SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 22
Cumulative Impacts

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22.0 Cumulative impacts

22.1 Introduction

BM Alliance Coal Operations Pty Ltd (BMA) is seeking approval to develop the Saraji East Mining Lease Project (the Project) involving a single-seam underground mine and supporting infrastructure on Mining Lease Application (MLA) 70383 and MLA 70459 adjacent to, and accessed through, the existing open cut mine void within Mining Lease (ML) 1775.

This chapter of the Environmental Impact Statement (EIS) describes the potential impacts of the Project that are cumulative, both in combination with relevant aspects of the Project and in combination with other Projects and activities. Details of the assessments undertaken for the EIS are discussed in each of the relevant chapters.

22.2 Methodology

The objective of the cumulative impact assessment was to assess the potential for impacts from the Project to have compounding or synergistic interactions with similar impacts from other projects, including projects proposed, under development or already in operation within an envisaged sphere of influence of the Project. The sphere of influence varies based on each biophysical and social aspect considered in this EIS.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system.

There are three separate levels at which cumulative impacts may be relevant: Project Site localised cumulative impacts; regional cumulative impacts; and global cumulative impacts.

- **Project Site localised cumulative impacts** - these are the cumulative impacts that result from mining operations in the immediate vicinity of the Project Site. Project Site localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receptors. These include dust deposition, noise and vibration, groundwater drawdown, groundwater and surface water quality, and transport
- **regional cumulative impacts** - regional cumulative impacts include the Project's contribution to impacts that are caused by mining operations throughout the Bowen Basin region. Each coal mining operation in itself may not represent a substantial impact, however the cumulative effect on habitat value, water quality, and the socioeconomics of a region may warrant further consideration
- **global cumulative impacts** - the only impact from the Project that is potentially global is greenhouse gas (GHG) emissions. However, the level of emissions from the Project represents a very minor contribution at this scale.

The cumulative impact assessment (outlined in Section 22.4) focused on the localised cumulative impacts (Project Site) and the regional cumulative impacts (regional context), taking into consideration other developments (i.e. nearby mines), where relevant.

To establish the potential for the Project to contribute to cumulative impacts, publicly available information on proposed developments in the area has been reviewed. Where appropriate, baseline assessments undertaken as part of the EIS have also informed the contribution of existing developments and operations within the region. Together this information provides a basis for understanding the cumulative impact of all projects and developments to assess the significance of the Project's contribution on the receiving biophysical and social environment.

As the mechanisms for cumulative impact vary between each of the biophysical and social aspects considered, the methodology for assessing cumulative impacts necessarily varies. The specific methodology for each assessment is described further in the relevant sub sections of Section 22.4.

22.3 Relevant projects

To establish the potential cumulative impacts associated with the Project, consideration is made to other nearby projects and operations. Relevant projects that have been considered include:

- projects within the anticipated sphere of influence of the Project, listed on the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) that are undergoing assessment under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) for which an EIS is required
- projects within the envisaged sphere of influence of the Project, listed on the website of the Department of Environment and Science (DES) that are undergoing assessment under the *Environmental Protection Act 1994* (EP Act) for which an EIS is required
- existing resource operations located within the Bowen Basin.

The consideration of projects relevant to the cumulative impact assessment has generally been limited to resource projects within the vicinity of the Project as indicated in Table 22-1. Given the scale of the Project, development applications in accordance with the *Planning Act 2016*, such as those for residential housing development are not considered to be likely to contribute to cumulative impacts with the Project.

Nearby existing resource projects and proposed resource development projects considered in this assessment are provided in Table 22-1 and Figure 22-1. A discussion on potential cumulative impacts with existing projects is provided, where relevant, in Section 22.4.1 to Section 22.4.12.

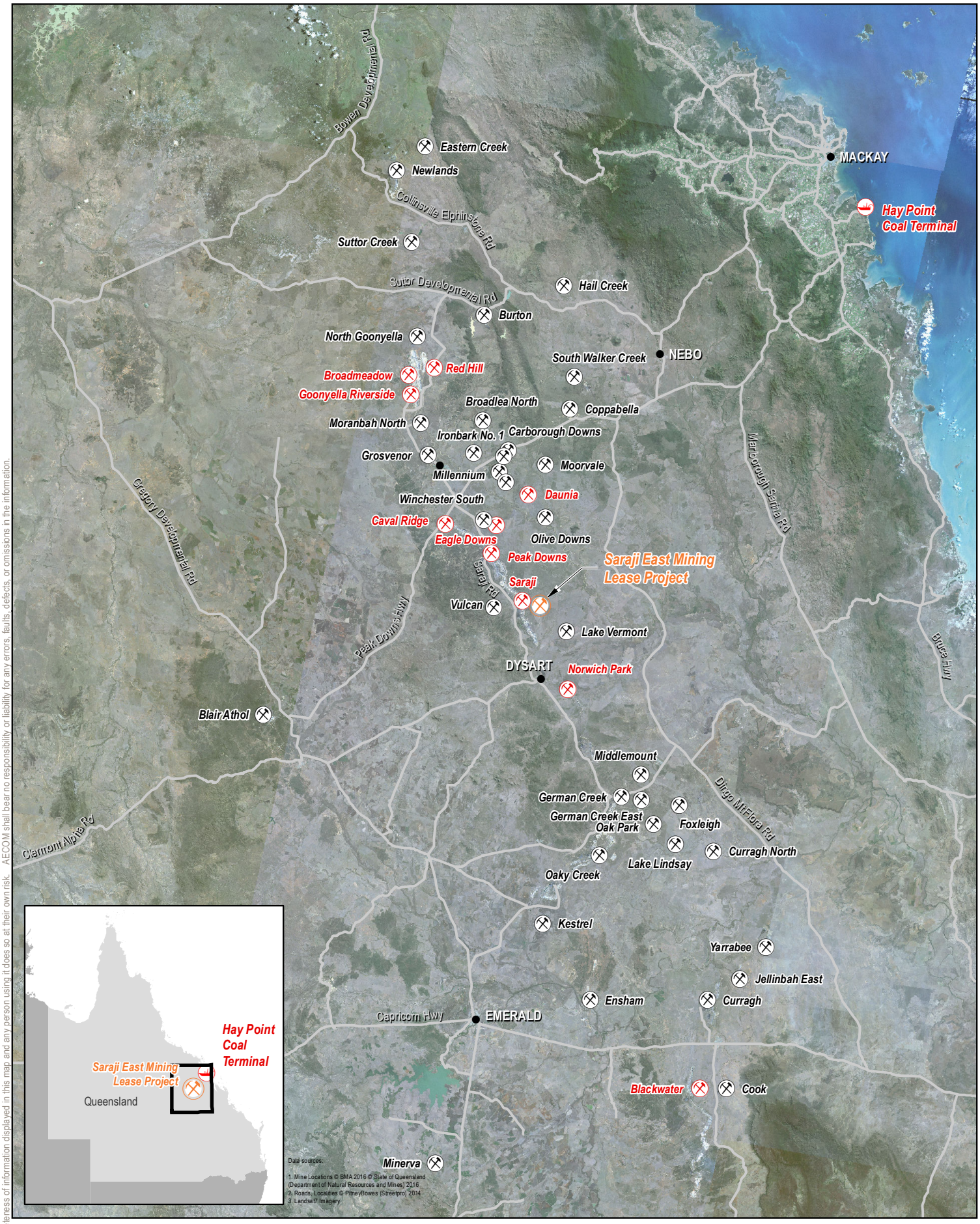
In most cases, impacts of existing developments such as operational mining activities have already been accounted for in terms of baseline data collection. For example, the conservation status of flora, fauna and vegetation communities is based on known extents of habitats or populations and hence, takes into account clearing that has occurred to date. For social and economic issues, assessment of impacts is based on potential changes when compared to current baseline conditions, which have already been influenced by existing developments and operations.

Contribution of existing activities to impacts is, therefore, already accounted for in the impact assessment and is only summarised in this chapter.

Table 22-1 Projects in development which are relevant to the cumulative impact assessment

Project	Description	Status	Location
Red Hill Mining Lease Project	A new underground coking coal mine (Red Hill Mine) with a yield of 14 million tonnes per annum (Mtpa); and expansion of two existing coking coal mines (Broadmeadow and Goonyella Riverside).	EIS approved with conditions June 2015 (SDPWO Act). EIS assumed development from 2020.	20 kilometres (km) from Moranbah.
China Stone Coal Project	Large scale, greenfield coal mine with a yield of up to 38 Mtpa of thermal coal.	EIS approved with conditions November 2018 (SDPWO Act). Execution status unknown.	Approximately 300 km west of Mackay.
Olive Downs Project	Greenfield metallurgical coal mine with a yield of up to 15 Mtpa of product coal for steel production.	EIS approved with conditions May 2019 (SDPWO Act). Construction 2019-2021, operation from 2020.	Approximately 40 km southeast of Moranbah and 40 km north of Dysart.

Project	Description	Status	Location
New Lenton Coal Project	Open cut mine with a yield of up to 8 Mtpa.	EIS process was suspended under section 67 of the EP Act.	Approximately 65 km northwest of Nebo, 65 km north of Moranbah, and 20 km south of Glenden.
Carmichael Coal Mine and Rail Project	Open cut and underground coal mine with a yield of 60 Mtpa and a 189-kilometre railway line.	EIS approved with conditions May 2014 (SDPWO Act). Early works commenced October 2017.	Approximately 160 km northwest of Clermont.
Byerwen Coal Project	Open cut coal mine with a yield of up to 10 Mtpa.	EIS approved with conditions July 2014 (SDPWO Act). Early works commenced 2017.	20 km west of Glenden.
Winchester South Project	Greenfield metallurgical coal mine with a yield of up to 8 Mtpa product coal for approximately 30 years, for steel production.	Draft EIS being prepared. Construction from 2021, operation from 2022-2023.	30 km southeast of Moranbah.
Eagle Downs Coal Mine Project	Greenfield underground coal mine producing up to seven Mtpa of coking coal and thermal coal for export over 50 years.	EIS approved with conditions in June 2010 (EP Act).	Approximately 20 km southeast of Moranbah.
Poitrel Coal Project	Open cut mine producing up to 3.4 Mtpa of product coal for export for at least 20 years.	EIS approved with conditions in November 2005 (EP Act).	Approximately 35 km east of Moranbah.
Grosvenor Coal Project	Greenfield underground coal mine to produce net 5 million tonnes per year of high quality coking coal for export for up to 24 years.	EIS approved with conditions in September 2011 (EP Act).	Approximately 3 km north of Moranbah.
Lake Vermont - Meadowbrook Project	Open cut coal mine with a yield of up to 9.1 Mtpa.	Public notification of EIS. If approved, construction commencing 2025 and operation December 2028.	30 km northeast of Dysart.
Isaac Downs Project	Greenfield, open cut coal mine with a yield of 1 – 4 Mtpa.	EIS process completed. Extension to Isaac Plains Complex. Under construction 2020-22, first coal production expected in 2022.	Approximately 5 km east of Moranbah.
Carborough Downs Mine	Underground coal mine with a yield of up to 5 Mtpa.	Approved in September 2022	Approximately 20 km east of Moranbah).
Ironbark No.1 Mine	Underground coal mine with a yield of up to 6 Mtpa.	Formerly known as the Ellensfield Coal Project, approved in 2012. Construction commenced January 2022.	Approximately 30 km northeast of Moranbah.



LEGEND

- Saraji East Mining Lease Project
- BMA Coal Terminal
- BMA Mine
- Other Mine
- Locality
- Major Road

N

Figure 22-1
Nearby Resource Projects

Environmental Impact Statement
Saraji East Mining Lease Project

0 5 10 20
Kilometres

Scale: 1:1,500,000 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 25/09/2023 VERSION: 3

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

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22.4 Cumulative assessment

22.4.1 Land resources

The Project's potential impact on land resources is discussed in **Chapter 5 Land Resources**. Land resource cumulative impacts have been measured using the following indicators:

- the dominant current land use and land suitability within the Project Site
- the presence of potential strategic cropping land (SCL) associated with the Project
- the agricultural values within and surrounding the Project Site
- the contamination status of the Project Site.

Prior to mining, the land surrounding the Project Site has been utilised for cattle grazing. During the operation of the mine, existing land uses such as grazing may be able to continue within the proposed mining lease, in areas not directly impacted by the mine and supporting infrastructure.

It has been identified that the proposed post-mining land use of cattle grazing will be suitable to the area and post-subsidence landform. The implementation of the **Subsidence Management Plan** (**Appendix K-2**) will manage potential impacts arising from subsidence.

As three of the major land lots for the Project are listed on the EMR there is potential for contamination to exist at the site. Some Project activities have the potential to contaminate the Project Site as a result of the generation and handling of wastes, including mine waste. Impacts have the potential to harm human, surface water, groundwater and soil health, leading to degradation of the natural environment, and a reduction in the productive capability of the land and the sustainable use of natural resources.

Areas of regional interest are protected from prescribed resource or regulated activities under the *Regional Planning Interests Act 2014*. A Regional Interests Development Approval (RIDA) is required when a resource activity is proposed in an area of regional interest. The RIDA process is discussed in **Appendix A-3 Approvals Framework**.

Assessment of soils and land suitability confirmed the southern extent of the Project Site (the location of the proposed overhead powerline) is mapped within a Strategic Cropping Area. The Project's infrastructure corridor encroaches within a lot mapped with SCA, but does not directly encroach within a SCA area. A field assessment of these mapped areas identified 17 SCL map units within the Project Site, of which nine (SCL map units 3, 7, 8, 9, 12, 13, 15, 16 and 17) meet the SCL criteria.

BMA will comply with the requirements of the RIDA issued by DSDILGP on 18 October 2021 under section 53 on the RPI Act to facilitate the construction of the 66 kV powerline (RIDA reference no: RPI121/001). The RIDA also confirmed that 6.90 ha of disturbance area has been confirmed as non-SCL area and is to be removed from the SCL trigger mapping.

Disturbed land will be developed to a condition that is self-sustaining or to a condition where maintenance requirements are consistent with an agreed post mining land use. Land disturbed by mining activities will be rehabilitated progressively as it becomes available, to minimise the risk of environmental impacts and reduce cumulative areas of disturbed land. The proposed post mining land use will be an undulating landscape that could be used as grazing land, consistent with the surrounding pastoral land use that dominates the region. Native vegetation outside of the surface infrastructure footprint will be retained in a way that is compatible with the pre-existing land use for biodiversity values. Where vegetation changes as a result of persistent ponding, associated with subsidence, it will be revegetated with species tolerant of inundation.

Appendix K-1 Rehabilitation Management Plan outlines BMA's proposed framework within which progressive and final rehabilitation can be planned and executed for the Project in line with the Mined Land Rehabilitation Policy (DES, 2018a) and BHP's Queensland Coal Rehabilitation Completion Criteria (BHP, 2018c), including successful rehabilitation objectives of the Project. It is considered unlikely that the Project would have a significant impact on land and soil resources based upon the review of potential impacts, suggested mitigation measures and continual review and management of the Project Site.

22.4.2 Terrestrial ecology

The assessment of terrestrial ecology impacts is detailed in **Chapter 6 Terrestrial Ecology**. The assessment took into consideration the ecological values within and surrounding the Project Site to identify the scale of the impacts and the cumulative impacts of mining within the region.

The Project Site supports some remnant vegetation protected under State and Commonwealth legislation. Two threatened ecological communities (TECs) occur within the Project Site:

- Brigalow (*Acacia harpophylla* dominant and codominant) TEC – endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC – endangered under the EPBC Act.

Most of the fauna habitat within the Project Site is generally of low conservation value, however some habitats, such as the riparian woodland (which act as a wildlife corridor), the oxbow wetland and the *Acacia harpophylla* (brigalow) woodland with gilgai, possess greater potential for supporting conservation significant fauna. The vast majority of the habitat proposed to be disturbed is non-remnant vegetation and is currently grazed.

Up to 1,200.22 hectares (ha) of remnant vegetation and 13.73 ha of high-value regrowth may be impacted by the Project. This includes the indirect disturbance of remnant vegetation associated with subsidence from underground mining operations. Approximately 210.31 ha of Brigalow TEC will be impacted by the Project. Natural grassland TEC occurs directly adjacent to the powerlines, which may span above this vegetation community.

Where possible, infrastructure has been rearranged during the Project's planning stage to mitigate disturbance to vegetation. Disturbance to key biodiversity values including TECs, and endangered and of concern REs will be avoided and managed, wherever possible. Rehabilitation of the Project Site will seek to incorporate native tree, shrub and grass species where appropriate. Where impacts to this significant remnant vegetation cannot be avoided, offsets are proposed in accordance with the *Queensland Environmental Offsets Framework*.

As part of the Project, offset areas will be established and managed to compensate for ecosystems and habitat impacted by the Project. These areas will be managed to control pest species and fire, ensuring that significant ecosystems and habitat values for significant species are retained and enhanced within the local area. **Appendix C-2 Offset Strategy** outlines the proposed framework to deliver and manage offsets.

Given the mitigation measures proposed for the Project (**Chapter 6 Terrestrial Ecology**), including the establishment of offsets where required, there is no potential for significant regional cumulative impacts on terrestrial ecology.

22.4.3 Aquatic ecology

The Project is located in the Isaac River sub-basin catchment and is crossed by five creek systems; Boomerang Creek, Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek. These watercourses are highly ephemeral, and aquatic habitat is dominated by small, isolated pools within the channel, interspersed with large areas of dry stream bed, with larger pools typically found in artificial waterbodies. Larger pools are likely to be perennial or near perennial and are considered important refugial habitat for aquatic fauna. Smaller shallower pools provide aquatic habitat for briefer periods after rainfall.

Riparian vegetation within the Project Site was identified as being disturbed to highly disturbed, with sparse to low cover of native Eucalyptus trees comprising the canopy at natural watercourse sites. Pasture grasses dominated the ground stratum. Boomerang, One Mile and Phillips Creeks were characterised by emergent plants growing in shallow water margins or dry areas adjacent to water; the only floating species were recorded in a billabong (lacustrine/palustrine) site off Phillips Creek (FRC Environmental, 2018). There were no listed threatened or protected aquatic plants present in the Isaac River sub-basin according to the available data.

Native fish species identified were common, widespread and tolerant of harsh environmental conditions (e.g. variable flow, fluctuating water quality including high turbidity and conductivity) typical of ephemeral watercourses of the region. No aquatic fauna species of special conservation significance were recorded during current or previous surveys of the Project Site and immediate surrounds. The

silver perch (*Bidyanus bidyanus*) is an EPBC Act-listed aquatic species recorded from the Isaac River sub-basin; however, this species is not within its natural distribution, they are not considered threatened in the context of the Study area or wider Isaac River sub-basin.

The Queensland *Water Act 2000* Water Plan Fitzroy Basin 2011 specifies ecological outcomes relevant to aquatic ecology:

- To protect flows and water quality for flow-spawning fish and endemic species, including the Fitzroy golden perch (*Macquaria ambigua oriens*)
- To provide for flows necessary for estuarine ecosystem functions, including flows for:
  - Barramundi (*Lates calcarifer*) and king threadfin salmon (*Polydactylus macrochir*) recruitment
  - Banana prawn (*Penaeus merguiensis*) growth.
- To provide groundwater levels to support groundwater dependent ecosystems (GDE) and wetlands.

Turbidity has consistently been detected as exceeding the relevant guideline and background concentrations of suspended solids in streams adjacent to the Project were well above applicable water quality objective (WQO) for upper Isaac River catchment waters, indicating that the streams are quite turbid in their existing condition. While a large, long-term increase in suspended solids may further degrade aquatic ecosystems, short term increases in storm events and relatively small sediment inputs from mine-related activities are unlikely to have any significant impact.

Cumulatively, the most significant potential for degradation of aquatic ecosystems may likely arise from multiple crossings of watercourses by linear infrastructure such as access roads, pipelines and powerlines. The design and construction of watercourse crossings by linear infrastructure will ensure fish passage is maintained in accordance with Queensland Department of Agriculture and Fisheries Accepted development requirements for operational work that is constructing or raising waterway barrier works (DAF, 2018). Where practical, locations will preferentially be selected in areas where the bank gradient is low and crossings will be constructed in the dry season.

The Isaac River catchment is mostly covered by either mining leases, mining claims or exploration permits (coal, petroleum and mineral). Within a highly modified environment for mining and agricultural activities in the region, development is widespread and associated activities are operating in similar ecological areas (ephemeral creeks and drainage paths).

The Project is unlikely to cause significant cumulative impacts to aquatic ecology values as the existing riparian vegetation is highly disturbed, and no conservation significant aquatic species were recorded.

Chapter 7 Aquatic Ecology further discusses the aquatic values surrounding the Project Site.

22.4.4 Surface water resources

The creeks within the Project Site are part of the Isaac River catchment, which drains to the Fitzroy River. The total catchment area for creeks and tributaries upstream and within the Project Site is approximately 590 km^2. Therefore, the total catchment area represents less than three per cent of the Isaac River catchment and approximately 0.4 per cent of the Fitzroy River catchment (142,665 km^2).

The Lower Fitzroy River and Fitzroy Barrage Water Supply Schemes have 28,621 megalitres (ML) and 62,335 ML of allocated water, respectively. The Lower Fitzroy and Fitzroy Barrage Water Supply Schemes are approximately 250 km downstream of the confluence with Isaac River. The total catchment area upstream and within the Project Site is less than 0.0004 per cent of the total catchment area for these water supply schemes. The Project is not expected to impact these water supply schemes.

BMA holds allocations of water from the Fitzroy and Burdekin water catchments and numerous licences to take water across BMA's mine sites. Raw water from BMA's existing surface water allocations will be piped to the Project Site and used to satisfy the Project's potable water and longwall mining equipment demands, with raw water used to supplement process make-up water as required. BMA will prioritise use of mine affected water (MAW) over raw water supply assuring BMA's current allocations are sufficient to meet the needs of the Project.

Cumulative impact of the Project on environmental values over time in combination with impacts created by the activities of other adjacent developments or landholders are detected by baseline monitoring. Land uses surrounding the Project Site have potential to contribute to sediment loads and

turbidity. As described in **Chapter 8 Surface Water Resources**, these land uses, and contributing factors, include:

- existing Saraji Mine operation – open cut mine, exposed soils
- nearby mine developments – open cut metallurgical coal mine, exposed soils
- agricultural land use – soil disturbance due to livestock and /or tilling
- construction/development – soil disturbance due to construction and earthworks.

Potential impacts (increased sediment load and salinity) on the water quality of the Isaac River and tributaries occurring on the Project Site will be mitigated through the use of a mine water management system, sediment basins, structures, restrictions to site water releases, progressive rehabilitation, spill controls, desilting of MAW dams, and water quality monitoring. Given the mitigation measures proposed for the Project described in **Chapter 8 Surface Water Resources**, and the mining industry standards and regulations for water quality protection, there is not expected to be significant regional cumulative impact on surface water.

The Project water management system has been designed to ensure low risk of off-site uncontrolled release of mine affected water during operations and sediment inputs can be controlled through drainage, and erosion and sediment control measures. During extreme wet seasons, BMA is seeking authority for licensed release of MAW from Process Water Dam into Boomerang Creek subject to certain conditions for release and receiving environment. On this basis, the Project is not expected to make any significant contribution to sediment loads in the Fitzroy River Basin.

22.4.5 Groundwater

A cumulative impact assessment was undertaken to assess the existing approved open cut mining operations of the Saraji Mine together with the proposed underground mine (SLR, 2023). The assessment also took into account the approved Grevillea Pit extension of the Saraji Mine (located adjacent to the Project Site). The cumulative impact assessment considered the following:

- multiple areas of groundwater abstraction
- overlapping cones of drawdown
- dewatering discharge locations
- distributions of ecosystems around the project
- catchment-scale groundwater levels.

Predictive groundwater modelling was conducted for the Project to analyse potential cumulative impacts for local scale drawdown. **Chapter 9 Groundwater** considered the modelled predictions of underground mining impacts which also included simulation of the approved Saraji Mine and the Project. The results showed the following:

- additional ingress because of proposed underground operations is 183 ML/year (0.5 ML/day) based on the model water balance data
    - groundwater outflow from the model mostly occurs via drain cells, used to simulate the open cut and underground mining activity in the model. The Project (Project model scenario) resulted in an increase in the average drain outflow (33.5 ML/day from 33.1 ML/day) predicted for the Approved model scenario
- groundwater drawdown contours will extend further to the east and north
    - the additional drawdown predicted to occur as a result of the Project, the maximum incremental drawdown, was determined by comparing the difference in predicted groundwater levels for the Approved model scenario and the Project model scenario at matching times
    - the drawdown predicted within Tertiary extends to the east and is different to the predicted drawdown in the target D seam, which extends along strike and is influenced by fault structures. The drawdown indicates that the faults are located within the more competent Permian bedrock and do not extend into the younger Tertiary age sediments.

The maximum cumulative drawdown predictions indicate the potential impacts on the Tertiary and target D seam (no drawdown in the alluvium due to the Project is predicted) due to the existing

approved mining within the model domain. The simulated cumulative drawdown shows whether the zone of impact from all the neighbouring mine operations within the model is predicted to interact with the predicted Project zone of impact in the Tertiary and the target D seam.

The maximum cumulative drawdowns represent the total impact to modelled groundwater levels resulting from all mining within the model domain. These drawdown predictions are derived by comparing the maximum difference in hydrostratigraphic unit groundwater levels for the Project model scenario with those in the theoretical “no mining” Null Run scenario, for all times during the predictive model period.

- The evaluation of cumulative impacts on the regional model scale indicated: the vast majority of these predicted cumulative drawdown impacts are not related to the Project but result from existing mining activities represented in the model.
- there are no cumulative drawdown impacts predicted for the Quaternary alluvium within or adjacent to the Project footprint
- cumulative drawdown impacts within the Tertiary indicate that the Project-related drawdown extends and interacts with the drawdown associated with the Peak Downs Mine and Saraji Mine open cut pits
- the maximum predicted cumulative drawdown in the target D seam is predicted to interact with zone of impact from the Peak Downs Mine and Saraji Mine open cut pits. This cumulative drawdown is predicted to elongate along the north-south trending fault located adjacent to the Project footprint.

Within the Project Site, the alluvial landform hosting Hughes, Boomerang, and Plum Tree creeks is extremely shallow. Phillips Creek presents terrestrial GDE (not aquatic GDE) hosting variable groundwater volumes seasonally recharged via surface flows and flooding. Vegetation fringing Hughes Creek to the east extent of EPC837does not meet the hydrological or ecological criteria for a terrestrial GDE.

Modelling associated with the Lake Vermont - Meadowbrook Project shows drawdown (greater than 20 m) will occur beneath reaches of Hughes and Phillips Creeks where terrestrial GDE have been identified and mapped. However, the risk to terrestrial GDE has been assessed as ‘Low’ to ‘Insignificant’ (3D Environmental, 2022). The interaction of modelled drawdown on Tertiary and alluvial groundwater systems has potential to compound potential impacts associated with both the Lake Vermont – Meadowbrook and SEMLP. Based on groundwater modelling from the Lake Vermont – Meadowbrook Project (JBT, 2022), groundwater drawdown in the alluvium and Tertiary sediments will directly interact with drawdown modelled for the SEMLP (SLR, 2023). In conjunction with the potential for reduced flow volumes along Hughes Creek due to mining related subsidence, the interaction between the two projects will increase the risk of impact to mapped GDE associated with Hughes Creek east of EPC837.

A groundwater monitoring program (GMP) will be developed to ensure an appropriate level of detail and scale. The purpose of the program will be to monitor the magnitude and distribution of actual changes to groundwater conditions in response to the Approved and Project mining and to provide early detection of any unforeseen impacts to groundwater levels, groundwater flows or groundwater quality The monitoring program will include, based on the mines up dip and along strike of the Project are all owned and operated by BMA, opportunities to combine groundwater monitoring data, refine the regional Bowen Basin groundwater models and model predictions, and assess mining operations to evaluate potential cumulative impacts.

The more regional groundwater monitoring, which allows BMA to detect and monitor potential groundwater related cumulative impacts, will assist in developing mine operation and closure plans to avoid, minimise, or mitigate pre- and post-closure impacts.

Given the limited quality of groundwater, the regional cumulative impact on groundwater is not considered significant. The assessment is supported by a conservative groundwater modelling approach with actual impacts expected to be equal to or lower than predictions.

22.4.6 Air quality and greenhouse gas

The airshed within which the Project will exist is complicated, with a number of existing open cut mining operations which will continue to be significant sources of dust throughout the life of the Project. The cumulative impact assessment included the following:

- Saraji Mine (existing)
- Peak Downs Mine
- Lake Vermont Mine
- The Project.

The Project involves underground mining activities and the potential for dust generation is substantially lower than surrounding open cut operations. While the Project is not considered likely to generate a significant impact on air quality, cumulative impacts are considered in relation to adjacent mining activities operated by BMA and others. As described in **Chapter 11 Air Quality and Greenhouse Gas**, cumulative impacts are assessed by:

- comparison of publicly available information reported to the National Pollutant Inventory (NPI) for adjacent projects with estimates of dust emissions from the Project
- modelling of PM_{10} (particulate matter 10 micrometres or less in diameter) emissions associated with Saraji Mine, Peak Downs Mine and the Project, combined with an estimate of non-anthropogenic background dust levels.

Results of the cumulative impact assessment based on dispersion modelling has been used to highlight the nature and extent of additional dust control options required to mitigate the risk of additional exceedances of the Queensland Environmental Protection Policy (Air Quality) objective for PM10.

For PM_{10} emissions, the **Appendix H-1 Air Quality Technical Report** found the Project was likely to contribute to less than 0.6 per cent of the total airshed loading, from four mining operations combined. Future increases or decreases in open cut mining production rates may have a significant influence on airshed loading of PM_{10} whilst the Project contribution is anticipated to be relatively consistent throughout the 20 year production schedule of the Project. Consequently, the Project is considered unlikely to generate a significant cumulative impact on air quality.

Adoption of a combination of engineering controls, dust suppression measures, rehabilitation of exposed surfaces, operational procedures, and measurement of ambient air quality is expected to result in adequate management of dust emissions from the Project and any potential cumulative impact from these emissions.

The operational phase of the Project is estimated to result in approximately 16.3 million tonnes of carbon dioxide equivalent (Mt CO_2-e) of GHG (Scope 1 and Scope 2) over the 20-year production schedule. This equates to 0.81 Mt CO_2-e on an annual basis. The annual greenhouse gas emissions for the Project represent 0.15 per cent of Australia's 2016 greenhouse gas emissions. The Project is considered to have a low vulnerability to the effects of climate change.

22.4.7 Noise and vibration

Cumulative noise impacts are assessed by considering the current or permissible noise levels from existing and future approved industry, and the predicted increase with the inclusion of the Project. In this instance, the subjective change in noise level associated with the cumulative increase in noise levels was used as the assessment metric.

The subjective effects outlined in **Chapter 12 Noise and Vibration**, based on the magnitude of change in noise levels, were used to assess the cumulative impacts of noise associated with:

- an increase in road traffic noise on nearby public roads
- an increase in rail traffic noise on the local rail network
- an increase in noise impacts to nearby receptors with regard to existing and future approved noise from other industrial noise sources.

Noise emissions during neutral and worst-case meteorological conditions were modelled for a range of construction and operational scenarios. Based on the results of the noise assessment, noise emissions from the Project during construction and operational phases were forecast to exceed the nominated noise criteria at five receptors.

The overall increase in operational mine noise levels as a result of the Project (when considering noise from the existing Saraji Mine) is predicted to be "clearly perceptible" to "twice as loud" at Saraji

Homesteads 2 and 3, “just perceptible” at the Meadowbrook Homestead, and not perceptible to most people at the other receptors.

The increase in noise levels associated with increased road traffic on public roads and rail movement on the local rail network is not predicted to be perceptible to most people, with the exception of Dysart Moranbah Road during the Financial Year (FY) 2023 when the increase is “just perceptible”.

The following co-existence agreements are currently in place, or being actively sought, at the following:

- Lake Vermont Homestead – BMA owned, when required for mining or subject to mining impacts the homestead will be vacated
- Saraji Homestead 1 – discussions between BMA and the landholder concerning a co-existence agreement have commenced
- Saraji Homestead 2 – co-existence agreement currently in place between BMA and the landholder. When required for mining or subject to mining impacts the homestead will be vacated
- Saraji Homestead 3 – co-existence agreement currently in place between BMA and the landholder. When required for mining or subject to mining impacts the homestead will be vacated
- Meadowbrook Homestead – BMA owned and unoccupied.

Notwithstanding these current or pending agreements with affected landowners, noise management strategies and treatments will be implemented for the Project. These are discussed in **Chapter 12 Noise and Vibration**. With the implementation of these management measures and landowner agreements, it is unlikely that the Project will cause any cumulative noise impacts.

22.4.8 Scenic amenity and lighting

An assessment of the potential impact of the Project on scenic amenity is presented in **Chapter 13 Scenic Amenity and Lighting**. At the regional scale, the infrastructure and landforms proposed for the Project are typical of current and previous underground mining in the area. The Project does not involve any additional overburden landforms (consistent with open cut mining) which are the most significant non-natural visual elements in the overall regional landscape. Where possible, the Project utilises existing services (power, road, rail, water) and thus potential cumulative impacts at a regional scale will be negligible.

The Project occurs in an area with few sensitive visual receptors and generally low landscape sensitivity due to the presence of extensive mining activities in the wider landscape. Much of the Project is underground but associated above-ground mine infrastructure will likely result in localised changes to views during both operation and construction and during both day and night. Affected views will primarily be experienced by travellers on Dysart-Moranbah Road and a small number of rural homesteads. No significant impacts on landscape character, scenic amenity or lighting were identified.

The above ground infrastructure elements associated with the Project will be similar in visual character and scale to the existing infrastructure associated with current mining at the existing Saraji Mine. Consequently, the contribution of the above ground infrastructure to the cumulative impacts of existing mining operations in the vicinity of the site will be very low.

22.4.9 Transport

The assessment of traffic impacts is presented in **Chapter 14 Transport**. The adopted methodology for the traffic assessment, which also addresses cumulative impacts, was centred on establishing a background ‘without development’ traffic scenario and comparing this with a scenario including the Project generated traffic, i.e. the ‘with development’ scenario. This process allows for the assessment of the traffic impacts of the Project in terms of access, intersections, link capacity, pavement and road safety.

The assessment concluded that most of the road links have exceeded the five per cent threshold. However, given the low background traffic in the network, it is anticipated that delay or congestion on the road links are unlikely to occur. Therefore, immediate road link mitigations are not warranted. The following mitigation measures are proposed to address road safety issues identified in this assessment:

- provide intersection lighting at Intersection 1 (Lake Vermont Road / Saraji Road) to improve visibility in low light conditions

- construct proposed Intersection A on Saraji Road, which would include deceleration lanes on the north and south approaches to the intersection on Saraji Road, and active devices such as boom barriers and flashing lights in addition to road lighting at the intersection
- provide intersection lighting at Intersection 3 (Peak Downs Mine Access / Peak Downs Mine Road / Saraji Road) to improve visibility in low light conditions.

The investments committed by the Department of Transport and Main Roads (DTMR) and listed in the Queensland Transport and Roads Investment Program (QTRIP) 2017-18 to 2020-21 (The State of Queensland (DTMR), 2017b) were considered in developing the mitigation measures proposed. The upgrades considered necessary and implementation would contribute to maintaining the long-term safety of road users are further described in **Chapter 14 Transport**.

Coal produced by the Project will be transported by rail along the existing Norwich Park Branch rail line. Level crossing assessments were undertaken to understand the potential impacts to road traffic, specifically vehicle queuing due to activation of the level crossings during peak traffic periods and the impact thereof on adjacent closely spaced intersections. Concept design of Level Crossing A on the Saraji East Mine access roads proposed several mitigation measures to contain the estimated vehicle queues, including:

- auxiliary turn lanes on Saraji Road to store vehicles
- stagger the workers' rosters to minimise number of vehicles at the level crossings
- vertical realignment of Saraji Road to increase queuing distance between Saraji Road and Goonyella Rail alignment.

The rail authority will be consulted on the findings of the Australian Level Crossing Assessment Model (ALCAM) assessments for all affected level crossings during the detailed design stage to determine the required treatment options for safety protection.

22.4.10 Social

The assessment of social impacts is presented in **Chapter 17 Social**. While the Project will bring with it a number of direct impacts (both positive and negative) in isolation it is unlikely to have significant impact on the local or regional communities. However, when combined with other growth projects and the expansion of mining operations by other proponents and the general increase in focus on the mining industry in general, the impacts become more significant.

The potential for cumulative social impacts during the Project's construction phase includes:

- changes to perceptions of safety or access to services resulting from an increase in non-resident workers
- safety issues associated with increased traffic volumes
- increased temporary demand on health and emergency services
- creation of additional direct and indirect local and regional employment
- contribution to regional skills shortages and labour market drain into the mining industry
- sustained and enhanced opportunities for service industries and businesses in the LGA
- new residents are likely to contribute to increased demand for childcare, and increased family support services may also be required
- new residents are likely to increase demand for school enrolments. With 260 additional residents, approximately 39 school enrolments may result in the Isaac LGA
- population increases will increase demand for settlement and community support services and recreational and cultural services
- increased workforce accommodation requirements affecting local housing affordability in Dysart, Moranbah, Middlemount and other LGA communities.

The potential cumulative social impacts to occur during the Project's operational phase include:

- contributions to an increased population growth rate in Isaac LGA

- health and safety issues associated with increased traffic volumes
- increased workforce accommodation requirements affecting local housing affordability in Dysart, Moranbah, Middlemount and other communities
- increased permanent demand on social infrastructure, including mental health, general health and emergency services
- continued provision of educational and training opportunities
- sustained opportunities for service industries and businesses in the LGA
- enhanced economic development opportunities across the Bowen Basin.

All cumulative impacts are likely to be significant, but their likelihood is unknown.

Prior to the Project's construction, BMA will reassess the potential for cumulative impacts and its local and regional implications, to inform further engagement with the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP), Isaac Regional Council (IRC) and other proponents.

The magnitude and timing of cumulative impacts of the Project are uncertain at this stage, however, it is anticipated that more than one major project will be constructed within in a similar time frame. As the Project is likely to strain social infrastructure (particularly health and emergency services), it may affect perceptions of community safety, traffic safety or access to services. If there is insufficient capacity to accommodate non-local personnel, housing impacts are likely.

Cumulative demands on Council infrastructure, community services, health and emergency services, schools, childcare and recreational infrastructure are likely as a result of multiple new coal mining projects commencing operation in the Isaac LGA. Significant demands on local housing stocks are possible, with potential for rent inflation and displacement of local residents and key workers.

Chapter 17 Social identifies that the Social Impact Assessment (SIA) includes a Social Impact Management Plan (SIMP) which details how BHP will work with local and regional stakeholders to mitigate social impacts and maximise opportunities identified in relation to the Project. This SIMP includes five Management Plans for:

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

Each Management Plan articulates:

- the overall purpose of the management plan, including social impacts and opportunities to be addressed
- the desired outcomes of the management plan, to help monitor effectiveness
- the measures designed to mitigate social impacts and enhance opportunities identified during SIA
- an action plan, providing a practical basis for implementing each measure.

A monitoring program is also provided, including outcomes sought, how management of the impacts will be monitored and reported, and the timing and frequency of monitoring. Revisions of the SIMP will account for nearby development projects and their potential impact on stakeholders.

22.4.11 Economics

The economic assessment is presented in **Chapter 18 Economics** and undertook two separate types of assessments:

- regional impact analysis, which is used to describe the size and nature of the effects on local, regional and state economies
- cost benefit analysis, which is used to identify the costs and benefits of the Project.

Additionally, assessment review of the economic baseline of the local and regional economy was undertaken.

In terms of cumulative economic impacts, the Project contributes to Queensland's most important export commodity. In the financial year ending 2017, coal contributed $3.4 billion in royalties to the Queensland Government.

Assuming Queensland coal mining royalty rates remain unchanged, the Project is expected to yield royalties of approximately $1.2 - $1.3 billion over the 20-year production schedule.

An initial capital investment of approximately $1.3 billion will be required to bring the Project to full production. Operational expenditure is estimated at $5.98 billion over the 20-year production schedule. The contribution to State royalties coupled with the direct and indirect employment opportunities and associated spending, highlights the value of the Project to Queensland.

The coal industry in the Isaac LGA employs 37.7 per cent of the total workforce. At full production, the Project will directly employ approximately 1,000 people, with many more employed indirectly as a result of flow-on opportunities.

The Project's high quality hard coking coal is attractive to overseas buyers. The Project forms part of a growth strategy designed to strategically service the expanding demands of India, China and other international metallurgical coal markets.

The cumulative economic impacts of the Project include increased export income, royalties and employment, generating wealth within Queensland and Australia that significantly benefits the wider community. An assessment of economic impacts of the Project is presented in **Chapter 18 Economics**.

22.4.12 Matters of National Environmental Significance

The MNES assessment is presented in **Chapter 21 Matters of National Environmental Significance**. The regional projects identified in Section 22.3 have been considered in terms of their proximity to the project site and their potential to interact with water resources, threatened species and ecological communities potentially impacted by the Project.

The greatest direct (clearing) and indirect (edge effects and habitat degradation) impacts are expected to occur during initial mine establishment and construction stage. Project infrastructure layout has been rearranged during the planning stage to mitigate direct impacts from removal of vegetation during construction disturbance, where possible. Following progressive rehabilitation, land-based offsets will be established and managed to compensate for Project impacts on MNES.

While fragmented and degraded habitat is not necessarily well adapted to climate change and increasing extreme climate events, BMA is well resourced and committed to progressive rehabilitation and land-based offsets that will reinstate vegetation communities and habitats that contribute to ecosystem function and actively reduce threats to biodiversity.

Subsidence impacts are included for conservatism, but long-term impacts may be far less, subject to monitoring and confirmation. With the mitigation measures outlined in **Chapter 21 Matters of National Environmental Significance**, the cumulative impacts to MNES across the region is minor.

22.5 Summary and conclusions

In summary, the following potential cumulative impacts may occur as a result of the Saraji East Mining Lease Project and other nearby projects and operations:

- terrestrial ecology
  - approximately 1,220.22 ha of remnant vegetation communities may be impacted
  - approximately 210.31 ha of the brigalow TEC may be impacted
  - given the mitigation measures proposed for the Project, including the establishment of offsets where required, there is no potential for significant regional cumulative impacts on ecology.
- aquatic ecology
  - the Project is unlikely to cause any significant cumulative impacts to aquatic ecology values as the existing riparian vegetation is highly disturbed, and no conservation significant aquatic species were recorded.
- surface water resources
  - increased sediment load and salinity
  - the site water management system for the Project has been designed such that the risk of off-site uncontrolled release of mine affected water during operations is very low
  - sediment inputs can be controlled through drainage, and erosion and sediment control measures.
- groundwater
  - limited potential for regional-scale drawdown effects
  - potential for reduced flow volumes along Hughes Creek due to mining related subsidence and an increased risk of impact to mapped GDEs associated with Hughes Creek
  - total groundwater ingress resulting from the cumulative open cut and underground mining over 25 years is estimated to be 3.57 gigalitres. This impact is not considered to be significant due to the absence of privately owned bores in the drawdown areas
  - given the limited quality of groundwater, the regional cumulative impact on groundwater is not considered significant.
- land resources
  - existing land uses such as grazing may be able to continue within the proposed mining lease, in areas not directly impacted by the mine and supporting infrastructure. The proposed post-mining land use of cattle grazing will be suitable to the area and post-subsidence landform
  - there is potential for contamination to exist at the site. Some Project activities have the potential to contaminate the Project Site as a result of the generation and handling of wastes, leading to environmental degradation
  - it is considered unlikely that the Project would have a significant impact on land and soil resources based upon the review of potential impacts, suggested mitigation measures and continual review and management of the Project Site.
- air quality and greenhouse gas
  - dust emissions are predicted to be minimal relative to existing open cut mining activities at the adjacent Saraji Mine and, therefore, the Project is not anticipated to have significant impacts on air quality
  - for fugitive PM_{10} emissions, the Project is likely to contribute to less than 0.6 per cent of the total airshed loading
  - the Project is considered unlikely to generate a significant cumulative impact on air quality
  - the annual GHG emissions for the Project represent 0.15 per cent of Australia's 2016 GHG emissions. The Project is considered to have a low vulnerability to the effects of climate change.

- noise and vibration
  - the overall increase in operational mine noise levels is predicted to be “clearly perceptible” to “twice as loud” at Saraji Homesteads 2 and 3, “just perceptible” at the Meadowbrook Homestead, and not perceptible to most people at the other receptors
  - the increase in noise levels associated with increased road traffic on public roads and rail movement on the local rail network is not predicted to be perceptible to most people, with the exception of Dysart Moranbah Road during the Financial Year (FY) 2023 when the increase is “just perceptible”
  - with the implementation of these management measures and landowner agreements, it is unlikely that the Project will cause any cumulative noise impacts.
- scenic amenity and lighting
  - no significant impacts on landscape character, scenic amenity or lighting were identified
  - the above ground infrastructure elements will be similar in visual character and scale to the existing infrastructure associated with current mining at the existing Saraji Mine.
  - the contribution to the cumulative impacts of existing mining operations in the vicinity of the site will be very low.
- transport
  - traffic is anticipated to exceed five per cent of the background traffic volumes.
  - all highway links and intersections are anticipated to operate within capacities and without significant congestion, delay and queuing. The impact to efficiency and operation of the road network is minimal
  - the adjacent road network, particularly the Peak Downs Highway and Moranbah Access Road, are expected to experience significant traffic growth due to other industrial activities planned for the vicinity.
- social
  - cumulative demands on Council infrastructure, community services, health and emergency services, schools, childcare and recreational infrastructure are likely as a result of multiple new coal mining projects commencing operation in the Isaac LGA
  - significant demands on local housing stocks are possible, with potential for rent inflation and displacement of local residents and key workers.
- economics
  - the cumulative economic impacts of the Project include increased export income, royalties and employment, generating wealth within Queensland and Australia that significantly benefits the wider community.
- MNES
  - with the outlined mitigation measures, the cumulative impacts to MNES across the region is minor.

The potential cumulative impacts identified as a result of the Project will be managed through the implementation of appropriate mitigation measures. The mitigation measures for each discipline are provided within the relevant chapter of the EIS.