

**Environmental Impact Statement (EIS) assessment report
under the *Environmental Protection Act 1994***

Central Queensland Coal

proposed by Central Queensland Coal Pty Ltd and
Fairway Coal Pty Ltd

April 2021



**Queensland
Government**

Prepared by: Environmental Impact Assessment, Department of Environment and Science

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List of acronyms and abbreviations

ACH Act	<i>Aboriginal and Cultural Heritage Act 2003</i>
AEP	Annual exceedance probability
AHD	Australian height datum
AQMP	Air quality management plan
ARI	Average reoccurrence interval
ASS	Acid sulfate soils
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
CBA	Cost-benefit analysis
CDMP	Coal dust management plan
CHMP	Cultural heritage management plan
CGE	Computable general equilibrium
DAF	Department of Agriculture and Fisheries
DATSIP	Department of Aboriginal and Torres Strait Islander Partnerships
DEE	Department of Environment and Energy (Commonwealth)
DIDO	Drive-in drive-out
DNRME	Department of Natural Resources, Mines and Energy
DO	Dissolved oxygen
DAWE	Department of Agriculture, Water and Environment
DES	Department of Environment and Science
DSDTI	Department of State Development, Tourism and Innovation
DTMR	Department of Transport and Main Roads
EA	Environmental authority
EC	Electrical conductivity
EIS	Environmental impact statement
EP Act	<i>Environmental Protection Act 1994</i>
EPC	Exploration permit for coal
EP Regulation	Environmental Protection Regulation 2008
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPBC EOP	EPBC Act Environmental Offsets Policy
ERA	Environmentally relevant activity
ERP	Emergency response plan
ESA	Environmentally sensitive area
ESCP	Erosion and sediment control plan
FA	Financial assurance
FIFO	Fly-in fly-out
FSL	Full supply level

FTE	Full-time equivalent
GBR	Great Barrier Reef
GBRWHA	Great Barrier Reef World Heritage Area
GDE	Groundwater dependent ecosystems
GES	General ecological significance
GHG	Greenhouse gas
GL	Gigalitre
GRP	Gross regional product
GSP	Gross state product
HES	High ecological significance
IAS	Initial advice statement
KLC	Kinetic leach column
kt	Kilotonne
LCM	Loose cubic metres
LOM	Life of mine
LNG	Liquefied Natural Gas
Mbcm	Million bank cubic metres
MDL	Mineral Development Licence
MIA	Mine infrastructure area
ML	Mining lease
MLA	Mining lease application
Mlcm	Million loose cubic metres
MR Act	<i>Mineral Resources Act 1989</i>
Mtpa	Million tonnes per annum
NC Act	<i>Nature Conservation Act 1992</i>
NCRL	North Coast Rail Line
NT Act	<i>Native Title Act 1993</i>
OCG	Office of the Coordinator General
OUV	Outstanding Universal Value
PASS	Potential acid sulfate soils
PM	Particular matter (e.g. PM _{2.5} , PM ₁₀)
PRCP	Progressive rehabilitation and closure plan
QPS	Queensland Police Service
QR	Queensland Rail
RE	Regional ecosystems
REMP	Receiving environment monitoring program
RIA	Road impact assessment
RL	Reduced level
ROM	Run-of-mine

RPEQ	Registered Professional Engineer of Queensland
RSHQ	Resources Safety and Health Queensland
RUSLE	Revised universal soil loss equation
SBTA	Shoalwater Bay Training Area
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
SEA	Strategic environmental area
SIMP	Social impact management plan
SIMR	Social impact management report
SSRC Act	<i>Strong and Sustainable Resource Communities Act 2017</i>
STP	Sewage treatment plant
t	Tonnes
TEC	Threatened ecological community
TI Act	<i>Transport Infrastructure Act 1994</i>
TMP	Traffic management plan
TOR	Terms of reference
tpa	Tonnes per annum
TSS	Total suspended solids
VM Act	<i>Vegetation Management Act 1999</i>
WMP	Water monitoring plan

1 Introduction

This Environmental Impact Statement (EIS) assessment report (assessment report hereafter) for the proposed Central Queensland Coal Project (the project), formerly known as the Styx Coal Project, was prepared by the Department of Environment and Science (the department) pursuant to Chapter 3 of the *Environmental Protection Act 1994* (EP Act). It provides an evaluation of the EIS prepared by Central Queensland Coal Pty Ltd and Fairway Coal Pty Ltd (the proponent hereafter), wholly owned subsidiaries of Mineralogy Pty Ltd.

The scope of the matters to be dealt with in the EIS were defined in the Terms of Reference (TOR) published by the department in August 2017.

This report is an assessment of the EIS prepared by the proponent. It outlines the findings of the EIS and information provided through public and advisory agency consultation. This assessment report:

- summarises the project, the EIS process and the regulatory approvals that would be necessary for the project to proceed (section 3)
- evaluates the potential environmental, economic and social impacts of the project
- assesses the potential impact of the project on prescribed environmental matters under State and Commonwealth legislation
- outlines avoidance, planning, management, monitoring and other measures proposed to minimise and manage adverse environmental impacts
- assesses the suitability of the project and identifies matters required to be dealt with for the project to proceed
- identifies issues that were not resolved or that require specific regulatory conditions or recommendations for the project to proceed
- recommends conditions relevant to the siting, operation, monitoring, management, offset and other requirements
- completes the EIS assessment process for the Central Queensland Coal Project under the EP Act.

This assessment report has been prepared and completed in accordance with the requirements of the EP Act and other departments in making decisions under their respective legislation. The EP Act EIS process for this project is accredited for the assessment of matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in accordance with the Bilateral Agreement between the Commonwealth of Australia and the State of Queensland (2014). A copy of this assessment report will be given to the Commonwealth Minister for the Environment, who will decide whether to approve or otherwise the project with respect to impacts on the project's controlling matters under Part 9 of the EPBC Act.

2 Project description

The proponent is proposing to develop a greenfield, open-cut coal mine and associated infrastructure located approximately 25 kilometres (km) northwest of the town of Marlborough within the Livingstone Shire Council (LSC) local government area in central Queensland.

Amended EIS process changes

The project has been subject to design changes over three amended EISs (2018–2020) in response to public and government agency submissions and subsequent advisory agency review comments. Design changes have been made to the project layout, operations and equipment with the objective of avoiding and mitigating potential impacts to environmental values.

The project description below describes the latest version in the amended EIS (version 3) dated October 2020 (amended EIS hereafter) that was provided by the proponent. A detailed description of the project is provided in Chapter 1–Introduction and Project Description, of the amended EIS. For completeness and clarity about what this assessment report refers to, a summary of the key project elements is provided below.

Key project elements

The total project area is approximately 2,661 hectares (ha). The mine area would be located on mining lease application (MLA) 80187, an area covering approximately 1,915ha comprising two open-cut pits, two waste rock stockpiles (WRS), dams, and two mine infrastructure areas (MIA) containing coal handling and preparation plants (CHPP). This area and associated infrastructure is herein referred to as the 'mine area' and is depicted in Figure 1 Proposed project area.

A transport corridor and train load-out facility (TLF) would be located on MLA700022, an area of approximately 745ha, connecting the mine and the TLF via a 7km haul road to enable the loading of coal onto trains and provide a new 4.4km rail connection to the Queensland Rail (QR) North Coast Rail Line (NCRL) regional freight and passenger rail network.

The project would require a total disturbance area of approximately 1,360.2ha across the two MLAs. An additional 12.4ha of land would be disturbed outside the MLAs to construct the western and eastern mine access roads.

The first mine pit, Open Cut 2 (OC2) and associated infrastructure would be developed over an initial two year construction period. A second construction period for the second pit, Open Cut 1 (OC1), and associated infrastructure would occur over the year 9 to 11 operational period. Works would include site preparation; vegetation and topsoil removal; topsoil stockpiling; earthworks; civil works; and building of structures and plant, including the CHPP.

The mine is expected to operate for approximately 19 years with a total mine life, including construction, final rehabilitation, closure and decommissioning, over an approximate 24 year period. Both semi-soft coking coal (SSCC) and high grade thermal coal (HGTC) would be produced using open-cut truck and shovel mining methods producing up to a maximum 10 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Approximately 64Mt of ROM coal would be mined over this period from an estimated coal resource of 206Mt. This coal resource is estimated to produce a total of 51Mt of product coal for export.

The project is estimated to employ a peak workforce of approximately 222 people during the initial two year construction period; 100–500 during operation; 150 during the second construction period for OC1 in year's 9 to 11 of the mine operation; and 20 during decommissioning. The majority of the workforce is expected to be sourced locally (with a component who would relocate) and augmented by a regional workforce. Local workers are anticipated to drive to work and a bus service is being considered for workers commuting from Rockhampton, Yeppoon, Clairview and St Lawrence.

The project is estimated to result in an economic benefit to the Queensland economy of between \$7.8 billion to \$8.2 billion. Royalties are estimated to be approximately \$703 million to \$766 million.

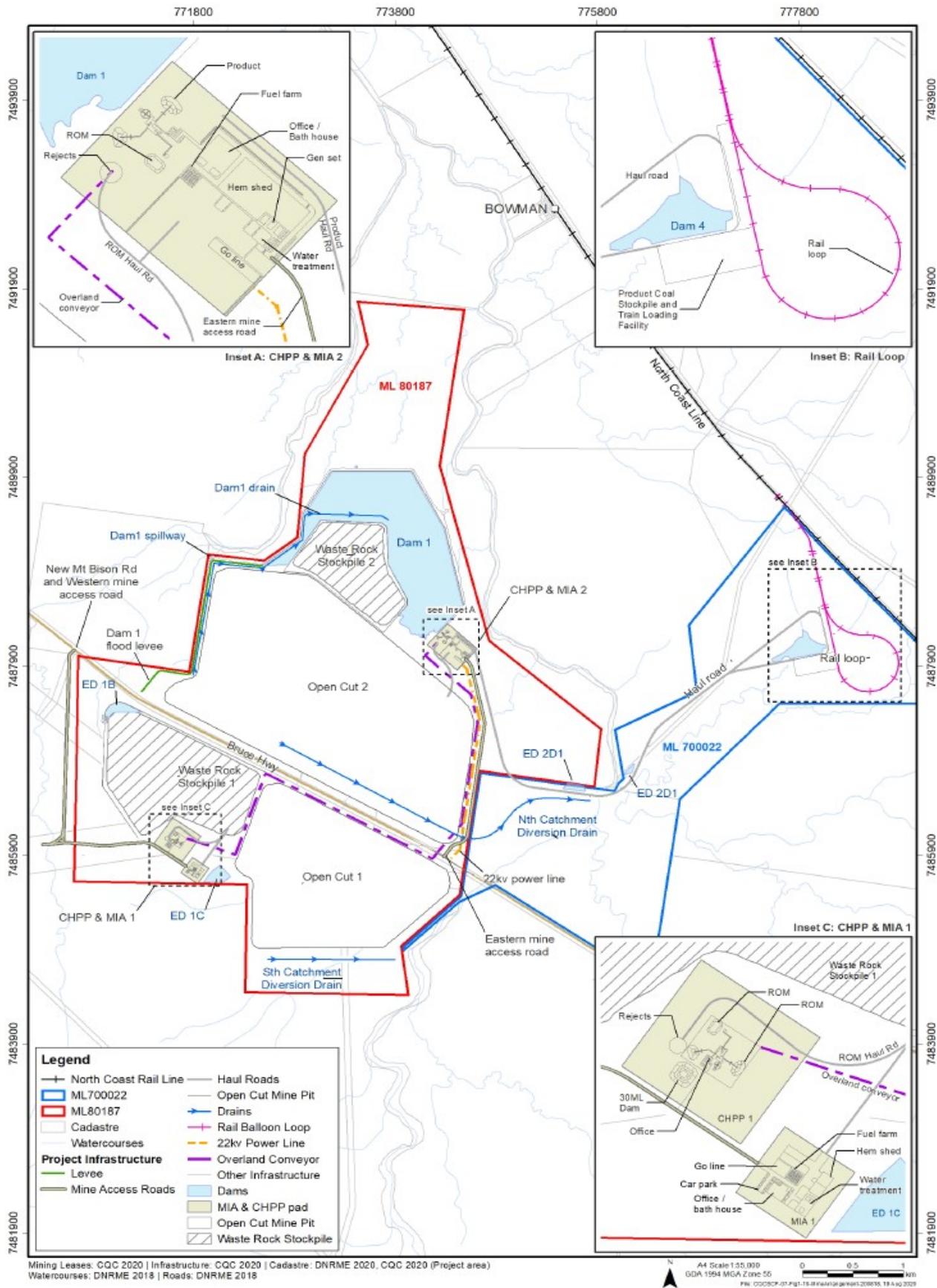


Figure 1 Proposed project area

Source: AEIS Figure 1-19: Project layout

2.1 Project location

The project would be located approximately 10km south of Ogmore and 25km northwest of Marlborough, in coastal central Queensland, within the Livingstone Shire Council local government area. Regionally, the project is located approximately 130km by road northwest of Rockhampton. The closest community, Ogmore, has a population of approximately 105 people.

The landscape of the proposed mine site is generally flat and located on a slightly elevated anticline of approximately 130–160m elevation within the Tooloombah Creek catchment. The proposed mine site would be located on a floodplain consisting of sodic soils in close proximity to two significant watercourses, Tooloombah Creek and Deep Creek. These creeks join approximately 2.3km north (downstream) of the proposed mine site to become the Styx River. The Styx River flows approximately 10km north-west into Broad Sound. Broad Sound forms part of the Great Barrier Reef World Heritage Area (GBRWHA).

The project would be located on freehold land –Mamelon Station–owned by the proponent that is currently used for cattle grazing and surrounded predominantly by other grazing properties. The project area is bisected by the Bruce Highway, with the North Coast Rail Line to the north and south, and the Tooloombah Creek Conservation Park to the west. The project is within the Brigalow Belt bioregion and contains a range of environmental values, including habitat for threatened species.

The proposed mine area is illustrated in Figure 2 Location of proposed project.

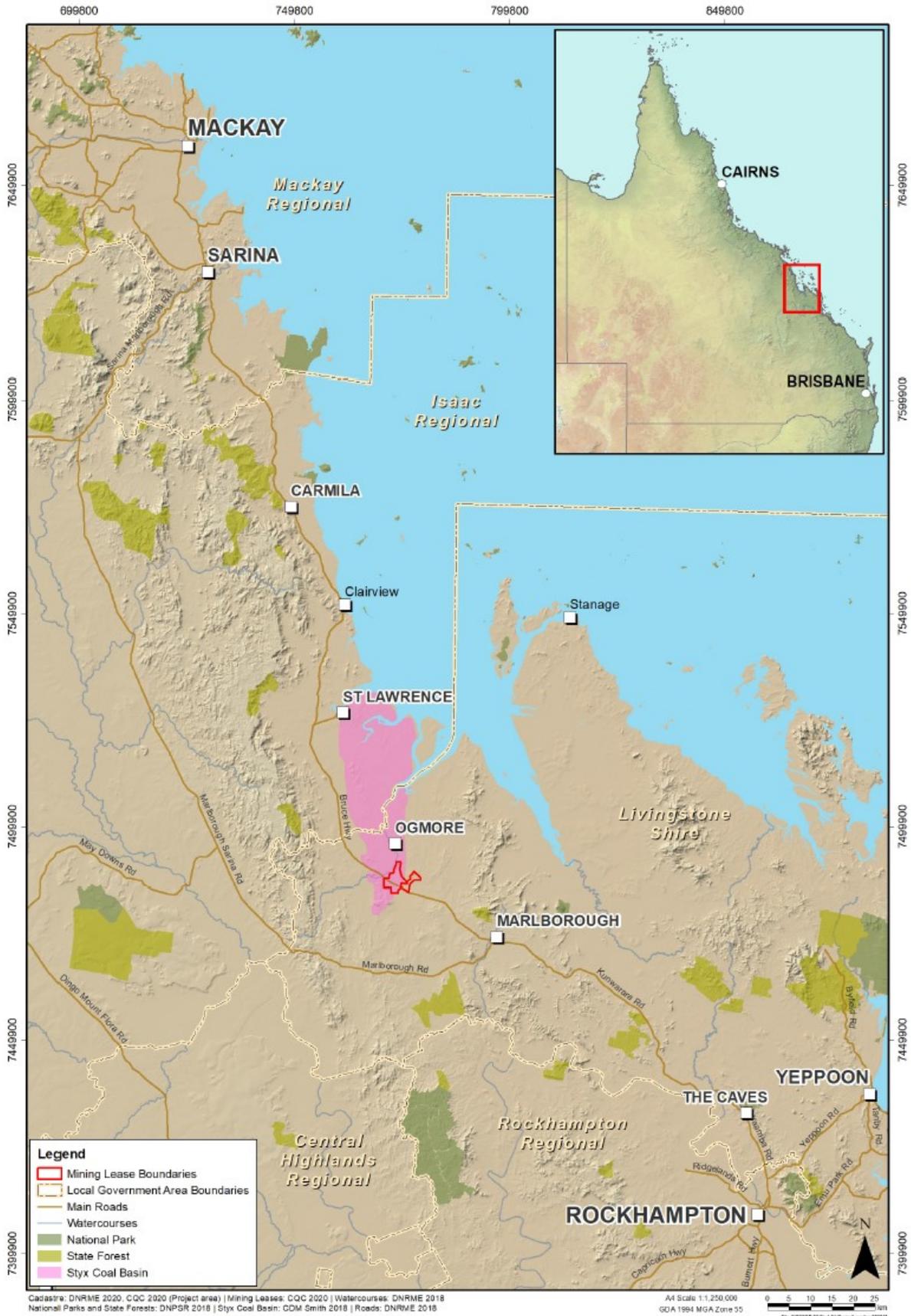


Figure 2 Location of proposed project

Source: AEIS Figure 1-1: Project regional location

2.2 Tenure

The project area is located on Mamelon Station, a grazing property of 6,259ha that consists of four freehold land parcels, Lot 1 on RL3001, Lot 9 on MC496, Lot 10 on MC493 and Lot 11 on MC23. Mamelon Station is owned by QNI Metals Pty Ltd which is a related company to the proponent, having common shareholder ownership and control.

The haul road and train loadout facility are located on a portion of Mamelon Station, Lot 10 on MC493; a portion of the freehold 'Brussels' property on Lot 85 and Lot 87 on SP164785; and a portion on the freehold 'Strathmuir' property on Lot 107 on SP316283.

An exploration permit for coal (EPC) was granted in April 2006 (EPC1029). A mineral development licence (MDL) was granted to the proponent in January 2014 (MDL468).

A mining lease application (MLA) for the project was applied for in June 2012 (MLA80187). A MLA for the transport corridor and TLF infrastructure was applied for in May 2017 (MLA 700022). The tenure required for the project would be applied for under the *Mineral Resources Act 1989* (MR Act) at the conclusion of the EIS process.

2.3 Sensitive receptors

The amended EIS identified nine sensitive receptor locations for the purposes of air quality, noise and vibration, and visual amenity impacts assessment and are identified in Table 1 Sensitive receptors for the project.

Table 1 Sensitive receptors for the project

Sensitive receptor	Distance from project
BAH H-1 homestead	4.1km north
Brussels homestead	3.2km southeast
Neerim-1 homestead	6.9km southeast
Neerim-2 homestead	3.4km south-east
Oakdean homestead	4.5km northeast
Ogmore township	6.8km northwest
Strathmuir homestead	6.3km east
Tooloombah Service Station (including two residences)	2.2km west
Tooloombah homestead	10.2km west

The closest sensitive receptor location is a residence at Tooloombah Service Station (approximately 2.2km west) and the nearest urban area is the Ogmore township (approximately 6.8km northwest) of the project site.

No accommodation camp is proposed as part of the project. Non-local workers are expected to use Marlborough Caravan Park located approximately 25km to the east.

The amended EIS also identified four wetland receptors: one on Tooloombah Creek 2.2km to the west (off lease); one on Deep Creek on MLA700022; Wetland 1 and Wetland 2. It is noted that the nearest protected area, Tooloombah Creek Conservation Park, also classed as an Environmentally Sensitive Area (ESA) is located approximately 2km to the west. The GBRWHA is located approximately 9.7km to the northeast.

2.4 Workforce

The workforce would comprise contractors, labourers and suppliers sourced predominantly from the regional area that includes communities from near Sarina to the north, Emerald to the west and Gladstone to the south. The local study area was defined as approximately one hour drive time to the project, spanning from St Lawrence in the north to the Rockhampton suburbs of Kunawarra and Canoona in the south.

Two workforce sourcing scenarios were modelled for the construction and operations workforces in order to understand the potential social consequences of the project. Construction workforces are recognised as temporary and mobile. A predominantly regional scenario for the construction workforce calculated 85% of the workforce emanating from the regional study area whereas a predominantly state scenario calculated 47.5% of the workforce sourced from across the state.

Operations workforces by contrast are considered to be more stable and long term. For the operations workforce, a predominantly local scenario calculated 50% of the workforce emanating from the local study area whereas a predominantly regional scenario calculated 45% of the workforce sourced from across the state.

It is estimated that up to 222 employees would be required during the initial construction period and 150 at the second construction period (for the operation of OC1 and associated infrastructure) in year's 9 to 11 of operation.

An operational workforce from 100 to 500 employees would be required during mining operations.

The mine would operate up to 24 hours a day, five days a week, with no work on weekends. A proposed construction worker roster is for a single shift, seven days rotating roster. There would be two shifts – day shift and night shift. A proposed operational worker roster would generally be for a five days on and two days off roster to encourage workers to live locally.

2.5 Mine plan

The project area contains Cretaceous coal measures within the Styx Basin. The coal measures are indicated to be approximately 9m thick and have been divided into eight seams that are relatively thin with an average thickness of 1.1m.

The project area contains an estimated 206Mt measured resource, 38Mt indicated resource and 169Mt inferred resource based on data from 154 exploration drill holes.

Two grades of coal are proposed to be processed on site and exported HGTC and SSCC. The majority of the coal produced would be SSCC with an estimated volume of saleable coal of approximately 46.2Mt. HGTC would only be produced in year's 11 and 12, producing an estimated volume of saleable coal of 4.8Mt. Total production volume of HGTC and SSCC over the life of the project is approximately 51Mt.

The mining sequence would commence with an initial box cut using a ramp formed in the low wall of pit OC2, with a truck and shovel terraced mining method running north–south across the strike and progressing eastwards. A 500m buffer to the Bruce Highway road reservation boundary is planned to be maintained for the first 11 years of mine operations. The location of WRS 2 would be sited to the north of the pit boundary, separated from the pit by a haul road.

The mining of OC1 would commence in year 12 of operation running from south to north. The location of WRS 1 would be sited to the west. The indicative mining schedule is illustrated in Figure 3 Indicative mining schedule.

Year 19 would mark the final year of mining, with rehabilitation anticipated until year 25 when the final landform criteria is predicted to be achieved. For the post-mining landform, the amended EIS proposes that both pits would be backfilled to approximately the original ground level and the WRSs would be recontoured to a maximum height of 150m AHD with slopes less than 12°, before topsoiling and revegetating. Grazing has been identified as the preferred final land use for the rehabilitated overburden dumps and infrastructure areas.

The expected end use of the coal product is for the overseas export market with shipping of product from

the Dalrymple Bay Coal Terminal at Gladstone in central Queensland.

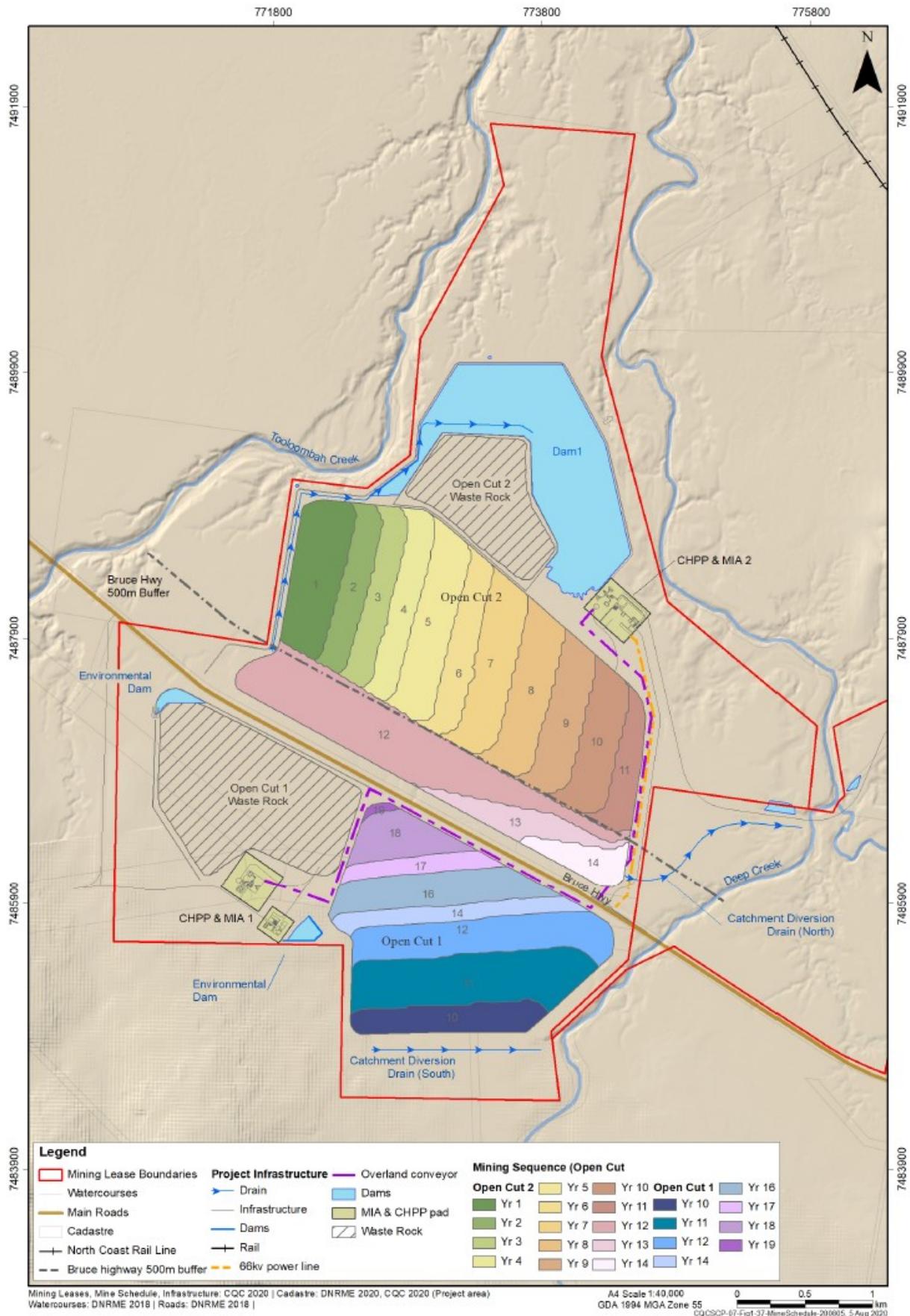


Figure 3 Indicative mining schedule

Source: AEIS Figure 1-36: Mining Schedule

2.6 Construction, operation and decommissioning

Conventional open-cut mining techniques would be used to target coal seams in two open-cut pits. Blasting would break and fragment the overlying rock formations above the target coal seam. Excavators with front end loaders and trucks will be used to remove the waste rock and coal resource. Groundwater would be pumped out to control inflows to the pit and maintain the stability of the pit wall.

The two pits would cover an extent of approximately 787ha and have a maximum depth of approximately 150m below the natural ground surface. The first open-cut pit to be mined is OC2 (covering an area of approximately 532ha) located on the northern side of the Bruce Highway. It would be operational for approximately 13 years. OC1 would be the second open-cut pit (approximately 256ha in size) and would be located on the southern side of the Bruce Highway. Mining of the second pit would last nine years and would operate concurrently with OC2 for a five year period during year's 10-14. The pits would be mined 24 hours a day, five days a week and produce between 1-10Mtpa of ROM coal.

The ROM coal would be processed on site in one of two CHPPs that would be located on each side of the Bruce Highway. The coal would be crushed to reduce its physical size and then undergo a series of physical treatments and separation processes to remove unwanted sediment and rock extracted with the coal. This improves the quality of the coal to produce the required SSCC standard. The HGTC bypasses the wash plant and would only be produced in year 11 and year 12 of the mine schedule. The output from the CHPPs would be product coal, coarse rejects and tailings.

Approximately 740 million bank cubic metres (Mbcm) of mine waste rock would be generated and disposed of over the life of the mine. Disposal would involve:

- co-disposal of tailings and waste rock by placement of 9.3 million loose cubic metres (Mlcm) of material from coal processing (i.e., tailings and coarse rejects from the CHPP) and 740Mbcm of waste rock (i.e. overburden and interburden) in the open-cut pits behind the working face
- permanent disposal of 743Mbcm in two dedicated waste rock dumps (one adjacent to each pit).

WRS1 would be approximately 153ha in area and WRS2 would be 76ha. Both WRS would be 135m higher than the surface level with WRS1 developed up to a reduced level (RL) 150m and WRS2 up to RL170m. After completion of mining operations and backfilling of the pits the WRS would have a maximum final landform height 100m above the surface level. Approximately 140Mbcm of waste rock materials stored within the WRSs would be used to progressively backfill the two pits to ensure that no voids remain on the floodplain at mine closure.

The two CHHPs and MIAs are located on each side of the Bruce Highway adjacent to OC2 and OC1. They would cover a total area of approximately 39.5ha. Key components would include: two ROM coal stockpile areas sized at 6000t capacity and ROM dump stations (comprising dump hopper, product conveyor, crushers and surge bin); water supply pipeline and management facilities, including raw water supply, storage and a water treatment plant to treat water to potable quality; mine affected water dams, sediment affected water dams and clean water dams.

Additional infrastructure located on the mine area would include internal roads and security building; power lines and substation; transmission line relocation and new transmission lines; explosives storage facility; ROM coal haul roads and waste rock haul roads and a coal conveyor.

A conveyor would transport coal under the Bruce Highway via a purpose built culvert between the western product coal stockpile at CHHP 2 and the eastern product coal stockpile at CHHP 1. Coal would then be transported 7km northwest from MIA 2 to the TLF on a haul road. Additional activities required within the haul road corridor and adjacent to the TLF would include waterway barrier works; cross-drainage structures; two sediment dams with sumps to collect surface runoff; and fencing.

At the TLF, coal would be loaded onto trains via a new rail loop connecting to the NCRL (See Figure 2 Location of proposed project). The TLF would cover an area of approximately 23ha and comprise a coal stockpile area with capacity for 50,000t of product coal, Dam 4, train loading hardstand area, and a 4.4km rail loop and rail spur.

Coal trains consisting of approximately 44 wagons up to 66 wagons long would transport average loads of 3,200t of product coal to the DBCT located approximately 175km north of the mine site. An average of eight 1,000 metres (m) long trains would be loaded per week at the 2Mtpa ROM project output level, with

the same number returning empty from DBCT. This would ramp up to a maximum 21 train movements per week with a train length of 2,082m at the 10Mtpa ROM project output level. An additional 1,110 train movements per year would be added to 150km of the NCRL and 25km to the Aurizon Goonyella rail corridor.

A western mine access for the project would be via a proposed new Mt Bison Road, joining the Bruce Highway on the western perimeter of the project, approximately 29km north of Marlborough. This infrastructure project while described in the EIS was not assessed and is outside of the MLA. Assessment and approval would be applied for through the local government planning process under the *Planning Act 2017*.

An eastern mine access road is proposed to be constructed off the Bruce Highway located on MLA80187 approximately 600m north of Deep Creek and 25km north of Marlborough. This access road would provide a short and direct route to CHPP 2 and MIA 2.

Raw water supply for the project would be harvested from on-lease stormwater runoff and rainfall, and mine affected water from pit dewatering activities. Potable water would be sourced from an external supply to make up any demand shortfall and to supply drinking water. The overall maximum mine water demand is 3.1ML per day for the 10Mtpa ROM coal scenario. Water reuse within the CHPPs is seen as an efficient use of water.

Dams would be constructed to store clean and mine affected water (MAW), including raw water, sediment and rainfall runoff from industrial areas, water from the open-cut pits and mine waste rock dumps. Water collected in the dams would be reused on site in mine operations.

Dam 1 covers an area of approximately 128ha at full supply level (FSL) and would hold a full supply storage of approximately 2783ML. This dam would be the main water storage for runoff from active mine areas and groundwater inflows from the open-cut pits. It would also receive MAW from sediment dam 1C. The dam would be constructed to release the 0.1% annual exceedance probability (AEP) rainfall event via a spillway.

A levee is proposed to be constructed to provide flood protection and contaminated water containment. It would extend 2.3km from the Dam 1 wall along a portion on the western boundary MLA80187 to protect mine operations in OC2.

Four sediment dams referred to as 'environmental dams' in the amended EIS are proposed to capture rainfall runoff from MIA 1 and CHPP 1, runoff from the haul road to the TLF, and runoff from WRS 1. The primary function of the sediment dams is to capture sediment laden runoff for sediment removal. The sediment dams would be designed to contain 1% AEP rainfall events. A perforated riser pipe outlet is proposed to allow gravity draining of the sediment dam within 48 hours of filling.

Non-mine affected runoff water from local catchments would be diverted around operational areas and fed back into the same catchment further downstream. An approximately 3.5km northern catchment diversion drain of four minor drainage lines of Deep Creek (three 1st and one 2nd Order drainage feature) would be required to be constructed around OC2 and Dam 1. An approximately 1.3km southern catchment diversion drain of a single 1st Order drainage line of Deep Creek would be constructed around OC1. These diversions would be carried out in a progressive manner as the pits expand and would be rehabilitated post mine closure.

All disturbed areas would be rehabilitated and maintained as mining progresses. The two pits would be filled with excavated waste rock leaving no voids after mining. Infrastructure areas would be decommissioned, dismantled and removed once mining operations were complete.

3 Environmental impact assessment process

The EIS for the project was jointly assessed under Queensland's EP Act and the Commonwealth EPBC Act. The EIS process under the EP Act was used in accordance with the assessment bilateral agreement between the Commonwealth of Australia and the State of Queensland. Further information on the EIS process under the EP Act is described in the department Guideline titled '[The EIS process for resource projects under EP Act](#)' which is available on the department's website at www.des.qld.gov.au.

3.1 Environmental Protection Act 1994

The key steps undertaken in the project's EIS assessment process are described below and summarised in Table 2 Key steps undertaken during the EIS process for the project.

2016

- On 16 December 2016, the proponent applied to the department for approval to voluntarily prepare an EIS. The application included an initial advice statement, a draft TOR and a list of interested and affected persons.

2017

- On 27 January 2017, the department approved the application. From 10 April to 8 June 2017 the draft Styx Coal TOR was publicly notified inviting comment on the draft TOR. The proponent responded to all comments received by the department during the comment period.
- On 31 July 2017, the department was notified of a change of proponent name from Styx Coal Pty Ltd to Central Queensland Coal Pty Ltd. The project name was also changed from the former Styx Coal Project to the Central Queensland Coal Project.
- On 4 August 2017, the department considered the responses and all comments received and issued the final TOR for the EIS.
- The department determined that the original EIS submitted in October 2017 sufficiently addressed the TOR for the EIS to be publicly notified. A 30-day EIS submission period was nationally advertised from 6 November 2017 to 18 December 2017.
- On 22 December 2017, the department provided all 32 submissions to the proponent to respond to. A number of significant issues were raised in submissions (see section 3.3.5).

2018

- On 8 February 2018, the department agreed to the proponent's request for a 12 month extension of time to allow the proponent to adequately address the submission comments.
- On 18 May 2018, the proponent provided to the department an amended EIS (V1) addressing the submission comments. The proponent's response to critical issues raised in submissions were assessed by the department, the Department of Agriculture and Fisheries (DAF), the former Commonwealth Department of the Environment and Energy (DEE), the former Department of Natural Resources, Mines and Energy (DNRME), the Department of Transport and Main Roads (TMR) and the Office of the Coordinator-General (OCG). Key matters from these advisory agency's submissions were assessed as still not adequately addressing submission comments. Some additional new issues were also raised relating to changes in the amended EIS.
- On 15 June 2018, the department decided the response to submissions and the amended EIS were not adequate for the EIS process to proceed to the EIS assessment report stage. On that date the department also agreed to the proponent's request to extend the period to respond to submissions by two years until 18 June 2020.
- On 20 December 2018, the proponent provided the department an amended EIS (V2) addressing submission and advisory agency comments.

2019

- On 16 January 2019, the department accepted the amended EIS for assessment. The amended EIS was assessed by the department, DAF, DEE, DNRME, TMR and OCG. Key matters from five agencies were assessed as still not adequately addressing submission and review comments.
- On 14 June 2019, the department provided a letter to the proponent stating that the submitted EIS did not adequately address a range of submissions and failed to appropriately amend the submitted EIS as required by section 56A(4) of the EP Act. In order for the EIS to proceed through the EIS process, the department requested that the proponent amend the statement of response to the submissions and make all the necessary additional amendments to the EIS

within the existing agreed timeframe i.e. by 18 June 2020.

2020

- On 5 May 2020, the department agreed to the proponent's request for a further extension of time due to travel restrictions imposed by COVID-19 interrupting field surveys and extended the period for submitting the amended EIS to the department until 29 January 2021.
- On 8 October 2020, the proponent provided to the department an amended EIS (V3) undertaken by a new consultancy—Orange Environmental—addressing submission and review comments. The amended EIS was assessed by the department, DAF, DAWE, DNRME, TMR and OCG.

2021

- On 26 February 2021 the delegate of the chief executive of the EP Act decided that the responses to the submissions and the submitted EIS was adequate to allow the EIS process to be completed.
- On 28 April 2021 the EIS process under Chapter 3 of the EP Act was completed.

Table 2 Key steps undertaken during the EIS process for the project

Step in the EIS process	Date completed
The proponent prepared and submitted a voluntary EIS application to the department	16 December 2016
The department approved the voluntary EIS application	27 January 2017
Proponent referred the project to the Commonwealth Environment Minister for the former Department of Environment and Energy	22 January 2017
Commonwealth Minister for the Environment decided the project is a 'controlled action'	3 February 2017
The proponent prepared and submitted a draft TOR to the department	13 March 2017
Comment period for the draft TOR	10 April to 8 June 2017
The department finalised the TOR	4 August 2017
The proponent notifies the department of a change of company name and a change of project name	31 August 2017
The proponent submitted the EIS	3 October 2017
The EIS submission period	6 November to 18 December 2017
Submissions were provided to the proponent	22 December 2017
The period within which the proponent had to prepare a response to submissions was changed by agreement	8 February 2019
The proponent responded to the submissions, provided an amended EIS (V1) and submitted an EIS amendment notice to the department	18 May 2018
The department decided the response to submissions and amended EIS were not adequate for the EIS process to proceed	15 June 2018

Step in the EIS process	Date completed
The period within which the proponent had to prepare a response to submissions was changed by agreement	18 June 2020
The proponent responded to the submissions, provided an amended EIS (V2) and submitted an EIS amendment notice to the department	16 January 2019
The department decided the response to submissions and amended EIS were not adequate for the EIS process to proceed	14 June 2019
The period within which the proponent had to prepare a response to submissions was changed by agreement	29 January 2021
The proponent responded to the submissions, provided any amendments of the EIS (V3); and submitted an EIS amendment notice to the department	8 October 2020
The department decided the response to submissions and amended EIS was adequate for the EIS process to proceed	26 February 2021
The department prepared the EIS assessment report	12 March 2021
EIS assessment report finalised and given to the proponent completing the EIS process	28 April 2021

3.2 Environment Protection and Biodiversity Conservation Act 1999

The project was referred on 22 January 2017 to the former Commonwealth Department of the Environment and Energy (DEE), now Department of Agriculture, Water and Environment (DAWE), to determine whether the action should be controlled. On 3 February 2017, the delegate of the Minister for the Environment determined the project to be a controlled action (EPBC 2016/7851) to be assessed by EIS in accordance with the bilateral agreement with the State of Queensland. The delegate of the Minister determined that the proposed action was likely to have a significant impact on six controlling provisions, including:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Great Barrier Reef Marine Park (GBRMP) (sections 24B and 24C)
- a water resource, in relation to coal seam gas development and large coal mining development (section 24D and 24E).

The potential impacts of the project on the controlling provisions was assessed under Queensland's EIS process which has been accredited for the assessment under the EPBC Act in accordance with the Bilateral Agreement between the Commonwealth of Australia and the State of Queensland (2014).

On 17 July 2017, the former DEE issued a notification of change of designation of proponent from Fairway Coal Pty Ltd to Central Queensland Coal Pty Ltd.

On 4 August 2017 the department finalised the TOR for the project which included a specific appendix for MNES.

On 3 October 2017 the proponent submitted a draft EIS to the department. The submitted EIS was publicly notified for the period from 6 November 2017 to 18 December 2017. The department, as the

assessing agency, reviewed the submitted EIS for the project against the information requirements outlined in Appendix 3 of the TOR, EPBC Act guidelines and other relevant recovery plans, conservation advices and technical information.

As per the Bilateral Agreement, the former DEE carried out its own review of the EIS assessment documentation and provided the department with a submission on the submitted EIS and subsequent review comments on the amended EIS dated 2018 (V2) and 2020 (V3).

The former DEE and the department sought advice on the water resource controlling provision from the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC), a statutory body under the EPBC Act that independently advises government regulators on the impacts that large coal mining development may have on Australia's waters resources. The IESC provided advice on the project in 2017 for the draft EIS, 2018 for the amended EIS (V1) and 2020 for the amended EIS (V3) responding to joint referrals from the department and DAWE.

DAWE also provided comments to the department on the draft EIS assessment report as required by the administrative arrangements under the bilateral agreement. Section 4.15 MNES of this report explains the extent to which the Queensland Government EIS process addresses the actual or likely impacts of the project on the controlling provisions under the EPBC Act, characterises the potential impacts and provides a conclusion about the acceptability of the impacts in light of the commitments to undertake mitigation and management measures.

A copy of the final EIS assessment report will be given to the Minister for the Environment who will decide whether to approve or refuse the controlled action under part 9 of the EPBC Act and if relevant, apply conditions to the approval necessary to protect MNES.

3.3 Consultation

3.3.1 Commonwealth Department of Agriculture, Water and the Environment

DAWE was consulted throughout the assessment and attended various meetings with the department and the proponent, including a visit to the proposed project site in November 2017. DAWE, in its capacity as an advisory agency to the department, provided adequacy reviews of the TOR and submitted EIS prior to public notification. DAWE was invited to make a formal submission during the public consultation timeframes and to review the proponent's responses to its submission and adequacy review comments on the three amended EISs.

3.3.2 Public consultation

Chapter 2 of the EIS outlined the public consultation program carried out by the proponent in detail. The proponent completed the statutory requirements for advertising the TOR and EIS notices and the mailing of those notices to identified interested and affected parties. In addition, the proponent undertook community consultation with members of the public and other stakeholders before, during and after the public submission period of the EIS in accordance with the Coordinator-General's Social Impact Assessment guideline (required in the TOR).

The proponent reported that community and stakeholder consultation activities included:

- one-on-one meetings with landholders and local community groups
- government agency meetings and briefings
- elected representative briefings
- establishment of key project contact points
- factsheets/newsletters and letters
- media releases
- statutory consultation and public notice advertisements published in local and national newspapers
- information provided on the proponent's website, including making the EIS available online.

3.3.3 Advisory body

The department consulted the following organisations to assist in the assessment of the TOR and or EIS for the project:

- Dalrymple Bay Coal Terminal Pty Ltd
- Department of Aboriginal and Torres Strait Islander Partnerships
- Department of Agriculture and Fisheries
- Department of Energy and Environment (Commonwealth)
- Department of Communities, Child Safety and Disability Services
- Department of State Development, Tourism and Innovation and the former Department of State Development, Manufacturing, Infrastructure and Planning
- Department of Education
- Department of Energy and Water Supply
- Queensland Fire and Emergency Services
- Department of Health
- Department of Housing and Public Works
- Department of Natural Resources, Mines and Energy
- Department of Transport and Main Roads
- Fitzroy Basin Association
- Isaac Regional Council
- Mackay Conservation Group
- Mackay Regional Council
- Office of the Coordinator-General
- Queensland Ambulance Service
- Queensland Health—Mackay Public Health Unit
- Queensland Police Service
- Queensland Treasury (Workplace Health and Safety Queensland)
- Rockhampton City Council
- Aurizon
- Energy Queensland
- Road Accident Action Group Inc.

Not all of these organisations provided comments. Note that Queensland Government department names used in the remainder of this report are correct as at the time of submissions on the EIS, however there have been subsequent government changes resulting in alterations to departmental names.

3.3.4 Public notification

The EIS assessment process provides the public notification requirements for the site-specific and amendment applications for the EA.

In accordance with statutory requirements, public notices were placed in *The Australian* and in *The Rockhampton Morning Bulletin* newspapers to notify the availability of the draft TOR and EIS for review and public comment. In addition, notices advising the availability of the draft TOR and the EIS for public comment were displayed on the department's website. The EIS was available to the public on the

proponent's webpage.

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

- the department's Business Centre: Level 3, 400 George Street, Brisbane QLD 4000
- the department's Coal Mining Business Centre: 99 Hospital Road, Emerald QLD 4720
- Rockhampton Library, 230 Bolsover Street, Rockhampton, Queensland (TOR and EIS)
- Marlborough Library, 15 Milman Street, Marlborough, Queensland
- the department's website: <https://www.qld.gov.au/environment/pollution/management/eis-process/projects/current-projects/central-qld-coal-project>
- the proponent's website: <https://cqcoal.com.au/>

3.3.5 Key matters raised in submissions

The department finalised the TOR after considering comments from the proponent, the advisory body, the public and others.

Submissions on the published EIS were received from 32 submitters within the submission period, including one from the department, one from DEE, 12 from other state government organisations, three from local government, and 15 non-government submissions. Three of these submissions had nil comments on the project.

All government agencies that made submissions which raised matters were given the opportunity to review and provide comments on the adequacy of any amendments made to the EIS addressing their submission. The department also sought comments and recommendations on conditions that should apply to the project should it be allowed to proceed.

Key matters raised in submissions are summarised in Table 3 Key matters raised in submissions. These matters, as well as other comments and recommendations made in submissions were responded to by the proponent in their response to submissions and in changes made to the EIS. The matters raised, together with other comments and recommendations made by the advisory bodies on the EIS documents were considered in assessing the EIS and the drafting of this assessment report.

Table 3 Key matters raised in submissions

Topic	Issue summary
Project description	<ul style="list-style-type: none"> • Infrastructure location, design and inclusion on maps at appropriate scale • Impacts of construction • Impacts on matters of state environmental significance (MSES) • MIA buildings and activities – location outside flood areas and containment • Rehabilitation to comply with forthcoming progressive rehabilitation and closure plan (PRC plan) requirements
Surface Water / groundwater	<ul style="list-style-type: none"> • Insufficient groundwater modelling–requires peer review • Insufficient on-site hydrological data–lack of monitoring bores • Adequacy of monitoring locations • Potential adverse impacts on groundwater dependent ecosystems (GDEs) • Potential adverse impacts on GDEs from saltwater ingress • Risk of flooding due to location on a floodplain • Risk of flooding of coal product from the conveyor under the Deep Creek Bridge

Topic	Issue summary
	<ul style="list-style-type: none"> • MAW release limits not proposed for all contaminants • Erosion and sediment control plan required • Inadequate sediment sampling and risk of sediment mobilisation from sediment dams • Insufficient water quality sampling • Water quality guidelines and limits have not been derived in accordance with water quality guidelines • Inadequate information on watercourse diversions and flood bunds • Receiving Environment Monitoring Program • Groundwater and surface water contamination risk from backfilling voids
Land/ ecology	<ul style="list-style-type: none"> • All voids on the floodplain to be back-filled • Insufficient information on mitigation and management of waste rock, tailings and spoil, including inadequate sampling results • Insufficient waste characterisation studies to determine environmental risk and management of waste rock material • Potential seepage of contaminants of concern from waste rock stockpiles • Additional information on rehabilitation success and final landform • Risks to aquatic fauna and the Great Barrier Reef World Heritage Area from stream-bed and bank mobilisation • Additional ecology surveys required for quantifying potential impacts on riparian greater glider and koala habitat due to groundwater drawdown impacts • Additional wetland assessment required • Offset requirements for MSES and MNES • Adequacy of sampling of aquatic ecosystems outside of flow events • Waterways assessment for fish passage • Additional assessment of potential impacts to coastal values
Social	<ul style="list-style-type: none"> • Stakeholder engagement deficient • Social impact assessment (SIA) study area and baseline studies, potential impacts and mitigation measures not consistent with the TOR • Percentage of FIFO workers and where they would be sourced from • Baseline assessment of affected landholders • Health risk from coal dust deposited by coal trains through the community of Clairview • Noise impacts on sensitive receptors–accommodation village • More information on the locations of worker’s accommodation • A commitment to an indigenous employment target • Ongoing engagement and consultation has been incorporated into project design decisions • Workforce accommodation, the housing strategy and population census assumptions • Housing strategy to accommodate peak workforce
Economic	<ul style="list-style-type: none"> • Flawed economic analysis

Topic	Issue summary
	<ul style="list-style-type: none"> • Impacts on the local road network from worker transit
Other	<ul style="list-style-type: none"> • Proposed closure of Bruce Highway for mine blasting is not permitted • Insufficient geotechnical assessment of the Bruce Highway and potential impacts to its integrity • Mine blasting may damage the Bruce Highway and provide a health and safety risk to motorists • Requirement for a noise management plan to achieve compliance at the Tooloombah Creek Roadhouse sensitive receptor • Emergency response procedures require local and regional stakeholder engagement • Road safety risk

3.4 Matters considered in the EIS assessment

The following matters were considered in the assessment of the EIS and in the preparation of this report:

1. The **final TOR** for the EIS, issued on 4 August 2017, set out the key information requirements to be considered in the EIS, including critical and routine matters. While they were not exhaustive, the TOR outlined the scope of critical matters that should be given detailed treatment in the EIS. The TOR stated that if significant matters arose during the course of preparation of the EIS that were not incorporated in the TOR (e.g., currently unforeseen issues that emerge as important or significant from environmental studies) then these issues should also be fully addressed in the EIS.
2. Additional matters to those listed in the final TOR that were identified and addressed in the EIS including advice from the IESC on Coal Seam Gas and Large Coal Mining Development (IESC) and the Queensland Herbarium.
3. The **submitted EIS** refers to the combined submitted documents provided by the proponent. The submitted EIS comprised:
 - the EIS submitted on 3 October 2017 that was made available for public submissions from 6 November 2017 to 18 December 2017
 - the amended EIS (V1) submitted on 18 May 2018 consisting of:
 - the proponent's summary of the submissions
 - a statement of the proponent's response to the submissions EIS (referred to as the 'Response to Submissions' in this assessment report)
 - any amendments made to the submitted EIS because of the submissions (referred to as the 'amended EIS V1' in this assessment report)
 - the amended EIS (V2) submitted on 20 December 2018 consisting of:
 - the proponent's summary of the submissions
 - a statement of the proponent's response to the submissions EIS (referred to as the 'Response to Submissions' in this assessment report)
 - any amendments made to the submitted EIS because of the submissions (referred to as the 'amended EIS V2' in this assessment report)
 - the amended EIS (V3) submitted on 8 October 2020 consisting of:
 - the proponent's summary of the submissions
 - a statement of the proponent's response to the submissions EIS (referred to as the 'Response to Submissions' in this assessment report)

- any amendments made to the submitted EIS because of the submissions (referred to as the 'amended EIS V3' in this assessment report)
 - any other information provided to the department prior to the Assessment Report being completed in accordance with section 66 of the EP Act.
4. All **properly made submissions** and any other submissions accepted by the chief executive.
 5. The **standard criteria** listed in schedule 4 of the EP Act.
 6. **Matter(s) prescribed under a regulation.** For the purpose of assisting the decision stage of the EA assessment, the regulatory requirements, which the department is required to comply with for all environmental management decisions, are listed in Chapter 4 of the Environmental Protection Regulation 2008 (EP Regulation) and include:
 - assessment against the environmental objectives and performance outcomes specified in schedule 8, part 3 of the EP Regulation for the operational assessments of air, water, wetlands, groundwater, noise, waste and land, and the land use assessment of site suitability, location on site and critical design requirements
 - environmental values declared under the regulation
 - the attributes for the area under the *Regional Planning Interests Act 2014*
 - environmental protection policies
 - MNES under the EPBC Act (World Heritage properties; National Heritage places; Listed threatened species and communities; Listed migratory species; Great Barrier Reef Marine Park; a water resource, in relation to a large coal mining development).
 7. **Section 59 of the EP Act** requires that an EIS assessment report must:
 - address the adequacy of the EIS in addressing the final terms of reference
 - make recommendations about the suitability of the project
 - recommend any conditions on which any approval required for the project may be given
 - contain another matter prescribed under a regulation.

4 Assessment of the EIS

This section provides a summary of the existing environmental values, potential impacts and avoidance, mitigation and management measures, commitments and any recommendations and regulatory requirements for the project to be suitable to proceed.

This section of the assessment report also discusses in detail the adequacy of the submitted EIS (including amended versions), taking into account key matters of concern identified in the amended EIS and particularly those matters of significant concern raised in submissions and in responses to requests by DES to key administering authorities. The level of detail of the assessment considers the significance of the potential impacts of the project including the magnitude, intensity and scale of the identified impact, having due regard to the affected environmental values.

The assessment of the submitted EIS by the department and advisory agencies has identified further assessment work that would need to be completed prior to any EA application and prior to environmental conditions being finalised for an EA approval. Recommendations for resolving these issues are detailed in relevant sections of the Assessment Report.

4.1 Project alternatives

The project description provided in the submitted EIS was considered adequate for the purposes of public consultation and met the requirements of the TOR. The submitted EIS described feasible alternatives to the project addressing the requirements of the TOR. A number of scenarios were considered to evaluate the relative social, economic and environmental advantages and disadvantages

of different project alternatives. Results were used to select the final project proposal and scope, largely confined by the fixed location of coal resources and MLA areas. In response to public submissions and advisory agency review comments, design changes have been made to the project layout, including location and types of activities, mine planning and final landform, operations and equipment with the objective of avoiding and mitigating potential impacts to environmental values.

Locality and operational (technological) alternatives documented in the submitted EIS include:

- **No development scenario**—the EIS stated that the existing current practice of cattle grazing would continue to result in sediment loads leaving the site and continued eutrophication and weed issues in vegetated sites and creek banks. The projected social and economic benefits, including employment of up to 500 people, and positive impacts on local, regional, state and national economies would not be realised if the project did not proceed.
- **Location alternatives of mine pits and infrastructure**—the EIS stated that locations are limited by the presence of coal deposits and the beneficial locality to existing rail, road, electricity and telecommunications infrastructure.
 - Impacts on MNES and MSES habitat have been reduced by siting the disturbance area predominantly on non-remnant vegetation areas previously cleared for cattle grazing. The northern end wall of OC2 was moved 40m south to avoid impacts to a patch of 'endangered' semi-evergreen vine thicket (EPBC Act). The haul road from OC2 was realigned to avoid impacts to three 'of concern' regional ecosystems. The original MLA area has also been reduced in order to excise 349ha of land from the southern portion of MLA80187.
 - Two previous WRS have been combined into WRS1 and this has been located outside of the Tooloombah Creek floodplain. WRS2 has approximately halved in size to 68ha due to refined mine scheduling and increasing the height of the WRS.
 - Five options were originally considered for the location of the TLF and rail loop. Three of these were selected for detailed consideration based on economic, social and environmental criteria. The preferred option was chosen as the haul road area that crosses Deep Creek has not been excised from the original underlying EPC and it does not traverse land subject to Native Title.
- **Transport alternatives**—rail was considered the preferred form of transporting coal product due to the proximity of the existing Rail Line close to the project. Dalrymple Bay Coal Terminal in Mackay was selected as it is the shortest distance (179km) to one of the four coal ports.
- **Technological alternatives**
 - Alternative mining methodologies—a margin ranking process was used and it was determined that underground mining was not economic based on the cut-off depth of the relatively shallow coal seams. Two voids were originally proposed but removed in response to the department's submission comments.
 - Alternative rejects and tailings management technologies—were considered but filter pressing of fine rejects was chosen over wet tailings storage.
 - Assessment of Alternative Haul Trucks—determined that the original haul trucks were predicted to exceed the noise criteria at the nearest receptors. Noise minimisation would be achieved by using a quieter fleet of haul trucks and this has been adopted.
 - Assessment of Alternative Methods of Loading Coal Wagons—the original concept to load coal hopper wagons by front end loaders has been changed to now load by an overhead bin in order to minimise coal dust and the potential loss of coal during train transit.
- **Conceptual alternatives**
 - Open-Cut Configuration and Optimisation—the sequence and mining direction of the various pits was changed in response to determining the final pit limits and preferred basal coal seam.

- Water supply—water storages have been consolidated into providing one large dam on MLA 80187. Additionally, the removal and consolidation of WRS and the use of two catchment diversion drains are considered to increase storage capacity and provide better flood immunity.
- Alternative energy sources—connection to the regional 275kV line that crosses the southwest of Mamelon Station was not considered feasible due to the lack of a transformer able to step down the high voltage for mine supply.
- Alternative accommodation—the EIS originally proposed a worker’s accommodation camp, but this option now will not proceed. The option of re-developing a previously existing accommodation village near Marlborough Caravan Park has also previously been undertaken. The proponent now intends to staff the project predominately as a daily commute operation using a local work force to the greatest extent possible and encouraging personnel to live in the local area.

4.2 Climate

The key amended EIS document used to assess climate was Chapter 4—Climate and Climate Change. The EIS described climate patterns and vulnerability of the project to natural disasters, hazards and the impacts of climate change. Additional information was also sourced from Appendix 5b—Project Flood Study and Water Balance; Appendix 7—Air Quality and Greenhouse Gas; Appendix 12—Draft Environmental Management Plan; and Chapter 21—Hazard and Risk where natural events (e.g., floods, heatwaves, and cyclones) are further described.

The TOR required the EIS to describe the proposed project area’s climate patterns, particularly with regard to discharges to water and air. The EIS assessed the vulnerability of the project area to natural and induced hazards, and climate change, while considering the relative frequency and magnitude of these events, including describing possible adaptation strategies to minimise the risk of impacts from climate change.

4.2.1 Assessment

The amended EIS adequately described the local and regional climatic conditions and the potential impacts of climate, natural disasters, natural hazards (including floods, bushfires and landslides) and climate change. It also described climate change adaptation strategies. Natural hazards are more fully described in section 4.10 Hazards and safety.

Likely changes to observed mean temperatures, annual rainfall, and cyclone activity are anticipated to amplify over the next century (CSIRO, 2015). A climate risk assessment identified potential impacts to the project from climate change and extreme climate events, including bushfire, cyclone and flood hazards. These climate risks present implications for all phases of the project, particularly to water supply, damage to infrastructure and equipment, and rehabilitation strategies.

The project area experiences a distinct four month wet season (December to March). The nearest Bureau of Meteorology weather station located approximately 2km west of the project area at Tooloombah Station, recorded an average annual rainfall 820mm. The amended EIS stated that rainfall projections for central Queensland as well as the Livingstone Shire LGA are associated with low rainfall frequency, but increased intensity of heavy rainfall events. Potential impacts that may affect mining operations related to water supply demand, competition between water users in rural areas, vegetation die back at rehabilitation and stabilisation sites, and increased dust generation.

The EIS identified that there is an increased likelihood of extreme rainfall events such as that experienced in the region from Tropical cyclone Debbie in March 2017. Project infrastructure would be designed in accordance with cyclone prone areas and the proposed mine’s Emergency Response Plan would be enacted to manage the health and safety risks to workers. The amended EIS stated that it was unlikely that storm surge associated with cyclonic weather would travel further upstream than the current tide limit around the confluence of Tooloombah Creek and Deep Creek.

The mine site is located on a floodplain between two watercourses, one of which, Deep Creek, is known to discharge across the floodplain at numerous sites. It is noted that the risk of flooding would be

minimised by locating the mining infrastructure area above the 0.1% AEP flood level and that open pits would be protected from inundation by flood levees. There is a 1.9% probability of this flood level being exceeded over the expected 19 year operational mine life.

The amended EIS stated that the effects of climate change leading to more intense rainfall events could potentially result in a greater magnitude of controlled spills from the sediment dams. As the sediment dams are rated for the 9.5% AEP event there may be a greater sediment load migrating to the receiving environment. Flooding impacts and mitigation measures are more fully described in section 4.4.3.

A climate change sensitivity scenario was undertaken for the 1% AEP event representing a 20% increase in rainfall intensity. This would result in a flood impact that sees the overtopping of the Bruce Highway in both the existing and developed scenarios, with no additional impacts on the mine site. The amended EIS considers that the emissions warming scenario is predictive to 2100 and that the project is likely to be completed by approximately 2040, before the full impacts of the predicted climate change scenario are realised.

The combined effects of rising temperatures, higher evaporation rates and prolonged droughts have implications for the project's effective management of water supplies. It is noted that the site's current water balance is not able to harvest sufficient on-lease stormwater runoff and rainfall and would require an external supply for making up the demand shortfall. Adaptive management measures proposed to deal with dry conditions include reducing the production of ROM coal and/ or not washing the coal such that it only meets the HGTC standard rather than the SSCC standard that requires washing. Strategies proposed to manage reduced water supply include reuse and recycling of water through all mine operation stages. For example, surface water collected from the MIA and stored in sediment dams would be used for dust suppression on coal conveyors/ stockpiles and mine operations, such as on haul roads.

An increase in wind intensity of 2% to 5% is projected for the location that may result in increased dust dispersion at the mine site. Routine air quality monitoring would be established on the project area to determine dust deposition rates and airborne dust levels. The effectiveness of dust suppression measures are discussed in section 4.7 Air. The amended EIS stated that changes in average wind speed would be within design tolerances and would not pose a significant risk to operations or workplace safety.

The amended EIS has committed to a range of mitigation measures, including design and engineering standards for infrastructure and equipment to manage extreme climatic conditions and events, adaptive management from the commencement of the project, and emergency response and fire management plans. Adaptive management and control measures would establish criteria for managing erosion and rehabilitation, the mine site water balance, flood runoff and protecting offsite water quality through routine monitoring, maintenance, and reviews of existing management operational activities.

Should an extreme event occur, and excess water be stored on site, then consultation with the department would be carried out to enable the lawful and temporary release of flood water. Dams would also be designed to enable uncontrolled releases via a spillway should extreme flooding occur.

4.2.2 Conclusions

The EIS adequately addressed the requirements of section 8.1 of the TOR in relation to climate. The values and the potential risks have been adequately described. Climate factors have been also assessed in relation to the project's potential discharges to water and air.

The project included adequate design controls and strategies to generally mitigate the risks associated with climate factors. Climate change risk would continue to be assessed during further stages of the project's implementation, particularly in relation to securing a reliable water supply. The EIS has considered adaptation measures in the design and operation of the proposed project, including measures to minimise high risk impacts to the damage of mine infrastructure and mine pit waters from flood events.

With the implementation of proposed mitigation measures the residual risk ranking for impacts from extremes of climate and climate change was presented as low and climatic changes during the life of the project were considered unlikely to significantly impact on the operations or rehabilitation phase of the project.

Commitments are proposed by the proponent to mitigate and manage climate change risk and extreme climatic events, including the development of an emergency response plan, a land use management plan, a bushfire management plan, a safety and health management system, and an erosion and sediment control plan. Provided these commitments are implemented, climate based risks are expected to be adequately managed.

4.3 Land and rehabilitation

The relevant sections of the EIS that describe and assess potential impacts to land were Chapter 5–Land and Chapter 11–Rehabilitation and Decommissioning. Additional information was also sourced from Appendix 3a–Land, Soil and Geochemistry, Appendix 3b–Geochemical Assessment of Waste Rock and Rejects, Appendix 3c–Land Suitability Assessment, Appendix 15a–Draft Erosion and Sediment Control Plan and Appendix 15b–Styx Catchment Sediment Budget. These documents were revised in response to EIS submissions.

A range of related matters associated with water resources are detailed in Chapter 9–Surface Water. Potential impacts on vegetation are detailed in Chapter 14–Terrestrial ecology. Management of waste streams are detailed in Chapter 7–Waste Management and Chapter 8–Waste Rock. Potential impacts on native title rights and interests were discussed in Chapter 18–Cultural Heritage. Social impacts on neighbouring land uses are detailed in Chapter 19B–Social.

Section 8.2 of the TOR required the EIS to adequately describe: any changes to the landscape and visual amenity; tenure arrangements; temporary or permanent land use changes; existing or proposed incompatible land uses; impacts to any existing stock routes; measures proposed to avoid or minimise land use impacts; assessing the project against the requirements of the *Regional Planning Interests Act 2014* including how the project would avoid or minimise impacts to Strategic Cropping Land (SCL); whether there is contaminated land on the site; and existing or potential native title rights impacted by the project.

4.3.1 Land assessment

The existing environment of the project area is described as rural on generally flat or undulating lands. The mine site has been largely cleared of remnant vegetation, but is dominated by poplar box, *Eucalyptus populnea*, a woodland with remnant riparian vegetation persisting along the watercourses. Open grasslands now predominate, with sparse patches of remnant vegetation. Low intensity grazing is the dominant land use with surrounding areas described in the EIS as good quality agricultural land. There are no stock routes near the project site. The nearest environmentally sensitive area (ESA) is Tooloombah Creek Conservation Park, a 261ha area of remnant vegetation, located approximately one kilometre to the northwest. Land ownership and tenure is discussed in section 2.2–Tenure. Native title matters are discussed in section 4.12–Cultural Heritage.

The project site is dominated by floodplains associated with the main watercourses, and the elevation ranges from 11.4m AHD to 43.8m AHD. The Tooloombah Creek and Deep Creek sub-catchments comprise an area of approximately 673km² and are the main watercourses adjacent to the project. These two ephemeral watercourses contain a number of permanent and semi-permanent pools. The watercourses converge approximately 2.3km downstream of the project site and form the Styx River which discharges to Broad Sound approximately 8km downstream. The GBRWHA boundary is located approximately 10km downstream of the project. Broad Sound starts at the mouth of the Styx River and is a large, shallow marine and estuarine bay subject to the largest tidal range on the east coast of Australia.

The geology of the project site is dominated by the Styx Coal Measures, consisting of eight relatively shallow coal seams (no more than 2m thick) contained within an approximately 120m of coal bearing strata. The coal seams are overlain by undifferentiated sediment and quaternary alluvium of approximately 25m depth.

Soil properties and mapping derived from field surveys (including 145 soil profiles) indicate that the proposed mining area is dominated by strongly sodic and highly dispersive soils. Both Sodic Vertosols on alluvial plain soils and Sodosols on alluvial terrace soils overlap in the project area. Five soil mapping units were mapped within the mine site. Three of these units, comprising 95% of the disturbance

footprint, were considered sodic to strongly sodic. The sodicity and dispersivity of these soils were measured and were identified as susceptible to erosion and soil structural decline when disturbed.

Project land clearing would disturb approximately 1,360ha within the MLA areas. Another area of approximately 12ha would be disturbed for the construction of the proposed western road access outside of MLA801087. The erosion hazard for the project area was calculated using the Revised Universal Soil Loss Equation (RUSLE) accounting for dispersible soil materials. Bare soil erosion rates for the floodplains on the project site were approximately 167t/ha/yr for topsoil and approximately 335t/ha/yr for subsoil. These erosion rates are doubled for slopes. The high erosion rates are due to the sodic duplex soils on terrace plains and alluvial plains that dominate the project area.



Figure 4 Deep Creek – gully erosion

Source: Department of Environment and Science

Erosion and sediment control measures detailed within a draft ESC plan have been designed to reduce erosion potential. Management of erosion associated with mining activities and progressive rehabilitation are discussed in section 4.3.2–Rehabilitation assessment.

The EIS assessed the probability of occurrence of acid sulphate soil (ASS) on site as low based on CSIRO National ASS mapping, the location of the 5m and 20m AHD contours, and the modelled groundwater drawdown extent. The EIS stated that the project area was within the ‘low’ to ‘extremely low’ ASS categories. I note an (ASS) survey for the project site was not undertaken despite submission comments from the department and DAWE concerning the potential exposure of ASS from mining activities.

An agricultural land class assessment identified the majority of the project site as moderate quality grazing land comprising an area of approximately 1,285ha. This equates to land class 3 which is suitable for native pastures and is not considered good quality agricultural land (GQAL). An area of approximately 336ha was considered to be GQAL. A small portion of SCL of approximately three hectares is mapped to the east of Dam 1. The EIS stated that this area is mapped as a strategic cropping area, which is an area of regional interest under the Regional Planning Interests Act 2014. The EIS undertook an SCL assessment and determined that this area which extends into the mine disturbance area from the adjacent Deep Creek alluvial terrace should be reduced to 0.8ha in area.

A search of the department’s contaminated land register identified no known existing land contamination sites and no known notifiable activities for the project site. Should the project be allowed to proceed, I

consider the department's model mining conditions relating to the management of contaminated soils and land would suffice to manage this risk if any contaminated land is encountered during mine construction and operational stages. Activities that may lead to land contamination are required to be listed as notifiable activities under Schedule 3 of the EP Act. No anticipated notifiable activities for the project were identified in the EIS.

A visual amenity assessment was undertaken for the project's identified sensitive receptors to assess the potential extent of visual change to the landscape. The project would result in significant land disturbance resulting in changes to the local topography and surface water drainage patterns on the project site. Approximately 1,372ha of land would be directly disturbed by clearing for the project. A range of above ground infrastructure would be constructed and would influence the visual amenity and landscape character of the mine and off-lease access road. GIS modelling determined the potential visibility of the project from the receptors. A zone of theoretical visibility used elevation data to determine sight-lines to the project with only two homesteads, Brussels and Neerim-2, considered to be potentially impacted. Existing screening from vegetation is expected to result in minimal daytime impact but lighting from the project in the evening and night periods would be visible.

However, I am not satisfied that the visual amenity assessment has adequately accounted for the impact the project would have on motorists using the Bruce Highway. I note that earthen bunds would be constructed to screen mine operations, but no detail on the dimensions, extent or staging of these structures was provided. No visual amenity assessment for motorists was provided despite the location of open-cut pits and the approximately 135m high waste rock stockpile 1 proposed within approximately 100m of the highway.

4.3.2 Rehabilitation assessment

The EIS addressed rehabilitation in Chapter 11–Rehabilitation and Decommissioning. It described the post-mining land use, soil management and rehabilitation methods, how progressive rehabilitation would be undertaken over the life of mine and monitoring and maintenance requirements post-closure.

Section 8.2.1 of the TOR required that elements of rehabilitation be described and assessed, including progressive rehabilitation requirements, final landform and final land-use. The TOR also required that the EIS must address legislative requirements about the strategies and methods for progressive and final rehabilitation of the environment disturbed by construction, operation, and decommissioning of the project.

Following is an assessment of key matters that were raised in submission comments on the EIS and recommended measures to address those issues.

4.3.2.1 Rehabilitation goals, strategy and completion criteria

The project's mining activities would progressively disturb approximately 1,372ha of land over the project's 24-year life, that includes the final rehabilitation and mine closure period.

The project would be subject to major rehabilitation reforms introduced by the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act). Those reforms included replacement of the financial assurance regime with a new financial provisioning scheme for all resource authorities; and amendment of the EP Act to introduce new requirements for the progressive rehabilitation and closure of mined land, including the requirement for a progressive rehabilitation and closure plan (PRC plan). A PRC plan must be submitted with any EA application post-EIS approval and must address a number of statutory information requirements outlined in the department's Guideline *Progressive rehabilitation and closure plans (PRC plans)* (DES 2019) (the PRCP guideline).

The new financial provisioning scheme commenced on 1 April 2019. The department now determines the estimated rehabilitation cost (ERC) for the mining project. The scheme manager then decides on the required financial provisioning contribution or amount of surety based on an assessment of risk to the State of Queensland.

A requirement under the PRCP guideline is that the constructed landforms post-mining must be subject to rehabilitation goals, objectives, material specification, design criteria and performance criteria.

The stated rehabilitation objective for the post-mining land use (PMLU) is to create a final landform

suitable for low intensity cattle grazing with areas of native vegetation. General rehabilitation goals would accord with post-mining site conditions that are safe to humans and wildlife; non-polluting; stable and able to sustain an agreed PMLU.

Rehabilitation completion criteria have been nominated in the EIS in order to achieve the nominated post-mining land use in line with *Rehabilitation Guidelines for Mining Resource Activities, Version 2.01* (DES 2018). Completion criteria have been updated to reflect the intended PMLU for each domain and to address submission comments. The completion criteria would be used as the basis for preparing the consequential PRC plan. Performance indicators and completion criteria would be subject to ongoing refinement based on monitoring and testing of completed progressive mine site rehabilitation.

The rehabilitation completion criteria in the EIS for achieving the goal of 'able to sustain a post mine land use' states that it would be determined through comparison with reference sites. There is no discussion about the pre-mining land class and the post-mining land use potential.

I consider that the information provided with the PRC plan should link the recommendations from the land suitability assessment with the methodology described by the proponent for achieving the proposed final land use. This would demonstrate that the land use outcome is possible at this site post-mining in the proposed final landform.

Post-mining landforms with similar physical characteristics and landform are referred to as rehabilitation domains. The mine site has three major mining domains:

- mining and infrastructure area
- haul road to the TLF, sediment dams on Deep Creek, Dam 4 and the TLF
- rail loop and spur line.

These domains have been further subdivided into sub-domains based on individual project components such as the open cut pits and waste rock stockpiles.

Based on projected mine domain disturbance areas, approximately 1,287ha of land on MLA801087 would be subject to clearing for mining and infrastructure and would require rehabilitation. An area of approximately 73ha of land on MLA700022 would require rehabilitation that would be subject to construction of the proposed transport corridor haul road, water storages, TLF, rail loop and spur line.

Rehabilitation is planned to commence in year two after the first stage of mining has been completed. Progressive rehabilitation of mining would be initially undertaken in OC2. As mining progresses, waste rock would be hauled from WRS2 and emplaced in completed mined areas. The voids would be in-filled, shaped, topsoiled with sufficient suitable material and seeded with a mixture of native and introduced pasture species.

Surplus waste rock from actively mined areas would continue to be temporarily stored in the waste rock stockpiles. A significant portion of this waste rock would be used to back fill the mine pit at closure to ensure that no final voids remain in the landscape. Once the open-cut pits are in-filled, the remaining waste rock stockpiles would be reshaped and contoured, stabilised, topsoiled and seeded.

The management of mine waste on waste rock stockpiles prior to rehabilitation is discussed in section 4.10 – Waste Management.

After completion of mining in year 19 of operation there would be five years of ongoing rehabilitation until completion by the end of year 24. Management milestones would be developed to track progress against the approved PRC plan Schedule and any conditions imposed by the department, should the project be allowed to proceed.

Post-closure of the mining operation, mine infrastructure such as the MIA areas, diversion drains and water storages, haul roads and the TLF would be decommissioned, removed and rehabilitated to achieve the PMLU goal. It is proposed to fill both pit voids, flatten waste rock stockpile slopes to a maximum 7 degree overall grade and rehabilitate and stabilise all previously disturbed areas to achieve a post mining land use that is stable, vegetated and self-sustaining and supports the intended final land use.

Completion criteria have been drafted to ensure the final landform would not produce acid or saline drainage. The stability of the waste rock stockpiles would be monitored and reassessed as required

based on the nature of foundation materials, fill materials, and capping materials.

Figure 5 illustrates the extent of the progressive rehabilitation and proposed final landform.

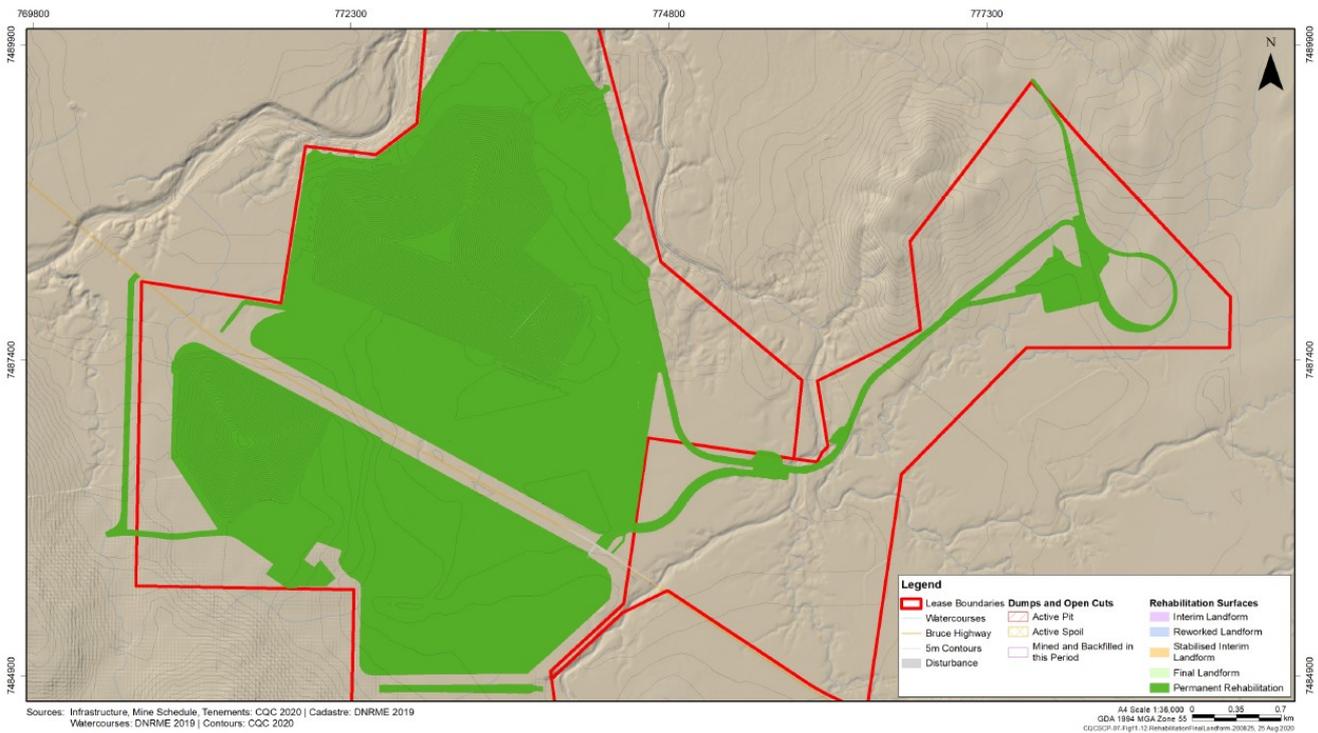


Figure 5 Proposed final landform

Source: AEIS Figure 11-12: Progressive rehabilitation (final landform at 2044)

4.3.2.2 Proposed rehabilitation methods

An agricultural land capability and soil suitability assessment undertaken for the EIS estimated both the amount of topsoil material to be used as primary growth media to re-establish vegetation on rehabilitated mine land, and the amount of subsoil material to be used as secondary growth media that can be placed on overburden. The disturbed topsoil is low in fertility and shallow. The subsoil is sodic, saline and dispersive constraining its use at the land surface. Stripping depths were calculated based on the soil properties. Stripped soil for progressive rehabilitation requires it to be re-used ideally within three months. Stockpiling of soil would be located at least 50m from drainage lines with stockpiles no greater than 2m high.

The soil loss estimates calculated by the RUSLE method indicate significant erosion potential, particularly for subsoils placed on the steep waste rock stockpile slopes. The draft ESC plan proposes to mitigate erosion potential by treating stockpiled soil with gypsum in order to flocculate the exposed soil and ameliorate its dispersive properties. Further discussion of this issue is in the Final landform section below and in section 4.3–Water Quality, Water Resources and Flooding.

The department and DAWE provided comments querying the likelihood of success and the timeframe of the proposed rehabilitation methods. It is unknown whether the highly dispersive properties of the sodic soils would be fully stable and over what timeframe this is likely to occur.

I am supportive of a proposed trial rehabilitation site for WRS2 that would be established on site to demonstrate successful rehabilitation outcomes. The trial would cover an area of approximately 8.4ha of on the western edge of WRS2 and be shaped down and rehabilitated to the final landform design by Year 4 of operation. Ongoing monitoring and review of the rehabilitation over time would significantly assist in refining and optimising the final landform design and associated rehabilitation activities.

4.3.2.3 Watercourse diversions

The department raised concerns about the lack of detail about the post-closure flooding impacts on the catchment diversion drains, particularly how they would remain safe, stable and non-polluting during

operation and closure.

I note that the proponent is not proposing to divert any watercourses as defined under the *Water Act 2000*. Instead, the project would include the construction of two catchment diversion drains to divert clean upslope catchment runoff around the mine site. The Northern Catchment diversion drain is temporary and would be mined through after year 13–14 of operation. The downstream portion of this drain would be rehabilitated as it is not required post-mining. The Southern Catchment diversion drain would commence in year 10 of operation and remain as a permanent structure to divert local stormwater runoff around the backfilled OC1.

The proponent has stated that detailed flood impact and geomorphological assessments have confirmed that the diversion drains would not have a significant impact on flooding or erosion.

However, the EIS does not provide any specific details about the rehabilitation and need for on-going maintenance of these diversion drains. The rehabilitation indicator for the diversions is that they meet approved design criteria, but no relevant completion criteria were provided in the EIS.

Additionally, the backfilled pit would include reinstated drainage paths to drain local runoff and flow breakouts from Deep Creek, to Tooloombah Creek and Deep Creek. Detailed design of the reinstated drainage paths is required to be carried out to ensure that the final landform is safe, stable and non-polluting in the long-term. The drainage lines are proposed to be vegetated and self-sustaining. I consider that the reinstatement of drainage lines has not been adequately discussed in sufficient detail. Should the project be allowed to proceed, further clarification would be required in any future PRC plan about the location of the Southern Catchment diversion drain in the final landform and its role in achieving the final land use.

The rehabilitation indicators for the diversion drains should specify the design criteria that they would be required to meet to ensure that they are safe, stable and non-polluting. This is especially the case if they are not required to be authorised under the *Water Act 2000*. The rehabilitation completion criteria would also need to include a final assessment and sign-off by a suitably qualified person.

More detail would be required in the PRC plan about how the drainage paths would be reinstated in the final landform to achieve the rehabilitation goals. This should not only include consideration of soil, vegetation and hydraulic characteristics, but also water quality.

The PMLU should identify and describe all built infrastructure that will remain post rehabilitation, including the ongoing maintenance requirements for the structures and any residual risk they may pose. These requirements would also need to be costed in relation to the diversion drains in any future ERC calculations.

4.3.2.4 Final landform

I note that the waste rock dumps would be constructed with outer slopes of up to 1 in 3 which is a batter slope angle of approximately 18 degrees, shaped and temporarily rehabilitated to be safe and stable. They would eventually be used to backfill the open-cut pits. Initially they would be developed to up to RL 170m but would be re-profiled to a slope angle of less than 7 degrees and a final maximum landform height of RL 100m.

The EIS states that the stability of the waste rock dumps and their risk to the environment would be monitored and re-assessed throughout construction and operation and managed accordingly to achieve the proposed rehabilitation outcomes. I support measures to compact the surface waste rock materials and capping using a low permeability material such as clay, to prevent deep infiltration of surface water flows resulting in tunnel erosion. I note however, that once tunnel erosion commences it is difficult to contain. In order to minimise erosion of slopes I recommend that a revised ESC plan commits to a range of stabilisation techniques, including terracing, geotextile or geo-matting in combination with riprap at drainage points, and with seeding and mulching. I note that the completion criteria for the waste rock stockpiles is only for 70% vegetative cover of the battered slopes and recommend that vegetative cover is maximised.

The sediment basin ED1B would receive runoff primarily from WRS1. The EIS states that the estimated 'worst-case' operational sediment generation is approximately 69,300tpa of soil from a catchment area of approximately 165ha. I note that the size of this sediment basin is approximately 24ML—less than 10% of

the volume of Dam 1, but its sediment generation rate is half that of Dam1. This indicates the significant runoff potential associated with the steep slopes of WRS1.

I consider that successful rehabilitation of the mine site would require careful management of saline and sodic soil/ spoil, which is highly dispersive. The soil near the proposed rail loop also has the potential to become acidic. Therefore, the high seasonal rainfall and wind conditions present at the site have the potential to increase erosion and runoff from the rehabilitated landforms. If not carefully managed poor runoff water quality would invariably enter the local watercourses and be transported to the highly sensitive receiving environment.

I note that the waste rock dumps are proposed to have slope angles of less than 7 degrees in order to achieve the goal of stability. However, this may not be sufficient for highly dispersive soil. I note inconsistency in the EIS depicting the landforms that have long gentle slopes on one side and steep slopes on the other. Landform modelling would be a requirement of the PRC plan process to enable the final landform to be designed in such a way that it is safe, stable and non-polluting over the long term.

The EIS states that sodic subsoils would potentially be used as a primary growth medium following amelioration with gypsum and fertilizer, and the addition of organic matter. The soil remediation is recommended to occur during the stripping and stockpiling process to ensure they are suitable for rehabilitation. However, I note elsewhere in the EIS that it is proposed to selectively bury high to very high sodic soil within the waste rock dumps well below the final landform. It is not clear how the sodic soil would be buried and not subject to disturbance when the waste rock dumps are eventually used to backfill the voids.

The EIS states the intent to co-dispose of coal rejects that have the potential to be PAF in the waste rock dumps. There is potential when this material is reworked as part of backfilling that the PAF would be exposed to air and water on the surface. In order to reduce this risk, I would recommend a program of resampling of the surface before the cover is installed to ensure that any sodic or PAF material on the surface layer is buried deeper or a thicker cover put in place to achieve a stable landform. I recommend that the proponent apply the approach described in *ACARP Project C24033 – Applying risk based principles of dispersive mine spoil behaviour to facilitate development of cost effective best management practices* (ACARP, 2018).

DAWE stated there was a lack of information regarding the nature, extent and timing of post-closure monitoring to ensure potential long-term impacts (after mining and decommissioning) do not occur or can be identified and rectified in a timely manner to ensure desired environmental outcomes are achieved. I recommend that an amended ESC plan address long-term impacts post-closure in order to identify potential legacy issues and appropriate and effective mitigation measures.

The IESC also raised the issue that the physical and geochemical characteristics of the materials that are placed in the final voids could provide a long-term source of contaminants that could gradually leach and mobilise through groundwater flow. However, I note that geochemical testing of waste rock and rejects—as detailed in section 4.10—Waste management—has identified a low contamination risk. In order to manage the potential risk of contaminant leaching, I would recommend completion criteria are provided for each domain that states runoff and seepage from rehabilitated landforms would be of a quality which is unlikely to adversely impact known environmental values. Additionally, the proponent must ensure that continuous testing of waste rock and rejects to backfill the pits is required as part of the waste rock and coal rejects management plan.

4.3.2.5 Retention of water storages

I note that the EIS proposes that water infrastructure may be retained if it is considered stable and they are considered to have a long-term beneficial use for the landholder. However, I consider that the risk of dam failure of Dam 1 and/ or the failure of the levee have potentially significant consequences on the receiving environment, including the highly sensitive GBRWHA. Consequently, should the project be allowed to proceed, I would require the proponent to complete flood failure assessments prior to commencement of the project. I would also recommend a requirement to rehabilitate all water storages to a post-mining low intensity grazing land use within a PRC plan approval. This would include an approved strategy for rehabilitation of the remaining water body dependent on water quality and remediation of the base of the dam storage.

I note the EIS states that dams would be remediated at the completion of mining, but very limited information was provided describing the process for achieving this goal. I note from the EIS where water quality characteristics allow, water from the dams would be used as part of final rehabilitation activities. Alternatively, the water would be treated so that it is suitable for use. There is also a need to adequately describe how saline soils would be remediated and to explain how the MAW dams would be dewatered to facilitate their rehabilitation. It is necessary to explain how this would be achieved through processes such as treatment and release or reuse on-site to demonstrate that the proposed rehabilitation and final land use can be achieved.

The proponent should also clarify the meaning of using the MAW water in the dams for rehabilitation activities as part of mine closure. It is not clear if the intent is to use the remaining water so the dam can be decommissioned and fully rehabilitated, or so the dams can be retained for stock water in the post-mining landform.

The department raised concerns about the potential for the final rehabilitated landform to produce acid or saline drainage as there were no completion criteria for ensuring that runoff and seepage water is of good quality. I note that the EIS has responded with completion criteria stating that runoff and seepage from rehabilitated landform would be of a quality which is unlikely to adversely impact known environmental values.

4.3.3 Conclusions and recommendations

4.3.3.1 Land

The EIS has adequately addressed the TOR in relation to land resources.

The EIS identified the majority of land on the project site as relatively poor agricultural land class 3, suitable for the current land use of low intensity grazing. A small portion of mapped SCL was identified within the mine site but is located outside of the disturbance footprint. I note that it is the proponent's intention to demonstrate that the land is not SCL by lodging a Regional Interests Development Approval under the Regional Planning Interests Regulation 2014.

The EIS has identified that the majority of soils on the project site are highly sodic and dispersive and susceptible to erosion when disturbed.

If the project is allowed to proceed, I recommend that the proponent be required to provide notification to the department's Environmental Management Register for all notifiable activities. Those notifiable activities should be clearly identified and listed in a future mine plan. Any notifiable activity, as defined under Schedule 3 of the EP Act would be a relevant mining activity if it is directly associated with, or supports or facilitates, the mining or processing of coal on the project's tenures.

4.3.3.2 Rehabilitation

I consider the amended EIS has provided reasonably sufficient high-level information to allow the department to adequately assess the mine site rehabilitation outcomes and final landform designs as set out in the TOR and in the department's submission. I am concerned that there is a general lack of detail and supporting evidence on the construction and management of the final landform to ensure it does not pose an ongoing risk to the downstream receiving environment, including the highly sensitive GBRWHA.

I note that the EIS included an updated assessment and description of soil management and rehabilitation methods, including an adequate description of the planned progressive rehabilitation of areas across the mine site, and rehabilitation monitoring and maintenance requirements. It has also revised the PMLU to grazing, supporting the reinstatement of the existing predominant land use on the site. However, I note that this is not reflected in the draft EA conditions proposed in EIS Chapter 23–Draft EA conditions.

Should the project be allowed to proceed, I recommend the finalisation of a certified ESC plan and the mine site water management plan. This would allow the implementation of appropriate overburden management measures, as well as a suitable surface water and groundwater monitoring program to monitor the performance of the proposed mitigation and management measures. Furthermore, any future approval should set out clear and comprehensive rehabilitation requirements and completion criteria for the waste rock stockpiles to ensure they are stable, safe, non-polluting and sustainable for

any proposed land use in the long-term.

4.3.3.3 PRC plan

I note that the proponent has acknowledged the requirement to fully address the MERFP Act and associated rehabilitation reforms. The requirement to develop a PRC plan is a critical element of the Queensland Government's recent Mined Land Rehabilitation reforms. The proponent did not prepare a PRC plan for assessment in the EIS assessment stage. I note that the department requires the proposed PRC plan to be submitted concurrently with any future EA application, should the project be allowed to proceed. I consider that substantially more information would be required for a PRC plan application than what has been included in the EIS. The submitted PRCP application must comply with the information requirements prescribed in the PRCP guideline.

Throughout the EIS the proponent has stated that more detailed studies, assessments, and modelling would be developed with respect to rehabilitation outcomes before mining commences. Note that the department requires this information to be included in any future PRC plan application that would accompany any EA application.

Note that the project would require approval of an EA and a PRCP schedule under the EP Act before the relevant mining leases are granted. An ERC decision would need to be in force for the activity prior to the commencement of mining.

I note and support a return to a low intensity grazing land use for the project as the PMLU.

However, I consider that there is no long-term beneficial use for Dam 1 and that it presents a potential risk to the highly sensitive receiving environment as detailed in section 4.5—Regulated structures. I consider this risk to be too high, particularly if it is not appropriately maintained and monitored post-mine closure. I also note that certainty around the retention of mine infrastructure would be a requirement of the PRC plan and would inform any future ERC calculations.

I would require the proponent to develop and provide a suitable PRC plan that clearly demonstrates how and where mining would be carried out on the project land in a way that minimises any potential impacts on the floodplain and maximises the progressive rehabilitation of land to be safe, structurally stable, would not cause environmental harm, and is able to sustain a PMLU.

I consider the EIS did not provide necessary specific details about the rehabilitation of the diversion drains. The rehabilitation indicator for the diversions is that they meet approved design criteria, however no relevant completion criteria were provided in the EIS. More specific detail and supporting information would be required in the PRC plan about how the drainage paths would be reinstated in the final landform to achieve the rehabilitation goals. This needs to not only include consideration of soil chemical and physical properties, vegetation and hydraulic characteristics as stated by the proponent, but also the sediment transport regime, substrate characteristics and mine site water quality. The department also needs to fully understand the ongoing required monitoring, performance and maintenance requirements for the structures and any residual risk they may pose. These requirements would also need to be costed in relation to the diversion drains in any future ERC calculations.

In order to minimise erosion of slopes I recommend that a revised ESC plan commits to a range of stabilisation techniques, including terracing, geotextile or geo-matting in combination with riprap at drainage points, and with seeding and mulching.

In order to manage the potential risk of contaminant leaching, I would recommend completion criteria are provided for each domain that states runoff and seepage from rehabilitated landforms will be of a quality which is unlikely to adversely impact known environmental values. Additionally, the proponent must ensure that continuous testing of waste rock and rejects to backfill the pits is required as part of the waste rock and coal rejects management plan.

I recommend that an amended ESC plan address long-term impacts post-closure in order to identify potential legacy issues and the effectiveness of proposed mitigation measures. The ESC plan must include a figure with clear identification of topography of the terrain contour lines must be provided.

4.4 Water quality, water resources and flooding

The relevant sections of the EIS used to describe and assess potential impacts to water quality, water resources and flooding were Chapter 9–Surface Water and Chapter 10–Groundwater. Additional information for Surface Water was also sourced from Appendix 5a–Surface Water Quality Technical Report, Appendix 5b–Flood Study and Water Balance, Appendix 5c–Draft Mine Water Management Plan, Appendix 5d–Fluvial Geomorphology, Appendix 5e–Preliminary Dams Consequence Category. Additional information for Groundwater was also sourced from Appendix 6b–Numerical Groundwater Model and Groundwater Assessment Report, Appendix 6c–Groundwater Quality Data Summary, Appendix 6d–Surface Water-Groundwater Interactions Report, Appendix 6e–Groundwater Model Peer Review, Appendix 6f–Transient Electromagnetic Survey Report, Appendix 6g–Core Permeability Tests, and Appendix 6h–Cross Sections of Regolith. Appendix 10f–Receiving Environment Monitoring Program, and Appendix 15a–Draft Erosion and Sediment Control Plan were also referred to.

Section 8.3 Water quality of the TOR required the EIS to: identify the environmental values of surface waters within the project area, downstream and upstream that may be affected by the project; define and/or establish the relevant water quality objectives; detail the chemical, physical and biological characteristics of surface waters and groundwater; describe all potential and/or proposed releases of contaminants; assess the likely impacts of any releases on all relevant environmental values; the assessment should consider the quality and hydrology of receiving waters and the assimilative capacity of the receiving environment; describe how impacts on water quality objectives and environmental values would be avoided or minimised; describe how monitoring would be used to demonstrate that objectives were being assessed, audited and met.

Section 8.4 Water resources of the TOR required the EIS to: describe present and potential users and uses of water in areas potentially affected by the project; provide details of any proposed changes to, or use of, surface water or groundwater; describe all aquifers that would be impacted by the project; detail any significant diversion or interception of overland flow; describe the options for supplying water to the project; describe how ‘make good’ provisions would apply to any water users that may be adversely affected by the project; describe the proposed supply of potable water for the project; describe the practices and procedures that would be used to avoid or minimise impacts on water resources; quantify the volume of all takes from the groundwater system including pit dewatering and assess the impacts on groundwater levels, quality and ecosystem interactions for each aquifer and any implications for surface-groundwater interactions.

Section 8.4.1 The Independent Expert Scientific Committee of the TOR required the EIS to: include a specific section responding to the information requirements contained in the Independent Expert Scientific Committee’s (IESC’s) Information guidelines for proposals relating to the development of coal seam gas and large coal mines where there is a significant impact on water resources (Commonwealth of Australia, 2015).

Section 8.5 Flooding of the TOR required the EIS to: describe current flood risk for a range of annual exceedance probabilities (AEPs) up to the PMF for the project site; use flood modelling to assess how the project may potentially change flooding and run-off characteristics on-site and upstream and downstream of the site; demonstrate how any residual voids and mining features such as waste rock dumps would not impact on the ecological functioning and physical processes of the floodplain and GBR in the longer-term; assess the project’s vulnerability to climate change and possible adaptation strategies.

Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water and Wetland Biodiversity)

The EPP (Water and Wetland Biodiversity) identify environmental values (EVs) and associated water quality objectives (WQOs) for Queensland waters. All Styx Basin fresh and estuarine waters, including the Styx River, groundwaters and wetlands are covered by the *Styx River, Shoalwater Creek and Water Park Creek Basins Environmental Values and Water Quality Objectives: Basins 127, 128 and 129, including all waters of the Styx River, Shoalwater Creek and Water Park basins and adjacent coastal waters* (EHP, 2014).

The WQOs for the Styx River Basin and adjacent coastal waters are applied against the aquatic ecosystem environmental value. The project watercourses are mapped as lowland freshwaters that have

a 'slightly to moderately disturbed' ecosystem type. The Styx River within the Broad Sound estuary is mapped as slightly disturbed.

4.4.1 Assessment

The Surface Water and Groundwater chapters of the EIS describe and assess the existing surface water and groundwater resources likely to be impacted by the proposed project.

4.4.1.1 Water quality

The project area is located within the Styx River basin, an area of approximately 3000km² which contains both major watercourses—Tooloombah Creek and Deep Creek—that flow north to become the Styx River and then to Broad Sound and the GBR. Tooloombah Creek is the watercourse on the western boundary of the mine site and has a catchment size of 366km². Deep Creek is the watercourse on the eastern boundary and has a catchment size of 288km².

The geology of the Styx River catchment is characterised as Holocene sediments in the estuary and in the floodplain of some watercourses and local drainages, with large areas of Quaternary alluvial deposits overlying the early Cretaceous Styx Coal Measures.

Surface water quality

Baseline water quality sampling of the watercourses has been undertaken for the project site from February 2017 to May 2020 and were presented in the EIS. Insufficient sample numbers were available for a baseflow dataset and results were predominantly for no-flow conditions. This led to exceedances from WQOs (which are baseflow only criteria) for dissolved oxygen, ammonia and nitrogen at all sample sites; suspended solids and turbidity at Deep Creek; and total phosphorous in Deep Creek. Deep Creek shows much higher suspended solids and turbidity levels than Tooloombah Creek. Water quality in Tooloombah Creek and Deep Creek was stated to be suitable for stock watering and irrigation purposes.

The EIS reported that for surface water in watercourses at the site, total nitrogen and total phosphorous exceeded guideline values likely indicating the influence of grazing on the site and catchment. Salinity values in Tooloombah Creek were higher than Deep Creek indicating potential differences in catchment mineralogy. The extent of saline influence is considered to reach as far up the Styx River as the confluence of Tooloombah Creek and Deep Creek.

For metals and metalloids, aluminium, copper and zinc were recorded to be consistently high and above the guideline value at all sample sites.

Salinity values in Tooloombah Creek and Deep Creek showed increased levels downstream related to surface water runoff quality from sodic soil and nutrient influence.

Water quality sampling was also undertaken at three large pools in the dry season of 2019 and a pools assessment was undertaken in May and June of 2020 to determine groundwater dependence. Two of the pools on Tooloombah Creek indicated a groundwater reliance sustains them in the dry season.

The installation of a stream gauge in late 2019 into a permanent pool on Tooloombah Creek provided limited data on water levels and salinity. The recorded decline in water levels and higher salinity in the pool in late 2019 was compared against a simple daily water balance to determine evaporation rates. It was determined that there was additional inflow into the pool was likely to be from groundwater.

I note that sediment sampling of the watercourses was not undertaken for the project. Only one estuarine sediment sampling event was undertaken and that was in 2011. I consider that baseline sediment sampling is an important requirement for the water quality monitoring at all locations. I note that sediment quality monitoring, initially focussing on establishing a baseline data set, is now proposed in a Receiving Environment Monitoring Program (REMP). However, I would recommend that the REMP must suitably describe the proposed methods for measuring particle size and suspended sediment concentration for load determination before commencement.

Water management system

The water management system consisting of the dams, levee and sediment basins (referred to as 'environmental dams') is discussed in section 4.5—Regulated structures.

The main source of water supply for the site is proposed to be water harvesting from rainfall and overland flow and groundwater inflows. The water would then be piped to Dam 1, the main water storage for the project. The operational project water management strategy identifies four water types from different sources that would require managing.

- clean water, comprised of surface water runoff from undisturbed catchments would be diverted around the mine site
- mine affected water (MAW), comprised of seepage, groundwater and surface runoff inflows to the open cut mining areas with elevated salinity
- sediment laden water, comprised of surface runoff from non-mining areas with elevated concentrations of suspended sediment
- contaminated water, comprised of water from workshop or fuel storage areas with elevated oil, grease and other contaminants.

Dam 1, sized at 2,783ML at full supply level, would source water from catchment runoff, groundwater and rainfall from dewatering of the open-cut pits, and water captured from sediment dams. No water would be harvested from Tooloombah Creek. Minor amounts of potable water would be supplied, and existing farm dams would provide water for dust suppression in the construction phase.

The highest inflows are expected for stage 5 of operation equating to approximately 2,712ML/yr that would be predominantly sourced from catchment runoff and direct rainfall. I note that despite a revision of the mine site water balance and the provision of a single large Dam 1 there is still an annual shortfall for inflows requiring an external supply. The demand shortfall ranges from a low of 26ML/yr in Stage 2 to a maximum of 91ML/yr in Stage 4.

Contaminated water releases

The controlled release of mine affected water (MAW) would occur from Release Point 1 (RP1) of Dam 1 into a drainage feature referred to as "Surveyor's Creek" that is inundated from Deep Creek at the existing 9.5%AEP.

Controlled releases would occur in accordance with licence conditions. Recommended release rates have been determined by estimated flow rates for Deep Creek. Real-time discharge rates from the stream gauge on Deep Creek located slightly upstream of the end-of-pipe release point would be used to inform release rates and timing. Modelled controlled releases indicate that the EC level in Deep Creek downstream from RP1 would be below the regional WQO for high flows in the Styx River on all release days.

Controlled water release volumes from Dam 1 have been modelled for different climatic scenarios:

- for the very wet climatic conditions, equating to a 1% probability of occurrence in any one year, the maximum annual controlled release would be between 2,790ML/yr and 2,930ML/yr
- for wet climatic conditions, equating to a 10% probability, the predicted annual controlled releases would range between 780ML/yr to 1,430ML/yr
- for median to dry climatic conditions, equating to a 50% probability, no controlled releases would be required.

Modelling indicates that controlled releases would occur more often in the second half of the mine operation (from year 12 to 19) due to an increase in the upstream natural catchment draining to the dam. The EIS indicated that the highest annual average volume of controlled releases from dam 1 (407ML/yr) would occur in year 17.

The probability of controlled releases is in the range of 1-10% in any given year of operation. Without the mine, Deep Creek is ephemeral and flow days occur on average only 24% of the time.

Uncontrolled water release volumes from Dam 1 have been modelled for different climatic scenarios:

- for the very wet climatic conditions, equating to a 1% probability of occurrence in any one year, the maximum annual uncontrolled release would be approximately 2,500ML/yr

- for wet climatic conditions, equating to a 10% probability, the predicted annual uncontrolled release would be approximately 65ML/yr
- for median to dry climatic conditions, equating to a 50% probability, no uncontrolled releases would occur.

I note that the average annual water balance identifies the highest annual average volume of uncontrolled releases from the dams (98ML/yr) occurring at peak production.

Uncontrolled water release volumes from sediment basin's 2D (1 and 2), and Dam 4 to Deep Creek were considered to have only a very small risk—approximately 1%—of overflowing over the life of the project.

Uncontrolled water release volumes from sediment basin 1B were not presented. This sediment basin is proposed to discharge to Tooloombah Creek when it is unable to transfer to Dam 1 in 0.1% AEP events. For any future approval more information is needed on the modelled uncontrolled releases for the different climatic scenarios. Alternative release point options need to be considered. A release point to Tooloombah Creek near the location of sediment basin 1B is likely to have unacceptable impacts to environmental values due to poor quality discharge water.

Flow triggers are ideally calculated from the use of stream gauge flow data. No stream gauges for the local watercourses were in place so no baseline dataset was provided. During the assessment of the project, the department recommended the installation of stream gauges in 2018 but only one stream gauge on Tooloombah Creek and one on Deep Creek were installed in late 2020. Data provided in the amended EIS show only one flow event has been recorded. As a result, flow triggers in the EIS have been based on runoff/ stream flow estimates.

The water quality of uncontrolled releases from Dam 1 were modelled for the first ten years and then after the second ten years of operation. The amended EIS considered that the probability of an uncontrolled release in the first ten years of operation was 1% compared to a 10% chance in the second half of the operational period due to dam volumes. Contaminant levels in Dam 1 water would be higher in the first ten years e.g., maximum EC levels were predicted at 20,000 $\mu\text{S}/\text{cm}$ with median ranges 5,000 to 10,000 $\mu\text{S}/\text{cm}$. Results for pH were not provided

The EIS found that the water released from Dam 4 would need to be treated in accordance with MAW as defined in the model mining EA conditions. Any discharges to Deep Creek would be in accordance with release criteria on the EA.

This aligns with higher treatment efficiency and improved environmental outcomes outlined in the IECA Appendix B Revision 2018 (IECA, 2018). The use of Type A and B basins for dispersive soils allows for assisted settling of sediment as runoff passes through the basin. Type A basins includes an automated chemical dosing system and a decant structure at the outlet.

High efficiency sediment basins are needed in any future EA approval that are designed to capture sediment entrained in runoff by adding clarifying agents (coagulants and flocculants) to increase the settlement of suspended sediments. HES basins use automated (rain or flow activated) dosing to promote sedimentation of colloidal clay particles, and basin design promotes slow flow conditions to prevent re-suspension of settled particles.

I note there is no monitoring or release criteria stipulated for sediment basins. Uncontrolled releases are possible from Dam 1 and sediment basin 1B (as recognised in the ESC plan) and sediment basin 2D will flow into Deep Creek. I also note the conceptual ESC plan indicates that there may be a need to use coagulants to flocculate sediment from sediment treatment basins prior to discharge. Despite the likely need for this, there are no commitments made to treat water released via sediment basins. I would recommend that the proponent ensure that approaches to implement sediment flocculation would be adopted where required (i.e., where water quality in treatment basins exceeds 50 mg/L TSS).

Given the high erosion hazard, sensitivity of the receiving environment, proximity to the Broad Sound Estuary and Great Barrier Reef, I recommend that the release points for sediment basins are included in the draft EA conditions and that release limits for TSS/turbidity, pH and EC are prescribed. There is also a need to provide a commitment to ensure the design of sediment basins would comply with the IECA guidelines. This would require adequate maintenance including desilting and ensuring adequate settling storage and treatment capacity following rainfall events.

Sediment loss from erosive sodic soils due to mining activities may cause environmental harm is a key issue. Results from RUSLE modelling show a high amount of soil loss, approximately 21t/yr/ha for the estimated catchment area. Despite the proposed water management mitigation measures, there remains a risk that releases would not be able to meet the water quality targets as per the Great Barrier Reef 2050 Plan.

I note that a consequential EA application must satisfy the requirements of section 41AA of the EP Reg 2019 for releases of particular contaminants in reef catchments, which comes into force from 1 June 2021. No residual impacts are permitted in Great Barrier Reef catchment waters or State coastal waters as a result of a release of fine sediments from the mining activity and remain or are likely to remain in the water despite mitigation measures for the mining activity. The EA application would need to demonstrate how no residual impacts to the catchment would be achieved for total suspended solids.

I consider that an amended ESC plan must include sediment load monitoring results, and mitigation and management measures to reduce impacts to the receiving environment. This should include monitoring of total suspended solids, turbidity, pH and electrical conductivity in each of the proposed sediment basins to ensure that they are effectively treating and removing suspended sediment. The nutrient and fine sediment loads must be quantified with demonstrated effective management and control measures detailed to prevent potential impacts to the GBRWHA.

Mine affected water

A water balance model was developed to derive the configuration of the water management system. It was used to assess mine affected water (MAW), pit inundation characteristics, controlled and uncontrolled releases, and external water requirements. This model derived water quality concentrations for releases adopting six parameters. EC and sulfate are commonly used to indicate water quality impacts from coal mining. Salinity, as measured by EC would be the target contaminant due to the very high salinity recorded in groundwater and the estimated rates in pit floor, waste rock stockpiles and MIA runoff that comprise MAW. The metal's arsenic, molybdenum, selenium and vanadium were selected based on the waste rock geochemical assessment. However, I note that aluminium was also noted as an expected contaminant of concern in the geochemical assessment and I would recommend that this is added as an additional water quality parameter.

The proponent has classified Dam 4 as a MAW dam as it will collect and contain runoff from the haul road, rail loop and TLF, including product coal stockpile. In contrast, sediment dam 1B and sediment dam 2D (2D1 and 2D2 on both sides of Deep Creek) have been classified as sediment dams, although they will respectively collect and treat runoff from the waste rock stockpile 1, and haul road and TLF. Any overflows from these sediment dams would report to the receiving environment (Deep Creek).

The EIS states that waste rock and coal rejects have the potential to provide pollutants to downstream waterways, through erosion and leaching of contaminants and the waste rock has the potential to be highly sodic, which has potential to cause slaking, be dispersive, and tend to be highly erodible. The proponent should note the definition of MAW provided in the model mining conditions indicates MAW is 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. Erosion and sediment control structures are suitable to treat sediment only and not toxicants that may be generated from the activity. It is recommended that MAW is not treated within sediment dams that have a low frequency threshold for uncontrolled releases.

I would recommend that for sediment dams 1B and 2D, that proposed releases and release points must be regulated by the appropriate authority.

Spillway location of release point 2

I note that one of the two options for locating the spillway from Dam 1—release point (RP2)—is into a patch of semi-evergreen vine thicket on a steep incline to Tooloombah Creek. Controlled and uncontrolled releases would then transport MAW into a series of permanent and semi-permanent pools that are sensitive aquatic habitat. I consider this would result in unacceptable impacts to both a threatened ecological community and to a significant aquatic GDE. I recommend that an alternative spillway location is progressed that pipes water further north to either Tooloombah Creek or Deep Creek.

Sediment dam 1B

The EIS indicates that Environmental Dam 1B is a sediment dam although it captures water from the waste rock stockpile 1. Based on the definition of MAW provided in the model mining conditions, Environmental Dam 1B would capture MAW.

Surface water monitoring program

The department's submission recommended that some current proposed monitoring points be amended and that additional surface water monitoring locations were required in order to better describe and assess the potential impacts of the mining activity on environmental values. The department recommended new downstream monitoring locations located in the vicinity of environmental values on the Styx River and in the Broad Sound estuary adjacent to saltmarsh and mangrove habitat.

A draft REMP was provided in the amended EIS in line with the department's REMP guideline (DES, 2014). The REMP is required to assess the current condition of the receiving environment, and to monitor, identify and describe any adverse impacts to environmental values as a result of the mining activities. However, I consider that certain requirements of the guideline have not been met and would need the following amendments:

- suitably scaled maps should be included showing the location of downstream EVs or sensitive receptors, including wetlands. It is important that the maps show the location of wetland areas and other sensitive receptors in relation to receiving waters
- sufficient details should be provided regarding the spatial location and nature of each EV
- land uses and other point source releases should be described. Point source releases upstream and downstream of the activity within the REMP area that may:
 - influence existing water quality and/or hydrology, and/or
 - contribute to potential cumulative impacts, should be described
- stream flow monitoring should include stream level (height in metres), as well as discharge (volume in cubic metres per second) measurements
- monitoring sites should not be at the confluence of streams to avoid the mixing effects of the different streams
- an additional monitoring point must be included between the confluence of Styx River and Granite Creek and the Broad Sound Estuary
- the maintenance and/or calibration procedures undertaken to ensure the validity of the data collected should be described, and calibration and results data need to be recorded and kept for all field instruments used
- the REMP should describe the actions that will be taken if QA/QC procedures are breached, and any processes that will be used to identify erroneous data and rectify errors.

4.4.1.2 Groundwater quality

Groundwater model and sampling

A number of submissions on the EIS (V1) identified significant shortcomings of the original groundwater model including insufficient on-site hydrological data, and insufficient monitoring bore data and sampling to establish baseline conditions. The department recommended additional baseline data and improvements to the groundwater model in order to increase confidence in the outcomes of the modelling and the resultant scale of likely impacts resulting from the site mining activities.

In response, the proponent, in the amended EIS has presented the results of a comprehensive groundwater sampling program that included the installation of new groundwater monitoring bores from September 2017 until May 2020. A number of the monitoring sites provided more than the recommended 24 samples (two year's data) needed for establishing site-specific background water quality.

I note that the revised numerical groundwater model was guided by the *Australian Groundwater Modelling Guidelines* (Barnett et al. 2012), the IESC Information Guidelines and Explanatory Notes,

previous improvements suggested through external and peer reviews and improvements made by the Queensland Office of Groundwater Impact Assessment, as well as improvements in uncertainty analysis through a combination of statistical methods and scenario-based analysis. The department and DAWE were also consulted on the development of the model.

The revised modelling delineated and parameterised the model into further layers, such as the coal seams were split into five layers, representing three coal seam layers, and two interburden layers; improvements to the model structure with inclusion of historic mine workings to allow historic depressurisation (and recovery) in coal seams at depth; and the inclusion of faulting in the new model, to allow for zones of enhanced or reduced hydraulic conductivity to improve the predictions in the uncertainty analysis.

The Queensland Department for Regional Development, Manufacturing and Water advised that modelling undertaken, and the results provided in in the amended EIS and the proponent's response to the IESC submission was considered adequate.

However, due to the sampling methods adopted for part of the assessment, data quality issues have been identified and caution should be taken in relation to using some of the data collected.

The monitoring bore network may not be sufficient to determine all potential groundwater impacts. I consider there is some inconsistency within the grouping of bores within each unit between the Draft EA Chapter and the supporting documentation. There is high variability in water quality between bores within each unit, which is evident from the combined results. Percentiles for groundwater quality limits were not derived using methods described in DES Guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021).

The current groundwater monitoring network is complex and the proposed use of water levels and water quality to trigger compliance action is not supported. In addition, some monitoring bores that are predicted to be dry within three years of mining commencing have been included as groundwater quality monitoring bores.

Groundwater drawdown impacts

Predicted groundwater drawdown from mining the open-cut pits are likely to impact on groundwater quantity (baseflow) and groundwater quality. Modelling of drawdown was conducted at specific mining stages including up to 500 years after mining.

The predicted drawdown extent in the water table shows the drawdown extends to about 3 km to the north-north-west of the mine site and 3 km to the south-south-east of at the mine site at its maximum extent. Groundwater drawdown in the water table at different project stages are depicted in Groundwater drawdown contours. This figure shows that:

1. Groundwater drawdown of the water table in strata beneath the watercourses predicts the following drawdowns:
 - Tooloombah Creek - a maximum of about 4.7m, exceeding 4.0m drawdown for approximately 700m along the creek, with a lesser level of drawdown extending over a 6.5km reach of the watercourse
 - Deep Creek - a maximum of about 60m, exceeding 50m drawdown for approximately 230m, with the drawdown extending over a 13.7km reach of the watercourse
 - Barrack Creek - a maximum of about 12.6m, exceeding 10m drawdown for approximately 170m of the creek, with the drawdown extending over a 1.9km reach of the watercourse
 - Styx River – no impacts are predicted.
2. The predicted groundwater drawdown extent in the Styx Coal Measures is 0.5m at 5km to the north and 2km to the south of the mine, at its maximum extent.

Mounding of groundwater at full recovery post mining (after 100 years) was also modelled and indicates a maximum level of between 3m-3.8m (above existing levels) would occur, mainly centred in the vicinity of the elevated landforms formed by overburden. Mounding results from enhanced rainfall infiltration and the added head pressure of elevated land. The EIS stated that it would have the effect of 'pushing down' saline groundwater from the deeper levels. It was also predicted to increase baseflow in Tooloombah

Creek and Deep Creek.

Recovery of groundwater levels is predicted to occur around 150 years post-mining with stabilisation of the mounding effect after 250 years post-mining.

Two private landholder bores were identified as likely to be affected by groundwater drawdown by 5m or more. The proponent committed to 'make good' water arrangements such as replacing or deepening the impacted supply bore to be detailed in the consequential UWIR.

Instream baseflows

The modelled baseflow reduction due to the project for Tooloombah Creek is approximately 1L/s/km over a 9.3km reach of the watercourse. The modelled baseflow reduction for Deep Creek is approximately 0.3L/s/km over a 17.5km reach of the watercourse.

Impacts to Groundwater Dependent Ecosystems

The EIS considered that the relatively small drawdown levels predicted for Tooloombah Creek would have minor impacts on aquatic GDEs. Field studies and drilling in the alluvial corridor of the creek have identified low permeability sediments (weathered clay underlying the alluvium) that are considered to reduce the potential for leakage from groundwater stored in the stream banks. Flows of groundwater stored in the creek banks to the creek are predicted to occur for approximately 150 days after drawdown providing a potential safeguard for pools persistence.

The EIS stated that the watercourses are predominantly ephemeral with some permanent or semi-permanent pools persisting throughout the dry season. Creek flows only occur on average 24% of the time and it was considered that recolonisation of pools by aquatic fauna would continue to occur after rain events.

The EIS concluded that 165ha of riparian vegetation along Deep Creek would be subject to minor impacts from the lowering of the water table. Potential impacts to this vegetation community, identified as a terrestrial GDE, include loss of condition and dieback of some large trees that may result in stream bank instability, erosion and consequential impacts to instream aquatic ecology values as well as to the downstream receiving environment through changes in water quality.

Reference sites outside the project area were established that are representative of GDEs in the project impact area. The sampling regime (number of sites and frequency of sampling) needs to reflect ecological value and condition, level of groundwater dependence and level of risk to the GDE.

I note that impacts to GDEs may not be immediate so monitoring data collection would need to continue to provide baseline data for approximately 10 years for the upper reaches of Tooloombah Creek and Deep Creek before OC1 is developed. This decadal period of monitoring would provide valuable information on ecological condition and natural variability that can be incorporated into the GDEMMP. I consider the pre-impact data would provide information that will improve the detection of any changes to GDEs.

I consider that detailed information on predicted drawdown in individual aquifers is needed to assist relevant regulatory agencies determine how to regulate this impact and how the proponent should monitor and manage drawdown for specific aquifers.

Impacts to GDEs are considered in more detail in section 4.6—Flora and Fauna.

Mobilisation of the groundwater (freshwater) – saltwater interface

The EIS (2017) stated that there was a small likelihood of the groundwater in the vicinity of the proposed project to be infiltrated by saltwater due to the drawdown impacts. Reduced groundwater levels were predicted to result in reduced groundwater quality, with salt-water intrusion from saline aquifers associated with the Styx River likely to intercept the freshwater aquifers associated with Tooloombah Creek.

Submissions from the department and DAWE sought further information on the location of the potential interface. Modelled groundwater drawdown contours extend outside of the project area but do not extend as far as the Tooloombah Creek and Deep Creek confluence. The theoretical freshwater-seawater interface surface was stated to be below 280m AHD at this confluence. At the location of the project

monitoring bore near Ogmores Bridge, approximately 4km downstream from the project, the interface surface was predicted to be between -40 to -80m AHD.

DAF in a submission comment expressed concerns regarding potential impacts to fisheries resources including the impacts to the nursery areas of commercial fish species such as barramundi within Tooloombah Creek. It noted in earlier versions of the amended EIS that impacts from drawdown were modelled to manifest to their greatest extent in the post mine closure timeframe (approximately 100 years).

Revised assessments in the amended EIS informed by a new regional groundwater model stated that groundwater drawdown impacts to Tooloombah Creek and Deep Creek would not significantly impact fish habitat values. Observed pools persistence and water quality data indicate that the primary source of baseflow to pools is from bank storage return. Impacts on Tooloombah Creek are expected to be minor due to the predicted drawdown (less than 4m), low permeability sediments reducing the potential for enhanced leakage, flows from bank storage sustaining some pools, and natural resilience of ephemeral pools (particularly on Deep Creek) already experiencing natural drying cycles under baseline conditions.

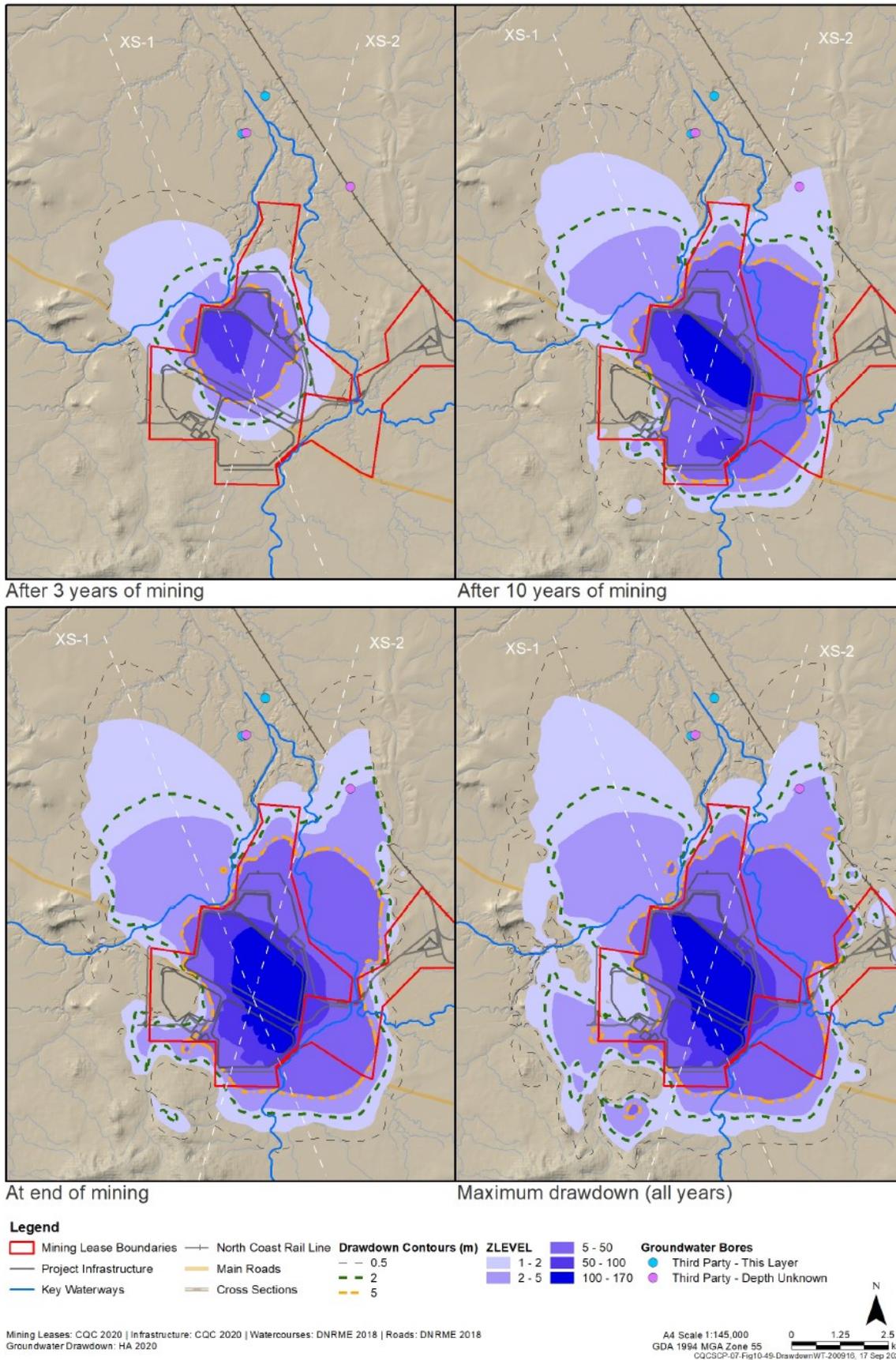


Figure 6 Groundwater drawdown contours

Source: EIS Figure 10-60: Water table drawdown contours

4.4.1.3 Water resources

EIS Chapter 9–Surface Water described the existing surface attributes and values within and surrounding the project, the potential impacts of the project on surface water values and proposed measures to avoid and minimise impacts.

Surface water

The Styx Basin is the catchment area associated with the Styx River. It comprises an area of 3,013 km² and is one of the six catchments of the Fitzroy region. Approximately 80% of the catchment has been converted to agricultural lands. The site and region consist predominantly of highly dispersive and sodic soils that are subject to moderate to severe erosion.

The Tooloombah Creek and Deep Creek sub-catchments comprise an area of 673km² and are the main watercourses adjacent to the project. Tooloombah Creek is the watercourse on the western boundary of the mine site and has a catchment size of 366km². Deep Creek is the watercourse on the eastern boundary and has a catchment size of 288km². Both watercourses are classed as major, non-perennial creeks. These two ephemeral watercourses converge 2.3km downstream of the project site and form the Styx River which discharges to Broad Sound another 8km downstream.

The catchment is considered to be degraded due to historic land clearing and current grazing as the primary land use, with approximately 30% of the catchment estimated to be highly disturbed with severe erosion in parts. The Styx River Basin Environmental Values and Water Quality Objectives (DEHP, 2014) classifies the waterways as moderately disturbed.

Simulated flow duration curves for the two watercourses were calculated at the creek flow gauging stations. They are stated to be ephemeral, flowing for 24% of the year predominantly in the wet season. Storm flows were modelled for less than 1% of flows indicating they persist for one to three days which is sufficient to provide baseflow for one to three months.

When not flowing the watercourses form a series of disconnected pools, some of which are permanent. Large pools exist on Tooloombah Creek. Water quality sampling was undertaken at three large pools in the dry season of 2019 and a pools assessment was undertaken in May and June of 2020 to determine groundwater dependence. Two of the pools on Tooloombah Creek indicated a groundwater reliance sustains them in the dry season.

Barrack Creek joins Deep Creek from the east at the location of the proposed haul road crossing. It is classed as a minor, non-perennial stream with flow observed on only two occasions from 2017 to 2020 at the water monitoring site.

There are a number of minor un-named drainage lines across the project site that feed into both watercourses.

Tooloombah Creek and Deep Creek join at a confluence location approximately 2.3km downstream of the project site. This watercourse becomes the Styx River with the upstream tidal limit of the Styx River Estuary considered to be another 1.4km downstream of the confluence. However, it is recognised that the mapping of highest astronomical tide extends to the confluence. It is also noted that sparse occurrences of Marine Couch, *Sporobolus virginicus*, known to be dependent on saline influence, extend up to the confluence.

See section 4.16.2 existing environmental values of World heritage properties and National heritage places, for a description of the downstream environmental values of Broad Sound.



Figure 7 Styx River – near the confluence of Tooloombah Creek and Deep Creek

Source: Department of Environment and Science

Watercourse diversions

The department raised concerns about the lack of detail around the post closure flooding impacts of the catchment diversion drains and how they would be constructed so that they are safe, stable and non-polluting (mainly due to erosion) during operation and post closure.

I note that the proponent is not proposing to divert any watercourses as defined under the *Water Act 2000*. Instead, the project will include the construction of two catchment diversion drains to divert clean upslope catchment runoff around the mine site. The Northern Catchment diversion drain is temporary and would be mined through after Year 13/14 of operation. The downstream portion of this drain would be rehabilitated as it is not required post-mining. The Southern Catchment diversion drain would commence in Year 10 of operation and remain as a permanent structure to divert local stormwater runoff around the backfilled OC1.

The proponent has stated that detailed flood impact and geomorphological assessments have confirmed that the diversion drains will not have a significant impact on flooding or erosion.

4.4.1.4 Groundwater

A revised Groundwater model informed by results from extensive groundwater monitoring bores both on-site and off-site indicate the general direction of groundwater flow at a catchment scale is toward the Styx River and the coast. The inferred water table surface of the local region generally occurs within 10-20mBGL. Diffuse rainfall recharge occurs across the Styx River catchment with highest rates of recharge from flood events, predominantly in the wet season. Groundwater discharge is via evaporation from shallow water tables, surface water pools—both permanent and semi-permanent—and transpiration from riparian vegetation.

A regional and local conceptual hydrogeological model provided surface and groundwater interactions in proximity to the project area.

The original groundwater conceptualisation and modelling aggregated all Cenozoic sediments into one hydrostratigraphic unit without delineation between the Quaternary (Holocene), Alluvium and Quaternary Pleistocene Alluvium units. A revision provided in the amended EIS has adopted hydrostratigraphic that have determined two alluvial units, two sedimentary rock—Styx Coal Measures relating to upper and

lower strata, and two sedimentary and fractured basement rock–Permian Measures.

Near surface unconfined sand aquifers required more detailed groundwater modelling. Imaging of the groundwater resource up to 80m deep was undertaken using towed transient electromagnetic devices. Resulting electrical conductivity (EC) images depict the proportion of ions in solution of the groundwater and rock at different depths. Dry ground, good aquifers and fresh basement rock show as electrically resistive (low EC) while clays and saline aquifers show as electrically conductive (high EC). The most resistive features were mapped as sand/gravel and sandstone. Extremely conductive data was modelled at 45m deep that was considered to be suggestive of higher salinity or seawater. The EIS considered this result may not be accurately modelled.

The modelled groundwater inflows into the open-cut pits predicts a take of 0.5ML/day for the operational period and a peak of 1.2ML/day in the first six years of operation.

Two types of GDEs existing in the project area and downstream were identified for assessment associated with potential groundwater drawdown impacts:

- aquatic GDEs comprising ecosystems dependent on the surface expression of groundwater e.g., wetlands, river baseflow and estuaries; and
- terrestrial GDEs comprising ecosystems dependent on the subsurface expression of groundwater e.g., riparian vegetation that depends on groundwater fully or on a seasonal or episodic basis to prevent water stress.

The assessment concluded that aquatic GDEs in the project area include groundwater fed pools on both Tooloombah Creek and Deep Creek and the fringing riparian *Melaleuca leucadendra* vegetation.

Terrestrial GDEs were identified as Wetland 1 and riparian vegetation communities along the Tooloombah Creek and Deep Creek corridors where they are accessing groundwater less than 15mbgl and an EC level below 10,000µS/cm. These vegetation communities were stated to be RE 11.3.4, RE 11.3.25, RE 11.3.12, RE 11.3.27 and RE 11.3.35.

While the EIS stated that the stygofauna assessment was in accordance with the *Queensland Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DSITIA 2015), the guideline requires that where the pilot survey confirms the presence of stygofauna, a comprehensive survey is required. The EIS did not undertake further survey work after the original surveys from 2011 and 2012.

Assessment of potential impacts to GDEs is described in section–Flora and fauna & biosecurity.

4.4.1.5 Underground water impact report

The underground water management framework is established under Chapter 3 of the *Water Act 2000* (Water Act). When a mine pit is dewatered or experiences evaporative losses from the open cut, underground water levels decline in the surrounding area potentially affecting any active landholder bores. Under the Water Act, a resource holder is required to prepare an underground water impact report (UWIR) to identify groundwater impacts and set out monitoring and management strategies for the project. Where potential impacts are predicted for landholder bores, a ‘make good’ process must be entered into between the resource holder and the landholder and a ‘make good’ agreement between parties is required. The resource holder is required to provide ‘make good’ measures to bores that are likely to be impaired.

The EIS acknowledges the underground management requirements under Chapter 3 of the Water Act will apply to this project, including requirements to prepare UWIRs, conduct baseline assessments and enter make good agreements as described.

The EIS reported that there were two active landholder groundwater supply bores that may be potentially impacted by groundwater drawdown within the full extent of the mapped drawdown contours.

I recommend that the proponent must complete an initial UWIR before the day the mining tenure holder exercises its underground water rights. The proponent must adhere to their obligations under Chapter 3 of the *Water Act 2000*.

4.4.1.6 IESC advice 2017, 2018 and 2020

The TOR requirement for the EIS to include a specific section responding to the information requirements contained in the IESC's *Information guidelines for proponents preparing coal seam gas and large coal mining development proposals* (Commonwealth of Australia, 2018). The information guideline was addressed variously in different chapters of the EIS. A surface water–IESC compliance checklist and a groundwater–IESC compliance checklist was provided in the EIS.

A joint referral by the former DEE and former EHP to the IESC for advice on the EIS October 2017 was made on 1 November 2017 requesting responses to three specific questions relating to the standard of information provided in the EIS documentation; the key identified risks and impacts of the proposed project to water resources; and whether the measures and commitments proposed in the EIS were appropriate. The IESC provided advice (IESC 2017-091) on the proposed project dated 15 December 2017 that addressed the referral questions.

A second joint referral by DEE and DES to the IESC for advice on the amended EIS (V1) May 2018 was made on 14 June 2018. The request for advice centred on the three key questions raised in the 2017 referral. The IESC reviewed the amended EIS (V1) and provided advice (IESC 2018-094) dated 31 July 2018.

A third and final joint referral by DAWE and the department to the IESC for advice on the amended EIS (v3) October 2020 was made on 27 October 2020. The request for advice asked whether the amended EIS (V3) had adequately addressed the IESC's previous advice and concerns taking account of the revised numerical groundwater model and additional studies; and whether the proposed measures and commitments were appropriate to effectively manage impacts to water resources. The IESC reviewed the amended EIS (October 2020) and provided advice (IESC 2020-118) dated 23 December 2020.

The IESC's findings and the proponent's responses are addressed in section 4.15–MNES.

4.4.1.7 Flooding

The EIS stated that during extreme rainfall events both Tooloombah Creek, Deep Creek and associated tributaries overflow onto the floodplain. Both Tooloombah Creek and Deep Creek are generally steeply incised in the centre and northern parts adjacent to the mine site with slope contours of 5% to 6%.

The middle portion of the catchment that includes the project area is prone to surface erosion and exhibits a number of deeply incised erosional channels resulting from storm events. Heavy rainfall events, such as that experienced with ex-tropical Cyclone Debbie in March 2017 can lead to widespread local flooding. Tooloombah Creek was stated to experience an average of three flood events in a year with a 4.5m water stage height.

Flood modelling

A hydrologic model of the Styx River upstream of Ogmoo was developed to estimate AEP design discharges. As there is no streamflow data for the Styx River catchment there was no calibration against stream gauging stations. Recently installed streamflow gauges on Tooloombah Creek and Deep Creek did not have enough flow data to be used. Instead, estimated peak design discharges used rainfall data validated against the Regional Flood Frequency Estimation method.

A flood impact study used a TUFLOW hydraulic model to assess flooding extents, depths and velocities for a range of AEP events and impacts on beds, banks and floodplains during operational and post-mining flood conditions. The model extends past the upstream boundary of the mining lease area along Tooloombah Creek and Deep Creek and approximately three kilometres downstream of the confluence of Tooloombah Creek and Deep Creek. A climate change scenario adopted a 20% increase in rainfall intensity.

Baseline and operational conditions were modelled for different AEP events. Flood modelling for the first half of the project accounts for the removal of areas that would be used for the open cut pit and catchment diversion on the north side of the Bruce Highway only. It takes into account the construction of the water storage infrastructure, especially Dam 1 that would capture runoff from overbank areas between the watercourses, the northern catchment diversion drain, MIA1, the installation of a haul road to the TLF and three sets of culverts, and the TLF hardstand area. Flood modelling for the second half of

the operation removed the northern drain and included the southern drain. It did not include the coal conveyor culvert.

Flood impacts

Mining activities would capture runoff and reduce flow volumes from Deep Creek to the Tooloombah Creek confluence by approximately 15km² or 1500ha. This is a reduction of approximately 4% of the existing catchment section. The catchment area from the confluence of Deep Creek and Tooloombah Creek to the Ogmore Bridge on the Styx River, a distance of approximately 2.5km would also be reduced by approximately 15km². However, the EIS stated that flows days are not expected to decrease due to wet weather releases from the water management system and the impact is considered negligible.

Increases in flood levels due to the construction of infrastructure and the operation of the water management system are predicted to be minor with a predicted 0.3m increase in flood depth at Deep Creek in the vicinity of the haul road for the 1% AEP event. No increase in flood levels are predicted before the confluence of Tooloombah Creek and Deep Creek. Increases to watercourse flow velocity would be minimal apart from the two locations where the drainage diversions release their concentrated flows to Deep Creek, and the haul road crossing structure at Deep Creek. Flood immunity for the Bruce Highway would be retained. The open cut pits and associated mining infrastructure would not be flooded by the probable maximum flood event. The EIS concluded that the developed flood levels would provide suitable project immunity to the 0.1% AEP event.

A regulated structures assessment was undertaken to determine the risk profile of the water storages and the levee from flood events. A number of structures were classified with a high or significant consequence category for the 'failure to contain – overtopping' scenario and the 'dam break' scenario. This assessment is provided in section 4.5–Regulated structures.

Under the developed scenario, six areas were identified that are likely to experience a slightly higher risk of scour and have a higher potential for geomorphic change due to increased stream velocities in flood events. Management measures were proposed to reduce the risk of erosion including maintenance of vegetation cover and the fortification of rock rip-rap if monitoring indicates there is a heightened risk of significant incision occurring. Two locations in particular were identified as requiring fortification—the release point from Dam 1 to Deep Creek, and the lower 500m of the northern diversion drain.

Minimal detail is provided in the EIS regarding post-closure flooding impacts from diversion drains. The post-mining landform would contain the backfilled pits and the two reformed waste rock stockpiles that represent the largest erosion risk areas if unmitigated.

I note that the flood model did not account for the proposed culvert under the Bruce Highway for the coal conveyor. There is a risk that this may increase flood depth and velocities within the state-controlled corridor.

DTMR also stated that the Flood Study and Site Water Balance Report had not adequately demonstrated that the stormwater and flooding management of the development would ensure that the project would not result in a worsening of flooding and other impacts to the railway corridor and state-controlled road for all relevant design events up to and including the 1% AEP.

Flood mitigation

The levee that is proposed to be 2.3km in length and designed for a 1m freeboard height above the 0.1% AEP event is designed to provide flood protection and containment of contaminated waters on the northern side of the Bruce Highway. The levee and the Dam 1 embankment would extend flood protection around MIA2, CHPP2 and the eastern entrance road. The EIS stated that failure of the levee under flooding conditions would result in the inflow of large volumes of clean water into Dam 1 and OC2 which would likely overwhelm the mine water containment system, impact the mining operations and potentially cause Dam 1 to fail and release its contents into the downstream receiving environment. This scenario is discussed more fully in section 4.5–Regulated structures.

Probable maximum flood event modelling shows that the OC1 processing and waste storage areas (MIA1, CHPP1, Sediment Dam 1C, and WRS1) are outside of the maximum floodplain extent. The EIS also states that there would be suitable flood immunity for the 0.1% AEP event.

The sediment basins are sized to contain the 9.5% AEP, 24 hour rainfall event. They are designed to overflow only during flood events where the receiving waters are flowing.

I note that the EIS recommends ongoing geomorphic monitoring and management measures for the six areas identified as the site will be subject to geomorphic change resulting from the mining activities. However, erosion control measures for these specific areas have not translated into the conceptual ESC plan. Ongoing geomorphic monitoring and management measures should be implemented within an amended ESC plan.

I consider that an updated flood model would need to account for potential flooding to the state-controlled corridor from construction of the approximately 4.5m wide culvert. Any works must not interfere with or cause damage to the existing stormwater drainage on the state-controlled corridor. DTMR have provided recommended requirements regarding this issue in Appendix 5.

Realigned drainage paths would divert local runoff, including any breakouts from Deep Creek, from entering the post-mining landforms and divert it to both watercourses. Reinstated drainage paths would need to be designed to convey runoff water across the site in a low velocity non-erosive manner and to ensure that fish passage is maintained in the creek crossings.

4.4.2 Conclusions and recommendations

4.4.2.1 Water quality

The project, as proposed, is located on a floodplain subject to large flood events. The EIS has stated that controlled and uncontrolled releases of mine affected water and runoff will not significantly impact on downstream water quality, over the life of the mine. However, overtime, and with successive floods there is a high risk that dissolved, and sediment-bound contaminants from the mine may move downstream to the nearby Styx River and to the GBRWHA.

I consider that the additional work done in the revised EISs in response to submissions and particularly in response to the IESC recommendations has increased my confidence in the groundwater model. This is due to the additional input data, expansion of the bore network, and better characterisation of the hydrogeology following additional field work. However, a number of aspects of the groundwater model and the groundwater monitoring network, are inadequate:

- The monitoring network for groundwater quality needs to be simplified and must address potential contaminant sources with pathways, and up-flow and down-flow monitoring locations identified for all potential contaminant sources
- A re-run of the groundwater model is needed to achieve a higher confidence level
- Raw data was not provided so the department was unable to examine whether the dataset used to determine site specific values in Table E2 of Chapter 23—Draft EA Conditions, and the data used to calculate the 80th/95th percentile were appropriate (to determine the temporal variability in groundwater quality)
- An adequate map of the groundwater monitoring network in relation to the proposed mining activities and the changes in levels and drawdown contours for each aquifer is required.

I note additional technical studies provided in the amended EIS included revised hydrological (surface water) modelling, a regional groundwater model, field studies on GDEs, the geological properties of the alluvium of Tooloombah Creek and Deep Creek, a sediment budget for the site and upstream catchment, a fluvial geomorphology study, and a surface water-groundwater interactions study.

I have considered the extensive material provided in the amended EIS, review comments from my department, review comments from DNRME, and the review comments provided by DAWE, the IESC and the GBRMPA. I consider that a number of significant risks to the GBRWHA and the National Heritage Place while better understood, have not been adequately addressed. In addition, due to the ecological significance of the values downstream of the mine, and the lack of any buffer distance between the mine and the Broad Sound, the consequences of an event impacting these values is significant].

While draft water quality release limits have been provided, there remains uncertainty that appropriate

standards can be met under all climatic and hydrological conditions. The description of the proposed water management system is largely adequate, however there are limited design details for the dams and levee. Also, a failure impact assessment and certified CCAs for each structure have not been provided.

I note that sediment basin 1B is proposed to discharge to Tooloombah Creek when it is unable to transfer to Dam 1 in 0.1% AEP events. Further information on the modelled uncontrolled releases for the different climatic scenarios is needed to adequately determine the acceptability of impacts of these events. Also, alternative release point options should have been identified and assessed. A release point to Tooloombah Creek near the location of sediment basin 1B is likely to have unacceptable impacts to environmental values due to the adverse water quality, steepness of the site and high erodibility of the banks and bed of the creek.

I also note that sediment dam 1B and sediment dam 2D (2D1 and 2D2 on both sides of Deep Creek) have been classified as sediment dams, although they would respectively collect and treat runoff from the waste rock stockpile 1, and haul road and TLF. Any overflows from these sediment dams would report to the receiving environment (Deep Creek). However, the model mining conditions definition of MAW clearly identifies that this runoff should be treated as MAW. MAW should not be treated via sediment dams.

4.4.2.2 Water resources

The sensitivity of the receiving environment to potential impacts is considered of paramount importance. The advice provided by the IESC and DAWE and the GBRMPA has been valuable in understanding the potential risks of the project.

Commitments are made in the EIS to provide offsets for the possible loss of 165ha of GDE vegetation. I consider that a precautionary approach is appropriate for the level of risk this presents.

I support the EIS recommendations for additional field studies to confirm initial results and conceptualisations regarding surface water-groundwater interactions and their relationship to GDEs. The development of local-scale, cross-section models to support the groundwater impact assessment and adaptive management process are also supported.

I consider that the EIS did not adequately address a range of departmental submissions relating to surface water and groundwater quality. A number of the outstanding issues are committed to be addressed via planned field studies and the provision of specific management plans by the proponent prior to the commencement of works. It is unclear whether any residual environmental risk could be adequately addressed with conservative and robust conditioning.

4.4.2.3 IESC advice

I have reviewed the IESC advice and have considered this advice in the assessment of the EIS material. I consider the latest IESC advice highlights the potential unmitigated risks of the project to downstream environmental values.

4.4.2.4 Flooding

I consider that the EIS has adequately addressed the flooding section of the TOR.

I consider that the six areas identified to experience higher risk of scour and have a higher potential for geomorphic change have not been fully addressed. A commitment to ongoing monitoring and specific management measures to reduce the risk of erosion was made in the amended EIS. Two locations in particular were identified as requiring fortification—the release point (RP1) from Dam 1 to Deep Creek, and the lower 500m of the northern diversion drain. Details of how these risks at the sites would be managed, were not provided.

I also note that DTMR were critical of the flood modelling and consider that an updated flood model should have been provided to adequately account for potential flooding to the state-controlled road and railway corridor.

4.5 Regulated structures

The key EIS documents used to describe and assess regulated structures include Chapter 9–Surface Water, Chapter 10–Groundwater, Chapter 21–Hazard and Risk, Chapter 23–Draft EA conditions, Appendix A5E–Preliminary Dams Consequence Category Assessment, Appendix A5c–Draft Mine Water Management Plan, Appendix 12–draft EMP, Appendix 14–Socio-Economic, Appendix 15a–draft Erosion and Sediment Control Plan and Appendix 16_2– Styx Mine Dam #1 Civil Drawings 200805.

Section 9.4 of the TOR required the EIS to conduct impact assessments on proposed regulated structures in accordance with departmental guidelines; describe the purpose and location of all proposed dams and levees; undertake a consequence category assessment for structures proposed to store potentially hazardous materials; and to describe how risks relating to storage failure, seepage or overtopping would be avoided, minimised or mitigated.

4.5.1 Assessment

The EIS provided details about the structures which are dams proposed for the project, including location, storage volumes and area, as well as the water management rules for moving water between the dams. A total of six dams are proposed, three dams are for the storage of mine affected water (MAW) (Dam 1, Dam 4 and Environmental Dam 1C) and three dams are for capture and storage of sediment affected runoff (referred to in the EIS as Environmental Dams 1B, 2D1 and 2D2).

The largest dam is Dam 1 for MAW storage, with a proposed designed full supply storage capacity of approximately 2,783ML and covering an area of approximately 128ha. The wall (embankment) height of Dam 1 is proposed to be generally less than 10m although detailed design would confirm this. Mine pits would dewater into Dam 1. A release structure would allow for controlled releases from Dam 1 into Deep Creek during wet conditions. Dam 1 also incorporates a spillway on its western side (with a possible alternative spillway location identified on the northern wall) for overflows into Tooloombah Creek with capacity to pass a 0.1% AEP event.

All other dams would be managed to operate empty and to dewater into Dam 1, through a pump and pipe system, with uncontrolled releases into Deep Creek and Tooloombah Creek via spillways during extreme rainfall events. Dam 4 (MAW storage) is also proposed to have an authorised release point into a Deep Creek tributary although it would be managed to preferentially transfer water to Dam 1. The sediment dams (Environmental Dams 1B, 2D1 and 2D2) would also include release points with releases to receiving waters to be managed under the site Erosion and Sediment Control Plan, in the event that water cannot be transferred to Dam 1.

Dam 1 is the primary water storage and source for site water needs, with the remaining dams having smaller storage capacities ranging from approximately 24–96ML. Concept drawings and design details were not provided in the EIS for these smaller dams.

The embankment for Dam 1 is proposed to be extended 2.3km west and south to form a levee adjacent to OC2 and between the pit and Tooloombah Creek. Crest level of the levee will be above 0.1% AEP.

The levee was characterised in the EIS as a flood protection structure, protecting project components on the north side of the Bruce Highway, including the MIA and CHPP 2 although it was also described as providing containment for contaminated water from the mine activities. The levee embankment height would also be generally less than 10m above ground level but above 0.1% AEP level. Preliminary design drawings in the EIS provide specifications for the Dam 1 and levee embankments' construction materials and batters.

The receiving environment for uncontrolled releases was also described, including receiving waterways, groundwater, MSES and MNES and surface water users. Habitable dwellings near the project were mapped, with the township of Ogmore, population of 105 people located approximately 5km downstream of the project site. The EIS was not able to definitively assess the risk of inundation to Ogmore as a result of dam failure in the absence of a dam break study.

Preliminary consequence category assessments (CCA) were undertaken for each of three failure events (seepage, overtopping and dam break) for all proposed dams and the levee in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (the Manual) (DES, 2016a). The results from the final CCA will determine which of the structures are 'regulated

structures' and inform the design requirements and hydraulic performance criteria for the dams and levee.

The preliminary CCA assigned 'high' or 'significant' consequence categories to four of the six dams (Dam 1, Dam 4, Environmental Dams 1B and 1C) and the levee, which would therefore be regulated structures as defined in the Manual. The potential harm to humans in the event of a dam break (failure) for Dam 1 was unknown in the absence of a dam break assessment, however Dam 1 scored 'high' for general environmental harm so would be subject to the strictest design criteria under the Manual. The levee as a regulated structure would be required to have a crest elevation higher than the peak 0.1% AEP flood level at the site.

The likelihood of levee failure was not provided, but the magnitude of impact to the downstream environment is considered to be catastrophic. Failure of the levee under flooding conditions would result in a large volume of flood water flowing into both Dam 1 and the northern open-cut mine pit (OC2). The EIS stated that this would overwhelm the mine water containment system, impact the mining operations and potentially result in the failure of the Dam 1 embankment. This would then release its contents, including MAW with likely elevated salinity, into the downstream environment. The preliminary CCA determined the consequence category to be significant relating to all three categories of harm: harm to humans, general environmental harm, and general economic loss or property damage.

A failure impact assessment (FIA) was not undertaken for the project as the dam embankments were not expected to exceed 10m height and therefore would not be considered as 'referrable' dams, requiring this assessment. The EIS did acknowledge this requirement, should final design embankment heights exceed 10m. Drawings for the dam embankment show full supply level (FSL) in places greater than 10m above natural surface level which suggests that there is a strong possibility that the embankment may exceed 10m height and the structure would therefore require an FIA. However, it was not clear whether the requirement for an FIA would be applicable to the project dams. This assessment is performed under the *Water Supply (Safety and Reliability) Act 2008* and the EIS states that regulated dams for the project would be exempt from the requirements of this Act. A dam break study would therefore be more appropriate.

As per the guideline on *Structures which are dams or levees constructed as part of environmentally relevant activities* (DES 2019), targeted consultation with potential affected persons (e.g., Ogmoo residents) should occur prior to the construction of a regulated dam and emergency action plans put in place prior to operation of the dam. The EIS does not provide information on targeted consultation with potential affected persons in relation to the regulated structures that would be constructed on the project site.

DTMR in its review of the amended EIS stated that the potential for dam failure had not considered potential impacts on state-controlled transport infrastructure and corridors (the state-controlled road and railway corridors). DTMR requires that the project ensures there would be no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from dam failure, or the risk of dam failure, for the life of the development.

The TOR also required information to be provided on how risks from dam and levee failure, seepage and overtopping can be avoided, minimised or mitigated.

The design for Dam 1 presented in the EIS incorporates a spillway with capacity to pass the 0.1% AEP event for the site in accordance with the Manual's minimum hydraulic design criteria. The EIS states that spillways are provided on all dams and all would have the capacity to pass the 0.1% AEP event to minimise the risk of dam break or failure.

Seepage impacts from the smaller dams were evaluated in the EIS as minor due to the small footprint, low height and dilution capacity of receiving groundwaters. There was limited information on mitigation of seepage through design requirements, such as those set out in the Manual, although the Preliminary design drawings in the EIS provide specifications for Dam 1 embankment construction materials, including permeability and dispersion characteristics. There are no criteria in the drawings for the dam floor materials.

Monitoring for seepage at the dam toe and in receiving waters (bores) is proposed in the groundwater monitoring and management plan. However, the details of the seepage detection and management provisions and procedures are deferred to the detailed design phase for the dams. These would need to

be designed and incorporated in accordance with the design criteria for 'failure to contain' scenarios in the Manual. The draft mine water management plan does not provide any details of monitoring or mitigation for seepage.

In terms of overtopping, Dam 1 and Dam 4 have the capacity to make controlled releases to minimise the risk of uncontrolled discharges. All dams except Dam 1 would be operated empty, with waters transferred to Dam 1 for storage, in order to reduce the risk of overtopping. In addition, Environmental Dam 1C which also contains MAW would be designed with additional storage allowance to contain inflows, and if at full capacity, would overflow into Dam 1 as opposed to into receiving waters.

The material proposed to be used for levee construction must adhere to technical design specifications with the objective to mitigate the risk of failure. The EIS did not provide adequate detail on the proposed construction material of the water storages and levee or where it would be sourced from. The EIS did not provide a discussion on the potential risks to the integrity of the embankment walls and levee such as piping through the embankment or foundation, desiccation cracking or erosion/ scour.

It is noted that the soils on the majority of the project area are Sodosols described as sodic, dispersible surface soils with high erodibility. Where dispersive soils are proposed to be used, they must be subject to conservative erosion and control measures stipulated in an updated ESCP which may include the need for construction to use non-dispersive material.

Engineering and Industry standards require that embankment walls and the levee must be constructed from good quality, non-dispersive, impervious, well-graded sandy/ silty clay material. Specifications for grading (soil particle sizing), Atterberg limits (e.g., liquid limits), and Emerson class, and construction controls for compaction and treatment of dispersive soils were not discussed. Constructing the embankment walls and levee using these specifications and practices is recommended to significantly reduce the risks of piping and erosion and ultimately failure of the regulated structures on the mine site.

4.5.2 Conclusions and recommendations

The EIS has addressed the TOR requirement for describing the purpose of all dams and levees proposed for the project. Preliminary CCAs have been undertaken, identifying five regulated structures.

The uncertainty over the final designs and in particular over the final embankment heights have meant that a dam break study on downstream affected persons was not provided in the EIS. I note with concern that the magnitude of impact to the downstream environment from levee failure could be potentially catastrophic.

I note that DTMR, in providing a number of significant recommendations and considers that the information presented in the EIS is lacking in a number of areas. These recommendations are provided in Appendix 5. In addition, the recommendations include a requirement for an RPEQ certified operational management plan, including an emergency action plan that deals with procedures to protect the railway corridor and state-controlled road in the event of dam failure and other incidents.

Design details provided in the EIS for the dams or levee lacked detail. Given the volume of water to be stored, the proximity of adjacent and downstream sensitive receptors and the sodic nature of the soils at the site, it is critical that the dams and levee embankments are designed and constructed to minimise the risk of uncontrolled releases and contamination from and failure of these structures. In particular, I consider that the use of site materials may not be appropriate for construction. If site materials are to be used these should be certified as part of the design plan as being fit for purpose.

I consider that a dam break study is warranted in order to properly assess, in detail, the potential impacts and risk of those impacts on downstream environments and potentially affected persons from the project's water management system. This is based on:

- the proximity of Ogmore
- the potential for a chain of events failure with failure of the levee causing large volumes of water to flow into Dam 1 and potentially cause Dam 1 to fail
- due to the relatively short distance to Broad Sound and other MNES and MSES values, opportunities to control and mitigate any failures are severely limited

- the height of the embankment for Dam 1 and the levee
- the volume of water stored.

I recommend that a dam break study is undertaken, that includes:

- modelling and assessment of the chain of events failure
- that appropriate consultation with potentially affected persons and emergency planning is implemented and included in the study
- that the results are reported on to the department prior to commencement of construction.

4.6 Flora and fauna, offsets and biosecurity

EIS documents used to describe and assess flora and fauna and offsets include Chapter 14–Terrestrial Ecology, Chapter 15–Aquatic and Marine Ecology and Chapter 20–Offsite Water Storage Facility and Associated Pipeline. Appendices A10–Offset Strategy; A20–Terrestrial Ecology Technical Report; A28–Aquatic Ecology Assessment and Stygofauna Pilot Study; and A33–Offsite Water Storage Facility and the Associated Infrastructure Technical Ecology Report also dealt with impacts on flora and fauna.

EIS documents used to describe and assess biosecurity include Chapter 17–Biosecurity.

This section of the assessment report assesses project impacts on terrestrial, aquatic and marine ecology. It focuses on the Queensland regulatory requirements and matters of state environmental significance (MSES). Environmental offsets for MSES that are also MNES are described and assessed in section 4.16–MNES.

The TOR required the EIS to describe the biodiversity and existing environmental values of the project area, the effectiveness of any proposed avoidance, mitigation or management measures and propose suitable offsets for any significant residual impacts (SRIs) consistent with the Queensland Government and Commonwealth’s environmental offsets framework. It also required the EIS to identify and adequately assess biosecurity matters, including detailing measures to effectively remove, control and limit the spread of pests and weeds on the proposed project area.

4.6.1 Assessment – existing environmental values

The following section is a summary of the occurrence of environmental values based on database searches, field surveys and habitat assessments as documented in the EIS. A number of site surveys and studies were undertaken as part of the EIS process to gather data about ecological and flora and fauna values.

The EIS identified that the proposed mining area is mapped as being within the Marlborough Plains subregion of the Brigalow Belt North bioregion. The majority of the project area consists of non-remnant grazing lands; remnant woodland community dominated by RE 11.4.2 and riparian watercourse vegetation RE 11.3.25.

4.6.1.1 Environmentally sensitive areas

The nearest formally recognised environmentally sensitive area (ESA) is Tooloombah Creek Conservation Park, a 261ha area of remnant vegetation, located approximately one kilometre to the northwest of the project site.

4.6.1.2 High Ecological Value waters/wetlands

No high ecological value waters or wetlands listed under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 are mapped or ground-truthed within the project area. Note, however, that five wetlands are mapped on the site as either high ecological significance (HES) or general ecological significance (GES).

4.6.1.3 Vegetation communities

The EIS identified 11 regional ecosystems (REs) within the project area based on Queensland Regional Ecosystem (RE) mapping (version 11) and confirmed by field surveys undertaken in 2018 and 2019. A

ground-truthing survey commissioned by the proponent in 2017 resulted in regional ecosystem mapping that differed from State RE mapping. The Queensland Herbarium reviewed proposed changes to the RE mapping and approved a new version of RE mapping for the area which was used in the final EIS assessment.

The majority of the remnant vegetation within the project area (approximately 57%) consists of Narrow-leaved ironbark, *Eucalyptus crebra*, and poplar box, *E. populnea*, woodland mapped as RE 11.4.2. Most REs in the project area are listed as 'least concern' under the *Vegetation Management Act 1999* (VM Act) and 'no concern at present' under the Queensland Herbarium's biodiversity status. Ground-truthed REs identified in the project area are shown in Table 4 Regional ecosystems ground-truthed within the project area.

Table 4 Regional ecosystems ground-truthed within the project area

Regional ecosystem	Description	VM Act status	Biodiversity status*	Extent (ha)
RE 11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on Cainozoic alluvial plains and terraces, occurring on a variety of soils	Least concern	No concern at present	18.92
RE 11.3.11	Semi-evergreen vine thicket or semi-deciduous notophyll rainforest occurring on Cainozoic alluvial plains	Endangered	Endangered	0.001
RE 11.3.12	<i>Melaleuca viridiflora</i> , <i>M. argentea</i> +/- <i>M. dealbata</i> woodland on older alluvial plains on strongly duplex clay soils with restricted drainage	Least concern	No concern at present	4.18
RE 11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland to open forest occurring fringing drainage lines and banks of major rivers	Least concern	No concern at present	46.02
RE 11.3.27	Freshwater wetlands. Vegetation is variable including open water with or without aquatic species and fringing sedgeland and eucalypt woodlands. Occurs in a variety of situations including lakes, billabongs, oxbows and depressions on floodplains.	Least concern	Of concern	3.40
RE 11.3.35	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland occurring on Cainozoic alluvial plains	Least concern	Of concern	19.72
RE 11.4.2	<i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. grassy or shrubby woodland on Cainozoic clay plains	Least concern	No concern at present	192.36
RE 11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains including weathered basalt	Endangered	Endangered	3.91
RE 11.5.8	<i>Melaleuca</i> spp., <i>Eucalyptus crebra</i> , <i>Corymbia intermedia</i> woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	No concern at present	33.51
RE 11.11.1	<i>Eucalyptus crebra</i> or tall woodland often with <i>Acacia rhodoxylon</i> , occurring on sub-coastal hills and ranges on old sedimentary rocks with varying degrees of metamorphism and folding	Least concern	No concern at present	6.42

RE 11.11.15	<i>Eucalyptus crebra</i> woodland that occurs on undulating rises and low hills on deformed and metamorphosed sediments and interbedded volcanics	Least concern	No concern at present	10.22
Non-remnant vegetation	Vegetation that is not remnant vegetation.	–	–	2,322.51
Total area				2,661.16

*conservation status used for assessments under the EP Act.

Adapted from Table 14.4 of the EIS.

The ground-truthed REs are depicted in Ground-truthed regional ecosystems.

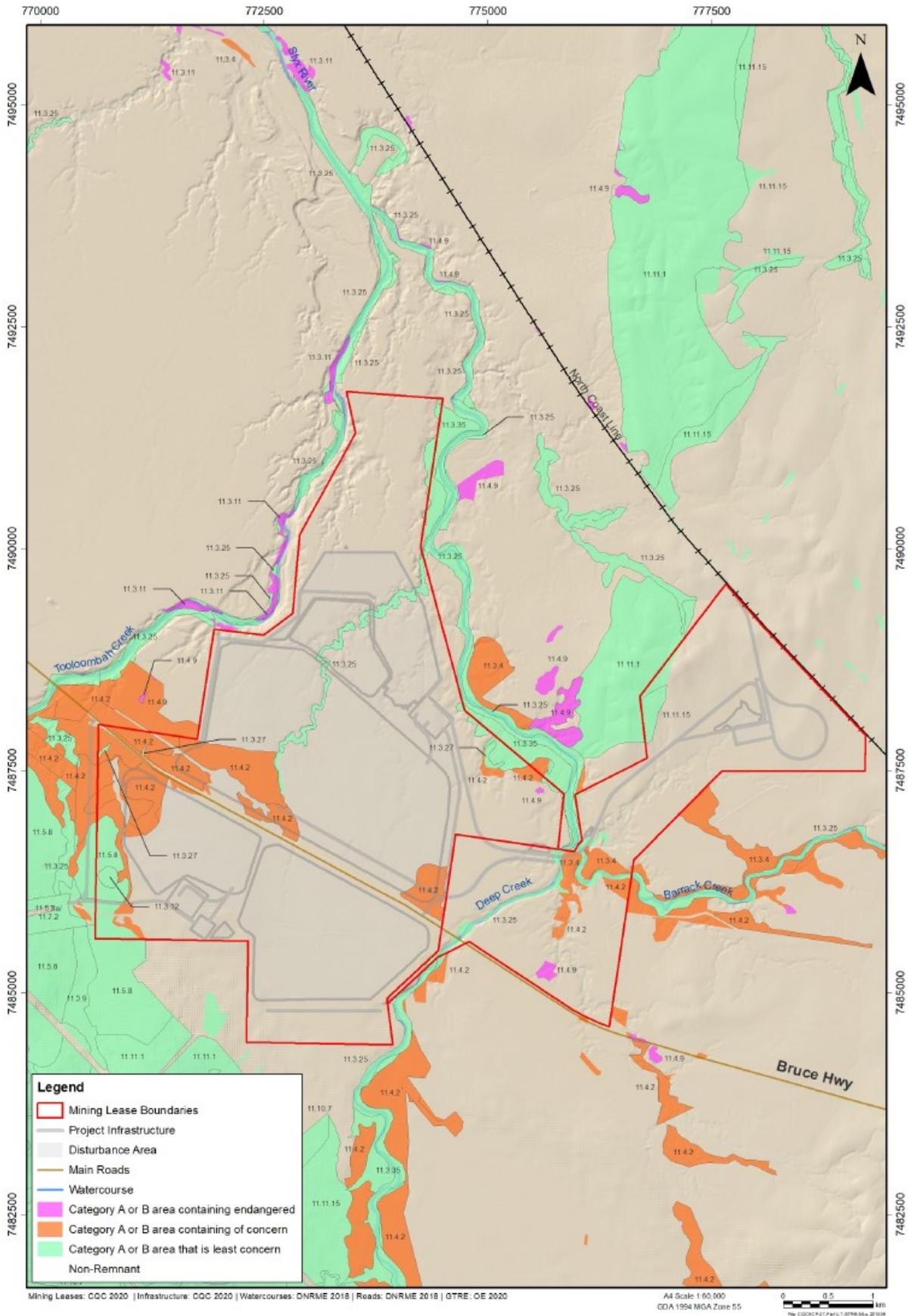


Figure 8 Ground-truthed regional ecosystems

Source: AEIS Figure 14-7: Ground-truthed regional ecosystems

4.6.1.4 Threatened ecological communities

Two terrestrial threatened ecological communities (TEC) are located within the project area in small and narrow patches.

There are two isolated remnant patches of the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC within the project site, a patch of 0.54ha within MLA 80187 and a patch of 3.37ha within MLA 700022. These patches are outside of the disturbance footprint of the project. Brigalow regrowth on the site has been extensively cleared over the last 15 years and has been subject to grazing.

The Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC in the study area is highly fragmented and exists mostly in relatively small patches along the watercourses with only one minor patch equating to less than one hectare within the project area. The total patch size of this TEC, mapped as RE 11.3.11, is 1.14ha.

Further assessment of these TECs is provided in section 4.16–MNES of this report.

4.6.1.5 Terrestrial flora

No threatened flora species listed under the *Nature Conservation Act 1992* (NC Act) were found within the project area during the field surveys across all survey periods. Desktop records of six threatened flora species were considered to have a potential likelihood of occurrence. No 'high risk' areas were mapped under the flora survey trigger map.

4.6.1.6 Marine flora

Marine plants such as marine couch, saltmarsh and mangrove species have been recorded in the Styx River and in Broad Sound, but no surveys were undertaken for the EIS. The EIS stated that marine couch has been recorded approximately 2.5km downstream of the project, saltmarsh is located 14km downstream, and mangroves are located 21km downstream.

4.6.1.7 Terrestrial fauna

Terrestrial ecology field surveys undertaken for the EIS project span the period 2017 to 2019. Some earlier studies prior to the EIS process were undertaken in 2011 and 2012. Combining the results from all field surveys of the study area identifies a total of 264 native terrestrial species comprising 170 birds, 40 mammals, 36 reptiles and 18 frogs. The amended EIS considers the total an overestimate of the species existing on the project site due to the results including surveys conducted in the wider underlying mining tenement EPC1029.

Desktop assessment identified 82 listed threatened and/ or migratory fauna species potentially occurring within the project area, near surrounds (within three kilometres of the project area) or downstream in the Styx River Estuary and Broad Sound.

Based on the results of field surveys and habitat suitability assessments, the amended EIS concluded that the following NC Act listed threatened species are either known or likely to occur within the project site and near surrounds:

Known:

- Latham's snipe, *Gallinago hardwickii* – special least concern
- Oriental cuckoo, *Cuculus optatus* – special least concern
- Squatter pigeon – (southern subspecies) *Geophaps scripta scripta* – vulnerable
- White-throated needletail, *Hirundapus caudacutus* – vulnerable
- Greater glider, *Petauroides volans* – vulnerable
- Koala *Phascolarctos cinereous* – vulnerable
- Short-beaked echidna, *Tachyglossus aculeatus* – special least concern

Likely to occur:

- Ornamental snake *Dennisonia maculata* – vulnerable
- Fork-tailed swift, *Apus pacificus* –special least concern
- Glossy ibis, *Plegadis falcinellus* – special least concern
- Rufous fantail, *Rhipidura rufifrons* – special least concern.

4.6.1.8 Aquatic fauna

Two comprehensive freshwater fauna field surveys (wet season 2011 and dry season 2017) and two targeted (freshwater turtle) fauna surveys (both in the dry season 2017) were undertaken for the EIS. In addition, benthic fauna field surveys were conducted in the Styx River estuary (and two adjacent estuaries to the north) in November 2011. Desktop assessment identified records of nine threatened marine fauna within a 50km radius of the site.

Three species of freshwater turtles, Krefft's river turtle, *Emydura krefftii*, the eastern snake-necked turtle, *Chelodina longicollis*, and the saw-shelled turtle, *Wollumbinia latisternum*, were recorded, with turtles most abundant in large pools on Tooloombah Creek. Evidence of estuarine crocodile slides were observed at two Styx River survey sites. No aquatic or marine mammals were observed adjacent to the project site.

A total of 28 common native fish species were collected in the 2011 survey. Diversity was highest at one survey site on Tooloombah Creek where 15 species were recorded. Two commercially targeted fish taxa were recorded during 2011 field surveys – barramundi, *Lates calcarifer*, and the sea mullet, *Mugil cephalus*. 51 individuals of barramundi were caught representing a range of size classes. It was concluded that barramundi use the waters of Tooloombah Creek in the vicinity of the mine as a nursery area for juvenile barramundi.

4.6.1.9 Marine fauna

No marine fauna surveys were conducted for the EIS. The EIS stated there are records of several MNES marine fauna from the wider Broad Sound region including:

- humpback whale, *Megaptera novaeangliae*–vulnerable
- green turtle, *Chelonia mydas*–vulnerable
- flatback turtle, *Natator depressus*–vulnerable
- dugong, *Dugong dugon*–vulnerable
- Australian hump-back dolphin, *Sousa sahalensis*–vulnerable
- Australian snubfin dolphin, *Orcaella heinsohni*–vulnerable

All were considered unlikely to occur at the project site and near surrounds, while the green turtle was the only one of these species also recorded from within the Styx River estuary. These are all listed migratory species and are assessed in section 4.16.4.

4.6.1.10 Habitat values and connectivity

The project area is located in a predominantly disturbed part of the bioregion where habitat fragmentation is an ongoing threat to most species. The native Poplar gum, *E. platyphylla*, ghost gum *Corymbia aparrerinja*, forest red gum, *E. tereticornis*, and paperbarks, *Melaleuca* spp. vegetation is widespread across lowland alluvial floodplains and is subject to periodic wet season flooding. A significant environmental pressure on regional wildlife habitat is habitat degradation from cattle grazing.

Wetlands and farm dams currently provide artificial wetland features for waterbirds and a stopover point for migratory birds. 15 individuals of the migratory bird species Latham's snipe, *Gallinago hardwickii*, were recorded using a farm dam. The endangered waterbird, the Australian painted snipe, *Rostratula australis*, is likely to occur and has been recorded in the Broad Sound region. Watercourses, palustrine wetlands and artificial wetland features provide important resources for native fauna, particularly in the late dry season. They also have the potential to contain ecological values, including refugia for some native fish habitat, for the birds' persistence in a dry environment and the provision of system recharge

after drought.

The project area is within the Marlborough Downs subregion of the Brigalow Belt (North) bioregion with a small region on the west within the Nebo-Connors Ranges subregion. The majority of the remnant vegetation in the project area is mapped as having regional biodiversity significance under the BRB Biodiversity Planning Assessment (BPA) (DES, 2018c). The BPA identifies the Torilla Plain and Broad Sound as an area of special biodiversity value for the nationally important wetland system and intact marine plain that supports a variety of ecosystem types. The BPA also identifies a second area of special biodiversity value known as the Southern Connors / Broad Sound Range. It states that this area has a high density of hollow-bearing trees used by the greater glider, *Petauroides volans*, and the yellow-bellied glider, *Petaurus australis*. The BPA states that threats, such as habitat loss, fragmentation, inappropriate fire regimes and feral plants and animals continue to erode the biodiversity values of the bioregion.

The EIS undertook an analysis of the proposed vegetation clearing on local and regional connectivity using the State's Landscape Habitat Connectivity and Fragmentation Tool. The Tool is used for calculating whether a project's clearing is considered to be a significant residual impact under the State's environmental offsets framework. The result of the analysis using the Tool is that local connectivity (within 5km of the proposed project) and regional connectivity (within 20km of the proposed project) would not be significantly impacted.

4.6.1.11 Watercourses

The project is located within the Styx Basin, a small coastal basin of approximately 3,000km² that discharges to Broad Sound via the Styx River. Tooloombah Creek is the watercourse on the western boundary of the mine site and has a catchment size of 366km². Deep Creek is the watercourse on the eastern boundary and has a catchment size of 288km². Both watercourses are classed as major, non-perennial creeks. The catchment is considered to be degraded due to historic land clearing and current grazing as the primary land use, with approximately 30% of the catchment estimated to be highly disturbed with severe erosion in parts. The Styx River Basin Environmental Values and Water Quality Objectives (DEHP, 2014a) classifies the waterways as moderately disturbed.

Simulated flow duration curves for the two watercourses were calculated at the creek flow gauging stations. They are stated to be ephemeral, flowing for 24% of the year predominantly in the wet season. Storm flows were modelled to contribute less than 1% of flows indicating they persist for one to three days which is sufficient to provide baseflow in the creeks for one to three months. When not flowing, the watercourses form a series of disconnected pools, some of which are permanent. Large pools exist on Tooloombah Creek.

Barrack Creek joins Deep Creek from the east at the location of the proposed haul road crossing. It is classed as a minor, non-perennial stream with flow observed on only two occasions from 2017 to 2020 at the water monitoring site.

There are a number of minor un-named drainage lines across the project site that feed into both watercourses.

Tooloombah Creek and Deep Creek join at a confluence location approximately 2.3km downstream of the project site. This watercourse becomes the Styx River with the upstream tidal limit of the Styx River Estuary considered to be another 1.4km downstream of the confluence. However, it is recognised that the mapping of highest astronomical tide extends to the confluence. It is also noted that sparse occurrences of Marine Couch, *Sporobolus virginicus*, known to be dependent on saline influence, extend up to the confluence.

4.6.1.12 Wetlands

A palustrine wetland mapped as a 'wetland protection area' (an HES wetland in a GBR catchment) (Wetland 1) is located in a wetland protection area (WPA).

A GES wetland (Wetland 2) was also described and mapped in the close vicinity of the project area, together with water storages and regional ecosystems associated with wetlands (RE 11.3.27).



Figure 9 Wetland protection area (Wetland 1)

Source: Department of Environment and Science



Figure 10 MSES wetland (Wetland 2)

Source: Department of Environment and Science

4.6.1.13 Groundwater dependent ecosystems

The results of two field surveys across five Groundwater Dependent Ecosystem assessment areas (Wetland 1, Wetland 2, Vine thicket, Tooloombah Creek and Deep Creek) conducted in August 2018, were reported in the EIS. Assessment methods consisted of drill cores to provide evidence for tree rooting depth and characterise the local hydrogeological conditions; soil moisture potential measurement; leaf water potential measurement; and stable isotope analysis of xylem water, soil

moisture, surface water and groundwater. The use of these multiple lines of evidence determined that Wetland 1, the riparian fringes and associated emergent red gum, *E. tereticornis*, of the vine thicket, are terrestrial GDEs. Both Tooloombah Creek and Deep Creek were stated to be aquatic GDEs with the fringing weeping paperbark, *M. leucadendra* and *M. fluviatilis*, determined as terrestrial GDEs.

Two stygofauna surveys were conducted, one in November 2011, one in March 2012 from sampling a total of 30 groundwater bores.

4.6.1.14 Broad Sound wetland

The Broad Sound wetland is recognised as a wetland of national significance and is on the Directory of Important Wetland Areas (DIWA). It also contains the Broad Sound Fish Habitat Area, the Great Barrier Reef Coast Marine Park, the Great Barrier Reef Marine Park, and the GBRWHA. One survey of the estuarine habitat of Broad Sound was undertaken in 2011 prior to the EIS process. Environmental values associated with this downstream area, located approximately 10km downstream from the project are assessed in section 4.16–MNES.

4.6.1.15 Aquatic ecology surveys

An aquatic ecology survey of the wider region outside the project area but within the Exploration Permit for Coal resource authority (EPC1029) was undertaken by the project proponent in the dry season of June 2011. A wet season aquatic ecology survey was conducted in February 2017, but the site was dry with no preceding rainfall and the watercourses were not flowing. Targeted freshwater turtle surveys were undertaken in the dry season of 2017. Wetland 1 and Wetland 2 were surveyed in January 2018. Water sampling and inspections of watercourse pools have been undertaken over the period from 2017 to 2020.

No threatened aquatic flora or fauna were recorded in those surveys.

4.6.2 Assessment – potential impacts and proposed mitigation measures

4.6.2.1 Impacts on terrestrial ecosystem values

The proposed project would directly impact on approximately 339ha of remnant vegetation that provides suitable habitat for the ornamental snake, greater glider, koala and squatter pigeon. Significant indirect impacts from mining activities related to groundwater drawdown would occur to riparian terrestrial GDE vegetation. This area also provides foraging, shelter and breeding habitat for the greater glider, koala and squatter pigeon, all of which are listed as threatened species under the NC Act. The EIS stated the total impact area to the GDE vegetation is approximately 165ha.

A range of avoidance, mitigation and management plans have been proposed in the EIS to mitigate the direct impacts related to loss of habitat, and from the indirect impacts of mining related to groundwater drawdown, vehicle strike, lighting, noise and dust. However, a number of these – including the biodiversity management plan – are proposed at a high level and only described in a sub plan of the environmental management plan framework. Proposed management plans committed to by the proponent, in response to biodiversity related submission comments, including the significant species management plan, the REMP and the GDEMMP, are noted.

4.6.2.2 Impacts on aquatic ecosystem values

Aquatic fauna

The EIS identified that the project may have impacts on aquatic ecological values due to point source discharges to watercourses, increases in erosion and sedimentation of watercourses from land modification, and changes to flow patterns from concentration of flows. However, there was no specific assessment on likely impacts to any specific aquatic taxa including the identified barramundi nursery in Tooloombah Creek.

Fish passage

The construction of the northern and southern catchment diversion drains across the mine site have the potential to act as a waterway barrier to fish during flow events. DAF's submission on the EIS sought

details on MSES waterways providing for fish passage and how the proposed project would avoid and mitigate potential impacts in the first instance, propose appropriate mitigation and management measures and then offset any remaining significant residual impact.

Two waterways mapped as moderate and low risk would be subject to unavoidable impacts from mining activities and would be cleared. The waterways consist of:

- two unnamed tributaries of Deep Creek mapped by DAF as 'moderate' and 'low' risk waterways for fish passage located north of the Bruce Highway and
- two 'low' risk tributaries of Tooloombah Creek located close to the northern extent of Dam 1.

The waterways were assessed as highly degraded, ephemeral and likely to provide only minimal value to aquatic species. However, the loss of fish passage is an MSES value that would result in an offset requirement. The proponent has committed to a financial offset to acquit this impact.

I note that the waterway with a moderate impact risk is referred to as 'Surveyors Creek' and is where the main Release Point from Dam 1 will discharge into for approximately 500m before joining Deep Creek. The threatened fauna investigations on Deep Creek and surrounds undertaken in November 2019 surveyed the length of this waterway. Confirmed greater glider and koala scat indicated the presence of these threatened species throughout this waterway with one sighting of a koala.

Waterway crossings have the potential to result in direct impacts to aquatic habitats and fauna including on fish passage. The EIS stated that waterway barriers associated with the haul road over Deep Creek and Barrack Creek would be designed and constructed to avoid significantly altering instream habitat and would not result in a reduction in fish passage.

4.6.2.3 Impacts on groundwater dependent ecosystems

Wetlands

The high ecological significance 'Wetland 1' was determined to be a terrestrial GDE but unlikely to be significantly impacted by groundwater drawdown. The GDE field assessment recorded extremely high leaf water potential (LWP) readings and groundwater monitoring bore results of soil moisture potential (SMP) indicate that the broad-leaved paperbarks, *Melaleuca viridiflora*, are using a saturated source of moisture perched at 8mbgl. There is significant physical separation between the perched unconfined groundwater aquifer and the water table at 13.5mbgl and it is noted the maximum drawdown at the wetland is predicted to be 2.7m.

The EIS concludes that Wetland 2 is surface water fed and therefore the water expression is unlikely to be impacted by groundwater drawdown. Field studies indicate strongly negative SMP values below 4m correlate with LWP measurements that the highest available soil moisture is in the 2mbgl to 3mbgl layer. Wetland 2 has been inferred not to be either an aquatic or terrestrial GDE.

The EIS states that no significant residual impacts from the project are predicted for the MSES Wetland 1 and Wetland 2. I note that these wetlands may also experience hydrological changes due to the construction of the nearby WRS2, the proposed western access road, and be subject to dust impacts. I note the maximum predicted dust deposition rates for both wetlands were significantly below the adopted criteria level. I recommend that a minimum 200m buffer width to the HES Wetland 1 is required to minimise impacts.

Measures to avoid or minimise impacts on the project's five identified wetlands include avoiding direct impacts on any natural wetlands, no discharges of site water to wetlands and avoiding any impacts on the hydrology of Wetland's 1 and 2 (with negligible impacts on other wetland hydrology).

Mining activities would capture runoff that normally flows to two GES wetlands. The catchment area of wetland 3 and wetland 4, both palustrine wetlands mapped as RE 11.3.27, would be reduced by approximately 40% to 115ha and 96ha respectively.

The site currently experiences a prolonged nine month dry season and the climate change projection data presented in the EIS indicates hotter temperatures and associated increases in evaporation rates. I further note that research (not presented in the EIS) has shown a linkage with groundwater abstraction and significant tree mortality, especially when coupled to higher than normal temperatures. Bore

hydrographs (presented in the amended EIS V2) located close to the WPA wetland showed a predicted water table reduction in response to groundwater drawdown of 2m persisting for approximately 90 years.

Aquatic GDEs

The potential loss of permanent and ephemeral pools from the impact of groundwater drawdown would reduce fisheries resources (such as nursery areas for the native fish species Barramundi) and refugial pools for freshwater turtles. DAF, in its submission on the EIS, emphasised the importance of maintaining pools as dry season refuges for many species of fish that would otherwise desiccate during times of drought.

Dewatering and depressurisation of groundwater due to mining open cut pits results in a loss of groundwater storage leading to groundwater drawdown in water tables in the vicinity of the proposed mine site. A large part of the aquifer associated with the water table between Tooloombah Creek and Deep Creek would become dry at the maximum extent of drawdown. Consequential reductions in watercourse baseflow and the height of the alluvial aquifer can adversely impact environmental values, particularly GDEs.

Groundwater modelling predicts drawdown contours extending approximately 3km north-north-west of OC2 and 3km south-south-east of OC1 at the peak of mining with recovery of groundwater levels after 150 years and stabilisation at 250 years. The EIS states that drawdown impacts are unlikely to extend to the downstream reach of Tooloombah Creek or to the Styx River. The model predicts that the alluvial aquifer would fall by a maximum of approximately 60m in a three kilometre reach of Deep Creek, 4.7m beneath a reach of Tooloombah Creek and 12.6m beneath a reach of Barrack Creek.

Comments made by the IESC noted that impacts to aquatic GDEs included the complete drying or decline in volumes of permanent pools along Tooloombah Creek and Deep Creek during the dry season, compromising their ecological roles as aquatic refuges and overall aquatic habitat connectivity; and reductions in baseflow, potentially affecting ecologically important components of the streamflow regime (e.g., number of low-flow days) which may adversely affect stream and riparian biota.

The EIS described the results of additional surface water–groundwater interactions studies on the project's watercourses in order to support the GDE conceptual models in the EIS. GDE studies estimated hydraulic conductivities and measured soil moisture and salinity levels and concluded that groundwater from stream bank storage is available and of suitable quality for uptake by GDE vegetation. Stable isotope analysis of GDEs indicated that the groundwater sampled is derived predominantly from rainfall recharge and has undergone little or no evaporation.

I note that initially, the EIS proposed to use supplementary water to mitigate potential groundwater drawdown impacts to the watercourses and riparian vegetation, but in the latest amended version of the EIS, this practice is no longer proposed. The EIS now considers that the persistence of bank storage of groundwater, derived from flooding or rainfall infiltration, is sufficient to maintain pools from drawdown impacts. The downward movement of water held in bank storage is considered restricted by the impermeable layer of weathered clay underlying the alluvium of Tooloombah Creek. The low permeability sediments are also considered to reduce the potential for enhanced leakage.

The EIS also stated that Stygofauna, a subterranean GDE, would be lost from the area of impact around the mine due to groundwater drawdown, and that stygofaunal assemblages upslope of the mine would be isolated from downstream communities.

Terrestrial GDEs

The EIS concluded that 165ha of riparian vegetation along Deep Creek would be subject to minor impacts from the lowering of the water table. The predicted vegetation communities subject to impact comprise RE 11.3.4, RE 11.3.12, RE 11.3.25, RE 11.3.27, RE 11.3.35 where they are accessing groundwater located less than 15mbgl and that groundwater has an EC less than 10,000 $\mu\text{S}/\text{cm}$. Potential impacts to terrestrial GDEs include loss of condition and structural elements such as dieback of some large trees that may result in stream bank instability, erosion and consequential impacts to instream aquatic ecology values as well as to the downstream receiving environment. Impacts to riparian vegetation are expected to occur 10 to 20 years after commencement of the project. See GDE vegetation subject to groundwater drawdown impacts.

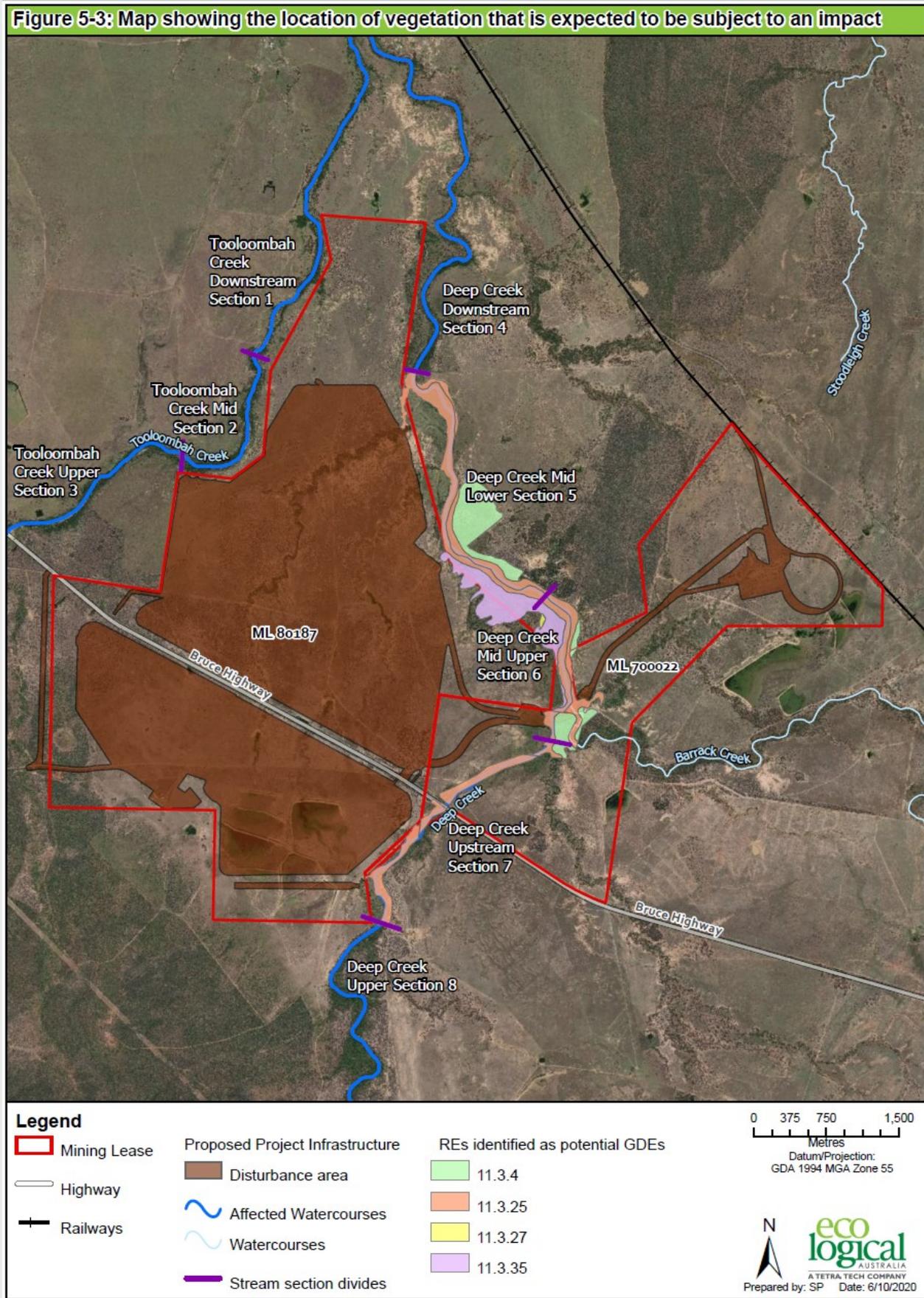


Figure 11 GDE vegetation subject to groundwater drawdown impacts

Source: AEIS Appendix 10e GDEMMP. Figure 5-3: Map showing the location of vegetation that is expected to be subject to an impact

The loss of this riparian vegetation would also have consequential impacts on the habitat of koalas, greater glider and squatter pigeon. An offset has been proposed where terrestrial GDEs have also been considered habitat for the greater glider, koala and squatter pigeon.

The EIS has proposed a revegetation program to be implemented in the Deep Creek riparian corridor likely to be impacted by groundwater drawdown. High level mitigation measures were described and include:

- riparian restoration measures including the planting of more drought-tolerant native species
- an increased riparian buffer width of 10m to improve the capture of sediment from runoff
- the exclusion of cattle access to the riparian corridor within the proposed project area and a staged reduction in herd numbers in the upper catchment of Mamelon Station.

DAWE criticised the proposed riparian restoration program due to a lack of detail in key elements of the program and recommended:

- comprehensive baseline data at control sites over multiple years to underpin environmental outcomes and performance criteria
- justification (such as scientific research, pilot programs, case studies and expert advice) to demonstrate that revegetation of riparian vegetation (particularly on highly erosive sodic soils) would be successful
- measurable and achievable environmental outcomes
- time-bound commitments on when success would be achieved
- a comprehensive monitoring program; and
- a comprehensive adaptive management framework, including time-bound corrective actions.

I consider that the combined actions mentioned in the EIS of a reduction in catchment grazing pressure and riparian restoration would likely lead to an increase in ground cover and biomass. This in turn has potential benefits of increasing infiltration and reducing surface runoff leading to a reduced risk of erosion. I note however, that the riparian restoration program remains as a commitment and no detailed management plan was provided for assessment. I consider that the entirety of the riparian corridors subject to groundwater drawdown impacts should be subject to the proposed restoration program. This should include off-lease areas on both Tooloombah Creek and Deep Creek.

I consider that best practice mitigation measures should be applied such as the immediate exclusion and removal of stock from these sensitive areas; the planting of drought-tolerant native shrub species; and the additional buffering of the riparian corridor by a minimum width of 10m, would enhance the resilience of the steeply incised creek banks and significantly reduce nutrient and sediment loads in the medium to long term. I also consider that these measures would slow runoff and increase infiltration and associated evapotranspiration rates. Measures would also lower the risk of large scale bank collapse due to vegetation dieback resulting from groundwater drawdown. I note that this scenario previously raised in earlier versions of the EIS is now considered unlikely.

A Riparian Revegetation Plan must be provided for assessment and approval.

4.6.3 Biosecurity

The TOR required the EIS to propose measures to remove, control and limit the spread of pests, weeds disease, pathogens and contaminants on the project site with reference to Queensland's *Biosecurity Act 2014*. Weed and pest animal management measures should be aligned with local government pest management priorities. A monitoring program is also required.

The proponent's general biosecurity obligation under the *Biosecurity Act 2014* was acknowledged. Controls and mitigation measures in relation to biosecurity risks and biosecurity events were detailed in the EIS.

Surveys undertaken for the EIS identified 54 introduced weed species within the project area, with 11 declared as restricted matters under the *Biosecurity Act 2014*. Rubber vine and lantana are common,

often forming dense infestations along the riparian zones of creeks. Buffel grass is the dominant ground layer in the northern section of the project area.

All landholders have a general biosecurity obligation under the *Biosecurity Act 2014* to control environmental weeds.

The pest fauna species feral cats, dogs, pigs, house mouse, rabbits, cane toad and common mynah were recorded in the project area and are also declared as restricted matters under the *Biosecurity Act 2014*. The Red fox was not recorded but is expected to occur.

The aquatic weed Olive hymenachne, *Hymenachne amplexicaulis*, is a restricted aquatic weed recorded at two locations in the project area. Rubber vine and Parthenium have been recorded in riparian zones but are not considered aquatic plants.

In response to a submission from Livingstone Shire Council (LSC), the EIS stated that the proponent would commit to implementing pest and vector controls consistent with the LSC Pest and Vector Management Plans, once finalised. These controls, including Rockhampton Regional Council's vector management program would be documented in the project's final land use management plan (LUMP) and implemented by licensed contractors.

A draft weed and pest management plan is a sub-plan of the LUMP. A number of suitable mitigation measures are proposed to reduce the introduction and/or spread of weeds, including vehicle wash-down protocols and tracking the removal, stockpiling and movement of topsoil that may contain weed species. There is also linkage to the management and control of invasive weeds and pest animals provided under the significant species management plan. A bushfire management plan in the LUMP also has linkage with pest control related to fuel load reduction measures.

Baseline weed and pest surveys would be conducted prior to construction and thereafter every two years in the dry and wet seasons to monitor progress in pest control programs. Pest fauna controls would focus on cats, wild dogs, feral pigs and foxes.

Mosquito management strategies would be implemented via the biting insect management plan to address the risk of vector borne disease.

Pest weed controls for identified declared and environmental weeds would be in accordance with pest fact sheets published by DAF. The proposed riparian restoration program for the area impacted by groundwater drawdown on Deep Creek includes the removal of known infestations of lantana, rubber vine, noogoora burr, olive hymenachne and replanting with native species.

I consider the EIS has adequately addressed the TOR and support the proponent's stated commitments in relation to biosecurity.

4.6.4 Conclusions and recommendations

The EIS has adequately identified flora and fauna values of the project area (and for some matters beyond the project area) that potentially would be directly and indirectly impacted by the project.

The total disturbance area for the project is predicted to be 1,372.5ha. Direct impacts from clearing of vegetation for mining and related infrastructure would result in the loss of approximately 339ha of remnant vegetation. Four threatened species under the NC Act that are also listed as MNES would be significantly impacted by the loss of this habitat and be subject to offsets requirements under the EPBC Act. MSES offsets would be required for unavoidable impacts to MSES regulated vegetation for 'of concern' REs and watercourse vegetation, and for waterway barriers for fish passage.

Potential indirect impacts from groundwater drawdown are likely to have widespread impacts to varying degrees on GDEs. I note that the EIS states that drawdown impacts may not be apparent until at least 10 years after project commencement. It also states that the impact to 165ha of GDE riparian vegetation may not be as extensive as predicted.

A range of environmental management measures such as management and monitoring plans proposed in the EIS would need to be applied. Limits and triggers for enhanced management of air, noise and water quality would also need to be regulated to ensure impacts on these matters, which have implications for flora and fauna on and off the site, are minimised. Additional recommendations are set out below.

4.6.4.1 Terrestrial Flora

Despite no threatened flora species being recorded in the proposed project area, I recommend that pre-clearance surveys are undertaken. If during the pre-clearing survey protected plants are identified in areas to be cleared a Clearing Permit (Protected Plants) would be required. Protected plants found in the impact zone should be considered for translocation into adjacent suitable habitat away from direct and indirect impacts. Relevant approvals under the NC Act would be required for translocation.

4.6.4.2 Terrestrial Fauna

The EIS conducted significant impact assessments for the 11 NC Act listed threatened fauna species that were known or likely to occur on the project site based on field assessments. Four of these species were determined to be significantly impacted.

I recommend that, any Australian Government approval for the proposed project should contain suitable offset conditions for the koala, greater glider, squatter pigeon (southern), and ornamental snake. I also recommend that targeted pre-clearance surveys be undertaken prior to clearing habitat. A Species Management Program under the NC Act, to manage impacts of interfering with animal breeding places, must be completed.

4.6.4.3 Aquatic ecosystems

Water quality of the watercourses is predicted to be improved from the current baseline due to a combination of measures related to capturing current sediment loads in runoff. The water management system (comprising the mine water dam and four sediment basins) is stated to capture and treat sediment and combined with reductions in the current grazing pressure is estimated to halve the current rate of soil loss. However, there are significant risks associated with the effectiveness of the proposed surface water management system, particularly during extreme events.

4.6.4.4 Waterways – fish habitat

Mine construction of mine pits and dams would lead to the loss of 8.5ha of waterway providing for fish passage. As provided for in legislation, I recommend that the loss of this MSES value is offset via the proposed financial offset under the Queensland Government environmental offsets framework.

I recommend that any waterway crossings such as those for haul road crossings proposed for Deep Creek and Barrack Creek are designed and constructed to at least meet accepted development requirements and are subject to a certified design that enables fish passage and that redundant crossings should be removed, and the site rehabilitated as per DAF recommendations (see Appendix 3).

4.6.4.5 Wetlands

No direct clearing of MSES wetlands should be allowed. I note that both Wetland 1 and Wetland 2 are within the area subject to groundwater drawdown and may be subject to indirect impacts.

I note that WPA wetlands located in the GBR catchments are afforded the State's highest regulatory protection and subject to management measures detailed in the *Wetlands in the Great Barrier Reef Catchments Management Strategy 2016-21* (DEHP, 2016). There is a target for no loss of the extent of natural wetlands in the *Reef 2050 Water Quality Improvement Plan* (State of Queensland, 2018).

Monitoring and reporting of groundwater drawdown impacts to Wetland 1, classed as a terrestrial GDE, is a requirement of the GDEMMP.

4.6.4.6 Groundwater dependent ecosystems

I consider that a number of significant risks to the GDEs of the project area identified in previous versions of the EIS have been reduced, but an elevated level of risk would remain during and after the mining operation.

I note additional technical studies provided in the amended EIS included revised hydrological (surface water) modelling, a regional groundwater model, field studies on GDEs, the geological properties of the alluvium of Tooloombah Creek and Deep Creek, a sediment budget for the site and upstream catchment, a fluvial geomorphology study, and a surface water-groundwater interactions study. I consider that these additional studies have provided some clarity on the likely groundwater dependence

of the aquatic and terrestrial ecosystems.

I consider that there is a medium level of confidence in the groundwater model due to the additional input data, expansion of the bore network, and better characterisation of the hydrogeology following additional field work consistent with IESC recommendations. I note that modelled baseflow changes to the watercourses is considered by the EIS to be negligible and that aquatic GDEs such as the watercourse pools would have minimal impacts as a result of groundwater drawdown.

Further, I note that the draft GDEMMP has been informed by GDE investigations including an aquatic pools assessment, a transient electromagnetic survey, geological coring of the soil profile, and analysis of surface water and groundwater data, including groundwater quality and water level data from several bores and stream flow data collected from gauges installed at Tooloombah Creek and Deep Creek in 2019.

I note DAWE's concerns that the magnitude and extent of groundwater drawdown has potentially been underestimated leading to a lack of confidence in the extent of the proposed impact area. I note the EIS states that there is still uncertainty about the quantum of impact to the riparian terrestrial GDEs from groundwater drawdown. The proponent has appropriately concluded that an offset is required for the potential loss of 165ha of terrestrial GDE vegetation.

The EIS concluded that groundwater drawdown was an indirect significant impact on the vulnerable Koala, Greater Glider and Squatter Pigeon (Southern) that use this habitat and would require MNES offsets for those species. However, I note that terrestrial GDEs are a protected matter under the Water Resources controlling provision (sections 24D and 24E) of the EPBC Act and should be subject to a separate offset. As such, any proposed environmental offsets for these values are assessed as MNES and would not be subject to the Queensland environmental offsets framework.

I consider the single sampling event for the GDE areas assessment is insufficient to fully characterise plant/ water interactions or to determine seasonal vegetation dependence on groundwater. I recommend that further baseline assessment is provided of the watercourse baseflow mechanisms, recharge and discharge rates of GDEs that accounts for seasonal variation.

There has only been one targeted survey of five GDE areas on the project site which provided useful initial characterisation of groundwater dependency. Conceptual ecohydrological models for the GDE areas were provided but require additional seasonal studies to increase confidence in their predictions.

A revised GDEMMP would require further information on predicted drawdown in individual aquifer layers including a review of the adequacy of preliminary groundwater level investigation trigger thresholds. Monitoring of stygofauna across and outside the project site must also be undertaken. This would include more extensive and targeted sampling from locations outside of groundwater drawdown areas to understand stygofauna distribution patterns across the broader Styx River basin. This would include sampling of the network of alluvial bores in the wet and dry seasons of the first year of operation. Identifying the groundwater quality conditions that support these stygofauna assemblages, and more information on the distribution and assemblages of stygofauna would be an important objective for establishing subsequent monitoring thresholds for management action. Monitoring must be in accordance with the DSITIA (2015) Guideline. An updated GDEMMP would require the locations of the monitoring points to be depicted and mitigation and management measures to be outlined.

Extensive monitoring requirements of GDEs would inform the adaptive management framework of the GDEMMP. It includes continuation of groundwater monitoring from existing groundwater monitoring bores and the installation of additional bores both upstream and downstream of Wetland 1 and the aquatic and terrestrial GDEs associated with Tooloombah Creek and Deep Creek. Real time groundwater data obtained from monitoring bores is important for GDE monitoring programs so that mitigation actions are as effective as possible. Identifying hydrological and ecological variables that can serve as early indicators of groundwater change would provide an early warning on imminent impacts to GDEs. Once these thresholds have been breached, intervention measures can be implemented.

Further information on water levels and chemistry of watercourse pools, and LWP/ stable isotope analysis of Wetland 1 and riparian vegetation communities on Tooloombah Creek and Deep Creek should be collected to inform ecological trigger levels monitoring and reporting requirements.

I would require an amended GDEMMP to be developed and submitted to the department prior to

commencement of mining activities and reviewed annually. The results of ongoing monitoring would inform any adaptive management measures.

I consider that the combined actions of a reduction in catchment grazing pressure and riparian restoration would lead to an increase in ground cover and biomass. I note however, that the riparian restoration program remains as a commitment and no detailed management plan was provided for assessment. I consider that the entirety of the riparian corridors subject to groundwater drawdown impacts should be subject to the proposed restoration program. This would include off-lease areas adjacent to both Tooloombah Creek and Deep Creek.

The proposed restoration of Tooloombah Creek and Deep Creek should be required to occur from the start of construction. I consider that committed mitigation measures such as the immediate exclusion and removal of stock from these areas; the planting of drought-tolerant native shrub species; and the additional buffering of the riparian corridor by at least 10m, would enhance the resilience of the steeply incised creek banks and could contribute to reducing nutrient and sediment loads in the medium to long term.

Due to the sensitivity of the site and its location, I would have expected that commitments were made in the EIS that, at a minimum, reflect the above and include an undertaking that mining activities would be conducted in a way that meets best management practice.

4.6.4.7 Marine

I consider the field surveys undertaken in the Broad Sound for the project were deficient. I note that baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area in 2011. I consider this data is unlikely to be representative of current conditions and that a single sampling event would not be representative of the variability of these indicators.

Baseline surveys of terrestrial or marine migratory species in Broad Sound have not been undertaken. I consider that biological surveys are an essential component of significant impact assessments and should be conducted in all areas likely to be subject to indirect impacts. Without a full description of baseline conditions prior to project commencement, it is difficult to determine the potential magnitude of impacts to migratory species or their habitats that may result from the proposed mining activities.

For a further description of the environmental values of Broad Sound see section's 4.16.2 existing environmental values of World heritage properties and National heritage places, and 4.16.5 existing environmental values of the Great Barrier Reef Marine Park.

4.6.5 Offsets

Under Schedule 1 of the Environmental Offsets Regulation 2014 (EO Regulation), a resource activity carried out under an Environmental Authority under the EP Act is a prescribed activity for the purposes of the *Environmental Offsets Act 2014* (EO Act). Any MSES values listed in Schedule 2 of the EO Regulation subject to mining activities are therefore required to be assessed. The proponent identified and assessed the potential impacts of the proposed project on prescribed environmental matters defined as MSES.

The EO Act requires offsets to compensate for significant residual impacts on MSES after all on-site avoidance and mitigation measures have been applied. The proponent demonstrated that all reasonable on-site avoidance and mitigation measures have been applied to most MSES. The amended EIS changed the proposed number and location of dams in order to avoid impacts on of concern and wetland vegetation. However, direct and indirect impacts from project related clearing to protected wildlife habitat, regulated vegetation and waterways providing for fish passage cannot be avoided.

Based on material provided in the EIS the department expects that the following MSES would be impacted by proposed project mining, mining infrastructure including the TLF and water management construction and operational activities:

- regulated vegetation – vegetation within a defined distance from defining banks of a relevant watercourse (RE intersecting a watercourse)
- regulated vegetation – RE that is of concern

- protected wildlife habitat (habitat for an animal that is endangered or vulnerable wildlife or special least concern animal)
- waterways providing for fish passage.

4.6.5.1 Regulated vegetation—intersecting a watercourse

The project was stated to result in a significant residual impact on Of Concern RE 11.3.4, 4.3ha and RE 11.3.25, 78.8ha.

The groundwater drawdown impacts along Deep Creek were concluded to be a significant residual impact requiring an offset of 165ha of GDE type 2 vegetation. This is comprised of impacts to RE 11.3.25 (87.51ha); RE 11.3.27 (0.59ha); RE 11.3.35 (37.81ha) and RE 11.3.4 (39.31ha).

However, the Water Resources MNES did not provide an offset specifically for this value. Instead, it recognised that the impact area was habitat for three listed threatened species and included those impact areas into the total impact areas for each of the three species.

The proponent has proposed that this MSES is partially acquitted via direct land-based offsets on two offset properties – Mamelon (the project site) and a second property. Field surveys undertaken in 2020 on the two offset properties identified higher habitat quality scores on the offset area than on the impact area (generally in accordance with the superseded *Guide to Determining Terrestrial Habitat Quality* (version 1.2; DEHP 2017). However, there is insufficient habitat for RE 11.3.25 available on the two offset properties for the total calculated offset area (using the required multiplier of four). The shortfall area of 33.95ha is proposed to be offset via a financial offset payment. This would be combined with the fish passage financial offset and would total approximately \$874,585.

4.6.5.2 Regulated vegetation—endangered or of concern

The project was stated to result in a significant residual impact on Of Concern RE 11.3.4, 40.7ha and RE 11.4.2, 110.8ha.

4.6.5.3 Protected wildlife habitat

An SRI for the MSES Protected wildlife habitat for endangered and vulnerable species was conducted. Three species listed as vulnerable under the NC Act were assessed as subject to a significant residual impact under the Queensland environmental offsets framework: the koala, greater glider and squatter pigeon. A fourth species, the ornamental snake (also listed as vulnerable), was not assessed as being subject to a significant residual impact. However, the proponent made a commitment to offset this species in 2018 and has provided an offset. As these four species are listed as MNES they have been assessed in accordance with the bilateral agreement under the EPBC Act. Offsets under the State environmental offsets framework do not apply in these circumstances but would be subject to the EPBC Act offsets framework. Offset assessment for these species is provided in section 4.16–MNES.

4.6.5.4 Waterway providing for fish passage

The project was stated to result in a significant residual impact on fish passage of 8.35ha. It would be subject to a financial offset under the Queensland environmental offsets framework. The department's financial settlement offset calculator was used to calculate the cost of this offset. The total cost of the financial settlement for impacts on fish passage is approximately \$207,750.

4.6.5.5 Offset properties

Direct land-based offsets are proposed to be acquitted on two properties – one of which, Mamelon Station – is the property subject to the proposed project and is freehold owned by the proponent. The proposed offset areas comprise approximately 2,803ha of the property and are located in the southern and western portions of the property upstream of the proposed mining activity.

The closest proposed offset area on Mamelon Station is directly adjacent to the western boundary of the proposed project footprint on MLA100087 in the vicinity of Wetland 1 and Wetland 2. I note this area is within the area subject to groundwater drawdown. Appropriate justification and evidence that habitat values would not be adversely impacted by long-term drawdown would need to be provided for any future offset assessment and approval.

The location and ownership of the second offset property is subject to a confidentiality agreement with the department. Information provided to the department in the unredacted Biodiversity Offset Strategy indicates that there are sufficient habitat values on that property to fully acquit the ornamental snake offset, and to partially acquit the regulated vegetation offsets. The total proposed offset area on that property is 227ha.

4.6.5.6 Conclusions and recommendations

Offsets applicable for the project under the EP Act and EO Act for the significant impact on MSES are summarised in Table 5 Significant residual impacts on MSES requiring an offset.

Table 5 Significant residual impacts on MSES requiring an offset

MSES	Description	Significant residual impact requiring an offset (ha)
Regulated vegetation (intersecting a watercourse)	RE 11.3.4	4.3ha
	RE 11.3.25	78.8ha
Regulated vegetation (of concern)	RE 11.3.4	40.7ha
	RE 11.4.2	110.8ha
Protected wildlife habitat: habitat for an animal that is endangered, vulnerable or special least concern wildlife * The species listed are also identified as MNES and were assessed in accordance with the bilateral agreement under the EPBC Act.	Koala (vulnerable)*	324.6ha
	Ornamental snake (vulnerable)*	18.8ha
	Greater glider (vulnerable)*	281ha
	Squatter pigeon (vulnerable)*	306.6ha
Waterway providing for fish passage	Waterways on MLA80187	8.5ha

Any outstanding offsets for unavoidable impacts to MSES would need to be offset in accordance with the EO Act. This may occur in relation to MSES for any protected plants identified in pre-clearance surveys and any MSES aquatic flora and fauna identified in future committed surveys.

There are also requirements under the NC Act for tampering with any breeding places for NC Act listed species. This would require management of any potential impacts under an approved species management program.

4.7 Coastal environment

The relevant sections of the EIS documents used to describe and assess coastal environments for the project were Chapter 9–Surface Water, Chapter 15–Aquatic and Marine Ecology, Chapter 16– MNES, and Appendix 5b–Flood Study and Water Balance, Appendix A10i–Estuarine Benthic Study, Appendix 12– Draft EMP, Appendix A10a–Aquatic Ecology, GDEs, Marine Ecology and the GBR, Appendix A10b–2011 Baseline Monitoring Program, Appendix 10f–Draft REMP.

Section 8.8 of the TOR required the EIS to: conduct impact assessments on coastal environments in accordance with departmental guidelines; detail the coastal zone potentially affected by the project and

any proposed works in the coastal zone; describe State and Commonwealth marine parks and marine plants and fish habitat areas in the region of the project; assess potential impacts in the coastal zone and measures to avoid, minimise or offset potential impacts; develop indicators for measuring coastal resources and values, set objectives for protecting them and detail monitoring and corrective actions to meet the objectives.

4.7.1 Assessment

The project is located adjacent to, but outside of, the State mapped Coastal Zone, which has its landward boundary at the western bank of Tooloombah Creek (on the opposite side to the project). The project is sited outside of the coastal management district and erosion prone area, although Tooloombah and Deep Creeks just downstream of the site are considered erosion prone.

Hydrological modelling in the EIS concluded that it was very unlikely that the project would contribute to downstream coastal erosion issues. The storm tide high hazard and medium hazard extents were adequately described and mapped and also shown to be located outside of the mining lease boundaries.

Surface water tidal limits and *Water Act 2000* watercourse downstream limits were also described and mapped. The highest astronomical tide extends upstream to the confluence of Deep Creek and Tooloombah Creek where the Styx River commences, approximately 2.3km downstream of the project. The Styx River discharges into Broad Sound approximately 10km downstream of the project area. Broad Sound is a large coastal embayment and is described as a remote and relatively undisturbed area of the Great Barrier Reef. The EIS describes the downstream systems that include important environmental areas such as:

- the GBRWHA and the Queensland Great Barrier Reef Coastal Marine Park (GBRCMP), and the GBRMP which commence at intervals within approximately 10km downstream of the project site, providing protection over intertidal and tidal areas as far upstream as the highest astronomical tide
- the GBRMP and GBRCMP marine national park zone located approximately 41km downstream of the project area
- the Broad Sound Wetland, listed on the Directory of Important Wetlands of Australia (DIWA) at the mouth of the Styx River
- the Broad Sound Fish Habitat Area (FHA) commencing approximately 10km downstream of the project area.

The coastal environmental values downstream of the project were adequately described in the EIS, including the habitats and values of the Styx intertidal and estuarine areas and DIWA listed Broad Sound wetland, such as coral reefs, marine plants, fish habitat areas, waterways providing for fish passage, estuarine and marine fauna, the GBRWHA and GBRMP and GBRCMP.

Impacts from the project on these coastal, estuarine and marine MSES and MNES, together with proposed management and mitigation measures are assessed in section's 4.6 and 4.16 of this report. A significant residual impact is predicted for approximately 8.35ha of waterways providing for fish passage and a financial offset is proposed.

Existing impacts from human activity on Broad Sound were adequately described in the EIS, including the presence and effect of extensive ponded pastures and the impacts from vegetation clearance and cattle grazing on erosion, sediments and nutrients from the catchment entering waterways and ultimately the Broad Sound. Contrastingly, the EIS also states the region is a relatively undisturbed area of the GBR.

The EIS states that there would be no impacts (direct or indirect) to the coastal zone. No mine infrastructure is proposed in the coastal zone or coastal management district and no tidal works or dredging in marine waters are proposed by the project. As a result, the EIS concludes that no impacts on coastal processes are anticipated.

However, I note that coal product would be transported within the coastal zone. The coal product would be handled through the Dalrymple Bay Coal Terminal (DBCT) at Hay Point (approximately 170km north of the project site) for export. A port allocation would need to be secured to export the coal product. The

EIS considered that DBCT had existing capacity to handle the project's initial product volumes based on its nominal capacity being 85Mtpa and throughput is historically less than this.

I note there is also mention that as mine production increases, the project may need to secure increased capacity at DBCT through port expansion as per the DBCT Management - Master Plan 2016. While the EIS concludes that capital dredging would not be a requirement of any port expansion at DBCT/Hay Point, it is not clear how this conclusion is reached given the Master Plan for the DBCT expansion acknowledges that a future stage may require dredging of additional berths.

The EIS does recognise that there are potential indirect impacts on coastal environmental values from controlled and uncontrolled water releases from the mine site and associated potential reduction in downstream water quality and introduction of contaminants. Changes to downstream water quality (including estuarine and coastal waters) may also arise as a result of land clearance, mine site runoff and potential impacts resulting in changes to riparian zones. Those impacts may result from groundwater drawdown and loss of GDEs or from the construction of stream crossings, leading to erosion and associated downstream sediment transport. Mine water management systems, erosion and sediment control systems, a reduction in grazing pressure, and stream bank revegetation measures are proposed to mitigate these potential impacts. Water quality impacts and their proposed mitigation and management are assessed in section's 4.4, 4.6 and 4.16 of this report.

The TOR requires the proponent to develop objectives and suitable indicators for maintaining and measuring coastal resources and values. The EIS includes a draft REMP which proposes quarterly field-based surface water quality and sediment monitoring in receiving environments, including four sites in the estuarine waters of the Styx River and the adjacent Waverley Creek, and two sites in tidal waters of the Styx River. I note there are no sampling sites proposed near mapped reefs in the marine waters of Broad Sound.

The EIS proposes that the REMP would also undertake a desktop assessment of the mangrove areas and locations in these estuaries, on the basis that mangrove distribution would respond to sediment accumulation or potential erosion impacts as a result of proposed mine activities. Fish would be sampled at least twice a year at one site in the tidal waters of the Styx River. Water quality results would be compared with site specific reference data and derived trigger values and sediment results would be compared with default guideline values (or preferably locally derived values from sampling) to identify any changes in water quality that exceed regulated values. Biological data could then be used to evaluate the response of biota to any exceedances.

I note that in 2011, baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area. I consider this data is unlikely to be representative of current conditions and that a single sampling event would not be representative of the variability of these indicators. For any future environmental approval, I would recommend a condition that a REMP be required to collect adequate baseline data prior to the commencement of mining. The REMP must also provide detail on the duration of the proposed baseline data collection in tidal and estuarine waters.

4.7.2 Conclusions and recommendations

While the project site is close to the coast, I note that it is not located within the coastal zone or coastal management district or subject to mapped coastal hazards. There are no proposed works in the coastal zone for the project, although the project may be a contributor to the demand for a future expansion of the DBCT. The EIS states that the mine is considered unlikely to contribute to coastal hazards or coastal erosion.

I consider that the environmental values of the adjacent coastal, estuarine and marine areas have been adequately described. Potential impacts from mine activities on the flora and fauna, and MNES and MSES of these areas, together with the proposed mitigation and management of those impacts have been assessed in section's 4.4, 4.6 and 4.16 of this report.

Freshwater wetlands in GBR catchments are recognised as having particular connectivity and habitat values. The disturbance footprint of the mine does not intersect with 'natural freshwater wetlands' and groundwater drawdown is not expected to significantly impact wetlands although some impacts to the surface hydrology of wetlands are predicted.

I note that mobilisation of ASS is not predicted as a result of the project. The EIS stated that the risk of ASS at the site was considered so low that detailed ASS investigations were not considered warranted. However, I am not convinced that the risk should be discounted, especially considering the project's close proximity to significant downstream sensitive environmental receptors.

I note that concerns about the mine's relatively close proximity to high environmental value coastal and marine areas was the subject of several submissions to the EIS, particularly in relation to the potential for releases of contaminated MAW and increased sedimentation. In response, the proponent provided a draft REMP for the project that includes sampling sites in the Styx River and Waverley Creek estuaries for water quality and sediment sampling, as well as desktop monitoring of mangrove areas. However, the REMP only provides for monitoring. It is not clear what management measures would be taken if monitoring indicates adverse impacts on water quality.

I consider that there are some deficiencies in the proposed management and monitoring measures that require further consideration and assessment. I note there are no indicators or monitoring sites proposed for the marine waters of Broad Sound. In addition, the draft REMP does not detail effective management measures nor any suitable corrective actions in the event of adverse changes in water quality occurring. I recommend that any REMP monitoring program be extended to the marine waters of Broad Sound to detect any potential impacts from the project on the Broad Sound beyond the Styx estuary. The REMP must also detail effective monitoring and management measures, triggers and corrective actions and audit the success of proposed mitigation measures. In addition, I recommend that a minimum of 12 months of baseline REMP monitoring is completed for estuarine and marine indicators prior to the commencement of any mining activities.

4.8 Air

The relevant sections of the EIS used to describe and assess impacts to air quality and its management were EIS Chapter 12–Air Quality and Greenhouse Gas, and Appendix 7–Air Quality and Greenhouse Gas.

Section 8.10 of the TOR required the EIS to: describe existing air environments at the site and surrounds; provide an emissions inventory for the project; predict risks and impacts as a result of the project including cumulative impacts and impacts on human health; outline and demonstrate environmental objectives and performance outcomes for air emissions; describe mitigation measures and their application and monitoring, reporting and corrective actions. The TOR also explicitly required an emissions inventory, assessment of impacts and minimisation measures for greenhouse gases (GHG).

Environmental Protection (Air) Policy 2019 (EPP Air)

The EIS stated that the ambient air quality goals relevant to the project are prescribed by the EPP Air. The EIS stated the project is subject to the air criteria for the pollutants - total suspended particulates (TSP); particulate matter less than 10µm diameter (PM₁₀); particulate matter less than 2.5µm (PM_{2.5}); and dust deposition as outlined in the *Guideline Mining-Model Mining Conditions* (DES, 2017). Project air quality goals in the EIS also took into account dust deposition rates for wetland vegetation and riparian environments to address submission comments from the department.

4.8.1 Assessment

4.8.1.1 Air quality emissions assessment

The air quality impact assessment modelling was revised as part of the EIS V3 to ensure that any impacts arising from the rearrangement of project elements (in particular, the relocation of MIA 2 and CHPP 2) were assessed. As a result, both Chapter 12 and Appendix 7 have been amended to reflect the latest modelling and impact assessment.

Emissions estimations were calculated for three project points – construction, stage 1 (year 3 of operations); and stage 2 (year 12 of operations). Stage 2 represents the maximum production level of 10Mtpa when predicted primary dust activities are closest to the nearest sensitive receptor, Tooloombah Creek Service Station (R8), and has been adopted as the worst case scenario for air emission impacts. Emission rates for TSP, PM₁₀ and PM_{2.5} were calculated for all identified dust sources, including CHHP

operations, waste handling, wind erosion, wheel generated dust, mining operations, blasting/ drilling and the TLF using the National Pollutant Inventory Emission Estimation Techniques Manual for mining and using The Air Pollution Model (CSIRO) and CALMET modelling.

The amended EIS stated that modelling results indicate that pollutant concentrations from the mining operation would increase in year 12 at some sensitive receptor locations while being reduced at other receptors, generally dependent on the location of CHPP2 with respect to the sensitive receptors. Overall, the modelling predicted there would be no exceedances of any air quality criteria at identified sensitive receptor locations.

During Stage 2, the maximum cumulative PM₁₀ 24-hour average concentration at sensitive receptor R8 is predicted to be 47.2µg/m³. This is just below the EPP (Air) objective of 50µg/m³.

The dust control efficiency of haul roads was assumed as 86% for level 2 watering (>2 litres/m²/h). In the previous versions this control efficiency was assumed as 75% for level 2 watering. Both reports refer to National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Mining V3.0 for the selection of this efficiency. It is noted that the NPI document specifies dust control efficiency as 75%. It is not clear how the control efficiency of 86% was adopted. There is a possibility that if the 86% dust control is not achieved then the PM₁₀ concentration may exceed the EPP (Air) objective of 50 µg/m³ at the sensitive receptor R8.

Dust emissions from the unpaved road were estimated assuming a vehicle speed of less than 40km/h. However, this vehicle speed limit is not reflected in the EMP (Appendix C2–Air Quality Management Plan). It is noted that speed limits of 60km/h and 50km/h are stipulated in Appendix C12.1–Traffic and transport management plan.

Dust deposition rates for wetland receptors were calculated based on an operational goal of a 120-day rolling average deposition rate of 200mg/m²/day. This was based on work undertaken for the Port of Abbot Point Cumulative Impact Assessment. The maximum predicted dust deposition rates for the four wetland receptors were all below the adopted goal value. Wetland 1 (the State MSES wetland) was predicted to have a cumulative dust deposition rate of 76.41mg/m²/day.

Three electrical power generation units are proposed during the construction and operation stages of the project. However, the stack information was not provided in the report.

4.8.1.2 Toxic fumes assessment

The risk of potentially adverse impacts from blasting emissions was not addressed in Chapter 21–Hazard and Risk of the amended EIS. Open-cut blasting uses ammonium-nitrate-based explosives that would generate oxides of nitrogen that, under particular circumstances can pose a serious human health risk. Nitrogen dioxide (NO₂) is the principal hazardous nitrous fume. It is an extremely poisonous gas that is highly irritating to the respiratory system. A submission received from Doctors for the Environment Australia (DEA) stated that imperfect blasting can result in high levels of toxic gas that have resulted in hospitalisation of affected mine workers. The submission stated that there was a high risk to people travelling on the Bruce Highway during mining operations.

An assessment of impacts from gaseous blasting emissions (NO₂, CO and SO₂) used emission factors specified in NPI standards. The mine plan includes a 500m buffer to the Bruce Highway such that no blasting would be undertaken in this buffer area until year 12 of operations. The modelled blasting activities have therefore been located 500m on each side of the Bruce Highway. Maximum gaseous ground level concentrations of the NO₂, CO and SO₂ pollutants at five sensitive receptors (representing vehicles travelling along the Bruce Highway) predict that they would be well below the modelled criteria.

DEA provided a response to the amended EIS (V1) highlighting that the NPI method is inappropriate as it is concerned with total annual output. The estimate of NO₂ exposure over a 1-hour exposure period was stated not to match the behaviour of blast plumes. Instead, the worst-case scenario should have estimated peak output from a poorly conducted blast which was stated to be thousands of times higher than the average output of NOX. It was contended that toxicity is caused by the 5-minute exposure to high levels of NO₂, not the 1-hour exposure. DEA concluded that the risk of non-dispersing blast plumes means that a 500m setback for public safety to the Bruce Highway from blasting is inadequate. There remains a high risk to people travelling on the Bruce Highway during mining operations, and a lower risk to the 30 residents of Ogmore 6.8km away, which is at the limit of previously observed risk from

predicted blast plumes.

I note that the intention of the mine plan is to mine the buffer area from year 12 to year 19 of operations. This would be contingent on ongoing biannual geotechnical assessments that confirm there would be no impacts from project blasting activities on the structural integrity and flyrock at the Bruce Highway. I consider that modelling of gaseous emissions should have adopted the worst-case scenario i.e., blasting activities undertaken approximately 100m on each side of the centreline of the Bruce Highway. I note that DTMR have stated that closure of the Bruce Highway for any period due to the mining activity is not acceptable.

I further note that the proponent has made an undertaking not to require closing the Bruce Highway for safety reasons due to blasting. Advice provided by RSHQ indicates that blasting could be scaled down with the use of smaller shots, less explosives and different grid patterns. This would have the effect of reducing both gaseous emissions and the risk of flyrock from blasting damaging road infrastructure or posing a human safety risk. I note this issue was not addressed in Chapter 20–Health and Safety or Chapter 21–Hazards and Risks. Further assessment of this matter is recommended below.

4.8.1.3 Coal dust from rail haulage assessment

A submission from residents of Clairview stated concerns with the emission of coal dust from increased coal rail haulage (both laden and unladen) on the NCRL. Resident's homes are located, in some instances, less than 50m from the rail line. The submission identified potential impacts, including coal dust contamination of rainwater tank supplies and rain events mobilising coal dust and washing it into the nearby ocean, an area of significance for dugong and marine turtles. Re-suspension of coal dust from any train using the line was also stated to be a matter of concern.

The EIS addressed this issue indirectly by examining the results of coal dust monitoring from rail lines in South-east Queensland as detailed in the *Western Metropolitan Rail Systems Coal Dust Monitoring Program* (DSITIA, 2013). The monitoring results showed that ambient particle concentrations complied with ambient air quality objectives at all rail corridor monitoring sites during both the pre- and post-venueering monitoring periods. Ambient PM₁₀ and PM_{2.5} concentrations did not exceed the EPP Air 24-hour average air quality objectives of 50µg/m³ and 25µg/m³ respectively on any day during the investigation period.

The EIS concluded that impacts of coal dust from rail haulage would be unlikely to result in additional adverse health effects for people living along the NCRL and that impacts on ecosystems and water supplies would be minimal.

I consider that appropriate mitigation measures such as the adoption of the air quality management plan (AQMP) and the proposed coal dust management plan (CDMP) would stipulate control measures to effectively mitigate dust emissions from loaded and unloaded coal haulage trains. This includes wagon design with sloped sills to avoid coal remaining on external surfaces; wagon loading practices and profiling to improve veneering and avoid spillage; and the use of veneer suppressant on the surface of loaded wagons to provide a membrane that is resistant to dust lift-off.

The department also made submission comments about the predicted air quality emissions from the TLF. It was noted that the TLF was modelled as a volume source, however the air emissions from this source were not provided. Air emissions from the TLF from the dumping of coal product on stockpiles from haul trucks and the probable train loading method by front end loader were responded to in the EIS. In response, the EIS now proposes to implement and maintain water spraying or fogging systems at the product coal stockpile and TLF to minimise dust emissions from the product coal stockpile and to ensure that product coal delivered for train-loading has an optimum coal-surface water content. A train load-out bin for loading coal onto trains is now also proposed to reduce dust emissions.

4.8.1.4 Greenhouse gas emissions assessment

The National Greenhouse and Energy Reporting (NGER) scheme, established by the *National Greenhouse and Energy Reporting Act 2007* states that certain gases—carbon dioxide, methane and NO₂—associated with coal mining must be reported. A GHG assessment was undertaken for the project based on the methodology published in the National Greenhouse Accounts Factors (DotEE, 2019). GHG emissions were calculated in accordance with GHG protocol emissions scope 1—direct emission factors

from points of emission release such as mining activities, processing activities, fuel use and energy use; and scope 2–indirect emission factors such as the generation of electricity purchased and consumed by the proponent for the project.

Scope 3 emissions were not included in the TOR and are not reported under the NGER Scheme but were raised in submissions on the EIS. The proponent responded that scope 3 emissions are measured at the location that coal is used and did not propose to update the EIS.

Modelling adopted the peak production of year 12 of operation as the worst-case scenario. Estimated annual scope 1 GHG emissions is 428,460 tonnes (t) CO₂-e, and the life of project emissions is 53,450,730t CO₂-e. The annual operational phase emissions estimate was stated to represent 0.08% of Australia's most recent greenhouse inventory. A project based GHG abatement strategy is proposed to be developed to reduce emissions, energy consumption and energy costs.

4.8.2 Conclusions and recommendations

I consider that the EIS generally addressed the TOR. It adequately demonstrated that the air quality environmental objectives and performance outcomes stated in schedule 8, part 3 of the EP Regulation could be met but there are several matters that have not been fully resolved.

I consider that issues on toxic fume emissions from imperfect blasting and the potential impacts to motorists on the Bruce Highway have not been adequately addressed in the amended EIS. This is due to the gaseous emissions estimates not adopting the location of the worst-case scenario or accounting for shorter, more toxic periods of NO₂ exposure from imperfect blasting.

I support the proponent's commitment to the implementation of the AQMP and the CDMP and proposed mitigation measures to reduce coal dust emissions at the TLF and on the rail haulage route. Recommended requirements relating to these aspects are provided in Appendix 5.

I consider that the AQMP has adequately addressed requirements of the TOR and provides additional information on actions related to air quality management roles and monitoring. Proposed dust deposition monitoring would monitor dust levels at background and potentially impacted sites. Dust monitors would be installed at the nine identified sensitive receptor locations, including the Tooloombah homestead, located approximately 10km to the west of the project area.

Some proposed air quality abatement measures proposed in the EIS require amending, including the dust control efficiency level of haul roads, and reducing dust emissions from the unpaved road based on revised speed limits.

I would also recommend implementation by the proponent of all commitments for the mitigation and management of potential air quality impacts, including measures to reduce emissions of GHGs.

4.9 Noise and vibration

The relevant sections of the EIS used to describe and assess potential impacts of noise and vibration emissions by the project on identified sensitive receptors and the surrounding environment were EIS Chapter 13–Noise and Vibration and Appendix 8–Noise and Vibration.

Section 8.11 of the TOR required the EIS to:

- describe sensitive receptors defined in the Environmental Protection (Noise) Policy 2019 (EPP Noise)
- describe sources and characteristics of noise and vibration emitted during all stages of the project
- conduct noise and vibration assessments including potential cumulative impacts from existing and known future developments
- describe how the project would be managed to be consistent with best practice environmental management
- describe how the management of noise and vibration impacts would be monitored, audited and reported to meet management objectives.

Environmental Protection (Noise) Policy 2019 (EPP Noise)

The EPP Noise lists the environmental values and the acoustic quality objectives to enhance or protect the environmental values. As described in the EPP Noise, environmental values of the acoustic environment have been developed to protect the health and biodiversity of ecosystems, human health and wellbeing, and community amenity.

The EPP Noise includes acoustic quality objectives to protect environmental values for sensitive receptors which include residential and other premises including protected areas. Noise limits (criteria) for the operational stage of the project have been derived from the Model Mining Conditions (DES, 2017) and used by the EIS for impact assessment purposes. A low frequency noise limit of 50dBZ was adopted in the EIS.

Blasting noise and ground vibration limits have also been adopted from the Model Mining Conditions (DES, 2017).

Site specific noise criteria have also been adopted from the Model Mining Conditions (DES, 2017).

4.9.1 Assessment

The EIS followed the assessment framework outlined in the department's Noise and Vibration–EIS information guideline (DES, 2020).

The existing noise environment is predominately rural with sources of noise associated with local activity at dwellings, and plant and machinery used for agriculture. The topography of the project site is generally flat floodplains associated with the main watercourses varying in elevation from 11.4m AHD to 43.8m AHD.

There are nine sensitive receptor locations within approximately 10km of the project, while two additional receptors were identified as uninhabitable dwellings. The town of Ogmoo located approximately 7km northwest of the project area was counted as one noise receptor.

The EIS stated that noise monitoring of the existing environment was undertaken only once, in March 2011, prior to the commencement of the EIS assessment process.

The project would operate 24 hours per day, 5 days per week and would need to demonstrate it could meet relevant daytime (7am to 5pm), evening (5pm to 10pm), and night time (10pm to 7am) noise criteria. Construction would only occur during daytime.

Noise modelling was conducted for three scenarios: construction stage (during year 0) that would include the construction of dams, CHPP 1, haul roads and the rail siding; stage 1 (year 3 of operations); and stage 2 (year 12 of operations) representing the worst-case scenario when the maximum production level of 10Mtpa is reached with maximum equipment usage. The final rehabilitation phase once mining has been completed (year's 19-24) was not modelled as it was considered not to exceed the year 12 worst-case scenario.

Average and worst climatic conditions scenarios were also modelled to determine likely wind speed, wind direction and temperature for day, evening and night periods. The sensitive receptors would generally be upwind of mining noise sources.

Atmospheric stability was modelled and determined that temperature inversions associated with clear and calm conditions in the night time period would occur approximately 34% of the time. It is noted that during temperature inversions noise emissions from distant sources can be carried and amplified. Modelling of noise contours was undertaken to determine likely noise emissions at the nine sensitive receptor locations and whether specific night time criteria would be exceeded.

The results of the noise modelling identify the following predicted potential impacts, including:

- construction noise levels in year 0 would comply with the noise criteria
- operation noise levels in year 3 would comply with the noise criteria for the majority of receptors during the daytime period with minor exceedances at the Tooloombah Creek Service station and associated residence TSC RES 1 under the worst climatic scenario
- operation noise levels in year 3 for the night period would occur at Bar H-1, Oakdean,

Tooloombah Creek Service Station, TSC RES 1 and TSC RES 2 under both scenarios with Brussels predicted to exceed criteria during the worst case climatic conditions

- operation noise levels in year 12 for both the day, evening and night periods would exceed noise criteria at a number of receptors.

The most impactful period was identified as the night period of year 12. Exceedances are predicted to occur at Bar H-1, Oakdean, Tooloombah Creek Service Station, TSC RES 1 and TSC RES 2 under both scenarios with Brussels and Strathmuir homesteads predicted to exceed noise criteria only under the worst case climatic conditions.

Noise emission source locations included mining activities such as the operation of the CHPP and the TLF. Noise from highly mobile machines such as haulage trucks, excavators, graders, dozers, front end loaders, a Franna crane, drills, generators and water carts were generally distributed over a number of locations such as mine pits and haul roads in the noise model scenarios.

Blasting would be required for extraction of coal from the open-cut pits. The noise assessment identified Tooloombah Creek Service Station to the west as the closest receptor with a separation distance from blasting of approximately 2km, and the Brussels residence to the east with a separation distance of approximately 3km. No draft blast management plan was provided for assessment. Estimations of potential blasting vibration and airblast overpressure levels indicate an airblast overpressure level up to 127dB (Linear) which exceeds the department's guideline blasting level of 120dB (Linear) at a sensitive place (DES, 2020). The EIS states that appropriate stemming and local blast control measures would result in compliance with the criteria. I note that the propagation of airblast is influenced by atmospheric conditions and terrain and the sound waves are difficult to screen using vegetation or barriers. Energy frequencies can be below the human threshold of hearing, but secondary effects such as rattling of roofing iron or windows would be audible.

Noise impacts on fauna were assessed as inconclusive, with assumed native animal habituation to noise emission disturbances expected over time. It is noted from the assessment that the noise and vibration from haul truck movements is the most likely potential impact on animals. The EIS undertook targeted surveys of greater glider and koala in 2019 in the section of Deep Creek downstream of the Bruce Highway, including the proposed haul road crossing area in response to the department's review comments. Both greater gliders and koalas were recorded in this habitat. The EIS proposes a 24 hour, 5 days per week operational period with predicted haulage truck movements conveying product coal to the TLF along this transport corridor for approximately 19 years. Noise prediction contours for this location indicate that even with implementation of the proposed mitigation measures, the crossing of Deep Creek would result in the highest noise emission levels. The sound power level for the CAT 793D haul truck is noted to be 123dB(A), a level commonly described as "very noisy" and equivalent to a heavy rock concert.

Mitigation measures proposed to minimise noise emissions indicated that replacing Caterpillar haulage trucks (the major contributor of noise) with quieter Hitachi haulage trucks would achieve compliance with noise limits criteria for all scenarios except the year 12 night period. Minor exceedances of 4dB(A) to 6dB(A) are modelled for Tooloombah Creek Service Station, TSC RES 1 and TSC RES 2, and a noise exceedance of 4dB(A) at Brussels homestead under the worst-case scenario climatic conditions. Additionally, a fleet management system to monitor and control the movement of mining equipment could be used to eliminate or restrict equipment movement during sensitive night periods.

Several submitters identified concerns with noise, vibration and dust impacts the project would have on the surrounding community. Mitigation measures to reduce noise from haulage trucks were proposed by the proponent to reduce noise levels and achieve compliance with noise criteria limits for the construction phase and all operational phases except the year 12 night period.

Additional noise mitigation measures have been identified for the Tooloombah Creek residence and Brussels homestead to reduce noise exceedances such as the construction of earthen mounds and the provision of insulation and double-glazing in the affected residences. I would recommend that a Trigger Action Response Plan (TARP) is needed by the proponent to respond to any complaints or exceedances of predicted noise levels.

4.9.2 Conclusion and recommendations

I consider that the requirements of the TOR in relation to noise and vibration potential impacts were largely addressed in the amended EIS. The EIS has provided information on the baseline noise levels, predicted noise and vibration emission levels at sensitive receptors and proposed noise limit criteria.

However, the blasting noise and vibration assessment has not provided sufficient detailed information about likely impacts. In particular, no modelled potential blasting vibration and airblast overpressure levels were depicted indicating the likely extent of impacts in relation to sensitive receptors. I consider this would be particularly helpful in understanding the potential noise impacts on motorists travelling along the Bruce Highway from the open-cut mine blasting. In particular, the EIS has not described to my satisfaction, whether the impacts of blasting in the period of operation in year's 12 to 19, when mining would be within 100m to 500m of the Bruce Highway, would be acceptable to DTMR and users of the highway.

The department notes that the year 12 worst-case scenario does not extend beyond one year at this maximum production level and that the year 3 noise levels are more representative of the potential operational project impacts.

I recommend that the proponent establish EA noise and vibration limits for the project in accordance with the EPP Noise and demonstrate how they would be met. A noise and vibration management plan would also be required that states noise and blasting trigger values, control measures, and monitoring procedures to identify, mitigate and manage noise for each stage of the mine. The plan should include an automated real-time (24/7 system) monitoring of the ground movement and vibration readings to be developed and implemented.

4.10 Waste management

The relevant sections of the EIS used to describe and assess the non-mining and mining waste streams anticipated to be generated by the project's activities and their management were EIS Chapter 7–Waste Management and Chapter 8–Waste Rock. Additional supporting information was also provided in Appendix 3b–Geochemical Assessment and Appendix 3c–Land Stability Assessment. The risk assessment of the potential impacts of waste streams on surface and ground waters was addressed in Chapter 6–Water.

Section 8.12 of the TOR required the EIS to: describe the expected waste streams such as waste rock, tailings and coarse rejects from all project activities for each stage of the project; describe the quantity and physical and chemical characteristics, hazard and toxicity of each significant waste; assess proposed management measures against the preferred waste management hierarchy, namely: avoid waste generation; cleaner production; recycle; reuse; reprocess and reclaim; waste to energy; treatment; disposal. The TOR also required an assessment of the potential discharges of water and contaminants from the project. These matters were addressed in EIS Chapter 9–Surface Water and are responded to in section 4.4, Water Quality, Water Resources and Flooding of this assessment report.

4.10.1 Assessment

4.10.1.1 Waste streams

The main waste streams anticipated to be generated from the project include non-mining waste (general and regulated wastes), and mining waste from removal of waste rock.

4.10.1.2 Non-mining waste streams

The EIS adequately described the characteristics and volume of general waste and regulated waste predicted to be generated through the project stages, and the preferred management methods such as off-site recycling or disposal options.

General waste such as food scraps, packaging waste, non-regulated general waste, non-recyclable plastics and timber are estimated to generate the largest amount of waste by volume of less than 235t over the life of the project. This waste stream would be disposed of off-site to a municipal landfill facility either at Yeppoon or Rockhampton. These facilities would have sufficient disposal capacity for the

project's waste generation over the life of mine.

On-site disposal of non-mining waste is limited to green waste from the clearing of vegetation that would be preferentially mulched with some limited timber reuse on site. The controlled burning of vegetation would be undertaken where stockpiles are considered an unacceptable fire risk.

No sewage treatment plant is proposed for the project, instead portable toilet facilities would be used. Sewage and septic waste would be removed by licenced contractors to a licenced facilities (in the Rockhampton region) for treatment. I consider this to be a costly option as approximately 20ML of sewage per annum would result in a large increase in truck movements on the road network. Should a future sewage treatment plant option be considered, a full assessment of potential impacts would be required. This would also include future design of an appropriately sized effluent irrigation area and wet weather storage management.

The risk of contamination to land, groundwater or the watercourses from spillage of fuels, leakage of sewage effluent, mobilisation of surface contaminants by stormwater, or seepage of contaminants from temporary waste storages would be managed by a waste management plan. Mitigation measures include separating waste storage areas from overland flow paths and for stormwater to be directed away from those areas; minimise quantities of waste liquids, chemicals and hazardous wastes to be kept on-site at any one time; for waste storage areas to be bunded on a concrete pad with dedicated waste skips or bins; and spill response procedures and training undertaken for relevant employees. Contaminated soils from fuel and oil spills would be treated at a bio-remediation pad, if required or disposed within back-filled mine pits.

I note that an Emergency Response Plan would require that prior to the start of the wet season, all waste materials, receptacles and storages are properly contained and stable, and would be able to withstand wet season rainfall events without leaching or other loss of any contaminants.

Recyclable waste and regulated waste would be removed from the site by a licensed waste transport contractor for recycling, treatment, and/or disposal at licensed facilities. Regulated waste categories include waste oils and grease, and sewage effluent.

The transport of waste off-site was estimated to be approximately 600 heavy vehicle loads over 20 years, or up to three vehicle movements a month. Waste transport is a prescribed environmentally relevant activity that is regulated under the EP Act.

At mine closure, mine equipment, infrastructure and services not subject to future use agreements with the landholder would be decommissioned, removed from the site and the land rehabilitated to the pre-mining land use. No non-mineral waste is proposed to be permanently disposed of on mine site.

4.10.1.3 Mining waste streams

Waste rock consists of overburden—rock that lies above the uppermost target coal seam, and interburden—rock material that lies between the targeted coal seams. Rejects are the processing waste consisting of rock and small amounts of low-grade coal particulates extracted as part of ROM coal. The crushing, screening and washing of ROM coal at the CHHPs results in product coal, coarse rejects and fine rejects (based on particle size).

The EIS identified mining waste streams from mining the open-cut pits resulting in excavated waste rock (comprising overburden, interburden and fine rejects from the CHHPs). Initial mining for OC2 would haul the waste rock and rejects to the location of the waste rock stockpile (WRS2). Mining for OC1 from year 10 would see waste rock and rejects dumped at WRS1.

The total volume of waste rock for the life of mine is expected to be 743Mbcm. A swelling factor of 22% has been applied to the material to estimate an approximate total 906Mlcm of waste rock. The total volume of rejects is estimated to be 9.3Mlcm.

As mining progresses, waste rock would be encapsulated into the completed mining areas to facilitate progressive rehabilitation. Approximately 140Mbcm of waste rock stored in the two WRS would be used to completely backfill the two open-cut pits.

I note that the EIS has not identified methane emissions that would occur from dewatering the coal seams as a waste stream. The EP Act defines that waste can be a gas. As methane is likely to be

released through vents and the potential environmental impact of this waste stream should have been adequately assessed. Potential mitigation measures, such as options for collection or flaring, should also be described. For any future EA application, I would recommend that this environmentally relevant gaseous waste stream is thoroughly assessed.

4.10.1.4 Geochemical testing

Geochemical testing of waste rock was undertaken to determine the degree of risk from the presence and potential oxidation of sulfides, as well as the generation and the presence/leaching of soluble metals/ metalloids and salts. One hundred and seventy four representative samples of waste rock and potential coal rejects were collected from the 2012 exploration drilling program, while a further 21 fine reject samples were collected in 2018. The samples cover the entire stratigraphic profile of the proposed mining area. The results of the testing showed that approximately 96% of the waste rock and rejects samples were classified as non-acid forming (NAF) with low sulfur content and some neutralising capacity. A coal resource sulfur assay indicated that the total sulfur content of the coal materials is mainly found in fine coal rejects.

The EIS concluded that there is likely to be a relatively low risk of acid-mine drainage (AMD) or neutral mine drainage (NMD) generation from sulfide oxidation of the waste rock material.

A submission from the department sought further evidence that the assumed leaching of metals/ metalloids from waste rock is likely to have a negligible impact on surface and groundwater. In response, the EIS undertook further testing of fine reject samples to determine the likely leachate potential of the mine waste materials. Elevated concentrations of aluminium, arsenic and selenium were found in some water extracts as compared to the aquatic ecosystem guideline concentration trigger values. These concentrations were typically below the applied water quality guideline criteria for livestock drinking water, except for selenium.

I note that these metals/ metalloid concentrations would be regularly monitored as part of the surface water and groundwater quality monitoring program. I recommend that ongoing monitoring supported by further analysis of these contaminants of concern and the sources of contaminants (e.g., the waste rock stockpiles) are undertaken in any future updated mineral waste management plan (MWMP).

The salinity and sodicity of waste rock was also analysed as they affect the erodibility of mining waste. Waste rock and potential coal reject samples were tested, and results indicated alkaline material with a very high pH, with salinity measured as moderate. Sodicity, in the form of Exchangeable Sodium Percentage, results were very high. As previously noted, the strongly sodic soils that are highly dispersive and prone to erosion prevalent on the mine site present challenges and potential significant environmental risks for the proponent. Mine operations need to ensure the effective management of sodic soils and surface water runoff containing potentially high suspended sediment loads would not impact high-value ecosystems downstream of the project area.

Kinetic leach column (KLC) testing of waste rock and coal reject samples identified some exceedances of site-specific water quality criteria for aluminium, arsenic, molybdenum and selenium, with only some of the sample results exceeding for zinc and vanadium. Water quality is further discussed in section 4.4– Water Quality, Water Resources and Flooding. I note that KLC testing was not completed for coal fine rejects. I would recommend that any future updated MWMP includes additional KLC testing of fine coal rejects.

4.10.1.5 Waste rock placement and disposal strategy

The waste rock stockpiles have been redesigned in the amended EIS to address submission comments. Changes include locating the WRS largely out of the flood zone, minimising the area of disturbance, and better facilitating post-mining rehabilitation works in order to achieve reduced landform slopes. The two previous WRS on the southern side of the Bruce Highway have been combined into WRS1 and this has been located outside of the Tooloombah Creek floodplain and the MSES Wetland 2. WRS2 has nearly been halved in size to 76ha due to refined mine scheduling and increasing the height of the WRS.

The proposed placement and disposal strategy for the waste rejects (comprising dried coarse rejects and filter pressed rejects) is to place them at the base of the temporary waste rock stockpiles or co-dispose of them with waste rock deep within the open-cut pits in the area behind the working face as

operations progress. This ensures that these materials are encapsulated within the final landforms and not re-disturbed following rehabilitation works that would include reworking of the stockpile and pit areas.

To effectively manage the erosion risk associated with the highly sodic nature of the waste rock and rejects, it is proposed that the waste material is covered by regolith. The Land Stability assessment identified that regolith, recorded 25mbgl at most locations, consisted of suitable material, including clay lenses that were geochemically tested as NAF with low to moderate salinity. The regolith properties were considered to be suitable, with suitable amelioration, as a primary growth medium for the final shaping and rehabilitation of the waste rock stockpiles.

I note, however, that some sodic material may be used for profiling of the outer slopes of the waste rock stockpiles or that some PAF or saline reject material could unavoidably be placed near the surface of the landform. This material is required to be carefully managed and would likely to be treated with gypsum but there was no quantification of the amount of material that may be used or the potential erosion risk this may present (e.g., tunnel erosion). I consider that avoiding placement of sodic material near the surface would reduce this risk along with careful management and appropriate detailed mining and rehabilitation scheduling in place.

4.10.2 Conclusions and recommendations

4.10.2.1 Non-mining waste streams

The EIS commits to managing all non-mining waste in accordance with the waste management hierarchy and all waste streams would be reused on-site or transported off-site and recycled, where possible. The proposed waste management approach is consistent with industry best practices and was assessed in sufficient detail in the EIS.

Environmental values are unlikely to be affected unless a spill or a containment or waste transfer failure occurs. Bunding and the use of specific waste bins would be used to isolate waste liquids, chemicals and hazardous wastes. Spill kits would be located close to areas where chemicals are being stored or used. Licenced contractors would be used to regularly remove waste to an appropriately licenced facility. Waste that is sent off-site would be managed in accordance with licenced transport and recycling and disposal facilities where required by law.

I consider the proposed transport of sewage and septic waste for off-site treatment as an expensive option. I would recommend that the proponent consider managing sewage waste via an appropriately sized sewage treatment plant while noting the information requirements in the *Waste–EIS information guideline* (DES, 2020). This would require a full assessment of the potential impacts and design of an appropriately sized effluent irrigation area and wet weather storage management.

4.10.2.2 Mining waste streams

Overall, I note that the geochemical assessment indicates the leachate generated from bulk mine waste materials exposed to oxidising conditions would have a very high pH, very low acidity, low sulfate, low to moderate salinity, and low metal/ metalloid concentrations, with the exception of aluminium, arsenic, molybdenum and selenium, and to a lesser extent zinc and vanadium. The coal rejects are expected to be classified as NAF and have a relatively low risk of generating acidic drainage. Surface runoff and seepage is expected to be alkaline and have a low level of salinity. However, most samples were identified as sodic and highly dispersive and present a high potential erosion risk to downstream highly-sensitive environments.

I consider that the elevated concentrations for some metals and the sodic nature of the waste material would require additional work to be provided in an updated mineral waste management plan. This would include, but not be limited to:

- additional KLC testing of fine coal rejects
- a geo-environmental block model informed by geological and geochemical, physical and analytical sampling program data. This would assist in identifying beneficial mine waste units to be mined, hauled and placed into the most appropriate area (ex-pit or in-pit) to achieve progressive rehabilitation outcomes

- a detailed hydro-geo-chemical conceptual model should be developed for the backfilled pits to depict how the landform design would manage settlement and consolidation of the foundation materials. Settlement can impact surface drainage features that would then require reinstatement or repair
- a detailed soil characterisation assessment to quantify the total amount of suitable topsoil to fully cover and rehabilitate the final landform.

I am not satisfied that some sodic and dispersive soils may be used for profiling of the outer slopes of the temporary waste rock stockpiles or that some PAF or saline reject material could unavoidably be placed near the surface. I am of the opinion that these risks can be avoided with careful management and appropriate detailed mining and rehabilitation scheduling in place.

I am satisfied that adequate monitoring and reporting of surface water and groundwater quality (including runoff and seepage) from the waste rock stockpiles, combined with slope stabilisation measures and implementation of an updated mine water management plan and erosion and sediment control plan would effectively minimise and appropriately manage the potential environmental risks.

I note that the EIS has not identified methane emissions that would occur from dewatering the coal seams as a waste stream. Should the project be allowed to proceed I would recommend that this environmentally relevant gaseous waste stream be adequately assessed.

4.11 Hazards and safety

The key amended EIS document used to assess the project hazards and risk was EIS Chapter 21–Hazard and Risk. The EIS described the potential hazards and risk to people and property that may be associated with the project based on qualitative risk assessments. Chapter 19B–Social, assessed the risk to the workforce, stakeholders and local communities. Chapter 20–Health and Safety, assessed the potential impacts to the existing health and safety community values. More detail on specific issues is also detailed in a range of the amended EIS chapters.

Section 8.13 of the TOR required the EIS describe the potential risks to people and property associated with the project in the form of a risk assessment; and details of the proposed safeguards that would reduce the likelihood and severity of hazards. Details of emergency planning and communication and consultation with emergency services were required. An assessment of the risk of spontaneous combustion for the proposed coal mine were also required.

4.11.1 Assessment

A qualitative environmental risk assessment was undertaken of hazards and risks to the community from the construction and operation phases of the project.

The project area is surrounded by rural agricultural land use. Nine sensitive receptors were identified within 10km of the project. Tooloombah Creek Service Station complex which consists of a service station and two residential buildings is the nearest residential and commercial receptor to the mine site. It is located adjacent to the Bruce Highway and is 2.2km west of the edge of OC1. See Table 1 Sensitive receptors for the project for further details.

Three downstream water users who have surface water entitlements for irrigation, stock and domestic supply from Tooloombah Creek and Deep Creek were identified that may be potentially impacted from controlled and uncontrolled contaminant storage releases.

A natural hazard assessment adequately assessed the potential adverse impacts from bushfires, landslides and flooding as follows:

- Bushfires may be caused from project activities such as accidental ignition, explosions or spontaneous combustion of existing fuel loads. Consequences include damage to mining infrastructure, combustion of coal stockpiles and human injury or fatality.
- Landslides may be caused by heavy rain events or earthquakes. Consequences include open-cut pit wall collapse, damage to mining infrastructure, dam or levee failure, rupture or

damage to a dangerous goods storage facility and human injury or fatality.

- Flooding may be caused by extreme rainfall events or from changes to land use and overland flow paths from mining activities. Consequences include open pit flooding and possible contamination of runoff, controlled and uncontrolled releases of contaminated water due to dam overtopping, impacts to downstream water users from contaminated water releases, loss of production and operations shut down and human injury or fatality.

Coal hazards related to the potential adverse impacts from spontaneous combustion, explosions and the inhalation of coal dust were described as follows:

- Spontaneous combustion is caused by heat generated from oxidation within coal or waste rock stockpiles. Consequences include bushfires, health impacts from reduced air quality, damage to mining infrastructure and human injury or fatality.
- Explosions of combustible dust or gases is caused by dust generated from machines and mechanical errors. Consequences include fires, health impacts from reduced air quality, damage to mining infrastructure and human injury or fatality.
- Release of coal dust during coal handling and processing is caused by the breaking of coal through the crushing/ processing process, blasting and wind generated from machines or mining activities. Consequences include respiratory disease, coal workers' pneumoconiosis and chronic obstructive pulmonary disease, lung impairment, disability and premature death, potential to lead to cancer and decreased visibility leading to injury.

Major operational hazards related to the potential adverse impacts from mining construction and operation were assessed. An assessment of high potential incidents at Queensland surface coal mines in 2018-19 was presented. The top four incidents from this assessment that all had greater than 10% potential to occur were:

- Fires caused by a range of factors including chemical reaction, open flame and faulty equipment. Consequences include bushfires, damage to mining infrastructure and human injury or fatality.
- Explosions caused by build-up of methane and excessive heat, and from open flames. Consequences include bushfires, damage to mining infrastructure and human injury or fatality.
- Vehicle collision and vehicle loss of control caused by rail haulage failure, personnel transport accident, driver fatigue, vehicle or equipment failure and heavy and large loads. Consequences include crushing, contusion and fracture injuries, and fatality.
- Electrocution caused by contact with concealed and live overhead power sources and power lines, lightning strike, equipment failure and open wires. Consequences include injury or death, explosions, burns, electrical fault leading to mine and equipment failure and fire.

Mine wall collapse was also considered a hazard caused by inappropriate mine planning, design and construction. The amended EIS identified that a mine wall failure would be a catastrophic event that may occur once or twice over the project lifetime. It considered there would be a low residual risk to workers as there is limited manual labour undertaken in the pit. It also proposed mitigation measures such as appropriate drilling and blasting procedures and the incorporation of geotechnical aspects into design and operation.

A Safety and Health Management System (SHMS) is required to be prepared and implemented under the Queensland *Coal Mining Safety and Health Act 1999* in order to protect the safety and health of all site workers, contractors and visitors and ultimately the broader community. The amended EIS stated that an Emergency Response Plan (ERP) would be a critical component of the SHMS in order to minimise the potential consequences of emergency situations such as unplanned explosions which create air and noise quality issues for surrounding receptors, and traffic collisions (both onsite and offsite).

Dam failure was recognised as a risk and attributed to equipment failure, dam design and erosion and slumping. Consequences were stated to include stockpile damage and injury and death. However, there was no recognition of the preliminary consequence assessment undertaken for the project that identified a 'high' or 'significant' risk to four of the six dams and the levee. The potential harm to humans in the

event of a dam break (failure) for Dam 1 is unknown in the absence of a dam break assessment, however Dam 1 scored 'high' for general environmental harm so would be subject to the strictest design criteria under the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (the Manual) (DES, 2016). The levee as a regulated structure would be required to have a crest elevation higher than the peak 0.1% AEP flood level at the site.

It is noted that all referable dams must have an approved emergency action plan (EAP) in place under the *Water Supply (Safety and Reliability) Act 2008*. An EAP must have provisions regarding:

- identification, detection and management of dam hazards, as well as dam hazard and emergency events
- how effective warnings and notifications are communicated to those potentially impacted.

DTMR, in its comments on the amended EIS review stated that the potential for dam failure has not considered potential impacts on state-controlled transport infrastructure and corridors (the state-controlled road and railway corridors). DTMR stated that the project is required to ensure there will be no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from dam failure, or the risk of dam failure, for the life of the development.

The risk of potentially adverse impacts from blasting emissions was not addressed in Chapter 21–Hazard and Risk of the amended EIS. Open-cut blasting uses ammonium-nitrate-based explosives that generate oxides of nitrogen that can pose a serious human health risk. Nitrogen dioxide (NO₂) is the principal hazardous nitrous fume and is an extremely poisonous gas that is highly irritating to the respiratory system. A submission from Doctors for the Environment Australia stated that imperfect blasting can result in high levels of toxic gas that have resulted in hospitalisation of affected mine workers. The submission stated that there was a high risk to people travelling on the Bruce Highway during mining operations.

An assessment of impacts from gaseous blasting emissions was provided in Chapter–12 Air Quality. The EIS concluded that modelled gaseous pollutant concentrations at a distance of 500m from the Bruce Highway would be well below the EPP Air ambient air quality criteria and no impacts to road users are expected. However, there is concern that the location of the air dispersion modelling did not model the worst-case scenario i.e., at the edge of the state-controlled road corridor if the buffer area was mined. An assessment of the air dispersion modelling and impacts is provided in section 4.8 Air, of this report. Blasting impacts as it relates to the management of fumes on the safety of road users is discussed in section 4.15 Transport, of this report.

Chapter 21–Hazard and Risk of the amended EIS did not provide a hazard and safety assessment of impacts on the Bruce Highway from blasting. DTMR provided a submission on the original EIS raising the risk of potential damage to the state-controlled road from mining activities and stating that a more detailed geotechnical report was required for assessment. DTMR, in its review comments on the amended EIS (V3), noted the proponent's commitment not to undertake blasting that would cause closure of the Bruce Highway; to prepare a blast management plan if proposing blasting within 500m of the Bruce Highway; and to provide bi-annual geotechnical assessments to DTMR about the risk excavation blasting is posing to the Bruce Highway. Blasting impacts as it relates to the geotechnical stability of the Bruce Highway and safety of road users is discussed in section 4.15 Transport, of this report.

The project would store and use a number of hazardous substances, including an estimated 18,600tpa of ammonium nitrate emulsion required for blasting. Hazchem storage onsite would consist of approximately 1,200,000L of diesel fuel in bunded tanks.

Transport of hazardous substances to the project site would be transported via the Bruce Highway in accordance with the most recent version of the Australian Dangerous Goods Code (Commonwealth of Australia, 2020). The risk of collisions and spills is addressed in section 4.15 Transport, of this report.

4.11.2 Conclusions and recommendations

The department determined that the amended EIS largely addressed the impacts of natural and project induced hazards on people and property and their management addressing section 8.13 of the TOR.

The provision of an ERP developed in consultation with emergency service providers and the implementation of an SHMS that integrates risk management elements and practices to ensure the safety of workers, contractors and the community are both supported.

A spontaneous combustion management plan should be developed and implemented before mining commences.

DTMR recommends that the operational management of the development must ensure that there would be no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from dam failure, or the risk of dam failure, for the life of the development. This requires a Registered Professional Engineer of Queensland (RPEQ) certified operational management plan which includes an emergency action plan that deals with procedures to protect the railway corridor and state-controlled road in the event of dam failure and other incidents. DTMR recommended requirements for this issue are provided in Appendix 5.

The department would require certified CCAs for each of the regulated structures for the project, to ensure that sufficient investigation work has been undertaken, and that all foreseeable environmental and safety risks of the structures are identified and suitably assessed before construction.

Due to the hazard and risks of fly rock and other adverse impacts on the Bruce Highway, DTMR recommends that any blasting undertaken within 500m of the Bruce Highway is informed by ongoing bi-annual geotechnical assessments of the mine's impacts on the Bruce Highway and that this information be provided to DTMR. DTMR recommends that any excavation or ground disturbance that may reduce the safety, efficiency or structural integrity of the Bruce Highway is managed via an approved excavation and blast management plan. This plan should also extend to include the risk that any ground disturbance (e.g., cutting and filling for the Rail Loop) may impact on the safety and efficiency of the proposed rail line. See recommended requirements in Appendix 5.

In addition, it is recommended that the department would require that a draft blast management plan be provided for review and comment by both the department and DTMR before any mining occurs. It is also recommended that an automated real-time (24/7) system be used by the proponent to monitor ground movement and vibration. Implementation and maintenance of a protocol for the management of flyrock is also needed.

4.12 Cultural heritage

The EIS chapter used to assess Indigenous and non-Indigenous cultural heritage for the project area was Chapter 18—Cultural Heritage.

Section 8.14 of the TOR required that the EIS was to:

- conduct the impact assessment in accordance with the department's EIS information guidelines: *Indigenous cultural heritage; and non-Indigenous cultural heritage*
- develop a Cultural Heritage Management Plan (CHMP) in accordance with Part 7 of the *Aboriginal Cultural Heritage Act 2003*
- undertake a study to describe known and potential non-Indigenous cultural and landscape heritage values by an appropriately qualified cultural heritage practitioner
- provide strategies to mitigate and manage impacts to non-Indigenous cultural heritage values.

4.12.1 Assessment

4.12.1.1 Indigenous cultural heritage

The project would be located within the Styx Coal Basin, known as an area holding Aboriginal connection to country, historical mining and grazing related communities in Central Queensland. The project area consists of resource tenures and freehold land, predominantly used for grazing.

The EIS reported that a Native Title search identified the Barada Kabalbara Yetimarala People #1 (QC2013/004) claimant over the proposed mine pits and ancillary infrastructure area. Another claim by the Barada Kabalbara Yetimarala People #2 (QC2013/005) exists over the proposed TLF area. That

claim is described as a shared country claim with the Darumbal People's active Native Title claim (QC2012/008) which is over the TLF area. The Darumbal People also have a Native Title claim to the east of the project area.

The *Aboriginal Cultural Heritage Act 2003* (ACH Act) imposes a duty of care on proponents when carrying out an activity to take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage. One of the duty of care matters is the extent to which the proponent has consulted with Aboriginal parties. Offences under the ACH Act in relation to unlawful harm to Aboriginal cultural heritage, and the excavation, relocation or taking away of Aboriginal cultural heritage by a corporation are not committed if the person is acting under an approved CHMP.

Any future agreement with a native title claimant would include the implementation of an agreed CHMP. A CHMP would need to be developed for the project area over both MLA801087 and MLA700022 in accordance with Part 7 and section 87 of the ACH Act to detail how the proposed project activities would avoid or minimise potential impacts to Aboriginal cultural heritage.

The Indigenous cultural heritage assessment was undertaken as a desktop assessment only. The amended EIS stated that site information was collated via online resources, registers, database and data obtained during surveys within the project location. The proponent's search on the Australian Heritage Database found no items of Indigenous nor non-Indigenous cultural heritage significance within the project area. The proponent also found no entries recorded for the project area in either the Aboriginal Cultural Heritage Register or the Livingstone Shire Council's Local Heritage Register Sites. However, the department has no indication that the searches and records have been re-visited or updated since the original EIS was submitted in 2017.

Although the project area has been extensively cleared for grazing cattle, it was considered highly probable that some Indigenous cultural heritage values would be present, such as stone artefacts in remnant vegetation areas near watercourses. If items of Indigenous cultural heritage values are identified during works, management procedures would include cessation of work to investigate the findings. No field archaeological surveys were planned or undertaken for the project area for the amended EIS.

The amended EIS stated that the CHMP has not been finalised as negotiations are continuing with the Aboriginal parties. A commitment was made that further systematic Indigenous cultural heritage assessment of the proposed disturbance area would be undertaken once a CHMP is finalised. An EIS submission from Darumbal Enterprises expressed concern over the lack of engagement with Aboriginal parties, the limited relevant research data on regional cultural heritage values, and reasons why a CHMP had not been completed.

4.12.1.2 Non-indigenous cultural heritage

The amended EIS stated that results from the desktop studies found that no cultural significant items were identified on Commonwealth Heritage lists and databases; no registered sites were detected by the Queensland Heritage Register search; and no cultural heritage places were identified in the Livingstone Shire Council Draft Plan 2016.

Based on the desktop assessment, targeted field surveys were undertaken for the proposed project area to verify the locations of homesteads, cattle yards and windmills, and to assess the significance of any identified historical sites or objects. The results of the field studies identified six potential features with cultural heritage values: two main farm residences, a worker's residence, stockyards and two windmills. The proponent undertook the cultural heritage significance assessment using the department's Cultural Heritage Criteria (DEHP, 2013) and concluded that none of the six sites had cultural heritage significance.

4.12.2 Conclusion and recommendations

I have determined that the amended EIS has not adequately addressed the cultural heritage section of the TOR. I am not satisfied with the proponent's lack of progress towards finalising the required Indigenous CHMP for the project. I note there has been no update as to what stage negotiations have reached, and with which Aboriginal parties, over the three versions of the amended EIS dating from 2017. There have been no Indigenous cultural heritage surveys undertaken on the site. There has been

no additional Indigenous cultural heritage research provided in the amended EIS.

To address this issue, I recommend that the proponent complete the required Indigenous cultural heritage surveys to identify Aboriginal cultural heritage matters in the project area and for the protection of any Aboriginal cultural heritage values identified in the project area. The proponent must also provide evidence of negotiations undertaken with relevant Aboriginal parties. This should take the form of written confirmation from relevant Aboriginal parties that further consultation has taken place to their satisfaction; and that an executed CHMP adequately addresses their concerns in relation to the project's mining activities.

I consider the non-indigenous cultural heritage assessment sufficient for the project. I recommend the development and implementation of a protocol for unexpected archaeological finds and the provision of cultural heritage inductions for employees and contractors, in accordance with the *Queensland Heritage Act 1992* be implemented by the proponent.

4.13 Social

4.13.1 Social impact assessment process

The relevant section of the EIS that described and assessed the potential social impacts (both positive and negative) of the proposed project and identified relevant impact mitigation and benefit enhancement measures were Chapter 19B–Social and Appendix 14c–Social Impact Assessment (SIA). These documents were revised in response to EIS submissions.

As the EIS was publicly notified in November 2017, prior to the commencement of the *Strong and Sustainable Resource Communities Act 2017* (SSRC Act) on 30 March 2018, the provisions of the SSRC Act and the requirements of the statutory Social Impact Assessment Guideline (DSDMIP, 2018) do not currently apply. However, in section 8.15 of the TOR, the proponent committed to meeting the requirements of the SIA Guideline (2018).

The SIA Guideline (2018) identifies five key matters to be addressed in the SIA:

- community and stakeholder engagement
- workforce management
- housing and accommodation
- local business and industry procurement
- health and community wellbeing.

The following social assessment does not report on all social matters identified in Chapter 19B–Social of the EIS, rather it considers the key social issues for the project and identifies outstanding matters requiring further attention, for which recommendations have been provided.

4.13.2 Social impacts and submission issues

The SIA determined that the project is likely to have impacts on and provide opportunities for the local communities of Ogmoo, Marlborough, Clairview, St Lawrence, Canoona and Kunwarara, which are located within a safe daily commute distance (maximum one-hour drive time) from the project site. The proponent has committed to supporting local employment by preferentially employing residents from these towns. Regional communities, including Yeppoon and Rockhampton, would also likely benefit from employment and procurement opportunities.

The SIA also identified that the project presents opportunities for local and regional businesses to benefit economically from increased procurement, trade and workforce spending.

The key social issues raised by submitters during public notification of the EIS included:

- ongoing engagement and collaboration with local stakeholders
- existing demand for local short-term accommodation and potential impacts to the tourism industry
- potential project impacts on community health and wellbeing

- capacity of community and health services to accommodate increased demand by the project workforce
- workforce recruitment, accommodation, and management
- cumulative workforce demands resulting from other projects in the area
- need for detailed management strategies and associated action plans.

The proponent responded to the EIS submissions on the social issues in the amended EIS.

4.13.3 Management measures

In the EIS, the proponent proposed measures to avoid potential adverse social impacts and enhance potential social benefits. These measures were collated in a social impact management plan (SIMP) provided as part of the SIA. The SIMP provides for the management and monitoring of social impacts throughout the construction and operation of the project. Key impact management strategies proposed by the proponent are assessed below, and recommendations made.

4.13.3.1 Workforce and housing

The SIA identified two workforce sourcing scenarios for both the construction and operational phases of the project. The construction workforce would either be predominantly sourced from the regional area or the rest of Queensland (rather than the local study area), while the operational workforce would be predominantly sourced from either the local or regional areas. The SIA did not confirm the anticipated scenario for sourcing labour for the project's workforce or the proportion of workers likely to relocate to live in the local or regional study areas for both project phases. Management strategies identified in the Workforce Management Action Plan, include prioritising recruitment of residents from local and regional communities and providing incentives to all employees permanently residing or relocating permanently to the local area. I recommend the action plan be updated (prior to construction commencing) to ensure that it is appropriate for the actual workforce sourcing scenario for both phases of the project.

The project intends to accommodate all non-resident workers (those not residing in the local or regional study area) at Marlborough Caravan Park during both project phases. However, the SIA acknowledged that the demand for construction workforce accommodation under the predominantly state sourcing scenario would far exceed existing supply at the caravan park. The proponent has committed to working with Marlborough Caravan Park to support expansion of workforce accommodation on site and collaborate with Livingstone Shire Council regarding camp planning. I acknowledge that this process would be ongoing and would need to be resolved prior to the commencement of construction.

The SIA also identified that the negative impacts on housing were rated 'high' should this proposed strategy (subject to separate approvals process) not eventuate within an appropriate timeframe or at an adequate scale. I recommend alternative non-resident workforce accommodation options and/or strategies be explored as part of the Housing and Accommodation Study, which the proponent has committed to undertaking prior to construction. Further detail on the caravan park's expansion development approval is also recommended for inclusion in the study. The findings of the study should inform housing management measures proposed in the updated SIMP. I expect the updated SIMP would be made publicly available on the proponent's website.

4.13.3.2 Community health and wellbeing

During consultation undertaken by the proponent to inform the SIA, a key concern raised by stakeholders was the potential for the project to impact on local services and infrastructure, particularly the additional demand associated with operational workers relocating with their families to the local study area. To manage this demand, the proponent has made commitments in the SIMP Health and Community Wellbeing Action Plan to monitor project impacts through continued engagement with local councils and services providers; and provide on-site medical staff to minimise additional demand on local health services. I recommend utilising statistics on worker demand for local services as a SIMP monitoring indicator.

Local residents also identified that existing local utility (electricity) services were less than reliable and subject to disruptions. The SIA concluded that the project's potential to increase demand on utility

services is unlikely to be significant as the project proposes to generate its own electricity. I consider service reliability issues could be exacerbated by the project's in-migrating and non-resident workforce accommodated in the local study area. I recommend further consideration of the potential impacts from the project's workforce on local services and engagement with utility operators to better understand likely project impacts and develop appropriate management measures (where required).

The SIA identified some increased demand for police services during both project construction and operations, however anticipated impacts are expected to be minimal. To further reduce potential road traffic risks, the proponent committed to operating bus services for all workers, particularly those who reside outside of a safe commuting distance (one-hour drive time) to the project. I recommend confirming details of the bus services (number and service area) in the updated SIMP and monitoring the number of workers utilising the provided services as part of the SIMP monitoring.

4.13.3 Social impact management plan

The SIA identified that the effectiveness of the SIMP implementation would be regularly reviewed by the proponent and impact management actions would be adjusted as needed. I recommend the SIMP be updated, prior to commencement of construction, to include further detail on the proposed management measures and clearly demonstrate how these would minimise project impacts and enhance local and regional opportunities. Should the proposed project not proceed within three years post completion of the EIS process, I recommend the SIA and SIMP be comprehensively reviewed and updated in consultation with local government and relevant stakeholders.

I support the proponent's commitment to preparation of an annual report monitoring SIMP indicators. I expect that this annual SIMP report would be made publicly available on the proponent's website. I also expect that key social commitments identified in the EIS are delivered by the proponent to ensure potential project impacts are appropriately managed.

4.13.4 Conclusions and recommendations

I have determined that the amended SIA adequately addressed the TOR and submissions on the EIS and is generally consistent with the requirements of the SIA Guideline (2018) although some matters remain unresolved and require additional studies and refinement of the project's SIMP.

I consider the effective implementation of the SIMP would address the potential negative social impacts identified in the SIA, such as increased demand for housing and accommodation in the local and regional study area, and enhance potential social benefits, such as opportunities for local/regional employment and business procurement.

I recognise the proponent's commitments ensure that potential negative social impacts of the project are avoided, minimised and/or mitigated, and that potential social benefits are realised. I expect the proponent to deliver on these commitments and implement these recommendations.

The Office of Coordinator-General's recommendations for Social aspects are provided in Appendix 4.

4.14 Economics

The relevant section of the EIS that described and assessed potential economic benefits and impacts for the project were EIS Chapter 19A—Economics and Appendix 14a—Economic Model Outputs. These documents included only minor revisions in response to EIS submissions.

Section 8.15 of the TOR required the EIS to:

- identify the potential adverse and beneficial economic impacts of the proposed project on the local and regional area and the state
- quantify economic impacts where suitable data and methodology can be applied
- address labour demand, including the ability for labour to be drawn from the existing local workforce, and the potential effects this may have on local businesses
- describe relevant prices, including wages, input costs and/or household goods and services.

4.14.1 Assessment

A local, regional and state economic impact assessment was undertaken to determine the potential economic benefits and adverse impacts of the project. The project's mine plan was designed to extract all the economically viable coal resources in order to mine and process semi-soft coking coal (SSCC) and high grade thermal coal (HGTC) over a planned mine life of approximately 24 years. The majority of product coal would be SSCC, with an estimated volume of saleable coal of approximately 46.2Mt. HGTC would only be produced in year's 11 and 12, producing an estimated volume of saleable coal of approximately 4.8Mt. Total production volume of HGTC and SSCC over the life of the project is approximately 51Mt. The EIS estimated the project site to contain an inferred, indicated and measured total mineral resource of approximately 206 Mt at 83.1% average theoretical yield.

The SSCC quality comprises of generally lower than average volatile matter and a lower ash content. The thermal coal was characterised as having a moderate sulphur content, acceptable moisture content and volatile matter, low ash levels, and high energy content. The latter being approximately 5% above the standard Newcastle-type specification.

The EIS stated that the market for the coal product is 100% export. The EIS stated the project's economic benefits were to significantly assist economic stimulus; increase export revenue associated with the sale of coal product; and increased supply chain and employment opportunities in the regional catchment and Queensland.

The assessment approach undertaken for the EIS used a regional input-output method. This approach applies four different measures of economic impact: output, household incomes, employment, and value added (Gross Regional Product). These measures are used to provide indicative results relating to the total demand generated by the proposed project.

The total economic impact of the activity comprises a direct or initial effect of the stimulus for the economic impact, and flow on effects, comprising production and consumption induced effects. The extent of these impacts are represented by two sets of multipliers calculated in aggregate for various regional, state, and national economies. The EIS acknowledged there are limitations to this regional impact modelling approach.

The input output model was criticised by several submitters. The model was considered not suitable to adequately weigh-up the costs and benefits of a project, it assumed the project would be approved and finalised, and that there are unlimited resources in the economy. By using this model, the EIS was considered to over emphasise the potential income that would be derived from the coal product, while ignoring externalities and failing to adequately consider proportionality.

The EIS did not conduct a cost benefit analysis as it was considered to not adequately address the scope of project requirements, particularly the impacts on both the regional and state economies, and supplier markets, as specified in the TOR. The EIS stated the aim was to assess the spectrum of potential impacts of the project, based on the maximum footprint of the proposed project on the environment.

A number of submitters considered the data and analysis in the economic technical report to be flawed. Submissions raised concerns with the economic viability of the project; the lack of sufficient elaboration on the selected methodology and parameters used; and the flawed analysis of project forecasts and asset calculations. I note the proponent has stressed the project has experienced a number of delays and it was not considered necessary to update the economic model, as the changes in commencement dates were not considered to be material to the overall conclusions drawn. I note the proponent has only made minor amendments to EIS Chapter 19A—Economics and Appendix 14a—Economic Model Outputs since the December 2018 version of the EIS was modified. Due to the minimal updates to the EIS, I consider that submitter's comments and recommendations may not have been adequately addressed, and the resulting information may rely on out-dated sources and assumptions about coal price forecasts.

I note cost benefit analysis is the preferred framework for evaluating economic impacts of a project by both reviewers and regulators (DSDILGP, 2017). A cost benefit analysis would typically assess the potential impact of a project on the economic welfare of the economies of interest by estimating a dollar value for as many economic, social and environmental benefits and costs as can reasonably be predicted.

Economic costs associated with the proposed project include an initial construction capital cost of developing the project open-cut, the CHPP, and processing infrastructure of \$262.3 million. Operating costs are estimated to average approximately \$566.5 million/year during peak production. However, I note that a submitter's comment recognises that the EIS does not address how the proponent would pay for progressive rehabilitation and that the EIS does not provide any information about the cost of implementing the rehabilitation strategy over the life of mine. I note that mining rehabilitation reforms have led to a new financial provisioning scheme that commenced on 1 April 2019. The department now determines the estimated rehabilitation cost (ERC) for a mining project. The scheme manager then decides on the required financial provisioning contribution or amount of surety based on an assessment of risk to the State of Queensland. An ERC decision would need to be in force for the activity prior to the commencement of mining.

The reported gross regional product (GRP) was estimated at an average annual growth between 2001-2011 of 10.3% in Central Queensland and 8.8% for Queensland. Notable drivers of Central Queensland GRP growth were construction, mining, manufacturing and transport, postal and warehousing.

I consider the EIS did not adequately describe and assess the potential negative economic impacts of the proposed project, including all potentially relevant stakeholder groups that may be affected by the project. The EIS estimated the opportunity cost, in terms of the lost production of cattle grazing land from the impacted mine area (estimated in terms of forgone annual output and annual gross margin) would be approximately \$1.92 million and \$0.29 million respectively. This analysis assumes that cattle could have been grazed over the entire mining lease area. The project plans on undertaking progressive rehabilitation of the land over the 24 year mine life. The primary aim of the rehabilitation is to establish a landform with no final voids that would be suitable for low intensity grazing. I note the estimated costs associated with the proposed progressive rehabilitation strategy were not provided in the EIS for review and assessment.

The economic impact assessment estimated that the total export revenue of the coal product is approximately AUD\$7.78 billion to \$8.23 billion over the life of the project. Value added impacts during the operational phase of the project are estimated to be approximately \$476.7 million to the Central Queensland region, \$107.3 million to the rest of Queensland, and \$115.9 million to the national economy.

The project's contribution to output, household income, employment and value added during the construction phase for Central Queensland, rest of Queensland and the National economy is estimated to be:

- Central Queensland—Total output contribution of \$60.7 million, comprising \$26.8 million in direct impacts and \$33.8 million in indirect impacts
- Rest of Queensland—Total output contribution of \$23.3 million, comprising \$12.5 million in direct impacts and \$10.8 million in indirect impacts
- National—Total output impacts of \$22.0 million, comprising \$11.0 million in direct impacts and \$11.0 million in indirect impacts.

During the operational phase the output contributions are estimated to be:

- Central Queensland—Total output contribution of \$1,148.7 million, comprising \$566.5 million of direct output contribution and \$582.2 million of indirect output contribution
- Rest of Queensland—Total output contribution of \$240.9 million, comprising \$141.6 million in direct output contribution and \$99.2 million in indirect output contribution
- National—Direct output contribution of \$258.0 million, comprising \$141.6 million in direct output contribution and \$116.4 million in indirect output contribution.

The EIS stated the proposed project would generate increased employment opportunities as well as opportunities for suppliers of goods and services within Central Queensland. During the operational phase of the mine, total output impacts (relating to increased regional supply chain and employment opportunities) to the Central Queensland region are estimated at an average of \$343.3 million/year, including \$169.3 million in direct impacts.

The project plans to utilise a local workforce to the extent possible. The non-local commute workforce would be accommodated at facilities potentially being developed at the Marlborough Caravan Park. The proposed expansion of the existing facilities would likely mitigate the likelihood for increased pressures on the local housing market. The housing strategy for new local workers is discussed in section 4.13–Social of this assessment report. The employment support generated by the local supply chain activity is estimated to be at an average of 863 FTEs per annum, including 507 direct FTEs/year. Operational employment on-site is estimated to be between 100 (2019) to 500 workers at full production (2030).

The EIS identified that the workforce in the local area is largely employed in the agriculture sector, with mining the second largest industry sector employer. The EIS stated approximately 2.5–7.5% of the construction workforce would be recruited from the local study area. Approximately 20–50% of the workforce would be sourced from the local study area in the operational phase of the project, including 10–25% in-migrating. The EIS estimated the contribution of household income for Central Queensland workers in the peak construction phase of the project at approximately \$11.7 million, and \$253.8 million during the peak operational phase.

The EIS estimated that if all coal product is exported it would contribute approximately \$7.8–8.2 billion to Queensland’s export economy. The EIS estimated that the Queensland Government would receive between \$703.3 million and \$766.0 million in royalties over the life of the project.

The EIS stated the predicted benefits from the project include economic stimulus to the regional, state and national economy during construction and operation; export revenue associated with the sale of coal product, which in turn would result in the payment of royalties over the life of mine; and increased regional supply chain and employment opportunities throughout the construction and operation stages. Submissions received by the department on the EIS raised important concerns, including the risks to opportunity costs of forgone output in gross annual margin, tightening of local and regional labour market and costs, skills shortages, increased pressure on housing and property markets, and increased burden on Central Queensland infrastructure.

4.14.2 Conclusions and recommendations

I consider that the project has the potential to contribute to the local and regional workforces in Queensland by provide employment, export revenue, and economic stimulus to the regional, state, and national economy.

I note that the coal production schedule has changed significantly from the original EIS increasing from approximately 36.9Mt to 51Mt. Export revenues from coal product are estimated to be between \$7.78 billion to \$8.23 billion that would yield royalties of approximately \$703.3 million to \$766 million over the life of mine.

I note that the project could increase pressure on regional labour, local housing, industrial property markets, and would result in an opportunity cost in terms of foregone output from cattle grazing, of approximately \$1.92 million/ year.

I support the proponent’s commitments to prepare and implement local business and industry content strategies to ensure engagement and procurement opportunities with industry, local contractors in Livingstone Shire Council and Rockhampton Regional Council.

4.15 Transport

The relevant section of the EIS used to describe and assess transport matters of the project were Chapter 6–Transport, Appendix 4A–Road Impact Assessment; Appendix 4b–Geotechnical Assessment, Appendix 4c–Draft Road-Use Management Plan, and Appendix 12–Environmental Management Plan that included a Traffic and Transport Management Plan.

Section 8.16 of the TOR required the EIS to:

- conduct the impact assessment in accordance with the department’s *EIS information guideline–Transport*
- undertake a road impact assessment (RIA) in accordance with DTMR guidelines

- present assessment for each mode of transport (road, rail, air and sea)
- discuss how identified impacts on existing infrastructure (e.g., including local roads, state-controlled roads and the NCRL) would be mitigated for each transport mode.

4.15.1 Assessment

4.15.1.1 Overview

The project proposes to use the existing state-controlled road (the Bruce Highway) for supply of materials, equipment and personnel to the mine site. It also proposes to use the existing rail line—the NCRL—that is adjacent to the northern boundary of MLA700022, to transport the coal product approximately 170km north to the Dalrymple Bay Coal Terminal (DBCT). Coal would be exported to overseas markets; however, these export markets were not identified in the EIS. The EIS did not identify any public transport or active transport systems that would be impacted by the project.

The nearest regional airport is Rockhampton, an approximately 90 minute drive south of the project area. The EIS stated that the permanent workforce is not expected to be fly-in fly-out and did not assess the air transport mode.

Securing a port allocation at DBCT would be done outside the EIS process. The project's product coal would be within DBCT's existing throughput capacity and not require any additional coastal works, dredging or materials handling infrastructure. Ship transportation was stated to be in accordance with current legislation and travel through designated shipping areas. There was no discussion in the EIS as to the likely vessel movements.

4.15.1.2 Road impact assessment

The Bruce Highway is currently a two-lane, two-way, undivided road with a 110km/h speed limit at the mine site location. The section of the Bruce Highway adjacent to the two project MLAs is approximately 6.6km long and traverses approximately 2km south of the Deep Creek Bridge to the Tooloombah Creek Bridge to the north.

The project proposes installation of an eastern access road off the highway to the site for access to the initial construction activities, including the open-cut pits OC2 and MIA2. The access point located off the Bruce Highway is approximately 25km north of Marlborough and approximately 600m north of the Deep Creek Bridge. Works may require temporary diversion of traffic for the construction of right hand and left hand turning lanes.

A western access road is proposed off the highway for access to the southern OC1 and associated infrastructure such as WRS1, CHHP1 and MIA1 in approximately year 10 of operations. This would require a realignment of Mount Bison Road at a location approximately 29km north of Marlborough. Construction activities would not commence until the second half of the operational period.

The proposed new Mt Bison Road is outside of the MLA and approvals would be needed under the *Planning Act 2016*. An indicative design and location identifies approximately 11.5ha of disturbance. The EIS reported that design of the intersection has not been finalised and would require future approval from DTMR for works under the *Transport Infrastructure Act 1994* and provision of a traffic management plan (TMP) prior to construction. A submission from the Queensland Police Service (QPS) highlighted that a TMP is needed to ensure the safety of all road users especially when traffic is accessing and egressing the Bruce Highway during change of shifts.

All materials, plant and equipment would be transported to the site by truck. Annual heavy vehicle movements were modelled for the construction and operational periods. Hourly heavy vehicle movements are expected to be less than three, but 10 vehicles per hour has been adopted as a worst-case scenario for the road link and intersection turn warrant assessments. Approval for the transport of oversized loads for the construction period may also be sought. The majority of project heavy vehicle movements, approximately 85%, would be sourced from the surrounding region that includes Mackay to the north and Rockhampton to the south. Total heavy vehicle movements from local, regional or state-based means over the life of the project are estimated to be approximately 57,000 vehicles. A pavement impact assessment stated that heavy vehicle impacts on the Bruce Highway are considered insignificant.

The transport of dangerous goods and hazardous materials for the project would include fuel, explosives such as ammonium nitrate and waste materials. This increases the potential environmental risk should there be spills and contaminated runoff from transport vehicles. A submission from the QPS noted that B-Double vehicles with an average load of 50,000L would deliver fuel to the mine site and that total lubricant consumption is estimated to average around 10,000L per week. QPS recommended that a detailed TMP be developed and provided to the QPS (local command) for consideration on transportation of bulk fuel into the site.

Design of the mine has ensured that coal would not be transported on the Bruce Highway. The mining of coal from OC2 on the northern side of the Bruce Highway would see truck haulage on dedicated mine site haulage roads transporting coal approximately 7km north-east from MIA2 to the TLF coal stockpile. No Council controlled roads would be used. In the second half of the operational period, with the mining of OC1 on the southern side of the Bruce Highway, ROM coal would be transported to MIA2 exclusively by a coal conveyor.

The coal conveyor is proposed to traverse approximately 1.5m beneath the Bruce Highway via a dedicated culvert. It has been redesigned and relocated away from under the Deep Creek Bridge as originally planned. However, only an indicative design of the culvert and conveyor arrangement was provided in the EIS and its location has not been finalised. The design of the culvert and conveyor arrangement will need to be further refined in consultation with DTMR and then approved by DTMR as per the requirements of *Transport Infrastructure Act 1994*.

Traffic management activities would need to ensure that two-way movement on the Bruce Highway is maintained during the construction activity. An updated flood model would need to account for potential flooding to the state-controlled corridor from construction of the approximately 4.5m wide culvert. Any works must not interfere with or cause damage to the existing stormwater drainage on the state-controlled corridor.

The regional workforce generated traffic is expected to be sourced entirely from the local or regional area. The annual average daily traffic generated by the project is forecast to generally exceed 30% in the local area from St Lawrence to Marlborough. The peak workforce traffic scenario for year 12 of operations estimates 876 vehicles entering and exiting the proposed project site from both access roads in a 24 hour period.

A road safety risk assessment identified a number of transport risks, including an increased risk of vehicle collision due to driver fatigue, and undertaking construction and/ or mining works during night time where poor lighting might limit visibility. No school bus routes use the Bruce Highway in the vicinity of the proposed access points into the mine.

4.15.1.3 Geotechnical stability of the Bruce Highway assessment

The mine plan proposes to excavate open-cut pits on each side of the Bruce Highway. The northern OC2 mine is proposed to extend in a southerly direction entering a 500m 'buffer zone' to the Bruce Highway in year 12 of mine operation. The mine sequence would extend in a south to north direction for approximately 3.5km mining the buffer zone over three years of production. Rock cuts would be excavated with 45m deep batters and 10m berms using blasting techniques, including pre-splitting and vibration monitoring in order to reduce disturbance. The mine pit depth would be approximately 164mBGL at the southern end and approximately 101mBGL at the northern end. The maximum length of batter exposed at any one time is 200m and there would be immediate backfilling after coal extraction. The mine pit walls are planned to extend on each side to within approximately 90m of the Bruce Highway centreline.

DTMR, in their submission on the EIS identified that the Bruce Highway (road users and infrastructure) may be at risk from both the potential impact of excavation works and from damage caused by blasting including from flyrock. Another submitter highlighted the routine mine blast at Dawson Mine on 9 November 2017 that triggered ground movement from the pit's end wall resulting in extensive damage to the adjacent Gibihi Road. This resulted in Gibihi Road's closure—considered a vital access road for the community of Moura—a 45km detour, and construction of a new alternative road to replace the damaged road that opened nearly three years later in August 2020.

The EIS presented a geotechnical assessment of the Bruce Highway that undertook slope stability and

deformation analyses based on laboratory testing of two cored boreholes drilled to full pit depth for the northern OC2 pit adjacent to the highway. The deformation analysis showed a maximum 15mm horizontal movement and 5mm vertical settlement modelled at the highway centreline for pit edges 100m from the highway with safety berms as per the proposed pit design. This was not considered to be significant and would not result in disruption to the highway. The assessment recommends that careful attention to blasting techniques would be required, including pre-splitting and limitation of peak particle velocities with vibration monitoring. DTMR in review comments noted that the number of boreholes proposed may need to be increased based on the complexity of the geology and that no assessment was provided for the southern open-cut pit OC1 when completing the six-monthly geotechnical assessments committed to by the Proponent.

4.15.1.4 Blasting flyrock and toxic fumes assessment

The EIS states that the proponent does not propose to undertake any project related activities that require the closure of the Bruce Highway. DTMR provided EIS submission comments in 2017 stating that the department does not support any closures of the highway given its state-wide freight function and the need for it to remain open at all times for emergency vehicle use. The EIS stated that no blasting would occur within a 500m buffer to the Bruce Highway until a specific blast management plan (BMP) has been approved by both the department and DTMR.

DTMR in EIS (V3) review comments stated that they had sought advice on blasting from Resources Safety and Health Queensland (RHSQ) given their role administering the *Explosives Act 1999* and the *Coal Mining Safety and Health Act 1999*. Advice from RHSQ was that there may have to be a 1,000m exclusion zone provided to the Bruce Highway to effectively reduce the potential for flyrock hazard. This recommendation was on the basis that flyrock from blasting can pose an unreasonable safety risk up to 1000m, depending on the nature of the blast, making the 500m buffer proposed by the EIS inadequate.

DTMR recommended that the department seek advice from RSHQ on the need for and suitability of a permanent exclusion zone for blasting from the Bruce Highway; and the likelihood of the proposed mine being able to fulfil its public safety obligations. Advice provided to the department from the RSHQ Principal Inspector of Explosives was that the higher risk zone close to the Bruce Highway could potentially be managed by the use of smaller shots, less explosives and different grid patterns. The use of predictive software to help with calculating the safety margins and the planned geotechnical studies for this site would be an important input. It was also important that the bench faces for placing explosives are oriented away from the Bruce Highway to lessen the risk of flyrock damaging infrastructure or posing a human safety risk.

A submission from DEA stated that there was a high risk to people travelling on the Bruce Highway during mining operations from gaseous blasting emissions (NO₂, CO and SO₂) due to imperfect blasting. The EIS modelled blasting activities outside of the 500m buffer on each side of the Bruce Highway. The EIS stated that the management of blast fumes would be in accordance with a blast fume management plan but did not provide a draft management plan for review. I consider that modelling of gaseous emissions should have adopted the worst-case scenario i.e., blasting activities undertaken approximately 100m on each side of the centreline of the state-controlled road. This issue is more fully discussed in section 4.7 Air of this assessment report.

4.15.1.5 Rail assessment

The project would transport the product coal from the project site on the existing Queensland Rail (QR) North Coast Rail Line (NCRL) approximately 170km north to the Port of Townsville. Rail infrastructure to the project TLF would require construction of a 4.4km rail spur from the existing NCRL that borders the northern boundary of MLA700022. This connection would not cross any roads. Works within the NCRL corridor to connect the project rail loop to the NCRL would be undertaken by a separate QR approval process.

I note that no detailed design of the proposed rail spur or estimations of earth works required for maintaining an appropriate grade were provided in the EIS. DTMR advised in its review of the amended EIS that a revised flood model should be underpinned by an earthworks plan that clearly shows the location and extent of proposed excavation and filling, including likely volumes of cut and fill and the resulting cut and fill balance. DTMR also stated that the Flood Study and Site Water Balance Report had

not adequately demonstrated that the stormwater and flooding management of the development would ensure a no worsening impact to the railway corridor and state-controlled road for all relevant design events up to and including 1% AEP.

DTMR stated that the potential impacts on state-controlled transport infrastructure and corridors (state-controlled road and railway corridors) from dam failure had not been adequately assessed and recommended a dam failure risk assessment to be undertaken.

Rail haulage rates have been estimated based on proposed mine schedule rates of production. Coal trains of approximately 44 wagons increasing to 66 wagons would transport average loads of 3,200t of coal to the DBCT. An average of eight 1km-long trains would be loaded per week at the 2Mtpa ROM project output level, with the same number returning empty from DBCT. This would ramp up to a maximum 21 2km-long trains per week at the 10Mtpa ROM project output level. An additional 1,110 train movements per year would be added to 150km of the NCL and 25km of the Aurizon Goonyella rail corridor. Modifications to the QR network, including track strengthening and construction of longer passing loops were forecast for the peak production period.

A submission from residents of Clairview raised concerns about amenity issues related to potential coal dust issues and increased train haulage movements. A submission from Isaac Regional Council also suggested coal dust management procedures to mitigate the emission of coal dust from loaded and unloaded trains. Coal dust issues have been addressed in section 4.7 Air. I am satisfied that coal dust impacts from rail haulage would be unlikely to result in additional adverse health effects for people living along the NCRL and that impacts on ecosystems and water supplies would be minimal.

I consider that appropriate mitigation measures such as the adoption of the air quality management plan (AQMP) and the proposed coal dust management plan (CDMP) would stipulate control measures to effectively mitigate dust emissions from loaded and unloaded coal haulage trains. This initiative would also require wagon design to incorporate sloped sills to avoid coal remaining on external surfaces; wagon loading practices and profiling to improve veneering and avoid spillage; and the use of veneer suppressant on the surface of loaded wagons to provide a membrane that is resistant to dust lift-off.

4.15.2 Conclusions and recommendations

The EIS has undertaken an impact assessment as required by the TOR with a focus on the state-controlled road – the Bruce Highway – and the rail line from the TLF. The EIS has provided a draft RUMP and TIA in response to matters raised, primarily from DTMR in a submission on the EIS.

DTMR has advised that there is a considerable suite of matters that have not been adequately dealt with in the amended EIS that would need to be addressed before the project could proceed. These requirements are in addition to commitments to prepare a BMP and establish a 500m buffer to the Bruce Highway in consultation with key regulators, including the department and DTMR for part of the life of the project.

I consider that DTMR's requirement for the mine to not close the Bruce Highway may mean that the 500m buffer area cannot be mined at a future stage of the project. I am therefore unable to approve the current proposed mine plan that assumes the 500m buffer area proposed for each side of the Bruce Highway could be mined from year 12 of operation. The proponent needs to recognise whether this potential outcome potentially makes the project economically unviable.

DTMR consider that approval for mining of the 500m buffer zone is contingent on biannual geotechnical assessments over the first 11 years of operations as the mine pit progresses. DTMR has recommended that the geotechnical assessments are undertaken by an appropriately qualified RPEQ and provided to DTMR commencing six months prior to mine operations and every six months thereafter for the duration of the mine's operation. This is to ensure that there are no adverse impacts from project excavation, ground disturbance or blasting on the state-controlled transport infrastructure.

DTMR are also requiring the proponent to provide an RPEQ geotechnical assessment that has an overriding objective to ensure that excavation and blasting does not compromise the safety or efficiency of the Bruce Highway. The geotechnical assessment may stipulate a permanent blasting exclusion zone to the Bruce Highway. The risk for the proponent is that the proposed mine schedule to mine the 500m buffer area from year 12 may not be recommended by the RPEQ assessment. I am not satisfied that the

proponent has adequately addressed the eventuality of not being able to mine the buffer based on advice provided in the geotechnical assessment

DTMR recommendations to the proponent include:

- provide a final RUMP, and TIA, including a final Pavement Impact Assessment that considers cumulative impacts of all project-related traffic on the state-controlled road network, and identifies any mitigation measures required to adequately manage all project-related traffic impacts. A road safety risk assessment is also required that undertakes a road safety audit of the current conditions of the state-controlled road network and identifies potential mitigation measures to improve road safety. See recommended requirements in Appendix 5.
- provide DTMR with an updated Flood Study and Site Water Balance Report and a Stormwater Management Plan to demonstrate that management of stormwater and flooding post-development would achieve a no worsening impact on the pre-development condition. A Groundwater Management and Monitoring Plan has also been recommended to assess construction and operational impacts on the state-controlled road. See recommended requirements in Appendix 5.
- provide a Dam Failure Risk Assessment in accordance with the Risk Assessment Guide of the Guide for Development in a Transport Environment: Rail (DTMR, 2015) prepared by an appropriately qualified RPEQ. The objective is to ensure that there is no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from the risk of dam failure. See recommended requirements in Appendix 5.
- DTMR has recommended that an Earthworks and Blast Management Plan and a Ground Movement and Vibration Monitoring Plan prepared by an RPEQ is provided for assessment and approval at least three months prior to mining the buffer zone to confirm that the geotechnical stability of the highway would not be adversely impacted by blasting or subject to damage from flyrock.

I have highlighted the above issues to ensure that the proponent is fully aware of its responsibility to protect the safety, health and well-being of the existing community, project employees and visitors using State, local and mine-site road networks and the rail network.

4.16 Matters of national environmental significance

4.16.1 Introduction

The EIS document used to assess matters of national environmental significance (MNES) was EIS Chapter 16 – Matters of National Environmental Significance. Additional chapters and appendices were also reviewed to cross reference information provided in Chapter 16. This consisted of EIS Chapter 14 – Terrestrial Ecology; Chapter 15 – Aquatic Ecology; EIS Appendix A6 Groundwater Technical Report and Appendices A9a, A9b, A9c, A9d, A9e, A9f and A9g containing specialist ecology and stygofauna desktop and survey results from 2011-12 and 2017. The EIS documents were updated and resubmitted by the proponent in response to EIS submissions.

The MNES appendix in the TOR states that the proposed project's assessment of the potential impacts, mitigation measures and offsets for residual significant impacts must be dealt with in a stand-alone section of the EIS that fully addresses the controlling provisions.

This section of the Assessment Report deals the potential impacts of the proposed project on MNES that are 'controlling provisions' for the project and protected under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The department and DAWE have considered the information provided in the EIS and other relevant information to assess the likelihood of occurrence and potential impacts on MNES.

This assessment combines the two controlling provisions relating to the GBR –World heritage values of a declared World Heritage property, and Natural heritage properties –into one assessment. It is noted in the Significant Impact Guideline that the criteria for their assessment is based on the same Outstanding Universal Values (OUVs) nominated under the World Heritage Commission.

The assessment and recommendations in this Assessment Report have been made by the department

in accordance with the requirements of the bilateral agreement. DAWE will consider these recommendations and decide on the acceptability of identified and potential impacts on MNES, and the conditions that might apply to an approval under the EPBC Act 1999.

EPBC referral

On 21 December 2016, Fairway Coal Pty Ltd referred the proposed Styx Coal Project under the EPBC Act to the Commonwealth Minister for the former Department of Environment and Energy (DEE) for the mining activities on MLA80187, the TLF and associated infrastructure.

On 3 February 2017 the project was determined to be a controlled action requiring assessment and approval under the EPBC Act – EPBC 2016-7851. The Minister determined that the proposed action was likely to have a significant impact on six controlling provisions:

- World heritage properties (sections 12 & 15A)
- National Heritage places (sections 15B & 15C)
- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 & 20A)
- Great Barrier Reef Marine Park (sections 24B & 24C)
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D & 24E).

On 17 July 2018 the EPBC referral was amended to change the person proposing to take the action from Fairway Coal Pty Ltd to Central Queensland Coal Pty Ltd. The name of the project was also changed from the Styx Coal Project to the Central Queensland Coal Project.

4.16.2 World heritage values of a declared World Heritage property and National heritage places

The two controlling provisions – World heritage properties and National heritage places – have been combined for the purposes of this assessment. The four OUV attributes listed for the GBRWHA (Commonwealth of Australia, 2014a) are:

- Criterion (vii) – ‘contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance’
- Criterion (viii) – ‘be outstanding examples representing major stages of earth’s history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features’
- Criterion (ix) – ‘be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals’; and
- Criterion (x) – ‘contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation’.

In the EIS these two controlling provisions were combined in the MNES chapter assessment.

4.16.2.1 Existing environmental values

The Great Barrier Reef World Heritage Area (GBRWHA) was inscribed on the World Heritage List in 1981 and includes a range of Outstanding Universal Values (OUVs) that underpin the World Heritage Convention. The World Heritage Property is considered to meet four of the ten OUV criteria – natural beauty and natural phenomena; major stages of the Earth’s evolutionary history; ecological and biological processes and habitats for conservation of biodiversity.

The GBRWHA boundary is located approximately 10km downstream of the proposed project. Broad Sound starts at the mouth of the Styx River and is a large, shallow marine and estuarine bay (of depths less than 10m) subject to the largest tidal range on the east coast of Australia (up to 9m). Broad Sound is listed as a nationally important wetland extending over an area of 2118km² (DIWA, 2010). See Figure 10 Location of project in relation to the Great Barrier Reef World Heritage Area.

It contains a range of wetland habitats including extensive intertidal mudflats, seagrass beds (35% of the

area) and significant mangrove and saltmarsh communities that provide critical providing foraging, roosting and nesting habitat for water birds such as the straw-necked ibis, *Threskiornis spinicollis*, black swans, *Cygnus atratus*, and royal spoonbill, *Platalea regia*.

There were 16 species of migratory shorebirds considered known or likely to occur in the downstream area. Significant aggregations of migratory shorebirds have been recorded in the nearshore environments of Broad Sound that are considered important at a national and international level. This includes nationally important numbers of eastern curlew, great knot, red-necked stint, whimbrel and sharp-tailed sandpiper.

The critically endangered Yellow Chat (Dawson), *Epthianura crocea macgregori*, is endemic to the terrestrial areas of Broad Sound and known particularly from the Torilla Plains region located 40km east of the project area.

Broad Sound is Queensland's largest declared Fish Habitat Area and sustains trawl, line, net and crab commercial fisheries. It comprises critical habitats for important juvenile stages of commercial fish species, barramundi (*Lates calcarifer*), sea mullet (*Mugil cephalus*) and penaeid prawns.

A range of threatened marine migratory mammals have been recorded in Broad Sound. The important seagrass meadow habitat for Dugong, *Dugong dugon*, are recognised within the Dugong Protection Special Management Area located approximately 25km from the Styx River mouth. Indo-Pacific humpback dolphins, *Orcaella heinsohni*, and Australian snubfin dolphins, *Tursiops aduncus*, have also been recorded in Broad Sound (Brooks et al, 2019).

Broad Sound contains 48 largely undisturbed National Park Islands, two of which – Wild Duck Island and Avoid Island – host large nesting rookeries for the threatened flatback turtle, *Natator depressus*. Flatback turtles and green turtles, *Chelonia mydas*, use Broad Sound for inter-nesting foraging and resting habitat within the nesting season.

Small fringing reefs occur around Turtle Island and Charon Point located approximately 35km downstream of the project area.

The Styx Basin is the catchment area associated with the Styx River. It comprises an area of 3,013km² and is one of six catchments in the Fitzroy region. Approximately 80% of the catchment has been converted to agricultural use. The site and region consist predominantly of highly dispersive and sodic soils that are subject to moderate to severe erosion.

The Fitzroy catchment is the second largest contributor of anthropogenic fine sediment of the 35 catchments that drain to the GBR, with the largest sources of fine sediments derived from streambank and gully erosion (State of Queensland, 2018). Fine sediment reduction for the Fitzroy catchment was 10.1% in the GBR Report Card 2019 (The State of Queensland, 2019). This is a rating of 'very poor' progress against the 2025 target of a 25% reduction in anthropogenic end-of-catchment fine sediment loads. The current end-of-catchment anthropogenic water quality target for the Styx River is to maintain the current load of fine sediment (State of Queensland, 2018).

The Tooloombah Creek and Deep Creek sub-catchments comprise an area of 673km² and are the main watercourses adjacent to the project. These two ephemeral watercourses converge 2.3km downstream of the project site and form the Styx River which discharges to Broad Sound another 8km downstream.



Figure 12 Styx River in the Great Barrier Reef World Heritage Area

Source: Department of Environment and Science

Field surveys

The EIS did not provide information from any field surveys undertaken in the GBRWHA. The only project specific surveys undertaken for the project in Broad Sound are from 2011, prior to the EIS process, which collected information on estuarine habitats, resident benthic fauna, water quality and sediment texture and chemistry. This work was undertaken in relation to Waratah Coal's exploration for coal permit with the expectation that it would inform the proposed Styx Coal Project EIS.

Baseline surveys consisted of five sample sites across the upper, mid and lower Styx River estuary and two estuaries further north, Waverley Creek and St Lawrence Creek, considered to be control sites. No seagrass assessment was undertaken. Benthic taxa were chosen for assessment as they contain a range of taxa and functional guilds with different sensitivities to pollution and therefore are considered suitable for detecting anthropogenic impacts.

Adequacy of the description of existing environmental values

I consider the desktop description of environmental values for the MNES have been adequately identified and described in the EIS. However, the lack of field surveys undertaken in the GBRWHA for species most likely to be impacted by the project, or for species where there is limited local information, were deficient. I note that baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area in 2011. This data is unlikely to be representative of current conditions and a single sampling event would not be able to determine the variability of these indicators. For any future approvals I would recommend conditions requiring a program to collect adequate baseline data on water quality, saltmarsh, seagrass and mangrove habitat prior to construction and mining activities commencing.

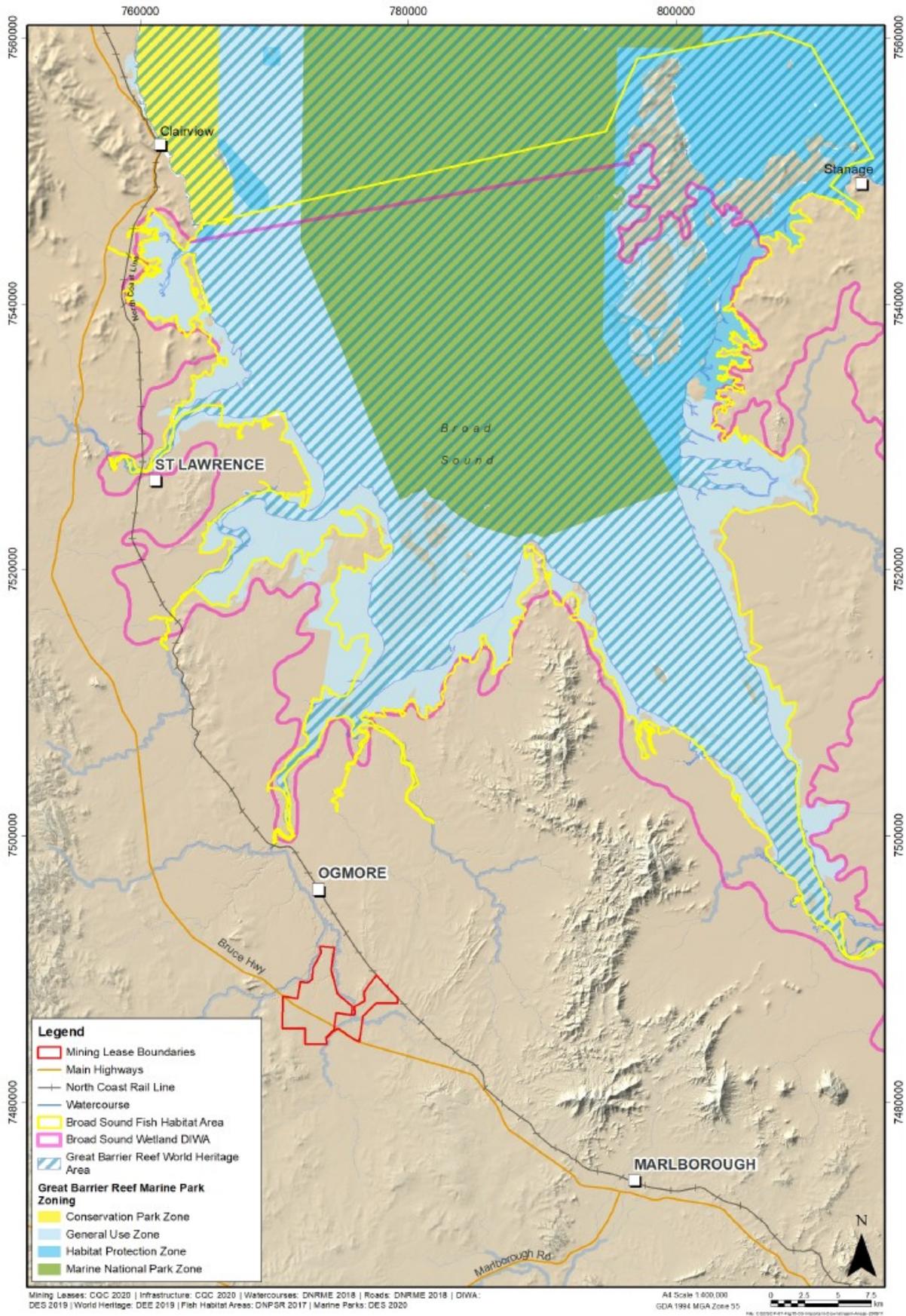


Figure 13 Location of project in relation to the Great Barrier Reef World Heritage Area

Source: EIS Figure 16-37: Important downstream environmental areas

4.16.2.2 Potential impacts

There are three significant impact criteria listed for the GBRWHA in the EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013). An action is considered likely to have a significant impact if there were a possibility it would cause one or more of the World Heritage values to be lost, degraded or damaged, or notably altered, modified, obscured or diminished. Additionally, impacts on the integrity (natural properties) of the GBRWHA need to consider the extent to which the property suffers adverse effects of development (Commonwealth of Australia 2014). The impact assessment relates to the potentially impacted part of the World Heritage property, not to the whole of the Great Barrier Reef.

The EIS identifies potential impacts from the proposed project to GBRWHA values as being related to indirect impacts from surface water runoff and/ or changes to groundwater levels and groundwater quality.

Impacts to surface water quality

Contaminated runoff from the mine site (controlled and uncontrolled) has the potential to enter the Styx River from the two tributary watercourses and then be transported to Broad Sound and the GBRWHA. In the EIS, impacts were predicted on the local watercourses primarily due to reductions in flow from catchment excision, reductions in instream pool persistence and water quality due to groundwater drawdown, point source discharges from controlled and uncontrolled releases, area source discharges and changes to flow patterns from the change in land use leading to increased erosion and sedimentation, and broad based leakage from groundwater and waste rock stockpiles.

Controlled and uncontrolled releases

The department regulates controlled releases of MAW to watercourses in accordance with relevant release criteria for water quality and water quantity and receiving environment flow rates. Release criteria (quantity, quality and timing) are designed to protect the environmental values of the receiving environment and controlled releases are considered to have a low risk of adverse impact to these aquatic ecological values. Controlled releases also have the goal of maintaining adequate storage balances in the water management system in order to reduce the risk of uncontrolled releases.

Two parameters are commonly used to measure contamination or pollution levels resulting from coal mining – electrical conductivity (EC) and sulfate. In the EIS the quality of mine affected water was modelled for Dam 1 and indicated that EC peaks in the first ten years with a median between 5000 and 10,000 μ S/cm and declines in the last eight years of the project. Modelling also indicates sulfate is likely to have higher concentrations in the first half of the project. However, the EIS stated that increased EC and sulfate levels are not considered to result in adverse impacts to environmental values.

MAW releases were also modelled for four metals (molybdenum, vanadium, arsenic and selenium) based on the potential for these parameters to have elevated levels resulting from groundwater dewatering and surface runoff sources such as from mineral waste rock stockpile runoff. Kinetic Leach Column test results from 2012 reported that leachate from mine waste materials would contain metals/metalloids at concentrations generally below the water quality guideline criteria for livestock drinking water. The modelling of the metal's Molybdenum and Vanadium and the metalloids Arsenic and Selenium indicate a slightly increasing concentration over the life of the project. Modelling for these parameters was not presented for post-mining timeframes.

In the EIS, testing results indicate that the majority of the waste rock and potential coal reject materials have a low sulfide content, a very low risk of acid generation and would be classified as non-acid forming (NAF). Surface runoff from waste rock and coal rejects would be alkaline and have a low level of salinity.

The EIS proposes that controlled releases would occur from Dam 1 into a tributary of Deep Creek in wet conditions. Controlled releases would accord with flow based release rules based on real-time data from the Deep Creek stream gauge. Flow rate and maximum EC and sulfate levels would be used to determine the timing and volume of releases.

Controlled release volumes have been modelled for three scenarios: very wet, wet and median climatic conditions. The probability of a controlled release in any one year of the operational life of the proposed project ranges between 1-10%. A maximum release discharge of 2,930ML is modelled for any one year (for very wet conditions); a volume between 780–1,430ML/yr for wet conditions; and up to 40ML/yr under

median climatic conditions. No controlled releases would be allowed in dry or very dry climatic conditions.

Uncontrolled releases may occur as a result of seepage from the floor and/or sides of Dam 1 or as a result of overtopping when inflows are unable to be contained in significant rain events. There is a very low probability (1%) of an uncontrolled release from Dam 1 from overtopping occurring in the first ten years of operation, with a maximum volume discharge of 320ML/yr. The annual risk increases to 10% in the second half of the operation due to the additional upstream catchment draining to Dam 1, with a maximum volume discharge increasing to 2500ML/yr. The uncontrolled release is designed to overflow via the spillway that would discharge to Tooloombah Creek.

Uncontrolled releases from Dam 1 would contain a large quantity of water with elevated salinity that could result in material environmental harm to the highly sensitive receiving environment. Salinity, as measured by EC, would be the target contaminant due to the very high salinity recorded in groundwater and the estimated rates in pit floor, waste rock stockpiles and MIA runoff that comprise MAW.

Uncontrolled releases resulting from significant rainfall events are also modelled to occur from the sediment dam ED 1B that contains runoff from the WRS areas and would spill to Tooloombah Creek, with Dam 4 and the two sediment dams ED 2D1 and 2D2 spilling to Deep Creek. Maximum annual overflow volumes were calculated in the water balance model for Dam 4 as 130ML/yr and for ED 2D1 and 2D2 as 22ML/yr.

Modelling of receiving water quality was undertaken to determine the potential impact of controlled and uncontrolled releases from the water management system storages. Modelling over an 18 year period was conducted for the median, wet, and very wet climatic conditions. It was concluded that both controlled and uncontrolled releases would result in only small changes from pre-mining levels to downstream water quality. The predicted levels for the six parameters modelled were well within historical levels and are expected to be within the range of natural variability.

Erosion and sedimentation

Downstream impacts to the Styx River and Broad Sound from mining operations were considered in the EIS (v2 2018) to result from increased suspended sediment loads from runoff resulting in reduced light, lower photosynthetic rates for aquatic vegetation and lower dissolved oxygen concentrations.

Suspended sediments were also considered to contain higher nutrient loads from the grazing activities of Mamelon Station that can potentially lead to algal growth/ blooms and deoxygenation in periods of low flow. Erosion and sedimentation impacts were considered to have a moderate impact on downstream water quality, aquatic ecosystems and the marine environment of Broad Sound if not adequately mitigated.

Current grazing practices across Mamelon result in erosion and sediment generation due to the reduction in ground cover and increased erosion in riparian zones from unrestrained cattle movement. The existing contribution of sediment from the project area to Tooloombah Creek and Deep Creek from natural geomorphological function and the current grazing land use was calculated in the EIS. Under average climatic conditions, a total sediment export rate of 5,037t/yr has been calculated for the existing grazing land use on Mamelon station including MLA700022 (proposed location of the haul road and TLF).

Both Tooloombah Creek and Deep Creek are geomorphologically active with bed sediment transport of sand, gravel and cobble sized material in larger flood event conditions based on modelled velocity and bed shear stress values. Exposed banks on the outside of meander bends are predicted to be subject to scour.

Floodplain deposition rates occurring from overbank flows of Deep Creek and Tooloombah Creek were not presented. The amount of fine sediment and particulate nutrients that would normally be expected to be deposited is regulated by the residence time of water on the floodplain and the settling velocity of the sediment (McDougall et al, 2014).

The soils on the majority of the project area are Sodosols described as sodic, dispersible surface soils with high erodibility. An assessment of soil erosion susceptibility confirmed that out of the five major soil orders to be disturbed on the site, the sodic soils have the highest erosion potential when disturbed.

An assessment of gully erosion rates from surveys undertaken in 2009 and 2011 were provided for sites on Barrack Creek, Deep Creek, Tooloombah Creek and the Styx River. The total mass erosion rate of the six gullies was estimated at 5,232t/ha/yr. Cattle grazing is regarded as a primary agent for accelerating gully erosion on highly erodible sodic soils (Shellberg and Brooks, 2013).

A sediment budget assessment undertaken for the EIS estimates a baseline sediment export rate for the project area of 5,037t/yr to the receiving watercourses. Potential impacts from mining related sediment mobilisation were considered by the EIS as likely to dissipate with distance from the proposed mine site due to the settling out of suspended sediments close to the upstream extent of the salt wedge i.e., the confluence of Tooloombah Creek and Deep Creek.

Pollutants of concern include fine sediments that can cause loss of water clarity along the inner shelf of the GBR thereby impeding photosynthesis, and sedimentation effects on organisms such as smothering that can impact coral reefs (Brodie et al 2017).

The risk of erosion from the two proposed waste rock stockpiles is high due to the very high sodicity of waste rock and coal reject composite samples. Strongly sodic materials are dispersive leading to erosion in rain events with high suspended sediment loads. The two proposed waste rock stockpiles would have maximum slopes of 30% (reduced to 12% for the final landform) and a total surface area of approximately 229ha. The higher erosivity of the steeper WRS slopes was recognised in the sediment budget assessment with significantly higher estimated soil loss volumes.

Changes to the catchment affecting flooding and hydrology

A flood impact study was undertaken using a TUFLOW hydraulic model to simulate flood extents, depths and velocities for developed conditions across the study area that extended approximately three kilometres downstream of the Tooloombah Creek and Deep Creek confluence. The most significant potential impacts of the Project on flooding are associated with the early phase of mine development with the northern catchment diversion drain in place intercepting floodplain flows and re-directing to Deep Creek.

Increases in flood levels due to the construction of infrastructure and operation of the water management system are predicted to be minor with a predicted 0.3m increase in flood depth at Deep Creek in the vicinity of the haul road for the 1% AEP event. Flood immunity for the Bruce Highway would be retained. No increase in flood levels are predicted before the confluence of Tooloombah Creek and Deep Creek. Increases to watercourse flow velocity would be minimal with no significant impact predicted to the GBRWHA.

Changes to the freshwater-saltwater interface in downstream tidal waters

The EIS (2017) stated that there was a small likelihood of the groundwater in the vicinity of the proposed project being infiltrated by saltwater due to the drawdown impacts. Reduced groundwater levels were predicted to result in reduced groundwater quality, with salt-water intrusion from saline aquifers associated with the Styx River previously considered likely to intercept the freshwater aquifers associated with Tooloombah Creek.

The theoretical location of the groundwater-seawater interface was determined at three locations. The EIS stated that the seawater interface with groundwater in the vicinity of the mine would be at least -480m AHD and -280m AHD at the Tooloombah Creek and Deep Creek confluence. At the location of the project monitoring bore near Ogmores Bridge, approximately 4km downstream from the project, the interface surface was predicted to be between -40 to -80m AHD. Evidence supporting this conclusion were the results from groundwater monitoring bore (WMP29) near the Ogmores Road Bridge, that measured salinity only half that of seawater at a depth of 229mbgl.

Impacts from groundwater drawdown

Dewatering and depressurisation from mining the open cut pits results in loss of groundwater storage leading to groundwater drawdown in water tables in the vicinity of the proposed mine site. A large part of the aquifer associated with the water table between Tooloombah Creek and Deep Creek would become dry at the maximum extent of drawdown. Consequential reductions in watercourse baseflow and the height of the alluvial aquifer can adversely impact environmental values, particularly GDEs.

Groundwater modelling predicts drawdown contours extending approximately 3km north-north-west of

OC2 and 3km south-south-east of OC1 at the peak of mining with recovery of groundwater levels after 150 years and stabilisation at 250 years. The drawdown impacts are considered unlikely to extend to the downstream reach of Tooloombah Creek or to the Styx River. The model predicts that the alluvial aquifer would fall by a maximum of approximately 60m in a three kilometre reach of Deep Creek, 4.7m beneath a reach of Tooloombah Creek and 12.6m beneath a reach of Barrack Creek.

The EIS concluded that 165ha of riparian vegetation along Deep Creek would be subject to minor impacts from the lowering of the water table. Potential impacts to this vegetation community, identified as a terrestrial GDE, include loss of condition and dieback of some large trees that may result in stream bank instability, erosion and consequential impacts to instream aquatic ecology values as well as to the downstream receiving environment.

4.16.2.3 Avoidance, mitigation and management measures

Controlled and uncontrolled releases

Controlled and uncontrolled releases of MAW are proposed to Deep Creek via the release point. Based on the modelling of impacts to water quality from the discharged water, release rules would need to ensure a minimum dilution ratio of five i.e., the Deep Creek water flow has to be at least five times greater than the release rate. Dilution ratios are also needed to increase up to a maximum of 80 depending on flow events.

The proponent stated that MAW releases would need to be monitored for a range of water quality parameters – EC, sulfate, pH, turbidity and the metals arsenic, molybdenum, selenium and vanadium based on findings of the Geochemical Assessment of Waste Rock and Coal Reject report.

The department considers that all monitoring should be incorporated into A Receiving Environment Monitoring Program (REMP) that was provided by the proponent in the EIS. This program would need to describe the planned monitoring actions that would be undertaken to identify potential impacts to the receiving environment from the release of MAW. Key environmental values that would need to be monitored are surface water quality, sediment quality and physical characteristics, aquatic habitat quality, in-stream macroinvertebrate assemblages, fish assemblages and mangrove distribution. Monitoring locations include the main watercourses of the project area and the downstream estuarine and marine environment associated with Broad Sound and the GBRWHA.

Ongoing static and kinetic geochemical testing of coal reject samples is needed. This would monitor the assumed high factor of safety attributed to the potential acid generation of bulk waste rock and coal reject materials. Additionally, pyritic waste rock and coal reject materials would require placement in the core of the waste rock stockpiles, not on the outside where it may be exposed to surface runoff. This principle would be extended to backfilling of the pits.

The EIS considers that the large tidal regime of Broad Sound would adequately dilute any contaminated runoff and thereby not result in any significant or lasting impact to Broad Sound environmental values. However, the tidal regime of Broad Sound was not assessed or quantified. No stream gauges or tidal gauges are in place in the Styx River and no seasonal data on tidal velocities was sampled for the project.

Two stream gauges have been installed on the local watercourses adjacent to the project site, one on Tooloombah Creek and one on Deep Creek. Real-time flow data from these gauges are proposed to be used to ensure that controlled releases accord with relevant water quality parameter limits and flow rates.

The EIS considered that the risk of MAW contamination from coal particle runoff from coal stock piles at the TLF is low as runoff from the TLF would be directed to Dam 4 and would be subject to settlement and appropriate removal prior to each wet season.

Erosion and sedimentation

The EIS in response to review comments regarding the risk of erosion and sediment export to the GBRWHA provided an analysis of baseline export rates and developed sediment export rates for the project site.

Water management system

The Sediment Budget analysis in the EIS stated that the imposition of the water management system (comprising the mine water dam and four sediment basins referred to as “environmental dams”) combined with reductions in current grazing capacity would halve the current estimated soil loss from 5027t/yr to 2297t/yr under average climatic conditions. Under very wet climatic conditions the assessment stated that both Dam 1 and ED1B would overflow at an increased frequency exporting an additional 630t/yr of sediment. This worst-case sediment generation rate was noted to still be well under the existing baseline rate.

Sediment loads would also be lowered by use of water management measures that allow water storages to effectively settle out captured sediment and to be routinely de-silted prior to the start of the wet season. Monitoring requirements within the ESCP would evaluate and report on the effectiveness of these measures annually. The use of flocculation for potentially dispersal material in water storages is an additional control measure that may be actioned based on monitoring results.

Other proposed sediment controls such as rock socks, mulch, rock checks, sand bags and sediment fences would be required within the ESCP in order to provide temporary protection around stockpiles and laydown areas.

Implementation of strategies adopted in the ESCP would involve diversion of water flowing into disturbance areas, minimising erosion within disturbance areas, and intercepting the majority of sediment before it is mobilised off site.

Surface water management measures would divert floodwater from the sub-catchments and overland flow via the northern and southern diversion drains to Deep Creek. This is modelled to result in negligible impacts to the extent of flood inundation of the Deep Creek, Tooloombah Creek and Styx River floodplains.

The fluvial geomorphological study identified seven gully erosion sites associated with the wider area incorporating Tooloombah Creek, Deep Creek and the Styx River. These areas were identified as likely to experience higher potential for geomorphic change due to increased stream velocities in flood events. Management measures to reduce the risk of erosion include maintenance of vegetation cover and the fortification of rock rip-rap if monitoring indicates the risk of significant incision occurring.

To reduce the very high potential for erosion on WRS, the EIS proposed to stabilise the slope surface using hard rock. The project site’s regolith composed of sand, clay lenses, siltstone and sandstone is proposed to be used to cover the waste material and support the growth medium. Capture of sediment from surface runoff from WRS2 would be directed by a drain to Dam 1 that would be located directly adjacent. Surface runoff from WRS1 would be directed by a drain to the sediment basin ED1B that would be located directly adjacent and then dewatered to Dam 1.

WRS would require the addition of gypsum to any sodic waste rock materials emplaced on the outer slopes and the covering of well vegetated subsoil and topsoil in the rehabilitation phase in order to lower the sodicity of waste rock and coal reject material.

The EIS concluded that the proposed water management system would effectively lead to a net benefit to water quality for the GBRWHA due to the quantifiable reduction (50%) in sediment loads to the Styx estuary. It noted that that this level of reduction accords with the Reef 2050 Plan water quality target of at least a 20% reduction in anthropogenic end-of-catchment loads of sediment in priority areas. Additionally, the EIS considered that the removal of cattle grazing is expected to lead to a reduction in nutrient loads.

Riparian restoration

The EIS proposes the removal of cattle from the proposed mining leases and the proposed offset area in the southern portion of Mamelon station, and the exclusion of stock from entering riparian areas. Exclusion of grazing has the potential to reduce erosion impacts from stock in sensitive riparian habitats, especially on the steeper incised stream banks. The estimated reduction in stock numbers is also expected to significantly reduce on-farm nutrient runoff, particularly nitrogen and phosphorus.

Well vegetated banks are expected to lower the risk of bank erosion. The EIS stated that forest cover would provide better channel stability in watercourses with high banks due to the root systems of trees providing bank stabilisation. Additionally, the existing vegetated riparian buffer would be widened by 10m

and planted with drought tolerant species with similar ecological function to species predicted to be impacted.

Groundwater drawdown

The EIS states that potential erosion from groundwater drawdown impacts on riparian vegetation would be mitigated via a proposed riparian restoration program. This would include measures to select and plant suitable drought tolerant species that are not dependent on groundwater, removing grazing pressure from the streambanks, and providing an additional 10m buffer to the corridor. It is noted that the works are committed to be undertaken from the commencement of construction to ensure effective establishment of vegetation 10 years prior to modelled drawdown impacts occurring.

A Groundwater Dependent Ecosystem Management and Monitoring Plan (GDEMMP) would monitor the actual vegetation impacts of this area as well as areas that are located on the fringe of the impact area and in reference locations outside of groundwater drawdown impacts. It is not clear what management actions could be taken should any impacts be detected.

4.16.2.4 Significant impacts and offsets

The EIS considered that the operation of the water management system, the range of erosion and sediment control measures and the removal of cattle grazing would effectively reduce sediment export rates. It highlighted additional studies undertaken in order to understand the existing environmental conditions and to propose effective mitigation and management measures to reduce potential impacts.

An assessment against the significant impact criteria for the GBRWHA was undertaken using the EPBC Act significant impact guidelines 1.1 (DEE 2013). It stated that as the project does not occur directly within the GBRWHA it would not damage, modify or alter landforms or landscape processes, and would not divert, impound or channelise a river, wetland or other water in the GBRWHA. The EIS considered that the project would not result in the loss of any elements, features or processes necessary for the GBRWHA to express its OUV, nor would there be any reductions in size or boundaries of the property.

The EIS recognised the risk of increasing suspended sediment and other contaminant concentrations in the GBRWHA from mine activities if not managed properly. However, it considered that the proposed mine site water management system, associated water release operating rules and erosion and sediment control mitigation measures would adequately address this risk.

It concluded that the assessment demonstrates the project would not result in a significant impact on the GBRWHA or the National Heritage Place and has therefore not proposed any offset or compensatory measures.

4.16.2.5 Assessment and conclusion

The EIS considered that the operation of the water management system, the range of erosion and sediment control measures and the removal of cattle grazing would effectively reduce sediment export rates. It highlighted additional studies undertaken in order to understand the existing environmental conditions and to propose effective mitigation and management measures to reduce potential impacts.

DAWE acknowledged in its assessment the substantial amount of work undertaken to inform the revised groundwater model and the additional studies undertaken by the proponent in the EIS. It considers that it had an increased level of confidence in the ability of the groundwater model to predict the likely direct and indirect impacts on MNES within, adjacent to and downstream of the project site. DAWE also acknowledged that the groundwater model had been peer-reviewed and that the peer reviewer concluded the model was generally suitable and did not identify any fundamental flaws which were likely to significantly affect model predictions.

However, DAWE stated that it considers the IESC to be the most appropriate source of advice with respect to the groundwater model and the associated technical analysis of the potential water-related impacts of the proposed action on MNES.

MAW releases

I consider it likely that the proposed development would lead to indirect impacts on the GBRWHA from the release of MAW from the mine dam. Water quality impacts from pollutants comprising mainly

sediment and trace heavy metals are likely to be transported downstream via the Styx River approximately 10km to the GBRWHA property. Flood events may also transport these pollutants via flood plumes to the mid-shelf and outer reef.

The potential transport of coal particles and metals within MAW from the proposed project area downstream approximately 10km to the receiving environment was considered by the Great Barrier Reef Marine Park Authority to present a high risk of contamination. Advice provided by the Authority is that the EIS is relying on the dilution of contaminants and assumes contaminants in MAW would assimilate and not enter the sensitive environments downstream either bound to sediment particles or dissolved within the water column. The Authority considers that pollutants such as heavy metals, chemicals and sediment would be transported downstream and resuspended under higher flows and/ or tidal exchange, with large flood plumes able to transport contaminants to the mid or outer reef.

The EIS stated that dissolved metal/metalloid concentrations in both waste rock stockpile runoff and surface runoff are modelled to be low and unlikely to present a significant risk to the receiving environment. It was stated that metals transported within MAW would bind with sediments and would likely be deposited no further than the confluence of the watercourses approximately 2.3km downstream of the proposed project.

The EIS states that controlled releases from the mine dam would occur infrequently and only in accordance with water release conditions that stipulate receiving water flow criteria for discharge, maximum release rates and release limits for EC and sulphate levels. The EIS also stated that releases would be within natural background turbidity limits, would not elevate those levels and are considered to pose a low risk to downstream receptors. Uncontrolled releases due to large rain events are estimated to occur across all four water storages.

I note in the EIS, the modelling of receiving water quality undertaken to determine the potential impact of controlled and uncontrolled releases from the water management system storages did not specifically model impacts to the GBRWHA. I also note that there are no effective mitigation measures to prevent uncontrolled releases in very wet climatic conditions. The draft TARP for MAW storage states actions in this event are to measure water quality to confirm the impact and to remediate any environmental harm where possible. Contingency actions in the event of a water storage structure failure are to notify downstream residents and the department, to investigate the reason for failure and to complete a report on the downstream impacts of the failure.

The proposed water storage and flood protection structures for the project were subject to a Consequence Category Assessment required under the TOR. The likelihood of levee failure was not provided; however, I consider the magnitude of impact to the downstream environment is to be potentially catastrophic. I note that failure of the levee under flooding conditions would result in large volumes of flood water flowing into both dam 1 and the open cut mine pit (OC2). The EIS stated that this would overwhelm the mine water containment system, impact the mining operations and potentially result in the failure of the Dam 1 embankment releasing its contents into the downstream environment. The preliminary CCA determined the consequence category to be significant relating to all three categories of harm: harm to humans, general environmental harm, and general economic loss or property damage.

DAWE stated that it had concerns the EIS did not adequately assess the risks associated with uncontrolled discharges from extreme weather events and associated surface water quality impacts. The Authority stated that uncontrolled releases during high rainfall events can result in mangrove dieback, fish kills and sedimentation of sensitive environments. It also observed that MAW releases from mines in flood events has been recorded hundreds of kilometres downstream from their source in the Fitzroy River estuary.

The IESC advice in 2020 re-stated a key potential impact identified in its 2018 advice that MAW would result in significant and irreversible damage to internationally valued estuarine and near-shore ecosystems. It also stated that the potential impacts from MAW on ecological processes and species downstream, including within the Styx River estuary, the Broad Sound Fish Habitat Area and the GBRWHA are poorly understood. The advice noted that proposed mitigation and rehabilitation options have not been adequately detailed in relation to uncontrolled releases of MAW during severe weather events. They also considered that proposed Trigger Action Response Plans are unlikely to protect

GBRWHA values due to the decadal time lags associated with detection of impacts and effective responses.

Sediment releases

DAWE stated in its advice that the EIS does not adequately assess the risks associated with uncontrolled discharges from extreme weather events and associated surface water quality impacts. It highlighted the project area's sodic soils and their high erosion potential when disturbed.

Mitigation measures proposed in the EIS state that the proposed water management and sediment and erosion control systems are designed such that sediment-laden water is captured and treated on site. The sediment budget assessment predicted that current sediment export loads (from erosion and overland flow) would be reduced by 50% due to these measures.

The Authority stated that the EIS has only assessed the initial deposition of sediment within the Styx River under discharge conditions and has not assessed the resuspension of these sediments from the downstream sites under higher flows and/or tidal exchange.

Current grazing practices are committed to cease on a large area of Mamelon station however, DAWE stated that it is not clear whether the proposed future use of grazing to manage fuel loads and weeds was included in the sediment budget calculations. If not, there may be a higher sediment export rate than quoted.

The Great Barrier Reef Marine Park Authority noted that Deep Creek on the southern mine lease was identified as the highest contributor of sediment and nutrients into Styx River, and considered this would likely continue if the cattle remained on this property. It noted that no stocking rates or management/rehabilitation activities for this portion of the mining lease have been identified in the management plans and that rehabilitation and erosion control appears centred on the northern mine lease. The sediment budget considers the net benefit over one average year and in very wet conditions but does not provide guidance on what the net benefit to the GBRWHA is beyond the life of the project. The Authority states that it is unsure how the sediment budget targets will be achieved if this is not managed appropriately.

A riparian revegetation program is committed to for portions of Deep Creek predicted to be most at risk from the adverse impacts of groundwater drawdown. However, I note that a draft riparian revegetation plan was not provided in the EIS for review.

DAWE has advised in its review of the EIS that it considers there is the potential for serious adverse impacts on MNES from controlled and uncontrolled surface water releases.

Impacts from groundwater drawdown

It is noted that groundwater drawdown impacts to the area of approximately 165ha of GDE vegetation would not occur for the first ten years of operation. DAWE stated that they consider there are inherent uncertainties in the revised groundwater modelling which limit the reliability of groundwater predictions for potential adverse impacts on MNES. Further, they consider the risk remains that the magnitude and spatial extent of groundwater drawdown has potentially been underestimated which reduces confidence in the accuracy of the proponent's assessment of potential impacts on MNES. This lack of confidence extends to the adequacy of the environmental offsets proposed to compensate for residual significant impacts on MNES, as groundwater drawdown predictions have been used to calculate the proposed environmental offsets for riparian habitat (also terrestrial GDEs).

The IESC noted impacts to aquatic GDEs included the complete drying or declines in volumes of permanent pools along Tooloombah Creek and Deep Creek during the dry season, compromising their ecological roles as aquatic refuges and overall aquatic habitat connectivity; and reductions in baseflow, potentially affecting ecologically important components of the streamflow regime (e.g., number of low-flow days) which may adversely affect stream and riparian biota.

The Authority stated that the predicted impact to riparian GDEs would likely lead to erosion and sediment entering the waterways and ultimately to the GBRWHA, especially as the soils are erosive. It considered that revegetation would not mitigate this issue in the short term, especially in high rainfall events. It noted that the riparian GDEs include Melaleuca stands that take a number of years to mature and hold riverbank soils in place, and the groundwater systems they depend upon would likely take decades to recover, long after the life of the mine.

Conclusion

DAWE stated that it agrees with the IESC position that the proponent's additional work provided in the amended EIS has reinforced the very significant risks associated with local and downstream impacts of the project on highly sensitive national and international environments with high ecological values, including state listed wetlands, Tooloombah and Deep Creeks, the Styx River estuary, the Broad Sound FHA and the GBRWHA.

DAWE considers the nature of the proposed action and its location in close proximity to the GBRWHA provides the potential for serious adverse impacts to the World Heritage property, Great Barrier Reef Marine Park, listed threatened and migratory species and their habitat. In particular, DAWE considers the potential degradation of water quality and quantity within, adjacent to, and downstream of the proposed action, and the resultant potential increased erosion, is of concern for the Great Barrier Reef due to a combination of:

- the known presence of highly erosive sodic soils on the Styx Basin floodplain and downstream to the GBRWHA
- predicted unavoidable groundwater drawdown of up to 4.7m along sections of Tooloombah Creek and up to 60m along 11.8km of Deep Creek reducing seasonal groundwater availability for GDEs
- expected degradation and potential residual loss of approximately 165ha of riparian GDEs in the Styx River alluvium and located on highly erosive sodic soils; and
- the proposed discharge of MAW from controlled and uncontrolled releases.

Further, DAWE considers there are deficiencies in the proponent's proposed avoidance, mitigation, management and monitoring measures which reduce DAWE's confidence that the potential adverse impacts of the proposed action would be adequately addressed. In particular, there is a lack of detail in the EIS on measurable environmental outcomes, a lack of supporting baseline data and scientific evidence to demonstrate effectiveness, a lack of achievable time-bound commitments and a lack of committal language.

Based on the information available in the EIS, DAWE considers the proponent has not adequately addressed the key issues identified by the Department in comments and advice generated from reviews of December 2017, June 2018 and March 2019. This view has been informed by extensive technical advice from the IESC and advice from the Authority.

I have considered the extensive material provided in the amended EIS, review comments from my department, review comments from DNRME, and the review comments provided by DAWE, the IESC and the Authority. I consider that a number of significant risks to the GBRWHA and the National Heritage Place have not been adequately addressed.

I consider that there is increased confidence in the groundwater model due to the additional input data provided in the amended EIS, expansion of the bore network, and better characterisation of the hydrogeology following additional field work based largely on IESC recommendations.

I note additional technical studies provided in the amended EIS included revised hydrological (surface water) modelling, a regional groundwater model, field studies on GDEs, the geological properties of the alluvium of Tooloombah Creek and Deep Creek, a sediment budget for the site and upstream catchment, a fluvial geomorphology study, and a surface water-groundwater interactions study. I consider that these additional studies have provided improved clarity on the likely water quality releases to the receiving environment but has not adequately addressed the potential risks to the significant environmental values downstream.

Improved baseline data, particularly further downstream, would have been useful in increasing the confidence in and understanding of the potential for impacts on seagrass and mangrove habitats and tidal and estuarine waters.

While the description of the proposed water management system is largely adequate, there are limited design details for the dams and levee. The EIS has not provided the detail needed to demonstrate that the risk of dam failure can be minimised through the provision of a failure impact assessment and certified CCAs for each structure.

4.16.3 Listed threatened species and ecological communities

In assessing the project for the purposes of sections 18 and 18A of the EPBC Act, it is noted that the Commonwealth Minister for the Environment must not act inconsistently with Australia's obligations under a recovery plan or threat abatement plan (TAP).

The Minister must also, in deciding whether to approve the taking of the action, have regard to any approved conservation advice for the threatened species or ecological community that are likely to be or would be significantly impacted by the project.

This section assesses the project against the objectives and priority actions of conservation advices, recovery plans and TAPs for the project relevant threatened species and communities. The significant residual impacts of the project on threatened fauna and threatened ecological communities (TEC) are also considered in this section.

4.16.3.1 Existing environmental values

The following section is a summary of the predicted occurrence of MNES relevant to the project based on database searches, field surveys and habitat assessments documented in the EIS and amended EIS. Desktop information was sourced from various databases including: the EPBC Act Protected Matters Search Tool (25km radius); the Queensland Wildlife Online flora and fauna database (50km radius); Atlas of Living Australia database; data on migratory shorebird counts in the Broad Sound (Appendix A9h of the AEIS); Queensland Regional Ecosystem mapping; Queensland Protected Plants Flora Survey Trigger Map; and wetland and watercourse data from the Queensland Wetland Protection Area and Wetland Environmental Values mapping and the Directory of Important Wetlands in Australia; and the Bureau of Meteorology's GDE Atlas.

Threatened ecological communities

The database searches identified five endangered TECs that have the potential to occur in the project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow)
- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland
- Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions
- Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (north and south) and Nandewar bioregions
- Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural grasslands).

Surveys of vegetation communities in the mine area (MLA 80187) and the transport corridor and TLF (MLA 700022) were undertaken from 2011 until 2019. The ground-truthing survey in 2017 resulted in mapping that differed from State RE mapping. The Queensland Herbarium reviewed proposed changes to the RE mapping and approved a new version which was used in the final EIS assessment.

Brigalow and SEVT TECs are located within the project area in small and narrow patches. The other three TECs that have the potential to occur were not found during field surveys. A patch of less than one hectare and one patch of 3.3ha of Brigalow occur in the mine area. Brigalow regrowth on the site has been extensively cleared over the last 15 years and been subject to grazing. The lack of floristic composition and stand structure compared to remnant brigalow is related to its age of less than 20 years, and height of generally between 3-5m. These characteristics do not meet the criteria for inclusion as Brigalow TEC under the Brigalow Conservation Advice (2013).

Terrestrial flora

The database searches undertaken for the EIS identified three threatened terrestrial flora species listed under the EPBC Act occurring within a 50km radius of the project site. Based on the results of field surveys and habitat suitability assessments (presence of preferred REs, vegetation communities and soils), the EIS concluded that all three species are unlikely to occur in the project site.

None of these species were found during the EIS field surveys.

Terrestrial fauna

Terrestrial ecology field surveys undertaken for the EIS project span the period 2017 to 2019. Some earlier studies prior to the EIS process were undertaken in 2011 and 2012. Combining the results from all field surveys of the study area identifies a total of 264 native terrestrial species comprising 170 birds, 40 mammals, 36 reptiles and 18 frogs. The amended EIS considers the total an overestimate of the species existing on the project site due to the surveys conducted in the wider underlying mining tenement EPC1029.

Desktop assessment identified 82 listed threatened and/ or migratory fauna species potentially occurring within the project area, near surrounds (within three kilometres of the project area) or downstream in the Styx River Estuary and Broad Sound.

Based on the results of field surveys and habitat suitability assessments, the amended EIS concluded that the following EPBC Act listed threatened species are either known or likely to occur within the project site and near surrounds:

Known:

- Squatter pigeon – (southern subspecies) *Geophaps scripta scripta* – vulnerable
- White-throated needletail, *Hirundapus caudacutus* – vulnerable, migratory
- Greater glider *Petauroides volans* – vulnerable
- Koala *Phascolarctos cinereus* – vulnerable.

Likely to occur:

- Ornamental snake *Dennisonia maculata* – vulnerable.

Potential to occur:

- Collared delma, *Delma torquata* – vulnerable
- Yakka skink, *Egernia rugosa* – vulnerable
- Dunmall's snake, *Furina dunmali* – vulnerable
- Australian painted snipe, *Rostratula australis* – endangered
- Red goshawk, *Erythrorchis radiatus* – vulnerable
- Northern quoll, *Dasyurus hallucatus* – endangered
- Grey-headed flying-fox, *Pteropus poliocephalus* – vulnerable
- Ghost bat, *Macroderma gigas* – vulnerable
- Large-eared pied bat, *Chalinolobus dwyeri* – vulnerable.

Aquatic fauna

Two freshwater fauna field surveys (wet season 2011 and dry season 2017) and two targeted (freshwater turtle) fauna surveys (both dry season 2017) were undertaken for the EIS. In addition, benthic fauna field surveys were conducted in the Styx River estuary (and two adjacent estuaries to the north) in November 2011. Desktop assessment identified records of nine threatened marine fauna within 50km radius of the site.

I note that there are records of several MNES marine fauna from the wider Broad Sound region including:

- humpback whale, *Megaptera novaeangliae* – vulnerable
- green turtle, *Chelonia mydas* – vulnerable

- flatback turtle, *Natator depressus* – vulnerable.

All were considered unlikely to occur at the project site and near surrounds, while the green turtle was the only one of these species also recorded from within the Styx River estuary. These are all listed migratory species and are assessed in section 4.16.4.

Conclusion on description of existing environmental values

I consider that the EPBC listed threatened species in the project area and near surrounds have been adequately identified and described in the EIS. The EIS concluded that species that were unlikely to occur or had the potential to occur in the project site were not considered to be at risk due to impacts from the project and were therefore not subject to further impact assessment. For instance, an assessment of the likelihood of occurrence for the vulnerable reptile Collared delma, *Delma torquata* was undertaken. It determined that there was potentially suitable habitat located adjacent to the southern part of the project area but noted there would be no clearing of this habitat, it was well beyond the disturbance footprint and a significant ecological buffer would remain in place.

4.16.3.2 Potential impacts

The process of impact assessment used in the amended EIS was to initially establish likelihood of occurrence of threatened species based on desktop analysis, location of records and determine whether suitable habitat exists on site.

The following assessment is of fauna species that the department considers are likely to occur in the project area due to the presence of suitable habitat, modelled species habitat or nearby records. The department agrees with the amended EIS assessment that some threatened species are not expected to occur or unlikely to occur and these are not discussed further.

There are differences between the significant impact criteria for listed threatened species and communities in the EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) based on conservation status. However, the general test for significance is whether an impact is 'important, notable or of consequence, having regard to its context or intensity'.

Threatened ecological communities

Whether there is a real chance or possibly that an action is likely to have a significant impact on a critically endangered or endangered ecological community is determined by a number of criteria. Following is an assessment of the likelihood of impacts on the key threatened ecological communities found in the project site. These are:

Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow TEC)

EPBC Act Listing Status

Endangered.

Distribution

The listed Brigalow TEC extends from south of Charters Towers in Queensland and in a broad swathe east of Blackall, Charleville and Cunnamulla south to northern NSW near Narrabri and Bourke.

Description

The Brigalow TEC is characterised by the presence of *Acacia harpophylla* as one of the three most abundant tree species. It is either dominant in the tree canopy or co-dominant with species such as *Casuarina cristata*, other *Acacias* or eucalypts. The community has a wide range of vegetation structure and composition united by a suite of species that tend to occur on acidic and salty clay soils. The Brigalow vegetation community is mapped by the state as RE 11.4.9, *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

Occurrence in study area

The Brigalow community in the local region is highly fragmented and exists mostly in relatively small patches. There are two isolated remnant patches within the project site, a patch of 0.54ha within MLA 80187 and a patch of 3.37ha within MLA 700022. These patches are outside of the disturbance area

footprint. Regrowth Brigalow of between 3m and 5m in height exists on the project site on the northern side of the Bruce Highway. The regrowth patches have been heavily impacted by clearing, grazing and introduced pasture grasses and do not meet the TEC classification requirements.

Impacts of the proposed action

The project has been designed to avoid direct and indirect impacts on the remnant Brigalow TEC. The two small remnant patches on the project site are outside of the clearance footprint area and would be protected and managed in the proposed EMP. The amended EIS considered there was very little risk to the TEC from indirect impacts due to increased dust, weeds, pests or fire. The Brigalow TEC is not considered to be dependent on groundwater and therefore unlikely to be impacted by groundwater drawdown caused by the project.

Mitigation of impacts

The amended EIS did not propose specific mitigation measures due to the avoidance of impacts to the Brigalow TEC. However, it did state that the boundaries of clearing and 'no-go' areas will be clearly pegged/ flagged on the ground prior to clearing commencing. Personnel would also receive training that would include information on identifying these marked areas and characteristics of the TEC. The project's EMP would include measures for weed and pest control, dust suppression, and fire prevention and management. Additionally, a vegetation monitoring program would monitor project activities and potential impacts would be subject to corrective actions.

Assessment

The Commonwealth *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community* (2013) (Brigalow Conservation Advice) lists the main threats to the Brigalow TEC as (in order of importance) clearing, fire, weeds, feral animals, inappropriate grazing and climate change.

There is one threat abatement plan relevant to management of the species in the community: *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads* (Commonwealth of Australia, 2011).

There is no adopted or made Recovery Plan for this TEC.

The EIS provides an assessment of project impacts on the Brigalow TEC against the EPBC Act significant impact guidelines 1.1. For every criteria it concludes that the project would not significantly impact the Brigalow TEC.

Other threat reduction actions identified by the Brigalow Conservation Advice include minimising hydrological disruption, implementing sediment erosion control and establishing buffer zones to protect remnants. These measures would be undertaken by the proponent including excluding grazing from the project area.

Conclusion

The EIS states that the project would not result in the clearance of the Brigalow TEC and indirect impacts would not lead to a significant impact on the TEC. I agree with the findings in the amended EIS and support the proposed management measures.

Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

EPBC Act Listing Status

Endangered.

Distribution

The listed semi-evergreen vine thicket (SEVT) TEC extends from the Townsville area south to northern NSW. SEVT in the vicinity of the project area corresponds to the description of Central semi-evergreen vine thicket (central SEVT) in the sub-coastal areas of the Marlborough Plains subregion of the Brigalow Belt Bioregion.

Description

The SEVT TEC is considered by the SPRAT database to be an extreme form of dry seasonal subtropical

rainforest. It is generally characterised by the prominence of trees with microphyll sized leaves (i.e., leaves usually 2.5–7.6 cm long), the presence of Bottle Trees (*Brachychiton* spp.) as emergents from the vegetation, and the thickets occurring in areas with a subtropical, seasonally dry climate on soils of high to medium fertility. The project site and local area contains one of the 10 recognised SEVT REs – RE 11.3.11, Semi-evergreen vine thicket on alluvial plains.

Occurrence in study area

The SEVT community in the study area is highly fragmented and exists mostly in relatively small patches along the watercourses with only one minor patch equating to less than one hectare within the project area. The total patch size of the SEVT, mapped as RE 11.3.11, is 1.14ha.

There are a range of SEVT patches along Tooloombah Creek downstream of the proposed project site and potentially subject to impacts from the project.



Figure 14 Semi-evergreen vine thicket on the high bank of Tooloombah Creek

Source: Department of Environment and Science

Impacts of the proposed action

The project will not result in the direct clearing of the SEVT TEC.

Indirect impacts related to groundwater drawdown are not predicted to impact SEVT. A GDE assessment assessed leaf water potential (LWP), soil moisture potential (SMP) and stable isotope analysis of twig xylem, soil moisture, surface water and groundwater for a vine thicket community adjacent to the mine site on the southern bank of Tooloombah Creek. The assessment determined that the vine thicket trees are accessing a source of soil moisture in the unsaturated zone above the alluvial unconformity within the Styx Coal Measures. Borehole measurements show a maximum rooting depth of 6m below ground level (bgl) for vine thicket trees. Recharge of this moisture zone is dependent on high-flow events and resulting stream bank return.

Mitigation of impacts

The EIS has proposed the following mitigation measures:

- the disturbance footprint has been designed specifically to avoid direct impacts to areas of SEVT TEC located near the high bank of Tooloombah Creek
- a nominal 50m buffer between the edge of the OC2 pit and mapped SEVT TEC has been incorporated in the mine plan to minimise the risk of indirect impacts

- a riparian restoration program
- exclusion of cattle from the mining area
- project-wide procedures to manage weeds and pest animals
- erosion and sediment control measures
- dust suppression measures.

Assessment

There is no Approved Conservation Advice for this ecological community.

There is a Recovery Plan for this ecological community – *National recovery plan for the “Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions” ecological community* (McDonald, 2010). The Recovery Plan identifies a range of threats including clearing and provides five specific recovery objectives. Specific objective 3 is to ensure that best-practice management is applied to sites containing SEVT. This includes a performance objective of improving the integrity and connectivity of vine thicket fragments by encouraging the regeneration of native woody species in buffer zones surrounding and linking the fragments.

There are two TAPs relevant to management of the species in the community:

- *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads* (Commonwealth of Australia, 2011).
- *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa)* (Commonwealth of Australia, 2017).

The EIS provides an assessment of project impacts on the SEVT TEC against the EPBC Act significant impact guidelines 1.1. For every criteria it concludes that the project would not significantly impact the Brigalow TEC.

Conclusion

I am satisfied that the project is unlikely to directly impact the SEVT TEC. I note that potential indirect impacts from groundwater drawdown are unlikely to significantly impact the SEVT TEC. This is due to the relatively shallow rooting depth of the community compared with the depth to the existing water table as determined in GDE field analysis. The implementation of the management measures in the weed and pest management plan, the reduction in grazing pressure and the proposed riparian restoration program would all be consistent with the Recovery Plan and would likely mitigate potential impacts to the ecological community.

Terrestrial flora

The department is satisfied that the project is unlikely to impact listed threatened flora species. However, the department standardly recommends that pre-clearing surveys be undertaken to identify any listed flora species. I recommend that any project approval contain a condition that requires pre-clearing surveys of all proposed disturbed land on the site at each stage of mine development.

Terrestrial fauna

The amended EIS conducted significant impact assessments for the 11 EPBC listed threatened fauna species that were known or likely to occur on the project site based on field assessments. An action is considered likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population

- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

Known listed fauna species for the site:

- Squatter pigeon – (southern subspecies) *Geophaps scripta scripta* – vulnerable
- White-throated needletail, *Hirundapus caudacutus* – vulnerable, migratory
- Greater glider *Petauroides volans* – vulnerable
- Koala *Phascolarctos cinereus* – vulnerable

Likely to occur species:

- Ornamental snake *Dennisonia maculata* – vulnerable

The seven migratory species are assessed in section 4.16.4 listed migratory species. The four remaining species are assessed below.

The five species are listed as vulnerable under the EPBC Act. There are nine significant impact criteria for vulnerable listed threatened species in the EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013).

This assessment report provides an assessment on impacts, proposed mitigation measures and proposed offsets for each species.

Ornamental snake – *Denisonia maculata*

EPBC Act Listing Status

Vulnerable

Distribution and population

The ornamental snake is endemic to Queensland and occurs within the Brigalow Belt Bioregion, primarily in the Fitzroy River basin. The distribution of the species is associated with the Brigalow TEC. The population size is unknown but ornamental snakes are considered sparsely distributed and the extent of habitat clearance in their range is considered likely to be threatening their long term survival (Department of the Environment 2014).

Habitat

Ornamental snakes are found on floodplains, clay pans and along margins of watercourses and wetlands. They can also be found on adjacent elevated ground including woodlands and open woodlands associated with gilgai mounds and depressions. During dry periods, refuge habitats consist of soil cracks on gilgai mounds (SPRAT 2021). Microhabitat features include logs, coarse woody debris and leaf litter. Ornamental snakes feed almost exclusively on frogs.

Surveys

The description of ornamental snake habitat in the EIS was generally in line with the SPRAT Database, including consideration of regrowth Brigalow. It was noted by DAWE that the use of terms 'remnant' and 'non-remnant' to describe habitat did not align with Commonwealth requirements and did not provide sufficient specificity of the habitat types. There is also some contradiction in the description of the soils at the site, with the EIS stating both that soils in the project area are generally suitable for ornamental snake and that the gilgai communities support a soil type that results in infilling of cracking clays and therefore little foraging or shelter habitat.

In particular the EIS did not identify whether ornamental snake prey species (frogs) were located in the

potential habitat areas, which are an indication of ornamental snake preferred habitat identified in SPRAT.

Additionally, there is no discussion as to the suitability of the 3.91 ha of Brigalow TEC as habitat for ornamental snake.

The amended EIS identified 18.79ha of potential shelter and foraging habitat (remnant RE 11.3.25) for the ornamental snake. A further 444.75ha of potential non-remnant habitat was determined to lack the deep cracking clays and fallen timber characteristic of important ornamental snake (and their prey) habitats. The amended EIS concluded that with the additional impacts from clearing and grazing it was unlikely that the regrowth habitat would be considered important ornamental snake habitat.

No individuals were identified on the MLs during the fauna surveys during spotlighting and active searches. However, surveys using diurnal and nocturnal searching in 2011, with addition of pitfall traps in 2012, of the 342km² EPC 1029 did discover three specimens of ornamental snake 3.5km west and 5.8km to the northwest of the project site. A further survey using spotlighting and active searches was undertaken confined to ML 80187 and near surrounds in 2017.

Impacts of the proposed action

18.79ha of potential ornamental snake shelter and foraging habitat in remnant riparian vegetation (11.3.25) has been mapped within the project disturbance area and will be directly impacted. The EIS did not consider this to be important habitat for the ornamental snake when assessed against the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (Commonwealth of Australia 2011b). However, DAWE noted in their advice to the department that the proponent had not considered the definition for 'habitat critical to the survival of a species for the identified potential foraging habitat.

Other potential impacts from the project include:

- dust, lighting and noise impacts
- erosion and sedimentation of habitats
- increased predation, including by feral species
- direct mortality (during vegetation clearing and vehicle collision)
- impacts on prey species
- impacts on hydrology of floodplains

The EIS concluded that impacts on hydrology of floodplains from the project would not be significant.

Mitigation of impacts

The EIS has proposed mitigation measures for indirect impacts that would include:

- project-wide procedures to manage weeds and pest animals
- erosion and sediment control measures
- dust suppression measures
- noise reduction measures
- ecological considerations in lighting design
- traffic management and driver awareness of native fauna on roads.

Assessment

The *Approved Conservation Advice for Denisonia maculata (Ornamental Snake)* (DoE 2014) lists broadscale land clearing and habitat degradation, habitat modification through agricultural and urban development, destruction of wetland habitat by feral pigs and associated destruction of frog habitat and consumption of frogs, with ingestion of cane toads a potential threat. No TAPs have been identified as relevant for this species.

There is no adopted or made Recovery Plan for this species.

The fauna surveys largely met Commonwealth and State guidelines although the EIS did not present effort as person hours per ha in line with guideline values. The combined surveys incorporated all recommended methods in Australian government survey guidelines; however, the 2012 and 2017 surveys were undertaken in generally dry conditions, which may lead to reduced frog activity and ornamental snake detectability. However there had been so much rainfall prior to and during the 2011 survey that pitfall traps could not be safely utilised.

While ornamental snakes were not found on the project site, the EIS and the department concluded the species is considered likely to be present as:

- there are nearby records (3.5km); and
- suitable habitat exists on site.

The EIS provides a significant impact assessment against the Commonwealth Significant Impact Guidelines. The EIS did not consider the potential habitat identified at the project site to be important habitat and even though this potential habitat would be cleared the EIS concluded that there would be no significant impact on ornamental snakes as a result of the project.

I consider the potential foraging habitat for ornamental snake identified in the EIS as habitat critical to the survival of the species, in accordance with the MNES Significant Impact Guidelines (Commonwealth of Australia 2013). Clearance of 2ha or more important habitat is considered to be a high risk of significant impacts for ornamental snakes (Commonwealth of Australia 2011b). The project would result in the loss of 18.79ha of potential foraging habitat that is habitat critical to the survival of the ornamental snake and is therefore considered to be a high risk of significant impact.

While the EIS's significant impact assessment found that the project would not result in a significant impact on the ornamental snake, a commitment was made to offset impacts on potential remnant ornamental snake habitat. As a result, an offset is proposed for 18.8ha of ornamental snake habitat. DAWE did not consider that habitat types for the ornamental snake likely to be impacted by the project had been adequately described and that there is the potential that the amount of impact has been underestimated. DAWE considers the EIS does not provide sufficient information to demonstrate that an overall conservation outcome would be delivered for the ornamental snake.

Conclusion

The amended EIS did not consider that the project would result in a significant impact on the ornamental snake as it did not consider habitat at the site to be important habitat or habitat critical to the survival of the species. However, I consider that the 18.79ha of potential shelter and foraging habitat would comprise critical habitat and that the Brigalow TEC may also comprise important or critical habitat for the ornamental snake. Proposed clearing of this important habitat would be likely to have a significant impact on the species.

The amended EIS commits to offset the clearing impacts on 18.8ha of ornamental snake habitat. This offset may not be sufficient to address the total significant impact on ornamental snake habitat.

DAWE considers the amended EIS does not adequately describe the habitat types for the Ornamental Snake which are likely to be impacted. DAWE also notes that there is the potential the proponent has underestimated the amount of habitat to be impacted by the proposed action. DAWE considers it is unable to adequately determine whether the proposed environmental offset will, at a minimum, deliver an overall conservation outcome for the Ornamental Snake.

I recommend that an offset for ornamental snake habitat is revised for assessment by DAWE. I support the mitigation measures proposed in the amended EIS, particularly for dust, noise, lighting, erosion and sediment control, weed and pest control, traffic management and that the significant species management plan is implemented and reviewed regularly.

Squatter pigeon (southern subspecies) - *Geophaps scripta scripta*

EPBC Act Listing Status

Vulnerable

Distribution and population

The squatter pigeon (southern subspecies) is considered common north of the Carnarvon Ranges in Central Queensland with an estimated total population of 40,000 adult birds. There were 65 records of the species from the 50km radius Wildlife Online search results.

Over 60 individuals were recorded at more than 30 locations in the study area (with approximately 17 locations within the project area). Squatter pigeons were mainly found in open eucalypt woodlands (narrow-leaved ironbark, poplar box and ghost gum poplar box) and in cleared areas dominated by introduced pasture grasses. The species was recorded in all three habitat types described in the SPRAT Database.

Habitat

The squatter pigeon is a seed-eater that forages and nests on the ground.

Natural foraging habitat for the species is open woodlands and open forests or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils and typically within 3km of permanent or seasonal water bodies or watercourses. Squatter pigeons feed primarily on seeds that have fallen to the ground from low vegetation such as grasses herbs and shrubs and even from *Acacia* species.

Breeding habitat occurs on stony rises within 1km of permanent water. The species also occurs in heavily grazed country and in regrowth or partly modified vegetation communities.

Dispersal habitat is considered any forest or woodland occurring between foraging or breeding habitat that facilitate the local movement of the subspecies between these habitats or in the wider search for water sources.

The amended EIS identified approximately 928ha of squatter pigeon breeding foraging and dispersal habitat in the project site. The individual areas of breeding, foraging and dispersal habitat were mapped but the areas (hectares) for each habitat type were not quantified. In addition, the mapping does not depict the dispersal habitat in non-remnant vegetation.

Surveys

The breeding, foraging and dispersal habitat descriptions for squatter pigeon were clarified to the proponent by DAWE in 2019 and updated in the amended EIS. The amended EIS states that this clarification has been considered in the habitat assessment for the species but notes that there is evidence of broader habitat usage by squatter pigeons in unpublished data, including additional land zones within the project site. However, it is not clear whether these additional land zones were included in the project specific habitat assessment for the species.

The amended EIS has recognised squatter pigeon habitat to mainly consist of remnant vegetation although regrowth and partly modified vegetation communities on a range of land zones are also considered squatter pigeon habitat where there are relevant habitat values. The site has been largely cleared and is currently used for grazing, with open forest and woodland habitats confined to the remnant vegetation on site. The terminology used to describe squatter pigeon habitat is not consistent with the terminology in SPRAT, which refers to regrowth vegetation potentially providing habitat values for the species.

Squatter pigeon field survey methods and effort were generally in accordance with Australian government survey guidelines. Targeted surveys included one sampling round during optimal survey months (May to October) and recommended methods including road searches, area searches and transect surveys.

Impacts of the proposed action

The amended EIS quantified the area of squatter pigeon habitat directly and indirectly impacted by the project, through vegetation clearance and groundwater drawdown respectively as:

- 5.2ha of potential breeding habitat
- 320.5ha of known or potential foraging habitat
- 256.9ha of potential dispersal habitat

The amended EIS further divided the impacts to squatter pigeon habitat into remnant (306.5ha impacted) and non-remnant (276.1ha impacted) and considered the impacts on these habitats separately.

The amended EIS concluded that the project is likely to have a significant impact on the squatter pigeon on the basis that the loss of remnant breeding, foraging and dispersal habitat would adversely impact habitat critical to the survival of the species. Direct and indirect impacts to this habitat were calculated to be 306.5ha.

The clearing of non-remnant habitat was considered not to result in a significant impact to the species. It was considered that non-remnant habitat exists widely in the surrounding landscape and that the total impact area of 306.5ha only represents 1.5% of potential habitat available within 10km of the project. However, DAWE notes that the non-remnant habitat included approximately 169ha of foraging habitat close to Tooloombah Creek and Deep Creek as well as non-remnant foraging habitat adjacent to remnant breeding habitat. As noted above, regrowth vegetation is considered able to provide habitat values for the species, including where it is adjacent to remnant vegetation.

Other potential impacts from the project include:

- dust, lighting and noise impacts
- erosion and sedimentation of habitats
- increased predation, including by feral species
- direct mortality (during vegetation clearing and vehicle collision)
- inappropriate fire regimes
- impacts on hydrology.

Groundwater drawdown impacts on the availability of surface water and on the persistence of pools may lead to indirect impacts on the squatter pigeon. Groundwater inflows to pools are likely to provide an important water source for terrestrial fauna in dry periods. The loss of baseflow or enhanced leakage resulting from drawdown impacts may mean that ephemeral pools would dry up more rapidly. This can lead to a concentration of predators around remaining pools. As a granivore, squatter pigeons are forced to drink daily and would be at increased risk of predation. However, the amended EIS did not consider that permanent pools were at greater risk of drying up, even under worst-case conditions.

Mitigation of impacts

The EIS has proposed mitigation measures for indirect impacts that would include:

- pre-clearing surveys and management for nesting birds in breeding habitats
- project-wide procedures to manage weeds and pest animals
- fire management under the project EMP
- erosion and sediment control measures
- dust suppression measures
- noise reduction measures
- ecological considerations in lighting design
- traffic management and driver awareness of native fauna on roads.

Assessment

The approved *Conservation Advice Geophaps scripta scripta squatter pigeon (southern)* (Threatened Species Scientific Committee, 2015) lists ongoing vegetation clearance and fragmentation, overgrazing of habitat, introduction of weeds, inappropriate fire regimes, thickening of understorey vegetation, predation by feral cats and foxes, trampling of nests by livestock and illegal shooting as the primary current threats to the species population. Threat abatement plans that are relevant to management of the squatter pigeons include the following:

- *Threat abatement plan for predation by feral cats* (Department of Environment, 2015)
- *Threat abatement plan for competition and land degradation by rabbits* (Department of Environment and Energy, 2016)
- *Threat abatement plan for predation by the European red fox* (Department of the Environment, Water Heritage and the Arts, 2008).

There is no adopted or made Recovery Plan for this species.

DAWE notes from the amended EIS that there is evidence from unpublished data that shows that the squatter pigeon (southern) has been recorded within a variety of land zones, some of which are not listed in the SPRAT database. This includes recording the species on land zone's 4 and 11 within and adjacent to the project site. DAWE considers it is unclear as to whether suitable vegetation on land zones other than 3, 5 and 7 has been factored into the project-specific habitat assessment for the species. Additionally, DAWE considers that the habitat type areas (in hectares) that are within, adjacent and downstream of the project site are unclear. Further, the terminology used, including regional ecosystems and 'potential habitat', does not accord fully with SPRAT database habitat terms.

DAWE in its advice considers that the total impact area of approximately 306ha does not adequately describe or quantify the regrowth vegetation within and adjacent to the project site which can provide foraging value for the species. The potential underestimate of actual impacted habitat would require revision of the proposed offset. Currently, DAWE considers it is unable to adequately determine whether the proposed environmental offset will, at a minimum, deliver an overall conservation outcome for the Squatter Pigeon (Southern).

Conclusion

The amended EIS concludes that a significant impact would occur to squatter pigeon as a result of the proposed project. This would be from impacts to habitat that is critical to the survival of the species as a result of vegetation clearing and groundwater drawdown. The amended EIS proposes that the extent of this impact is limited to 306.51ha of squatter pigeon habitat in remnant vegetation and that impacts on non-remnant vegetation would not constitute a significant impact.

However, I do not agree with this conclusion on the basis that:

- the distinction between remnant and non-remnant habitat values are not made in the SPRAT squatter pigeon habitat descriptions
- the mapped non-remnant habitat is contiguous with remnant habitat so likely to be providing habitat services; and
- squatter pigeons were surveyed in both remnant and non-remnant vegetation habitat at the site.

I note DAWE's concerns that the amended EIS does not clearly set out how squatter pigeon habitat was identified for the project. I also agree with DAWE that the extent of impact is likely to be underestimated and the quantum of the proposed offset would be inadequate.

I recommend that the project should be required to offset significant impacts to remnant and non-remnant vegetation that is squatter pigeon habitat and at a minimum this should comprise an offset for both the 306.5ha of remnant vegetation habitat and the 276.1ha of non-remnant vegetation habitat.

I also recommend that the proponent works with DAWE to better describe and quantify the squatter pigeon habitat at the site, the extent of impact on critical habitat and the avoidance, minimisation, mitigation and offset measures for the full extent of the impact.

I recommend that the mitigation measures proposed in the amended EIS, particularly for weed and pest control, fire management and driver awareness are implemented and reviewed regularly to assess their success and to amend these measures if not effective.

Greater glider - *Petauroides volans*

EPBC Act Listing Status

Vulnerable

Distribution and population

The greater glider is found in eastern Australia from the Windsor Tableland in North Queensland through to central Victoria from sea level to 1,200m above sea level. There are isolated inland subpopulations in the Gregory Range west of Townsville and the Einasleigh Uplands (TSSC, 2016).

Population declines have been recorded in all states within the greater glider range although there is no estimate of population sizes or trends across its total distribution. In the Emerald district of Central Queensland an 89% decline was recorded between the mid-1970s and 2001-2. The Threatened Species Scientific Committee concluded that an overall population decline in greater gliders of 30% over three generations has taken place and that the decline is ongoing (TSSC, 2016).

Habitat

The amended EIS describes the greater glider as an arboreal nocturnal species that utilises tree hollows during the day to rest. They favour forests with a diversity of eucalypt species and a variety of den trees that are large, older trees providing large hollows. Greater gliders feed almost exclusively on eucalypt leaves, with occasional flowers or buds.

Eight REs were assessed as suitable habitat for koalas out of a total of eleven ground-truthed REs across the project area. The habitat assessment considered that favoured, breeding and/ or foraging habitat exist within these REs but did not differentiate habitat types. Greater gliders are considered poor dispersers across open or cleared areas, so dispersal habitat was identified as larger remnant vegetation patches that are contiguous with existing habitat. Some small areas of non-remnant vegetation has been included as suitable habitat where known feed trees occur.

Targeted surveys in a 6km reach of Deep Creek downstream of the Bruce Highway in 2019 identified suitable habitat for greater glider. Very large hollow-bearing *Eucalyptus tereticornis* were recorded as common along this section of Deep Creek.

Surveys

Ecological surveys conducted in 2011 and 2017 recorded greater gliders within riparian habitat in Deep Creek mapped as RE 11.3.25, *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.

Additional comprehensive surveys for koala and greater glider were undertaken in 2019 in the section of Deep Creek downstream of the Bruce Highway including the proposed haul road crossing area in response to the department's review comments. The study site also included the central drainage line – referred to as "Surveyor's Creek" – that would be cleared for mining activities. The study site covered an area of approximately 255ha and was assessed in November 2019.

Survey methodologies to detect the presence of koalas and greater gliders included diurnal and nocturnal foot-based searches over a total of 85km of survey transects. Diurnal searches were conducted over five days for diagnostic signs of presence (scats of both species), tree trunk scratching (mainly koalas), canopy searches for koalas, and assessing presence of potentially suitable hollow-bearing trees which might indicate local presence of greater gliders (and inform nocturnal search efforts). Nocturnal searches used spotlighting over four nights.

The survey program resulted in 21 observational records of the greater glider. Indirect evidence of greater glider scats and/ or scratches were also observed. A high proportion of the gliders observed were in *Corymbia tessellaris*, a feed tree species common along Deep Creek. It was concluded that greater gliders use habitat along the surveyed sections of Deep Creek and its tributary, Surveyor's Creek. The amended EIS attributed the abundance and distribution of greater gliders along this section of creek to the abundance of large hollow-bearing eucalypts providing den/shelter sites, as well as to the diversity of suitable feed trees, i.e., *Eucalyptus* / *Corymbia* spp.

Impacts of the proposed action

An assessment against the significant impact criteria for listed threatened species was undertaken for vulnerable species using the EPBC Act significant impact guidelines 1.1 (DEE 2013). It was determined that the loss of habitat critical to the survival of the species triggered a significant impact.

An impact area of 281ha was proposed to be offset for the unavoidable clearing of 115.8ha of greater

glider habitat and the indirect impact to 165ha of greater glider habitat from groundwater drawdown.

Direct impacts from vegetation clearing

A total of 115.8ha of mapped greater glider habitat will be cleared for the project. Proposed vegetation clearance for the project includes losses of habitat patches on the western side of WRS1; the south-west corner of OC2; the south-eastern corner of OC2; the drainage line across the northern part of MLA 801807; and the haul road crossing across Deep Creek and Barrack Creek on MLA 700022.

Loss of habitat from clearing can lead to injury or mortality of wildlife; modification of habitat can reduce the amount of foraging resources and lead to displacement of species.

The linear clearing across riparian habitat for the haul road crossing of Deep Creek and Barrack Creek would directly impact greater glider habitat. Additionally, the road and its traffic use at night is likely to inhibit greater glider movement and potentially create a permanent barrier. This would have implications for loss of access to home range and denning trees; a reduction in seasonal access to preferred feed trees; fragment an existing population; and potentially restrict population dispersal and gene flow.

Indirect impacts from groundwater drawdown

The indirect impact from groundwater drawdown resulting in lowering of the water table is predicted to significantly impact 165ha of riparian vegetation along Deep Creek. This area corresponds to terrestrial GDE vegetation and is located between reach 5 and reach 7 of Deep Creek.

The amended EIS concluded that groundwater drawdown would result in at least a “possible” likelihood of there being a “minor” impact on 165ha of riparian vegetation along Deep Creek determined to be a terrestrial GDE.

Predicted impacts from groundwater drawdown to habitat critical to the survival of the greater glider were identified as:

- the loss of denning trees due to canopy thinning and/ or mortality of shelter/ denning trees
- a reduction in available forage, potentially forcing greater gliders to move, increasing their exposure to threats
- a reduction in leaf (foliar) water content from a reduction in the amount of soil water available to trees.

The amended EIS stated that the proposed haul road crossing would potentially lead to an additional barrier to movement, taking into account the existing significant barrier to movement due to the Bruce Highway.

Other potential impacts from the project include:

- dust, noise and light impacts
- increased risk of bushfire
- invasive weeds such as Lantana, *Lantana camara* creating a fire risk
- dieback of eucalypts from the root-rot fungus *Phytophthora cinnamomi*.

Offset

An assessment against the significant impact criteria for listed threatened species was undertaken for vulnerable species using the EPBC Act significant impact guidelines 1.1 (DEE 2013). It was determined that the loss of habitat critical to the survival of the species triggered a significant impact.

A total impact area of 281ha was proposed to be offset for the unavoidable impacts to greater glider habitat.

Mitigation of impacts

The EIS has proposed the following mitigation measures relevant to impacts on the greater glider:

- Habitat clearing protocols include pre-clearing surveys, sequential vegetation clearing and the use of a suitably qualified and experienced ecologist to ensure the appropriate method for removal of any hollow-bearing habitat trees
- To minimise the barrier risk from the clearing for the haul road the amended EIS proposes to minimise clearing widths and install wooden glide poles along the length of the riparian habitat edge corresponding with the haul road crossing
- A range of design options for reducing night lighting impacts on adjacent habitat areas
- A fire management plan to reduce the risk of high-intensity wild fires
- Control of invasive weeds, particularly for lantana infestations in Deep Creek habitat areas
- Specific hygiene procedures designed to prevent the introduction/ spread of *Phytophthora cinnamomi*
- The preferential exclusion of barbed wire for any new fencing within or adjacent to retained habitats.

Implementation of the significant species management plan has a range of mitigation, management and monitoring strategies that reflect the extensive broad practical experience of the report's ecologist authors.

Assessment

The approved *Conservation Advice Petauroides Volans (greater glider)* (TSSC, 2016) lists habitat loss and fragmentation as a primary current threat to the species population.

No Threat Abatement Plans have been identified as relevant for this species. There is no adopted or made Recovery Plan for this species.

Targeted greater glider surveys undertaken in 2019 show that greater glider are more widespread and abundant within the project area than results from previous surveys suggest. It was considered that the high number of observational records in 2019 was attributable to a more intensive, targeted survey effort within suitable habitat.

The potential impacts to the terrestrial GDE vegetation communities include loss of condition and dieback of some large trees that may result in stream bank instability, erosion and consequential impacts to instream aquatic ecology values as well as to the downstream receiving environment.

It is noted that groundwater drawdown impacts to the area of impact would not occur for the first ten years of operation. A proposed riparian restoration program including planting of an additional 10m buffer width, and the exclusion of cattle grazing are anticipated to provide benefits to the existing greater glider habitat.

DAWE stated that they consider there are inherent uncertainties in the revised groundwater modelling which limit the reliability of groundwater predictions for potential adverse impacts on MNES. Further, they consider the risk remains that the magnitude and spatial extent of groundwater drawdown has potentially been underestimated which reduces confidence in the accuracy of the proponent's assessment of potential impacts on MNES. This lack of confidence extends to the adequacy of the environmental offsets proposed to compensate for residual significant impacts on MNES, as groundwater drawdown predictions have been used to calculate the proposed environmental offsets for riparian habitat (also terrestrial GDEs).

The action would likely result in extensive habitat clearance and further fragmentation of greater glider habitat. Given the confirmed presence of the species and their limited home ranges, this was considered likely to interfere with the recovery of the species, resulting in a significant impact as per the criteria. The area of significantly impacted greater glider habitat totals approximately 281ha.

I note that the proposed project would result in a range of stressors to the local greater glider population. This includes:

- the direct loss of 115.7ha of suitable habitat from clearing vegetation for mining activities and infrastructure

- the fragmentation of habitat due to the clearing of habitat patches and linear strips, restricting access to resources and dispersal habitat
- the creation of barriers to movement such as heavily trafficked haul roads
- adverse impacts from groundwater drawdown leading to:
 - the loss of 165ha of suitable habitat (riparian vegetation and terrestrial GDE vegetation along Deep Creek)
 - the loss of denning trees due to canopy thinning and/ or mortality of shelter/ denning trees
 - a reduction in available forage, potentially forcing greater gliders to move, increasing their exposure to threats
 - a reduction in leaf (foliar) water content from a reduction in the amount of soil water available to trees
- disturbance impacts from mining related activities such as noise, dust, light, traffic.

An offset area assessment has been conducted on the proposed offset area on the Mamelon property. Targeted greater glider surveys confirmed the presence of suitable habitat comprising RE 11.10.7, RE 11.11.15, RE 11.4.2, RE 11.5.8 and RE 11.3.25. Targeted spotlighting surveys conducted on the offset area in 2019 recorded the presence of greater gliders including denning and foraging in a variety of trees.

It is noted that the portion of the Mamelon property proposed for offsets is south and upstream of the proposed mine site to ensure that it is not subject to the adverse impacts of groundwater drawdown. Potential indirect impacts from mining activities such as dust generation, traffic and noise are not expected to impact the offset area.

Conclusion

I agree with the proponent's conclusion that a significant impact would occur to the greater glider as a result of the action. I recommend that an offset is provided for a maximum disturbance limit of 281ha to compensate for the loss of both direct and indirectly impacted habitat.

Recognising that the clearing will be a permanent loss of habitat would require that an offset be in place for the duration of the impact. Staged offsets aligning with proposed staged clearing is recommended for any condition of approval.

I recommend that any future offset proposal would include conditions that require monitoring of the riparian restoration program. In particular, monitoring requirements should assess the effectiveness of management measures to increase greater glider habitat connectivity in the riparian zones of Tooloombah Creek and Deep Creek.

The proposed mitigation measures are supported, particularly for limiting vegetation clearance; the provision of glider poles in the Deep Creek haul road location and Tooloombah Creek Bridge; and the implementation of the significant species management plan.

Koala – *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT)

EPBC Act Listing Status

Vulnerable

Distribution and population

The combined populations of Queensland, NSW and ACT koalas' range extends from approximately the latitude of Cairns in northern Queensland to the NSW-Victoria border, and includes inland and island populations. The distribution is not continuous, and some populations are isolated due to development or unsuitable habitat.

In Queensland the koala population extends over the eastern half of the state from the NSW border to the Wet Tropics bioregion and inland bioregions, including the Brigalow Belt bioregion. Koalas occur at naturally low density and have large home ranges in the central Queensland region, where the project is located. The amended EIS stated that a study conducted within 50km of the project estimated koala

density of 0.12 koalas/ha.

Population estimates by the SPRAT database for koalas in the Brigalow Belt bioregion range from 69,000-80,500 individuals in 2010 with an estimated decline of 30-40% since 1990 (SPRAT/ TSSC, 2012).

Habitat

The koala inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid vegetation communities dominated by *Eucalyptus* species.

Habitat is broadly defined as any forest or woodland that contains known koala food tree species, or shrubland with emergent food trees, including modified and regenerating native vegetation. Shelter trees are also considered important habitat components for koala however there is no identified sub-set of trees known to be shelter trees.

Koala habitat was defined for the purposes of the project surveys taking into account the *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (Cwt of Australia, 2014). An appraisal against the EPBC Act Habitat Assessment Tool of the habitat provided a score of nine, confirming that 'Habitat critical to the survival of the koala' occurs within the project area and near surrounds.

Eight REs were assessed as suitable habitat for koalas out of a total of eleven ground-truthed REs across the project area. Known koala food tree species within these REs include *Eucalyptus tereticornis*, *E. camaldulensis*, *E. platyphylla*, *E. crebra*, *E. exserta*, *Corymbia clarksoniana*, and *C. intermedia*.

The habitat assessment considered that favoured, breeding and/ or foraging habitat exist within these REs and did not differentiate habitat types. Dispersal habitat was identified as treed remnant vegetation patches that do not support foraging habitat. Known or potential habitat consisting of non-remnant vegetation was also identified and mapped.

Surveys

Ecological surveys conducted in 2017, 2018 and 2019 have all recorded koalas on the project site. Surveys in 2017 and 2018 recorded koalas using Poplar Box, *Eucalyptus populnea* woodland (RE 11.4.2) and Poplar Gum, *Eucalyptus platyphylla* woodland. Surveys recorded koalas within all habitats associated with Deep Creek and koalas are expected to use the same habitats associated with Tooloombah Creek.

Additional surveys for koala and greater glider were undertaken in the section of Deep Creek downstream of the Bruce Highway including the proposed haul road crossing area in response to the department's review comments. The study site also included the central drainage line – referred to as "Surveyor's Creek" – that would be cleared for mining activities. The study site covered an area of approximately 255ha and was assessed in November 2019.

Survey methodologies to detect the presence of koalas and greater gliders included diurnal and nocturnal foot-based searches over a total of 85km of survey transects. Diurnal searches were conducted over five days for diagnostic signs of presence (scats of both species), tree trunk scratching (mainly koalas), canopy searches for koalas, and assessing presence of potentially suitable hollow-bearing trees which might indicate local presence of greater gliders (and inform nocturnal search efforts). Nocturnal searches used spotlighting over four nights.

The survey program resulted in eight observational records of the koala. Indirect evidence of koala scats and/ or scratches were also observed. It was concluded that koalas use habitat along the surveyed sections of Deep Creek and its tributary, Surveyor's Creek.

Impacts of the proposed action

Direct impact

The amended EIS stated that 159.4ha of koala habitat is proposed to be cleared for the project. This comprises approximately 139ha of remnant vegetation, 2ha of dispersal vegetation, and 18ha of non-remnant vegetation. The total direct impact of clearing equates to approximately 33% of the koala habitat on the project site. Proposed vegetation clearance for the project includes losses of habitat patches on

the western side of WRS1; the south-west corner of OC2; the south-eastern corner of OC2; the drainage line across the northern part of MLA 801807; and the haul road crossing across Deep Creek and Barrack Creek on MLA 700022.

Loss of habitat from clearing can lead to injury or mortality of wildlife; modification of habitat can reduce the amount of foraging resources and lead to displacement of species.

Indirect impacts

Additionally, the amended EIS identified that riparian vegetation, classed as a terrestrial GDE, associated with three of the stream reaches along Deep Creek (namely 5, 6 and 7) would be significantly impacted by groundwater drawdown.

The amended EIS has identified that groundwater drawdown would result in an indirect impact to koala habitat of 165.2ha. This comprises 41ha of remnant vegetation and 124ha of dispersal vegetation. The area predicted to be affected consists of RE 11.3.25 (87.5ha), RE 11.3.27 (0.6ha), RE 11.3.35 (37.8ha), and RE 11.3.4 (39.3ha). Non-remnant vegetation was not considered to be impacted.

The amended EIS provided a GDE assessment that identified permanent and ephemeral pools on both Tooloombah Creek and Deep Creek would likely be impacted by groundwater drawdown. This was predicted to lead to a reduced availability of surface water along the ephemeral watercourses. Ephemeral pools are likely to dry up more quickly and for longer periods than existing conditions. It was considered that the reduced water availability could force koalas to travel over land in search of water.

Offset

An assessment against the significant impact criteria for listed threatened species was undertaken for vulnerable species using the EPBC Act significant impact guidelines 1.1 (DEE 2013). It was determined that the loss of habitat critical to the survival of the species triggered a significant impact.

A total impact area of 324.6ha was proposed to be offset for the unavoidable clearing of koala habitat.

Mitigation of impacts

The EIS has proposed the following mitigation measures relevant to impacts on the koala:

Habitat clearing protocols include pre-clearing surveys, sequential vegetation clearing and the use of koala spotters to ensure koalas move out of a clearing site without human intervention. Measures would be consistent with Part 3 of the *Nature Conservation (Koala) Conservation Plan 2017*.

A range of dedicated road crossing treatments would be implemented where the proposed access road from the Bruce Highway traverses the riparian areas of Deep Creek to reduce koala mortality and injury from vehicle strike. This would include grade-separated crossings with dedicated fauna movement underpasses (including underpass 'furniture') and specific roadside treatments such as koala directional and exclusion fencing, refuge poles, and vegetation management.

Access and internal speed limits and the provision of koala awareness signage at strategic locations are also proposed.

Feral animal management strategies would be implemented including wild dog control measures as predation by wild dogs is a known major threat to koalas. Domestic dogs would be prohibited from the project area.

A bushfire management plan would be implemented for the life of the project in order to reduce the risk of high-intensity fires. In addition, reducing the risk of spontaneous combustion of product coal would be managed by routine monitoring of coal stockpiles, compacting stockpiles and minimising coal stockpile stagnancy.

Implementation of the significant species management plan has a range of mitigation, management and monitoring strategies that reflect the extensive broad practical experience of the report's ecologist authors.

Assessment

The Approved Conservation Advice for *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (TSSC, 2012) lists habitat loss and fragmentation

as a primary current threat to the species population. Drought and extreme heat events can also cause very significant mortality and myrtle rust can also damage forests containing koalas. No Threat Abatement Plans have been identified as relevant for this species.

There is no recovery plan adopted or made for koala however a recovery plan is currently required following the expiration of the National Koala Conservation and Management Strategy in 2014.

No specific figure was provided in the amended EIS to depict the disturbance area attributable to direct and indirect impacts on koala habitat. It is also noted that a significant proportion of this habitat is located outside of the mining lease. Land tenure within the riparian corridor that adjoins the project site is State land under the Land Act 1994. Land impacted on the other side of Deep Creek from the mine site corresponds to both the 'Strathmuir' property and the 'Brussels' property.

The amended EIS noted that an assessment of potentially suitable koala habitat in the local region (within 10km of the project site) identified an area of 8,326ha of well-connected remnant habitat. Large contiguous habitat patches were identified to the north-west, west and south of the project area.

The amended EIS stated that the loss of koala habitat from direct impacts was 1.4% of the mapped remnant koala habitat within 10km of the project area. The loss of koala habitat from indirect impacts was not calculated in terms of additional loss to koala habitat within 10km of the project area.

The targeted survey of koala habitat in the Deep Creek area from 2019 observed eight koalas including an adult female with joey. The targeted survey concluded that koalas are more widespread and abundant within the project area than previous surveys have suggested.

The department notes that the proposed project would result in a range of stressors to the local koala population. This includes:

- the direct loss of 159.4ha of suitable habitat from clearing vegetation for mining activities and infrastructure
- the fragmentation of habitat due to the clearing of habitat patches and linear strips, restricting access to resources and dispersal habitat
- the creation of barriers to movement such as heavily trafficked haul roads
- adverse impacts from groundwater drawdown leading to:
 - the loss of 165ha of suitable habitat (riparian vegetation and terrestrial GDE vegetation along Deep Creek)
 - the reduction in persistence of ephemeral pools in the dry season, potentially forcing koalas to move, increasing their exposure to threats
 - the loss of shelter and shade due to canopy thinning and/ or mortality of shelter trees
 - a reduction in available forage, potentially forcing koalas to move, increasing their exposure to threats
 - a reduction in leaf (foliar) water content from a reduction in the amount of soil water available to trees
 - increased physiological stress due to reduced availability of food / water and shelter
- disturbance impacts from mining related activities such as noise, dust, light, traffic.

It is further noted from the amended EIS that a reduction in the availability of food, water and shelter due to the impacts of groundwater drawdown could increase the susceptibility Koalas to diseases such as Chlamydia. This disease is a major threat to koalas and can lead to reduced fertility, increased blindness and increased mortality.

Conclusion

I recommend that an offset is provided for the total direct and indirect significant impacts on 324.6ha of koala habitat.

I recommend that any future offset approval would include conditions that require monitoring of the

riparian restoration program. In particular, monitoring requirements should assess the effectiveness of management measures to increase koala habitat connectivity in the riparian zones of Tooloombah Creek and Deep Creek.

I also recommend that the avoidance and mitigation measures proposed in the amended EIS are adequately incorporated into any future approval conditioning. In particular, the implementation of the significant species management plan that has eight specific management plans directly addressing threatened fauna protection measures.

Other threatened bird species

There are several wetlands in the project area that contain habitat for threatened birds that are also migratory, including the artificial water bodies in the centre of the project area, and the adjacent watercourses.

The Australian painted snipe, *Rostratula australis*, (endangered) was considered to have the potential to use the project area sporadically. It was not recorded during EIS surveys. The likelihood of occurrence was considered possible but the potential impact to the species from the clearing of habitat was considered negligible.

Several farm dams would be cleared for mining activities leading to the loss of some potential foraging habitat. The EIS concluded that the project is unlikely to have a significant residual impact on the Australian painted snipe and no offsets were proposed. No mitigation measures are proposed as impacts are expected to be absent or minor.

I accept the EIS conclusion that there is no evidence of a significant impact to the Australian painted snipe as a result of the project. It is recognised that a series of new water storage areas would be constructed prior to mining. It is noted that the surface area of Dam 1 at full supply level would be approximately 128ha and is likely to provide additional foraging habitat.

The yellow chat (Dawson), *Epthianura crocea macgregori* listed as critically endangered has been recorded from the Torilla Plains region of the Broad Sound peninsular. Potentially suitable habitat is present in the Styx River estuary. The amended EIS concluded that the project is unlikely to have a significant residual impact on the yellow chat due to the project's distance upstream. Additionally, the amended EIS stated that potential indirect impacts to downstream habitats as a result of surface water changes, erosion of stream banks and groundwater drawdown were not anticipated.

4.16.3.3 Cumulative impacts

The proposed project, if approved, would be the only coal mine operating in the Styx Basin. As such, the amended EIS did not consider that the potential project's impacts would be in addition to existing impacts of other mining activities in the region.

An assessment of known potential future expansions or developments by the proponent and other proponents in the region and vicinity was undertaken. The expansion of the Shoalwater Bay Training Area (SWBTA) has seen one of the underlying properties for the project, Strathmuir, purchased by the Department of Defence. However, the proponent has agreed to purchase the land subject to the project and it is noted that the nearest use of the SWBTA would be approximately 50-100km from the project area.

The proposed Clarke Creek Wind Farm and Connors Arc Projects were the only two projects identified within the Styx Basin. The Connors Arc Project is currently an early-stage gold exploration project. It was noted that the Clarke Creek Wind Farm has been approved under the EPBC Act (EPBC 2018/8141) in 2018. It would significantly impact on habitat for three of the same listed threatened species as the project site, 18ha for the greater glider and squatter pigeon and 1513ha for the koala. Offsets are proposed for both projects. The cumulative impacts were considered to be at a regional scale due to the 20km distance between the projects. The amended EIS stated that the local scale impacts are considered not to contribute significantly to cumulative impacts at the regional scale.

However, the cumulative impacts identified in the EIS did not take into account vegetation clearing for grazing that will occur and the resultant modification of habitat of a number of listed species.

4.16.3.4 Significant impacts and offsets

Table 6 Proposed Listed threatened species offset requirements summarises the assessment presented in the amended EIS for significant impacts to the four listed threatened species and the likely offset areas required for their acquittal using the EPBC Act Offsets Policy 2012. Impact and offset habitat quality scores were calculated using the *Guide to determining terrestrial habitat quality, Version 1.2* (DEHP, 2017).

Table 6 Proposed Listed threatened species offset requirements

Protected matter	Impact habitat quality score	Impact (ha)	Proposed offset property - Mamelon			Proposed offset property – second property			Total % acquit
			Offset habitat quality score	Offset area (ha)	% acquit	Offset habitat quality score	Offset area (ha)	% acquit	
Greater glider	7	281.0	7	2,428.4	100.03	-	-	-	100.03
Koala	7	324.6	7	2,803.4	100.10	-	-	-	100.10
Squatter pigeon	7	306.6	7	2,667.1	100.80	-	-	-	100.80
Ornamental snake	5	18.8	-	-	-	7	121.1	102.37	102.37

Adapted from Chapter 16 MNES Table 16-87: MNES offset requirements

4.16.3.5 Assessment and conclusion

The amended EIS undertook an assessment of listed threatened species and ecological communities against the relevant objectives and priority actions of conservation advices, recovery plans and TAPs.

Appropriate survey methodologies were undertaken by suitably qualified ecologists and field survey results spanned the period from 2011 to 2019.

The amended EIS found that the project would result in both direct and indirect significant impacts on habitat of four listed threatened terrestrial fauna species. A summary of the impacts and proposed offsets for the ornamental snake, squatter pigeon, greater glider and koala are provided below.

Terrestrial flora

The EIS concluded that the project would not impact on three EPBC Act threatened terrestrial flora species recorded in the wider region. This was based on the results of field surveys and habitat suitability assessments indicating that the three species are unlikely to occur in the project site.

I am satisfied that the project is unlikely to have unacceptable impacts on listed threatened flora species. Nevertheless, as committed to in the EIS, I recommend that pre-clearing surveys should be carried out at each stage of mine and infrastructure development to identify and manage threatened species that may be present in the clearing footprint.

Threatened ecological communities

The EIS concludes that the project would not result in the clearance of the Brigalow TEC and indirect impacts would not lead to a significant impact on the TEC. The department agrees with the amended EIS and supports the proposed management measures.

I am satisfied that the project is unlikely to directly impact the SEVT TEC. It is noted that potential indirect impacts from groundwater drawdown are unlikely to significantly impact the SEVT TEC. This is due to the relatively shallow rooting depth of the community compared with the depth to the existing water table as determined in GDE field analysis. The implementation of the management measures in the weed and pest management plan, the reduction in grazing pressure and the proposed riparian restoration program would all be consistent with the Recovery Plan and would likely mitigate potential

impacts to the ecological community.

Terrestrial fauna

Ornamental snake

The amended EIS did not consider that the project would result in a significant impact on the ornamental snake as it did not consider habitat at the site to be important habitat or habitat critical to the survival of the species. I consider, however, that the 18.79ha of potential shelter and foraging habitat would comprise critical habitat and that the Brigalow TEC may also comprise important or critical habitat for the ornamental snake. Clearing of this important habitat would be likely to have a significant impact on the species.

I also note that in the amended EIS the proponent commits to offset the clearing impacts on 18.8ha of ornamental snake habitat and proposes a biodiversity offset strategy to address this. This offset may not be sufficient to address the total significant impact on ornamental snake habitat.

DAWE considers the amended EIS does not adequately describe the habitat types for the Ornamental Snake which are likely to be impacted. DAWE also notes that there is the potential the proponent has underestimated the amount of habitat to be impacted by the proposed action. DAWE considers it is unable to adequately determine whether the proposed environmental offset will, at a minimum, deliver an overall conservation outcome for the Ornamental Snake.

I recommend that an offset for ornamental snake habitat is revised for assessment by DAWE. I support the mitigation measures proposed in the amended EIS, particularly for dust, noise, lighting, erosion and sediment control, weed and pest control, traffic management and that the significant species management plan is implemented and reviewed regularly.

Squatter pigeon

The amended EIS concludes that a significant impact would occur to squatter pigeon as a result of the proposed project. This would be from impacts to habitat that is critical to the survival of the species as a result of vegetation clearing and groundwater drawdown. The amended EIS proposes that the extent of this impact is limited to 306.51ha of squatter pigeon habitat in remnant vegetation and that impacts on non-remnant vegetation would not constitute a significant impact.

I note DAWE's concerns that the amended EIS does not clearly set out how squatter pigeon habitat was identified for the project. I also concur with DAWE that the extent of impact is likely to be underestimated and the quantum of the proposed offset would be inadequate.

I recommend that the project should offset significant impacts to remnant and non-remnant vegetation that is squatter pigeon habitat and at a minimum this should comprise an offset for both the 306.5ha of remnant vegetation habitat and the 276.1ha of non-remnant vegetation habitat.

Greater glider

I agree with the proponent's conclusion that a significant impact will occur to the greater glider as a result of the action. I recommend that an offset is provided for a maximum disturbance limit of 281ha to compensate for the loss of both directly impacted and indirectly impacted habitat.

Recognising that the clearing will be a permanent loss of habitat would require that an offset be in place for the duration of the impact. Staged offsets aligning with proposed staged clearing is recommended for any condition of approval.

I recommend that any future offset approval would include conditions that require monitoring of the riparian restoration program. In particular, monitoring requirements should assess the effectiveness of management measures to increase greater glider habitat connectivity in the riparian zones of Tooloombah Creek and Deep Creek.

The proposed mitigation measures are supported, particularly for vegetation clearance, the provision of glider poles, and the implementation of the significant species management plan.

Koala

I recommend that an offset is provided for the total direct and indirect significant impacts on

approximately 325ha of koala habitat. I note that the proposed project would result in a range of stressors to the local koala population that may have additional long-term impacts.

I recommend that any future offset approval would include conditions that require monitoring of the riparian restoration program. In particular, monitoring requirements should assess the effectiveness of management measures to increase koala habitat connectivity in the riparian zones of Tooloombah Creek and Deep Creek.

I recommend that the mitigation measures proposed in the amended EIS are adequately incorporated into any future approval conditioning. In particular, the implementation of the significant species management plan that has eight specific management plans directly addressing threatened fauna protection measures.

Aquatic species

No threatened aquatic fauna have been recorded from the vicinity of the project. There is potential for estuarine crocodiles to be present in the Styx River downstream of Ogmoo. I am satisfied that the project is unlikely to have unacceptable impacts on listed aquatic species.

EPBC offset requirements

The department considers that the clearing of riparian, woodland and some non-remnant vegetation for mining activities would result in a significant residual impact on four listed threatened species – koala, greater glider, squatter pigeon and ornamental snake. The proposed direct clearing of suitable habitat and the loss of suitable riparian habitat from the adverse effects of groundwater drawdown has the potential to remove foraging, breeding and dispersal habitat for these species.

The amended EIS re-assessed the potential impacts to the four threatened species in response to comments from DAWE. A Biodiversity Offset Strategy was provided in the amended EIS. The strategy detailed two offset properties that were considered able to meet offset principles under the EPBC EOP. Habitat quality scores for the impact areas have been compared to scores on the proposed offset areas.

One potential offset property is the southern portion of the Mamelon Station outside of the project site MLA 801087 boundary. It consists of a 2803ha area calculated using the EPBC EOP to acquit the loss of 325ha of koala habitat. This area is also proposed to acquit offsets for squatter pigeon and greater glider.

DAWE stated that the proposed environmental offsets do not currently align with the principles of the EPBC Act Environmental Offsets Policy (2012), that it had low confidence in both the listed threatened species habitat assessments (in accordance with Commonwealth requirements), and the MNES significant impact assessments used to inform the proposed environmental offsets at both properties.

DAWE considers the amended EIS does not adequately describe the habitat types for the Ornamental Snake which are likely to be impacted. DAWE also notes that there is the potential the proponent has underestimated the amount of habitat to be impacted by the proposed action. DAWE considers it is unable to adequately determine whether the proposed environmental offset will, at a minimum, deliver an overall conservation outcome for the Ornamental Snake.

DAWE in its advice considers that the total impact area for the Squatter Pigeon (Southern) of approximately 306ha does not adequately describe or quantify the regrowth vegetation within and adjacent to the project site which can provide foraging value for the species. The potential underestimate of actual impacted habitat would require revision of the proposed offset. Currently, DAWE considers it is unable to adequately determine whether the proposed environmental offset will, at a minimum, deliver an overall conservation outcome for the species.

I agree with the amended EIS conclusion that a significant impact would occur to the greater glider and the koala as a result of the proposed project. I recommend that an offset is provided for the permanent loss of 281ha of greater glider habitat and approximately 325ha of koala habitat.

In addition to direct land-based offsets under the EPBC EOP, I recommend that any approval conditions also consider the following management measures:

- implement measures to avoid, mitigate and manage impacts on EPBC listed threatened species and communities during vegetation clearing, construction, operation, and decommissioning of the

project. The proponent should undertake vegetation clearing for each project phase in a manner that avoids or minimises the potential for impacts on EPBC listed fauna species

- undertake pre-clearance surveys; spotter catchers must be in residence for clearance activities; and management plans detailed in the significant species management plan are implemented
- restoration of riparian habitat along both Tooloombah Creek and Deep Creek to create and maintain koala and greater glider habitat connectivity
- a monitoring program is undertaken to determine whether riparian habitat restoration is effective in maintaining the density and carrying capacity of koala and greater glider
- implementation of priorities identified in relevant recovery plans, threat abatement plans and/or approved conservation advices, and the evaluation of their success and cost effectiveness
- a Species Management Program under the Queensland NC Act would be required for interfering with the breeding place of any species in the project area
- the implementation of the significant species management plan must be in accordance with both the EPBC Act and the NC Act.

4.16.4 Listed migratory species

In assessing the project for the purposes of sections 20 and 20A of the EPBC Act, it is noted that the Commonwealth Minister for the Environment must not act inconsistently with Australia's obligations under a recovery plan or a TAP.

The Minister must also, in deciding whether to approve the taking of the action, have regard to any approved conservation advice for the threatened species or ecological community that are likely to be or would be significantly impacted by the project.

This section assesses the project against the objectives and priority actions of conservation advices, recovery plans and TAPs for the relevant threatened species and communities. It also assesses the proposed action against relevant conventions and agreements of which a migratory species is listed, including the Bonn Convention, CAMBA, JAMBA and agreements relevant to the conservation of the species. The significant residual impacts of the project on migratory species are also considered in this section.

4.16.4.1 Existing environmental values

See section 4.16.2 existing environmental values of World heritage properties and National heritage places, for a description of the environmental values of Broad Sound.

The amended EIS undertook a desktop assessment that identified a range of migratory species potentially occurring within or near the project site, or in the downstream Broad Sound area. This consisted of migratory terrestrial birds, migratory shorebirds, migratory seabirds (terns and osprey), marine mammals, marine reptiles and rays and sharks.

The amended EIS identified 30 species listed as migratory under the EPBC Act as known or likely to occur in the Broad Sound area based on a likelihood of occurrence assessment. 23 species were birds (16 migratory shorebirds), four marine mammals, and three marine reptiles.

Migratory birds

Six migratory birds were considered known or likely to occur at the project site or near surrounds:

- Latham's snipe, *Gallinago hardwickii*
- Oriental cuckoo, *Cuculus optatus*
- White-throated needletail, *Hirundapus caudacutus*
- Fork-tailed swift, *Apus pacificus*
- Glossy ibis, *Plegadis falcinellus*
- Rufous fantail, *Rhipidura rufifrons*

Five migratory birds were considered known or likely to occur at the Styx River Estuary or Broad Sound:

- Caspian tern, *Hydroprogne caspia*
- Crested tern, *Thalasseus bergii*
- Eastern osprey, *Pandion cristatus*
- Gull-billed tern, *Gelochelidon nilotica*
- Little tern, *Sternula albifrons*.

Up to 15 Latham's snipe were observed at a farm dam on the project site in 2017.

Migratory shorebirds

16 species of migratory shorebirds were considered known or likely to occur at the Styx River Estuary or Broad Sound:

- Bar-tailed godwit (*baueri*), *Limosa lapponica baueri*
- Common greenshank, *Tringa nebularia*
- Curlew sandpiper, *Calidris ferruginea*
- Eastern curlew, *Numenius madagascariensis*
- Great knot, *Calidris tenuirostris*
- Greater sand plover, *Charadrius leschenaultia*
- Grey plover, *Pluvialis squatorola*
- Grey-tailed tattler, *Tringa brevipes*
- Latham's snipe, *Gallinago hardwickii*
- Lesser sand plover, *Charadrius mongolus*
- Marsh sandpiper, *Tringa stagnatilis*
- Red knot, *Calidris canutus*
- Red-necked stint, *Calidris ruficollis*
- Sharp-tailed sandpiper, *Calidris acuminata*
- Terek sandpiper, *Xenus cinereus*
- Whimbrel, *Numenius phaeopus*.

Significant aggregations of migratory shorebirds have been recorded in the nearshore environments of Broad Sound that are considered important at a national and international level. This includes nationally important numbers of eastern curlew, great knot, red-necked stint, whimbrel and sharp-tailed sandpiper. Migratory shorebirds were stated to undertake key lifecycle activities such as overwintering and building condition for the northern migration.

It is noted that three migratory shorebird species are classified as both migratory and critically endangered – the curlew sandpiper, *Calidris ferruginea*, the eastern curlew, *Numenius madagascariensis*, and the great knot, *Calidris tenuirostris*. A further two species of migratory shorebirds are classified as both migratory and endangered – the lesser sand plover, *Charadrius mongolus* and the red knot, *Calidris canutus*.

The amended EIS presented survey data results from surveys conducted in 2008 and 2009 for the Fitzroy Basin Association; and from 2010 to 2017 surveys conducted by Birdlife Capricornia at three Broad Sound roost locations (Charon Point, Hoogly Point and Bar Plains Point). Charon Point located approximately 33km downstream of the project site may support nationally important numbers of migratory shorebirds (>2000 individuals). Both Hoogly Point and Bar Plains Point also support nationally important numbers of migratory shorebirds with Hoogly Point recording an internationally important

number of eastern curlew in 2013.

Marine mammals

Four species of marine mammals were considered known or likely to occur at the Styx River Estuary or Broad Sound:

- humpback whale, *Megaptera novaeangliae*
- dugong, *Dugong dugon*
- Australian hump-back dolphin, *Sousa sahalensis*
- Australian snubfin dolphin, *Orcaella heinsohni*.

The humpback whale, *Megaptera novaeangliae* are known to use the northern entrance to Broad Sound during the southern migration, particularly for whales that have recently calved.

The dugong, *Dugong dugon* are known to use the seagrass beds to the northwest of Broad Sound. A Dugong Protection Area (DPA) associated with extensive seagrass beds extending from Carmilla Creek south to Clairview Bluff which is approximately 55 km north of the project area.

The Australian hump-back dolphin, *Sousa sahalensis* and Australian snubfin dolphin, *Orcaella heinsohni* are both known to use Broad Sound. Sightings of low numbers of both species were recorded north of the Styx River in the channel on the western side of Rosewood Island.

Marine reptiles

Three species of migratory marine reptiles were considered known or likely to occur at the Styx River Estuary or Broad Sound:

- green turtle, *Chelonia mydas*
- flatback turtle, *Natator depressus*
- estuarine crocodile, *Crocodylus porosus*.

The marine turtles: the green turtle, *Chelonia mydas* and the flatback turtle, *Natator depressus*, are known from the Styx River Estuary and Broad Sound. Broad Sound contains 48 largely undisturbed National Park Islands, two of which – Wild Duck Island and Avoid Island – host large nesting rookeries for the threatened migratory flatback turtle, *Natator depressus*. Both islands are located approximately 75km north of the project.

Nesting of green turtles has been recorded on several offshore islands in the wider region including the Percy Islands group, Curlew Island and islands and mainland beaches in Shoalwater Bay.

The estuarine crocodile, *Crocodylus porosus* is known to occur in both the Styx River Estuary and Broad Sound. There are also records of the estuarine crocodile from the Styx River approximately 2.2km downstream of the project boundary and this species is considered likely to occur within the project site or near surrounds.

Rays and sharks

Four species of rays and sharks identified in desktop searches. The amended EIS considered the Giant manta ray, *Manta birostris*, Green sawfish, *Pristis zijsron* and the Porbeagle, *Lamna nasus* unlikely to occur in the Styx River Estuary or Broad Sound. It state there were no database records from the wider region for these species. It was considered that the Reef manta ray, *Manta alfredi* had the potential to occur in the wider Broad Sound area but there was limited suitable reef habitat available.

Field surveys

Only one benthic habitat field survey was conducted in Broad Sound in 2011 prior to the EIS process. Terrestrial surveys were conducted on the project site or near surrounds in 2011, 2017, 2018 and 2019. No estuarine or marine surveys of migratory species have been conducted in Broad Sound.

Conclusion on existing environmental values

I consider the desktop assessment of environmental values for migratory species has been adequately undertaken and described in the EIS. I consider the field surveys undertaken in the Broad Sound for the project were deficient. I note that baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area in 2011. I consider this data is unlikely to be representative of current conditions and that a single sampling event would not be representative of the variability of these indicators.

Baseline surveys of terrestrial or marine migratory species in Broad Sound have not been undertaken. I consider that biological surveys are an essential component of significant impact assessments and should be conducted in all areas likely to be subject to indirect impacts. Without a full description of baseline conditions prior to project commencement, it is difficult to determine the potential magnitude of impacts to migratory species or their habitats that may result from the proposed mining activities.

For a further description of the environmental values of Broad Sound see section's 4.16.2 existing environmental values of World heritage properties and National heritage places, and 4.16.5 existing environmental values of the Great Barrier Reef Marine Park.

4.16.4.2 Potential impacts

There are three significant impact criteria for listed migratory species in the EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013). An action is considered likely to have a significant impact if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The amended EIS considers there would be no significant impact to any listed migratory species either on the project area or in the downstream receiving environment.

The amended EIS recognises there is a risk of indirect impacts from water quality changes on habitat features of Broad Sound. This includes potential impacts from contaminants transported in controlled and uncontrolled releases from the mine site, erosion of streambanks and groundwater drawdown impacts on water quality and quantity.

The potential indirect water quality impacts from mining activities on downstream migratory species were considered by the amended EIS to be adequately mitigated by the operation of the water management system, the range of erosion and sediment control measures and the reduction in grazing pressure.

Migratory birds

The amended EIS stated that there would be no significant impact to the Latham's snipe, the only migratory shorebird recorded on the project site. Despite the high number recorded in a degraded farm dam in 2017 (15 individuals), it considered that ephemeral farm dams in the wider region are common and widespread and that the retention of wetlands on the project site would support potentially suitable habitat.

The five migratory birds known or likely to occur on the project site or near surrounds were not considered to be significantly impacted by the proposed action. It was stated that the project site did not provide suitable important habitat.

The 16 species of migratory shorebirds known or likely to occur downstream of the project site were not considered to be significantly impacted by the proposed action. Habitat critical to the survival of the critically endangered and endangered species - great knot, curlew sandpiper, eastern curlew, lesser sand plover and red knot - was considered likely to occur in Broad Sound. However, potential impacts from water quality changes, erosion of streambanks and groundwater drawdown were not anticipated to impact migratory shorebird habitat.

Similarly, the five migratory birds that are not classed as shorebirds – the osprey, gulls and terns – were not observed in significantly large enough numbers that were considered to constitute an ecologically significant proportion of the population of a migratory species.

Marine mammals and reptiles

The amended EIS stated that there was no known important populations of the estuarine crocodile, green turtle, flatback turtle, Australian hump-back dolphin, Australian snubfin dolphin, dugong and humpback whale in the Styx River estuary or Broad Sound. The EIS considered that no significant impacts to these species were expected due to:

- suitable habitat for the inshore dolphins is not expected to occur upstream beyond Rosewood Island
- the nesting habitat for the green turtle and flatback turtle on Wild Duck Island and Avoid Island were not considered to be impacted due to their significant distance (75km) from the project
- Broad Sound is considered too turbid due to its large tidal range to provide suitable habitat for humpback whales
- the lack of seagrass and records of dugong around the Styx River estuary are considered not to provide suitable habitat
- suitable habitat exists for the estuarine crocodile along the Queensland coastline and there are no unique habitat features present for this species.

The estuarine crocodile is considered to occur in the Styx River but is not considered to be significantly impacted by the proposed project. It was stated that the project would not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of estuarine crocodile.

4.16.4.3 Avoidance, mitigation and management measures

See section 4.16.2 in relation to proposed avoidance, mitigation and management measures for potential downstream impacts to the GBRWHA.

No specific mitigation measures are proposed for the identified downstream listed migratory species.

4.16.4.4 Significant impacts and offsets

An assessment against the significant impact criteria for listed migratory species was undertaken using the EPBC Act significant impact guidelines 1.1 (Cwt of Australia, 2013). The EIS stated that any areas that may be ecologically significant or suitable to harbour important populations of these species are a significant distance downstream of the project area. It considered water quality changes from the project were highly unlikely to significantly impact a downstream important population of a threatened migratory species.

It stated that there was no known important population of any of the seven migratory species known to occur downstream of the project - the estuarine crocodile, green turtle, flatback turtle, Australian hump-back dolphin, Australian snubfin dolphin, dugong and humpback whale.

The significant impact assessment considered whether the action would interfere with the recovery of a species. It stated that the project would not interfere with:

- the interim recovery objectives for marine turtles relating to the green turtle and flatback turtle (DEE 2017)
- five mitigation measures for dugongs listed in the Action Plan for Australian Mammals (Woinarski

et al 2012)

- five actions to address threats in the Humpback whale conservation advice (TSSC, 2015)
- the recovery of the Australian hump-back dolphin or the Australian snubfin dolphin (noting there was no recovery plan for these species); and
- the recovery of the Estuarine crocodile (noting there is no recovery plan for these species).

The EIS stated that there would be no significant impact to the 16 migratory shorebirds known or likely to occur downstream of the project site. Five species of the total of 16 - great knot, curlew sandpiper, eastern curlew, lesser sand plover and red knot – are also classified as critically endangered and endangered species. These species were also assessed not to be significantly impacted under the significant impact criteria for listed threatened species and communities in the EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) based on the critically endangered and endangered species conservation status. Two species are also listed as vulnerable, the bar-tailed godwit (*baueri*) and the Greater sand plover and were also assessed as to not be significantly impacted under the vulnerable species conservation status.

The EIS stated that there would be no significant impact to the five migratory birds – the osprey, gulls and terns – known or likely to occur downstream of the project site.

The EIS stated that there would be no significant impact to the one migratory shorebird, or the five migratory (terrestrial) birds known or likely to occur on the project site.

The EIS has concluded that there will be no significant residual impacts on the listed migratory species and therefore has not proposed any offsets or compensatory measures.

4.16.4.5 Assessment and conclusion

The amended EIS considered that the project is not expected to result in a significant impact to listed migratory species located within or nearby to the project area or to listed migratory species in the downstream receiving environment.

Baseline surveys of terrestrial or marine migratory species in Broad Sound were not undertaken. I consider that biological surveys are an essential component of significant impact assessments and should be conducted in all areas likely to be subject to direct and indirect impacts. Without a full description of baseline conditions prior to project commencement it is difficult to determine the magnitude of impacts that may result from the proposed mining activities and whether those impacts would be significant for the habitat and species in the Broad Sound. Failing to survey appropriately for migratory species that may be present at a site would trigger the department applying the 'precautionary principle' when determining whether a significant impact is likely.

I note that there is very little information on the population and distribution of marine and migratory species in Broad Sound. I further note that the identified terrestrial and marine migratory species for the project site and Broad Sound have broad distributions and occupancy of relatively broad habitats. I am satisfied that no direct impacts would occur to migratory species.

However, the amended EIS recognised there was potential for indirect impacts from potential reductions in water quality leading to reductions in habitat values and/ or ecosystem health. These indirect impacts were considered to apply to migratory shorebirds, inshore dolphins, humpback whale and marine turtles. I note the EIS considered that the proposed mine site water management system, erosion and sediment controls and the reduction in sediment loads from stock removal would ensure that the quality of water releases would be within acceptable levels. However, this assessment did not consider the risks and likely impacts due to the water quality discharges not meeting predicted levels due to upset events, climatic events and changes in water management at the site.

I am not satisfied that the EIS has presented sufficient baseline information on marine migratory species. I would recommend that the proponent provide additional baseline population demographic information for any future approval. This would include information on the location, extent/ density and condition of habitats used by marine migratory species such as foraging, nesting and inter-nesting habitats for the marine turtles. A survey methodology must be appropriate to the biology of the species of interest in terms of behaviour (e.g., foraging or inter-nesting for marine turtles), habitat type (including consideration

of depth and substrate) and seasonality of habitat use. For marine turtles, it must be consistent with the requirements of the *Queensland Marine Turtle Conservation Strategy* (DES, 2018).

Baseline survey results would inform consequential monitoring programs and plans such as the REMP. Monitoring programs must be capable of accurately quantifying any water quality impacts from the project on marine migratory species habitats. The REMP must be amended to adequately survey and monitor the identified marine migratory species and additional habitats such as intertidal mudflats, seagrass meadows and mangroves in line with the *Monitoring and sampling manual* (DES, 2018a).

4.16.5 Great Barrier Reef Marine Park

The Great Barrier Reef Marine Park Act 1975 provides for the establishment, control, care and development of the Great Barrier Reef Marine Park (the Marine Park). The Great Barrier Reef Marine Park Authority (the Authority) is responsible for the management of the Marine Park. The Great Barrier Reef Marine Park Zoning Plan 2003 (Australian Government, 2003) is the primary planning instrument for the conservation and management of the Marine Park.

Four of the six significant impact criteria for this controlling provision are considered to apply to this proposed project. The significant impact criteria state that an action is likely to have a significant impact on the environment of the Great Barrier Reef Marine Park if there is a real chance or possibility that the action will:

- modify, destroy, fragment, isolate or disturb an important, substantial, sensitive or vulnerable area of habitat or ecosystem component such that an adverse impact on marine ecosystem health, functioning or integrity in the Great Barrier Reef Marine Park results
- have a substantial adverse effect on a population of a species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution
- result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological health or integrity or social amenity or human health
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, or social amenity or human health may be adversely affected.

4.16.5.1 Existing environmental values

The EIS stated that Broad Sound is considered one of the five main centres within the GBR for both saltmarsh and mangrove communities. Saltpans and saltmarsh communities occupy 372km² and mangroves occupy 216km² of the Broad Sound wetland area. The only known mapped seagrass beds are small patches located in the north-east corner of the wetland. Extensive seagrass beds occur to the northwest in the Clairview area (approximately 53km north of the Project) and in Shoalwater Bay, including small patches near the islands off Stanage Bay approximately 70km north-east of the Project. The EIS stated it was likely the lack of seagrass was due to the influence of the extreme tidal range in Broad Sound and associated high turbidity levels.

The EIS identified 30 species listed under the EPBC Act as known or likely to occur in the Broad Sound area based on a likelihood of occurrence assessment. 23 species were birds (16 migratory shorebirds), four marine mammals, and three marine reptiles.

The EIS stated that the 16 species of migratory shorebirds considered known or likely to occur in the downstream area. Significant aggregations of migratory shorebirds have been recorded in the nearshore environments of Broad Sound that are considered important at a national and international level. This includes nationally important numbers of eastern curlew, great knot, red-necked stint, whimbrel and sharp-tailed sandpiper. Migratory shorebirds were stated to undertake key lifecycle activities such as overwintering and building condition for the northern migration.

It is noted that three migratory shorebird species are classified as both migratory and critically endangered – the curlew sandpiper, *Calidris ferruginea*, the eastern curlew, *Numenius madagascariensis*, and the great knot, *Calidris tenuirostris*.

A further two species of migratory shorebirds are classified as both migratory and endangered – the lesser sand plover, *Charadrius mongolus* and the red knot, *Calidris canutus*.

The humpback whale, *Megaptera novaeangliae*, are known to use the northern entrance to Broad Sound during the southern migration, particularly for whales that have recently calved.

The dugong, *Dugong dugon* are known to use the seagrass beds to the northwest of Broad Sound. A Dugong Protection Area (DPA) associated with extensive seagrass beds extending from Carmilla Creek south to Clairview Bluff which is approximately 55 km north of the Project.

The Australian hump-back dolphin, *Sousa sahalensis* and Australian snubfin dolphin, *Orcaella heinsohni* are both known to use Broad Sound. Sightings of low numbers of both species were recorded north of the Styx River in the channel on the western side of Rosewood Island.

The marine turtles: the green turtle, *Chelonia mydas* and the flatback turtle, *Natator depressus*, are known from the Styx River Estuary and Broad Sound. Large nesting aggregations of flatback turtles occur at Wild Duck Island and Avoid Island, both islands are located approximately 75km north of the project. Nesting of green turtles has been recorded on several offshore islands in the wider region including the Percy Islands group, Curlew Island and islands and mainland beaches in Shoalwater Bay.

The estuarine crocodile, *Crocodylus porosus* is known to occur in both the Styx River Estuary and Broad Sound.

For a further description of the environmental values of Broad Sound see section's 4.16.2 existing environmental values of World heritage properties and National heritage places, and 4.16.4 existing environmental values of listed migratory species.

The Marine Park overlays much of the GBRWHA. The boundary of the General Use zone of the Marine Park is co-located with the GBRWHA approximately 10km downstream from the project area. The majority of the marine area in Broad Sound is Marine National Park Zone, with the coastal area zoned General Use Zone, Habitat Protection Zone and Conservation Park Zone under the Great Barrier Reef Zoning Plan 2003. The Styx River estuary is zoned General Use.

Conclusion on existing environmental values

I consider the desktop assessment of environmental values for the MNES values have been adequately identified and described in the EIS. I consider the field surveys undertaken in the Marine Park for the project were deficient. I note that baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area in 2011. I consider this data is unlikely to be representative of current conditions and that a single sampling event would not be representative of the variability of these indicators. For any future EA application, I would condition that a REMP collects adequate baseline data prior to mine commencement including for seagrass and mangrove habitats. The REMP must also provide detail on the duration of the proposed baseline data collection in tidal and estuarine waters.

4.16.5.2 Potential impacts

The EIS identified potential downstream impacts from project activities resulting in surface water changes, erosion of stream banks, and groundwater drawdown. For an assessment of these potential impacts see section 16.4.2.

4.16.5.3 Avoidance, mitigation and management measures

The EIS provided a range of mitigation and management measures addressing controlled and uncontrolled releases, erosion and sedimentation, and groundwater drawdown. For an assessment of these proposed measures see section 16.4.2.

4.16.5.4 Significant impacts and offsets

The EIS stated that the Marine Park zoning is not relevant to any actions taking place due to the location of the proposed project approximately 10km upstream. It also stated that the project is not expected to impact the existing environmental values of the Marine Park.

An assessment against the significant impact criteria for the Marine Park was undertaken using the EPBC Act significant impact guidelines 1.1 (DEE 2013). It stated there would be no direct impacts to the ecologically sensitive areas of the Marine Park. It stated that there was no known important population of

any of the seven known threatened species - the estuarine crocodile, green turtle, flatback turtle, Australian hump-back dolphin, Australian snubfin dolphin, dugong and humpback whale.

The significant impact assessment considered whether the action would interfere with the recovery of a species. It stated that the project would not interfere with:

- the interim recovery objectives for marine turtles relating to the green turtle and flatback turtle (DEE 2017)
- five mitigation measures for dugongs listed in the Action Plan for Australian Mammals (Woinarski et al 2012)
- five actions to address threats in the Humpback whale conservation advice (TSSC 2015)
- the recovery of the Australian hump-back dolphin or the Australian snubfin dolphin (noting there was no recovery plan for these species); and
- the recovery of the Estuarine crocodile (noting there is no recovery plan for these species).

The EIS recognised there was potential for indirect impacts from potential reductions in water quality leading to reductions in habitat values and/ or ecosystem health. These indirect impacts were considered to apply to migratory shorebirds, inshore dolphins, humpback whale and marine turtles. However, it was considered that the proposed mine site water management system, erosion and sediment controls and the reduction in sediment loads from stock removal would ensure that the quality of water releases would be within acceptable levels.

The EIS identified the potential risk of elevated concentrations of water quality parameters entering the marine environment via mine site runoff and discharges of MAW, with both sources being potentially elevated in chemicals and heavy metals. This could, in turn, adversely impact biodiversity, ecological health or integrity or social amenity or human health.

The EIS addressed this risk by highlighting that a combination of erosion and sediment controls, a mine site water management system and water release operating rules have been designed to ensure that water quality parameter loads remain within acceptable levels at all times. It stated that downstream water quality is expected to be within the range of natural variability under the proposed release conditions.

The EIS stated that water with high concentrations of defined parameters would be stored in dams and only released once water quality release limits are met and at an appropriate time to allow dilution into natural flows. Controlled releases would be undertaken to reduce the likelihood of non-compliant releases due to overtopping.

The EIS stated that any increases in the concentration of water quality parameters in the receiving environment would be short-lived and substantially diluted. It was considered unlikely that persistent organic chemicals, heavy metals, or other potentially harmful chemicals would accumulate in the marine environment. Uncontrolled releases are only expected during times of heavy rainfall, when there is also likely to be significant dilution of any high concentrations of water quality parameters.

The significant impact assessment of the EIS considered the risk of coal dust being deposited on Marine Park values to be negligible due to the relatively minor extent of the modelled dust deposition rates, the implementation of the ESCP, and the distance to the project site.

The EIS concluded that the project is not expected to result in a significant impact to the Marine Park. It stated that the risk of these impacts occurring was considered low and that alterations to habitat or population level impacts to species were highly unlikely.

4.16.5.5 Assessment and Conclusion

Existing environmental values

I note that no field surveys were conducted for the project within the Marine Park. The only specific surveys undertaken in Broad Sound are from 2011, prior to the EIS process, which collected information on estuarine habitats, resident benthic fauna, water quality and sediment texture and chemistry. See section 4.16.2 for details.

GBRMPA provided advice on the EIS that noted the limited field observations of the receiving environment's values and an overreliance on desktop information that in many cases is dated. It stated

that more recent studies (2016-2020) on dugong and turtles have been conducted within the Shoalwater, Broad Sound and Clairview area. This work involved the use of telemetry to determine the utilisation of habitat and distribution of these fauna. It found that dugong traverse Broad Sound when travelling between Shoalwater and Clairview and flatback turtles use Broad Sound for inter-nesting. Inter-nesting areas are considered critical habitat for the rookeries as they are used for resting between each nesting session within a nesting season.

The Authority noted that both Indo-Pacific Dolphin and the Australian Snubfin dolphin are also found in these waters, however, they are usually found in clearer and calm waters of Broad Sound to the north of the Styx River estuary.

The Authority also highlighted critical habitat in Broad Sound for the flatback rookeries of Avoid and Wild Duck Islands and as an inter-nesting site. Dugong traverse Broad Sound from the DPA to the north and south of Broad Sound. It was noted that no habitat assessments of the marine species known to occur within Broad Sound were provided in the EIS.

The Authority noted that a description of the heritage values of the Marine Park did not include the substantial Indigenous heritage that lies within and adjacent to Broad Sound and the adjacent Marine Park. The Authority recommended that Indigenous heritage of the Marine Park is best sourced via consultation with the Indigenous owners of these areas. The Darumbal people hold claim over the southern portions of Broad Sound and into Styx River. There are also cultural sites for the Barada Barna Kabalbara & Yetimarla People in the area. It noted that any impacts on the marine resources within Broad Sound are likely to impact upon the Darumbal traditional use of these resources.

The Authority did not consider the supporting information adequate to inform the assessment of potential impacts on the Marine Park.

Potential impacts

The Authority considered advice that there was a high residual risk of MAW (either controlled or uncontrolled), increased sediment from reduction of GDEs along the drainage lines entering Broad Sound and coal particulates entering the Great Barrier Reef Marine Park from depositions on floodplains. This was despite the proposed management and mitigation measures outlined within the EIS.

In relation to the proposed water management system, the Authority considered that the consequences for the Marine Park as a result of overtopping of the dams holding mine associated water or through critical failure of the dam wall are significant. The EIS determined the likelihood of a failure to be low, however, the Authority notes that impacts from MAW during high rainfall events have been recorded within the Fitzroy River estuary and these dams are hundreds of kilometers from the Marine Park.

The proposed dams are much closer to the Marine Park boundary. Large freshwater inflows often result in mangrove die back, fish kills, and sedimentation of sensitive environments such as seagrass communities. In addition, freshwater inflows laden with heavy metals/ chemicals and other fines would likely lead to impacts (such as increased disease risk or starvation) to the long-term survival of marine fauna such as dugong, dolphin and flatback turtles. Recent research has found over 4000 compounds in turtles, including metals. The impact of these contaminants on turtle populations are not yet known. The Authority considers that as Broad Sound is a critical habitat for Queensland populations of flatback turtle, it may have cumulative impacts on the long term fecundity of this species.

The Authority also considered that the proponent had not adequately described all the relevant cumulative impacts. It recognised climate change as the greatest threat to the Reef but considered the EIS had not addressed the cumulative impact of climate change on the environment when assessing ecosystem resilience. The Authority also stated that the EIS did not address the potential cumulative impacts of the project on the ecosystem resilience of the downstream environments. It stated that pollutants in land-based run-off are a major threat to the GBR, particularly inshore areas. It also noted from the EIS that the downstream environments are considered modified and potentially at the limit of assimilation which could indicate the resilience of the ecosystem is very low.

I note that the EIS recognised threats to the GBR including land-based runoff and climate change. The EIS undertook a sediment budget assessment to quantitatively calculate the existing baseline sediment generation attributed to the current grazing land use from the project area. It also estimated sediment generation rates for the project including for very wet climatic events which conclude that the proposed

de-stocking of the project area combined with the water management system would halve the sediment runoff to the receiving environment.

The Authority stated that consequential impacts could result from increased shipping through the Marine Park and from the action of transporting coal. The EIS notes that the product would be exported from the Hay Point loading facilities. However, the Authority considers the consequence of increased shipping through the Marine Park has not been assessed. Impacts from shipping include increased risks of ship groundings, whale strike, oil spills and the introduction of pests and disease through biofouling and ballast water. The increase of artificial light at anchorages on marine fauna has also not been considered.

The Authority stated that the Reef 2050 Plan has recently been reviewed with particular emphasis around port anchorages. Specific impacts from the shipping of transporting coal can include unintentional escape of coal dust during transfer to the ship and dislodgement of larger coal rocks during adverse weather. Coal dust can impact corals through light limitation, direct smothering and reduced feeding ability and impact fish by reducing growth rates, gill morphology and impacting bacteria in larval fish gills.

In conclusion, the Authority considers the proponent has not adequately described the environment of the Marine Park, nor the value of the habitat within Broad Sound that would likely be affected by the project. The Authority considers the project is likely to result in major, possibly irreversible, impacts on the Marine Park.

I have considered the material provided in the amended EIS, review comments from my department, review comments from DNRME, and the review comments provided by DAWE, the IESC and the Authority.

The EIS recognised there was potential for indirect impacts from potential reductions in water quality leading to reductions in habitat values and/ or ecosystem health of the Marine Park. These potential indirect impacts were considered by the EIS to apply to migratory shorebirds, inshore dolphins, humpback whale and marine turtles.

Inadequate baseline data has been provided on the extent and condition of seagrass and mangrove habitats potentially affected by the project.

I also consider that water quality releases must meet the specific water quality release limits to comply with regulatory standards under the EP Act. I am concerned that the proposed water management system provides only limited design details for the dams and levee and for their operation, particularly during flood events.

4.16.6 A water resource, in relation to coal seam gas development and large coal mining development

The EIS undertook assessment of the significance of impacts to water resources in accordance with the Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DEE, 2013).

The significant impact criteria state that an action is likely to have a significant impact on a water resource if there is a real or not remote chance or possibility that it will directly or indirectly result in a change to the hydrology of a water resource or the water quality of a water resource, that is of sufficient scale or intensity as to reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes, or to create a material risk of such reduction in utility occurring.

The EIS is required to describe current water resources and their use in the region and assess impacts on water resources as a result of the project by addressing the information requirements in the Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals (IESC Guidelines). The EIS refers to both guidelines in its assessment and provides a table showing how the IESC Guidelines have been addressed.

The water resources of the project include the groundwater and surface waterways and local catchments of the project area. The environmental values of these water resources were defined to be aquatic

values of watercourses including aquatic GDEs, terrestrial GDEs, general wetlands, the Broad Sound wetland, the GBR and human users associated with water entitlement holders and groundwater bores.

4.16.6.1 Existing environmental values

Surface water

The project is located within the Styx Basin, a small coastal basin of approximately 3,000km² that discharges to Broad Sound via the Styx River. Tooloombah Creek is the watercourse on the western boundary of the mine site and has a catchment size of 366km². Deep Creek is the watercourse on the eastern boundary and has a catchment size of 288km². Both watercourses are classed as major, non-perennial creeks. The catchment is considered to be degraded due to historic land clearing and current grazing as the primary land use, with approximately 30% of the catchment estimated to be highly disturbed with severe erosion in parts. The Styx River Basin Environmental Values and Water Quality Objectives (DEHP, 2014) classifies the waterways as moderately disturbed.

Simulated flow duration curves for the two watercourses were calculated at the creek flow gauging stations. They are stated to be ephemeral, flowing for 24% of the year predominantly in the wet season. Storm flows were modelled for <1% of flows indicating they persist for one to three days which is sufficient to provide baseflow for one to three months. When not flowing the watercourses form a series of disconnected pools, some of which are permanent. Large pools exist on Tooloombah Creek.

Barrack Creek joins Deep Creek from the east at the location of the proposed haul road crossing. It is classed as a minor, non-perennial stream with flow observed on only two occasions from 2017 to 2020 at the water monitoring site.

There are a number of minor un-named drainage lines across the project site that feed into both watercourses.

Tooloombah Creek and Deep Creek join at a confluence location approximately 2.3km downstream of the project site. This watercourse becomes the Styx River with the upstream tidal limit of the Styx River Estuary considered to be another 1.4km downstream of the confluence. However, it is recognised that the mapping of highest astronomical tide extends to the confluence. It is also noted that sparse occurrences of Marine Couch, *Sporobolus virginicus*, known to be dependent on saline influence, extend up to the confluence.

See section 4.16.2 existing environmental values of World heritage properties and National heritage places, for a description of the downstream environmental values of Broad Sound.

Baseline water quality sampling of the watercourses has been undertaken for the project site from February 2017 and results up to May 2020 were presented in the EIS. Insufficient sample numbers were available for a baseflow dataset and results were predominantly for no-flow conditions. This led to exceedances from Water Quality Objectives for dissolved oxygen, ammonia and nitrogen at all sample sites; suspended solids and turbidity at Deep Creek; and total phosphorous in Deep Creek. Deep Creek shows much higher suspended solids and turbidity levels than Tooloombah Creek.

For metals and metalloids, aluminum, copper and zinc were recorded to be consistently high and above the guideline value at all sample sites. The nutrient's total nitrogen and total phosphorous exceeded guideline values 50% of the time likely indicating the influence of grazing from the site and catchment. Salinity values in Tooloombah Creek and Deep Creek showed increased levels downstream related to surface water runoff quality from sodic soil and nutrient influence.

Water quality sampling was also undertaken at three large pools in the dry season of 2019 and a pools assessment was undertaken in May and June of 2020 to determine groundwater dependence. Two of the pools on Tooloombah Creek indicated a groundwater reliance sustains them in the dry season.

Groundwater

A revised Groundwater model informed by results from extensive groundwater monitoring bores both on and offsite indicate the general direction of groundwater flow at a catchment scale is toward the Styx River and the coast.

Two types of GDEs existing in the project area and downstream were identified for assessment:

- aquatic GDEs comprising ecosystems dependent on the surface expression of groundwater e.g. wetlands, river baseflow and estuaries; and
- terrestrial GDEs comprising ecosystems dependent on the subsurface expression of groundwater e.g., riparian vegetation that depends on groundwater fully or on a seasonal or episodic basis to prevent water stress.

The assessment concluded that aquatic GDEs in the project area include groundwater fed pools on both Tooloombah Creek and Deep Creek and the fringing riparian *Melaleuca leucadendra* vegetation.

Terrestrial GDEs were identified as Wetland 1 and riparian vegetation communities along the Tooloombah Creek and Deep Creek corridors where they are accessing groundwater less than 15mgl and an EC level below 10,000 μ S/cm. These vegetation communities were stated to be RE 11.3.4, RE 11.3.25, RE 11.3.12, RE 11.3.27 and RE 11.3.35.

While the EIS stated that the stygofauna assessment was in accordance with the Queensland Guideline for the Environmental Assessment of Subterranean Aquatic Fauna (DSITIA 2015), the guideline requires that where the pilot survey confirms the presence of stygofauna, a comprehensive survey is required. The EIS did not undertake further survey work after the original surveys from 2011 and 2012.

Conclusion on existing environmental values

I consider the desktop assessment of environmental values for the MNES values have been adequately identified and described in the EIS. I consider the field surveys undertaken in the Marine Park for the project were deficient. I note that baseline water quality and sediment monitoring was undertaken on one occasion in estuarine waters, and at nine sites in the Styx River and adjacent creeks to the north of the project area in 2011. I consider this data is unlikely to be representative of current conditions and that a single sampling event would not be representative of the variability of these indicators.

Limited survey effort was undertaken to find stygofauna on the project site or in groundwater potentially impacted by the project. Monitoring of stygofauna across and outside the project site and including sampling from locations outside of groundwater drawdown areas was needed to understand stygofauna distribution patterns across the broader Styx River basin. This information has not been provided.

4.16.6.2 Potential impacts

Flooding

A flood impact study used a TUFLOW hydraulic model to assess flooding levels and velocity for a range of AEP events. Flood modelling for the first half of the proposed project accounts for the removal of areas that would be used for the open cut pit and catchment diversion on the north side of the Bruce Highway only.

Increases in flood levels due to the construction of infrastructure and operation of the water management system are predicted to be minor with a predicted 0.3m increase in flood depth at Deep Creek in the vicinity of the haul road for the 1% AEP event. No increase in flood levels are predicted before the confluence of Tooloombah Creek and Deep Creek. Increases to watercourse flow velocity would be minimal. Flood immunity for the Bruce Highway would be retained.

Mining activities would capture runoff and reduce flow volumes from Deep Creek to the Tooloombah Creek confluence by approximately 15km² or 1500ha. This is a reduction of approximately 4% of the existing catchment section. The catchment area from the confluence of Deep Creek and Tooloombah Creek to the Ogmore Bridge on the Styx River, a distance of approximately 2.5km would also be reduced by approximately 15km². However, flows days are not expected to decrease.

Groundwater drawdown

Predicted groundwater drawdown from mining activities are likely to impact on groundwater quantity (baseflow) and groundwater quality. Modelled water table drawdown contours for different stages of the project are shown in Figure 10, Water table drawdown contours. The modelled baseflow reduction for Tooloombah Creek is approximately ~1L/s per km over a 9.3km reach of the watercourse.

Revised assessments in the EIS informed by a new regional groundwater model stated that groundwater drawdown impacts to Tooloombah Creek and Deep Creek would not significantly impact aquatic habitat values. Observed pools persistence and water quality data indicate that the primary source of baseflow

to pools is from bank storage return. Only minor impacts on Tooloombah Creek are expected due to the relatively small drawdown (less than 4m) over a 700m reach, low permeability sediments reducing the potential for enhanced leakage, flows from bank storage sustaining some pools, and natural resilience of ephemeral pools (particularly on Deep Creek) already experiencing natural drying cycles under baseline conditions.

The predicted 60m drawdown on a 230m reach of Deep Creek was stated to have only minor impacts on aquatic GDEs.

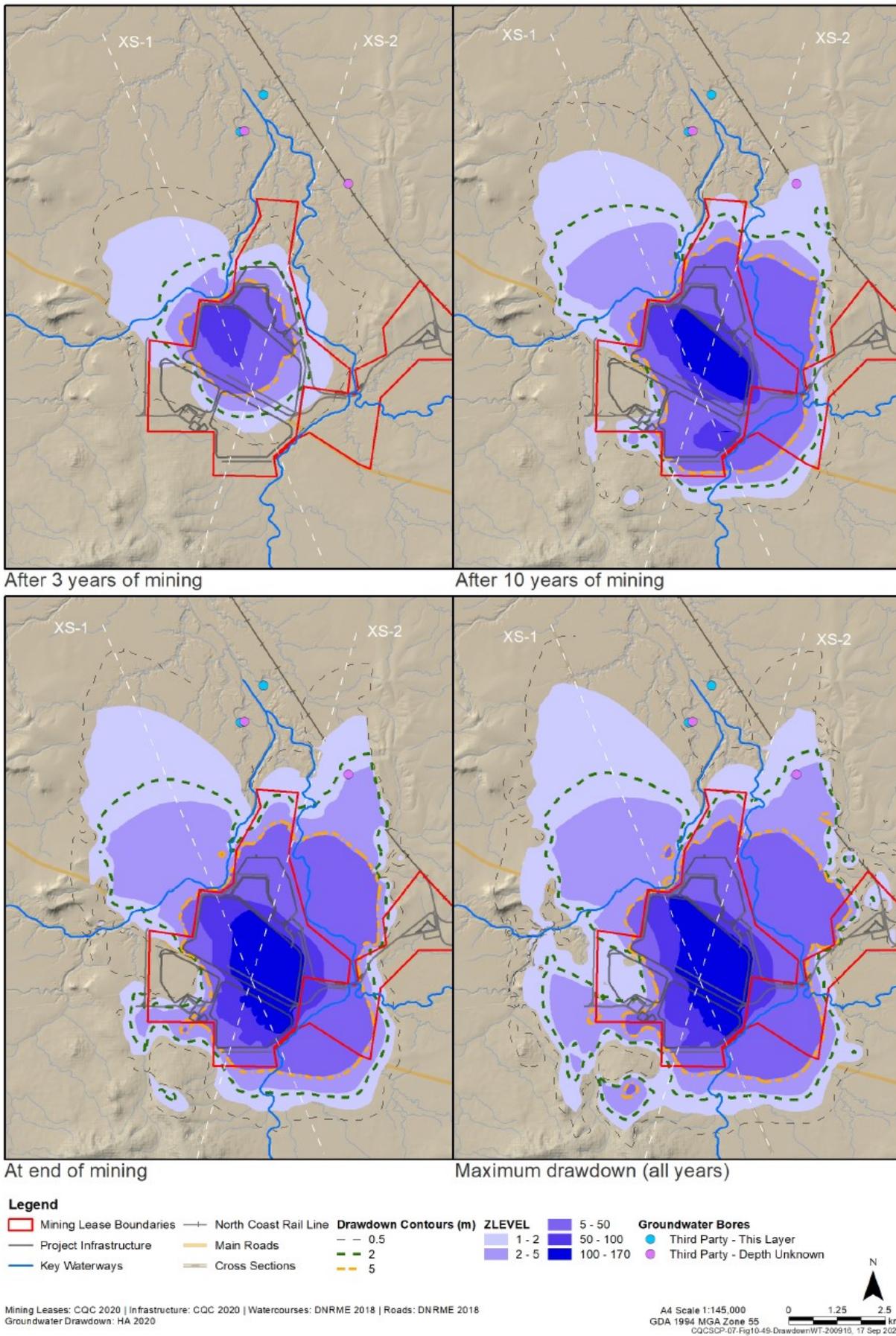


Figure 10 Water table drawdown contours

Source: EIS Figure 10-60: Water table drawdown contours

Dewatering and depressurisation from mining the open cut pits results in loss of groundwater storage leading to groundwater drawdown in water tables in the vicinity of the proposed mine site. A large part of the aquifer associated with the water table between Tooloombah Creek and Deep Creek would become dry at the maximum extent of drawdown. Consequential reductions in watercourse baseflow and the height of the alluvial aquifer can adversely impact environmental values, particularly GDEs.

Groundwater modelling predicts drawdown contours extending approximately 3km north-north-west of OC2 and 3km south-south-east of OC1 at the peak of mining with recovery of groundwater levels after 150 years and stabilisation at 250 years. The drawdown impacts are considered unlikely to extend to the downstream reach of Tooloombah Creek or to the Styx River. The model predicts that the alluvial aquifer would fall by a maximum of approximately 60m in only a 230m section of a three kilometer reach of Deep Creek, 4.7m beneath a reach of Tooloombah Creek and 12.6m beneath a reach of Barrack Creek.

Revised assessments in the EIS informed by a new regional groundwater model stated that groundwater drawdown impacts to Tooloombah Creek, Deep Creek and Barrack Creek would not significantly impact aquatic habitat values. Observed pools persistence and water quality data indicate that the primary source of baseflow to pools is from stream bank storage return. Only minor impacts on Tooloombah Creek are expected due to the relatively small drawdown (<4m), low permeability sediments reducing the potential for enhanced leakage, flows from bank storage sustaining some pools, and natural resilience of ephemeral pools (particularly on Deep Creek) already experiencing natural drying cycles under baseline conditions.

Areas adjacent to the central part of the mining lease along Deep Creek are predicted to be subject to drawdown of between 20m and 40m. The predicted 60m drawdown on a reach of Deep Creek was stated to have only relatively minor impacts on aquatic ecological values. Three reaches of Deep Creek in total (reaches 5, 6 and 7) are expected to be impacted by groundwater drawdown such that it in turn adversely impacts riparian vegetation. The modelled timeframe for the impact is between 10 to 20 years after commencement of mining activities.

The EIS concluded that 165ha of riparian vegetation along Deep Creek would be subject to minor impacts from the lowering of the water table. Potential impacts to this vegetation community, identified as a terrestrial GDE, include loss of condition and dieback of some large trees that may result in stream bank instability, erosion and consequential impacts to instream aquatic ecology values as well as to the downstream receiving environment.

The high ecological significance 'Wetland 1' was determined to be a terrestrial GDE but unlikely to be significantly impacted by groundwater drawdown. The GDE field assessment and groundwater monitoring bore results highlighted the significant physical separation between the perched aquifer and the water table and noted the maximum drawdown at the wetland is predicted to be 2.7m.

The EIS also stated that Stygofauna, a subterranean GDE, would be lost from the area of impact around the mine, and stygofaunal assemblages upslope of the mine would be isolated from downstream communities. I note that the proponent recognises there would be localised loss of stygofauna assemblages from groundwater drawdown impacts.

Additional impacts from groundwater recovery after completion of backfilling the pits include mounding of groundwater. Modelling at full recovery indicates the groundwater table may be elevated between 3 to 3.8m above the pre-mining water table levels. The EIS stated that this could result in enhanced infiltration of fresher waters into more saline aquifers, but the impact was considered to be minor.

Mobilisation of the groundwater (freshwater) – saltwater interface

The original EIS (2017) stated that there was a small likelihood of the groundwater in the vicinity of the proposed project to be infiltrated by saltwater due to the drawdown impacts.

Reduced groundwater levels due to groundwater drawdown impacts are predicted to result in reduced groundwater quality, with salt-water intrusion from saline aquifers associated with the Styx River likely to intercept the freshwater aquifers associated with Tooloombah Creek.

The location of the potential interface was not determined. Modelled groundwater drawdown contours extend outside of the project area only as far as 3km to the north-north-west of the MLA801807 boundary but do not extend as far as the Tooloombah Creek and Deep Creek confluence. The theoretical freshwater-seawater interface surface was stated to be below 280m AHD at this confluence.

At the location of the project monitoring bore near Ogmore Bridge, approximately 4km downstream from the project, the interface surface was predicted to be between -40 to -80m AHD.

IESC advice 2017 and proponent's response

A joint referral by DEE and EHP to the IESC for advice on the proposed project relating to the original EIS (October 2017) was made on 1 November 2017. The referral requested responses to three specific questions relating to the standard of information provided in the EIS documentation; the key identified risks and impacts of the proposed project to water; and whether the measures and commitments proposed in the EIS were appropriate.

The IESC advice provided (IESC 2017-091) on the proposed project of 15 December 2017 addressed the referral questions. A total of 58 issues were identified by the IESC the majority about inadequate assessment and insufficient information. The IESC also provided advice on additional work the proponent needed to undertake address the deficiencies in the EIS.

The proponent responded to this advice and made amendments to the EIS in the EIS (V1) (May 2018). This included:

- changing the mine sequencing plan so that mine pit OC2 is mined and rehabilitated first – with anticipated recharge benefits
- two residual voids are no longer proposed and would be backfilled
- the proposed coal conveyor location under the Deep Creek Bridge has been moved outside of the riparian corridor
- the installation of groundwater monitoring bores on site; with one additional bore upstream and one bore downstream to better capture the extent of impacts and provide a baseline for comparison post-mining
- additional parameterisation and aquifer analysis to upgrade the groundwater model
- monitoring and reporting commitments based on the additional groundwater monitoring and data analysis from project site monitoring bores providing continuous logging information
- further mapping and assessment of (GDEs), updates to the groundwater conceptual model and providing a peer-review of the groundwater model used in the EIS. The proponent also committed to further monitoring of groundwater to model and predict the localised impacts of dewatering and/or contaminants on natural ecosystems including waterways and GDEs
- Reduction in the size of the raw water dam on the second order tributary of Deep Creek; and water harvesting from Tooloombah Creek is no longer proposed
- a new train loading design and veneering of coal in wagons to reduce coal dust.

IESC advice 2018 and proponent's response

A joint referral by DEE and DES to the IESC for advice on the EIS (V1) May 2018 was made on 14 June 2018. The request for advice centered on the three key questions raised in the 2017 referral.

The IESC reviewed the EIS (V1) and provided advice (IESC 2018-094) dated 31 July 2018. The advice identified the key potential impacts from the proposed project.

The IESC re-iterated the 2017 advice that was considered not to have adequately been responded to. This included a number of issues with the impact assessment, modelling and proposed mitigation and management measures.

The advice raised new issues including:

- contaminants contained within the waste rock and tailings could be mobilised and transported by groundwater through the backfilled voids potentially leading to a long-term legacy risk to sensitive ecological receptors
- changes in the mine plan have altered the magnitude and nature of key risks and potential impacts associated with surface water and the final landform
- proposed water infrastructure would be ineffective in containing sediment-laden water during most flood events.

The proponent responded to this advice and made amendments to the EIS (V2) December 2018. This included:

- reducing the disturbance area of the waste rock stockpiles
- redesigning OC2 to avoid impacts to SEVT and providing a buffer width of 100m
- relocating the coal conveyor outside of the Deep Creek channel
- removing dam 5, providing two additional water supply dams and moving environmental dam 2a to better capture sediment from the waste rock stockpile.

IESC advice 2020

A joint referral by DAWE and DES to the IESC for advice on the EIS (v3) was made on 27 October 2020. The request for advice asked whether the EIS (V3) October 2020 had adequately addressed the IESC's previous advice and concerns taking account of the revised numerical groundwater model and additional studies; and whether the proposed measures and commitments were appropriate to effectively manage impacts to water resources.

The IESC reviewed the EIS (October 2020) and provided advice (IESC 2020-118) dated 23 December 2020. The advice reiterated the risks and concerns previously raised and identified key potential impacts.

The proponent responded to this advice outside of the EIS process. The proponent met with both the department and DAWE to discuss the advice. The proponent also provided three documents to the department and published the documents on the Central Queensland Coal website.

4.16.6.3 Avoidance, mitigation and management measures

The EIS described the results of additional surface water – groundwater interactions studies on the project's watercourses in order to support GDE conceptual models.

GDE studies estimated hydraulic conductivities and measured soil moisture and salinity levels and concluded that groundwater from stream bank storage is available and of suitable quality for uptake by GDE vegetation.

Stable isotope analysis of GDEs indicated that the groundwater sampled is derived predominantly from rainfall recharge and has undergone little or no evaporation.

The GDEMMP would require more extensive and targeted sampling of stygofauna than that undertaken in 2011 and 2012 including sampling of the network of alluvial bores in the wet and dry seasons of the first year of operation. Identifying the groundwater quality conditions that support these stygofauna assemblages would be an important objective for establishing subsequent monitoring thresholds for management action.

Extensive monitoring requirements of GDEs would inform the adaptive management framework of the GDEMMP. Further information on the distribution and assemblages of stygofauna, water levels and chemistry of watercourse pools, and LWP / stable isotope analysis of Wetland 1 and riparian vegetation communities would be collected to satisfy monitoring and reporting requirements.

A draft groundwater management and monitoring plan was provided as part of the EIS. It includes continuation of groundwater monitoring from existing groundwater monitoring bores and the installation of additional bores both upstream and downstream of Wetland 1 and the aquatic and terrestrial GDEs associated with Tooloombah Creek and Deep Creek.

Surface water would be managed in accordance with the mine site water management plan that includes operating and controlled release rules, monitoring and mitigation and includes TARPs.

A draft REMP was provided as part of the EIS. The objective of the REMP is to describe the planned monitoring actions that would be undertaken to identify potential impacts to the receiving environment from the release of MAW. Key environmental values that would be monitored are surface water quality, sediment quality and physical characteristics, aquatic habitat quality, in-stream macroinvertebrate assemblages, fish assemblages and mangrove distribution. Monitoring locations include the main watercourses of the project area and the downstream estuarine and marine environment associated with Broad Sound and the GBRWHA.

A draft mineral waste management plan was provided as part of the EIS. It aimed to identify the potential for pollution from waste rock during all phases of the project and manage it to prevent leachate and acid drainage.

An updated and refined geo-environmental block model and detailed landform haulage schedule to ensure that waste rock is backfilled and stockpiled to ensure long term stability in terms of both the landforms and the quality of runoff and leachate generated. This also includes encapsulation of rejects and potential sodic materials, and/ or amelioration.

4.16.6.4 Significant impacts and offsets

The EIS concluded that the project would not result in a significant impact on water resources.

The surface water resource was considered not to be significantly impacted due to:

- modelling that predicts no significant reduction in surface water quantity or a significant change in flow regimes
- a negligible impact on the hydrological characteristics of surface waters that would only last 24 years and not affect any third-party users
- no further impacts to the hydrological characteristics of the surrounding waterways post-closure
- the water quality of controlled and uncontrolled releases would be well within the range of the typical historical receiving water concentrations
- a low risk of impact on surface water quality from accidental spills
- a negligible to low risk of rapid and significant geomorphic change in Tooloombah and Deep creeks and the Styx River due to the proposed mining activity; and
- projected sediment load reductions to the receiving environment of approximately 2740t/yr.

The groundwater resource was considered not to be significantly impacted due to:

- modelled localised and temporary changes to the hydrological characteristics of groundwater
- mitigation measures to reduce impacts to riparian vegetation as a result of groundwater drawdown
- assumed benefits of groundwater mounding effects leading to enhanced infiltration of fresher waters to watercourses and wetlands and some extension of pool persistence
- no reduction in groundwater quality due to the inherent low risk of contaminants from waste rock stockpiles and leachate from mine water dams
- the implementation of management plans such as the GMMP and GDEMMP.

The EIS concluded that groundwater quantity would be altered but only at a localised, temporary scale with impacts extending approximately 3km north and 3km south from the open cut pits. Once mining has ceased, and the pits are filled it is predicted that groundwater levels will recover to pre-mining levels after 150 years.

The EIS concluded that groundwater drawdown would result in at least a 'possible' likelihood of there being a 'minor' impact on 165ha of riparian vegetation along Deep Creek determined to be a terrestrial GDE. Impacts to riparian vegetation include loss of condition and structural elements and are expected to occur 10 to 20 years after commencement of the project. An offset has been proposed where these terrestrial GDEs have also been considered habitat for the greater glider, koala and squatter pigeon.

4.16.6.5 Assessment and Conclusion

The IESC advice was reviewed by DAWE and highlighted in DAWE's advisory agency response on the EIS. DAWE stated that they agree with the IESC that the proponent's additional work has reinforced the very significant risks associated with local and downstream impacts of the project on highly sensitive national and international environments with high ecological values, including the GBRWHA, Broad Sound FHA, Tooloombah Creek and Deep Creek, the Styx River estuary and state listed wetlands.

DAWE noted the IESC's concerns with the revised groundwater modelling which limit the reliability of groundwater predictions for groundwater drawdown, intrusion of seawater into aquifers, and alterations of groundwater discharge into local and downstream waterways. DAWE considers that the magnitude and extent of groundwater drawdown has potentially been underestimated leading to a lack of confidence in the adequacy of the offsets proposed for the potential impact to 165ha of riparian GDEs.

This lack of confidence extends to the adequacy of the environmental offsets proposed to compensate for residual significant impacts on MNES, as groundwater drawdown predictions have been used to calculate the proposed environmental offsets for riparian habitat (also terrestrial GDEs).

No specific offset for the loss of the 165ha terrestrial GDE was provided. The EIS concluded that groundwater drawdown was an indirect significant impact on the vulnerable Koala, Greater Glider and Squatter Pigeon (Southern) that used this habitat and would instead require offsets for those species. DAWE stated that terrestrial GDEs are a protected matter under the Water Resources controlling provision (sections 24D and 24E). As such, any proposed environmental offsets would need to be confirmed as terrestrial GDEs to align with the principles of the Offsets Policy (i.e., 'like for like' environmental offsets) with demonstrated evidence that there is a risk that these terrestrial GDEs would be completely lost if an environmental offset was not implemented.

The Great Barrier Reef Marine Park Authority stated that the predicted impact to riparian GDEs would likely lead to erosion and sediment entering the waterways and ultimately to the GBRWHA, especially as the soils are erosive. It considered that revegetation would not mitigate this issue in the short term, especially in high rainfall events. It noted that the riparian GDEs include Melaleuca stands that take a number of years to mature and hold riverbank soils in place, and the groundwater systems they depend upon would likely take decades to recover, long after the life of the mine.

The IESC noted impacts to aquatic GDEs included the complete drying or declines in volumes of permanent pools along Tooloombah Creek and Deep Creek during the dry season, compromising their ecological roles as aquatic refuges and overall aquatic habitat connectivity; and reductions in baseflow, potentially affecting ecologically important components of the streamflow regime e.g., number of low-flow days, which may adversely affect stream and riparian biota.

DAWE also considers there is a lack of detail in the EIS and draft management plans on measurable environmental outcomes, a lack of supporting baseline data and scientific evidence to demonstrate effectiveness, a lack of achievable time-bound commitments and a lack of committal language. It provided examples of the lack of measurable environmental outcomes for five draft management plans including that there were no management objectives and performance criteria underpinned by robust site-specific data for the GDEMMP.

Additionally, DAWE cited a lack of supporting baseline data and scientific evidence to demonstrate effectiveness. It provided as an example the proposed riparian revegetation program referenced in draft management plans but not included as part of the EIS. DAWE stated that there was a lack of detail in key elements of the program including:

- comprehensive baseline data at control sites over multiple years to underpin environmental outcomes and performance criteria
- justification (such as scientific research, pilot programs, case studies and expert advice) to demonstrate that revegetation of riparian vegetation (particularly on highly erosive sodic soils) would be successful
- measurable and achievable environmental outcomes
- time-bound commitments on when success would be achieved
- a comprehensive monitoring program; and
- a comprehensive adaptive management framework, including time-bound corrective actions.

I note that the additional technical studies provided in the amended EIS included revised hydrological (surface water) modelling, a regional groundwater model, field studies on GDEs, the geological properties of the alluvium of Tooloombah Creek and Deep Creek, a sediment budget for the site and upstream catchment, a fluvial geomorphology study, and a surface water-groundwater interactions study. I consider that these additional studies have improved understanding of several matters including the likely groundwater dependence of the aquatic and terrestrial ecosystems.

Further, I note that the draft GDEMMP provided in the EIS has been informed by GDE investigations including an aquatic pools assessment, a transient electromagnetic survey, geological coring of the soil profile, and analysis of surface water and groundwater data, including groundwater quality and water level data from several bores and stream flow data collected from gauges installed at Tooloombah Creek and Deep Creek in 2019.

I have considered this material provided in the amended EIS, reviewed comments from my department, the former DNRME, and comments provided by DAWE, the IESC and the Authority.

I note that the Queensland Department for Regional Development, Manufacturing and Water, considered

adequate the revised modelling undertaken and described in the EIS and the proponent's response to the IESC submission.

I have reviewed the IESC advice and considered this advice in the assessment of the EIS material. I consider that the latest IESC advice highlights the potential risks of the project to downstream environmental values. The sensitivity of the receiving environment to potential impacts is considered of paramount importance.

I consider that despite the quantum of work done to improve understanding of groundwater and surface water, both on-site and off-site, their interactions and the potential for direct and indirect impacts, significant risks to downstream environmental values remain. I consider these to be threshold (locational) issues and based on the information provided in the EIS documents, it is difficult to see how these issues and their inherent risks, could be resolved. As an example, I note that there remains uncertainty about the quantum of impact to the riparian terrestrial GDEs from groundwater drawdown, and the potential for consequential adverse impacts on stream stability and sediment loads. That the proponent has appropriately concluded that an offset is required for the potential loss of 165ha of terrestrial GDE vegetation, supports my concerns.

4.16.6.6 Cumulative impacts

The proposed project is the only proposed coal mine operating in the Styx Basin. As such, the EIS did not consider that the potential project's impacts would be in addition to existing impacts of other mining activities in the region.

An assessment of known potential future expansions or developments by the proponent and other proponents in the region and vicinity was undertaken. The expansion of the Shoalwater Bay Training Area (SWBTA) has seen one of the underlying properties for the project, Strathmuir, purchased by the Department of Defence. However, the proponent has agreed to purchase the land subject to the project and it is noted that the nearest use of the SWBTA would be approximately 50-100km from the project area.

The proposed Clarke Creek Wind Farm and Connors Arc Projects were the only two projects identified within the Styx Basin. The Connors Arc Project is currently an early-stage gold exploration project. It was noted that the Clarke Creek Wind Farm has been approved under the EPBC Act (EPBC 2018/8141) in 2018. It would significantly impact on habitat for three of the same listed threatened species as the project site, 18ha for the greater glider and squatter pigeon and 1513ha for the koala. Offsets are proposed for both projects. The cumulative impacts were considered to be at a regional scale due to the 20km distance between the projects. The EIS stated that the local scale impacts are considered not to contribute significantly to cumulative impacts at the regional scale.

The Authority stated that the EIS did not address the potential cumulative impacts of the project on the ecosystem resilience of the downstream environments. It stated that pollutants in land-based run-off are a major threat to the GBR, particularly inshore areas. It also noted from the EIS that the downstream environments are considered modified and potentially at the limit of assimilation which could indicate the resilience of the ecosystem is very low.

I note that the EIS recognised threats to the GBR including land-based runoff and climate change. The EIS undertook a sediment budget assessment to quantitatively calculate the existing baseline sediment generation attributed to the current grazing land use from the project area. It also estimated sediment generation rates for the project including for very wet climatic events which conclude that the proposed de-stocking of the project area combined with the water management system would halve the sediment runoff to the receiving environment.

I consider the potential cumulative impacts of the project on the ecosystem resilience of the downstream environments has been adequately described in the EIS.

5 Recommendation on the suitability of the project

In completing assessment of the EIS for the Central Queensland Coal Project, I have considered the EIS (comprising EIS and amended EIS), all properly made submissions from stakeholders, the public, and advice from relevant state and commonwealth government agencies.

I am satisfied that the proponent has met the statutory requirements of Chapter 3 of the EP Act, and that sufficient information has been provided to enable the assessment of potential impacts of the project.

I note that the EIS process commenced in 2017 and has involved a significant body of work by the proponent, including a number of amendments to the EIS to address deficiencies in the information provided in the EIS that were identified during the process.

5.1 Overall suitability of the project

One of the primary purposes of this Assessment Report is to make recommendations about the suitability of the project and to inform the necessary approval decisions.

Based on the information provided in the EIS, I consider the project would significantly contribute to the regional and Queensland economy, provide social and economic benefits, opportunities for direct and indirect employment and export trade to Queensland and Australia.

However, the project presents a number of significant risks, due to its location, particularly its proximity to important environmental values, including the Great Barrier Reef Marine Park and World Heritage Area, the Broad Sound Fish Habitat Area, Tooloombah Creek, Deep Creek, the Styx River Estuary, and associated groundwater resources and groundwater dependent ecosystems.

It is these risks, along with potential impacts to other matters such as land, flora and fauna, air, noise, waste, cultural heritage, social, economic and transport (including significant infrastructure including the Bruce Highway), that I have sought, and received advice from submitters, relevant agencies and independent experts about during the EIS process. I note that in response to this advice, the proponent has made a significant number of changes to their proposed mine plan, proposed additional mitigation and avoidance measures, developed a revised monitoring network, provided for additional offset proposals, and a range of other commitments, including adopting an adaptive management approach.

I consider that a number of the issues raised, may be able to be adequately managed by the proponent, including by conditions of an approval. However, on balance I consider that the project presents a number of unacceptable risks that cannot be adequately managed or avoided, due primarily to the location of the project, but also in part to the lack of effective mitigation measures proposed in the EIS.

Taking into account all of the relevant information, I have determined that overall, the project poses a number of unacceptable risks and that the project, as proposed, is not suitable.

As such, I consider that the project is not suitable to proceed.

In making my recommendations, I have also considered the potential impacts of the project and my recommendations on human rights, as outlined in Appendix 1.

5.2 Summary of key impacts influencing the suitability of the project

Table 7 Key known and potential impacts of the project, summarises the key impacts of the project on land, water resources, flora and fauna, air, noise, waste, cultural heritage, social, economic and transport.

Table 7 Key known and potential impacts of the project

Matter	Key impacts	Section
Land and rehabilitation	<ul style="list-style-type: none"> • Direct disturbance of 1,372ha of land • The strongly sodic soils that are highly dispersive and prone to erosion on the mine site present known and potential significant environmental risks • The proposed rehabilitation strategy would need to be developed, applied for, and approved under a PRC plan 	4.3
Water	<ul style="list-style-type: none"> • Potential adverse impacts to surface water and groundwater quantity and quality • Potential adverse impacts to watercourses and aquatic habitat from 	4.4

	mining activities	
Regulated structures	<ul style="list-style-type: none"> • Magnitude of impact to the downstream environment from levee failure could be potentially catastrophic 	4.5
Ecology	<ul style="list-style-type: none"> • Direct and indirect impacts to MNES and MSES including threatened fauna, vegetation communities and fish passage • MNES – GRBWA, National Heritage Place, Great Barrier Reef Marine Park, listed migratory species – potential indirect impacts from controlled and uncontrolled releases of mine affected water • MNES water resources – impacts to terrestrial groundwater dependent ecosystems of up to 165ha • MNES listed threatened species and MSES protected wildlife habitat for – direct impacts to koala, greater glider, squatter pigeon, ornamental snake habitat • MSES regulated vegetation – loss of watercourse and ‘of concern’ vegetation communities • MSES waterway barriers – loss of 8km of waterways for fish passage • Potential impact on the ecological function of aquatic GDEs 	4.6 4.16
Social and economic	<ul style="list-style-type: none"> • Contribution to the local, regional, state and national economies through royalties, taxes, charges and wages • Potential opportunities and flow-on effects for local businesses, regional development and investment • The value of the project to the Queensland economy would be approximately \$7.8 billion to \$8.2 billion with an estimated \$703 million and \$766 million in royalties over the life of the project • Creation of an estimated 222 construction jobs and 100 to 500 operational jobs required over the 24-year life of the mine • Increased opportunities for employment in the local and regional area • Project workforce is estimated to be sourced predominantly from the regional catchment with an increasing local population residing in the Marlborough vicinity • There is a likely increased pressure on local social services • Impacts to local property values and housing accommodation affordability in regional towns 	4.13 4.14
Cultural heritage	<ul style="list-style-type: none"> • Lack of progress towards finalising the required Indigenous agreement 	4.13
Transport:	<ul style="list-style-type: none"> • Potential safety risk to motorists and stability impacts on the Bruce Highway due to blasting • A 500m buffer to the Bruce Highway would require a significant change to the mine plan • Increased coal train haulage on the North Coast Rail Line 	4.8 4.15

In making my recommendation about the project’s suitability, I consider the following to be the key threshold matters:

Impacts to the Great Barrier Reef World Heritage Area and Broad Sound Fish Habitat Area:

1. Some of the surface water quality impacts from the project may be able to be partially mitigated through the implementation of land and water management plans and measures, the proposed

monitoring network, site-specific data and reporting. However, the potential water quality impacts from controlled and uncontrolled releases of MAW (including chronic or acute exposure to contaminants) pose a significant risk to the saltmarsh, mangrove, seagrass and coral communities of the GBRWHA and to threatened marine migratory species. In addition, the potential impacts of uncontrolled releases of MAW during heavy and/or intense rainfall events and extreme flooding, cannot be adequately mitigated due to the project's location. Flood events leading to releases would result in mine pollutants and sediment being transported in a flood plume to the inner or mid-shelf of the GBR before settling. In addition, water management infrastructure including levees around the mine pits, water diversion banks, water storage dams, sediment basins and the haul road have a significant risk of partial or complete failure due to the highly erodible material available for construction.

2. The proposed mitigation measures for erosion and sediment control, including the reduction of grazing on the project site would likely significantly reduce the additional sediment load in watercourses downstream of the site. However, sediment loss from erosive sodic soils due to mining activities can cause environmental harm, particularly in the sensitive estuarine and near shore ecosystems within the GBRWHA. Despite the proposed mitigation measures, there remains a real risk that releases would not be able to meet the water quality targets as per the Great Barrier Reef 2050 Plan.

Impacts to Groundwater Resources:

1. The proponent completed a range of additional technical studies as part of the amended EIS including a regional groundwater model, field studies on GDEs, the geological properties of the alluvium of Tooloombah Creek and Deep Creek, and a surface water-groundwater interactions study.
2. Despite this additional work, a number of inherent uncertainties limit the reliability of groundwater predictions for drawdown (and flow on impacts), intrusion of seawater into aquifers, and alterations of fresh groundwater discharge to Tooloombah Creek and to the Styx River estuary. Predicted groundwater drawdown impacts are modelled to significantly reduce the water table and baseflow of the two adjacent watercourses (Tooloombah Creek and Deep Creek) for significant reaches. Drawdown of up to 4.7m along sections of Tooloombah Creek and up to 60 m along 11.8 km of Deep Creek, over an extended duration, resulting in a loss of access to groundwater for groundwater dependent vegetation, which is likely to lead to die-back of 165ha of riparian groundwater dependent vegetation.

Impacts to State Controlled Road – Bruce Highway:

1. The location of the proposed mining leases on either side of the state-controlled road—the Bruce Highway—has presented significant challenges to the proponent. It has led to duplication of mine pits, waste rock stockpiles and mining infrastructure areas.
2. The risk of non-dispersing blast plumes means that a 500m setback for public safety to the Bruce Highway from blasting is inadequate. There remains a high risk to people travelling on the Bruce Highway during mining operations, and a lower risk to the 30 residents of Ogmoo 6.8km away, which is at the limit of previously observed risk from blast plumes.
3. The EIS did not provide an adequate assessment of the management of fume exposure relating to blasting or indicate likely fume management zone and blast exclusion zones, identify occupational exposure standards or health effects for NO₂, or assess the risk to motorists for the project from the worst-case scenario.
4. In addition to blast fume concerns, the Bruce Highway may be at risk from both the potential impact of excavation works and from geo-technical damage caused by blasting. As a result, the current mine plan has no mining proposed within a buffer area until 12 years from the commencement of construction – dependent on ongoing geotechnical studies. The proposed mining of the 500m buffer in year 12, 13 and 14 would not be approved if the geotechnical assessment indicated that there is likely to be adverse impacts to the Bruce Highway from excavation and blasting. Should mining not be appropriate within 500m on each side of the Bruce Highway the economic viability of the project could be significantly impacted. The EIS does not present an alternative economic assessment based on the project not being able to access these

coal reserves.

6 Project approvals and recommended conditions

Throughout this EIS process a number of environmental impacts and relevant mitigation measures have been identified. Where the EIS has shown that such impacts are likely and where legislation, policy or guidelines dictate, some activities associated with the proposed project would need to be constrained to ensure acceptable environmental outcomes through conditions of approval. In the absence of detail about a particular matter, the proponent, in the EIS, has made certain commitments to achieve suitable outcomes.

Following the release of this report, the proponent would be required to obtain statutory approvals from Commonwealth, state and local government agencies before the project can proceed. An overview of the approvals required for the project are summarised in Table 8 Approvals required for the proposed Central Queensland Coal Project. Key approvals required for the project include an Environmental Authority under the *Environmental Protection Act 1994*, a Mining Lease under the *Mineral Resources Act 1989* and approval by the Australian Government under *the Environmental Protection and Biodiversity Conservation Act 1999*. The EIS process has sought to identify and provide an assessment of matters relevant to all approvals and where possible, provide advice and recommendations concerning key matters regulated by these approvals.

6.1 Environmental authority (EP Act)

6.1.1 Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of a subsequent EA approval for the proposed project, the holder must also meet their obligations under the EP Act and the regulations made under the EP Act. This includes that the holder of the EA must comply with the following provisions of the Act.

6.1.2 Recommended conditions of an environmental authority

In Chapter 4 of this report, comments and recommendations have been made concerning the relevant conditions that would be required to ensure the project was delivered in a manner that would meet the statutory requirements of the *Environmental Protection Act 1994* and other approvals. A number of the findings of this report could be used to develop relevant, site-specific EA conditions of approval specifically tailored for the project to regulate risks to environmental values and capture key commitments made by the proponent in the EIS. EA conditions are considered necessary to achieve the environmental objectives and performance outcomes of the EP Regulation and desirable for the regulation of identified and potential environmental impacts identified in this assessment. The subsequent EA application and PRCP application would need to adequately address all the outstanding matters identified in this Assessment Report.

6.2 Australian Government approval (EPBC Act)

The EIS provided an assessment of the likelihood of occurrence of MNES, potential impacts, and proposed avoidance and mitigation measures including offsets.

These matters have been assessed in this report for their adequacy in meeting the MNES section of the TOR. The department has taken into account MNES review comments provided by DAWE, IESC advice and advice from the GBRMPA. DAWE has also reviewed the MNES section of this AR in accordance with the Bilateral Agreement.

Recommendations have been made, in some instances, for the Commonwealth Minister for the Environment to consider when making a decision about the action and any conditions that might be placed on such an approval.

The publishing of this Assessment Report concludes the EIS process under the EP Act and starts the approval process under the EPBC Act. The Commonwealth Environment Minister then has 30BD to make a decision on whether to approve the action under Part 9 of the EPBC Act.

6.3 Approvals

A number of approvals other than those under the *Environmental Protection Act 1994* and the EPBC Act are required for the proposed project, these have been identified in Table 8. Where possible, advice and recommendations have been made in the relevant sections of this report concerning key matters that can be regulated by these approvals. Specific conditions for these approvals would need to be developed during the application and assessment processes under the relevant legislation.

It is the responsibility of the proponent to obtain the required approvals for the project.

One of the purposes of this report is to provide useful information to decision makers. Hence, it is requested that decision makers responsible for decisions on approvals consider the comments and recommendations made in this report.

Table 8 Approvals required for the proposed Central Queensland Coal Project

Approval	Legislation (administering authority)	Detail
Key state approvals		
Granting of MLs	<i>Mineral Resources Act 1989</i> (Department of Resources)	Resource tenure is sought in the form of two MLs (MLA 80187 and MLA 700022) for mining and infrastructure including the haul road, TLF and rail loop pursuant to the MR Act.
Environmental authority (mining activities) (EA)	<i>Environmental Protection Act 1994</i> (the department)	<p>A granted EA for the proposed project would allow the proponent to mine black coal under schedule 3 (ERA 13, mining black coal) of the Environmental Protection Regulation 2008 (EP Regulation).</p> <p>The EA would also cover the following activities that are directly associated with, or facilitate or support, the mining activities, and which would otherwise require approval under the EP Act as 'prescribed ERAs', listed under schedule 2 of the EP Regulation:</p> <ul style="list-style-type: none"> • ERA 8 (1)(a) – Chemical Storage – storing more than 500 m³ of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c) • ERA 15 – Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour. • ERA 31 (2)(b) – Mineral processing– processing in a year >100,000 tonnes or more of mineral products (EP Regulation – Sch 2, Part 7).
Commonwealth approvals		
Approval to undertake an action that may impact on MNES	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (DAWE):	The Project was referred on 9 August 2017 (EPBC 2017/8007) and on 8 September 2017, DAWE declared the

Approval	Legislation (administering authority)	Detail
(Controlled Action)	<ul style="list-style-type: none"> • GBRWHA • National heritage place • GBRMP • listed threatened species and communities • migratory species • water resources 	<p>Project a controlled action under the EPBC Act.</p> <p>This assessment report includes an assessment of impacts on MNES as a result of the proposed action. This assessment would be provided to the Commonwealth Environment Minister to inform decision-making about whether or not to approve the proposed action and any conditions that should be applied under part 9 of the EPBC Act.</p> <p>This assessment report includes, for some matters, the department's recommended conditions of approval for the project to manage and offset impacts to MNES (not addressed through state imposed conditions).</p>
Indigenous heritage	<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)</i>	Notification to the Commonwealth Department as soon as practical and to include location and description of discovery.
Native title	<i>Native Title Act 1993 (Commonwealth)</i>	The proponent may enter a future Ancillary Agreement with Native Title Parties. The ancillary agreement would include a Cultural Heritage Management Agreement (CHMA) which covers the protection and management of all Aboriginal Cultural Heritage in the CHMA area for the purposes of the proposed mining activities.
Offsets (State and Commonwealth)		
Offset requirements for MNES and MSES	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ; EPBC Act Environmental Offsets Policy 2012 (DAWE) - assessment of MNES <i>Queensland Environmental Offsets Act 2014 (EO Act)</i> , Environmental Offsets Regulation 2014, Queensland Environmental Offsets Policy (the department) - assessment of MSES	Offsets would be required under State and Commonwealth legislation (refer to sections 4.6 and 4.15 of this report). However, under the EO Act an offset condition cannot be required by the state if the Commonwealth has imposed a condition for the same, or substantially the same, impact on the same matter OR if the Commonwealth has decided an offset is not required.
Other State approvals		
Species management program for tampering with animal breeding places	<i>Nature Conservation Act 1994</i>	If pre-clearing surveys indicate the presence of breeding places, then a SMP for tampering with a breeding place is required.

Approval	Legislation (administering authority)	Detail
Protected Plants permit	<i>Nature Conservation Act 1994</i>	A flora survey is required prior to clearing, and if the flora survey identifies the presence of protected plants in the clearing impact area then a clearing permit is required. A clearing permit is not required if impacts to protected plants can be avoided (i.e., there is no clearing to take place within 100m of the protected plants).
Water licence – to take or interfere with water Water permit to take water (surface water or groundwater) for an activity with a reasonably foreseeable conclusion date	<i>Water Act 2000</i> (DNRME)	The proponent would need to consult with DNRME on: <ul style="list-style-type: none"> • Approvals that may be required prior to the take of water including water permits to take surface water or groundwater and/or a water licence for dewatering groundwater. • Depending on the location of any proposed bores, development approval in addition to water licences may also be necessary.
Waterway barrier permit Code for Self-assessable Development – Minor Waterway Barrier Works	<i>Fisheries Act 1959</i> (DAF)	Waterway barrier works approvals are associated with waterway crossing outside of the MLA. As all waterway crossings would be within the MLAs and managed under the conditions of an EA, separate waterway barrier works approvals are not required to be obtained. Water barriers and MSES offsets for significant residual impacts would be managed through a condition on the EA.
Biosecurity management strategies, e.g., weed and pest, diseases (such as foot-and-mouth disease) and contaminants (such as lead on grazing land)	<i>The Biosecurity Act 2014</i> (DAF)	The proponent would have an obligation to undertake all reasonable steps to ensure no spread of pest, disease or contaminants. There are seven categories of restricted matters listed under the Biosecurity Act. Each category places restrictions on the biosecurity matter or requires actions to be taken to minimise the spread and adverse impact of the matter.
Cultural heritage management plan	<i>Aboriginal Cultural Heritage Act 2003</i> (Department of Aboriginal and Torres Strait Islander Partnerships - DATSIP)	The proponent has a duty of care by which all reasonable and practicable measures must be implemented to ensure the activity does not harm Aboriginal cultural heritage.
Permits for the occupation of a reserve, road, stock route or	<i>Land Act 1994</i> (Department of Resources)	In accordance with the Act, permits will be required to be obtained for the occupation of a reserve, road, stock

Approval	Legislation (administering authority)	Detail
unallocated state land, and to temporarily close a road.		route or unallocated state land, and to temporarily close a road. In addition, development on any leasehold or other state land requires the consent from the state as the landholder.
Approvals from Queensland Rail	<i>Rail Safety National Law (Queensland) Act 2017</i> (DTMR)	All rail activities during both construction and operation of the Project will comply with this Act.
Approvals from TMR	<i>Transport Infrastructure Act 1994</i> (DTMR)	Approvals under this Act will be required for any upgrades to State Controlled Roads and their intersections.
RIDA	<i>Regional Planning Interests Act 2014</i> (DAF)	The north-eastern area of the Project Site, in the vicinity of Deep Creek, intersect with mapped strategic cropping areas, as such approval under the Act will be obtained post EIS.
Environmental authority	<i>EP Act 1994</i>	Waste transport is a prescribed environmentally relevant activity (Regulated waste transport ERA 57) that is regulated under the EP Act.
Assessment reporting of previously unrecorded sites of non-Indigenous cultural heritage significance	<i>Queensland Heritage Act 1992</i> (the department)	No areas have been identified on the site that are listed on the Queensland Heritage Register. If non-Indigenous cultural heritage artefacts are found, then notification to the department is required as soon as practical and must include location and description of discovery.

7 Assessment report approved by

ORIGINAL SIGNED

Signature

Christopher Loveday
Director, Technical and Assessment Services
Department of Environment and Science
Delegate of the chief executive
Environmental Protection Act 1994

28 April 2021

Date

Enquiries: EIS Coordinator
13QGOV (13 74 68)
Email eis@des.qld.gov.au

Appendix 1 Assessment Report consideration of the *Human Rights Act 2019*

The delegate for the chief executive of the Department of Environment and Science has to consider the human rights listed in the Human Rights Act in any decision-making and action.

Table 9 demonstrates how each of the 23 human rights in the Act were considered in the Assessment Report.

Table 9 Consideration of the human rights in the Assessment Report

Act section	Human Right	Evaluation of which rights are relevant to the Assessment Report	Will the action limit or restrict any of the rights identified?
s15	Recognition and equality before the law	No change	
s16	Right to life	Increased risk due to link between greenhouse gas emissions and climate change. See Section 4.8 Air.	There is link between greenhouse gas emissions, climate change and risks to human life. The assessment of the project correctly dealt with the contribution of the project to greenhouse gas emissions and adopted the appropriate projected climate change forecasting model to predict the risk of climate change on key matters including flooding. The level of residual risk identified in the EIS complies with current legislative and best industry practice
s17	Protection from torture and cruel, inhuman or degrading treatment	No change	
s18	Freedom from forced work	No change	
s19	Freedom of movement	No change	
s20	Freedom of thought, conscience, religion and belief	No change	
s21	Freedom of expression	No change	
s22	Peaceful assembly and freedom of association	No change	
s23	Taking part in public life	No change	
s24	Property rights	Impacts on landowners through decreased amenity and tenure changes. See	The proposed project will reduce the human rights of landowners and others living in close proximity to the proposed project. The Assessment Report considers that while legislation will remove some statutory rights (e.g., some tenure and amenity rights due to the

		Section 3.3 Consultation and Section 4.13 Social.	location of the individuals), the remaining rights will not be further eroded if the recommendations of the Assessment Report are followed by the proponent.
s25	Privacy and reputation	No change	
s26	Protection of families and children	Longer term indirect changes due to greenhouse gas emissions	See s16 above.
s27	Cultural rights—generally	No change	
s28	Cultural rights—Aboriginal peoples and Torres Strait Islander peoples	Potential change to land access, land degradation and disturbance of cultural sites. See Section 4.12 Cultural heritage.	Land and cultural Interests of traditional owners were identified in the EIS. I considered that the legislative requirements for identifying and mitigating potential impacts to land and cultural sites had not been met. It is recommended that the proponent would need to meet current legislative requirements prior to the mining activity commencing.
s29	Right to liberty and security of person	No change	
s30	Humane treatment when deprived of liberty	No change	
s31	Fair hearing	No change	
s32	Rights in criminal proceedings	No change	
s34	Children in the criminal process	No change	
s35	Right not to be tried or punished more than once	No change	
s36	Retrospective criminal laws	No change	
s37	Right to Education	No change	
s38	Right to health services	No change	

Appendix 2 Recommended conditions for the environmental authority (resource activity)

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of an environmental authority for the project, the holder must also meet their obligations under the EP Act and the regulations made under the EP Act. This includes that the holder of the EA must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443).
- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443).

Recommended conditions of an environmental authority

The environmentally relevant activity(ies) described in Table 8 of this report must be conducted in accordance with the site specific conditions of approval that would be assessed and approved under Chapter 5 of the EP Act. Subsequent EA conditions of approval would be tailored for the project to regulate risks to environmental values and capture key commitments made by the proponent in the EIS. EA conditions are considered necessary to achieve the environmental objectives and performance outcomes of the EP Regulation and desirable for the regulation of identified and potential environmental impacts identified in this assessment. The subsequent EA application and PRC plan application would need to address all the outstanding matters identified in this Assessment Report.

Appendix 3 DAF recommendations

Waterway barriers

Recommendation 1:

Construction works within the bed and banks of Deep Creek, Barrack Creek and Tooloombah Creek are only undertaken during no-flow periods in the dry season.

Recommendation 2:

Works within waterways (other than those identified as being lost to pit and related construction) are to be where possible avoided. Avoidance can be guided by the factsheet [What is not a waterway barrier work?](#) Where avoidance is not possible the works are to be undertaken in accordance with the [Accepted Development Requirements for operational work that is constructing or raising waterway barrier works](#).

Recommendation 3:

Haul Roads and other waterway crossings of Deep Creek, Barrack Creek and Tooloombah Creek are to be designed and constructed to meet the standards of either [What is not a waterway barrier work?](#) or the [Accepted Development Requirements for operational work that is constructing or raising waterway barrier works](#).

Recommendation 4:

Fisheries resources (fish and invertebrates) trapped by or likely to be negatively impacted during construction works within the mining area are to be relocated to suitable habitats as per the [Guidelines for Fish Salvage](#).

Recommendation 5:

The reduced extent of fish passage through the loss of waterways (8.35 ha) due to pit construction is to be offset. The offset must be finalised (e.g. paid to the DES environment offset fund and receipted) prior to any works disturbing this MSES.

Recommendation 6:

Monitoring (fish surveys and pool persistence) of the impacts of the construction and mining activities (including groundwater drawdown) on fisheries resources is to be undertaken.

- Monitoring must include sites as per Table 4.2 of Appendix 10f REMP. Sampling timing and frequency as per Table 4-3 Appendix 10f.
- Monitoring must include an Alert-to-Action Protocol to address impacts to fisheries resources. The Alert-to-Action Protocol must include informing DES of the impacts (exceedances) within 14 days of the monitoring event. A description of the impacts must include the area impacted, the date and timing of the impact, the fisheries resources impacted (species and numbers) and proposed steps for rectification. Actions such as supplementing water flow with additional water from the mine site, via the approved discharge locations must be included in the protocol.
- Fish salvage is to be undertaken immediately the loss of fish is observed or monitoring suggests that it is imminent. Fish salvage is to be undertaken as per the [Guidelines for Fish Salvage](#).
- Once an Alert-to-Action event has occurred monitoring is to be increased to every two months for subsequent years. This timing is to continue until the matter is rectified.

Recommendation 7:

Monitor the water level in Tooloombah Creek at the sites of the permanent pools and enact the Alert-to-Action protocol if water quality falls below the guideline values for Wild Fish Stocks of the [Australian and New Zealand guidelines for fresh and marine water quality](#)

Recommendation 8:

Assess the extent of mangrove and saltmarsh communities in Styx River / Broad Sound. Changes to the extent or distribution of marine plants must be reported to DES and any decrease in area or density investigated. Assessment to be undertaken at least every three years (Sampling timing and frequency as per Appendix 10f, Table 4-3).

Appendix 4 Social impact management recommendations

Social impact management recommendations

It is recommended that:

- Prior to commencement of construction, the SIA/SIMP be updated to include further detail regarding the proposed management measures to clearly demonstrate how key issues of stakeholders have been addressed.
- The SIMP would be made publicly available on the proponent's website.
- The number of workers utilising the provided bus services and project demand on local emergency services are provided as indicators in the SIMP for monitoring purposes.
- Clarification is required regarding the realistic anticipated workforce sourcing scenario and capacity of the existing workers accommodation at Marlborough Caravan Park.
- Alternative workforce accommodation options/strategies are identified and explored as part of the assessment of project impacts on local housing and accommodation. These matters should be considered in the consultation on the housing and accommodation study prior to construction and further development approvals for the workforce accommodation.
- Should the project not proceed within three years that the SIA and SIMP should be comprehensively reviewed and updated in consultation with local government and other stakeholders.
- While the SIMP includes a commitment to implementation tracking and annual reporting against performance indicators, annual reporting documents should be made publicly available on the proponent's website.
- The SIMP should be updated against the annual reporting and nominated performance indicators to support the proposed management measures/actions and to demonstrate that identified project impacts are being appropriately managed and local/regional benefits/opportunities are enhanced.
- The proponent's commitment to collaborate with council regarding the accommodation camp planning and developing an agreement with the local accommodation provider to underwrite the expansion of workforce accommodation should be implemented.
- Details of the capacity of existing local short-term accommodation facilities, in particular the Marlborough Caravan Park, should be obtained. Prior to construction, the Housing and Accommodation Study should be prepared considering this information and details of what approvals would be needed to enhance local accommodation facilities.
- The number and service area of the proposed bus operations be confirmed to reflect the latest proponent commitment on this matter.
- Detailed investigation is needed once project design has been finalised on the effects and needs of the project's in-migrating and non-resident workforce on local essential services. Engagement with utility owners/operators could assist with better understanding of the likely impact extent from the increased demand by the project's workforce accommodated in the local study area.

Appendix 5 DTMR recommendations

DTMR Recommended requirements for Central Queensland Coal Project

No.	TMR Recommended requirements for Central Queensland Environment Impact Statement Assessment Report	Condition timing
Central Queensland Coal Project		
Development layout in relation to railway corridor		
1.	The development must provide a 'rail loop' setback approximately 250m from the railway corridor with the 'haul road', 'dam' and 'product coal stockpile and train loading facility' situated on the western side of the 'rail loop' generally in accordance with Figure 1-19: Project Layout in Chapter 1 of the Central Queensland Coal Project SEIS, dated October 2020, version 3.	Prior to the commencement of use and to be maintained at all times
Earthworks adjacent to railway corridor		
2.	Any excavation, filling/backfilling/compaction, batters, retaining structures, stormwater management measures and other works involving ground disturbance must not encroach upon or destabilise the railway corridor, including all transport infrastructure or the land supporting this infrastructure, or cause similar adverse impacts.	At all times
Stormwater and flood management		
3.	<p>Stormwater and flooding management of the development must ensure no worsening or actionable nuisance to the railway corridor and state-controlled road.</p> <p>(b) Any works on the land must not:</p> <ol style="list-style-type: none"> i. create any new discharge points for stormwater runoff onto the railway corridor or state-controlled road; ii. interfere with and/or cause damage to the existing stormwater drainage on the railway corridor or state-controlled road; iii. surcharge any existing culvert or drain on the railway corridor or state-controlled road; iv. reduce the quality of stormwater discharge onto the railway corridor or state-controlled road; reduce the flood storage capacity of the site; v. impede or interfere with overland flows paths and/or hydraulic conveyance on the site. <p>(c) RPEQ certification with supporting documentation must be provided to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au), confirming that the development has been designed in accordance with parts (a) and (b) of this condition. In particular, the RPEQ certification must include a stormwater management plan and a flood impact assessment.</p> <p>(d) The development must provide stormwater and flooding management in accordance with parts (a) and (b) of this condition.</p>	<p>(a) & (b) At all times</p> <p>(c) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(d) Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p>

Fencing		
4.	Fencing sufficient to prevent unauthorised access by people, vehicles and projectiles (including particles from stockpiling) must be provided along the site boundary with the railway corridor.	Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times
Railway level crossing safety		
6.	<p>(a) The development must ensure that there is no disruption to the safety and operational integrity of railway level crossings.</p> <p>(b) RPEQ certification must be provided to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) confirming that the development has been designed in accordance with part (a) of this condition. In particular, the RPEQ certification must include supporting documentation addressing the following.</p> <ul style="list-style-type: none"> i. a swept path analysis of the maximum design vehicle demonstrating adequate queuing distance between impacted railway level crossing/s and relevant intersections/access points. The minimum clearance must be 5m from the edge running rail (of the closest railway track) as per Section 5.4 – Short Stacking and Figure 3.2 – Yellow Box Marking of AS1742.7:2016 <i>Manual of Uniform Traffic Control Devices, Part 7: Railway</i> plus the length of the maximum design vehicle; and ii. written evidence that comparative Australian Level Crossing Assessment Model assessments demonstrate the development will not worsen the safety risk at the impacted railway level crossing/s or detailed design drawings showing mitigation measures in accordance with AS1742.7:2016 <i>Manual of Uniform Traffic Control Devices, Part 7: Railway</i> and other relevant standards to mitigate the identified risks. <p>(c) The development must be carried out generally in accordance with parts (a) and (b) of this condition.</p>	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(c) Prior to the commencement of construction and prior to the commencement of use</p>
Dam failure		
7.	<p>(a) The design and construction of the development must ensure that there is no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from the risk of dam failure.</p> <p>(b) RPEQ certification must be provided to Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au), confirming that the development has been designed in accordance with part (a) of this condition. The RPEQ certification must include supporting documentation such as:</p> <ul style="list-style-type: none"> i. a Dam Failure Risk Assessment in accordance with Attachment 1: Risk Assessment Guide of the <i>Guide for Development in a Transport Environment: Rail</i>; 	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction</p> <p>(c) Prior to the commencement of use and</p>

	<ul style="list-style-type: none"> ii. the geotechnical investigations completed during the detailed design phase; iii. the detailed engineering design drawings and supporting technical documentation for the development; and iv. relevant management plans. <p>(c) RPEQ certification must be provided to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au), confirming that the development has been constructed in accordance with parts (a) and (b) of this condition. The RPEQ certification must include supporting documentation such as:</p> <ul style="list-style-type: none"> i. the construction monitoring results and the mitigation measures employed; and ii. as-constructed drawings. 	<p>to be maintained at all times</p>
<p>8.</p>	<p>(a) The operational management of the development must ensure that there will be no disruption to the safety and operational integrity of the railway corridor and the safety and efficiency of the state-controlled road from dam failure, or the risk of dam failure, for the life of the development.</p> <p>(b) An operational management plan for the development must be prepared by a RPEQ and given to Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au). In particular, the operational management plan must address and include the following, amongst other relevant considerations.</p> <ul style="list-style-type: none"> • An Emergency Action Plan that deals with procedures to protect the railway corridor and state-controlled road in the event of dam failure and other incidents. This must be annually reviewed, include a communication protocol with State agencies and align with state-controlled transport corridor Emergency Management and Risk Management Standards and Procedures. • A maintenance regime to ensure that the safety of the railway corridor, state-controlled road and the general public is not compromised. • A maintenance regime to ensure that the operational integrity of the railway corridor and efficiency of the state-controlled road are not compromised such as by damage, obstruction or similar adverse impacts. • Adherence to relevant standards and Queensland Rail Civil Engineering Technical Requirements including <i>CIVIL-SR-002 – Work in or about Queensland Rail Property</i>. <p>(c) The development must be maintained in accordance with the operational management plan.</p>	<p>(a) At all times</p> <p>(c) At least 6 months prior to the commencement of use</p> <p>(d) Prior to the commencement of use and to be maintained at all times</p>
<p>Construction management</p>		
<p>9.</p>	<p>(a) The construction of the development must ensure that there will be no disruption to the safety and operational integrity of</p>	<p>(a) & (c)</p>

	<p>the railway corridor and safety and efficiency of the state-controlled road during construction.</p> <p>(b) A construction management plan must be prepared by a RPEQ, and given to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au). In particular, the construction management plan must address the following, amongst other relevant considerations.</p> <ul style="list-style-type: none"> • Construction methodology. • Work method statements for earthworks, service and utility connections and stormwater management measures. • Storage locations, site accommodation facilities, vehicular loading/unloading zones and vehicular access tracks. • Railway operational requirements and scheduled railway closures. • Unauthorised access prevention to the railway corridor and state-controlled road. • Fencing – temporary and permanent. • Railway level crossing safety. • Traffic management for state-controlled roads. • Over dimensional road loads. • Mitigation measures to address construction related road safety risks • Adherence to relevant standards and Queensland Rail Civil Engineering Technical Requirements including: <ul style="list-style-type: none"> ○ CIVIL-SR-002 – <i>Work in or about Queensland Rail Property</i>; ○ CIVIL-SR-008 – <i>Protection screens</i>; and ○ CIVIL-SR-016 – <i>Services under railway property (non-Queensland Rail services)</i>. <p>(c) The construction of the development must be undertaken in accordance with the construction management plan.</p>	<p>At all times during the construction of the development</p> <p>(b) At least 3 months prior to the commencement of construction</p>
Earthworks and blasting management		
<p>10.</p>	<p>(a) Any excavation, filling/backfilling/compaction, batters, retaining structures, blasting, boring, piling and any other works involving ground disturbance undertaken as part of the construction or operation of the mine must not:</p> <ol style="list-style-type: none"> i. encroach upon, de-stabilise or cause damage to the railway corridor or state-controlled road, including all transport infrastructure or the land supporting this infrastructure, or cause similar adverse impacts; ii. adversely impact on the railway corridor or state-controlled road through the addition or removal of loading such as but not limited to lateral, vertical or surcharge loading; iii. adversely impact on the railway corridor or state-controlled road as a result of directly or indirectly disturbing groundwater; iv. result in flyrock, vibration, structural and/or ground movement impacts on the railway corridor or state-controlled road; 	<p>(a) At all times</p> <p>(b) At least three months prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p> <p>To remove doubt, the geotechnical assessments referenced in b (iii) must be provided at least three months prior to the commencement of</p>

	<p>v. reduce the safety of the railway corridor or state-controlled road;</p> <p>vi. cause the closure of the Bruce Highway; or</p> <p>vii. require the closure of the railway corridor or state-controlled road at any time.</p> <p>(b) An earthworks and blasting management plan must be prepared by a RPEQ and given to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au). The Earthworks and Blasting Management Plan must address the development's construction and operational impacts on the railway corridor and state-controlled road. The earthworks and blasting management plan must establish and maintain a management and monitoring program which ensures the mine's construction and operation does not adversely affect the safety, efficiency and operational integrity of state-controlled transport infrastructure. The earthworks and blasting management plan must address at least the following:</p> <p>i. The requirement for the mine to not undertake any blasting that would:</p> <ul style="list-style-type: none"> • reduce the safety or efficiency of the Bruce Highway, or • necessitate the closure of the Bruce Highway. <p>ii. The need for a blasting exclusion zone from the Bruce Highway if required,</p> <p>iii. The requirement for the mine operator to undertake and provide to Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) RPEQ certified, bi-annual geotechnical assessments, from a geotechnical consultant with a GE3 pre-qualification, at least including:</p> <ul style="list-style-type: none"> • details to illustrate that the mine's operation complies with the requirements of AS2187.2 Appendix A Explosives: Storage and Use Part 2 – Use of Explosives; • detailed geotechnical investigations and modelling identifying all potential failure mechanisms and justifications for the engineering properties used for each geological layer identified; • detailed stability analyses including kinematic stability checks; • details on instrumentation (types, locations and the monitoring review procedure) and on the geological mapping procedure during the excavation of pits in order to validate the geological model(s) assumed in the stability assessment; • identification of any changes or impacts that would adversely affect the state-controlled transport corridors; • details of any mitigation measures required to ensure any excavation, 	<p>construction and every six months thereafter for the duration of the mine's construction and operation.</p> <p>(c) At all times</p>
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	<p>filling/backfilling/compaction, batters, retaining structures, blasting, boring, piling and any other works involving ground disturbance does not reduce the safety, efficiency or structural/geotechnical integrity of state-controlled transport infrastructure;</p> <p>iv. Mitigation measures to manage the identified risks on the state-controlled transport network including relevant management and monitoring plans;</p> <p>v. The requirement for the applicant to provide written notification to Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) of any issues impacting on the state-controlled transport infrastructure within one (1) business day.</p> <p>(c) The construction and operation of the development must be in accordance with the earthworks and blasting management plan.</p>	
Ground movement and vibration monitoring		
<p>11.</p>	<p>(a) The development must ensure that there is no disruption to the safety and efficiency of the state-controlled road and safety and operational integrity of the railway corridor from ground movement and vibration.</p> <p>(b) A ground movement and vibration monitoring plan must be prepared by a RPEQ and given to the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) which investigates any construction and operational impacts on the railway corridor and state-controlled road. The ground movement and vibration monitoring plan should consider the following:</p> <ul style="list-style-type: none"> i. details regarding pre and post dilapidation surveys of state-controlled transport infrastructure; ii. details on instrumentation including types, locations and number of movement monitoring instruments/devices adjacent to and within state-controlled transport infrastructure; iii. details of the geological mapping procedure during the excavation of pits in order to validate the geological models assumed stability assessments; iv. relevant requirements in accordance with Section 8.6 – Vibration of <i>Transport and Main Roads Specifications MRTS51 Environmental Management</i> (July 2020); v. the requirement for the applicant to engage a RPEQ to establish the baseline structural and ground movement and vibration readings; vi. the monitoring must be automated using a 24/7 system; vii. the requirement to agree with the Department of Transport and Main Roads as to the level of acceptable movement and trigger levels. In particular, the accuracy level of monitoring instrumentation must not exceed +/- 2mm; 	<p>(a) At all times</p> <p>(b) At least three months prior to the commencement of construction and at least three months prior to the commencement of use</p> <p>(c) Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p>

	<p>viii. detail protocols to be complied with when the movement and trigger levels are breached, including specific actions to be undertaken and who is responsible for each, the notification process, lines of communication, and stop work procedure;</p> <p>ix. the requirement to provide the overall monitoring results to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (Central.Queensland.IDAS@tmr.qld.gov.au);</p> <p>x. the requirement for the applicant to rectify any damage to state-controlled transport infrastructure caused by the construction and operation of the development.</p> <p>(c) The construction and operation of the development must be in accordance with ground movement and vibration monitoring plan. Where rectification works to the state-controlled transport infrastructure are to be required (as a result of the pre and post development dilapidation surveys) to ensure the post development condition has a no worsening impact on the pre-development condition:</p> <p>i. the applicant is required to obtain approval for and undertake all necessary rectification works to the state-controlled infrastructure at the applicant's expense; and</p> <p>ii. RPEQ certification must be provided to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) confirming that all necessary rectification works have been completed.</p>	
Groundwater management		
<p>12.</p>	<p>(a) The groundwater management of the development must ensure that there is no disruption to the safety and efficiency of the state-controlled road.</p> <p>(b) A groundwater management and monitoring plan, must be prepared by a RPEQ, and given to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au). The groundwater management and monitoring plan must investigate construction and operational impacts (including earthworks, boring, piling, blasting and the like) on the state-controlled road. The groundwater management and monitoring plan must establish a management and monitoring program which ensures the state-controlled road, is not adversely affected by the development. The groundwater management and monitoring plan should consider the following:</p> <ul style="list-style-type: none"> • The requirement for the applicant to engage a RPEQ to conduct controlled monitoring of groundwater (including, but not limited to, groundwater seepage, fluctuations and ground water levels adjacent to and above the state-controlled transport infrastructure) during construction and on-going operation and identify any changes that would adversely affect the state-controlled road; 	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(c) Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p>

	<ul style="list-style-type: none"> • Mitigation measures to manage the identified groundwater risks on the state-controlled road; • The requirement for the applicant to provide written notification of any groundwater issues impacting on the state-controlled road within one (1) business day. <p>(c) The construction and operation of the development must be in accordance with the groundwater management and monitoring plan.</p>	
Coal dust management plan		
13.	<p>(a) The development must ensure that coal dust is effectively managed to ensure no adverse impacts on the state transport infrastructure network.</p> <p>(b) A coal dust management plan must be prepared by suitably qualified person and provided to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au). The coal dust management plan must establish a management and monitoring program that ensures coal dust emissions from the operation of the mine (including the haulage of coal) are effectively managed to ensure no adverse impacts on the state transport infrastructure network. The coal dust management plan must include at a minimum control measures to effectively mitigate dust emissions from loaded and unloaded coal haulage trains generated by the development, at least including the measures identified in table 12-18 in Chapter 12 of Central Queensland Coal Project SEIS, dated [TBD].</p> <p>(c) The construction and operation of the development must be in accordance with the coal dust management plan.</p>	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(c) Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p>
Traffic Impact Assessment		
14.	<p>(a) The development must manage and mitigate its traffic impacts to maintain the safety and efficiency of the state-controlled road network.</p> <p>(b) The applicant must provide a RPEQ certified Traffic Impact Assessment that to the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) that, among other things, includes the following as per the TMRs' Guide Traffic Impact Assessment.</p> <ul style="list-style-type: none"> • A final Traffic Impact Assessment (TIA) including a final Pavement Impact Assessment (PIA) that considers cumulative impacts of all project-related traffic on the state-controlled road network, and identifies any mitigation measures required to adequately manage all project-related traffic impacts; • A road safety risk assessment, which among other things: <ul style="list-style-type: none"> - a road safety audit of the current conditions of the SCR network and identifying potential mitigation measures as necessary to improve road safety; 	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(c) Prior to the commencement of use and to be maintained at all times</p>

	<ul style="list-style-type: none"> - confirms the total transport task for the project including workforce, inputs and outputs, during the construction and operational phases (including a description of the expected volumes, weights and origins/destinations of materials, products, hazardous goods or wastes for each phase of the project); - confirms existing pavement conditions and defects which may lead to safety issues; - existing intersection performance from a safety perspective; - existing SCR infrastructure and impacts of project related traffic. <p>(c) The applicant must implement the mitigation measures identified in the updated Road Impact Assessment as agreed with TMR and obtain all relevant approvals as required under the Transport Infrastructure Act 1994.</p>	
Road use management plan		
15.	<p>(a) The operational management of the development must avoid and manage the impact of project traffic on the safety, efficiency and integrity of state-controlled roads.</p> <p>(b) The applicant must provide the Program Delivery and Operations Unit, Central Queensland Region within the Department of Transport and Main Roads (FitzroyDistrict@tmr.qld.gov.au) a finalised road use management plan that considers (and includes where appropriate) the following:</p> <ul style="list-style-type: none"> i. haulage routes for construction and operational phases of the project ii. public safety at worksites; iii. obstruction to road users; iv. workforce management strategies to reduce traffic generation including but not necessarily limited to: <ul style="list-style-type: none"> • provision of a shuttle service for workers to reduce private vehicle usage and overall traffic generation; • provision of a ride sharing scheme to increase worker vehicle occupancy and decrease overall traffic generation; • scheduling shift times and heavy vehicle movements such that project traffic does not coincide with network peak periods. v. management of driver behaviour to ensure that project traffic is driving in a safe manner; vi. driver fatigue management strategies; vii. use of vehicle location tracking systems that allow monitoring of driver behaviour; and viii. providing a system of identifying project related vehicles and provision of a free call number for community members and other road users to contact if they have concerns, queries or complaints about driver behaviour; ix. defining responsibilities and procedures for implementation, monitoring and RMP strategy amendment; 	<p>(a) At all times</p> <p>(b) At least 6 months prior to the commencement of construction and at least 6 months prior to the commencement of use</p> <p>(c) Prior to the commencement of construction, prior to the commencement of use and to be maintained at all times</p>

	<ul style="list-style-type: none">x. management strategies to limit the impacts of over size and over mass loads through the National Heavy Vehicle Regulator (NHVR);xi. management strategies for the transportation of hazardous materials such as fuels and chemicals; andxii. ongoing monitoring for road safety impacts from project activities (for example, dust, debris/construction materials on roads and site lighting and so on). <p>(c) The construction and operation of the development must be in accordance with the road use management plan.</p>	
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