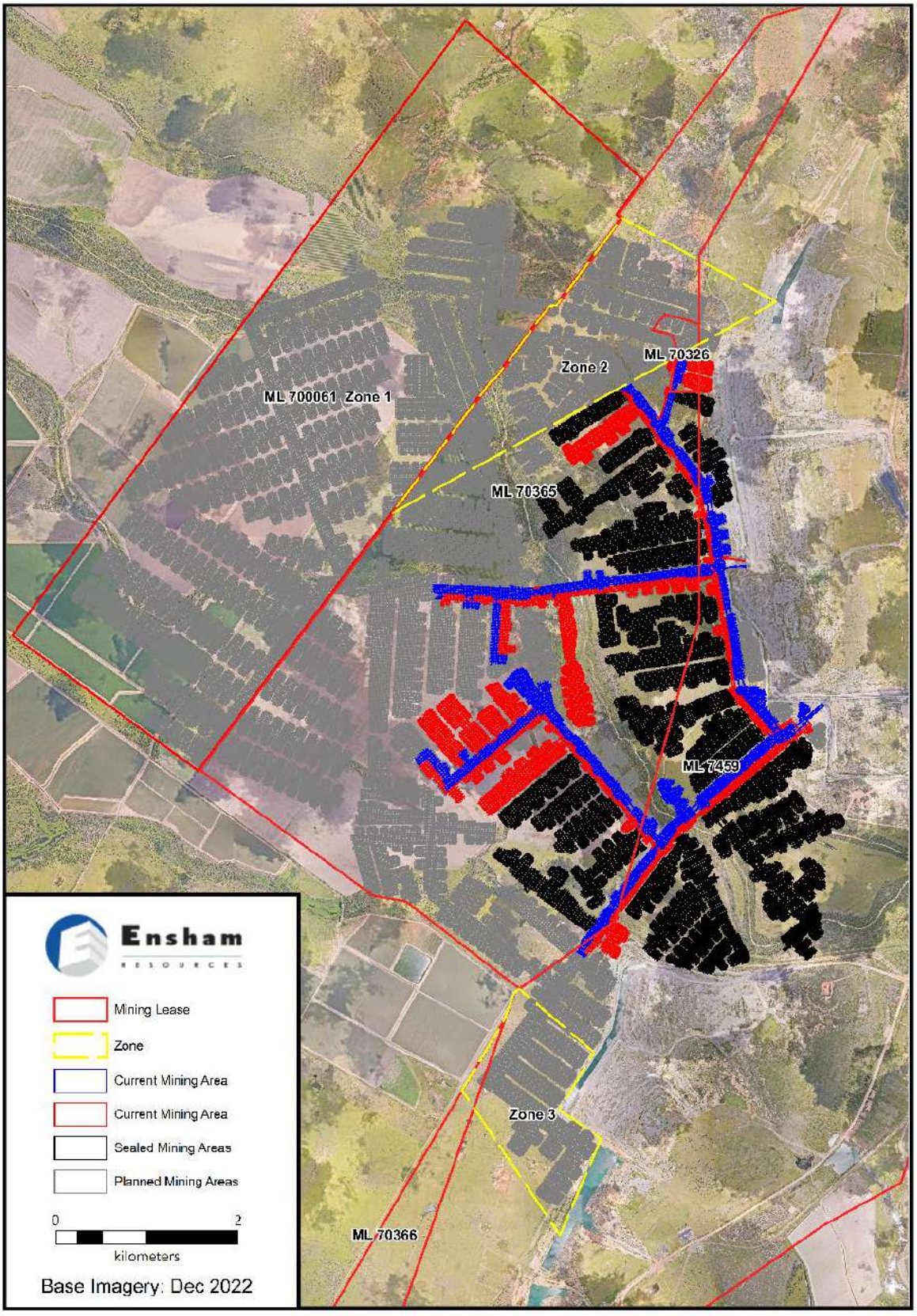

FIGURE 1-1 EXISTING OPERATIONS AND PROPOSED MINING PLAN FOR ZONES 1, 2 AND 3.

2. ENSHAM MINE OVERVIEW

2.1 MINING ACTIVITIES

The Ensham underground mine has been operating since 2011. The mine will continue to produce around 4.5 million tonnes per annum (Mtpa) of thermal coal with the addition of Zone 1 to the existing operation.

Coal from the underground mine is mined by five production units and transferred to the surface via the Ramp 4 drift conveyor.

2.2 TOPOGRAPHY AND DRAINAGE

The terrain in the Ensham area is generally low-lying, and the few hills within the area are capped by a hard layer formed on the surface known as duricrusts (Figure 2-1). The main drainage of the area is via the Nogoa River, which flows in an easterly and south-easterly direction through the Ensham mining leases before joining the Comet River to form the Mackenzie River near the town of Comet.

In the Ensham area, the elevation of the Nogoa River banks average 150 metres above Australian Height Datum. The Nogoa River is used for irrigation, drinking water and stock water supply, with flow maintained by releases from Fairbairn Dam, located south of Emerald. Due to the supply of water from the Fairbairn Dam to downstream users, the Nogoa River flows essentially all year round. The anabranch however is ephemeral and flows generally following a significant rain event.

The low-lying area includes floodplains and riparian zones along the Nogoa River and an anabranch, which runs to the north of the Nogoa River.

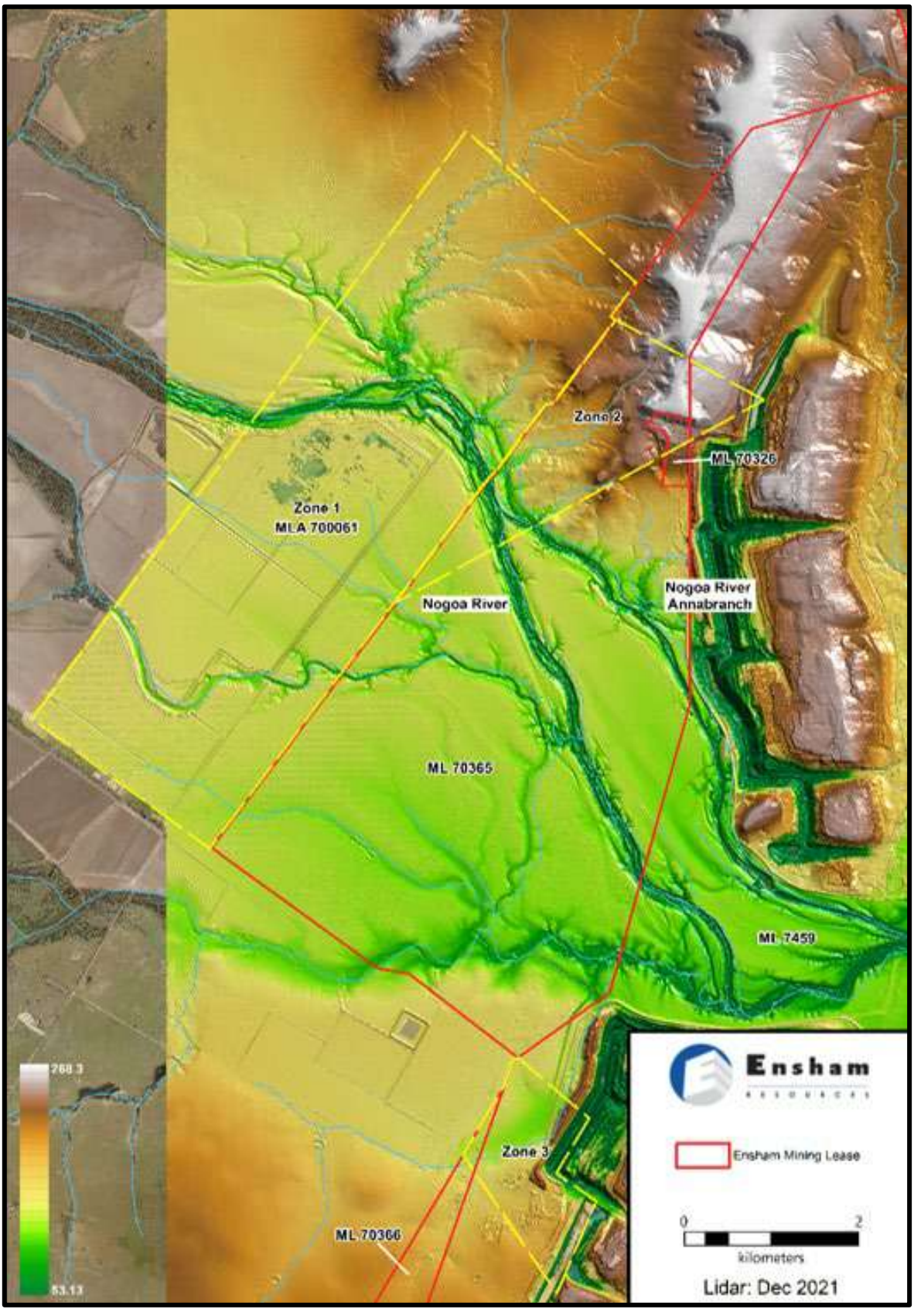

FIGURE 2-1 SURFACE TOPOGRAPHY AND DRAINAGE

2.3 SOILS

Soils in the areas above zones 1, 2 and 3 have been identified and are presented in Figure 2-1. The different soil types are known to not display a uniform reaction to climatic influences. The Vertosol is known to shrink and swell with varying moisture, which manifests as significant variation of surface elevation relative to Australian Height Datum.

The amount of natural movement of the soil surface exceeds the maximum predicted and measured subsidence movement. For this reason, RTK GPS monitors buried into the ground have been used to measure ground movement as opposed to the soil movement.

2.3.1 VERTOSOLS

These are soils with the following characteristics:

- A clay field texture or 35% or more clay throughout the solum except for a thin, surface crusty horizons 0.03 m or less thick,
- When dry, open cracks occur at some time in most years. These are at least 5 mm wide and extend upward to the surface or to the base of any plough layer, peaty horizon, self-mulching horizon, or thin, surface crusty horizon, and
- Slickensides and/or lenticular peds occur at some depth in the solum.

The Vertosols generally consisted of greyish brown medium clay A horizons (topsoil) with moderate structure, overlying a medium to medium heavy clay B2 horizon with strong angular blocky structure. The topsoil showed strongly alkaline, non-sodic and low saline properties. The B2 horizon generally showed strongly alkaline, sodic and high saline properties.

FIGURE 2-2 VERTOSOL USED FOR GRAZING

FIGURE 2-3 VERTOSOL USED FOR CROPPING

2.3.2 DERMOSOLS

These are soils other than Vertosols, Hydrosols and Calcarosols which:

- Have B2 horizons with a structure more developed than weak throughout the major part of the horizon, and
- Do not have clear or abrupt textural B horizons.

The Dermosols generally consisted of very dark brown to very dark greyish brown light clay to medium clay A horizons (topsoil) with weak to moderate structure, overlying a light medium clay to medium clay B2 horizon with moderate to strong angular to sub angular blocky structure. The topsoil and subsoils showed variable pH, sodicity, and salinity properties.

FIGURE 2-4 DERMOSOL

2.3.3 RUDOSOLS

Rudosols are other soils with negligible (rudimentary), if any, pedologic organisation apart from the minimal development of an A1 horizon or the presence of less than 10% of B horizon material. There is little or no texture or colour change with depth.

The Rudosols generally consisted of sandy clay loam A horizons (topsoil) with weak structure, overlying a sandy clay loam to clayey sand B2 horizon with weak sub angular blocky structure. The topsoil showed strongly acidic, non-sodic and very low saline properties. Similarly, the B2 horizon showed strongly acidic, non-sodic and very low saline properties.

FIGURE 2-5 RUDOSOL

2.3.4 KANDOSOLS

Kandosols are soils other than Hydrosols which lack a clear or abrupt texture contrast between the A horizon and a B horizon, with the major part of the B2 horizon consisting of a massive or weak pedality grade and a maximum clay content which exceeds 15%.

The Kandosols on site generally consisted of brown to black clayey sand to light medium clay A horizons (topsoil) with weak to strong structure, overlying a sandy clay loam to medium clay B2 horizon with weak to strong angular to sub angular blocky structure. The topsoil showed very strongly acidic, non-sodic and very low saline properties, similarly, the B2 horizon generally showed very strongly acidic, non-sodic and very low saline properties.

FIGURE 2-6 KANDOSOL

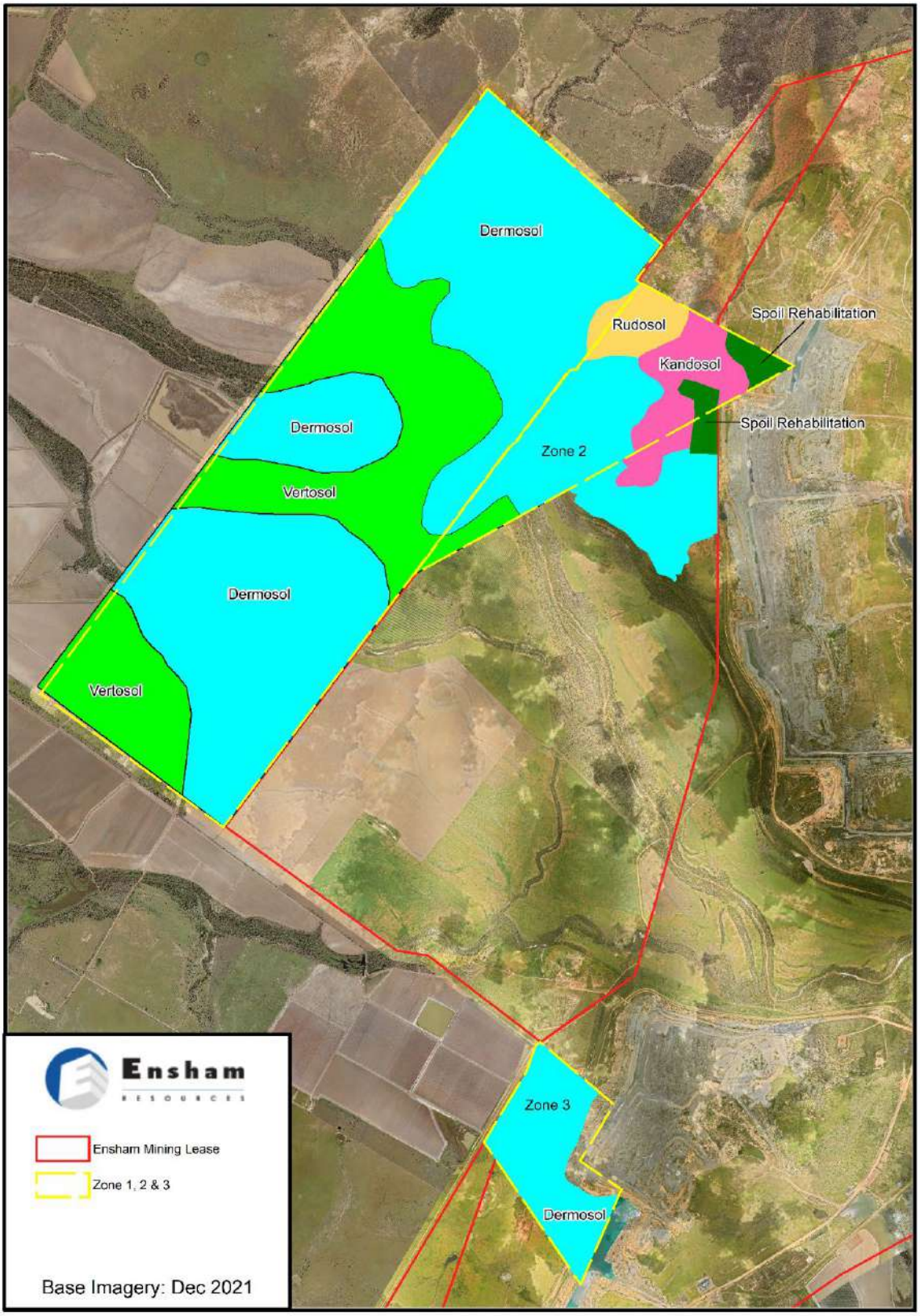

FIGURE 2-7 SOIL UNITS

2.4 GEOLOGY

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

Table 2-1 provides a summary of the stratigraphic sequence in the Ensham area. This comprises unconsolidated Quaternary aged sediments, unconformably overlying consolidated Tertiary and Permian sediments.

TABLE 2-1 STRATIGRAPHY

Age	Unit	Maximum thickness[1] (m)	Description
Quaternary	-	25	Alluvium - silt, clay, sand and gravel
Tertiary	-	ND	Duricrusted palaeosols at the top of deep weathering profiles, including ferricrete and silcrete; duricrusted old land surfaces
	Emerald Formation	50	Fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt; all deeply weathered in outcrop
	Basalt	ND	Tertiary volcanics (basalt) mapped as being present over 10 km west of the site
Triassic	Rewan Group	200	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base); deposited in a fluvial-lacustrine environment.
Permian	Rangal Coal Measures	125	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams. Coal seams include the Aries, Castor, Pollux and Orion seams. The main economic seams at Ensham are the Aries 2 and Castor seams.
	Burngrove Formation	200	Sandstones, siltstones and mudstones, and banded coal seams frequently interbedded with tuff and tuffaceous mudstones - coal seams include the Virgo and Leo seams.
	Fair Hill Formation	150	Lithic and feldspathic labile sandstone, siltstone, mudstone and conglomerate
	Macmillan Formation	100	Lithic and feldspathic sublabile mudstone, siltstone and sandstone

1 Approximate maximum thickness based on available exploration holes and/or relevant literature

ND: not defined, not enough data available

The Permian and Triassic strata form regular layered fluvio-deltaic sedimentary sequences, while the Quaternary sediments are more complex and irregular. The coal seams mined at Ensham Mine are found within the Rangal Coal Measures, which is the uppermost Permian unit of the portion of the Bowen Basin.

The Rewan Group aquitard overlies the Rangal Coal Measures and separates the Nogoa River and associated floodplain alluvium from the underground workings. Each are discussed in more detail in (Table 2-1).

The underground mine surface geology is dominated by the Nogoa River alluvium, with the Tertiary sediments mapped to the south and the north.

2.5 GROUNDWATER REGIME

The principal groundwater bearing formations in the Ensham area are associated with the Permian coal seams. The Triassic Rewan Group siltstones and sandstones are considered a regional scale aquitard. A conceptual hydrogeological model is shown in Figure 2-8.

Alluvial deposits are associated with the Nogoa River and its anabranch (Figure 2-8). The Quaternary aged alluvium comprises shallow sequences of clay, silty sand and sand, underlain by discontinuous basal sands and gravel. A comprehensive network of bores listed in the EA is located in the alluvium to monitor any impact of mining on the alluvial aquifers.

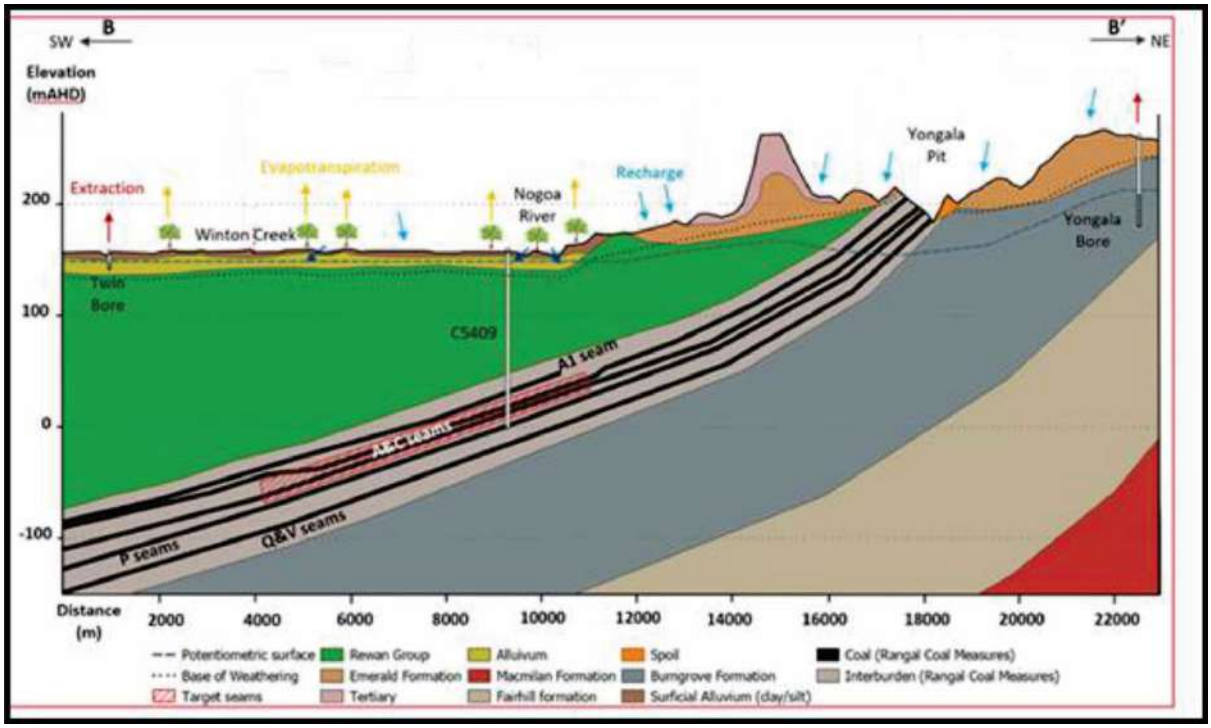

FIGURE 2-8 CONCEPTUAL HYDROGEOLOGICAL MODEL CROSS SECTION (EIS SUBMISSION, 2021).

2.6 LAND USE

Ensham mine is located within a rural setting, typical of the Central Queensland region, within the rural margins between a range of central township nodes. The largest nearby townships include Emerald, which is located approximately 35 km south-west, and Blackwater which is located 49 km south-east. The small township of Comet is located approximately 18 km south-east of the mine site.

The predominant land uses within the wider region include cropping, grazing and resource activities (Figure 2-9). The existing land uses include resource activities, cropping, grazing land and waterways with fringing riparian vegetation.

As part of Cultural Heritage Management Plans with the traditional owners' groups over Ensham, two preservation areas above underground workings have been set up where significant amounts of artefact material is stored (refer Figure 2-9). Both areas have been mined under, are fenced and are subject to periodic inspection.

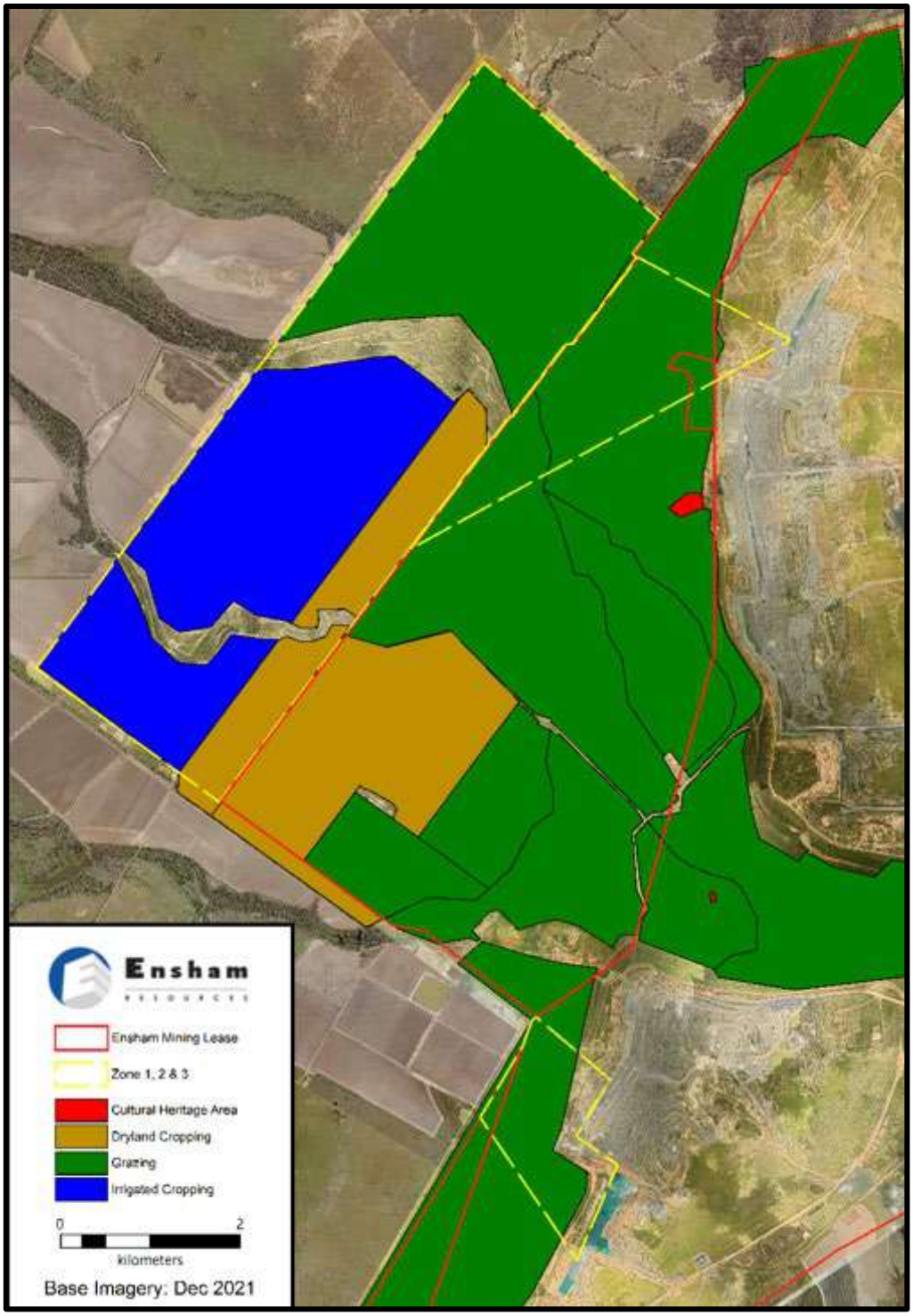

FIGURE 2-9 LAND USES AT ENSHAM MINE (2021).

2.7 BRIGALOW THREATENED ECOLOGICAL COMMUNITY

Within the mining leases and approval areas, the Brigalow (*Acacia harpophylla* dominated and co-dominated) threatened ecological community (Brigalow TEC) occurs. Brigalow TEC at the mine site is analogous with regional ecosystem (RE) 11.3.1 *Acacia harpophylla and/or Casuarina cristata* open forest on alluvial plains. It occurs as remnant and high value regrowth.

Across the Project area, there is a total of 63.66 ha Brigalow TEC occurring, with 46.1 ha in Zone 1. A total of 23.5 ha is located directly above the planned underground mining expansion area (Figure 2-10).

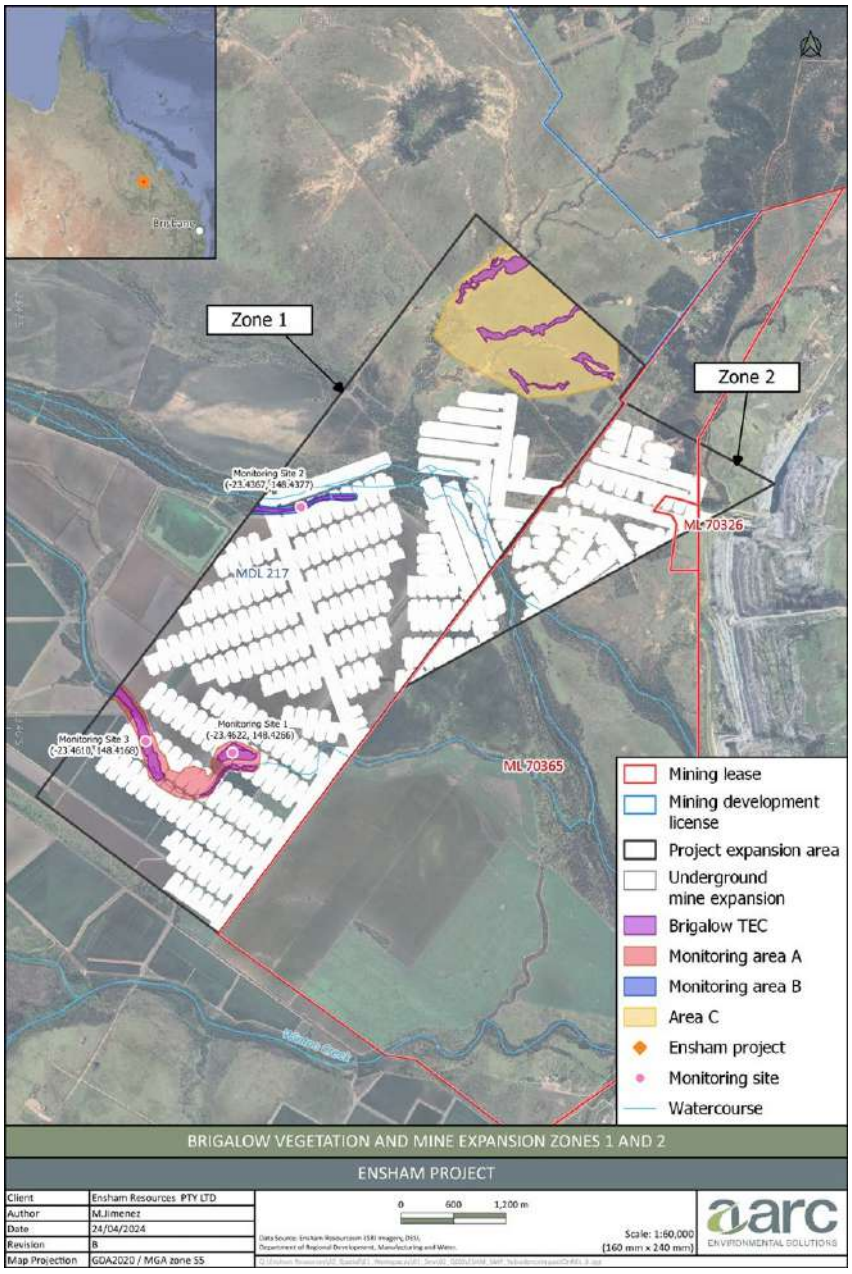

FIGURE 2-10 BRIGALOW TEC AREAS AND MONITORING LOCATIONS

3. PREDICTED SUBSIDENCE

3.1 INTRODUCTION

The bord and pillar mining layout at Ensham is specifically designed to prevent caving of the roof or collapse of the pillars. The long-term stability of the underground workings has been assessed using the design Factor of Safety (FoS), pillar dimensions (width to height ratio) and stability of the overburden.

Any subsidence that does occur will be due to strata compression. This typically results in low levels of surface lowering and minimal associated surface effects due to the associated low tilts, curvatures and strains.

The underground workings are designed where practical to avoid geological structures such as faults that may be associated with poorer mining conditions. This mining methodology minimises any potential impacts that geological structures may have on the subsidence behaviour. Seismic surveying is used to identify these structures prior to mining, allowing the optimization of the underground workings. For every panel that is mined, a hazard panel plan is produced that collates the available geological information such as:

- Location of geological structures.
- Depth of cover.
- Seam thickness.
- Seam levels.
- Roof strength.

Furthermore, the maximum excavation heights to maintain the required minimum FoS, in both the roadways and bell outs, are detailed on the Permit to Mine (PTM) for each mining area. The final roadway and pillar profiles are surveyed to confirm compliance with the design excavation heights. These checks are carried out by the Geotechnical Engineer and reported in the monthly geotechnical inspection report.

3.2 PILLAR DESIGN

The stability of the coal pillars in the Ensham underground mine are assessed using the industry accepted University of New South Wales Pillar Design Procedure to determine the design FoS as follows (Galvin et al, 1998):

FoS = Strength of Pillar/Load on Pillar

The strength and load carried by the pillars in the Ensham Area are calculated using the UNSW Pillar Design Power Strength Formulae and tributary area loading methodology respectively.

A minimum design FoS of 1.6 has been applied to ensure the long-term stability of the underground workings below the flood plain (Figure 3-1 Maximum Mining Height for a FoS of 1.6.). Where pillars are located below the flood plain, a conservative temporary flood depth of 4 m equating to an effective increase in depth of cover of 2.1 m should be applied to the load calculations in Figure 3-1.

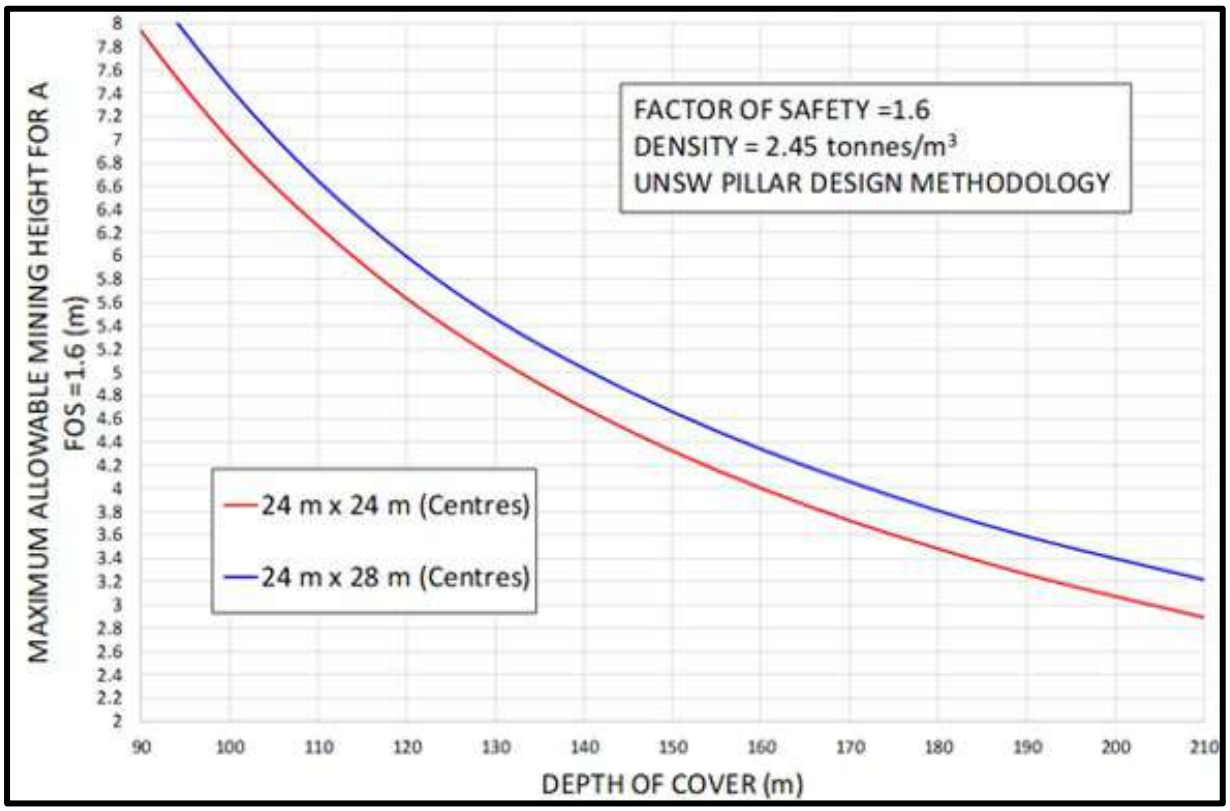

FIGURE 3-1 MAXIMUM MINING HEIGHT FOR A FOS OF 1.6.

The long term stability of the pillars (in excess of 200 years) has been confirmed by three separate industry recognized geotechnical consultants who have peer reviewed the subsidence assessment for the extension mining area. Below the Nogoa River channel and anabranch, a FoS of 2.11 will be adopted for mining, equating to a probability of pillar failure of 1 in 1 million. Similarly, a conservative temporary flood depth of 16 m in the channel and anabranch equates to an effective 7.5 m increase in the depth of cover and will be taken into account when undertaking pillar design.

The barrier pillars between panels and sub-panels are also designed to ensure FoS values greater than 2.11, equating to a probability of failure of 1 in 1 million.

3.3 COMPRESSION ANALYSIS

The deformation induced at the surface by bord and pillar mining due to strata compression can be estimated analytically by calculating the combined pillar, roof and floor compression using modulus values as follows.

The pillar compression is then calculated as follows using the methodology of Poulos and Davis (1974) for analysing rigid footings:

$$Compression_{pillar} = (\sigma c * h)/E$$

Where:

σc = Vertical stress change (MPa)

h = Pillar height (m)
E = Young's modulus of coal pillars (MPa)

The compression of the roof and floor is calculated as follows:

$$Compression_{roof\ or\ floor} = I_P*(\sigma_c * w/2)/E$$

Where:

σ_c = Vertical stress change (MPa)
I_P = Influence Factor (for a rigid footing) = 1.4
w = Pillar width (m)
E = Young's modulus of roof or floor (MPa)

The change in vertical stress on the pillars can be estimated as:

$$\sigma_c = \text{Tributary Area Stress} - \text{Virgin Stress}$$

3.4 PREDICTED SUBSIDENCE

LIDAR has been used to determine the existence of any subsidence over previously mined areas, with no trends or evidence being observed. Subsidence predictions for future mining areas indicate levels less than 35 mm in Zones 2 and 3, and typically less than 40mm in Zone 1, which is less than the accuracy of LIDAR and less than natural ground movement of up to 50 mm (the Commonwealth of Australia (2014 and 2015).

In 2021, more accurate RTK (Real Time Kinematic)-GPS monitoring (with an accuracy of + /- 5mm) above mined out bord and pillar panels at Ensham has confirmed the low levels of surface subsidence as discussed in Section 4.2. It is considered that the lower accuracy (± 50 mm) LIDAR surveys will still be applicable in assessing the possibility of pillar collapses or squeezes that may have occurred in previously mined out areas.

3.5 SURFACE AND SUBSURFACE CRACKING

No surface or sub-surface cracking relating to underground mining has been observed in the Ensham underground mined area since underground bord and pillar mining began in 2011.

3.6 SUBSIDENCE IMPACTS

Underground mining at Ensham considers potential impacts to the following aspects:

- Groundwater.
- Surface water - Nogoa and Anabranch and other creeks and flood plain.
- Flora and fauna.
- Surface infrastructure (mining).
- Agricultural infrastructure including laser levelled irrigation paddocks.

- Cultural Heritage.

The expected low levels of subsidence are unlikely to result in the formation of significant depressions in the surface topography where ponding of the surface drainage may occur. This subsidence is anticipated to form in a consistent and uniform manner, without significant undulations, as a result of elastic compression of the strata i.e. compression due to the additional load on the pillars after the coal is extracted.

Furthermore, based on mining experience at shallow depths of cover in the current Ensham underground workings, as well as experience at other mining operations around the world, the risk of sinkhole subsidence occurring in Zones 1 and Zones 2 and 3, where the depth of cover is greater than 120 m and 75 m respectively, is considered to be without known precedent.

4. SUBSIDENCE MONITORING

Subsidence monitoring at Ensham comprises:

- LIDAR (+/- 50 mm accuracy).
- Photographic monitoring at designated points
- Real Time Kinematic (RTK)-GPS monitoring (+/- 5 mm accuracy).
- General surface inspections if monitoring indicates exceedance of one or more subsidence trigger levels.

4.1 LIDAR MONITORING

LIDAR provides representation of surface elevation. The points derived during a LIDAR survey are classified according to the type of surface that was reflected, where “ground” points are selected to represent ground surface. Therefore, LIDAR requires a proportion of the ground surface to be visible in order to present a ground surface elevation. Generally LIDAR provides vertical accuracy of +/- 0.05m. The LIDAR is referenced to a common Australian Datum which are aligned to permanent survey markers. LIDAR metadata is maintained by Ensham in Australian Geodetic Datum 1984 (AGD84).

LIDAR data was collected over the underground mine initially in 2009, then on an annual basis since 2016, including areas where bord and pillar has been or will be carried out. LIDAR is collected at or about year end, each year and done so in accordance with (but not limited to) ISO 19115 as a minimum. No discernible surface movement due to subsidence has been able to be detected to date by LIDAR.

4.2 REAL TIME MONITORING

Based on LIDAR monitoring to date and more recently, fixed monitoring RTK (Real Time Kinematic) GPS stations, any ground movements resulting from bord and pillar mining are shown to be less than natural soil movement. Mitigation measures have therefore not been necessary to date for the bord and pillar mined areas.

Fixed monitor GPS stations were installed in 2021 and provide a much higher level of accuracy of +/- 5 mm than LIDAR (Figure 4-1). These stations are installed 1.5-2 m into the ground surface to be able to better determine ground movement and minimise the impact of surface soil movement.

FIGURE 4-1 FIXED MONITORING STATION 114_2

Ensham has now installed six of these remote GPS monitoring stations above 114, 500 Mains, 502 and 503 Panels in the current underground area, as shown in Figure 4-2. Five of the six monitoring stations started recording data in mid-April 2021. By May 2023, development mining (primary workings) had been completed under station 502_1 and secondary workings had also been completed under stations 114_1, 114_2, 502_2 and 503_1 (Figure 4-2). At this stage, no mining has been carried out below station 502_3 (Figure 4-2). This monitoring has been set up by GNSS Monitoring and the data can be easily accessed remotely in real time.

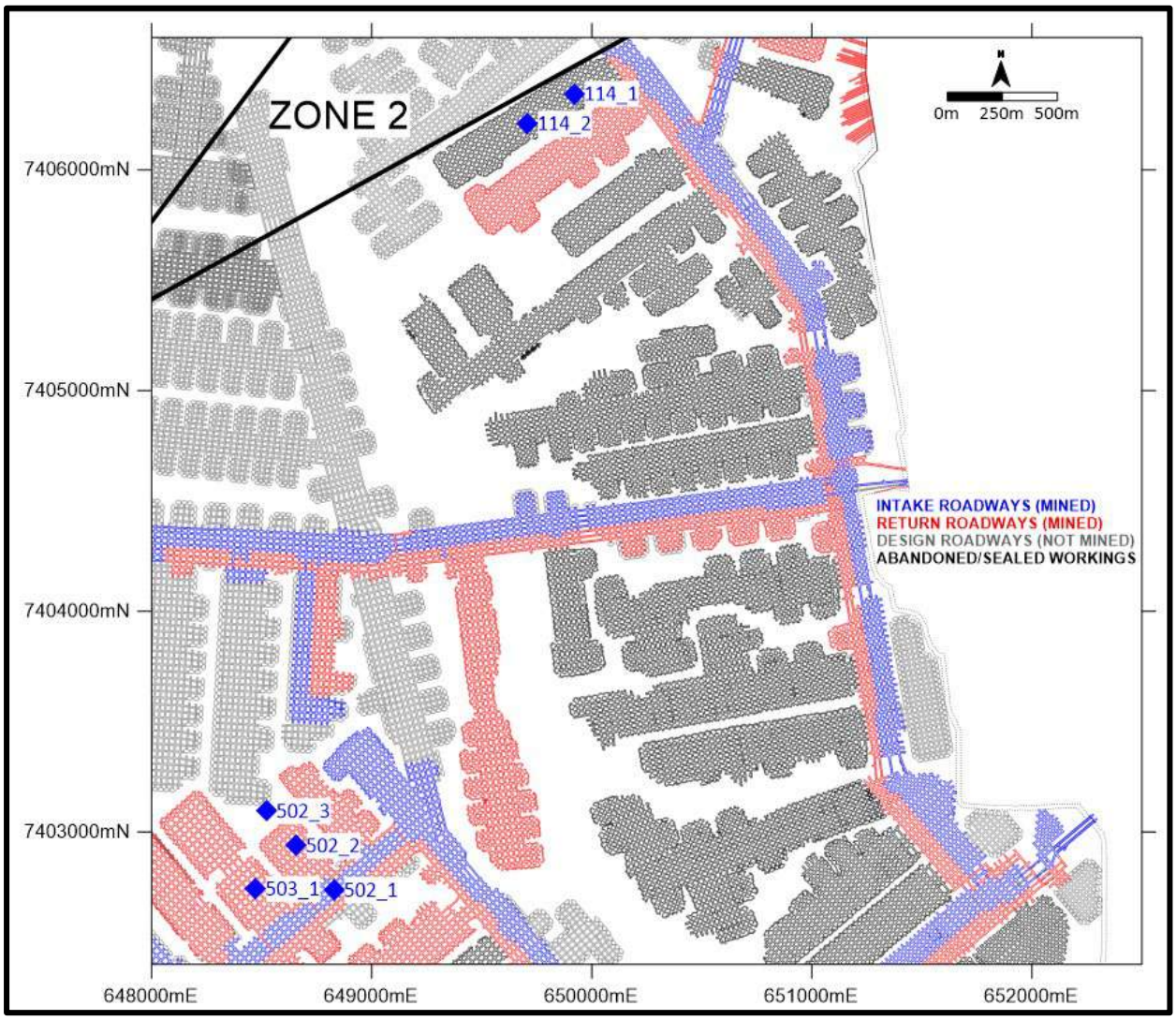

FIGURE 4-2 LOCATION OF REMOTE SUBSIDENCE MONITORING – ENSHAM UNDERGROUND AREA.

4.3 MONITORING SURVEYS

4.3.1 500 SERIES STATIONS

In the 500 Series Panel area, no mining has been carried out below station 502_3 (Figure 4-3). The 14 day moving average curve indicates any vertical movement is less than the survey error of ±5 mm (Figure 4-3). Also of note, the rainfall events since April 2021 do not appear to have significantly affected the vertical movement measured by this station (Figure 4-3). These stations are all located on vertosol soils.

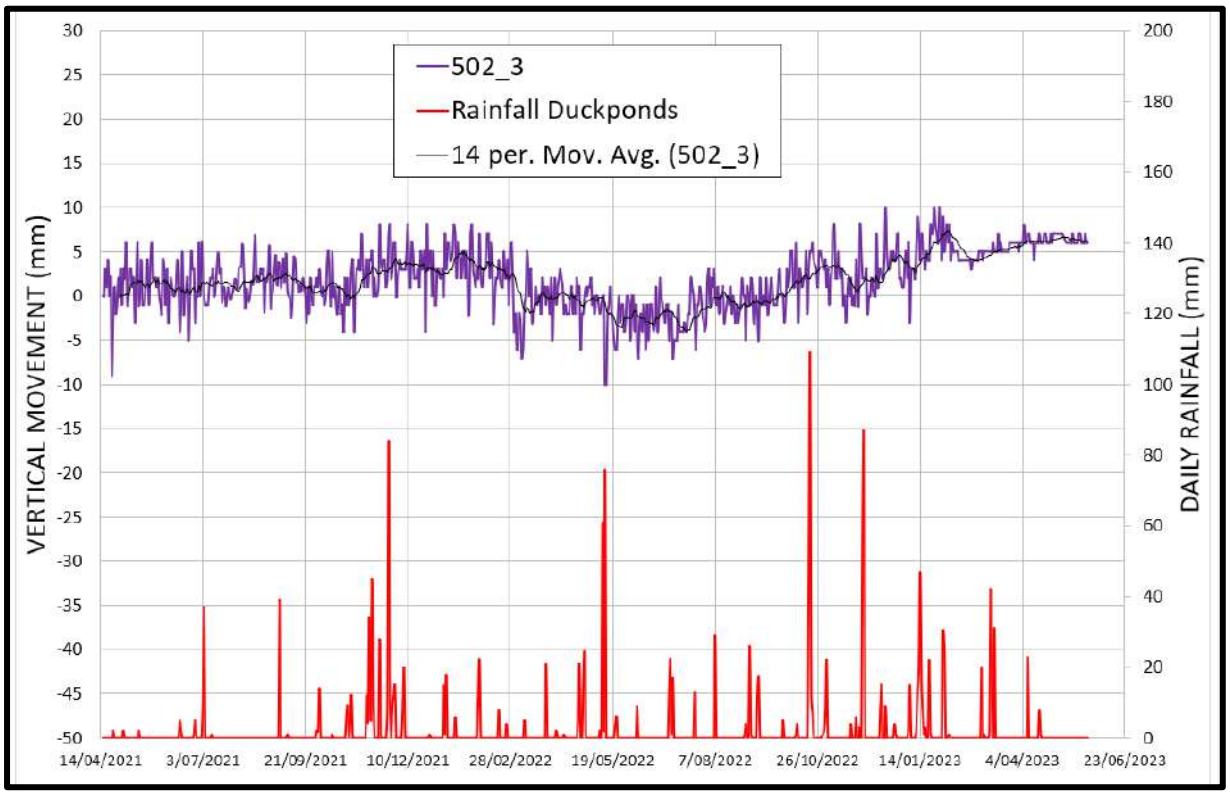

FIGURE 4-3 MONITORING DATA – 502_3 STATION.

FIGURE 4-4 MONITORING STATION 502_3

Similar observations are evident in station 503_1, where secondary extraction was carried out below this station in November 2022 (Figure 4-5). Any movement associated with mining below this station appears to be less than the survey error of ±5 mm (Figure 4-5).

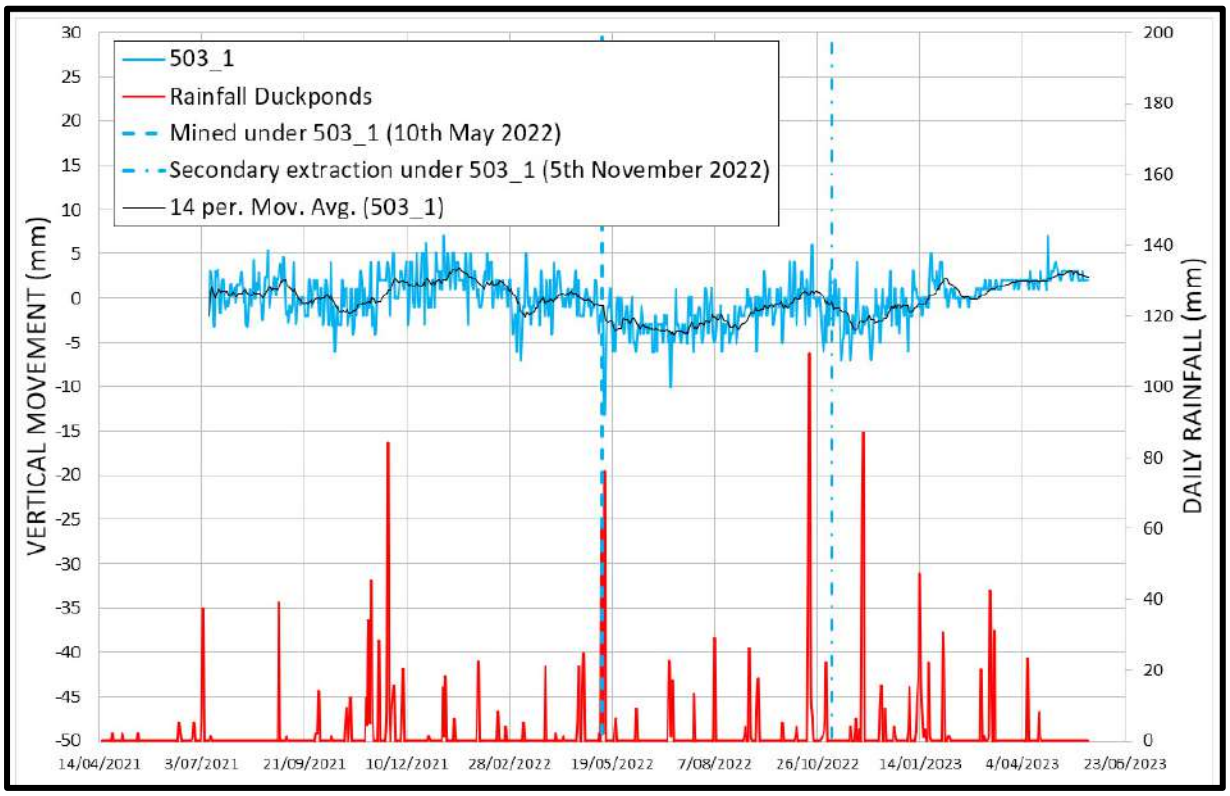

FIGURE 4-5 MONITORING DATA – 503_1 STATION

Development (primary workings) was carried out in the 500 Mains below station 502_1 in late May 2021. This mining appears to have been associated with approximately 5 mm of movement that occurred over a timeframe of a month (Figure 4-6). This timing is as anticipated based on the approximate 2 to 3 weeks required to mine the entire width of the panel below the survey station.

The reserve recovery in the 500 Mains below station 502_1 is 38.5%, at 195 m depth of cover. The FoS of the 500 Mains pillars for a 3.5 m mining height in this area is 1.90, equivalent to a probability of failure of 1 in 90,000.

502 Panel developed under station 502_2 in late August 2021, extracting coal to around 3.3 m high. Similar subsidence behavior to 502_1 was noted on the 502_2 station (Figure 4-7). Secondary workings of an additional 1 m of floor coal was completed under this station by late September 2021, with no additional vertical movement measured (Figure 4-7). This is consistent with the methodology of the strata compression analysis, which predicts a small amount of increased settlement (less than 2 mm) at the surface due to the increase in pillar height. Similarly, rainfall events do not appear to be significantly affecting the vertical movement measurements in this area.

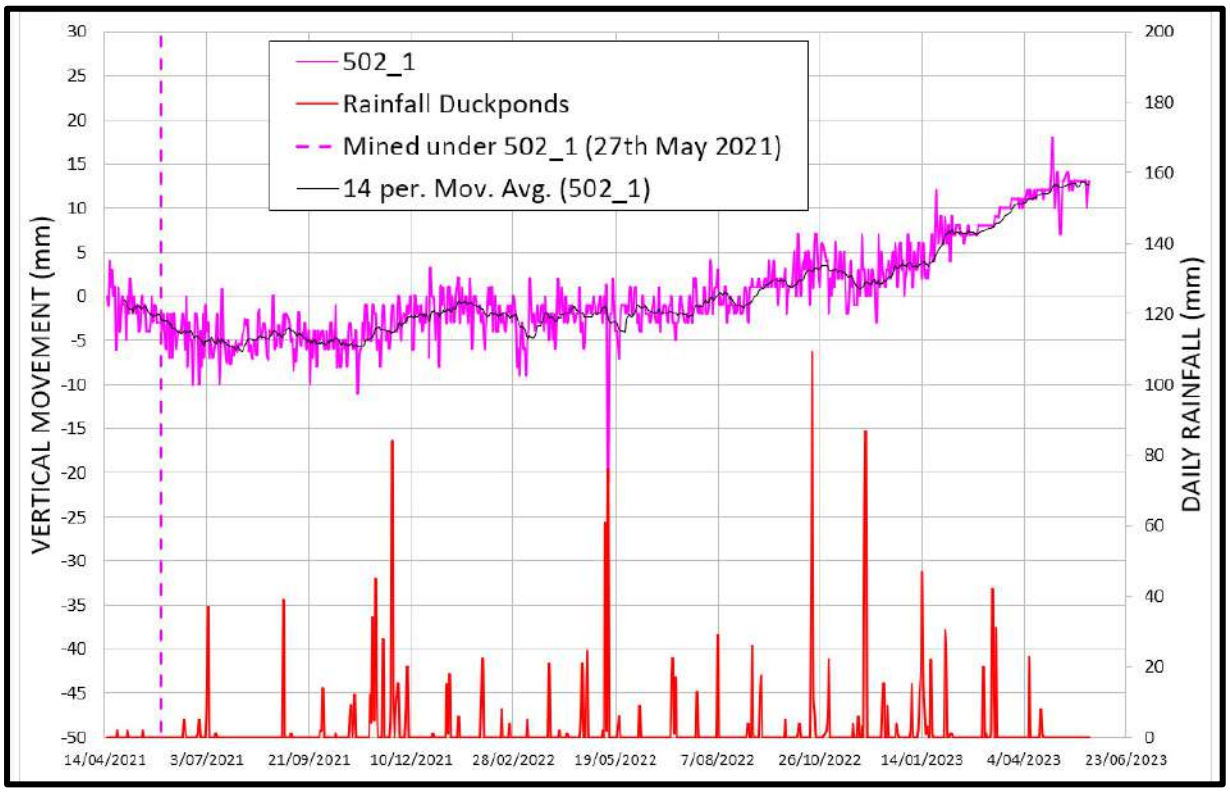

FIGURE 4-6 MONITORING DATA – 502_1 STATION.

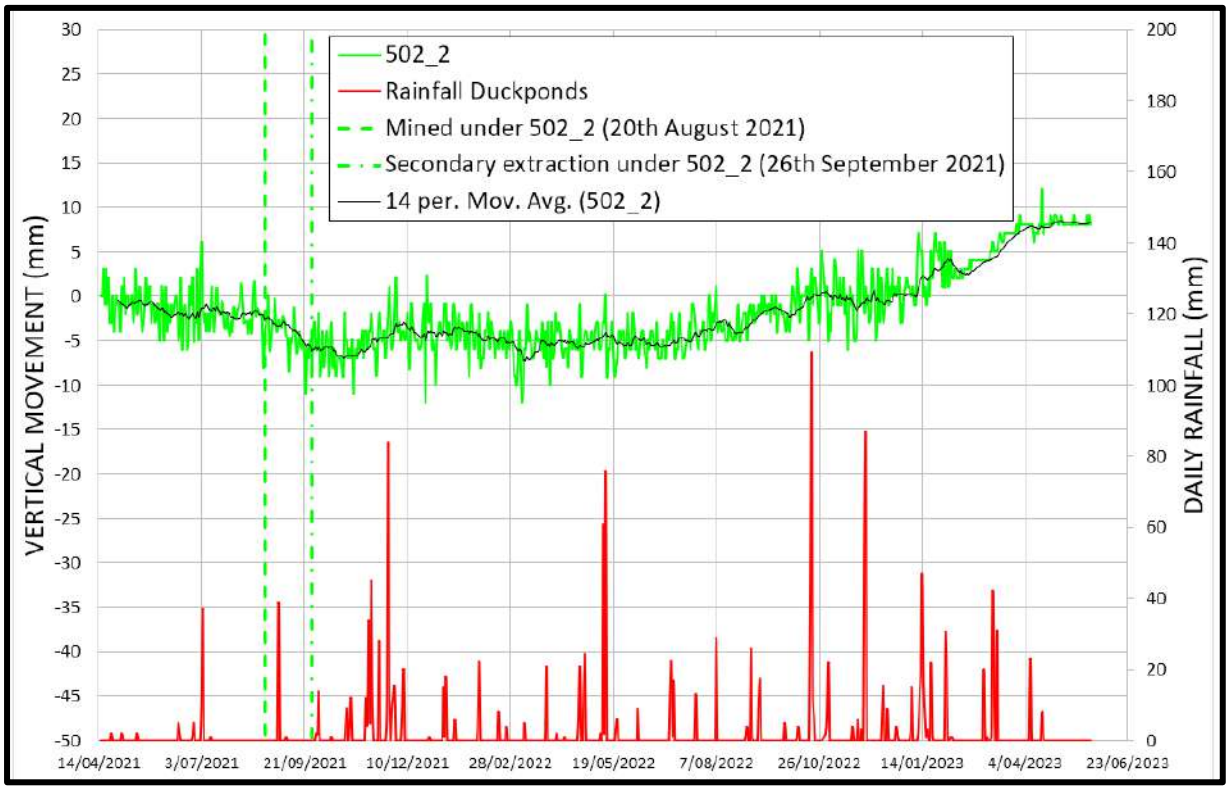

FIGURE 4-7 MONITORING DATA –502_2 STATION.

4.3.2 114 PANEL STATIONS

Mining of development roadways (primary workings) at 3.3 m high was carried out below survey stations 114_1 and 114_2 in mid-August and mid-September 2021 respectively (Figure 4-8 and Figure 4-10). Secondary extraction was completed below these stations in December 2021 and January 2022 respectively.

Prior to mining under station 114_1, a greater amount of scatter in the data was evident (Figure 4-8). This station also appears more susceptible to changes during rainfall events, such as those in in November 2021 and May 2022, which can be attributed to the type of material in which the station is anchored. It is located higher up the slope on Kandosol soil.

The data from station 114_2 appears less affected by rainfall and indicates around a two week period for the maximum 8 mm of subsidence to occur (Figure 4-10). Station 114_2 is located further down the slope on Dermosol soil.

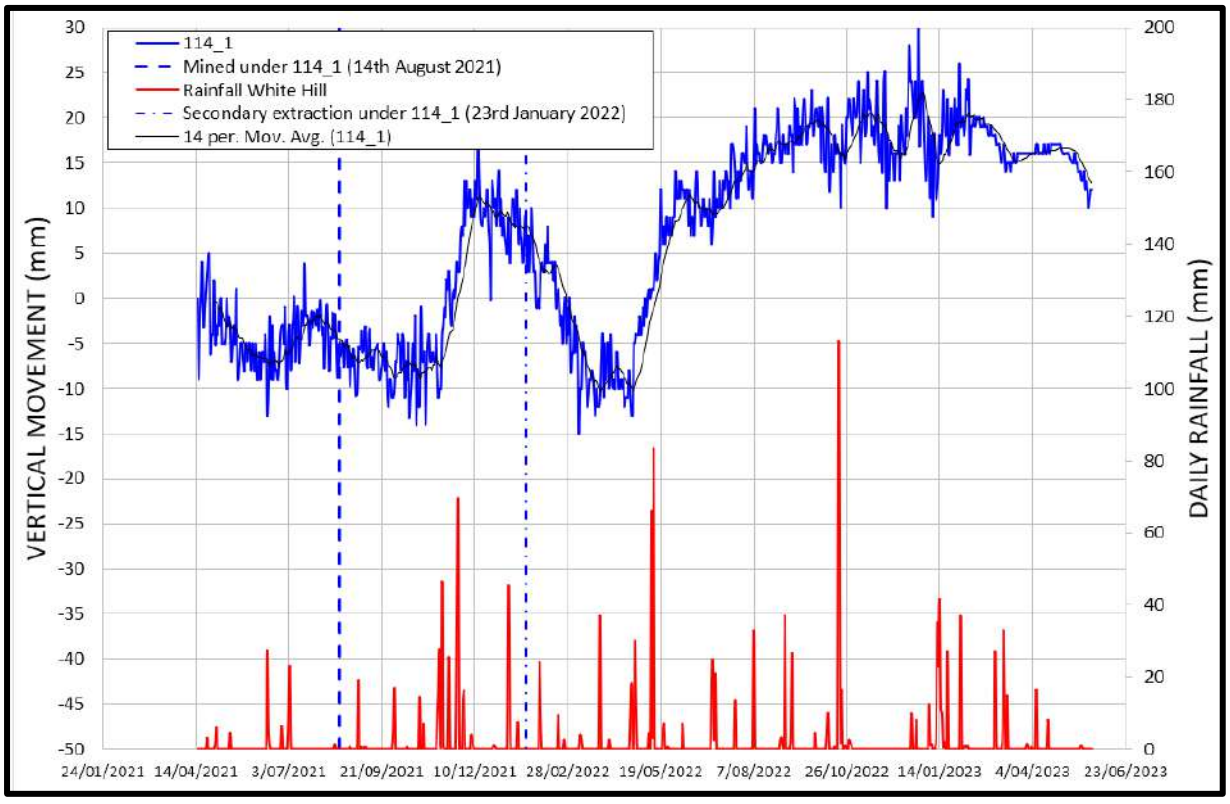

FIGURE 4-8 MONITORING DATA – 114_1 PANEL STATION.

FIGURE 4-9 MONITORING STATION 114_1 PANEL.

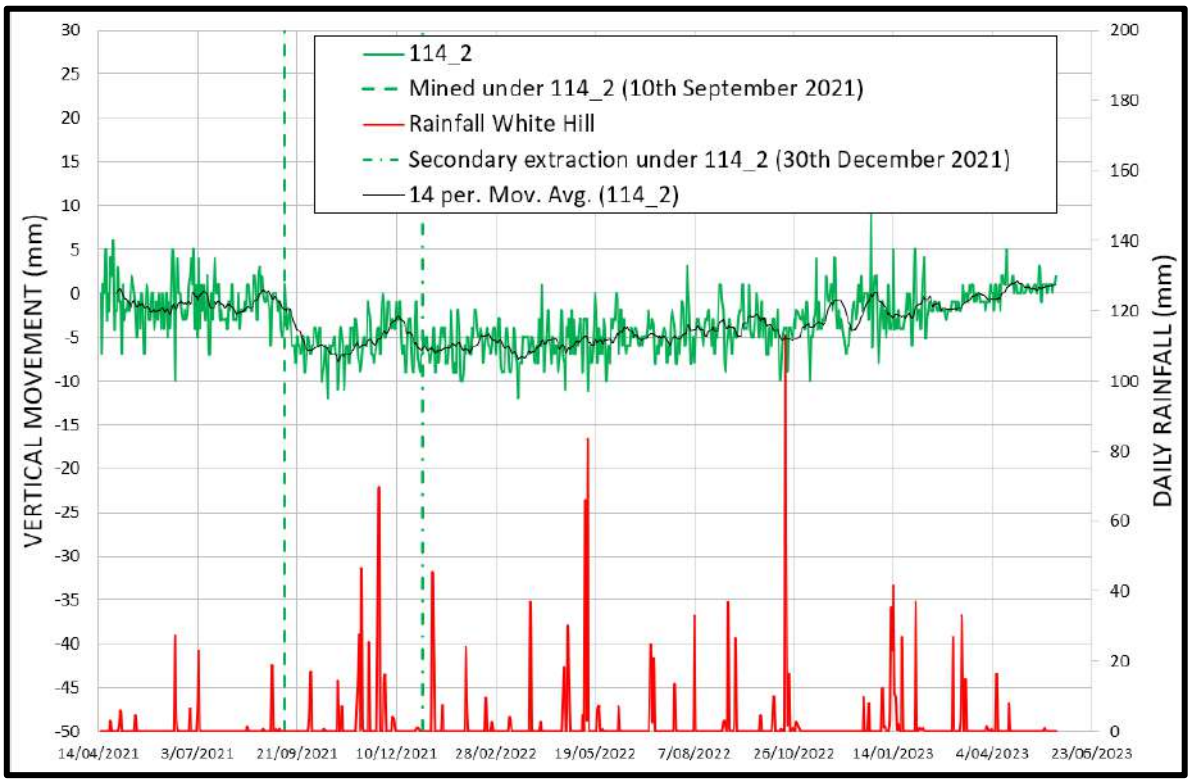

FIGURE 4-10 MONITORING DATA – 114_2 PANEL STATION.

4.3.3 SUMMARY

By September 2022, more than 18 months of higher accuracy (± 5 mm) monitoring survey data has been collected over the Ensham underground workings. This data indicates that underground mining has been associated with surface movements less than 10 mm, which is within the accuracy of the survey monitoring and validates the subsidence predictions.

It is anticipated that prior to mining in Zones 1, 2 and 3, more data of the natural surface movement will allow interpretation to determine any subsidence movement component. This data will be reviewed in conjunction with rainfall records and also the location of underground mining, to provide some guidance on the proportion of movement due to both mining induced subsidence and also the seasonal variation in ground levels due to changes in moisture content.

Nine monitoring stations are planned to be installed in Zones 2 and 3. Three of the stations will be used as a control and will be located within an area which will not be subject to mining as discussed in Section 4.2. An additional six monitoring stations are planned to be installed in Zone 1.

LIDAR surveys will still be required in assessing surface movements over larger areas and verification with compliance conditions.

This monitoring (LIDAR and RTK) should confirm the subsidence predictions and any significant changes in subsidence will trigger a review of the relevant impact assessments and associated mitigation and management measures, as discussed further in Section 4.9.

This review will also provide additional calibration data for any future subsidence predictions and assessments of subsidence effects.

A subsidence monitoring report will be produced as required for compliance and monitoring of subsidence impacts will be continued until rehabilitation milestones are achieved.

4.4 UNDERGROUND SURVEYING

As well as the surface monitoring, underground surveying of the completed mined roadways and pillar dimensions is carried out. The FoS and width: height ratio of the as-mined pillars can be calculated and checked against the design values.

These values can be referenced when reviewing the subsidence predictions.

4.5 SURFACE INSPECTIONS

Detailed surface inspections will be carried out on areas that have been identified through LIDAR or fixed GPS monitoring as having triggered an investigation as discussed in Section 4.8.

Any underground crossings under the Nogoa River within Zones 1 and 2 will be subject to an annual inspection of the bed and banks adjacent to the crossing to identify any visible subsidence as a result of mining operations that may impede on fish passage.

4.6 COMPLIANCE

4.6.1 PRCP APPLIES TO ALL UG MINING AREAS

The PRCP requires that:

- The extent and frequency of surface cracking and ponding of the mined land is comparable to the unmined land.
- Drainage features within the subsided areas is comparable with the pre-mining drainage features of the land as confirmed by a LIDAR Survey.

Photographic monitoring within mined panels and adjacent unmined areas will be used to confirm cracking and ponding is comparable between the two areas as proof towards achievement of PRCP Schedule Milestone RM12.

Annually a drainage map will be produced from LIDAR over mined areas and compared to pre-mine drainage to confirm no change to drainage features as proof towards achievement of PRCP Schedule Milestone RM12.

4.6.2 RIDA APPLIES TO ZONES 2 AND 3

The RIDA requires that:

- LIDAR is based on common geodetic datum.
- LIDAR metadata must be collected to any relevant Australian Standard.
- LIDAR data must be captured at the same time each year.
- Levels of subsidence must not exceed:

  - 100 mm of vertical subsidence.
  - A tilt of less than 5mm/m measured over 20 metres.
- Develop and implement an Erosion and Sediment Control Plan.
- Photographs of flare sites – date and GPS stamped of:
  - Pre-disturbance site conditions.
  - Post-restoration site conditions.
- Lodged report within 3 months of removal of bore casing.

Annually the LIDAR surface for zones 2 & 3 will be collected (in accordance with Section 4.1) and compared with the LIDAR surface from the previous year with the threshold set at 100mm. Any areas where the surface has greater than 100mm difference will be investigated to determine if it could be related to underground mining activities or is natural or agricultural processes. If the subsidence is less than 100mm than the tilt must be within acceptable criteria.

Strategies and actions outlined within the Erosion and Sediment Control Plan will be carried out at the flare locations. This will also include photographic records.

Photographic monitoring points within zones 2 & 3 will be established and recorded over the duration of mining activities to detect and record any changes due to mining activities over time. The photographs are to be date and GPS stamped.

4.6.1 EPBC 2020/8669 APPLIES TO ZONES 1, 2 AND 3

The EPBC approval requires:

- This SMP must reliability predict subsidence that may cause harm to protected matters ie. Brigalow.
- Subsidence levels must not exceed 500mm compared to pre-mining levels.

This is detailed more in Section 5.

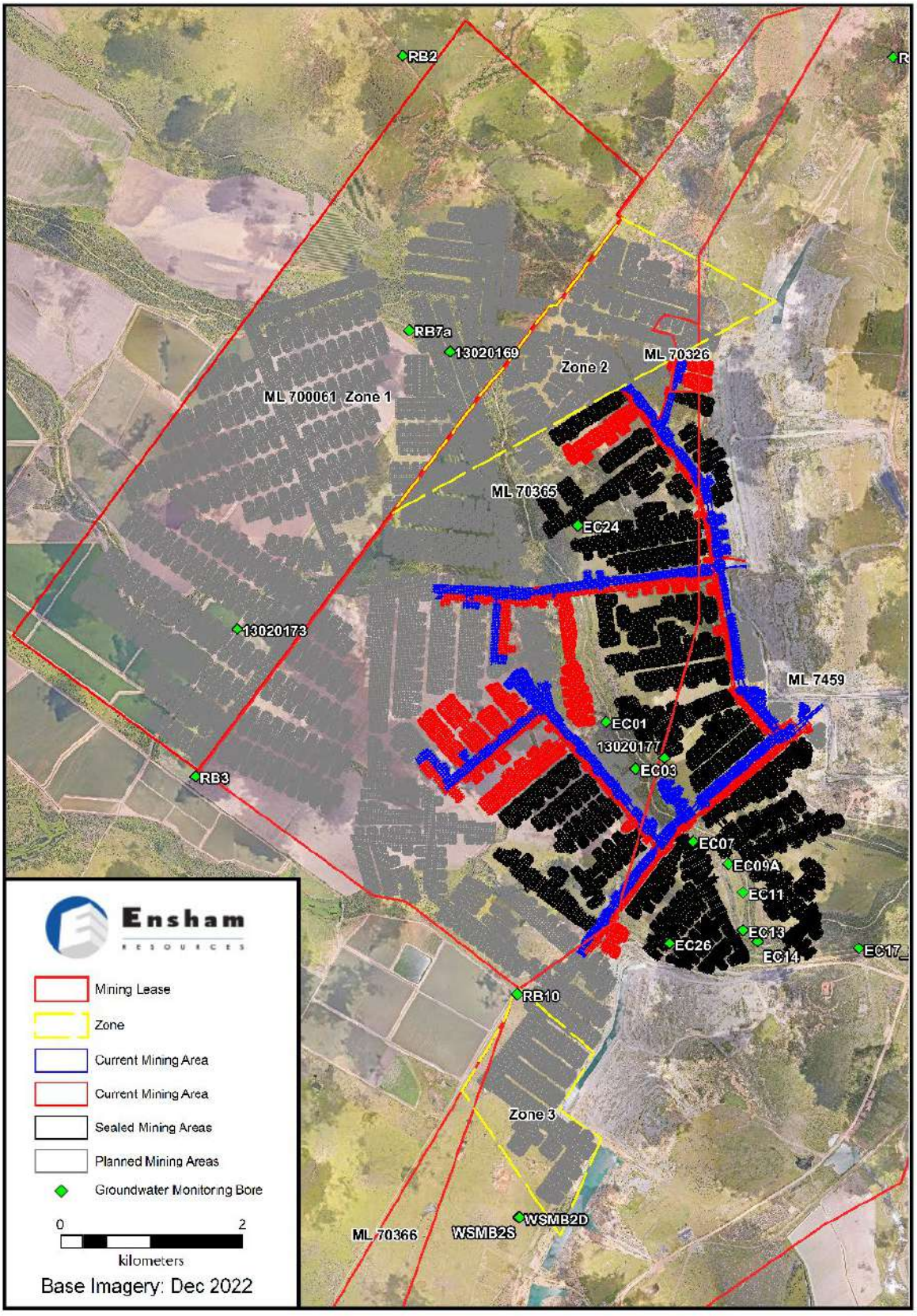

FIGURE 4-11 GROUNDWATER MONITORING BORES.

4.7 MONITORING SCHEDULE AND TRIGGER LEVELS

The monitoring schedule for the various aspects detailed in this SMP are summarized in Table 4-1. This schedule also includes the frequency and responsible department. Trigger levels based on various approvals for Zones 1 2 and 3 have also been specified to initiate a review. The Fixed GPS trigger is slightly higher in Zone 1 compared to Zones 2 and 3 due to the increased depth of cover.

TABLE 4-1 MONITORING SCHEDULE FOR SUBSIDENCE.

Monitoring/ Survey	Who by	How often	Trigger Levels – Zone 1	RIDA Trigger Levels – Zones 2 and 3	EPBC Trigger Levels – Zones 1, 2 & 3
LIDAR	Technical Services/Survey	Annual	>100 mm movement when LIDAR surfaces are compared on an annual basis	>100 mm movement when LIDAR surfaces are compared on an annual basis	500mm
Fixed GPS	Technical Services/Survey	Real Time	40 mm	35 mm	500mm
Surface Surveying	Technical Services/Survey	As per land compensation agreements	As per land compensation agreements	As per land compensation agreements	As per land compensation agreements
Underground Surveying	Survey	Daily	As per Strata Control Management Plan	As per Strata Control Management Plan	As per Strata Control Management Plan
Surface Inspections	Environmental	Annual or if investigation is triggered	Surface inspections will be instigated from LIDAR results. Water ponding, new gully erosion or changes to Nogoa River bed and banks (that may indicate an impact to fish passage) not attributed to	Surface inspections will be instigated from LIDAR results. Water ponding, new gully erosion or changes to Nogoa River bed and banks (that may indicate an impact to fish passage) not attributed to natural processes at	As required when the subsidence trigger is reached.

			natural processes at locations where underground mining has occurred	locations where underground mining has occurred	

4.7.1 SUBSIDENCE TRIGGER LEVELS

Based upon the accuracy of LIDAR (+/-50 mm) and the natural soil variation of 50 mm (Commonwealth of Australia, 2014 and 2015), a LIDAR trigger level of 100 mm lower than the previous annual LIDAR surface survey is considered a realistic value for cracking clay soils and other soils located on slopes to investigate.

Similarly, a 35 mm variation in the more accurate fixed pole RTK-GPS ground monitoring is considered a valid trigger level based on the initial monitoring over 114, 500 Mains and 502 Panels (Figure 4-3 to Figure 4-10), which is based on the magnitude of the predicted subsidence as per the Subsidence Report for the Ensham Life of Mine Extension – Zones 2 and 3, February 2022, and the Subsidence Report for the Ensham Life of Mine Extension – Zone 1, June 2022.

4.8 SUBSIDENCE MANAGEMENT MEASURES

Due to the low-level subsidence effects measured and observed as a result of bord and pillar mining at Ensham, remedial management measures are presently not required unless a significant deviation in the level of subsidence is identified from future monitoring. The subsidence monitoring results detailed in Section 4.3, confirm the surface movements due to mining of less than 10 mm. This level of movement requires no remediation in view of the natural soil variation, which may exceed 50 mm (Commonwealth of Australia, 2014 and 2015).

Any significant detection of subsidence (i.e. where the level of subsidence exceeds the trigger levels) will trigger a review of underground mining activities as detailed in Section 4.8. Depending on the land use and risk involved in the activity, different mitigation measures may be required:

- Grazing – rip to eliminate risk to stock.
- Dry land cropping – plough out if effecting crop yield.
- Irrigated cropping – re-level to ensure continued drainage.
- Brigalow TEC – offsets.

Where surface levels indicate a difference in elevation greater than the trigger levels in Table 4-1 an investigation will be undertaken by Ensham. Where the RIDA trigger levels are exceeded, the investigation undertaken must identify if the subsidence is likely a result of mining activities. If the investigation supports that the elevation change is associated with mining, then a detailed investigation will be completed by a suitably qualified person and, where warranted, an investigation report will be prepared and submitted to the Administering Authority and to the land owner/land occupier. The investigation will nominate the necessary rehabilitation (which may

include monitoring and management of soil erosion) to be undertaken if necessary. Land will be rehabilitated in accordance with the approved PRCP and the current Environmental Authority.

If subsidence monitoring identifies a potential impact to fish passage within the Nogoa River as a result of mining activities, then rehabilitation and restoration works would be undertaken. The trigger levels based on monitoring, surveying and inspection are detailed in Table 4-1. These trigger levels would be reviewed annually (or following an investigation) to ensure that there are no impacts to fish passage in the Nogoa River. Furthermore, the stability of the underground workings is checked by regular inspections. In the current underground workings, the thickness of floor coal is controlled during the mining process by spray painting the rib side to ensure the mined thickness does not exceed the amount specified on the sequence plan and Permit to Mine document (Figure 4-12).

The actions to be taken after exceedance of the EPBC trigger are detailed in Section 5.

Ensham's existing design, processes and monitoring target management of subsidence by prevention. In regards to long-term stability, after mining is completed and the workings flood with groundwater, the buoyancy effect of the groundwater will reduce the vertical load on the pillars by up to 40%. For a pillar below the Nogoa River anabranch, designed with a FoS of 2.11, at 140 m depth of cover, reducing the vertical load on the pillar by a conservative 25%, to account for any potential strength loss in the coal and surrounding strata, increases the FoS to 2.82. This FoS has a probability of failure in excess of 1 in 10,000,000. As well as the factor of safety approach, the long-term life expectancy of pillars can be estimated using empirical studies from South Africa. Using this methodology, the pillars are calculated to be stable well in excess of 200 years.

Furthermore, as detailed in Section 3.1, underground surveying of the completed mined roadways, bell outs and pillars is carried out. The FoS and width: height ratio of the as-mined pillars can be calculated and checked against the design values. These checks are carried out by the Geotechnical Engineer and reported in the monthly geotechnical inspection report. Experience to date has shown that there have been no exceedances of the planned mining heights in the secondary workings panels at Ensham.

FIGURE 4-12 PAINT MARKS TO CONTROL THE THICKNESS OF FLOOR COAL MINED.

No underground mining is proposed beneath the Nogoa River main channel within Zone 2, with mining only to occur to construct roadways to connect the bord and pillar mining areas (Figure 1-1). In Zone 1, mining is planned in five panels below the Nogoa River. Surface inspections for impacts from subsidence on the Nogoa River will be completed at each location where an underground crossing is constructed. Some underground mining is planned for approximately 200 m under the Nogoa River anabranch in Zone 2, however this channel only holds water at times of flooding and therefore provides limited fish passage compared to the Nogoa River main channel.

4.9 EMERGENCY PROCEDURES

A principal hazard management plan, PHMP (UG PHMP.09.17.01 Precautions Against Inrush Principal Hazard Management Plan) defines the requirements for the effective control of the risks associated with Inrush and the principal hazard of inundation due to water, gas, or material that flows, in the underground workings of Ensham Coal Mine. It applies to all aspects, activities and personnel associated with underground coal mining at Ensham Resources Pty Ltd. The objective is to identify areas where Inrush or inundation could occur and to prevent such occurrences. It also provides for the requirements of the Coal Mining Safety and Health Regulation 2017 (CMSHR) Sections 292, 293, 294, 295. The management plan is underpinned by Risk Assessment (RA.BT014 Inrush into underground workings) and Trigger Action Response Plan, TARP (UG TARP.09.17.01-01 Potential for Inrush Underground TARP).

Non-routine situations such as an incident or natural disaster that has the potential to impact Brigalow vegetation is discussed in Section 5.5.2.

5. POTENTIAL IMPACTS ON BRIGALOW TEC

5.1 INTRODUCTION

The mining activities are approved under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), with approval requirements to manage the impact of subsidence on Brigalow Threatened Ecological Community (Brigalow TEC). This plan includes requirements to address the condition requirements of EPBC 2020/8669 approval, being to develop a subsidence monitoring and management plan. The risk of Brigalow TEC being impacted by subsidence attributed to the Project is low (likelihood is rare, with minor environmental consequences). This is due to the limited subsidence depths expected. The main requirements to manage the subsidence impact associated with mining activities on Brigalow TEC will be:

- Monitoring to demonstrate no significant impacts on Brigalow have occurred despite Project subsidence levels; and
- Implementing correction actions to be taken if nominated trigger values are achieved.

5.2 POTENTIAL IMPACTS

The risk of Brigalow TEC experiencing a significant impact from the Project subsidence is low. This is based on studies investigating subsidence impacts on Brigalow and other vegetation in the brigalow belt of Queensland. No significant impacts have been observed, despite the subsidence levels being greater than 3 m (BHP 2023a, 2023b; Eco Logical Australia 2015). In the Project, the potential impact on Brigalow TEC, if any, would be in the area along the Nogoa River and a patch in the southwest corner of Zone 1. The two locations are described as area A and B in Figure 2-10.

5.2.1 SUBSIDENCE TRIGGER VALUE TO MONITOR FOR A SIGNIFICANT IMPACT TO BRIGALOW TEC

Studies from the literature review have indicated that Brigalow has not been impacted by subsidence movements of up to 3 m, with similar findings from studies assessing subsidence movements of between 2.4 and 2.9 m. As a highly conservative measure, it is proposed that a subsidence trigger value of 500 mm is selected for Ensham mine. This depth substantially exceeds the predicted subsidence depth for the Project and is significantly lower than the depth addressed in related studies that did not result in any impact to Brigalow.

The trigger value is considered appropriate to differentiate between normal ground movement, whilst capturing any potential impact from subsidence. As no impacts have been recorded where 3 m of subsidence has occurred, 500mm is considered appropriate to identify potential impacts from the Project subsidence on Brigalow TEC.

5.3 BRIGALOW MONITORING

Brigalow vegetation monitoring is proposed to consist of monitoring for two different purposes: pre-activity condition/baseline assessment; and Brigalow TEC impact monitoring when the subsidence is exceeded (Sections 5.3.1 and 5.3.2). The timing for each monitoring purpose is outlined in Figure 5-1.

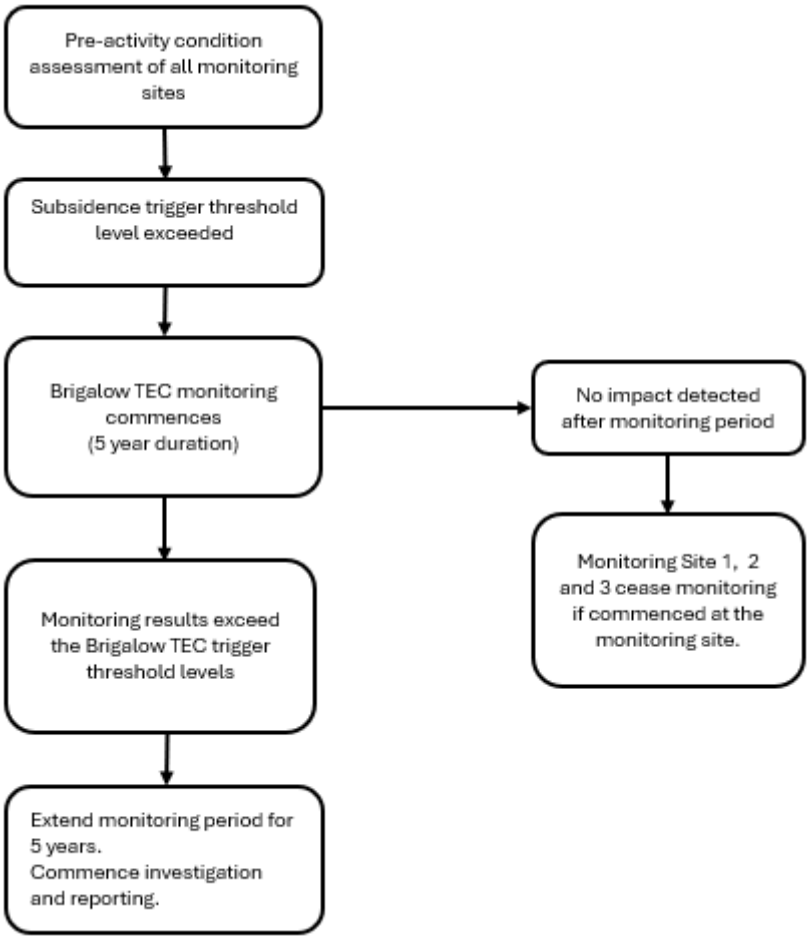

FIGURE 5-1 PROCESS TO DETERMINE MONITORING BRIGALOW TEC

5.3.1 PRE-ACTIVITY CONDITION ASSESSMENT

In the pre-activity condition assessment, three monitoring sites are proposed to be established to assess the condition of the Brigalow TEC using BioCondition and photo monitoring methods as the pre-mining/subsidence baseline (Figure 2-10). One round of measurements is proposed to be undertaken before mining commences at each monitoring site. The proposed monitoring sites are provided in Table 5-1.

5.3.2 BRIGALOW TEC SUBSIDENCE IMPACT MONITORING

The measured subsidence records may indicate a deviation, or an increased level of subsidence, from the level of subsidence predicted. Subsidence will be detected using the existing methods outlined in Section 4.1 and 4.2 of the SMMP. The existing measures in the SMMP will also be used to identify the level of subsidence that has occurred.

After underground mining activities have commenced, it is proposed that the monitoring sites, set up in the pre-activity condition assessment (Section 5.3.1) will be used for monitoring purposes if the trigger value for subsidence (Section 5.2.1) is exceeded during operations.

Brigalow TEC monitoring at the monitoring sites will only be undertaken after subsidence has been detected at a specific location.

Health of the Brigalow TEC is proposed to be verified by:

- annual photographic monitoring; and
- BioCondition monitoring conducted every two years; and
- the use Normalised Difference Vegetation Index (NDVI) assessment.

The methods are further described in Section 5.3.

With the proposed mining schedule, monitoring would be undertaken at monitoring sites 1 and 2, before monitoring site 3. Monitoring assessment methods are proposed to be undertaken, as stated in Table 5-2.

When the measured subsidence exceeds the trigger value without the Brigalow threshold triggers being exceeded, the process described in Section 5.5.1.1, will be undertaken.

If a decline in Brigalow vegetation condition is detected, the notification process and investigation process will be triggered. The process is described in Section 5.4.1 and 5.4.2. Monitoring under this scenario is proposed to be undertaken for a duration of a further five years if a significant impact on Brigalow TEC from subsidence is confirmed by ecologists. The confirmation would require evidence and an evaluation report.

5.3.3 MONITORING SITE LOCATIONS

The Brigalow TEC occurs in two distinct linear shaped areas above the proposed underground mining; monitoring area A is approximately 19.8 ha; and monitoring area B is a smaller area of 3.7 ha. Three monitoring sites have been selected to ensure adequate monitoring in the two areas (Table 5-1). Proposed locations may be adjusted based on local conditions such as accessibility.

TABLE 5-1 LOCATION OF MONITORING SITES

Monitoring Site	Latitude (GDA 94)	Longitude (GDA 94)	Pre-activity indicative year to be undertaken, or prior to nominated date	Brigalow TEC subsidence impact monitoring
Monitoring Site 1 (Area A)	-23.4622	148.4266	2030	TBD, if subsidence monitoring during operations exceeds trigger level.
Monitoring Site 2 (Area B)	-23.4367	148.4377	2030	TBD, if subsidence monitoring during operations exceeds trigger level.
Monitoring Site 3 (Area A)	-23.4610	148.4168	2030	TBD, if subsidence monitoring during operations exceeds trigger level.

Monitoring site 1 in monitoring area A was selected because it is the location of the site used in previous Brigalow assessment studies; existing data can be used for background information and there will be similar data parameters used to continue monitoring the site; and it appears to be within the polygon avoiding edge effects.

Two new monitoring sites are to be established. Site 2 in monitoring area B, and site 3 in monitoring area A (Table 5-1). These two sites have been selected because of the occurrence of Brigalow TEC within the area of potential subsidence; to be less exposed to edge effects; and the proposed scheduled mining in that area. Monitoring may be undertaken at the four separate patches (four monitoring sites) in Area C, if the mine plan is revised and potential subsidence may result in that area.

5.3.4 BRIGALOW TEC MONITORING ASSESSMENT METHODS

Brigalow monitoring at Ensham mine will use Queensland industry established qualitative and quantitative vegetation methods:

- Photographic monitoring at monitoring sites;
- BioCondition at monitoring sites; and
- Remote sensing using the Normalised Difference Vegetation Index (NDVI).

The proposed indicative monitoring schedule is provided in Table 5-2. Each method is described in the sections following. A review of the methods and the schedule for monitoring will occur as the monitoring results are analysed. Monitoring results and data records will be stored in electronic format by the mine. They will be used for annual reporting as required.

The frequency, purpose, accountable role, and benchmarks to be measured are provided in Table 5-3.

TABLE 5-2 MONITORING PURPOSE AND SCHEDULE FOR BRIGALOW TEC

Monitoring/ Assessment method	Monitoring stage	Role responsible for monitoring	Frequency	Benchmarks being monitored for
Photographic Monitoring	Pre-activity condition assessment Brigalow TEC subsidence impact monitoring	Environmental Advisor	Pre-activity condition assessment, then annually.	Mortality of multiple tree and shrub individuals at monitoring site.
BioCondition Assessment	Pre-activity condition assessment Brigalow TEC subsidence impact monitoring	Consultant Ecologist	Pre-activity condition assessment, then every 2 years.	Biocondition Score decline by 10; and 'Tree Canopy Cover' aspect declined by 5 from initial assessment.
NDVI	Exceeded trigger value monitoring.	Spatial specialist	As required based on trigger value of	Median NDVI value fails to maintain a value greater than

	May be used to validate site monitoring results.		photographic or BioCondition monitoring, or if trigger threshold value exceeded.	the first quartile of the reference site for at least 85% for any sample event.

5.3.4.1 PHOTOGRAPHIC MONITORING

Photographic monitoring will adopt the method described in the Guide to photo monitoring of ecological restoration projects (NSW Office of Environment and Heritage 2018) and be undertaken annually. Photographic monitoring is recommended as it is a rapid method and provides a relatively direct way to measure changes in vegetation and provides on ground evidence of vegetation condition (NSW Office of Environment and Heritage 2018).

An annual monitoring frequency for five years is proposed for photographic monitoring if the subsidence trigger level is exceeded, as subsidence impacts on Brigalow condition are not expected to be immediately noticeable.

5.3.4.2 BIOCONDITION ASSESSMENT

Biocondition assessment is recommended as it can quantitatively measure vegetation composition, structure and function (Eyre et al. 2015). Combined with photographic monitoring, the methods provide detailed information on vegetation condition that are complementary when used at different frequencies, and they diversify the data collected. Both photographic and Biocondition field-based methods are proposed to be used to measure and monitor vegetation. They are considered suitable to provide reliable records for vegetation condition and evaluate vegetation changes through time.

Biocondition assessment is proposed to be the primary assessment method to quantitatively measure vegetation condition. It will be undertaken according to the BioCondition Assessment Manual (Eyre et al. 2015). The assessment will be conducted twice within the five year period if the subsidence trigger threshold is exceeded.

5.3.4.3 NORMALISED DIFFERENCE VEGETATION INDEX (NDVI)

Normalised Difference Vegetation Index (NDVI) is recommended as a method to measure change throughout the entire TEC area. Based on vegetation colour, it is a commonly used vegetation imaging system to provide insights into vegetation condition for a broader vegetation area (Eco Logical Australia 2015).

Non-impacted Brigalow TEC in area C can be used as a reference area to provide a comparative baseline for the other areas above the mining area (Brigalow TEC in area A and B). By comparing the NDVI collected from each monitoring area with reference area C, Brigalow TEC with a median NDVI value 15% less than the first quartile of the reference site at any sample event throughout the year will trigger a field verification assessment.

5.3.5 BRIGALOW TRIGGER THRESHOLD LEVELS TO TRIGGER AN INVESTIGATION

If the subsidence trigger level is reached (>500mm), and monitored thresholds for photographic monitoring, NDVI and BioCondition assessments have been exceeded (Table 5-3), an investigation will be required (Section 5.4.1). Further justification for each threshold is also provided.

TABLE 5-3 TRIGGER THRESHOLD LEVELS FOR EACH MONITORING ASSESSMENT METHOD TO TRIGGER AN INVESTIGATION

Assessment method	Threshold to trigger additional requirements
BioCondition assessment	Total score declines by 10, and 'Tree Canopy Cover' score declines by 5.
Photographic monitoring	Photographic monitoring detects mortality of multiple trees and shrubs.
NDVI	Median NDVI value fails to maintain a value greater than the first quartile of the reference site for at least 85% for any sample event.

The total BioCondition score provides an overview of the vegetation, including grasses and shrubs. A decline by 10 indicates an overall condition decline in the vegetation. 'Tree Canopy Cover' is one of the aspects in BioCondition that characterises stand productivity, distribution and abundance of biomass of the tree component (McElhinny 2002). A change in both total score and tree canopy cover will identify a decline in the Brigalow TEC condition.

At any particular location, it is acknowledged that individual plants will naturally senesce over time. The trigger for photographic monitoring at the site will be when mortality of multiple individual trees and shrubs are observed at the monitoring site.

Brigalow TEC productivity can be measured using NDVI, and if there is a significant decrease in the median NDVI value, it can indicate a change in TEC condition.

5.4 COMPLYING WITH EPBC APPROVAL

This section outlines the requirements for notifying investigating and reporting, to address the EPBC approval. The diagram (Figure 5-2) identifies when each will be required, and the following sections provide further detail.

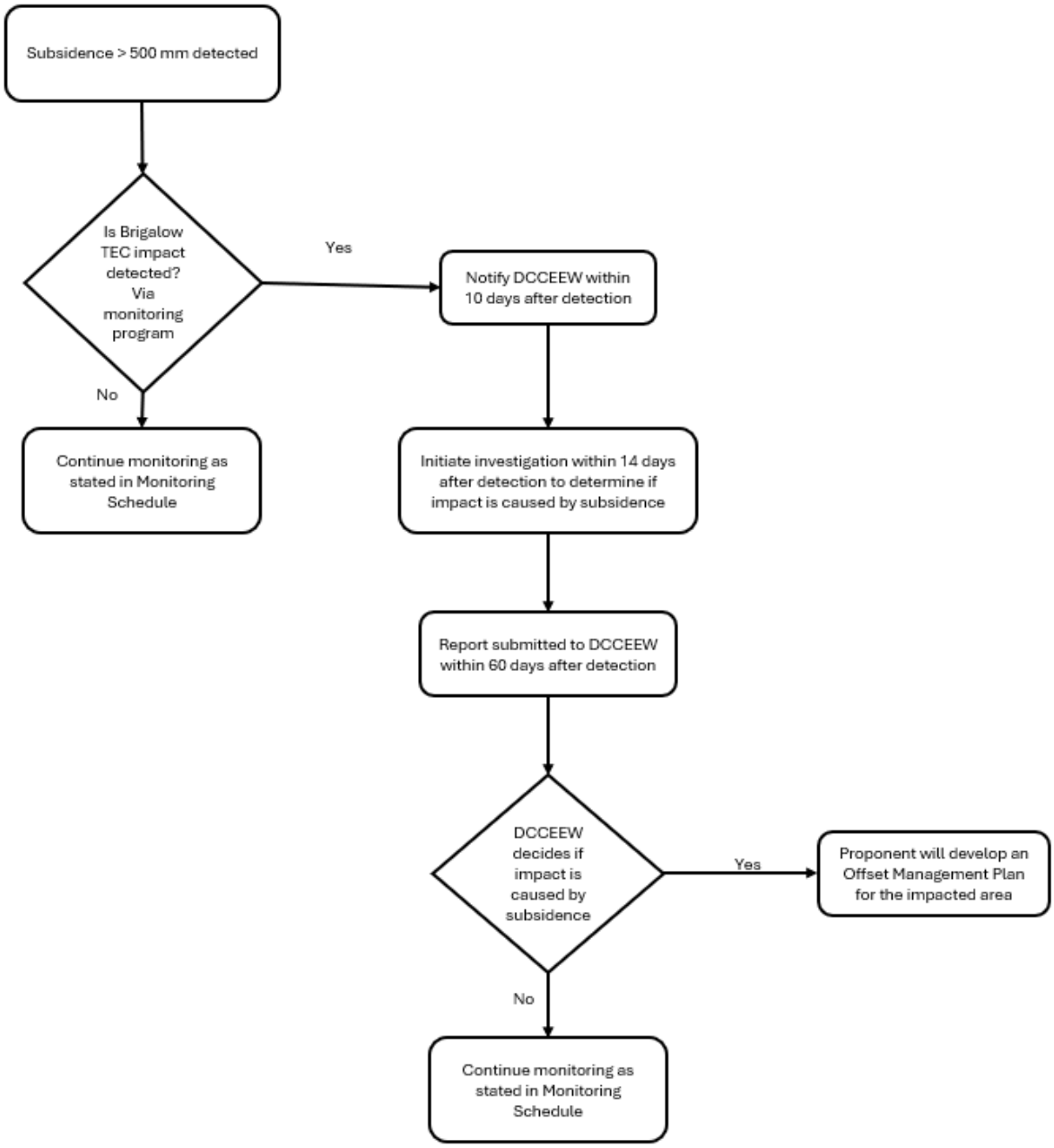

FIGURE 5-2 CONCEPTUALIZED FLOWCHART OF THE NOTIFICATION PROCESS

5.4.1 NOTIFYING THE DEPARTMENT OF CLIMATE CHANGE, ENERGY, THE ENVIRONMENT AND WATER

If the subsidence threshold is exceeded, and an impact to Brigalow TEC is detected, a process to notify the relevant Australian Government Department is required. The detection may be approximately 6- 12 months after the subsidence occurs, and within the five year monitoring period.

When the trigger values for photographic monitoring, BioCondition or NDVI are also exceeded (Table 5-3), the process to notify the Department according to the EPBC approval is to be implemented.

The approval holder must notify the DCCEEW of any potential non-compliance or actual non-compliance. The approval holder must notify electronically within two business days of a potential non-compliance (Condition 30). They must also notify in writing within 12 business days of the detection (Condition 32 of the approval), of an exceedance of the trigger values in Table 5.

The approval holder must notify the Department of Climate Change, Energy, the Environment and Water (DCCEEW) of any potential or actual noncompliance. The approval holder must notify electronically within 2 business days of a potential noncompliance; and notify in writing within 12 business days of the detection, being the exceedance of the trigger values in Table 5-6.

5.4.2 INVESTIGATING AND REPORTING

The Environmental section will notify the Area Supervisor to ensure they are made aware of the impacted area. The impacted Brigalow vegetation will be demarcated, by fencing if required, else using GPS coordinates for the impacted area collected in the field.

An investigation, aligned with the Ensham Resources SOP for incident notification, investigation and reporting (IMS.SOP.14.00.01), is to be commenced by ecologist(s) within 14 business days of detection, to determine if the reaching of the trigger value or exceedance of the limit is a result of the approved activity. The investigation and reporting process in the SOP will facilitate data collection and analysis to identify the cause of the trigger exceedance. All supporting documentation, including past data collected from photographic monitoring, NDVI and Biocondition assessments (including the photos), and reports will be attached to the investigation report. An NDVI assessment, combined with Biocondition and photographic assessments will be used to determine the extent and severity of the actual harm to the Brigalow TEC. All primary information shall be recorded by the Supervisor responsible for the incident. The Investigation Report will be completed by ecologist(s) and reviewed by a Supervisor.

The investigation report, highlighting the magnitude of impact, area of impact and potential cause of impact, must be submitted to the DCCEEW within 60 business days of the detection.

If the trigger value is reached by virtue of subsidence from the underground mining activities, the corrective actions stated in the Section 5.5 will be undertaken to halt and prevent further harm to protected matters.

5.4.3 WHEN AN OFFSET MANAGEMENT PLAN WILL BE REQUIRED

After an exceedance of the trigger thresholds has been detected, and it can be confirmed by an Ecologist working with relevant specialists, that the exceedance has been caused by subsidence; an Offset Management Plan will be required. The Offset Management Plan will be required to be developed within 12 months. It must be consistent with the Environmental Management Plan Guidelines and the Environmental Offsets Policy to address residual harm to protected matters. Once developed, it must be submitted to DCCEEW for the Minister's written approval.

5.5 BRIGALOW TEC CORRECTIVE ACTION AND MANAGEMENT MEASURES

5.5.1 CORRECTIVE ACTIONS FOR ROUTINE OPERATIONS

Due to the low-level subsidence effects measured and expected as a result of the bord and pillar mining operation at Ensham, remedial management measures are presently not required unless there is a significant deviation in the level of subsidence that would be detected during the monitoring program. It is also unlikely that any corrective action could be implemented to minimise an impact to Brigalow, once subsidence has occurred.

To avoid harm to the Brigalow TEC, the following will be integrated into the mining operation:

- vehicle tracks through the TEC area will be avoided;
- as per EPBC 2020/8669 condition 2, environmental officers will ensure no other mine related development is located in the Brigalow TEC; and
- weed management will be implemented on the mine site throughout the active mining operation period.

There are no identified remedial actions that are practical or feasible, in the short term, to improve the condition of Brigalow, should mortality or an impact be detected as a result of subsidence.

Any significant detection of subsidence change will trigger a review of underground mining activities, and this is described in section 4.8.

5.5.1.1 SUBSIDENCE LEVEL IS EXCEEDED WITH NO IMPACT TO BRIGALOW TEC DETECTED

If the subsidence level has exceeded the predicted expectations, however the assessments for Brigalow TEC in Section 5.3.2 do not indicate the community has been impacted (Table 5-3); monitoring requirements will cease after the 5 year period.

5.5.1.2 BRIGALOW SPECIFIC TRIGGER VALUE EXCEEDED

The corrective actions when achievement of trigger value(s), as stated in Table 5-3 is detected includes:

- demarcating or mapping, as appropriate, the impacted Brigalow vegetation area so that the location of the area can be communicated to mine staff;
- preparing and implementing a site-specific weed management plan;
- continuing monitoring as stated in Table 5, for TEC regrowth improvement during restoration process; and

- increasing Biocondition assessments to an annual frequency.

In addition, an Offset Management Plan will be developed, to comply with the information and commitments specified in Attachment 4 of the EPBC approval.

5.5.2 CORRECTIVE ACTIONS FOR NON-ROUTINE SITUATION

A non-routine situation for Brigalow vegetation is considered to be an incident or natural disasters that has caused decline in Brigalow TEC condition and caused the trigger values to be exceeded.

In case of an incident, the SOP for Incident Notification, Investigation and Reporting and actions will be implemented.

In the case of natural disasters, such as flood, the actions stated in Section 5.4.1 will be implemented. A report with details of the related natural disaster and its impacts to Brigalow TEC will be included in the annual compliance reporting submission to the DCCEEW.

6. LEGAL COMPLIANCE AND REFERENCES

TABLE 6-1 REFERENCES.

Legislation/Recognized Standards	• Regional Interests Development Approval (RIDA) RPI22/002 • Environmental Authority EPML00732813. • Environmental Protection Biodiversity Conservation Act 1999. • Water Act 2000.
Reports	Commonwealth of Australia (2014). Subsidence from coal mining activities, background review, prepared by Sinclair Knight Merz Pty Ltd for the Department of the Environment, Commonwealth of Australia, Canberra. Commonwealth of Australia (2015). Management and monitoring of subsidence induced by longwall coal mining activity, prepared by Jacobs Group (Australia) for the Department of the Environment, Commonwealth of Australia, Canberra.

7. TERMS AND ABBREVIATIONS

7.1 ABBREVIATION AND DESCRIPTION

TABLE 7-1 TERMS

Abbreviation	Description
EA	Environmental Authority
EPBC Act	*Environment Protection and Biodiversity Protection Act 1999* (Commonwealth).
GM	General Manager
GPS	Global Positioning System
HSE	Health, Safety and Environment
LIDAR	Light Detection And Ranging
NDVI	Normalised Difference Vegetation Index
PHMP	Principal Hazard Management Plan

Abbreviation	Description
RTK	Real Time Kinematic
SSE	Site Senior Executive
TARP	Trigger Action Response Plan
TEC	Threatened Ecological Community

8. DOCUMENT PREPARATION

This SMP has been prepared by Gordon Geotechniques Pty Ltd (GGPL), in conjunction with Ensham technical and environmental personnel. The SMP has been updated based on the Subsidence Report prepared for Zone 1 by Gordon Geotechniques in June 2022. The SMP has been updated based on Flora Technical Report (AECOM 2020) by AARC Environmental Solutions in April 2024.

9. REVIEW HISTORY

This Subsidence Monitoring Plan will be subject to review every 2 years or under the following conditions due to:

- Change to licence conditions and/or reporting requirements.
- Significant change to current mine plan/operations.
- An investigation report recommendation.

TABLE 9-1 REVIEW HISTORY.

Date of review	Revision Number	Trigger for review	New revision Number
8/2/2022	1	Requirement of EIS assessment report and EA Amendment – Zones 2 and 3 subsidence technical report	2
17/6/22	2	Addition of Zone 1	3
20/9/2022	3	Update as result of requirements from PRCP and RIDA	4
2/6/2023	4	RIDA application for Zone 1, Updated monitoring	5

		Update monitoring results	
25/06/2024	5	Inclusion of EPBC Brigalow Triggers and Monitoring Trigger Levels & Monitoring Section restructured to identify applicability to various approvals	6

10. ROLES AND RESPONSIBILITIES

Survey Section

- Carry out monitoring – fixed monitor and LIDAR.
- Prepare monitoring data.
- Ensure compliance of the dimensions of the underground pillars and roadways.

Environmental Section

- Surface inspections.
- Monitor creeks/rivers/groundwater.
- Prepare subsidence monitoring report.
- Monitor Brigalow population.
- Prepare Brigalow monitoring report.
- Review LIDAR and NDVI data.
- Liaise with landowners.

Technical Services Section

- Underground inspections.
- Plan subsidence monitoring requirements.
- Review and reconcile subsidence monitoring data.
- Facilitate review if trigger levels are exceeded.
- Liaise with landowners.

11. REFERENCES

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BHP 2023a, 'Saraji East Mining Lease Project Environmental Impact Statement: Chapter 6 Terrestrial Ecology', accessed March 20, 2024, from <https://www.bhp.com/-/media/bhp/regulatory-information-media/coal/bma/saraji-east/saraji-east-mining-lease-project-eis-2023/semlp_eis_ch_06_terrestrial-ecology.pdf>.

BHP 2023b, 'Saraji East Mining Lease Project Environmental Impact Statement: Appendix K-2 Subsidence Management Plan', accessed March 20, 2024, from <https://www.bhp.com/-/media/project/bhp1ip/bhp-com-en/documents/sustainability/environment/regulatory-information/bma-saraji-east/appendix-k-2-subsidence-management-plan.pdf>.

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Appendix D - Notification of Commencement of the Action

ENSHAM
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11th August 2023

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Department of Climate Change, Energy, the Environment and Water

Ensham Mine - Our ref: EPBC 2020/8669

Hi Damien,

Thank you very much for your letter dated 30th June 2023

> In relation to Notification of Approval : **Ensham Life of Mine Extension Project, Queensland (EPBC ref 2020/8669)**

In accordance with Item (19) **NOTIFICATION OF DATE OF COMMENCEMENT OF THE ACTION**

We would like to advise the action has commenced **11th August 2023**.

As required by the approval conditions 3 and 11 we will submit for approval:

A GDE Monitoring and Management Plan (GDEMMP)

A Subsidence Management and Monitoring Plan (SMMP)

Within the date of the approval being 30th June 2023

Yours,

A.D.Mifflin

A.D.Mifflin
General Manager and SSE
Ensham Mine