

**Environmental Impact Statement (EIS)
Assessment Report under the
*Environmental Protection Act 1994***

East End Number 5 Project

Proposed by Cement Australia (Exploration) Pty Ltd and
Cement Australia (Queensland) Pty Ltd



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1 Introduction

This report provides an evaluation of the environmental impact statement (EIS) process pursuant to Chapter 3 of the *Environmental Protection Act 1994* (EP Act) for the East End No. 5 Mine project proposed by the Cement Australia Group.

The Department of Environment and Heritage Protection (EHP) (formerly the Department of Environment and Resource Management) coordinated the EIS process as the administering authority of the EP Act. This assessment report has been prepared pursuant to sections 58 and 59 of the EP Act. Section 58 of the EP Act lists the criteria that EHP must consider when preparing an EIS assessment report, while section 59 of the Act states what the content must be.

The objective of this assessment report is to:

- address the adequacy of the environmental impact statement and the environmental management plan
- summarise key issues associated with the potential adverse and beneficial environmental, economic and social impacts of the East End No. 5 Mine project and the management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the project
- make recommendations on the suitability of the project to proceed and where so, to make recommendations on necessary conditions for any approval required for the project.

In meeting the requirements of the EP Act, this assessment report describes the project and the places likely to be affected by the project. It summarises the key issues associated with the potential adverse and beneficial environmental, economic and social impacts of the project. It also discusses the management, monitoring, planning and other measures proposed to minimise adverse environmental impacts. Finally, this assessment report identifies those issues of particular concern that were not resolved or that require specific conditions for the project to proceed. Section 2 of this assessment report describes the project in order to provide context for the findings of the report. Section 3 outlines the EIS process that was followed for the project and the approvals that would be necessary before the commencement of the project. Section 4 addresses the adequacy of the EIS documents in addressing the TOR, discusses the main issues with regard to the environmental management of the project and refers to the environmental protection commitments made in the EIS documents as well as any recommended conditions. Section 5 assesses the adequacy of the environmental management plan. Section 6 assesses the suitability of the project. Section 7 discusses recommended conditions for the project. Section 8 is the certification of the assessment report. The giving of this EIS assessment report to the proponent completes the EIS process under Chapter 3 of the EP Act.

2 Project details

Cement Australia (Exploration) Pty Ltd and Cement Australia (Queensland) Pty Ltd have made a joint application for a mining lease (ML80156), to expand the footprint of the current mining operations at the East End Mine. Both companies are part of the Cement Australia Group that is owned by Holcim and the Heidelberg Cement subsidiary Hanson. Holcim and Hanson each have a 50% share of the Cement Australia Group.

Currently, the Cement Australia Group mines limestone and clay at the East End Mine, which is then supplied by rail to the cement kiln at Fisherman's Landing, north of Gladstone, to be used for manufacturing cement clinker. Mining operations commenced in 1980, and mining has mainly been carried out on mining lease ML3631, which adjoins the proposed ML80156 (the project area) to the north-west. The mining operations would continue to the south east of the current mine footprint, using the existing infrastructure. The project is in a rural location, approximately seven kilometres south-west of Mount Larcom and approximately 28km south west of Gladstone. The closest dwelling is located 1.3km north of the northernmost point of the project area boundary. Land tenures that comprise the proposed ML80156 include Lot 9 on DS232, Lot 1 on RP604731, Lot 27 on SP101568 and part of an adjoining road reserve owned by the Gladstone Regional Council.

The resource within proposed ML80156 is located close to existing mine infrastructure which includes screening and crushing equipment, stockpiling facilities, a rail loop, railways, road access, rail loading plant, sewage treatment plant and ancillary mine facilities.

No associated processing or maintenance infrastructure, or waste disposal facility, would be located within proposed ML80156. A new haul road would be constructed within the open cut pit to connect with the existing haul road and infrastructure to the north-west. The project would involve the construction of an earthen bund wall to prevent flood waters entering the void and retain the majority of pit water at cessation of mining. The bund wall would be constructed to a height of up to 6.5m above the flood plain, and would be approximately 1.3km long between Larcom Creek and Scrub Creek and the southern extent of mining. It would remain after mining ceases.

The East End Mine currently employs about 40 staff. There would be no additional staff employed as part of the construction and operation of the extended mine footprint.

The same open cut mining methods currently employed on ML3631 would be used on the new lease. This includes progressively removing vegetation (mainly pasture grass) and the upper top soil layer, then either immediately reusing the top soil for rehabilitation works in another part of the mine or stockpiling it for future rehabilitation use. Clay overburden would be removed by hydraulic excavator or front end loader into haul trucks and transported to the primary crusher or adjacent surge pile on ML3631. Underlying clay and limestone would be fragmented by drilling and blasting then loaded out to the primary crusher pile by combinations of excavator, front end loader and haul trucks. Mining operations would be carried out below the pre-development groundwater level, which would require the workings to be dewatered. As with the current operations, the water would be pumped into East End Creek that runs into Schultz Lagoon, which then discharges into Larcom Creek. A series of benches, with elevations corresponding with those on ML3631, would be developed and advanced sequentially. Vertical separation between benches would be about 15m. The maximum depth of excavation is predicted to be -90m AHD¹, which is about 130m below natural ground level. Operational and final batter angles and bench widths would be designed to achieve the required level of safety and stability.

The mining process would generate a quantity of material unsuitable for clinker production, including:

- high alkali limestone
- volcanic rock, which occurs as dykes within the limestone deposit and sidewalls
- clay materials, either in excess of requirements or with unsuitable chemical characteristics.

These materials would be removed to spoil dumps established on mining leases adjacent to the existing mine (ML80002 and ML80127), and stored for later use or rehabilitated. It was expected that much of this material would be reclaimed for blending purposes.

The existing mine currently produces approximately 2.5 million tonnes a year (Mt/y) of limestone and clay, and it is anticipated that this rate of mining would continue on the new lease. At this rate, the overall mine life is estimated to continue for 55 to 70 more years. The mine life could be further extended by the relocation of mine infrastructure. It was anticipated that mining would commence on the proposed ML80156 in about five years, but this may change.

¹ AHD = Australian Height Datum

The proposed ML80156 is not proposed to be fully developed. Of the 86.84ha within the proposed mining lease, 59.9ha would be subject to disturbance associated with mining operations. The southern extent of ML80156 would not be mined due to: the proximity to the confluence of Scrub and Larcom Creek; the occurrence of volcaniclastic rock; the provision for a 100m wide buffer to Schulz Lagoon; and a 50m wide buffer to Larcom Creek on the southeast boundary.

At completion of mining, the remaining void would not be backfilled, leaving a water filled void which could be used as a water storage facility for local landholders.

3 The EIS process

3.1 Timeline of the EIS process

Table 3.1 outlines the stages, timing and actions undertaken in the EIS assessment process for the project.

Table 3.1 – EIS process stages, timing and actions

Stage	Section of EP Act	Relevant dates and actions
Environmental authority (EA) amendment application	238	On 1 December 2008, the former Environmental Protection Agency (now EHP) received an EA amendment application to incorporate the proposed ML80156.
EHP decision on EA amendment application	248	On 24 February 2009, the former EPA decided that an EIS was required.
TOR stage		
The proponent prepared and submitted draft TOR	41	On 10 June 2009, the proponent submitted draft terms of reference (TOR) for the EIS to the former Department of Environment and Resource Management (now EHP). On 17 June 2009, the former DERM advised the proponent that the submitted draft TOR would not allow the purpose of the EIS to be achieved in accordance with section 41 of the <i>Environmental Protection Act 1994</i> . On 31 July 2009, the proponent submitted an initial advice statement and revised draft TOR.
EHP prepared TOR notice	42	On 14 August 2009, the TOR notice was finalised and provided to the proponent.
EHP published TOR notice	43(1)	On 14 August 2009, the former DERM placed a public notice announcing the start of the comment period for the draft TOR on its website, and advertised in <i>The Courier Mail</i> and in the <i>Gladstone Observer</i> on Saturday 15 August 2009.
The proponent gave TOR notice to affected and interested persons	43(3)	21 August 2009
Public review and submissions	42(3)	The period for public review and submissions on the draft TOR commenced 17 August 2009 and ended at close of business 25 September 2009. The former DERM received nine submissions on the draft TOR from the advisory body and individuals within the comment period. Also, the former DERM received two late submissions that were accepted as valid submissions.
EHP provided comments to the proponent	44	On 9 October 2009, submissions on the EIS, together with a submission provided by the former DERM, were forwarded to the proponent. A late submission was accepted, and forwarded on 19 October 2009.

Stage	Section of EP Act	Relevant dates and actions
The proponent responded to comments	45	The proponent provided a response to comments on the draft TOR to the former DERM on 9 November 2009.
EHP prepared and published final TOR	46	The TOR were finalised by the former DERM and issued to the proponent on 4 December 2009. The TOR notice was published in The Courier Mail and in the Gladstone Observer on 5 December 2009.
EIS preparation stage		
The proponent prepared and submitted the EIS	47	An earlier version of the EIS was submitted and reviewed on 20 December 2012. The earlier version was not suitable for public viewing resulting in the proponent submitting a revised EIS to EHP on 1 November 2013. The time frames to submit the EIS were extended by agreement between the proponent and EHP.
EIS submission and assessment stage		
EHP decision to allow the EIS to proceed	49(1) and (2)	Following the proponent's submission of an EIS, EHP is required to decide under section 49(1) of the EP Act whether the EIS addresses the final terms of reference in an acceptable form and can be allowed to proceed. The legislation allows the decision period to be extended, typically at the proponent's request, if EHP considers the proponent needs to make changes to the EIS before the final decision is made. On 4 February 2013, 17 May 2013, 21 June 2013 and 16 September 2013, the proponent requested and was granted four extensions until 28 June 2013, 29 July 2013, 30 September 2013 and 4 November 2013 respectively to EHP's decision period. On 4 November 2013, EHP decided that the EIS could proceed.
EHP prepared and gave notice of decision to the proponent	49(5)	18 November 2013
The proponent gave the EIS notice to affected and interested persons (and made the EIS available on the proponent's website)	51	9 December 2013
The proponent published the EIS notice	51	The proponent published the EIS notice in The Courier Mail and the Gladstone Observer on Saturday 14 December 2013.
EIS public submission period	52	The period for the making of submissions about the EIS was voluntarily extended by the proponent beyond the minimum 30 business days due to the Christmas holiday period. The submission period started on Monday, 16 December 2013, and continuing until close of business on Tuesday, 25 February 2014. A total of 21 submissions were received.
The proponent provided a statutory declaration of compliance with notice requirements	53	20 December 2013
EHP provided all submissions to the proponent	56(1)	On 28 February 2014, EHP provided all submissions on the EIS to the proponent. A late submission was accepted, and forwarded on 11 March 2014.
The proponent responded to submissions in a supplementary report to the EIS	56(2) and (3)	The supplementary report to the EIS was lodged by the proponent on 1 August 2014. The proponent's response to submissions was initially due on 27 March 2014. However, the proponent requested, and was granted, an extension until the 1 August 2014 to the period in which they were required to provide the response.

Stage	Section of EP Act	Relevant dates and actions
EHP decided if the EIS and response to submissions were adequate for the EIS process to proceed	56A(2) and (3)	1 September 2014
EHP prepared and gave decision notice to the proponent	56A(4)	15 September 2014
EHP prepared the EIS assessment report	57	27 October 2014
EHP gives EIS assessment report to proponent— completes EIS process	60	27 October 2014

3.2 Approvals

The project will require amendment of the existing environmental authority (EA) for the mining activity under Chapter 5 of the EP Act.

As with the existing environmental authority, the amended environmental authority would also cover the following environmentally relevant activities that would be directly associated with, or support, the mining activities:

- ERA 16 – 2(d) Extractive and Screening Activities: Extracting, other than by dredging, more than 1 million tonnes of material, in a year
- ERA 16 – 3(c) Extractive and Screening Activities: Screening more than 1 million tonnes of material, in a year
- ERA 63 – 2(a)(ii) Sewage Treatment: Operating sewage treatment works at a site, other than no-release works, with a total daily peak design capacity of 21 to 100 EP.

The project would require a new mining lease, which would be designated with the number 80186.

The East End Mine is currently subject to special conditions under the *Mineral Resources Act 1989* relating to groundwater. These conditions define the proponent's obligations to landholders whose groundwater supplies may be affected by the operations of the East End Mine, requirements to provide an alternative water supply to affected bore owners. The Queensland Government considers that the management of potential impacts to groundwater supply may be best addressed under the *Water Act 2000* (Water Act) through the proposed chapter 3 reforms. The Water Act is currently in the drafting stage of amendments which include groundwater 'make good' requirements for mining tenures. The Water Act amendments are expected to commence in December 2014. In the event that the amendments relating to groundwater 'make good' requirements are either delayed or not passed, the Queensland Government will use other measures to ensure that the potential impacts of the proposed project on ground water users are addressed prior to the granting of the mining tenure.

The project may require clearing permits and/or species management plans under the *Nature Conservation Act 1992*. The need for such permits and plans should be assessed separately when more detailed field surveys have been undertaken at the design stage.

3.3 Consultation program

3.3.1 Public consultation

In addition to the statutory requirements for advertising of the TOR and EIS notices and the mailing of the notices to interested and affected parties, the proponent undertook community consultation with members of the public and other stakeholders during the public submission period of the EIS. Details of the consultation program were provided in Appendix 4, Consultation report, of the EIS. Formal forums for community consultation included:

- landholder visits
- community forums
- information sessions

- information sheets
- negotiations with Aboriginal parties.

3.3.2 Advisory body

The administering authority invited the following organisations to assist in the assessment of the TOR and the EIS by participating as members of the advisory body for the project:

- Department of Agriculture, Fisheries and Forestry Department of Communities, Child Safety and Disability Services (including the former Department of Communities)
- Department of Community Safety
- Former Department of Employment, Economic Development and Innovation
- Department of Housing and Public Works
- Department of Local Government
- Department of Natural Resources and Mines
- Department of Science, Information Technology, Innovation and the Arts
- Department of State Development, Infrastructure and Planning (including the former Department of Infrastructure and Planning)
- Department of Transport and Main Roads
- Office of the Coordinator General
- Queensland Health
- Queensland Police Service
- Queensland Treasury and Trade
- Fitzroy Basin Association
- SunWater
- Gladstone Regional Council
- East End Mine Action Group Inc.

On 3 April 2012, the names of several of the Queensland Government departments that were members of the advisory body for the project changed (see Public Service Departmental Arrangements Notices (No.1 and No. 2) 2012). Consistent liaison with relevant advisory bodies was maintained throughout the changes. Table 3.2 summarises the changes that occurred to Queensland Government departments referred to in this report.

Table 3.2 – Changes to Queensland Government departments

Previous department(s)	New departments (as of 3 April 2012)
Department of Employment, Economic Development and Innovation	Department of State Development, Infrastructure and Planning Queensland Treasury and Trade Department of Agriculture, Fisheries and Forestry
Department of Environment and Resource Management	Department of Environment and Heritage Protection Department of Natural Resources and Mines Department of Energy and Water Supply Department of Science, Information Technology, Innovation and the Arts Department of National Parks, Recreation, Sport and Racing

Previous department(s)	New departments (as of 3 April 2012)
Department of Local Government and Planning	Department of Local Government
Department of Communities Department of Community Safety Department of Education and Training	Department of Education, Training and Employment Department of Communities, Child Safety and Disability Services Department of Community Safety Department of Housing and Public Works Department of Aboriginal and Torres Strait Islander and Multicultural Affairs

During the notification stage of the EIS, a community information session was held at Mt Larcom on 22 January 2014. An advisory body briefing for the project, together with a field trip to inspect the project site, was held on 23 January 2014. Also, an advisory body briefing and a community information session was held at Brisbane on 29 January 2014.

3.3.3 Public notification

In accordance with the statutory requirements, advertisements were placed in The Courier Mail and the Gladstone Observer newspaper. The advertisements notified the availability of the draft TOR and EIS for review and public comment, as stated in section 3.1 of this EIS assessment report. In addition, notices advising the availability of the draft TOR and submitted EIS for public comment were displayed on the proponent's and department's websites.

The draft TOR and submitted EIS were placed on public display at the following locations during their respective public comment and submission periods:

- EHP website (draft TOR only)
- EHP office, level 3, 400 George Street, Brisbane
- Gladstone Public Library, Gladstone
- Mt Larcom Post Office.

3.4 Matters considered in the EIS assessment report

Section 58 of the EP Act requires, when preparing this EIS assessment report, the consideration of the following matters:

- the final TOR for the EIS
- the submitted EIS
- all properly made submissions and any other submissions accepted by the chief executive
- the standard criteria
- another matter prescribed under a regulation.

These matters are addressed in the following subsections.

3.4.1 The final TOR

The final TOR were considered when preparing this EIS assessment report. While the TOR were written to include all the major issues associated with the project that were required to be addressed in the EIS, they were not exhaustive, nor were they intended to exclude all other matters from consideration.

Where matters outside of those listed in the final TOR were addressed in the EIS, those matters have been considered when preparing this EIS assessment report.

3.4.2 The submitted EIS

The 'submitted EIS' was considered when preparing this EIS assessment report. The 'submitted EIS' comprised:

- the EIS that was made available for public submissions from 16 December 2013 to 25 February 2014
- the response to submissions and amendments to the EIS received by EHP on 1 August 2014.

3.4.3 Properly made submissions

The department received 20 submissions on the submitted EIS within the submission period and one submission after the submission period ended. All 21 of the submissions were accepted under section 55 of the EP Act. Those submissions were received from the following stakeholders:

- Department of Aboriginal and Torres Strait Islander and Multicultural Affairs
- Department of Agriculture, Fisheries and Forestry
- Department of Education, Training and Employment
- Department of Housing and Public Works
- Department of Natural Resources and Mines
- Department of State Development Infrastructure and Planning
- Department of Tourism, Major Events, Small Business and the Commonwealth Games
- Department of Transport and Main Roads
- East End Mine Action Group (Inc.)
- Ergon Energy
- Gladstone Regional Council
- Queensland Ambulance Service
- Queensland Department of Justice and Attorney General
- 8 local landholders.

The department provided its own submission on the EIS to the proponent.

In addition, there has been correspondence from stakeholders regarding the proponent's response to submissions on the EIS and supplementary information. All submissions and other comments made by stakeholders on the EIS documents were considered when preparing this EIS assessment report.

3.4.4 The standard criteria

Section 58 of the EP Act requires that, among other matters, the standard criteria listed in Schedule 3 of the EP Act must be considered when preparing an EIS assessment report. EHP has considered the standard criteria in preparing this report.

3.4.5 *Environmental Protection and Biodiversity Conservation Act 1999*

Assessment of the project identified that the project is unlikely to impact on matters of national environmental significance (MNES). Consequently, the proponent has not referred the project to the Australian Government's Department of the Environment for a referral decision, and the EIS for the project was not required to assess matters regulated under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

4 Adequacy of the EIS

Table 4.1 lists the main aspects of the project addressed in the submitted EIS and highlights the significant issues associated with those aspects. The table notes whether the submitted EIS adequately addressed the matters described in the final TOR. The subsections of this chapter provide further information on significant issues, discuss the findings of the EIS, and outline the environmental protection commitments made by the proponent.

Table 4.1 – Summary of the adequacy of the submitted EIS in addressing the final TOR

Matters included in the final TOR	Significant issues	Were issues adequately addressed in the submitted EIS?
Introduction	Overview of the project, its objectives and scope Outline of the necessary approvals and their assessment processes	Yes to all
Project need and alternatives	Project justification and any alternatives.	Yes to all
Project description	Location of the project in the regional and local contexts Description of the construction phase of the project Description of the operational phase of the project Product handling Infrastructure requirements Waste management	Yes to all
Climate	Climatic conditions at the site	Yes
Land	Topography/geomorphology Geology Mineral resources Soils Land contamination Land use Sensitive environmental areas Landscape character and visual amenity	Yes to all
Transport	Road Rail	Yes to all
Waste	Excavated waste rock Waste rock characterisation Regulated and other waste	Yes to all
Water resources	Surface watercourses and overland flow Groundwater	Yes to all
Air quality	Dust	Yes to all

Matters included in the final TOR	Significant issues	Were issues adequately addressed in the submitted EIS?
	Greenhouse gases	
Noise and vibration	Noise at sensitive receptors Low frequency noise Vibration due to blasting	Yes to all
Nature conservation	Terrestrial plants Terrestrial animals Aquatic ecology Groundwater dependent ecosystems Biodiversity offsets (Queensland)	Yes to all
Cultural heritage	Indigenous cultural heritage Non-indigenous cultural heritage	Yes to all
Social issues	Impacts on local community, housing and services	Yes
Health and safety	Air and water emissions. Disease vectors Traffic and road safety	Yes to all
Economy	Alienation of grazing land Effects on the local, regional and state economy	Yes to all
Hazard and risk	Unplanned discharges to air, water or land Transportation, storage and use of hazardous substances Emergency response	Yes to all
Rehabilitation	Rehabilitation and decommissioning	Yes

4.1 Introduction

The EIS provided an adequate introduction to the project, its objectives and scope. It adequately identified the necessary approvals required for the project and outlined the assessment and approval processes.

4.2 Project need and alternatives

The EIS provided adequate details for the need of the project, including:

- community demand for cement
- energy efficiency of the current existing mining operation and downstream processing
- proximity to markets
- economic benefits of local production.

Also, the EIS adequately discussed alternatives for the project, including:

- development of other mining leases in the Bracewell/East End area
- development of other mining leases in the Gladstone region
- alternative raw materials
- alternative mining methods
- cement importation.

4.3 Project description

The EIS adequately described the location, scope and phases of the project. An outline of the project is provided in section 2 of this report.

4.4 Climate

The EIS adequately described the local climate with regard to how the climate could affect the potential for environmental impacts and the management of operations at the site.

The climate of the Mount Larcom area is sub-tropical with relatively dry winters and wet summers. The average annual rainfall for the area is about 890mm with monthly rainfall averages of about 150mm between December and February and about 40mm between April and October. The area has average daytime temperatures of around 30°C during summer, falling to about 23°C during the winter months.

The total annual pan evaporation rate for the area is about 1660mm, which is higher than the average annual rainfall. The average monthly pan evaporation rates are about 138mm and are highest during the summer months.

The winds are predominantly from the south-east to north east during summer and from the south-west to south-east during winter.

4.5 Land

The EIS adequately described those aspects of the site and project related to the existing and proposed qualities and characteristics of the land. The following subsections address those qualities and characteristics in more detail.

4.5.1 Topography/geomorphology

The project area has ground surface elevations of between 33m and 66m AHD with the majority (74.6ha or 86% of the total project area) below 40m AHD. Only about 1ha in the south-west corner of the project area is above 45m AHD.

There are hills to the west of the project area with maximum elevations between 80m and 97m AHD (i.e. approximately 45 to 60m above the alluvial plain) and hills to the south and south-east with maximum elevations between 75m and 95m AHD. At its northern boundary, the project area adjoins the existing East End mine. The typical land surface gradient in the northern portion of the project area is approximately 2%.

The project area is bounded to the north-east by Schulz Lagoon, which is an impoundment on East End Creek that flows into Larcom Creek. Larcom Creek is located to the east of the project area and flows from north to south. The confluence of Larcom Creek with Scrub Creek is located approximately 450m south of the southern boundary of the project area. Larcom Creek then flows south-south-east to meet the Calliope River 11.5 km downstream. Parts of the project area have been subjected to flooding following periods of above-average rainfall.

The southern extent of the proposed ML80156 would not be mined due to: its proximity to the confluence of Scrub and Larcom Creek; the occurrence of volcanoclastic rock; the provision for a 100m wide buffer to Schulz Lagoon; and a 50m wide buffer to Larcom Creek on the south-east boundary. Of the 86.84ha within the proposed ML 80156, 59.9ha would be subject to disturbance associated with mining operations.

The project would involve the construction of an earthen bund wall to provide 1 in 1000 ARI² flood protection to mining operations and to the final void following cessation of mining. The bund wall would be constructed to a height of up to 6.5m above the flood plain and extend approximately 1.3km at the southern extent of mining.

At completion of mining, the remaining void would not be backfilled, leaving a water-filled void.

4.5.2 Geology

The EIS described the regional and local geology. The oldest rocks in the region are marine sediments and volcanics deposited in an oceanic island arc environment. They include two units, the Erebus beds and the Capella Creek Group, which overlap in age, but which contain distinctly different stratigraphic sequences.

Extensive deposits of limestone exist in the Erebus beds. The economically significant deposits are Late Silurian to Early Devonian in age. Limestone of Early Carboniferous age also occurs extensively in the area, but these deposits are generally of an inferior grade.

In the East End Belt, fresh limestone outcrops, many of which are known to be continuous below red soil cover, stretch over a length of 4.5km with an average width of approximately 500m. The north-western section of the central belt (between Scrubby and Machine Creeks) consists of several well elevated outcrops. The south-eastern section of the central belt contains very extensive limestone outcrops, in some places known to be connected below soil cover, over a distance of about 6km.

The strata of the East End Belt are folded, forming a broad anticlinal structure known as the East End Anticline³, the axis of which is thought to lie immediately to the east of the operating mine (Geological Survey of Queensland, 1989). The predominant dip of bedding in the mine area is steep (70° to 85°) towards the southwest. It is suggested that tight folds occur on the limbs of the anticline, with numerous faults generated along the fold axes (Oceanics Australia, 1975).

The EIS stated that the most recent drilling campaign had revealed a sliver of volcanoclastic rock protruding into the limestone unit at the south-eastern edge of the proposed pit extension. This may act as a barrier or aquitard to groundwater flow between Schultz Lagoon/Larcom Creek and the mining area. Dykes were also identified within the limestone, and these were considered likely to have similar geometry to the dykes seen in the faces of the existing mine pit. Figure 4.1 in this report, indicates the limestone deposits in and around the project area.

The EIS discussed karstic features identified within the East End limestone. The EIS stated that the hydraulic conductivity of the karst is largely controlled by the permeability of the silty infill and the fracture density, and that as a result, the limestone aquifer in the vicinity of the mine behaves like a porous medium.

4.5.3 Mineral resources

The EIS outlined the results of a systematic resource drilling program that was carried out in the project area and on land adjacent to the existing mine, which informed revised estimates of limestone and clay resources. The indicated resource within the project area was estimated to be 80Mt.

The EIS stated that the project would be likely to result in very little resource sterilisation since:

- waste dumps would be located adjacent to the limestone resource on separate mining leases sited on volcanoclastic rocks and not on clay or limestone resources
- other stockpiling or backfilling would be insignificant compared to the scale of the project
- there are no other coal, mineral or petroleum resources associated with the project area.

4.5.4 Soils

The EIS stated that a soil survey of the project area was conducted in March 2010. Soil classification was based on the soil classification system described in The Australian Soil Classification (Isbell, 1996). Previous detailed soil mapping of the Calliope area (Ross, 1999) was used as a guide for soil descriptions.

² ARI = average recurrence interval

³ An anticline is an upward fold of rock strata.

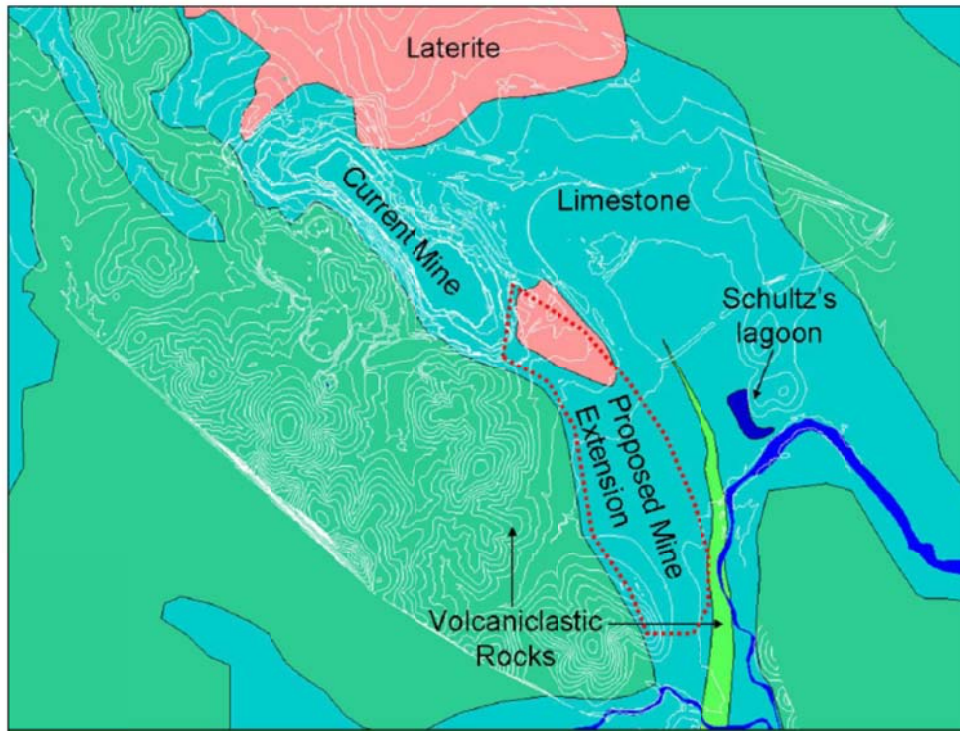


Figure 4.1 – Revised local geology (Source: Appendix 9)

Four soil types were described for project area:

- East End: Lateritic – autochthonous, highly weathered regolith, primarily a product of limestone weathering. Red dermosol, medium fine, gravelly, deep
- Blacks: Colluvium produced from erosion and weathering of volcaniclastic rocks and limestone. Yellow dermosol, medium fine, gravelly, deep
- Schultz: Higher alluvium – organic lagoonal mud. Black vertosol, very fine, non-gravelly, deep
- Larcom: Lower alluvium – deep cracking, Larcom Creek flood deposits. Grey vertosol, very fine, non-gravelly, very deep.

Three of the soil types (Blacks, Schultz, and Larcom) were classed as being marginally suitable for rain-fed broadacre cropping (Class 4).

The EIS stated that the project area was suitable for its current use of cattle grazing on native and introduced pastures with moderate limitations, and suitable for rain-fed, broadacre cropping with moderate to minor limitations.

Potentially dispersive subsoils were identified as occurring within the project area, with associated potential for soil erosion as a result of land disturbance by the project. An erosion and sediment control plan, stated to be consistent with Best Practice Erosion and Sediment Control (International Erosion Control Association, 2008), was provided as part of the stormwater management plan for the project area.

Part of the project area was mapped as potential strategic cropping land (SCL) under the *Strategic Cropping Land Act 2011* (SCL Act). The SCL Act has since been repealed and replaced by the *Regional Planning Interests Act 2014* (RPI Act). However, SCL trigger maps that show strategic cropping areas have remained unchanged and have been migrated into the RPI Act. A strategic cropping area is now defined as an area of regional interest under the RPI Act and is required to be protected.

The EIS stated that, on the basis of poor cropping history, the project area would not qualify as strategic cropping land, and that a validation application had been lodged with the Department of Natural Resources and Mines (DNRM) with the intention of removing the SCL classification. EHP has been advised by the proponent that a SCL validation decision was made by DNRM declaring the project area as non-strategic cropping land under the SCL Act. DNRM accepted the proponent's validation application that the land is not SCL, which removed the requirement for a regional interest development approval under the RPI Act.

The EIS estimated the total available topsoil from the project to be 266 tonnes, based on a stripping depth of 300mm in colluvial soils and 500mm in alluvial soils. The following management measures for topsoil were proposed:

- Topsoil would be stripped progressively immediately prior to removal of deeper overburden. Topsoil or surface materials in virgin areas would be won separately and used directly in rehabilitation works (at the existing mine or on the new project area) or loosely stored in stockpiles.
- Stockpiles would be positioned, shaped and revegetated or treated to minimise erosion. Topsoil stockpiles would be sited as close as possible to the place of origin and on land previously disturbed by mining. In order to maintain seed viability, the maximum height of stockpiles would be 3m and rehabilitation would commence within three years of land disturbance.
- Prior to topsoil stripping, vegetation surveys would be conducted to determine the prevalence of weeds. All topsoil stockpiles would be monitored for weed emergence. In the advent of contamination by weeds, weed control would include separation of stockpiles, herbicide treatment or manual removal, or disposal as fill or waste rock.

4.5.5 Land contamination

A preliminary site investigation for land contamination was carried out in the project area in conjunction with the soil survey, and involved:

- a site description and history-based assessment on the occurrence of notifiable activities at the project area
- title, contaminated land, and environmental management register searches
- review of historical site environmental assessments
- review of historical aerial photographs of the project area
- a visual site inspection with preliminary soil sampling and analysis.

The preliminary site investigation showed no evidence of land contamination within the project area. However, evidence was identified of notifiable activities previously undertaken on the project area, specifically a cattle dip and landfill. The EIS stated that a notification of land application had been prepared (under Section 371 EP Act) for Lot 27 on SP101568 and was waiting lodgement to EHP. The EM plan contained adequate commitments to address land contamination from a notifiable activity, including:

- avoidance of land disturbance within a 50m radius of notifiable activity locations, where practicable
- prior to any land disturbance within a 50m radius of a notifiable activity location, soil investigations to assess, delineate and remediate the former notifiable activity location shall be conducted in accordance with the Guidelines for the Assessment and Management of Contaminated Land (DoE, 1998).
- a suitably qualified person, as per section 564 of the EP Act, should be engaged when evaluating contaminated land matters.

The EHP submission on the EIS regarding the need for a suitably qualified person when evaluating contaminated land matters was adequately addressed in the supplementary report to the EIS, including the proponent's advice that the preliminary site investigation was conducted by a fully qualified person under section 564 of the EP Act.

4.5.6 Land use

Grazing of beef cattle was the existing land use within the project area. Adjacent land uses comprised:

- current East End Mine and rail load-out loop
- rural land predominantly used for grazing beef cattle, some cropping, and scattered rural residential dwellings.

Other than the East End limestone mine, there was no other quarrying or mining currently being carried out in the Bracewell/East End area.

The proposed ML80156 is located on three freehold leases and there is no Native Title claim over the properties.

The Department of Agriculture, Fisheries and Forestry (DAFF) advised that the project area potentially contained commercial quantities of timber tree species. The proponent provided a commitment that they would contact DAFF in relation to the potential for harvesting of commercial quantities of privately owned forest products before any project related work commenced.

The below Table 4.2 provides a breakdown of the proposed final land uses of the 60ha of disturbed land for the project.

Table 4.2 – Final land use and rehabilitation approval schedule (Source: EIS Table 4.13)

		Pre-mining land description		Post-mine land description	
Disturbance type	Disturbance area (ha)*	Land use	Suitability class	Land use	Suitability class
Quarry faces and benches above RL 37mAHD	5.06	Cattle grazing	2–4	Final void/wetland	5
Water storages below RL 37mAHD	51.2	Cattle grazing, road access to mining lease (0.85ha)	2–4	Final void	5
Water diversion/environmental bunds (incl. roadway)	4.33	Cattle grazing	2–4	Native Habitat	5
Roadway (on bund)	0.95	Cattle grazing	2–4	Road for farm access	5
Total	60.6				

*approximate values ($\pm 20\%$)

4.5.7 Landscape character and visual amenity

The closest dwellings to the project area are located 1.3km - 1.9km north of the northern-most point of the proposed ML80156. Desktop and in-field viewpoint analyses were carried out for five viewpoints at three dwellings to the north (between 1.3 and 1.9km away), one dwelling 2km to the west and a roadside location to the immediate north of proposed ML 80156.

The EIS stated that earthmoving machinery would be visible during preparation of the land for mining. The flood protection bund (levee bank) would provide screening of the short-term earthworks once constructed. Long-term visual impacts of the proposed mine would be addressed by progressive vegetative screening on the levee banks and selected areas within the proposed ML 80156. The EIS stated that the establishment of vegetative screening could commence following project approval to potentially achieve effective screening height prior to starting initial earthworks for the project.

4.5.8 Conclusion and recommendations

The EIS provided an adequate land assessment for the project.

Recommendations

The proponent should implement commitments made in the EIS to address land management, including topsoil management, land contamination, visual amenity and land use.

4.6 Transport

Road access to East End Mine is principally via the Bruce Highway–Wilmot Road T-intersection located 2km south of the Mount Larcom Township. Currently, the Bruce Highway is a single two-lane carriageway with frequent overtaking lanes. There is a southbound uphill overtaking lane between the Bruce Highway-Wilmot Road intersection and Mount Larcom and a northbound overtaking lane 1.3km south of this intersection. Right and left-turn lanes are constructed at this intersection.

The main route for 5.7km from the Bruce Highway towards the existing mine is via Wilmot Road, and via Davis Road for the last 700m to the mine entrance. Wilmot and Davis roads are both single two-lane carriageways, and are sealed between the Bruce Highway and the mine entrance. For through traffic past the mine entrance, Davis Road is a gravel road that continues to the west for 3.5km where it terminates at East End Road.

The EIS stated that the project is not expected to generate any discernible road traffic increase in the local area or further afield, either during the construction or operation phases. Employees commute from various localities in the Rockhampton and Gladstone area. There is currently no transport supplied by the mine to convey workers to the mine.

The average number of deliveries of supply items is one per day, typically by light truck. The infrequent movement of any heavy equipment (e.g. mining and earthmoving machinery and equipment, building materials) is also via the road network. The main origins of road transport to the mine are the cities of Gladstone and, to a lesser extent, Rockhampton. There is also some additional use of local roads for mine related activities, e.g. environmental monitoring, water supplementation and landholder liaison.

There is a dedicated rail line for the transport of clay and limestone from East End Mine to the processing facility at Fisherman's Landing. The EIS stated that the project would involve no change to the current rail infrastructure or its usage.

4.6.1 Conclusion and recommendations

The EIS provided an adequate transport assessment of the project. As the current volume of traffic by either road or rail is not expected to increase as a result of the proposed mine extension, there is no need to change the current management practices.

4.7 Waste

The EIS identified three main types of waste that would be produced by the project:

- liquid waste – pit dewatering, stormwater run-off, seepage from groundwater, sewage, and maintenance fluids
- solid waste – waste rock, general waste, waste tyres, organics waste from land clearing, and oily waste
- atmospheric waste – dust, including small particles known as PM₁₀⁴, and greenhouse gases including carbon dioxide.

Pit dewatering would produce a significant waste stream, and this matter is discussed in section 4.7 of this report.

The project is an extension of the existing mining footprint, and would not increase the rate, or change the type, of waste generated above that from the current operations. The project would produce approximately 0.3 million tonnes of excavated waste per year, consisting of high-alkali limestone, volcanic rock and clay material. Excavated waste would initially be placed on ML80002 and ML80127, but it is expected that much of this material will be reclaimed for blending purposes. The EIS stated that limestone and clay material mined at East End, including mine wastes, are chemically benign.

With regard to other solid waste, East End Mine generated 93.79 tonnes of waste in 2010–11 that was transferred to an off-site landfill. This waste included municipal waste, and originated from the workshop, office, store and amenities at the mine site.

Air emissions from the project are not predicted to exceed current emissions from the East End Mine during the construction or operational phases. Details on air emissions including mitigation measures are discussed in section 4.9 of this report.

The proponent provided adequate control strategies for solid waste, including:

- adoption of a waste management plan for the existing mining operations that was prepared using the principles outlined in the Environmental Protection (Waste Management) Regulation 2000
- waste minimisation through recycling, re-using and reduction practices
- use of overburden for the construction of amenity/flood protection bunds
- use of the existing designated waste rock dump areas in ML80127 and ML80002 for the storage of overburden
- no disposal of wastes within the project area, apart from overburden material
- use of specialist and licensed waste management contractors to provide appropriate on-site management and off-site disposal of general and industrial waste other than overburden
- appropriate signage and security for all waste receptacles and storage areas.

⁴ PM₁₀ means particles in the air environment with an equivalent aerodynamic diameter of not more than 10 microns

4.7.1 Conclusion and recommendations

The EIS provided an adequate waste assessment for the project. Current waste procedures would continue to be implemented, and revised as practice evolves, during the life of the East End Mine.

Recommended conditions for waste management are included in Appendix 4.

4.8 Surface water

4.8.1 Surface watercourses and overland flow

The project area is within the Larcom Creek catchment, which in turn forms part of the broader Calliope River drainage basin flowing into the Great Barrier Reef World Heritage Area at Port Curtis (Gladstone Harbour). Larcom Creek headwaters are located in the Mount Larcom Range to the east of the site, and the creek flows generally to the south-west towards the mine site where it turns south and joins the Calliope River.

Machine Creek flows from Lower Bracewell, through the East End area, 3km to the northwest of the mine pit, and changes from surface flow to diffuse subsurface flow approximately 3km north of the mine pit, near East End Road. The EIS found that the likely path of this sub-surface flow is west and then south-south-east towards Larcom Creek, although the low-lying swampy nature of the area near Wilmot Lagoon, suggests that a large proportion of this water is lost as evapotranspiration. Runoff from the Machine Creek sub-catchment is related more closely to rainfall than is the case for the East End Creek sub-catchment, which regularly receives mine water.

The confluence of Scrub Creek and Larcom Creek is 450m to the south of the project area. The south-west boundary of the proposed ML80156 is within 70m of Scrub Creek and the south-east boundary is within 50m of Larcom Creek.

4.8.2 Water use

About 1.2 million litres (ML) a year of treated potable water is used for amenities at the existing East End Mine site.

Additionally, about 219ML a year of raw water is used for watering of roads and rehabilitation at the existing East End Mine site. Raw water is sourced from either Howse Dam (which is an overland flow capture dam on the existing mine site), the sediment ponds, or the mine pit. This volume of water use at the mine works is significantly less than the typical pit dewatering rates that have ranged from 1.3GL/year in 1997–98 to 6.3GL/year in 2011–12. The excess pit water is discharged into East End Creek. It is unlikely that there would ever be a shortfall of water for operational uses. Pit dewatering will require effective water management measures, which are described in the stormwater management plan and section 4.4.2.1 of the EIS.

4.8.3 Surface water monitoring

Surface water quality and quantity around the existing mine has been monitored by the proponent since mining operations began in the 1970s. The EIS provided an outline of the surface water monitoring program, which includes:

- quarterly measurements of electrical conductivity (EC) and pH of surface water
- monthly measurements of pH, EC, total dissolved solids (TDS), total suspended solids (TSS) and dissolved oxygen (DO)
- biennial measurements of stock water quality indicators
- daily measurements of EC if flow rates in East End Creek exceed 6000m³/day.

Flow rates are gauged by the proponent at seven weirs in the Bracewell/East End area using rectangular notch weirs.

The EIS presented surface water quality data, such as: average daily runoff and average annual water quality at selected weirs from 1997 to 2013; and the water chemistry in surface waters at baseflow conditions. Also, the EIS provided a discussion on the surface water monitoring data, which may be summarised as follows:

- Surface waters were slightly brackish (EC>1,500 µS/cm) and alkaline (pH>7).
- The East End Creek surface waters, predominantly derived from mine dewatering, were Na-Ca-Cl water type according to the water classification scheme of Davis and De Wiest (1966). The water was derived from a combination of limestone and volcanoclastic aquifers.
- The mapping of major ion chemistry on Stiff diagrams indicated that calcite precipitation occurs between the mine sump and Schultz Lagoon.
- The pH of the water progressively increased downstream from 7.6 to 8.1 (probably due to CO₂ degassing), and

calcite oversaturation occurred as a result.

- Water in Larcom Creek upstream of the mine was designated as the background or natural condition for comparison when assessing mine water discharge. Water from that location was typically fresh, but occasionally brackish, and was neutral to alkaline. Larcom Creek water was typically more turbid than mine water or other local creeks.
- Machine Creek water was type Ca-Na-HCO₃-Cl, indicating that the creek was groundwater-fed and predominantly derived from limestone aquifers. Brackish base-flow water in Machine Creek at Weir 2, and in nearby alluvial bores with similar chemistry, suggested the mixing of saline groundwater from volcaniclastic rocks with shallow fresh groundwater hosted in limestone.
- Nitrate concentrations in East End Creek and Machine Creek were significantly higher than in Larcom Creek. However, between the mine sump and Schultz Lagoon, nitrate appeared to be largely attenuated.

4.8.4 Identified surface water values

The EIS stated that all waterways in the area were significantly degraded as a result of historical clearing of riparian vegetation and damage associated with grazing. Some water is extracted from Larcom Creek, primarily for stock watering, but there was no known use for recreation or for drinking water. The environmental values under Queensland Water Quality Guidelines (DERM, 2009) that were selected for protection were aquatic ecosystems (protection of slightly-to-moderately disturbed aquatic habitat) and stock water.

There are no nationally important wetlands (as identified by the Queensland Wetlands Programme) or Ramsar Wetlands in the vicinity of East End Mine.

The EIS presented water quality objectives for the project area and for the project's stream type (lowland) from the Queensland Water Quality Guidelines (DERM, 2009).

The EIS stated that the site specific trigger limits for Larcom Creek upstream of East End Creek, as listed in Table 4.3 below, were developed in accordance with the Queensland Water Quality Guidelines (WQOs).

Table 4.3 – Key water quality objectives for Larcom Creek (Source: SEIS Table 4.21)

Indicator	Units	Water quality guidelines	
		Queensland WQOs ¹	Field data ² – Monitoring point C
pH	pH units	6.5-8.0	7.3-8.1
Electrical conductivity	µS/cm	970	2,062 ³
Total suspended solids	mg/L	10	4-25
Dissolved oxygen	% (mg/L)	85%–110%	62%–91% (5.1–7.4)
Turbidity	NTU	50	8–25
Nitrogen oxides (as N)	µg/L	60	15 ⁴

Notes: ¹ 80th and/or 20th percentile, Central Coast South incl. Calliope lowland streams, slightly to moderately disturbed, Table 3.2.1a (EHP, 2009) and 75th percentile for EC.

² 80th and/or 20th percentile Cement Australia data

³ 75th percentile (Cement Australia data)

⁴ Maximum value from 4 sampling rounds

The EIS stated that there was insufficient chemical data to determine site specific trigger levels other than in Table 4.3 (above), for water ion chemistry of receiving waters. However, should key trigger levels be exceeded or there was a significant increase over time in key indicators, additional testing would be carried out on a suite of chemical indicators (listed in the EIS) that would be regularly reviewed as a component of the water management plan.

4.8.5 Potential surface water impacts and proposed mitigation measures

4.8.5.1 Surface water impacts

The project has the potential to impact on local surface waterways, particularly Larcom Creek. Although the potential impacts would be the same as for the existing mine, the existing and proposed mitigation measures would prevent any significant impact on waterways. Potential impacts on waterways include:

- decline in water quality of Larcom Creek due to mine water discharge
- changes in flood conditions in Larcom Creek and Scrub Creek due to impoundment of the mine pit from the flood protection bund
- increased erosion of Larcom Creek or East End Creek due to mine water discharge
- overland flow or seepage from disturbed land, spoil dumps or stockpiles containing elevated levels of metals and/or sediment
- modified catchment hydrology related to stormwater management design
- potential contamination of surface water from accidental release of grey water or sewage, or hydrocarbon spills
- discharge of water from the residual mining void.

4.8.5.2 Mine water management

All stormwater collected within the small watershed surrounding the existing mine currently drains to the mining void. The proposed stormwater management system would divert clean stormwater away from the mine or to storage as required. Contaminated stormwater would be directed to storages or to the mine pit. Treated water from storage ponds and the pit would be reused on-site, or discharged. Groundwater inflow to the pit, and excess stormwater, is currently passed through a series of storages and Schultz Lagoon that treat the water by removing sediment. The treated water is discharged to Larcom Creek via East End Creek, and this would continue for the proposed project.

The East End Creek drainage system includes an artificial wetland system that treats pit dewatering flows. Pit water within the sump on the mine floor would be pumped to a sediment dam adjacent the proposed pit. After coarse sediment has settled out, water within the sediment dam would then be pumped over the proposed levee to treatment ponds in East End Creek that reduce finer sediment in the water. The treatment ponds have been previously sized and designed to receive the maximum water flow from the stormwater management system of the existing mine. Schultz Lagoon discharges to Larcom Creek through a 750m long seepage zone along the eastern boundary of the project area and a 200m long channelized drain flowing directly south to Larcom Creek. Maximum rates of water discharge are currently subject to mine water quality, natural creek flow and water quality objectives detailed in the environmental authority.

There is a second discharge point located on a drainage line to the west of the existing mine. That discharge point received surface water flow from the sub-catchment draining to Jacobs Creek, in which some of the mine waste dumps are located.

The EIS stated that discharged mine water currently met the water quality objectives stated in the EA, and that measured chemical concentrations had been well within the suitability guidelines for livestock watering. The EIS presented the concentration of minor ions in mine water sampled during a discharge to Machine Creek in September 2008. Concentrations of most ions in mine water (barium, chromium, copper, lead, molybdenum, nickel, selenium, silver, antimony, arsenic, cadmium, iron, mercury and total cyanide) were below the relevant levels of reporting (LOR). The concentration of boron, 0.1mg/L, was at the relevant LOR, and the concentration of manganese was slightly above the relevant LOR (0.2mg/L cf. 0.1mg/L). Between 1997 and 2010, the measured electrical conductivity (EC) of mine water has ranged between 1000 μ S/cm and 3800 μ S/cm with a median value of 3000 μ S/cm. The EC value of mine water is suitable for stock watering, and suitable for discharge to Larcom Creek. Also, the EIS stated that a recent ecological assessment of salinity tolerance of local aquatic biota in Larcom Creek and Scrub Creek suggested that elevated salinity over a six-month period, with a maximum EC of 4000 μ S/cm, would have minimal impact on aquatic fauna (BAAM, 2011).

The EIS stated that the pit volume is generally adequate to accommodate a combination of groundwater inflow and surface runoff from large rainfall events. However, it is occasionally necessary to pump the discharge at a maximum allowable rate in order to minimise mining downtime as well as minimising environmental impact by pumping mine-affected waters during periods of high creek flow, therefore ensuring acceptable water quality downstream of the release point.

It was proposed that, if there should be significant future deterioration in mine water quality, the water quality treatment capacity of the East End Creek drainage system (including Schultz Lagoon) could be further developed with enhanced stormwater system and artificial wetland design.

The EIS stated that the wetland construction in the East End Creek system may affect the rate of mine water return via groundwater. The rate of groundwater return to the void would be more accurately determined by ongoing refinement of groundwater flow estimation through monitoring.

The EIS proposed existing and new measures to minimise the potential effects of mine water discharge, including:

- Existing measures:
 - implementation of a water management plan including the use of a mine water balance in mine water management
 - ongoing monitoring of the effects of mine water discharge on downstream water quality
 - erosion and sediment control inspections as detailed in the erosion and sediment control plan, particularly after periods of heavy rain
 - control of discharge of water with maximum flow rates dependent on natural creek flows and mine water quality in accordance with conditions of the EA
 - appropriate risk assessment in determining the size and design of storage dams and sediment basins.
- New measures:
 - constructing diversion drains to divert water away from the extended pit
 - vegetating the batters of all diversions bunds and drains to prevent erosion and sediment loss
 - modifying existing mine sumps to create sufficient capability to detain runoff from larger rain events.

Also, the water management plan would be updated to include the project area with the following measures:

- operational phase controls to minimise sediment and nutrient export
- optimisation of the volume of stormwater discharged from the mine having regard to the mass and concentration of contaminants
- operational phase runoff management and diversion controls that could be converted to water harvesting structures with minimal redesign
- segregation of stormwater by quality or source
- provision for staged development of the mine.

4.8.5.3 Stream geomorphology

The EIS identified that the mine extension would pose a risk of impact to Larcom Creek by erosion of disturbed land, modification of flood plain hydraulics, catchment change and wastewater discharge. The EIS noted a risk that large volumes of sediment could be mobilised during flood events due to the location of the proposed mine expansion in the floodplain, unless appropriate measures were implemented.

The EIS proposed the following mitigation measures:

- appropriate soil and water management during mine development and operation in order to mitigate the increased risk of sedimentation in Larcom Creek, such as the design of mine bunds and surface flow systems
- stabilisation of the overland flow-path confluence to the creek by implementation of reinforced swales
- stock exclusion from the creek by fencing along both sides of the creek bank and the provision of off stream watering
- bi-annual water quality and stream stability monitoring at two or three control points, comparison with baseline data and water quality guidelines, and remedial action to mitigate the risk of creek instability.

4.8.5.4 Overland flow and seepage

The EIS stated that the impact of overland flow on water quality would be mitigated through diversion of water from undisturbed areas away from mine workings and by keeping areas of disturbance to a minimum during mine development. A diversion channel has been designed for the rehabilitation area, trending in a south-easterly direction towards Howse Dam, this would enable the diversion of clean runoff from 25.6ha of catchment. The proponent stated that the proposed diversion channel would meet the requirements of Division 3 of the Water Resource (Calliope River Basin) Plan 2006.

The EIS stated that, because of the topography of the project area, it was difficult to gravity drain all gullies completely to Larcom Creek or Scrubby Creek, and minor ponding may occur in two locations along the southern bund. The ponding was proposed to be addressed at the detailed design stage and would involve:

- ensuring that the bund and channel works maximised the amount of water that would be diverted around the site

- protecting the proposed diversion bund from scouring effects using appropriate measures such as rock lining
- minimising ponding in areas against the proposed bund walls that cannot be drained due to topographic constraints.

The proponent stated that in areas where there would be some minor ponding against the bund walls, removal of the ponded water would occur through evaporation, seepage to groundwater, and drainage through the bund via a small PVC pipe. The pipe would have heaped gravel and geotextile to cover the upstream inlet, which would slow flows through the pipe and minimise the potential for blockages. It is anticipated that ponded water would be gone in less than 48 hours.

Spoil dumps, located on mining leases outside the project area, would be designed and formed so as to minimise erosion. These dumps would be revegetated as soon as practicable after land forming is completed. Spoil dumps would be located on high points away from waterways where there are low-permeability formations with saline groundwater. In this way, leachate from spoil dumps is not expected to result in significant impacts.

4.8.5.5 Surface water contamination

The EIS stated that the sewage treatment plant and grey water system at the existing mine, would continue to be used for the project expansion. The systems are subject to regular visual and chemical monitoring and are not of a sufficient scale to pose a threat to downstream water quality.

All on site fuel storages at the existing mine are bunded in compliance with Australian Standard 1940-2004: The storage and handling of flammable and combustible liquids. There would be no hydrocarbons or other chemicals stored on the new project area. Refuelling of mobile machinery would be carried out at the mine workshops and spills from this source would therefore pose a low risk to surface water quality.

4.8.5.6 Flooding

The EIS stated that the southern portion of the project area is subject to flooding from Larcom Creek and Scrub Creek. A bund wall would be built to prevent flood waters entering the pit from Larcom Creek and Scrub Creek. The bund wall would be a regulated structure, and therefore would be built in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2013).

The potential impact of the proposed bund on flood conditions in Larcom Creek and Scrub Creek was assessed using numerical modelling. Flood event hydrographs were generated using the Watershed Bounded Network Model (WBNM) hydrologic software and imported into MIKE 21 to create simulations for the 2 year, 5 year, 20 year, 50 year and 100 year ARI design storm events. The modelling predicted that for a 100 year ARI flood event, the water level would increase by about 100mm around the eastern and north-eastern edge of the expansion area. That level of impact was not considered to be significant, as the floodplain areas upstream of the site are entirely undeveloped.

The EIS stated that the highest absolute water level near the project area boundary, under the 1 in 1000 year ARI flood event for the developed case, is predicted to be 40.4mAHD. To provide a 1m allowance for freeboard, any protective bund around the edge of this area would be built to a crest level of at least 41.4mAHD.

The modelling predicted that the bund would increase peak flow velocity by 0.29m/s and 0.39m/s for the 50 year and 100 year ARI events respectively. The EIS stated that such velocity changes would be unlikely to cause any adverse impacts to the surrounding environment.

4.8.6 Major issues raised in submissions on surface water

Submissions on the EIS relating to surface water are summarised in Appendix 1 of this assessment report. EHP requested that a number of surface water issues be addressed in supplementary work, and these are also summarised in Appendix 1.

EHP wanted to ensure that EA conditions for the project relating to surface water are consistent with the Model Mining Conditions Guideline 2013, especially conditions for discharge to waters and receiving water turbidity and EC. The proponent has adequately amended the EA conditions and made the discharge limits for turbidity and EC consistent with the current EA that was approved by EHP in 2013. EHP is satisfied that the recommended conditions for the draft EA should minimise any potential impacts from mine water discharge. The management of ponding by the diversion bund should be addressed in the detailed design of the bund and its associated drain. The diversion bund would be required to be designed by a suitably qualified person and proposed installation of PVC pipes through the bund to drain any ponding water.

Gladstone Regional Council (GRC) reviewed the response to submissions and supplementary EIS (SEIS) and advised the following outstanding issues had not been adequately addressed:

- the cumulative impact of mine dewatering in conjunction with rain events had not been addressed and may lead to the capacity of stormwater assets being exceeded resulting in flows in excess of those predicted, and insufficient treatment of stormwater
- the impact of ponding against the bund wall.

With regard to these issues, the proponent advised that:

- the pit volume would be adequate to accommodate a combination of groundwater flow and surface water runoff from large rainfall events, while allowing the mine to pump out at the permitted rate, and the treatment ponds have been previously sized and designed to receive the maximum water flow
- mitigation measures would be provided to address ponding against the bund wall.

Submissions to EHP from the East End Mine Action Group (EEMAG) and some landholders following review of the SEIS stated that their surface water issues had not been fully addressed, including:

- impacts of mine works on flooding of surrounding areas
- impact of discharging mine water into Larcom Creek
- sediment accumulation in East End Creek
- stream disappearance at Scrub Creek is caused by the mine.

After reviewing information provided by the proponent, EHP considered that the issues raised by landholders and the EEMAG had been sufficiently addressed, through:

- the proponent undertaking flood modelling of the potential impact of the proposed bund on flood conditions in Larcom Creek and Scrub Creek
- assessing the impacts from mine water discharge on Larcom Creek and proposing adequate mitigation measures
- providing erosion and sediment control procedures to minimise impact of sediment accumulation in East End Creek
- explaining how the losing stream at Scrub Creek is likely to be a feature of the karst landscape, and proposing to monitor flows in Scrub Creek as part of the review of the mine's water monitoring program.

4.8.7 Conclusion and recommendations

The existing surface water values were adequately described in the EIS and discussed in section 4.8.4 of this assessment report. The environmental values under Queensland Water Quality Guidelines (DERM, 2009) that were selected for protection were aquatic ecosystems (protection of slightly-to-moderately disturbed aquatic habitat) and stock water.

Potential surface water impacts were assessed in the EIS and proposed mitigation measures are discussed in section 4.8.5 of this assessment report.

Discharges of mine affected water were addressed in section 4.8.5.2 of this assessment report. The EIS stated that the discharge mine water meets the water quality objectives of the EA and measured chemical concentrations have been well within the suitability guidelines for livestock.

Impacts of flooding in Larcom Creek and Scrub Creek were numerically modelled and discussed in section 4.8.5.6 of this assessment report. An outcome of the flood modelling is that the bund wall constructed to approximately 6m–7m above the lowest ground elevation with a crest level of at least 41.4m AHD would be sufficient to prevent a 1 in 1000 year ARI flood entering the proposed mine pit.

The EIS stated that the increase in flood levels that may occur due to bunding is not considered significant, as the floodplain areas upstream of the project area are entirely underdeveloped. Also, the EIS concluded that predicted flood velocities associated with the mine expansion would have no discernable impact on creek stability.

The EIS predicted minor ponding against the diversion bund and on the neighbouring lease ML80009. The proponent proposes to drain ponding by the installation of a PVC pipe through the bund with heaped gravel and geotextile to cover the upstream pipe inlet to minimise the potential for blockages.

EHP is satisfied that the commitments made in the draft EM plan, and the application of model mining conditions in the EA (refer to Appendix 4), particularly for water discharges and regulated structures for the flood protection bund, would provide adequate protection of aquatic environmental values.

Recommendations

It is recommended that the proponent:

- develop a piped system to drain ponding
- wherever possible, backfill areas of potential ponding with the agreement of the landholder to redirect drainage
- ensure surface water conditions are consistent with the current model mining conditions
- continue to liaise with the East End Mine Action Group and landholders regarding surface water impacts.

4.9 Groundwater

The EIS described the groundwater resources, aquifers and groundwater monitoring network of the project area, discussed potential groundwater impacts, and proposed measures to mitigate the impacts. The groundwater assessment included a discussion of a conceptual model of groundwater flow, and outlined the development and operation of a preliminary steady state groundwater (mathematical) model of groundwater flow in the vicinity of East End Mine. The groundwater model was used to: quantify hydrologic processes; build confidence in the conceptual model of aquifer properties and groundwater flow; assess the suitability of the current groundwater monitoring network; and assess likely post mining hydrologic scenarios. The modelling concentrated on the area in the vicinity of the project area and the existing pit.

4.9.1 Groundwater modelling

4.9.1.1 Conceptual model of aquifer properties

The EIS described a conceptual model of the aquifer properties at the East End Mine that was developed during previous investigations. This model was based on the vertical distribution of secondary porosity within the limestone, dividing it into three layers (see Figure 4.2 below). The topmost layer (Layer 1) has high secondary porosity and comprises laterite, clay and limestone with open fractures and solution channels. The middle layer (Layer 2) has a medium secondary porosity and comprises limestone with open fractures and some solution channels. The bottom layer (Layer 3) has a low secondary porosity and comprises limestone with closed fractures. The EIS stated that it is highly likely that diminishing secondary porosity with depth will mean loss of permeability.

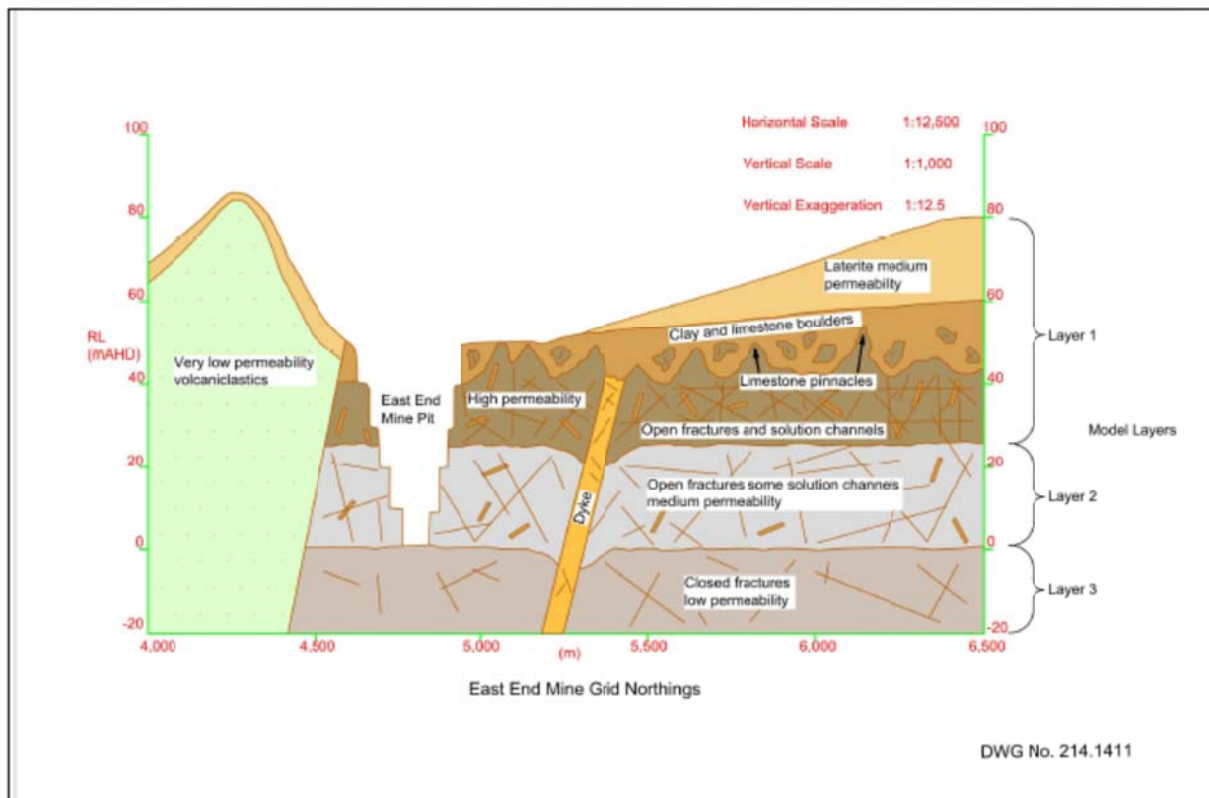


Figure 4.2 – Schematic section of East End aquifer (Source: EIS)

Based on this conceptual model, a 3D model of the layer boundaries within the project area was constructed based on recent diamond drilling information and using Surpac geological modelling and mine design software (see Figure 4.3 below).

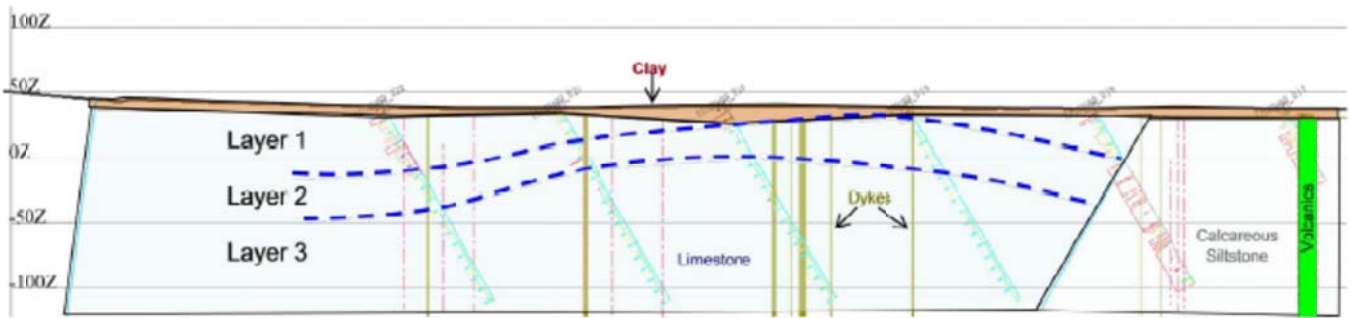


Figure 4.3 – Section view of aquifer layer model applied to project area; south-west – north-west transect (source: EIS Appendix 9)

The EIS identified the following features of the local geology as being pertinent to a conceptual model of groundwater flow:

- both volcanoclastic and limestone formations were considered likely to extend to depths of several hundreds of metres
- the contacts between rock types were found to be near-vertical, and were assumed to be vertical for the purposes of the numerical model
- the aquifer layers were all considered to be unconfined with recharge occurring across the area
- it was assumed that geologic structures in the area of interest (such as dykes and faults) may retard groundwater flow and/or act as seepage faces, but do not generally act as significant flow barriers.

4.9.1.2 Steady state groundwater (mathematical) model

The EIS stated that the steady state (mathematical) model of groundwater flow successfully identified some important features that were additional to those of the conceptual model:

- The delay in response of groundwater levels to rainfall is likely to be significant enough that accurate transient modelling of the groundwater recharge will require the application of a time lag to model inputs.
- The isolated volcanoclastic hills in the East End area require some degree of groundwater recharge in order to maintain groundwater levels elevated above groundwater levels in the surrounding aquifers. The amount of recharge to the volcanoclastic aquifer is likely to be less than to the limestone aquifer, but not by orders of magnitude. An estimated groundwater recharge rate for the East End limestone of 4.5% was reconciled with estimated pit base-flow rates. This estimate agreed with, and allowed more confidence in, the previous groundwater recharge estimate.
- The estimated base-flow rate to the present mine pit of 2.3ML per day may be conservatively high.
- The steady-state simulation of the elevated groundwater levels in the volcanoclastic rocks requires hydraulic conductivity estimates that are considerably less than the estimates for limestone and a recharge rate that is half of the recharge rate for limestone.
- The simulation of intercalated volcanoclastic rocks with low hydraulic conductivity near Schultz Lagoon are required in order to simulate the groundwater levels on both sides of this feature
- There is limited interaction between creeks to the south of the mine and the East End limestone aquifer. No conclusion is made about the degree of interaction between Machine Creek and the East End limestone aquifer. It is likely that mine water returning to the pit is sourced primarily from the East End Creek system, including Schultz Lagoon and associated wetlands
- The following features are not resolved by steady-state (mathematical) groundwater modelling:
 - the effect of assigning layers of depth-dependent permeability was not investigated
 - the hydrologic effect of geologic structures within the limestone was not investigated.

4.9.2 Description of environmental values

4.9.2.1 Groundwater use

The EIS stated that aside from mine dewatering, nominal amounts of groundwater were extracted in the Bracewell/East End area, primarily for stock watering. There was also limited use for irrigation of fodder crops and fruit trees. All homesteads were considered likely to use a combination of groundwater and rainwater for domestic use at typical household rates.

The EIS stated that there are no requirements under the Water Act for irrigators in the Bracewell/East End area to possess water allocations permits or to report their rates of groundwater use. In 2009, there were 390 bores and wells reported to EHP to be in existence in the Bracewell/East End area.

The EIS presented summary data from groundwater bores and wells in the Bracewell/East End area, as shown below in Table 4.5 of this assessment report.

Table 4.5 - Summary of groundwater bores and wells in the Bracewell/East End Area (Source: Appendix 9)

Aquifer Unit	No. Bores	No. Wells	Total	Median depth (m)	Median yield (L/s)	Median pH (pH units)	Median EC ($\mu\text{S/cm}$)
1 - Hut Creek	72	9	81	20	1.3	7.2	3,000
2 - Machine Creek Alluvium	7	9	16	14	2.1	7.4	2,000
3 - Bracewell North	28	2	30	30	2.5	7.0	2,300
4 - Mt Larcom Southwest	28	1	29	50	3.4	7.2	2,900
5 - East End Mine	51	10	61	45	2.5	6.9	2,900
6 - Bracewell Southwest	51	23	74	16	1	7.2	1,600
7 - Bracewell Central	16	10	26	22	1.9	7.5	1,400
8 - Bracewell West	22	5	27	19	1.1	7.4	1,900
9 - Bracewell East (Jacobs Creek)	39	7	46	21	0.6	7.2	3,700
TOTALS	314	76	390				

The EIS stated that there was a distinct trend in groundwater salinity with groundwater generally most brackish in the Bracewell East (Jacobs Creek) area (median EC of $3,700\mu\text{S/cm}$) and least brackish or fresh (median EC of $1,400\mu\text{S/cm}$) in the Central Bracewell area. Generally, groundwater salinity was much higher in volcanoclastic rocks than in alluvial and limestone strata. Some bores established in volcanoclastic rocks have quite saline groundwater.

The data show that groundwater in the East End area is generally suitable for livestock but of marginal use for irrigation of some crops.

4.9.3 Existing groundwater environment and potential impacts

4.9.3.1 Groundwater quality

Table 4.6 below provides a summary of groundwater quality at bores in the vicinity of the project area.

Table 4.6 – Groundwater quality at bores in the vicinity of proposed ML80156 (Source: Appendix 9)

Field ID	RN	N ¹	Average EC (mS/cm) ²	Average pH (pH units)	Aquifer lithology	Comments
Group 1 - South part of MLA						
*DHH96-7	97146	49	4.2 +/- 1.6	7.0±0.2	Weathered sediments	Brackish, variable

Field ID	RN	N ¹	Average EC (mS/cm) ²	Average pH (pH units)	Aquifer lithology	Comments
*DHH96-8	97147	37	2.3 +/- 0.2	6.9±0.3	Limestone	Slightly brackish, consistent
DHH96-41	97177	50	2.8 +/- 1.8	7.4±0.5	Limestone and clay	EC variable, freshening
Group 2 - North part of MLA						
*DHH96-9	97148	50	7.5 +/- 2.1	7.1±0.2	Limestone and clay	EC variable, decreasing
*DHH97-6	97546	50	4.7 +/- 1.6	6.8±0.3	Limestone and clay	EC variable
Group 3 - East of existing mine						
SE	111506	47	3.6 +/- 0.8	6.7±0.3	ND	EC brackish, increasing
*DHH96-30	97167	50	3.4 +/- 2.0	6.9±0.4	Limestone	EC increasing to brackish
*DHH96-29	97121	50	11.2 +/- 1.8	6.9±0.2	Limestone/Basalt	Very brackish
Group 4 - Jacobs Creek area, southwest of MLA						
DHH96-39	97175	48	3.7 +/- 0.2	8.3±0.5	Andesite	Slightly brackish, consistent
DHH96-12	97151	49	10.0 +/- 1.6	7.3±0.3	Limestone and clay	EC variable
DHH97-9	97547	49	7.8 +/- 1.3	6.9±0.3	Limestone and clay	EC variable
Group 5 - North of existing mine						
*DHH96-26	97164	29	5.7 +/- 0.7	6.9±0.4	Limestone and clay	EC variable
*DHH96-20	97051	47	3.0 +/- 0.5	6.8±0.2	Limestone and clay	EC decreasing
DHH96-19	97158	51	2.9 +/- 0.4	5.9±1.0	ND	EC consistent
Group 6 - Northwest of existing mine						
NE	111504	48	2.8 +/- 0.8	7.0±0.2	ND	EC increasing
*DHH96-25	97163	51	3.3 +/- 0.5	7.1±0.3	Limestone and clay	EC consistent
DHH96-31	97120	49	5.5 +/- 3.5	7.2±0.3	Limestone/Mudstone	EC decreasing

Notes

¹ N = no. of readings

* bore construction details available; bore screened at depth

The EIS stated that while most bores indicated consistent EC readings over time, there was a trend of freshening groundwater to the north of the mine (e.g. Bore DHH96-20). This was associated with lowering of the water table and was attributed to lowering of a salinity profile within the saturated water column and/or to increased groundwater recharge. Increases in salinity over time in some bores to the east of the mine (e.g. Bore DHH96-30) may also have been related to increased groundwater migration.

The EIS stated that the combined effects of aquifer freshening and salinization would continue with mine development. Any detrimental changes in these processes were considered likely to occur gradually and could, therefore, be monitored and managed within the framework of the existing bore rectification process.

The EIS stated that the EC measured in Bore DHH96-41 (RN97177) near Larcom Creek indicated freshening groundwater. It was proposed that direct recharge from rainfall and/or flood water, in conjunction with increased drawdown, or a combination of direct recharge and creek water, may be responsible for freshening of groundwater in the low lying parts of the new mining area. It was considered unlikely that this fresher water was due to significant migration from Larcom Creek and/or Scrub Creek. Other possible sources of fresh groundwater in the area are the two gullies entering the project area from the west.

4.9.3.2 Groundwater levels

The EIS provided groundwater level plots of selected bores for the East End area that showed an increase in drawdown with time since mining commenced. Also, the groundwater levels have been shown to recover after large rainfall events (Refer to Figure 4.4).

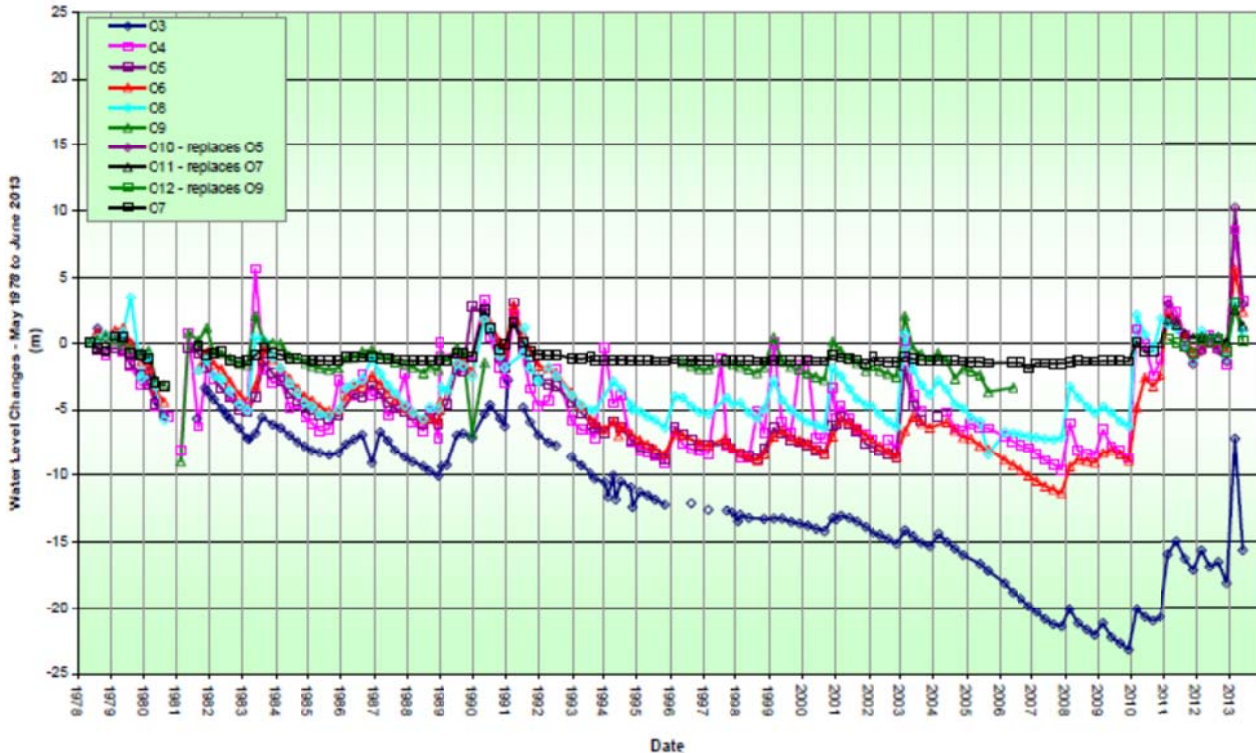


Figure 4.4 – Groundwater levels (Source: Appendix 9)

The pre-existing water table elevation at commencement of mining was 40m to 45m AHD. The EIS stated that mine dewatering at the existing mining operation has caused a cone of water table depression (known as drawdown) to occur around East End Mine. The water table has been lowered by a maximum of 40m to 50m in the vicinity of the mine pit. In combination with recent low annual rainfall, this drawdown has impacted mostly on extraction bores closest to the mine. Approximately 20 landholders were located within the designated zone of influence of groundwater drawdown by the existing mine, which may extend several kilometres to the north-west of the mine pit. However, estimation of the extent of mine related groundwater drawdown is compounded by climate variation and other groundwater extraction. There was less marked drawdown toward the south-east and north-east. The extended drawdown to the northwest compared to the south-east was considered to be possibly due to incomplete aquifer confinement. The drawdown toward the south-west was greatly reduced due to the mine abutting volcanoclastic rocks.

The EIS stated that numerical modelling indicated that mine extension and final development would have insignificant additional impact on groundwater resources to the north of the mine. Significant impact on the waterways to the south of the mine was considered to be more likely for the proposed project than with the existing mine, but quantification of this impact would require additional ongoing monitoring and determination of the extent of surface water – groundwater interaction following the planned installation of additional monitoring bores.

The EIS stated that during periods of low flow in the creeks in the local area (i.e. during base-flow conditions), groundwater discharge comprised a large proportion of this base-flow, and surface water quality was therefore representative of groundwater quality during these periods.

4.9.4 Mitigation of groundwater impacts

The EIS stated that Cement Australia has a history of carrying out mitigation (make good) works, including bore rectification, on behalf of affected landholders where mining impacts are evident or possible. Mitigation measures included drilling of deeper replacement bores, pump replacement, and the supply of water during times of drought.

The EIS stated that there would be a range of options available to reduce the impacts of mine-related groundwater drawdown and mine discharge water quality on the surrounding groundwater users and receiving waters.

The EIS stated that should additional mitigation works be required as a result of additional drawdown, existing consultation procedures would be followed. Other water management options that have been either proposed, trialled or implemented by Cement Australia in consultation with stakeholders included:

- pumping of mine water to Machine Creek. The pumping of mine water to Machine Creek was trialled between 2008 and 2009. It was concluded that the raising of water levels in Machine Creek provided some benefit for maintaining groundwater levels in the underlying limestone aquifer to the north of the mine
- groundwater injection bore. In 1998, an injection bore and associated monitoring bores were constructed on Wallaby Lane for the purposes of mine water injection. However, this bore injection has not yet been trialled and consequently, potential injection rates and other parameters associated with injection were undetermined
- piping of mine water directly to farm dams. The EIS noted that this option presented the most cost benefit to landholders despite having a significantly lower storage capacity than the groundwater aquifer replenishment options.

4.9.4.1 Groundwater monitoring program

The EIS stated that there was an existing network of some 115 groundwater monitoring points (including open wells) used for the purpose of assessing impacts from the existing mining operation. Many of the existing monitoring bores were located in the vicinity of the project area.

Groundwater monitoring activities at East End Mine involved the quarterly monitoring of groundwater levels and measuring physico-chemical parameters (EC and pH). Biennial chemical analysis (domestic and drinking water parameters) was carried out on groundwater samples from regularly pumped bores, mostly located north of the mine.

The EIS stated that the groundwater monitoring program has been reviewed in consultation with EHP and DNRM. The review included:

- installation of 17 new groundwater monitoring bores including the replacement of three monitoring bores. The new bores generally expanded the area of the monitoring network around the mine by approximately 100km³ to 125km³
- continued sampling of regularly pumped bores and the annual purging of other bores, where practicable
- more detailed water level monitoring using pressure transducers in selected bores in order to provide better understanding of processes such as rainfall response, pumping effects and aquifer confinement.

Other recommendations by the proponent, additional to those contained in the monitoring review were:

- additional and replacement monitoring bores to be installed, well in advance of mining commencing in the project area, in the vicinity of Larcom Creek, Scrub Creek and Machine Creek alluvium to confirm the extent of groundwater-surface water interaction
- any additional bores drilled adjacent to Larcom Creek and Scrub creeks should be hydraulically tested in order to develop an understanding of the connectivity between the river and the adjacent aquifer/s including the potentially low permeability volcanic layer identified within the limestone
- upgrading of existing bores where possible to facilitate bore purging and improve confidence in groundwater and geologic data. This would involve the progressive replacement of purging bores, faulty bores or abandoned bores with dedicated monitoring bores of small-diameter and detailed construction and strata logs
- following the acquisition of additional water level data from the monitoring network recommended above and additional pumping test data, refinement of a numerical model of groundwater flow would be feasible and should be completed. Features of such model would include: (a) additional vertical discretisation of the aquifer(s), (b) development of a transient flow model including delayed recharge, and (c) more accurate representation of groundwater-surface water interaction near creeks and other surface water bodies.

DNRM has reviewed the above groundwater monitoring program and advised that, given the proximity of the proposed extension of the pit area towards Schultz Lagoon, the program should include installing monitoring bores in the vicinity of Schultz Lagoon.

4.9.4.2 Transient groundwater modelling

The proponent proposed to develop a transient groundwater model for the project that would be a more complex model than the steady state (mathematical) model used for the EIS. The transient model would include a better understanding of geologic structures, stream-aquifer interaction, modelling of depth-dependent aquifer parameters, other water use, and the effect of transient rainfall. The transient groundwater model would allow more accurate prediction of groundwater impacts (in particular, impacts to landholder bores) and provide an improved basis for determining mitigation measures.

The recommended conditions for an EA in Appendix 4 of this assessment report include a condition requiring the proponent to replace the existing groundwater model with a calibrated transient model.

4.9.5 Residual mining void

The EIS predicted that mining operations at the East End Mine would continue for many decades and stated that it was therefore premature to make a definite prediction about the eventual use or land use classification of the mining void and surrounds. However, it was considered reasonable to assume that the mining void would become a water storage facility.

Based on estimated average groundwater levels prior to mining, the water in the pit was expected, in the long-term post-mining, to be occasionally high enough to discharge over the bund crest to East End Creek and Schultz Lagoon and then into Larcom Creek. Water levels in the pit were expected to come into equilibrium with the surrounding water table several years after mine closure and the void would be either at full or near full water storage. In the long term, the rates of surface water flow to East End Creek were not expected to be higher than the flow rates from the same area prior to mining.

The long-term quality of water in the filled mining void would be a function of evaporation rates, rates of surface water inflow, rates of water extraction and groundwater inflow and outflow.

Void water salinity was expected to be higher than within the existing pit due to evaporation. However, this effect could be partly mitigated by the beneficial use of this water and some stratification of the water body.

4.9.6 Major issues raised in submissions on groundwater

Submissions on the EIS relating to groundwater are summarised in Appendix 2 of this assessment report.

Gladstone Regional Council (GRC) reviewed the response to submissions and supplementary EIS (SEIS) and advised that the proponent had not adequately addressed the uncertainty over the impact of the mine on Larcom and Scrub creeks. However, after considering GRC's comments and information provided by the proponent, EHP was satisfied that the issue would be adequately addressed though conditions in the EA requiring the proponent to install additional monitoring bores, undertake ongoing monitoring, and assess in more detail the extent of surface water-groundwater interaction.

Submissions on the SEIS from the East End Mine Action Group and some landholders advised that not all of their groundwater issues had been adequately addressed, including:

- the characterisation of the karst groundwater aquifer
- the impact of groundwater drawdown on landholders' bores
- groundwater entering the pit from Larcom and Scrub creeks
- the potential installation of a grout curtain to reduce groundwater drawdown
- dissatisfaction with the outcomes of special conditions, including time taken for a replacement bore, and the replacement bore not being like for like.

In regard to these groundwater issues raised by the EEMAG and landholders, the proponent provided pertinent information as discussed below.

The proponent stated that the aquifer in the project area was adequately understood and was not a complex karst limestone system. The EIS categorised the local geology as buried karst, including epikarst that has been covered and in-filled with younger sediments. The hydraulic conductivity of the karst is therefore largely controlled by the permeability of the silty infill and the fracture density, rather than by cavities.

The numerical modelling of development scenarios with and without the mine indicated that the mine extension and final development would have insignificant additional impact on groundwater resources to the north of the mine. Significant impact on waterways to the south of the mine is more likely, but quantification of this impact would require additional ongoing monitoring. Consequently, the proponent will be required to install additional monitoring bores and undertake more detailed modelling of groundwater flow using a transient model to better understand potential impacts.

The additional monitoring and transient model will also assist a better understanding of groundwater–surface water interaction, particularly with regard to water entering the pit.

The proponent stated that the feasibility and practicality of implementing a grout curtain as a solution to groundwater drawdown was addressed in the report 'East End No. 5 Mine grout curtain evaluation and costs', which was attached to the SEIS. The report concluded that the installation of a grout curtain might solve some of the groundwater table drawdown issues at East End Mine. However, a grout curtain could also generate unforeseen impacts due to the redirection of localised groundwater flow, and such impacts are very difficult to predict. The cost of installing a grout curtain is estimated at a minimum of about \$37.2 million dollars. This high cost, combined with the uncertainty of the effectiveness of the outcome, make the installation of a grout curtain not the preferred option for the management of groundwater drawdown impacts.

The proponent considered that the matter of providing a due process for addressing underground water supplies affected by mining operations was addressed in Appendix 8c of the EIS, Underground Water Supplies affected by operations at East End Mine Information Sheet – Application for Determining Requirements. Although certain proposed amendments to the Water Act had not been enacted at the time of writing of this report, it was anticipated that the new Chapter 3 'make good' provisions in the Water Act will address the requirements of the existing special conditions.

4.9.7 Conclusion and recommendations

The EIS discussed a conceptual model of the aquifer properties at the East End Mine. Also, the EIS discussed the development of a preliminary steady state (mathematical) groundwater model for the East End area. The groundwater model was used to: quantify hydrologic processes; build confidence in the conceptual model of aquifer properties and groundwater flow; assess the suitability of the current groundwater monitoring network; and assess likely post mining hydrologic scenarios. However, EHP in consultation with DNRM has concluded that the current model is not adequate for the on-going consideration of potential impacts.

The proponent will be required to develop a transient groundwater model for the project that would be more complex than the steady state (mathematical) model used for the EIS. The transient groundwater model would allow more accurate prediction of groundwater impacts (in particular impacts to landholder bores) and provide an improved basis for determining mitigation measures.

Potential groundwater impacts were assessed in the EIS and proposed mitigation measures are discussed in section 4.9.4 of this assessment report. The EIS discussed the impact from mine dewatering at the existing mining operation that has caused drawdown to develop around the East End Mine. The EIS stated that numerical modelling of the mine development indicated that the mine extension and final development would have insignificant additional drawdown on groundwater resources to the north of the mine. Significant impact on the waterways to the south of the mine is more likely, but quantification of this impact would require additional ongoing monitoring.

The proponent proposes additional and replacement monitoring bores to be installed, well in advance of mining commencing in the project area, in the vicinity of Larcom Creek, Scrub Creek and Machine Creek alluvium to confirm the extent of groundwater-surface water interaction. DNRM has reviewed the groundwater monitoring program and found it adequate. The proponent will also provide a more detailed proposal to EHP and DNRM for the location of additional monitoring bores to facilitate a better description of the connectivity between the proposed mine and Schultz Lagoon on East End Creek.

Cement Australia will continue to carry out mitigation (make good) works, including bore rectification, on behalf of affected landholders where mining impacts are evident or possible. Mitigation measures will include drilling of deeper replacement bores, pump replacement, and the supply of water during times of drought.

Appendix 4 of this assessment report provides recommended conditions for the management of groundwater impacts. Having reviewed the information provided by the proponent and the measures to be undertaken to better monitor and predict groundwater impacts, together with the conditions that are recommended to manage impacts on groundwater resources, EHP considers that there will be acceptable overall outcomes.

4.10 Air quality

The ambient air quality assessment of the EIS focussed on dust deposition, and PM₁₀ and PM_{2.5} particulate matter, as the project would generate no other contaminants of air quality that have the potential to cause significant impacts.

PM₁₀ levels from the current East End mine were measured at the nearest sensitive residence, approximately 1.4km north of the project area, over two sampling periods: 3–10 June 2010 and 5–9 September 2010. The PM₁₀ monitoring was in accordance with the methodology described in the Air Quality Sampling Manual (EPA, 1997).

PM_{2.5} emissions were estimated as comprising 20% of the PM₁₀ emissions.

Dust deposition monitoring for the EIS was carried out between March 2003 and August 2005 in the north-east corner of Lot 37 on Plan SP 101570.

The EIS presented estimated background levels of PM₁₀ and PM_{2.5} particulate matter and dust deposition based on the 95th percentile of the levels measured during the sampling programs. The results are shown Table 4.7 below along with relevant guideline limits.

Table 4.7 – Background particulate matter and dust deposition levels (Source: EIS)

Pollutant	Averaging period	Concentration	Source	Guideline limit
PM ₁₀	24 hours	13µg/m ³	East End	50 µg/m ³ * – 24 hours (EPP Air)
PM _{2.5}	24 hours	2.6µg/m ³ **	East End	25 µg/m ³ – 24 hours (EPP Air)
Dust deposition (as total insoluble solids)	Month	1.9µg/m ²	East End	4 g/m ² /month (EHP Guideline)

* Allowed 5 exceedences each year

** Based on the assumption that 20% of PM₁₀ is in the form of PM_{2.5}

The particulate matter and dust deposition levels recorded were significantly lower than the Environmental Protection Air (Policy) 2008 (EPP Air) guideline limits for PM₁₀ and PM_{2.5}, and less than the EHP guideline for dust deposition. The EIS stated that results of the air survey were considered to provide a reliable statement of existing air quality adjacent to the proposed mining lease development and that future monitoring results could be compared to these baseline results to identify if the proposed East End No. 5 Mine project had any impact on air quality in the area.

The EIS stated that, providing the air emission mitigation measures currently implemented at East End Mine are continued for the proposed project, EPP Air objectives for concentrations of PM_{2.5} and PM₁₀ and EHP's dust deposition guideline limit should not be exceeded at surrounding existing dwellings. Activities in the extended mining pit would be located further away from existing nearest residential dwellings. The proponent stated that if a dust complaint is received as a result of on-site activities, further mitigation measures would be undertaken.

The EM plan provides adequate mitigation measures to address air impacts, including:

- use of a water truck to control dust in operational areas and haul roads
- limiting vehicle speeds to less than 40km/hr on unpaved roads within the project area
- installation of wind breaks around exposed storage and stockpile areas, avoidance of vegetation clearing, topdressing, blasting or other high dust generating activity on days with wind speed exceeding 5m/s blowing towards sensitive places
- restriction of fires to land management requirements subject to approval from the Area Fire Warden
- use of well-maintained modern plant and equipment to minimise greenhouse gas production
- use of bag filters on fixed plant and equipment where practicable
- implementation of a complaints handling protocol, which may require additional monitoring.

Greenhouse gases

The EIS stated that annual greenhouse gas emissions for Australia (year to September 2011) and Queensland (in 2009) were 539.8Mt CO₂-e and 155Mt CO₂-e respectively as reported in the Department of Climate Change and Energy Efficiency State and Territory Greenhouse Gas Inventories 2012. For the whole Gladstone operation of Cement Australia, which included the East End Mine and Fisherman's Landing clinker production plant, the 2010 annual greenhouse emissions were 1.24Mt CO₂-e representing 0.23% and 0.80% of Australian and Queensland greenhouse gas emissions respectively. Annual greenhouse gas emissions generated in the pre-mill part of the operation (primarily at East End Mine) of 3,393t CO₂-e represented 0.00063% of Australian emissions and 0.00219% of Queensland emissions. Greenhouse gas emissions from the proposed project are expected to be about the same as existing East End Mine emissions.

The proponent participated in the Australian Government's Energy Efficiency Opportunities Scheme (EEOS), which

aims to identify opportunities for cost-effective energy reduction. The EEOS scheme entails annual reporting, periodic development of forward plans and external audit.

Under the aegis of the Cement Industry Federation, Cement Australia has been participating in the Commonwealth's Greenhouse Plus scheme where greenhouse inventories, plans and improvements are reported

The EIS stated that modern plant and equipment would be deployed and kept well maintained to ensure greenhouse gas production was minimised.

4.10.1 Conclusion and recommendations

The EIS adequately described the existing air environment that may be affected by the project.

The EIS stated that the project is unlikely to result in any significant increase in air emissions, as the project would be a continuation of the existing mining operations. The EIS identified that the EPP Air objectives for concentrations of PM_{2.5} and PM₁₀ and EHP's dust deposition guideline limit are not be expected to be exceeded at surrounding existing dwellings. Furthermore, activities in the extended mining pit would be situated further away from the existing nearest rural residential dwelling. The proponent stated that if a substantial dust complaint is received as result of on-site activities, mitigation action would be undertaken.

The recommended conditions for the management of air quality are in Appendix 4.

4.11 Noise and vibration

The EIS stated that existing mining activities, adjacent to the project area, were conducted in a rural setting with significant separation distances between activities and sensitive receptors.

Baseline noise monitoring was carried out in 2010 at two locations adjacent to the nearest sensitive residences to the east and west of the project area. Long-term noise levels were measured over two periods: 3–11 June 2010 and 4–10 September 2010. Background noise levels ranged between 30.6dB(A) and 34.7dB(A). Measured seasonal and time of day variations in ambient noise level were attributed to insect and frog activity. Overall, the existing noise levels at both monitoring locations were observed to be due to natural sources, with the residual noise from the current mining operations considered to be negligible.

The project would be a continuation of the existing mining operation, with the extended pit maintaining the current separation distances to surrounding residential dwellings. Provided current management practices were maintained, no increase in the overall noise emissions compared with existing mining operation at surrounding noise sensitive places is expected.

Initial screening assessment of low frequency noise using the Environmental Protection Agency (now EHP) guideline, Assessment of Low Frequency Noise, indicated that low frequency noise would not cause annoyance at sensitive receptors.

The following mitigation measures were proposed in the EIS to minimise possible noise related impacts at sensitive receptors:

- adequate separation distances between mining operations and sensitive noise receptors
- acoustic barriers or earthen bunds between noise sources and adjacent sensitive receptors where necessary, with the barriers or screens located as close to the noise source as possible
- limiting extraction operations to day and evening periods where practicable or alternatively conducting activities in more distant areas at night, or behind earthen bunds or barriers
- locating haul roads a sufficient distance from sensitive receptors and to maximise screening (e.g. by hills, ridges or within the excavation pit)
- enclosing significant noise sources (e.g. vibratory screens, generators, crusher ,etc.), and ensuring that access doors are kept closed at all times.

The EIS stated that the effects of blasting would be managed by the adoption of good blast engineering practice. The contract between Cement Australia and the blasting contractor specified environmental performance criteria and conformance with regulatory requirements.

EHP provided a submission on the noise assessment, advising the proponent to use the World Health Organisation (2009) guideline that included the L_{max}42 indoor and the L_{max}49 outdoor criteria. The proponent provided an adequate response in the SEIS.

4.11.1 Conclusion and recommendations

Background noise levels were measured in 2010 at two locations, adjacent to the nearest sensitive residences to the east and west of the project area. The EIS stated that overall, the existing noise levels at both monitoring locations were observed to be due to natural features, with the residual noise from the current mining operations observed to be negligible.

The EIS predicted that noise from the project area would comply with all noise criteria. Adequate mitigation measures are proposed to further minimise possible negative noise related impacts.

The recommended noise and blasting conditions for the draft environmental authority are in Appendix 4.

4.12 Ecology

4.12.1 Identified ecological values

4.12.1.1 Vegetation communities

A desk top review of Queensland Government regional ecosystem mapping certified for the purposes of the *Vegetation Management Act 1999* (VM Act), showed that the proposed project area contained only non-remnant vegetation.

The field study conducted from 3 November 2009 to 5 November 2009, determined the dominant vegetation across the majority of the project area to be disturbed grassland with a range of introduced and indigenous plants and weeds. Small areas of remnant woodland with a total area of 8.1ha (9% of the total site area) existed in the north-west of the site. The EIS stated that these remnant patches were dominated by black tea-tree *Melaleuca bracteata* and corresponded to regional ecosystem (RE) 11.3.25d (Riverine wetland or fringing riverine wetland. *Melaleuca bracteata* woodland to open forest.) This regional ecosystem has the biodiversity status 'of concern' (regional ecosystem description database), and is classed as 'least concern' under VM Act. A narrow fringe of vegetation on the road on the northern boundary adjoining the site corresponded to RE 11.3.26 (Gum-topped box *Eucalyptus moluccana* woodland to open forest on margins of alluvial plains) which is classed as 'least concern' under the VM Act and has biodiversity status of 'no concern at present'.

The EIS stated that the project area would be isolated from large forested bushland habitats, would not form part of any fauna movement corridor, and that the degree of clearing of the surrounding district would preclude the re-establishment of any corridors on the site.

4.12.1.2 Terrestrial flora and fauna species

A terrestrial flora and fauna study, based on both desktop review and field investigations, was conducted to provide an inventory of species known to occur, or potentially occurring, within the project area.

A total of 37 species listed as threatened under the NC Act and/or the EPBC Act had previously been recorded, or were considered as potentially occurring within the project area, including 17 flora species and 20 fauna species. The site was considered to provide suitable habitat for one threatened fauna species, specifically the squatter pigeon (southern) *Geophaps scripta scripta*. None of the threatened flora species were considered likely to occur within the project area based on the remnant communities and degree of disturbance. The EIS did not address the potential occurrence of special least concern species (listed under the NC Act) other than koala.

The results of the flora and fauna site assessment, undertaken in November 2009, were as follows:

- no threatened flora species were observed and, because of the highly disturbed nature of the site, none were considered likely to occur
- one significant fauna species, the squatter pigeon(southern), was recorded with three pigeons observed walking in short dry grasses and on tracks in open country in the north of the project area
- four plant species declared under the *Land Protection (Pest and Stock Route Management) Act 2003* were recorded within the project area. The Class 2 weeds prickly pear (*Opuntia spp.*) and rubber vine (*Cryptostegia grandiflora*) were found in low numbers across the site. The Class 3 weeds lantana (*Lantana camara*) and creeping lantana (*Lantana montevidensis*) were recorded in low numbers in the remnant woodland.

4.12.1.3 Aquatic flora and fauna

A field study of aquatic biology was carried out on 23 June 2010. Two waterways, Scrub Creek and Larcom Creek, were surveyed at three sites for freshwater macroinvertebrate sampling, and searches were conducted for amphibians and waterbirds.

The macroinvertebrate scores for the sites investigated were stated to be typical of disturbed waterways in the Brigalow Belt Bioregion and to reflect the damage caused by land clearing and cattle grazing. Impacts to the creeks at the survey sites included large amounts of deposited sediment, damage to banks and levees through trampling, faecal contamination, eutrophication, and low levels of dissolved oxygen. Low numbers of a few highly tolerant taxa of macroinvertebrates were recorded.

The surveys recorded a few common frog species, Murray turtle (*Emydura macquarii*), eight species of freshwater fish, and eight species of water birds. None of the observed fauna species were of conservation significance.

4.12.1.4 Stygofauna and troglofauna

A desktop review and a pilot survey of stygofauna and troglofauna were carried out within the project area and the surrounding area. The desktop review considered previous investigations of stygofauna and troglofauna in Queensland and other parts of eastern Australia and concluded that the karstic limestone in the project area was likely to provide habitat for stygofauna and troglofauna, and that a field survey was warranted.

A pilot survey was carried out on 15 and 16 July 2010 that involved sampling fourteen bores inside and outside the project area. The sampling method for the pilot study was stated to be in accordance with the Western Australian Environmental Protection Authority – Guidance for the Assessment of Environmental Factors No. 54a (August 2007) the Western Australia E.P.A Guidelines.

The main findings from the pilot study were:

- Karstic limestone in the project area provided habitat for stygofauna and troglofauna.
- Stygofauna and troglofauna were detected in the limestone deposit within the project area and near the existing mine operations, and at locations further afield within the same limestone deposit. The collected stygofauna comprised *Amphipoda* (one species), *Copepoda* (at least two species), *Bathynellacea* (two species), *Oligochaeta* (one species), and *Nematoda* (one species). Terrestrial invertebrates collected included a species of *Thysanura* (silverfish) and a dipluran that were considered to be potential troglofauna, and a pauropod considered likely to be a soil fauna species.
- Several of the species were collected only from within the project area and in close proximity to the existing mine where significant groundwater drawdown had occurred. However, it was considered likely that these species would also occur in similar karstic subterranean habitats throughout the East End limestone belt, and possibly other local karstic limestone belts.
- The potential wider distribution ranges of the subterranean fauna collected were incompletely assessed due to the small number of surveys in the Central Queensland region.
- There was insufficient information to assess the conservation status of the recorded taxa relevant to potential impacts from existing or proposed mining operations and groundwater extraction at East End. However, it was noted that stygofauna and putative troglofauna were collected from areas currently experiencing groundwater drawdown.

EHP requested details of broader studies recommended by the pilot study report to determine the potential impacts of the proposed project on stygofauna and troglofauna. However, no further information was provided by the proponent.

4.12.2 Potential ecological impacts and mitigation measures

The EIS stated that the proposed development would result in the removal of all or most of the vegetation in the project area, including the small areas of remnant regional ecosystems. The EIS stated that the habitats to be impacted were abundant in the surrounding areas and that the fauna using the habitats within the project area, including the squatter pigeon (southern), were resilient and able to move on to other areas. It was further stated that the proposed development was not expected to have any detrimental impact on this species on the basis that:

- suitable habitat for the squatter pigeon (southern) was not a limiting factor in the region
- the site was not of special value to the species
- experience with the species at a number of central Queensland coal mine sites indicated that the species could
- be expected to continue to occupy the local area and forage wherever suitable open grassy areas existed, including the margins of the active mining area.

The EIS stated that the clearing of the black tea-tree woodland would result in negligible impact to fauna habitat values on the basis that

- the area was too small and disturbed to represent significant fauna habitat
- the vegetation type occurred commonly in the vicinity of the project area.

The Department of Agriculture, Fisheries and Forestry (DAFF) and a landholder provided a submission on the EIS requesting further information on weed and pest management. The proponent proposed the following measures for weed and pest management:

- storage of food waste and other potentially edible waste in secure containers before appropriate disposal
- reporting of pest animal sightings internally to management and externally to Gladstone Regional Council
- regular monitoring for weeds, and review of current weed management procedures to encompass the mining lease extension area and focus on targeted best practice management of Class 1 and 2 weed species
- construction and operational management to minimise the spread of weeds.

4.12.2.1 Offsets

An offset would be required if, when considering the requirements of the Queensland Biodiversity Offsets Policy 2011, the proposal would have an impact on state significant biodiversity values. The squatter pigeon (southern), which is listed as a vulnerable species under the *Nature Conservation Act 1992*, was found in the project area. However, the amount and quality of the habitat for this species at the site is not high, and suitable habitat is abundant nearby. Consequently, the impacts on habitat for the squatter pigeon at a local and regional scale are not likely to be significant, and no offset will be required.

4.12.3 Conclusion and recommendations

The EIS identified the ecological values of the proposed project area, the likely impacts of the project on these values, and outlined proposed weed and pest management measures. The survey effort for fauna was adequate given that the project area was mostly cleared grazing land. Impacts on ecological values due to the clearing of vegetation and habitat cannot be avoided because there is not alternative to the location of the resource that will be mined. However, the impacts would be relatively minor due to the cleared and disturbed nature of most of the site, and the fragmented and isolated nature of the small patches of remnant vegetation.

No offsets will be required for impacts on state significant biodiversity values under the Queensland Biodiversity Offset Policy.

4.13 Cultural heritage

The proponent commissioned a desktop study of historic cultural heritage in the area. This was followed by a survey of the project area in October 2010 by a qualified archaeologist. Potential items or features of interest were mapped and the landholder was interviewed.

One place of historic heritage interest was identified during the survey, specifically the old homestead at the south eastern part of the proposed ML80156 area and associated structures. Assessment against the *Queensland Heritage Act 1992* significance criteria determined that these structures were not significant local or state heritage places. The project would result in the destruction of the old homestead area.

A search of the department's Cultural Heritage Database found no registered sites within the project area. The site inspection identified no Aboriginal objects or areas likely to contain archaeological deposits. Negotiations with the endorsed Aboriginal parties are ongoing in order to develop a cultural heritage management plan (CHMP) for the project area.

The Department of Aboriginal and Torres Strait Island and Multicultural Affairs (DATSIMA) provided a submission on the EIS stating that, while the environmental authority for the project could be issued prior to the approval of a CHMP, in accordance with section 87(2)(b) of the *Aboriginal Cultural Heritage Act 2003*, the environmental authority must be subject to conditions to ensure that no excavation, construction or other activity that may cause harm to Aboriginal cultural heritage takes place without the development and approval of a CHMP. EHP provided the proponent with a list of deficiencies identified in the cultural heritage assessment. All deficiencies were adequately addressed in the SEIS.

The EM plan stated the following measures intended to minimise impacts on cultural heritage:

- areas and objects of cultural heritage significance would be identified on mine plans
- development of a CHMP prior to commencing the project
- cessation of work and notification of the relevant authority should any items or locations of cultural heritage value be identified

- identification and management of any potential significant cultural heritage items or sites in consultation with the appropriate government authorities and, in the case of indigenous items or sites, the endorsed Aboriginal parties.

4.13.1 Conclusion and recommendations

A non-Indigenous historical cultural heritage survey was conducted at the project area. An old homestead and its associated structures did not reach the threshold for being considered significant local or state heritage places. The EIS concluded that the project would not impact on any significant cultural heritage places or areas.

A preliminary Aboriginal cultural heritage survey was conducted at the project area in October 2010. No areas of potential Aboriginal heritage value were identified at the project area. The EIS stated that there are unlikely to be any cultural heritage impacts.

Nevertheless, because an EIS has been required for this project, it is a statutory requirement that the proponent must develop and gain approval of a cultural heritage management plan for the project.

4.14 Social

Approximately 40 Cement Australia staff and six explosives contractors are employed at East End Mine. Operation of the mine involves two separate day shifts. The train loading facility is also operated by Cement Australia staff. There would be no additional staff employed as part of the construction and operation of the extended mine footprint.

The EIS stated that the mine's workforce has been mainly sourced from the local area. Consequently, there is no on-site accommodation at the existing mine and no future requirement for such accommodation.

The EIS presented an outline of the social environment potentially affected by the proposed project. The study area, for the purposes of the EIS social analysis, was the Gladstone local government area being the primary source of the workforce for the project and likely to be the main area subject to any potential social change.

In its submission on the EIS, the Department of Housing and Public Works advised that the proponent should use more recent data rather than the superseded demographic data from the 2006 Australian Bureau of Statistics (ABS) census. The proponent provided updated demographic data (available as of 1 August 2014) in the SEIS.

The overview of the Gladstone local government area included the following information:

- an area of 10,465.8km² or 0.6% of the total area of the state
- estimated resident population of 63,955 as at 30 June 2013
- population of 121,266 by 2036
- average annual growth rate between 2003 and 2013 was 2.9%, compared with 2.2% for the Queensland state
- unemployment rate was 4.8% as at December quarter 2013
- at the time of the 2011 census, technicians and trades workers were the largest occupation group with 6332 persons or 22.4% of the region's employed labour force
- in the December quarter 2013, there were 1235 residential dwelling approvals
- the total value of agricultural production in 2005–06 was \$34.3 million, 0.4% of the total value of agricultural production in Queensland.

The project would be located within the statistical subregion of Calliope. The overview of the Calliope area included the following information:

- as of 30 June 2013, the estimated resident population was 3367
- the unemployment rate was 6.5% as at the December quarter 2013
- in the 12 months ending 30 June 2013, there were 14 residential dwelling approvals
- the total value of agricultural production in 2005–06 was \$36.1 million and the largest holding of land for agriculture was for meat cattle.

The EIS stated that significant social impacts as a result of the extension of the mine were unlikely. The majority of mine personnel live locally and the surrounding land was increasingly rural-residential in nature. The EIS stated that while mining could co-exist with agricultural industries, instances of incompatibility would invariably arise such as impacts to groundwater supplies and loss of grazing land as a result of the mine. Mitigation of specific or cumulative potentially detrimental social effects would be through ongoing engagement with government agencies and the community using the existing community consultation process.

The EIS concluded that the existing East End Mine was a major employer providing positive outcomes to the local community through steady employment, wages, salaries and demand for goods and services. Other positive impacts noted in the EIS were the provision of mining and rail royalties, license fees and taxes to the government. It was further stated that social impacts of the East End Mine (both positive and negative) were minor compared to recent larger developments in the Gladstone region that have affected housing availability and affordability in Gladstone and adjacent areas.

The Department of State Development, Infrastructure and Planning (DSDIP) provided a submission on the EIS, requesting clarification and further information on the East End Mine Community Consultation Forum. The proponent provided an adequate response outlining the proposed continuing engagement with the community through this forum.

Queensland Ambulance Service (QAS) provided a submission on the EIS requesting:

- consultation by the proponent with QAS and Queensland Chemical Hazards and Emergency Management in relation to treatment plans for injured workers
- provision to QAS of a major emergency incident plan, hazards and risks assessment, disaster management plan and a copy of access and egress areas of the site.

The proponent provided an adequate response to QAS submission in the response to submissions.

Also, DATSIMA requested that the proponent consult with them should employment opportunities increase in the future for employment options for Aboriginal and Torres Strait islander people for the project. The proponent provided an adequate response to the issues raised by DATSIMA.

4.14.1 Conclusion

The EIS adequately assessed the social impacts for the project. The study area, for the purpose of the social analysis, was the Gladstone regional local government area. The EIS found that it is unlikely that significant social impacts would occur as a result of the extension of the mine.

4.15 Health and safety

The EIS identified water, air and noise emissions as relevant for the consideration of the potential off-site risks to human health and safety. No other risks were identified.

The project would discharge pit water into Larcom Creek as discussed in section 4.8.5 of this report. The EIS stated that downstream waterways were not used as sources of drinking water, downstream water quality was assessed as suitable for stock watering and for aquatic ecosystems, and there would be comprehensive monitoring of water released from the mine.

No increase is expected in noise emissions, which are currently acceptable. Furthermore, air emissions would be well within limits of the Environmental Protection (Air) Policy and EHP's guideline values.

Consequently, water, air and noise emissions from the site are considered unlikely to present a nuisance or to impact detrimentally on human health.

4.15.1 Conclusion and recommendations

The EIS adequately assessed the potential impacts of the proposal on health and safety. It is recommended that the management measures recommended in the relevant sections above for water, air and noise emissions are implemented.

4.16 Economy

The project would be located in the Gladstone local government area, which currently has a number of key industries in refining, minerals processing, chemicals, liquid natural gas and mining. The area surrounding the project site supports broad-acre agricultural activities such as grazing and cropping.

The project would extend the footprint of the current mine, resulting in relatively low capital costs for the construction phase of the project. The main construction cost would be the construction of a flood protection levee estimated to cost in excess of \$15 million.

The EIS stated that the long-term viability of the project would be dependent on market forces and possibly political decisions, but that the ongoing production of clinker at Fisherman's Landing over many decades indicated the economic viability of the project.

Both limestone and clay are subject to royalties paid to the state government. Royalties for limestone and clay produced by the existing mine were estimated at \$1.7 million per year.

The other significant contributions to government highlighted in the EIS were payroll tax and Queensland Rail freight charges, noting that the existing mine is an integrated part of the Cement Australia Gladstone operation.

The EIS stated that the project would be unlikely to increase the cost pressures in the region, but would contribute to the local economy by maintaining existing jobs and ensuring existing qualified people remain in the region. The project would not impact on property prices, housing and rental costs as the employment numbers would remain similar to the existing operation.

The following measures were proposed to manage the economic impact:

- continue to use existing methods, or develop new methods, to attract people to the workforce who are local to the region, as well as those from under-represented groups
- ensure contracts with suppliers and contractors are aligned with Cement Australia's sustainability principles and objectives
- continue to collaborate on programs with government, training and educational groups that build the local skills base to meet the specific needs of the industry and other impacted sectors. This includes ongoing development of apprenticeship, traineeship, scholarship and higher education programs.

The Department of State Development, Infrastructure and Planning noted that the economic assessment did not reference the Queensland Resources and Energy Code of Proactive for Local Content as a private sector mechanism for providing full, fair and reasonable access to the project for local supplies. The EIS was amended to reference this code.

4.16.1 Conclusion

The EIS adequately assessed the potential economic impacts during construction and operational phases of the project.

The project would contribute to the local economy by maintaining existing jobs and ensuring existing qualified people remain in the region. It would not impact on existing property prices, housing and rental costs as the employment numbers would remain similar to existing operation.

Furthermore, both limestone and clay mining would continue to bring royalties to the state government.

4.17 Hazard and risk

The EIS included a hazard and risk assessment for the project site in accordance with the Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk Management – principles and guidelines (Standards Australia/Standards New Zealand, 2009). The environmental risk assessment identified the following:

- there were no extreme risks in the mining operation
- the one high risk identified for the mining operation was mine pit dewatering, impacting on surrounding landowner's groundwater supply through groundwater drawdown
- there were five medium risks identified for the mining operation:
 - damage to residences due to blasting of limestone
 - sediment-laden overland water flow
 - release of sediment-laden mine water
 - impact of mine dewatering on groundwater quality
 - release of contaminated material/litter/soils to surrounding environment.

The remaining 17 activities were assessed as being low risk. The EIS stated that a procedure for determination of the requirement for groundwater bore rectification works has been established by the regulatory authority. Mitigation of other risks (i.e. low and medium risks) would be achieved by implementing strategies and actions as necessary to comply with conditions of the EA.

The EIS stated that no hazardous goods would be stored in the proposed ML80156 during construction or operation.

4.17.1 Conclusion

An adequate environmental risk assessment was carried out as part of the EIS.

4.18 Rehabilitation

The EIS stated that over the life of the East End Mine to date, rehabilitation of the mine had been carried out to the satisfaction of the regulators. The opportunity for progressive rehabilitation at the existing mine was limited by the ongoing use of the mine spoil placement areas. The rehabilitation of parts of the project area prior to mine closure would largely be limited to establishment of vegetation on the proposed bund wall. The next major opportunity for rehabilitation would be at cessation of mining operations. The final void would remain as a water storage facility. At mine closure, rock or rip-rap would need to be placed at least on the mine side of the batter of the bund wall due to the likelihood of significant wave action within the water filled mining void.

Rehabilitation objectives proposed include:

- mining and rehabilitation will aim to create a landform with land use capability and/or suitability similar to that prior to disturbance, unless other beneficial land uses are pre-determined and agreed
- mine wastes and disturbed land will be rehabilitated to a condition that is self-sustaining or where the maintenance requirements are consistent with an agreed post-mining land use
- surface and groundwaters that leave the lease will aim to meet or improve the water quality objectives of the receiving waters
- current and future water quality parameters will be maintained at levels that are acceptable for uses downstream of the site
- site is safe for humans and animals now and in the foreseeable future
- low probability of rock falls with serious consequences.

Methods proposed to be used to achieve the stated rehabilitation objectives were outlined.

The EIS stated that land preparation methods and species selection for revegetation have evolved over the life of the mine with semi-evergreen vine thicket species currently preferred over previously planted eucalypt and acacia species. The proponent was trialling semi-evergreen vine thicket species in rehabilitation areas, with community engagement in revegetation and rehabilitation planning. Rehabilitation success criteria would be based on comparison with analogue sites where practicable. Parameters proposed for comparison included species type and abundance, leaf litter coverage and soil salinity.

The EIS stated that operational and terminal angles and bench widths would be designed around the appropriate safety factor.

4.18.1 Recommendation and conclusions

The EIS adequately addressed rehabilitation. Recommended conditions for rehabilitation are in Appendix 3.

5 Adequacy of the environmental management plan

On 31 March 2013, amendments to the EP Act commenced that removed the requirement for mining operations to have an environmental management plan (EM plan). However, as the application for amendment of the environmental authority for the East End Mine was made prior to 31 March 2013, the requirement for an EM plan still applies. The EM plan must meet the content requirements of s203 of the EP Act as it applied prior to 31 March 2013.

A draft EM plan was included with the EIS that was released for public notification. A number of submissions on the EIS raised issues that required amendments to the draft EM plan and many of these amendments were agreed to by the proponent and included in an amended EM plan. However, the amended EM plan does not meet the statutory content requirements. To assist the proponent revise the EM plan, Appendix 3 of this assessment report provides recommendations for changes. A revised version that meets the statutory content requirements must be submitted to EHP before a decision can be made to allow the application to proceed to the draft EA stage.

6 Suitability of the project

EHP has considered the TOR, the submitted EIS, all submissions on the EIS, and the standard criteria. The submitted EIS has not identified any detrimental impacts of sufficient magnitude to prevent the project from proceeding. However, the recommendations of this EIS assessment report, and particularly the recommendations relating to the EM plan in Appendix 4, should be fully implemented.

7 Recommended conditions

Section 59 of the EP Act states that this EIS assessment report must recommend any conditions on which any approval required for the project may be given. As noted in section 5, the requirement for an EM plan still applies to this application, and it is the statutory purpose of the submitted EM plan to propose environmental protection commitments to help the administering authority prepare the draft environmental authority for the application. As the submitted EM plan is not yet adequate and must be revised and resubmitted, there was insufficient information to enable this EIS assessment report to recommend a complete set of conditions for the draft environmental authority (EA). Appendix 4 contains recommended conditions to the extent possible from the information that has been provided. However, the conditions are incomplete, and must be finalised after the proponent has submitted a satisfactory EM plan.

8 Approved by

The EIS process is completed when this EIS assessment report is approved by the delegate for the chief executive and given to the proponent.

SIGNED

Signature

Lindsay Delzoppo
Director
Impact Assessment and Operational Support
Regulatory Support and Customer Service Branch
Department of Environment and Heritage Protection
Delegate of the chief executive
Environmental Protection Act 1994

27 October 2014

Date

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Appendix 1 – Summary of surface water submissions on EIS

Source group/department	EIS submission	Response to EIS submission
DNRM	The capture of overland flow has to comply with section 13 of the Water Resource (Calliope River Basin) Plan 2006. The proponent must ensure that the final void, during operation and after closure, does not capture overland flow water.	The proponent stated they propose to meet the provisions of the Water Resource (Calliope River Basin) Plan 2006. In order to reduce the inflow of runoff into the working mine void, a diversion channel would be constructed within the rehabilitation area, trending in a south-easterly direction towards Howse Dam and capable of conveying the peak discharge from a 1 in 100 year storm event from a contributing catchment area of approximately 25.6ha.
	The impact of mine water discharge on flooding.	The increase in inundation during flooding resulting from the pumping (mine water discharge) is considered to be negligible given the much larger flow rates in Larcom Creek.
	Provide the location of 3 weirs not shown on Map 30 and provide dimensions of all weirs.	The proponent advised that all weirs were installed in 1978 hence pre-date legislation that would require approvals. DNRM advise that the proponent should contact DNRM to discuss further details regarding these weirs.
	Excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with the DNRM Guideline: Riverine Protection Permit Exemption.	A statement provided in the EM plan that the new exemption requirements would be complied with. Also, the recommended conditions for the draft EA in Appendix 4 (F23) require temporary interference with waterways to be undertaken in accordance with the DNRM Guideline: Riverine Protection Permit Exemption.
	To continue to take overland flow via Howse Dam, the proponent is required to notify the DNRM of the works.	The proponent stated that the water would be taken in accordance with section 13(1)(e)(i) of the Water Resource (Calliope River Basin) Plan 2006, which provides for an EA holder to take overland flow, but not more than the amount necessary to satisfy the requirements of the EA issued under the EP Act.
	The bund spillway to allow the release of excess water should be designed and certified to ensure wall integrity during extreme flooding events.	The proponent stated that the design of the spillway would be undertaken by a certified engineer. The stormwater management plan has been amended to include reference to the design and certification of the bund, spillway and associated infrastructure. Also, the recommended conditions for the draft EA in Appendix 4 (I5) states: "All regulated structures must be designed by, and constructed under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)".
East End Mine Action Group	Data used to design the stormwater management plan has omitted data from the period 2010–13, a period of higher than average rainfall.	The stormwater management plan has been updated to reflect the use of data current to September 2013.
	All water monitoring data should be retained, not just a minimum of 'not less than 5 years'.	The proponent stated that the standard EA conditions require data to be kept for a minimum of not less than 5 years. This condition does not restrict the keeping of data for a much longer period. EHP considers that data should be retained by the

Source group/department	EIS submission	Response to EIS submission
		proponent for resource management purposes and for predicting impacts such as for the transient groundwater model. Furthermore, groundwater and surface water data that is received by Queensland Government is retained in perpetuity.
Gladstone Regional Council	The pumped flow from pit dewatering does not appear to have been taken into account when designing stormwater flows and little information has been provided in the report in relation to the mine dewatering pump and flow rates and volumes.	Water collected in the pit is allowed to settle in order to meet discharge criteria before being pumped to a series of wetland polishing ponds. The treatment ponds have been previously sized and designed to receive the maximum water flow from the stormwater management system.
	No details on: <ul style="list-style-type: none"> • how Sediment Basin C1 is to be amended to have an increased surface area and not conflict with the proposed bund • how the southern bund is to be protected from scouring in areas identified as possibly causing ponding. 	Requirement for Sediment Dam C1 has been removed and will now be replaced, after establishment of erosion control works, in favour of treatment of the discharge channel to avoid the need for a settling dam. The stormwater management plan and relevant figures have been amended to include revised detail.
Comments from landholders	Concern that the approach of the mine to a location 'right up to the edges of Larcom Creek' would drain the watercourse.	The mines void's closest approach to Larcom Creek is 280m. Groundwater monitoring was proposed near Larcom Creek to assess groundwater surface water interaction.
	Impacts of the mine works on flooding of the Bruce Highway and other areas.	Details were provided showing the afflux caused by the bund would be unlikely to have any discernable effect on the flood levels or duration of flooding experienced at the Bruce Highway and other areas.
	Impact of flooding of landscape, killing pasture through inundation and spreading weeds.	Proponent stated that that it was not envisaged that there will be any increase in the extent of weed infestation due to the mine expansion and bund construction. Any inundation due to ponding against the bund would be of short duration, and is expected to cause insignificant impact on vegetation.
	Impact on flooding on the Derrington property (North of the mine). With levy banks to be placed on Larcom Creek, could this push flood waters backwards. Sediment accumulation in East End Creek.	The proponent stated that the levy would be located downstream of the rail spur and as such should not have any detrimental impact on these local flows due to: <ul style="list-style-type: none"> • bund elevation would not be high enough to cause backup of flood waters internally within the mine site that would force waters east and into this property • the bund would be well clear of the railway bridge and would not impede Machine Creek flows from passing through the bridge and to Larcom Creek. The proponent stated the matter of sediment accumulation in East End Creek was being addressed with the respondent.
	Impact of mine water on water resource (Larcom Creek) and dependent wildlife.	The proponent stated that water entering the pit would be pumped out to the wetland on East End creek's northern floodplain which then discharges into Larcom Creek. It was not anticipated that there would be a significant effect on the water resource within Larcom Creek.
	Stream disappearance at Scrub Creek is caused by the mine.	The proponent stated that variation of flow in Scrub Creek over time was not necessarily related to mine dewatering. Apart from the effect of long term variation in rainfall,

Source group/department	EIS submission	Response to EIS submission
		<p>creek hydrology in limestone terrain can be dynamic and some stream capture may occur in different creek reaches. Losing streams are a feature of karst landscapes.</p> <p>The proponent stated that, should groundwater monitoring or flow monitoring in Larcom Creek indicate any significant increase in the extent of mine dewatering impacts south of the mine, then the monitoring of flow in Scrub Creek would be considered during the review of the mine's water monitoring program.</p>
	Request installation of additional monitoring weirs to gather data on stream disappearance.	The proponent provided an explanation of why the installation of an additional weir was not considered to be an efficient monitoring strategy.
EHP	<p>Figures 7 to 10 of Appendix 8a of the EIS indicated the location of predicted minor ponding against the diversion bund and on the neighbouring lease ML80009, but did not indicate the likely extent of the ponding.</p> <p>The proponent should illustrate and discuss the extent of ponding, particularly with regard to ML 80009, and propose mitigation measures.</p>	<p>The proponent anticipated that ponding in the indicated areas would not occur for any significant length of time.</p> <p>The proponent proposed installation of a PVC pipe through the bund, with heaped gravel and geotextile to cover the upstream pipe inlet to slow flows through the pipe and to minimise the potential for blockages.</p>
	<p>The EC value in Table 4.13 of the EIS, Table EMP 13 of the EM plan and Table 2 of Appendix 8a should be amended to 970µS/cm.</p> <p>A site specific WQO for EC in Larcom Creek should be based on the calculation of the 75th percentile of EC background data collected from one or more suitable reference sites in the receiving environment, such as from Monitoring Point C.</p>	<p>The proponent amended the EC values to reflect the 75th percentile of 970µS/cm in Table 4.13 of EIS, Table EMP 13 of the EM plan and Table 2 of Appendix 8a.</p> <p>The site specific WQO for EC has been based on data collected at Monitoring Point C and not Monitoring Point E. Table 4.21 was amended by the proponent to reflect this.</p>
	Check whether the term 'biannual' in Table 4.15 of the EIS, needs to be corrected.	The proponent advised the frequency of sampling is biennial (every 2 years).
	Table 4.19 of the EIS should indicate the specific time period of sampling and how many samples were used to derive statistics. There should also be some indication as to the flow conditions under which the samples were taken.	The proponent amended Table 4.19 to include: the time period over which the sampling occurred; the number of samples used to derive the averages and standard deviations; and the flow condition range under which the samples were taken. Also, the note under Table 4.19 describing the number of data recommended in the QWQG was amended from "n<18" to "n≥18".
	Methods used to analyse several of the parameters listed in Table 4.20 of the EIS had detection limits above the ANZECC guideline values for slightly disturbed aquatic ecosystems in southeast Australia lowland streams. The proponent should use, and report results from, a better sampling and analysis protocol in accordance with current guidelines.	The proponent agreed with the recommendation and will adopt for any future monitoring if it becomes necessary.
	It is not clear how the maximum turbidity value of 150NTU (in Column 5) was derived in Table W2 of the EM plan. Furthermore, it is considered to be too high. The background data in Table EMP 14 in the EM plan showed	<p>The proponent advised the following:</p> <ul style="list-style-type: none"> the nominated turbidity limit in Table W2 of 150NTU is consistent with the mining operation's existing EA set by EHP in 2013; therefore no change has been

Source group/department	EIS submission	Response to EIS submission
	<p>80th percentile of turbidity values of 24 and 16 for upstream and downstream of Larcom Creek, respectively. The WQOs for Central Regional lowland streams suggests a turbidity value of 50NTU. Therefore, a maximum turbidity value of 50NTU is recommended to be applied instead of 150NTU.</p> <p>The EC release limit should not be listed as a maximum value, as the limit would depend on the receiving water flow criteria for maximum release rate. Also, the EC limit should be specified in Table W3.</p>	<p>made.</p> <ul style="list-style-type: none"> • the EC release limits prescribed in Table W2 and W3 are also as per the mining operations existing EA therefore no change has been made. • these existing limits have been historically derived to take account local conditions (i.e. downstream manmade lagoon) and/or the receiving environment flow rate of Larcom Creek. • monitoring frequency is consistent with existing EA.
	<p>In Table W1, East End Creek is listed as the receiving water for monitoring point A, while Table W3 states Larcom Creek as the receiving water for monitoring point A. Also in Table W3, it is not clear how the proponent derived the receiving water flow criteria for discharge flow rate and the maximum release rates from Weir 1 (columns 5 and 6).</p>	<p>The proponent amended Table W3 to specify four low, one medium, one high and one very high flow event release criteria.</p>
	<p>The receiving waters location description for Monitoring Point D in Table W4 of the EM plan appears incorrect. The table states that monitoring point D is located 'upstream' of East End Creek and Larcom Creek junction (Weir 5), but on Map 30 of the maps appendix the monitoring point appears to be downstream of the junction.</p> <p>Also, the monitoring point locations in Table W4, and Table W1, are provided in eastings and northings and not in latitude and longitude (decimal degree, GDA94 datum), although the table headings indicate they should be, as required by the TOR.</p>	<p>The proponent advised that Table W4 reflected the existing EA conditions issued by EHP in 2013.</p> <p>The proponent replaced all release point and monitoring point locations throughout the EM plan to decimal degrees of latitude and longitude against the GDA94 datum.</p>
	<p>The EC trigger level of 5000µS/cm level is considered too high in Table W5 of the EM plan. The background data in Table EMP 14 of the EM plan showed 80th percentile of EC value of 2300µS/cm upstream of Larcom Creek (Location 5) and the 75th percentile EC value would be lower than that</p> <p>The turbidity trigger level was stated as 'not more than 110% of upstream (Monitoring Point 5)', but that is inconsistent with the ANZECC and ARMCANZ framework.</p>	<p>The proponent advised that the nominated trigger levels are as prescribed in Table W5 – Receiving waters contaminant trigger levels of the existing mining operations EA set by EHP in 2013 hence have not been changed.</p>
	<p>Table 3 of the Stormwater Management Plan, should be amended to replace the 10th percentile data with the 20th percentile for all parameters at each sampling location. For EC, the calculation should be based on the 75th percentile of background data.</p>	<p>The proponent amended Appendix 8a Stormwater management plan as requested.</p>
	<p>The proponent should illustrate and discuss the extent of ponding, particularly with regard to ML80009, and propose mitigation measures if impacts may occur.</p>	<p>The proponent amended the Stormwater Management Plan to include mitigation measures to minimise ponding.</p>

Appendix 2 – Summary of groundwater submissions on EIS

Source group/ department	EIS submission	Response to EIS submission
DNRM	In Section 4.4.1.2, it is assumed the following sentence is meant to read: 'It is likely that mine water returning to the pit via the limestone aquifer is sourced primarily from the East End Creek system including Schultz Lagoon and associated wetlands'.	The wording was incorrect as noted. However, the proponent stated that water does not return to the void via the limestone aquifer, but returns via a shallow unconfined creek aquifer.
	Section 7.3 of the EM plan should commit to recommendations made in Section 8.3 of Appendix 9 to the EIS. These recommendations included but were not limited to, additional monitoring bores to investigate and monitor surface water, groundwater connectivity in the Larcom Creek and Scrub Creek area, and development of a transient groundwater flow model.	Section 7.3 of the EM plan has been revised to include groundwater monitoring and refined modelling as described in Section 8.3 of Appendix 9 to the EIS. EIS Appendix 9 has been amended at Section 8.3 to refer to the Revised Groundwater Monitoring Program East End 1 March 2012.
	Section 8.3 of Appendix 9 to the EIS should be amended to include installation of monitoring bores in the vicinity of Schultz Lagoon.	The proponent did not amend Section 8.3 of Appendix 9 to the EIS as per the recommendation. However, a recommended condition for the EA (Appendix 4 of this assessment report) requires the installation of additional monitoring bores near Schultz Lagoon as discussed in Section 4.8.4.1 of this assessment report.
EEMAG	Section 8.3 of Appendix 9 should be amended, since the model used to evaluate groundwater flows in the region of the East End Mine were based on flawed assumptions and therefore invalid to draw conclusions from. The East End/Bracewell is a karst type aquifer and standard hydrological techniques are therefore not suitable.	The proponent disputed this assertion. The proponent stated that the aquifer in the project area was adequately understood and was not a complex karst limestone system. The EIS categorised the local karst as buried karst (including epikarst that has been covered and infilled with younger sediments). Also, the groundwater report considered groundwater chemistry and its significance for ground water flow.
	Appendix 9 to the EIS did not include a Map 16 that was referred to.	Appendix 9 was amended to include the previously omitted Map 16.
Gladstone Regional Council	Uncertainty over the impact of mine on Larcom and Scrub Creeks. EIS Chapter 4 provided recommendations that additional and replacement monitoring bores be installed in the vicinity of Larcom Creek and Scrub Creek to confirm the extent of groundwater-surface water interaction. Installation of monitoring bores within Machine Creek alluvium for the same purpose was recommended along with upgrading of existing bores where possible to facilitate bore purging and improve confidence in groundwater and geologic data. Council requested that these recommendations form part of the EA conditions, and a mechanism for mitigation of impacts be incorporated into the project planning.	The monitoring recommendations made in EIS Appendix 9 have been incorporated in the EM plan and groundwater monitoring program. The recommended EA conditions in Appendix 4, require the proponent to develop and implement a groundwater monitoring and management program that is capable of determining impacts to groundwater levels, and requires adequate monitoring adjacent to Schultz Lagoon, Larcom Creek and Scrub Creek.

Source group/ department	EIS submission	Response to EIS submission
Comments from landholders	Request reinstatement of the term 'injurious affection' into the special conditions of the approval (under the <i>Mineral Resources Act 1989</i>). Concern that as the mine develops the groundwater level and quality will continue to fall, necessitating rectification of water supply to avoid impact on landowners and land value.	The proponent acknowledged the concerns raised by the respondent regarding injurious affection of underground water supplies, but stated that the relevant regulatory agencies were responsible for appropriate conditioning of the EA and ML.
	Concern about the impact of groundwater drawdown on landholders bores and that the rectification process has not worked, or has been slow to work, in the past.	The proponent considered that the matter of providing a due process for addressing underground water supplies affected by mining operations was addressed in Appendix 8c of the EIS, 'Underground Water Supplies affected by operations at East End Mine Information Sheet – Application for Determining Requirements'. Although certain proposed amendments to the Water Act had not been enacted at the time of writing of this report, it was anticipated that the new Chapter 3 'make good' inclusion would address the requirements of the existing special conditions.
	Request installation of a grout curtain as a means of preventing the mine from impacting the surrounding water table.	The proponent stated that the feasibility and practicality of implementing a grout curtain as a solution to groundwater drawdown was addressed in the report 'East End No. 5 Mine grout curtain evaluation and costs' attached to the SEIS. The report concluded that the installation of a grout curtain is not the preferred option. The costs, at a minimum of about \$37.2 million dollars, combined with the uncertainty of the effectiveness of the outcome, make the grout curtain option appear to be a high risk option for a solution to the groundwater drawdown impacts.
	Contented that rainfall data has been neglected and interpreted incorrectly, stating that there was no drought in the 1980s—the period experienced 'better than average rainfall' hence the impacts on the groundwater table were due to the mine.	Hydrographs of selected bore water levels over the full period of monitoring were presented in EIS Appendix 9 Groundwater Study (Figure 6.1). The proponent stated that the 1980s were generally drier than the 1970s and most of the decline in groundwater levels in the district could be attributed to this change in weather. There were two strong El Nino events in the 1980s and one moderate El Nino event which were related to drier than normal conditions in Australia.
	Request consideration of pumping of pit inflow water to upstream or in-ground locations to mitigate the impact of groundwater drawdown.	The proponent stated that the option to pump pit inflow upstream to replenish ground and creek water was discussed, along with several other options, in EIS Appendix 9, Groundwater Study.
	Impact of the mine on water resource (Larcom Creek) and dependent wildlife.	The proponent stated that the potential for the broadening cone of groundwater depression around the East End Mine to adversely impact on Larcom Creek was acknowledged in the EIS. Additional groundwater monitoring bores recommended would be installed in the vicinity of Larcom Creek, and Scrub Creek and Schultz Lagoon. The additional bores would allow more accurate monitoring, and facilitate mitigation, if required, of groundwater impacts.

Appendix 3 – Recommended amendments to the environmental management plan (EM plan)

Environmentally relevant activities

The draft EM plan does not state that the project would include 'a mining activity that is an ineligible ERA, other than a mining activity mentioned in items 9 to 20', as mentioned in Schedule 2A of the Environmental Protection Regulation 2008.

Recommendation

The draft EM plan should state that the amended EA will cover a mining activity listed under Schedule 2A of the Environmental Protection Regulation 2008 – 'Aggregate environmental scores for particular resource activities':

Disturbance area

The draft EM plan does not provide a figure that clearly defines the disturbance area and the locations of ERA's within the mine site.

Additionally, the draft EM plan does not adequately describe whether or not the land would be 'significantly disturbed'.

Recommendation

The proponent should include a figure in the draft EM Plan that clearly defines the disturbance area and the locations of ERAs within the mine site.

Additionally, the level of disturbance should be stated, i.e. whether the land would be 'significantly disturbed' or not. Refer to Schedule 12, Part 1, 4 of the Environmental Protection Regulation 2008, for the meaning of significantly disturbed land.

Completion criteria

While rehabilitation indicators and success criteria are stated in the draft EM plan, rehabilitation success criteria for each stated goal are not clearly defined.

Recommendation

The proponent should provide details of what would be regarded as successful rehabilitation for each stated goal. The draft EM plan should state rehabilitation completion criteria in accordance with the guideline: Rehabilitation requirements for mining resource activities (EHP, 2014)

Topsoil management

The topsoil management section in the draft EM plan, does not adequately describe the management of topsoil that would be available from land stripping.

Recommendation

The draft EM plan should adequately describe how topsoil stored for rehabilitation would be stored, protected from contamination and used for future rehabilitation.

Also, the draft EM plan should describe how topsoil stored for rehabilitation would be managed to reduce erosion and siltation of creeks.

Final void

The draft EM plan does not clearly define the size of the final void and the expected volume of water that would be contained within the void.

The draft EM plan does not clearly state whether or not the final void would be 'reshaped' to make it safer to both humans and fauna.

Recommendation

The draft EM plan should provide details of the expected size of the final void and the estimated volume of water contained within it.

The draft EM plan should provide details as to whether or not the final void would be reshaped to be made safer after mining.

Erosion and sediment control structures

The draft EM plan should include a figure showing location and type of erosion and sediment control structures for the project.

Recommendation

A figure showing drainage lines and the location of proposed sediment and erosion control structures should be included in the draft EM plan.

Sensitive receptors

Sensitive receptors relevant to the proposed project have not been adequately described in the draft EM plan.

Recommendation

The draft EM plan should provide details of any sensitive receptors that need protection from noise and dust emissions, and should include a figure showing the location of nearby sensitive receptors.

Contaminant release points

The draft EM plan does not provide a figure showing the locations of release points and monitoring points.

Recommendation

The draft EM plan should include a figure showing:

- release points with coordinates in decimal degrees of latitude and longitude (GDA94)
- monitoring points with coordinates in latitude and longitude (GDA94)
- water management features such as drains, sediment ponds and Schultz Lagoon receiving waters.

Appendix 4 – Recommended conditions for the draft EA

Schedule A: General	
Condition number	Condition
A1	<p>General</p> <p>This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition, or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.</p>
A2	<p>In carrying out the mining activity authorised by this environmental authority, the holder of this environmental authority must comply with Figure 1A Project Infrastructure Layout – Mine Area and Figure 1B Project Infrastructure Layout – Support Infrastructure (To be provided).</p>
A3	<p>Monitoring</p> <p>Except where specified otherwise in another condition of this authority, all monitoring records or reports required by this environmental authority must be kept for a period of not less than five years.</p>
A4	<p>Financial assurance</p> <p>The activity must not be carried out until the environmental authority holder has given financial assurance to the administering authority as security for compliance with this environmental authority and any costs or expenses, or likely costs or expenses, mentioned in section 298 of the Act.</p>
A5	<p>The amount of financial assurance must be reviewed by the holder of this environmental authority when a plan of operations is amended or replaced or the authority is amended.</p>
A6	<p>Risk management</p> <p>The holder of this environmental authority must develop and implement a risk management system for mining activities which mirrors the content requirement of the Standard for Risk Management (ISO31000:2009), or the latest edition of an Australian standard for risk management, to the extent relevant to environmental management, within 3 months from date of issue of this environmental authority.</p>
A7	<p>Notification of emergencies, incidents and exceptions</p> <p>The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this environmental authority.</p>
A8	<p>Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following:</p> <ul style="list-style-type: none"> • results and interpretation of any samples taken and analysed • outcomes of actions taken at the time to prevent or minimise unlawful environmental harm • proposed actions to prevent a recurrence of the emergency or incident.

A9	<p>Complaints</p> <p>The holder of this environmental authority must record all environmental complaints received about the mining activities including:</p> <ul style="list-style-type: none"> • name, address and contact number for of the complainant • time and date of complaint • reasons for the complaint • investigations undertaken • conclusions formed • actions taken to resolve the complaint • any abatement measures implemented • person responsible for resolving the complaint.
A10	<p>The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the administering authority within 10 business days of completion of the investigation, or no later than 10 business days after the end of the timeframe nominated by the administering authority to undertake the investigation.</p>
A11	<p>Third-party reporting</p> <p>The holder of this environmental authority must:</p> <ul style="list-style-type: none"> • within one year of the commencement of this authority, obtain from an appropriately qualified person a report on compliance with the conditions of this environmental authority • obtain further such reports at regular intervals not exceeding three years from the completion of the report referred to above • provide each report to the administering authority within 90 days of its completion.
A12	<p>Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must:</p> <ul style="list-style-type: none"> • comply with the amended or changed standard, policy or guideline within two years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures referred to in condition I34, the time specified in that condition, • until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.

Schedule B: Air	
Condition number	Condition
B1	<p>Dust and particulate matter monitoring</p> <p>The environmental authority holder shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the dust and particulate matter emissions generated by the mining activities do not cause exceedences of the following levels when measured at any sensitive or commercial place:</p> <p>Dust deposition of 120 milligrams per square metre per day, averaged over 1 month, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method.</p> <p>A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM₁₀) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, for no more than five exceedences recorded each year, when monitored in accordance with the most recent version of either:</p> <ul style="list-style-type: none"> • Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 high volume sampler with size-selective inlet – Gravimetric method; or • Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 low volume sampler – Gravimetric method.

Schedule C: Waste	
Condition number	Condition
C1	Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.
C2	The holder of this environmental authority may burn vegetation cleared in the course of carrying out extraction activities provided the activity does not cause environmental harm at any sensitive place or commercial place.

Schedule D: Noise	
Condition number	Condition
D1	<p>Noise limits</p> <p>The holder of this environmental authority must ensure that noise generated by the mining activities does not cause the criteria in Table D1 – Noise limits to be exceeded at a sensitive place or commercial place.</p>

Table D1 – Noise limits

Sensitive Place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and Public Holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
LAeq, adj, 15 mins	47	43	37	47	43	37
LA1, adj, 15 mins	55	50	45	55	50	45
Commercial Place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and Public Holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	7am to 6pm	6pm to 10pm	10pm to 7am
LAeq, adj, 15 mins	55	50	45	55	50	45

D2	<p>Airblast overpressure nuisance</p> <p>The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in Table D2 – Blasting noise limits to be exceeded at a sensitive place or commercial place.</p>
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Table D2 – Blasting noise limits

Blasting noise limits	Sensitive or commercial blasting noise limits place limits	
	7am to 6pm	6pm to 7am
Airblast overpressure	115dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120dB (Linear) Peak at any time	No blasting
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	No blasting

D3	<p>Monitoring and reporting</p> <p>Noise monitoring and recording must include the following descriptor characteristics and matters:</p> <ul style="list-style-type: none"> • LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins) • background noise LA90 • the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels • atmospheric conditions including temperature, relative humidity and wind speed and directions • effects due to any extraneous factors such as traffic noise • location, date and time of monitoring • if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10–200 Hz range.
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Schedule E -- Groundwater	
Condition number	Condition
E1	Groundwater The holder of this environmental authority must not release contaminants to groundwater.
E2	A groundwater monitoring and management program must be developed by an appropriately qualified person to monitor groundwater in accordance with condition E1.
E3	The monitoring and management program required by condition E2 must be capable of determining impacts to groundwater levels and must include adequate monitoring adjacent Schultz Lagoon, Larcom Creek and Scrub Creek.
E4	Groundwater must be monitored at the locations and frequencies as defined in the Groundwater Monitoring and Management Program.
E5	The groundwater monitoring and management program required by condition E3 must be reviewed by 30 June each year by an appropriately qualified person.
E6	The annual review must as a minimum include an assessment of the adequacy of the monitoring program and recommend actions to ensure that any groundwater impacts are effectively managed. In relation to the annual review, the holder must: <ul style="list-style-type: none"> • upon receipt of the annual review, implement any recommendations from the review as soon as practicable • within twenty (20) business days of receipt of the annual review, notify the administering authority in writing, of actions being taken to address any recommendations from the review, including any changes necessary to the groundwater monitoring and management program.
E7	A copy of the annual review must be provided to the administering authority upon request.
E9	Within two years of the commencement of this authority replace the existing groundwater model with a calibrated transient model to be used in the groundwater monitoring and management program.
E10	Bore construction and maintenance and decommissioning. The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring results.

Schedule F: Water	
Condition number	Condition
F1	Contaminant release Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.
F2	Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points and at the monitoring frequency specified in Table F1 – Mine affected water release points, sources and receiving waters and depicted in Figure X – East End sample location points attached to this environmental authority (To be provided).
F3	The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with condition F24 is permitted.

Table F1 – Mine affected water release points, sources and receiving waters

Release point (RP)	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)	Mine affected water source and location	Monitoring point	Receiving waters description
A	-23.878288	150.967305	Mine affected waters from East End mining operations discharging at Weir 1 to East End Creek	TBA	East End Creek
E	-23.879226	150.94890	Mine affected waters from East End mining operations clay dumps discharging at the spillway from the settlement pond associated with the clay dumps	TBA	Jacobs Creek
F	-23.886692	150.966535	Mine affected waters from East End mining operations discharging at the spillway from the settlement pond at the end of southern diversion drain	TBA	Larcom Creek

F4	The release of mine affected water to waters in accordance with condition F2 must not exceed the release limits stated in Table F2 – Mine affected water release limits and Table F3 – Mine Affected Water Release Limits (Weir 1 >6ML/day) when measured at the monitoring points specified in Table F1 – Mine affected water release points, sources and receiving waters for each quality characteristic.
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Table F2 – Mine-affected water release limits

Release point	Parameter	Units	Minimum	Maximum
Monitoring point A <=6ML/day	Electrical conductivity	µS/cm	-	5000
	pH	pH units	6.5	8.5
	Turbidity	NTU	-	Not more than 110% of upstream (Monitoring Point 5)

F5	<p>The release of mine affected water to waters from the release points must be monitored at the locations specified in Table F1 – Mine affected water release points, sources and receiving waters for each quality characteristic and at the frequency specified in Table F3 – Mine affected water release limits (Weir 1 >6ML/day).</p> <p>Note: the administering authority will take into consideration any extenuating circumstances prior to determining an appropriate enforcement response in the event condition F5 is contravened due to a temporary lack of safe or practical access. The administering authority expects the environmental authority holder to take all reasonable and practicable measures to maintain safe and practical access to designated monitoring locations.</p>
F6	<p>Mine affected water release events</p> <p>The holder must ensure a stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table F3 – Mine affected water release during flow events.</p>
F7	<p>Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition F2 must only take place during periods of natural flow in accordance with the receiving water flow criteria for discharge specified in Table F3 – Mine affected water release limits (Weir 1 >6ML/day) for the release point(s) specified in Table F1 – Mine affected water release points, sources and receiving waters.</p>
F8	<p>The release of mine affected water to waters in accordance with condition F2 must not exceed the Maximum Release Rate (for all combined release point flows) for each receiving water flow criterion for discharge specified in Table F3 – Mine affected water release during flow events when measured at the monitoring points specified in Table F1 – Mine affected water release points, sources and receiving waters.</p>

Table F3 – Mine affected water release limits (Weir 1 >6ML/day)

Receiving water	Release point	Gauging station	Receiving water flow recording frequency	Receiving water flow criteria for discharge flow rate at Monitoring Point C (m ³ /sec)	Maximum release rate from Weir 1 Monitoring Point A (ML/day)	EC release limits Weir 1 Monitoring Point A based on maximum release rate from Weir 1 (µS/cm)
East End Creek	Monitoring Point A	Monitoring Point C (based on calculations derived from Monitoring Point D)	Daily	Low flow (<0.24)	14.1	2000
					11.3	2500
					9.4	3000
					8.1	3500
				Medium flow (>=0.24 to <0.35)	30	2500
				High flow (>=0.35 to <0.45)	30	3000
				Very high flow (>=0.45)	30	3500

F9	The daily quantity of mine-affected water released from each release point must be measured and recorded.
F10	Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.
F11	<p>Notification of release event</p> <p>The environmental authority holder must notify the administering authority as soon as practicable and no later than 24 hours after commencing to release mine affected water to the receiving environment. Notification must include the submission of written advice to the administering authority of the following information:</p> <ul style="list-style-type: none"> • release commencement date/time • details regarding the compliance of the release with the conditions of Water of this environmental authority (that is, contaminant limits, natural flow, discharge volume) • release point(s) • release rate • release salinity • receiving water(s) including the natural flow rate. <p>Note: Notification to the administering authority must be addressed to the Manager and Project Manager of the local administering authority via email.</p>

F12	<p>The environmental authority holder must notify the administering authority as soon as practicable and nominally no later than 24 hours after cessation of a release event of the cessation of a release notified under condition F11 and within 28 days provide the following information in writing:</p> <ul style="list-style-type: none"> • release cessation date/time • natural flow volume in receiving water • volume of water released • details regarding the compliance of the release with the conditions of Water of this environmental authority (i.e. contaminant limits, natural flow, discharge volume) • all in-situ water quality monitoring results • any other matters pertinent to the water release event. <p>Note: Successive or intermittent releases occurring within 24 hours of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with conditions F11 and F12, provided the relevant details of the release are included within the notification provided in accordance with conditions F11 and F12.</p>
F13	<p>Notification of release event exceedence</p> <p>If the release limits defined in Table F2 – Mine affected water release limits and Table F3 Mine affected water release limits (Weir 1 >6ML/day) are exceeded, the holder of the environmental authority must notify the administering authority within 24 hours of receiving the results.</p>
F14	<p>The environmental authority holder must, within 28 days of a release that is not compliant with the conditions of this environmental authority, provide a report to the administering authority detailing:</p> <ul style="list-style-type: none"> • the reason for the release • the location of the release • the total volume of the release and which (if any) part of this volume was non-compliant • the total duration of the release and which (if any) part of this period was non-compliant • all water quality monitoring results (including all laboratory analyses) • identification of any environmental harm as a result of the non-compliance • all calculations • any other matters pertinent to the water release event.
F15	<p>Receiving environment monitoring and contaminant trigger levels</p> <p>The quality of the receiving waters must be monitored at the locations specified in Table F5 – Receiving waters upstream background sites and downstream monitoring points for each quality characteristic and at the monitoring frequency stated in Table F4 – Receiving waters contaminant trigger levels.</p>

Table F4 – Receiving waters contaminant trigger levels

Quality characteristic	Trigger level	Monitoring frequency	
		Release volumes ≤6ML/day	Release volumes >6ML/day
pH	6.5–8.5	Quarterly	Daily
Electrical conductivity (µS/cm)	5000	Quarterly	Daily
Turbidity (NTU)	Not more than 110% of upstream (Monitoring Point 5)	Quarterly	Daily

Table F5 – Receiving water upstream background sites and downstream monitoring points

Monitoring points	Receiving waters location description	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)
Upstream background monitoring points			
Monitoring Point C	Larcom Creek 310 metres upstream of East End Creek and Larcom Creek junction (Location 5)	-23.88666311	150.978014
Downstream monitoring points			
Monitoring Point D	Larcom Creek 1330 metres downstream of East End Creek and Larcom Creek junction (at Weir 7)	-23.898434	150.976476

Table F5 – Receiving water upstream background sites and downstream monitoring points notes:

- a) The upstream monitoring point should be within X m of the release point.
- b) The downstream point should not be greater than X m of the release point.
- c) The data from background monitoring points must not be used where they are affected by releases from other mines.

F16	<p>If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table F4 – Receiving waters contaminant trigger levels during a release event the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and:</p> <p>(1) where the downstream result is the same or a lower value than the upstream for the quality characteristic then no action is to be taken, or</p> <p>(2) where the downstream results exceed the upstream results complete an investigation into the potential for environmental harm and provide a written report to the administering authority, outlining:</p> <p>i) details of the investigations carried out</p> <p>ii) actions taken to prevent environmental harm.</p> <p>Note: Where an exceedence of a trigger level has occurred and is being investigated in accordance with F16(2), no further reporting is required for subsequent trigger events for that quality characteristic.</p>
F17	<p>All determinations of water quality and biological monitoring must be performed by an appropriately qualified person.</p>
F18	<p>Receiving environment monitoring program (REMP)</p> <p>The environmental authority holder must develop and implement a Receiving Environment Monitoring Program (REMP) in accordance with the Receiving environment monitoring program guideline, For use with environmentally relevant activities under the <i>Environmental Protection Act 1994</i> (EHP, 2014).</p>
F19	<p>A REMP design document that addresses the requirements of the REMP must be prepared and made available to the administering authority upon request.</p>
F20	<p>A report outlining the findings of the REMP, including all monitoring results and interpretations must be prepared every five years and made available on request to the administering authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.</p>
F21	<p>Water reuse</p> <p>Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with the consent of the third party).</p>

F22	<p>Annual water monitoring reporting</p> <p>The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format:</p> <ul style="list-style-type: none"> • the date on which the sample was taken • the time at which the sample was taken • the monitoring point at which the sample was taken • the measured or estimated daily quantity of mine affected water released from all release points • the release flow rate at the time of sampling for each release point • the results of all monitoring and details of any exceedences of the conditions of this environmental authority • water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.
F23	<p>Temporary interference with waterways</p> <p>Excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with the Department of Natural Resources and Mines (or its successor) Guideline: The Riverine Protection and Permit Exemption.</p>
F24	<p>Water management plan</p> <p>A water management plan must be developed by an appropriately qualified person and implemented.</p>
F25	<p>Stormwater and water sediment controls</p> <p>An erosion and sediment control plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.</p>
F26	<p>Stormwater, other than mine affected water, is permitted to be released to waters from:</p> <ul style="list-style-type: none"> • erosion and sediment control structures that are installed and operated in accordance with the erosion and sediment control plan required by condition F25 • water management infrastructure that is installed and operated, in accordance with a water management plan that complies with condition F24, for the purpose of ensuring water does not become mine affected water.

Schedule G – Sewage treatment	
Condition	
G1	<p>Sewage treatment</p> <p>The only contaminant permitted to be released to land is treated sewage effluent in compliance with the release limits stated in Table G1 – Contaminant release limits to land.</p>

Table G1 – Contaminant release limits to land				
Contaminant	Unit	Release limit	Limit type	Monitoring frequency
five-day biochemical oxygen demand (BOD)	mg/L	20	Maximum	Monthly
Total suspended solids	mg/L	30	Maximum	Monthly
Nitrogen	mg/L	30	Maximum	Monthly
Phosphorus	mg/L	15	Maximum	Monthly
E-coli	organisms/100mL	1000	Maximum	Monthly
pH	pH units	6.5–9.0	Range	Monthly
G2	<p>Treated sewage effluent may only be released to land in accordance with the conditions of this approval at the following locations:</p> <ul style="list-style-type: none"> • within the nominate area(s) identified in – East End sample locations; and • other land for the purpose of dust suppression and/or fire-fighting. 			
G3	<p>The application of treated effluent to land must be carried out in a manner such that:</p> <ul style="list-style-type: none"> • vegetation is not damaged • there is no surface ponding of effluent • there is no run-off of effluent. 			
G4	<p>If areas irrigated with effluent are accessible to employees or the general public, prominent signage must be provided advising that effluent is present and care should be taken to avoid consuming or otherwise coming into unprotected contact with the effluent.</p>			
G5	<p>All sewage effluent released to land must be monitored at the frequency and for the parameters specified in Table G1 – Contaminant release limits to land.</p>			
G6	<p>The daily volume of effluent release to land must be measured and records kept of the volumes of effluent released.</p>			
G7	<p>When circumstances prevent the irrigation or beneficial reuse of treated sewage effluent such as during or following rain events, waters must be directed to wet weather storage or alternative measures must be taken to store/lawfully dispose of effluent.</p>			
G8	<p>A minimum area of 10m² of land, excluding any necessary buffer zones, must be utilised for the irrigation and/or beneficial reuse of treated sewage effluent.</p>			
G9	<p>Treated sewage effluent must only be supplied to another person or organisation that has a written plan detailing how the user of the treated sewage effluent will comply with their general environmental duty under section 319 of the Act whilst using the treated sewage effluent.</p>			

Schedule H: Land and rehabilitation	
Condition number	Condition
H1	Land disturbed by mining must be rehabilitated in accordance with Table H1 – Rehabilitation requirements.

Table H1 – Rehabilitation requirements

Mine domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Mine pit slopes that are greater than 30° and greater than 5m in height	Safe to humans and wildlife	Site is safe for humans and animals now and in the foreseeable future	Safety assessment of slopes that are greater than 30° and greater than 5m in height	Validation in rehabilitation report that slopes are safe and predictions about future safety
Mine water storages	Non-polluting	Surface and groundwaters that leave the lease will aim to meet or improve the water quality objectives of the receiving waters. Current and future water quality parameters will be maintained at levels that are acceptable for uses downstream of the site.	End of pipe and receiving waters meet environmental authority conditions	Validation in water quality report that surface and groundwater objectives are met.
Mine workings, void, water storages	Stable	Low probability of rock falls with serious consequences	Geotechnical studies of workings, high walls and voids	Evidence in Final Rehabilitation Report that appropriate risk assessment has been undertaken and control measures are in place.
Mine workings above RL40	Able to sustain an agreed post-mining land use	Mining and rehabilitation will aim to create a landform with land use capability and/or suitability similar to that prior to disturbance, unless other beneficial land uses are pre-determined and agreed.	<ul style="list-style-type: none"> • Tree density (trees/ha) • Shrub density (shrubs/ha) • Sedge/forb/grass density (grasses/ha) • Species composition • Species diversity • Unvegetated area (%) • Leaf litter depth and coverage 	Final Rehabilitation Report will be prepared as per administering authority rehabilitation guidelines including: <ul style="list-style-type: none"> • The results of a site investigation • The results of a residual risk assessment (including estimation of monitoring and maintenance costs)
Active spoil dumps		Mine wastes and disturbed land will be rehabilitated to a condition that is self-sustaining or where the maintenance requirements are consistent with an agreed post-mining land use	<ul style="list-style-type: none"> • Erosion indicators (e.g. depth and spacing of erosion rills) • Photographic records of the site 	<ul style="list-style-type: none"> • The results of contamination assessment, as required

H2	Rehabilitation must commence progressively in accordance with the plan of operations.
H3	<p>After decommissioning, all significantly disturbed land caused by the carrying out of the environmentally relevant activity(ies) must be rehabilitated to meet the following final acceptance criteria:</p> <ul style="list-style-type: none"> • the landform is safe for humans and fauna • the landform is stable with no subsidence or erosion gullies for at least three years • any contaminated land (e.g. contaminated soils) is remediated and rehabilitated • there is no ongoing contamination to waters (including groundwater) • for land that is not being cultivated by the landholder: <ul style="list-style-type: none"> ○ a groundcover, that is not a declared pest species is established and self-sustaining ○ vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining.
H4	<p>Contaminated land</p> <p>Before applying for surrender of a mining lease, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the mining lease which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use.</p>
H5	<p>Before applying for progressive rehabilitation certification for an area, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the area subject of the application which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use under condition H1.</p>
H6	Minimise the potential for contamination of land by hazardous contaminants.
Schedule I: Regulated structures	
Condition number	Condition
I1	<p>Assessment of consequence category</p> <p>The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM365) at the following times:</p> <ul style="list-style-type: none"> • prior to the design and construction of the structure, if it is not an existing structure; or • if it is an existing structure, prior to the adoption of this schedule; and • prior to any change in its purpose or the nature of its stored contents.
I2	A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
I3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635).

14	<p>Design and construction of a regulated structure.</p> <p>Conditions 15 to 19 inclusive do not apply to existing structures.</p>
15	<p>All regulated structures must be designed by, and constructed under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635).</p>
16	<p>Construction of a regulated structure is prohibited unless the holder has submitted a consequence category assessment report and certification to the administering authority has been certified by a suitably qualified and experienced person for the design and design plan and the associated operating procedures in compliance with the relevant condition of this authority.</p>
17	<p>Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635), and must be recorded in the Regulated Dams/Levees register.</p>
18	<p>Regulated structures must:</p> <ul style="list-style-type: none"> • be designed and constructed in accordance with and conform to the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) • be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: <ul style="list-style-type: none"> ○ floodwaters from entering the regulated dam from any watercourse or drainage line ○ wall failure due to erosion by floodwaters arising from any watercourse or drainage line. • have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.
19	<p>Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that:</p> <ul style="list-style-type: none"> • the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure • construction of the regulated structure is in accordance with the design plan.

I10	<p>Operation of a regulated structure</p> <p>Operation of a regulated structure, except for an existing structure, is prohibited unless:</p> <ul style="list-style-type: none"> • the holder has submitted to the administering authority <ul style="list-style-type: none"> ○ one paper copy and one electronic copy of the design plan and certification of the 'design plan' in accordance with condition I3, and ○ a set of 'as constructed' drawings and specifications, and ○ certification of those 'as constructed drawings and specifications' in accordance with condition I3, and ○ where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan, and ○ the requirements of this authority relating to the construction of the regulated structure have been met, and ○ the holder has entered the details required under this authority, into a Register of Regulated Dams, and ○ there is a current operational plan for the regulated structures.
I11	<p>Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in a manner that is consistent with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.</p>
I12	<p>Mandatory reporting level</p> <p>Conditions I13 to I16 inclusive only apply to regulated structures which have not been certified as low consequence category for 'failure to contain – overtopping'.</p>
I13	<p>The mandatory reporting level (MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.</p>
I14	<p>The holder must, as soon as practical and within 48 hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.</p>
I15	<p>The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.</p>
I16	<p>The holder must record any changes to the MRL in the Register of Regulated Structures.</p>
I17	<p>Design storage allowance (DSA)</p> <p>The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.</p>
I18	<p>By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the DSA volume for the dam (or network of linked containment systems).</p>
I19	<p>The holder must, as soon as possible and within 48 hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.</p>

I20	The holder must, immediately on becoming aware that a regulated dam) or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.
I21	Annual inspection report Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
I22	At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include recommended actions to ensure the integrity of the regulated structure.
I23	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635).
I24	The holder must: <ul style="list-style-type: none"> • within 20 business days of receipt of the annual inspection report, provide to the administering authority: <ul style="list-style-type: none"> ○ the recommendations section of the annual inspection report, and ○ if applicable, any actions being taken in response to those recommendations, and • if, following receipt of the recommendations and (if applicable) actions, the administering authority requests a full copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.
I25	Transfer arrangements The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this activity.
I26	Decommissioning and rehabilitation Structures must not be abandoned but be either: <ul style="list-style-type: none"> • decommissioned and rehabilitated to achieve compliance with condition I27, or • be left in-situ for a beneficial use/s provided that: <ul style="list-style-type: none"> ○ it no longer contains contaminants that will migrate into the environment, and ○ it contains water of a quality that is demonstrated to be suitable for its intended beneficial use(s), and ○ the administering authority, the holder of the environmental authority and the landholder agree in writing that the dam will be used by the landholder following the cessation of the environmentally relevant activity(ies).
I27	Register of Regulated Structures A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.

I28	The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated structure is submitted to the administering authority.
I29	The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with condition I10 has been achieved.
I30	The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.
I31	All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.
I32	The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.
I33	<p>Transitional arrangements</p> <p>All existing structures that have not been assessed in accordance with either the manual or the former Manual for Assessing Hazard Categories and Hydraulic Performance of Dams must be assessed and certified in accordance with the manual within six months of amendment of the authority adopting this schedule.</p>
I34	All existing structures must subsequently comply with the timetable for any further assessments in accordance with the manual specified in Table 1 Transitional requirements for existing structures , depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.
I35	<p>Table 1 ceases to apply for a structure once any of the following events has occurred:</p> <ul style="list-style-type: none"> • it has been brought into compliance with the hydraulic performance criteria applicable to the structure under the manual, or • it has been decommissioned, or • it has been certified as no longer being assessed as a regulated structure.
I36	Certification of the transitional assessment required by I34 and I35 as applicable must be provided to the administering authority within six months of amendment of the authority adopting this schedule.

Schedule I – Table 1 Transitional hydraulic performance requirements for existing structures

Transition period required for existing structures to achieve the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Dams			
Compliance	High	Significant	Low
>90% and a history of good compliance performance in last 5 years.	No transition required.	No transition required.	No transitional conditions apply. Review consequence assessment every 7 years.
>70–<90%	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 10 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	No transitional conditions apply. Review consequence assessment every 7 years.
>50–<70%	Within 5 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Review consequence assessment every 7 years.
<50%	Within 5 years or as per compliance requirements (e.g. TEP timing).	Within 5 years or as per compliance requirements (e.g. TEP timing).	Review consequence assessment every 5 years.

Definitions

Words and phrases used throughout this environmental authority are defined below. Where a definition for a term used in this environmental authority is not provided within this environmental authority, but is provided in the EP Act 1994 or subordinate legislation, the definition in the EP Act or subordinate legislation must be used.

Acid rock drainage any contaminated discharge emanating from a mining activity formed through a series of chemical and biological reactions, when geological strata is disturbed and exposed to oxygen and moisture.

Administering authority means the Department of Environment and Heritage Protection or its successor.

Affected person is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

Aggregation dam means a regulated dam that receives and contains coal seam gas water or coal seam gas concentrate. The primary purpose of the dam must not be to evaporate the water even though this will naturally occur.

Airblast overpressure energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

Annual exceedence probability or AEP the probability that at least one event in excess of a particular magnitude will occur in any given year.

Annual inspection report means an assessment prepared by a suitably qualified and experienced person containing details of the assessment against the most recent consequence assessment report and design plan (or system design plan):

- a) against recommendations contained in previous annual inspections reports
- b) against recognised dam safety deficiency indicators
- c) for changes in circumstances potentially leading to a change in consequence category

- d) for conformance with the conditions of this authority
- e) for conformance with the 'as constructed' drawings
- f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems)
- g) for evidence of conformance with the current operational plan.

Appropriately qualified person a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

Assessed and assessment by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

- a) exactly what has been assessed and the precise nature of that determination
- b) the relevant legislative, regulatory and technical criteria on which the assessment has been based
- c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts
- d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

Associated works in relation to a dam, means:

- a) operations of any kind and all things constructed, erected or installed for that dam
- b) any land used for those operations.

Authority means an environmental authority.

Background with reference to the water schedule means the average of samples taken prior to the commencement of mining from the same waterway that the current sample has been taken.

Blasting the use of explosive materials to fracture:

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

Certification means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635), including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs.

Certification, certifying or certified have a corresponding meaning as 'certification'.

Chemical means:

- a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994* (Commonwealth); or
- b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council; or
- c) a lead hazardous substance within the meaning of the Workplace Health and Safety Regulation 1997; or
- d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Minister's Advisory Council and published by the Commonwealth; or
- e) any substance used as, or intended for use as:
 - i. a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product; or
 - ii. a surface active agent, including, for example, soap or related detergent; or
 - iii. a paint solvent, pigment dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
 - iv. a fertiliser for agricultural, horticultural or garden use; or
 - v. a substance use for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
 - vi. manufacture of plastic or synthetic rubber.

Commercial place a workplace used as an office or for business or commercial purpose, which is not part of the mining activity and does not include employees' accommodation or public roads.

Consequence in relation to a structure as defined, means the potential for environmental harm resulting from the

collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

Consequence category means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635).

Construction or constructed in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

Dam a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

Dam crest volume means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneous maximum volume within the walls, without regard to flows entering or leaving (e.g. via spillway).

Design plan is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.

Design storage allowance or DSA means an available volume, estimated in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) published by the administering authority, must be provided in a dam as at 1 November each year in order to prevent a discharge from that dam to an annual exceedence probability (AEP) specified in that Manual.

Designer for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.

Disturbance of land includes:

- a) compacting, removing, covering, exposing or stockpiling of earth
- b) removal or destruction of vegetation or topsoil or both to an extent where the land has been made susceptible to erosion
- c) carrying out mining within a watercourse, waterway, wetland or lake
- d) the submersion of areas by tailings or hazardous contaminant storage and dam/structure walls
- e) temporary infrastructure, including any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be removed after the mining activity has ceased; or
- f) releasing of contaminants into the soil, or underlying geological strata.

However, the following areas are not included when calculating areas of 'disturbance':

- a) areas off lease (e.g. roads or tracks which provide access to the mining lease)
- b) areas previously disturbed which have achieved the rehabilitation outcomes
- c) by agreement with the administering authority, areas previously disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions)
- d) areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be left by agreement with the landowner
- e) disturbance that pre-existed the grant of the tenure.

EC means electrical conductivity.

Effluent treated waste water released from sewage treatment plants.

Emergency action plan means documentation forming part of the operational plan held by the holder or a nominated responsible officer, that identifies emergency conditions that sets out procedures and actions that will be followed and taken by the dam owner and operating personnel in the event of an emergency. The actions are to minimise the risk and consequences of failure, and ensure timely warning to downstream communities and the implementation of protection measures. The plan must require dam owners to annually update contact details.

Environmental authority an environmental authority granted in relation to an environmentally relevant activity under the *Environmental Protection Act 1994*.

Environmental authority holder the holder of this environmental authority.

Existing structure means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

Extreme storm storage a storm storage allowance determined in accordance with the criteria in the Manual for

Assessing Hazard Categories and Hydraulic Performance of Dams (EM635) published by the administering authority.

Flowable substance matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

Hazard in relation to a dam as defined, means the potential for environmental harm resulting from the collapse or failure of the dam to perform its primary purpose of containing, diverting or controlling flowable substances.

Hazard category a category, either low significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.

Holder any person who is the holder of, or is acting under, that environmental authority.

Hydraulic performance the capacity of a regulated dam to contain or safely pass flowable substances based on the design criteria specified for the relevant consequence category in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635).

Infrastructure means water storage dams, levees, roads and tracks, buildings and other structures built for the purpose of the mining activity.

Land in the 'land schedule' of this document means land excluding waters and the atmosphere, that is, the term has a different meaning from the term as defined in the *Environmental Protection Act 1994*. For the purposes of the *Acts Interpretation Act 1954*, it is expressly noted that the term 'land' in this environmental authority relates to physical land and not to interests in land.

Land use the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

Leachate a liquid that has passed through or emerged from, or is likely to have passed through or emerged from, a material stored, processed or disposed of at the operational land which contains soluble, suspended or miscible contaminants likely to have been derived from the said material.

Levee means an embankment that only provides for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releases from other works, during the progress of those stormwater or flood flows or those releases; and does not store any significant volume of water or flowable substances at any other times.

Licensed place the mining activities carried out at the mining tenements detailed in this environmental authority.

Low consequence structure any structure that is not a high or significant consequence category as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635).

m means metres.

Mandatory reporting level or MRL a warning and reporting level determined in accordance with the criteria in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) published by the administering authority.

Manual the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) published by the administering authority.

Measures includes any measures to prevent or minimise environmental impacts of the mining activity such as bunds, silt fences, diversion drains, capping and containment systems.

Mine affected water the following types of water:

- a) pit water, tailings dam water, processing plant water:
 - i. water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity
 - ii. iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water
 - iii. iv) groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated
 - iv. v) groundwater from the mine's dewatering activities

- v. vi) a mix of mine affected water (under any of paragraphs i)-v)) and other water.
- b) Does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by mining activities that have not yet been completely rehabilitated, has only been in contact with:
 - i. land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success, or
 - ii. land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater, for example:
 - a. areas that have been capped and have monitoring data demonstrating hazardous material adequately contained within the site
 - b. evidence provided through monitoring that the relevant surface water would have met the water quality parameters for mine affected water release limits in this environmental authority, if those parameters had been applicable to the surface water runoff; or
 - iii. both.

Modification or modifying see definition of 'construction'.

NATA National Association of Testing Authorities, Australia.

Natural flow the flow of water through waters caused by nature.

Non-polluting having no adverse impacts upon the receiving environment.

Operational plan includes:

- a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA allowance)
- b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

Peak particle velocity (ppv) a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mm/s).

Protected area a protected area under the *Nature Conservation Act 1992*, or

- a) a marine park under the *Marine Parks Act 1992*; or
- b) a World Heritage Area.

Receiving environment in relation to an activity that causes or may cause environmental harm, means the part of the environment to which the harm is, or may be caused. The receiving environment includes (but is not limited to):

- a) a watercourse
- b) groundwater
- c) an area of land that is not specified in this environmental authority.

Receiving waters the waters into which this environmental authority authorises releases of mine affected water.

Register of regulated structures includes:

- a) date of entry in the register
- b) name of the dam, its purpose and intended/actual contents
- c) the consequence category of the dam as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)
- d) dates, names and reference for the design plan plus dates, names and reference numbers of all document/s lodged as part of a design plan for the dam
- e) name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings
- f) for the regulated dam, other than in relation to any levees:
 - i. the dimensions (metres) and surface area (hectares) of the dam measured at the footprint of the dam
 - ii. coordinates (latitude and longitude in GDA94) within 5 metres at any point from the outside of the dam including its storage area
 - iii. dam crest volume (megalitres)
 - iv. spillway crest level (metres AHD)
 - v. maximum operating level (metres AHD)
 - vi. storage rating table of stored volume versus level (metres AHD)
 - vii. design storage allowance (megalitres) and associated level of the dam (metres AHD)
 - viii. mandatory reporting level (metres AHD)

- g) For a regulated levee:
- i. The crest length of the levee (metres) measured along the centreline of the levee
 - ii. Location Coordinates (latitude and longitude in GDA94), and chainage distances (metres), of each end of the levee, and of each point along the crest of the levee which marks a change in direction
 - iii. Levee crest level (metres AHD), also at each end of the levee, and at each point along the crest of the levee which marks a change in direction
 - iv. Maximum height of the levee (metres), from the crest level to the adjacent toe (inside or outside) of the embankment, and the location and chainage of this maximum height
 - v. The crest width of the levee (metres)
 - vi. The Annual Exceedence Probability of the design flood for operation of the levee
 - vii. The freeboard (metres) between design flood level and the crest level of the levee
- h) the design plan title and reference relevant to the dam
- i) the date construction was certified as compliant with the design plan
- j) the name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan
- k) details of the composition and construction of any liner
- l) the system for the detection of any leakage through the floor and sides of the dam
- m) dates when the regulated dam underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November for any year
- n) dates when recommendations and actions arising from the annual inspection were provided to the administering authority
- o) dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.

Regulated dam means any dam in the significant or high consequence category as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) published by the administering authority.

Regulated structure includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity.

Rehabilitation process of reshaping and revegetating land to restore it to a stable landform.

Release event surface water discharge from mine affected water storages or contaminated areas on the licensed place.

RL reduced level, relative to mean sea level as distinct from depths to water.

Representative a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

Saline drainage the movement of waters, contaminated with salts, as a result of the mining activity.

Sensitive place means:

- a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- b) a motel, hotel or hostel; or
- c) an educational institution; or
- d) a medical centre or hospital; or
- e) a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area; or
- f) a public park or gardens.

Note: The definition of 'sensitive place' and 'commercial place' is based on Schedule 1 of EPP Noise. That is, a sensitive place is inside or outside on a dwelling, library and educational institution, childcare or kindergarten, school or playground, hospital, surgery or other medical institution, commercial and retail activity, protected area or an area identified under a conservation plan under *Nature Conservation Act 1992* as a critical habitat or an area of major interest, marine park under *Marine Parks Act 2004*, park or garden that is outside of the mining lease and open to the public for the use other than for sport or organised entertainment. A commercial place is inside or outside a commercial or retail activity.

A mining camp (i.e. accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority) is not a sensitive place for that mine or mining project, whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the holders of the environmental authority for the mining project, or a related company. Accommodation for mine employees or contractors is a sensitive place if the land is held by a mining company or related company, and if occupation is restricted to the employees, contractors and their families for the particular mine or mines which are held by the same company or a related company.

For example, a township (occupied by the mine employees, contractors and their families for multiple mines that are held by different companies) would be a sensitive place, even if part or all of the township is constructed on land owned by one or more of the companies.

Structure means dam or levee.

Spillway means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the dam, normally under flood conditions or in anticipation of flood conditions.

Suitably qualified and experienced person in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:

- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design
- for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.

System design plan means a plan that manages an integrated containment system that shares the required DSA and/or ESS volume across the integrated containment system.

The Act means the *Environmental Protection Act 1994*.

µs/cm – micro siemens per centimetre.

Void means any constructed, open excavation in the ground.

Watercourse has the same meaning given in the *Water Act 2000*.

Water quality means the chemical, physical and biological condition of water.

Waters includes all or any of a river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined natural or artificial watercourse, bed and banks of a watercourse, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off and groundwater.

Water year means the 12-month period from 1 July to 30 June.

Wet season means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

END OF RECOMMENDED CONDITIONS