Section 5

Assessment of Matters of National Environmental Significance

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

WHITEHAVEN COAL

Resource Strategies

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5 ASSESSMENT OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

5.1 INTRODUCTION

This section has been prepared in accordance with the Terms of Reference to provide a consolidated assessment of the potential impacts of the Project on relevant MNES in accordance with the requirements of the EPBC Act.

As required by the MNES-related Terms of Reference, this section has been prepared as a stand-alone section, that provides a description and assessment of the impacts associated with the Proposed Actions (EPBC 2019/8460, EPBC 2019/8459 and EPBC 2019/8458) and proposed avoidance, mitigation, management and offset measures. Information and assessment presented throughout the rest of the EIS is therefore duplicated in this section.

This section seeks to demonstrate how the Project addresses the requirements of the following:

- EPBC Act;
- Division 5.2 of the EPBC Regulations;
- the Terms of Reference, specifically as they relate to MNES; and
- Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) (2018) *Information guidelines for proponents preparing coal seam gas and large coal mining development proposals* (IESC Information Guidelines).

5.1.1 Proponent Details

The proponent for the Project is Whitehaven WS (ABN: 87 625 165 004), a wholly owned subsidiary of Whitehaven.

The registered office and postal address for Whitehaven WS is:

Whitehaven WS Pty Ltd
Level 22, 12 Creek St
BRISBANE QLD 4000
Phone: (07) 3738 2000

Environmental Record

Whitehaven WS has adhered to its regulatory responsibilities associated with the exploration activities undertaken at the Project. Whitehaven WS has not been the subject of any environmental legal proceedings.

Whitehaven Coal Limited, Whitehaven WS's parent company takes its regulatory and environmental obligations seriously. Whitehaven has successfully operated multiple mining operations for many years in the North-Western region of New South Wales and is required to comply with an extensive range of conditions within multiple regulatory approvals granted by State and Federal regulatory agencies.

While Whitehaven continually works to improve its environmental performance, systems and compliance there have been some instances of non-compliance with environmental regulation over the past decade. Whitehaven's performance is in line with NSW sector-wide performance.

Health, Safety, Environmental and Community Policy

Whitehaven has a documented Health, Safety, Environmental and Community Policy that applies to Whitehaven WS. The stated aims of this policy are to:

- *Achieve zero workplace injuries and illnesses.*
- *Achieve zero environmental incidents.*
- *Maintain mutually beneficial relationships with the communities which host our operations.*

Furthermore, Whitehaven WS intends to conduct business in a way that maintains a safe and healthy workplace for its workers, visitors, and the surrounding community, and also protects the environmental, community, and cultural heritage values of the area throughout all stages of the Project – exploration, development, operation, progressive rehabilitation, closure and associated activities.

Whitehaven WS strives to achieve the above goals by:

- Considering health, safety, environment and community matters when planning and undertaking work activities.
- Consulting and communicating health, safety, environment and community matters in a fair and effective manner.
- Having processes in place for identifying and eliminating or minimising health, safety, environment and community risks and impacts, and sharing and applying learnings in a timely manner.
- Working to continuously improve health, safety, environment and community performance.
- Providing an effective injury management and return to work program for workers.
- Complying with applicable health, safety, environment and community legislation and other requirements.
- Providing workers with necessary health, safety, environment and community information, instruction, training and supervision to enable effective performance of the work.
- Utilising health, safety, environment and community resources and processes to implement and maintain the requirements of the policy and associated management systems.

In regards to workers responsibilities, the Health, Safety, Environmental and Community Policy states:

- *Workers have a responsibility to comply with applicable legislation, this policy and associated management systems.*
- *No work is to be undertaken without a clear understanding of a safe method that minimises the risk of injury or illness, plant or equipment damage, environmental, community or cultural harm.*
- *Workers must present for work in a fit and healthy state, take reasonable care for their own health and safety and have an obligation to take reasonable care for the health and safety of others.*
- *Workers must report any workplace incidents or injuries to their supervisors in a timely manner.*
- *Workers must also comply with any reasonable instruction given by Whitehaven Coal.*

The policy would apply to the Winchester South Project.

5.1.2 Project Description

Whitehaven WS proposes to develop an open cut metallurgical coal mine approximately 30 km south-east of Moranbah, in the Isaac Regional Council LGA, within the Bowen Basin in Queensland (Figure 5-1).

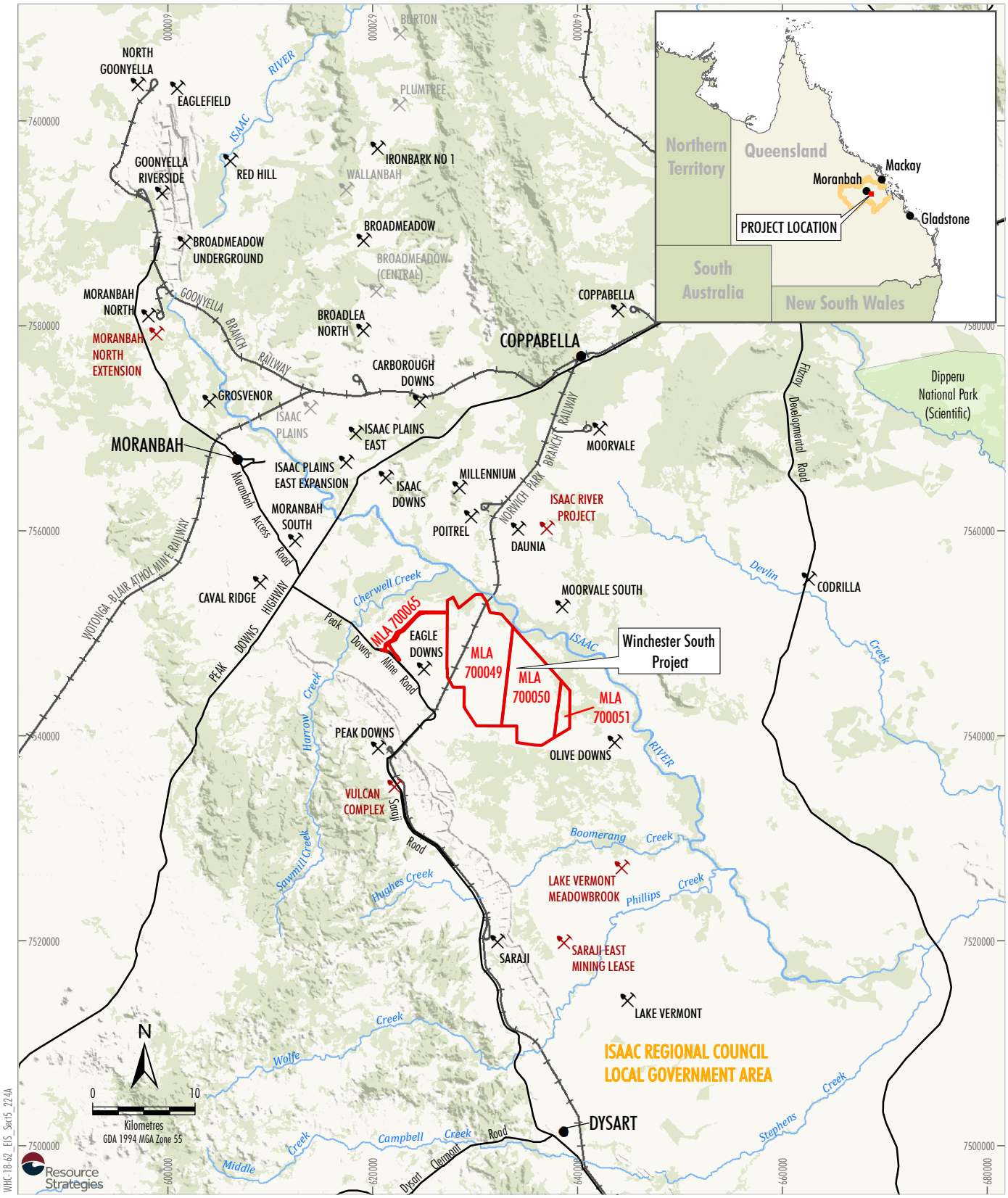
The open cut mine would produce a mix of products, including metallurgical coal, for use in the steel industry, and thermal coal.

The Project comprises an open cut coal mine and associated infrastructure corridor, including a raw water supply pipeline connecting to the Eungella pipeline network, an ETL and a mine access road (Figure 5-2). These key components of the Project and how they have been referred under the EPBC Act is described in detail in Sections 5.2.1, 5.2.2 and 5.2.3.

Project Summary

The main activities associated with the development of the Project include:

- development and operation of an open cut coal mine within MLA 700049, MLA 700050 and MLA 700051 (Figure 5-2);
- development and operation of an infrastructure corridor within MLA 700065, located outside MDL 183;
- use of open cut mining equipment to extract ROM coal with a current forecast rate of approximately 15 Mtpa (and up to 17 Mtpa);
- a mine life of approximately 30 years;
- placement of waste rock (i.e. overburden and interburden) in out-of-pit waste rock emplacements and within the footprint of the open cut voids;
- construction and operation of the MIA, including a CHPP, ROM pads, workshops, offices, raw and product handling systems, coal processing plant and train load-out facility;
- construction and operation of a Project rail spur and loop to connect the Project to the Norwich Park Branch Railway (Figure 5-2), including product coal stockpiles for loading of product coal to trains for transport to ports;



LEGEND
- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Local Government Area Boundary
- Railway
- Road

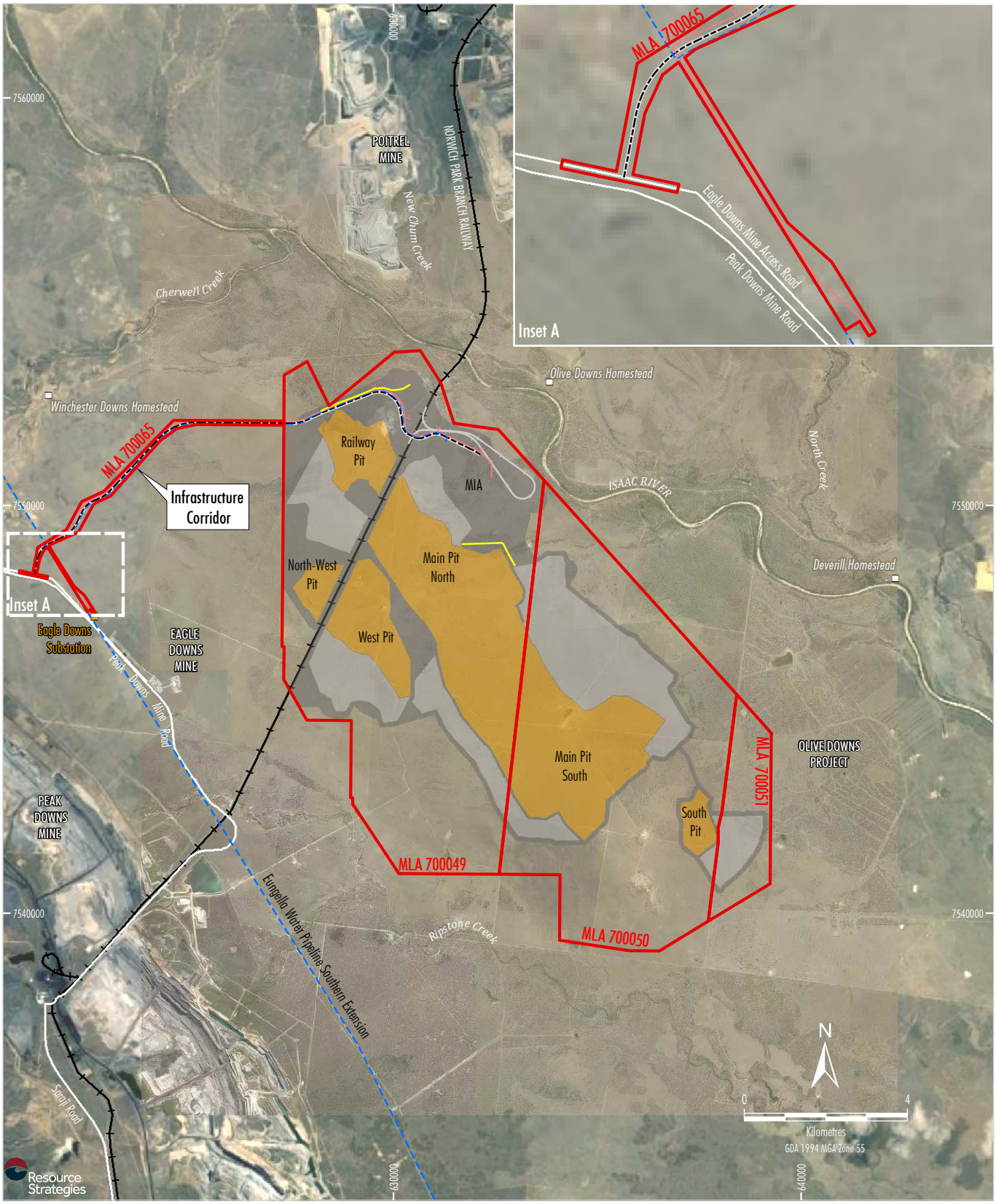
Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project Location

Figure 5-1



LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project General Arrangement

Figure 5-2

- progressive rehabilitation of out-of-pit waste rock emplacement areas;
- progressive backfilling and rehabilitation of the mine voids with waste rock behind the advancing open cut mining operations (i.e. in-pit emplacements);
- installation of a raw water supply pipeline;
- construction of a 132 kV/22 kV electricity switching/substation and 132 kV ETL to connect to the existing regional power network;
- on-site excavation, if suitable, and/or the use of the existing hard rock quarry for construction activities;
- drilling and blasting of competent overburden/waste rock material;
- construction of a mine access road (including associated railway crossing) from the Eagle Downs Mine Access Road, off Peak Downs Mine Road, to the MIA;
- construction and operation of ancillary infrastructure in support of mining, including electricity supply, consumable storage areas and explosives storage facilities;
- co-disposal of coal rejects from the Project CHPP within the footprint of the open cut voids and/or out-of-pit emplacement areas;
- progressive development and augmentation of sediment dams and storage dams, pumps, pipelines and other water management equipment and structures (including up-catchment diversions, drainage channel realignments and levees);
- progressive construction and use of soil stockpile areas, laydown areas and gravel/borrow areas (e.g. for road base and ballast material);
- progressive development of haul roads, light vehicle roads and services;
- wastewater and sewage treatment by a sewage treatment plant;
- discharge of excess water off-site in accordance with relevant principles and conditions of the *Model water conditions for coal mines in the Fitzroy basin* (DES [Department of Environment and Science], 2013);
- an on-site landfill for the disposal of selected waste streams generated on-site;
- ongoing exploration activities; and
- other associated minor infrastructure, plant and activities.

5.1.3 Consultation Undertaken

Stakeholders consulted to date include, but not limited to, the following:

- local landholders;
- local community members and groups;
- local businesses and service providers (including housing providers, emergency services, social and public service providers and public health providers);
- local and regional employment and training providers;
- Barada Barna Aboriginal Corporation (the prescribed body corporate for the Barada Barna People, the Aboriginal party for the purposes of Indigenous cultural heritage management);
- Isaac Regional Council;
- Mackay Regional Council;
- Office of the Coordinator-General;
- DAWE (Commonwealth Department of Agriculture, Water and the Environment) (formerly known as DEE [Department of Environment and Energy]);
- DES;
- DSDILGP (Department of State Development, Infrastructure, Local Government and Planning) (formerly known as the DSDMIP [Department of State Development, Manufacturing, Infrastructure and Planning]);
- DNRME (Department of Natural Resources, Mines and Energy) (now DoR [Department of Resources]);
- DATSIP (Department of Aboriginal and Torres Strait Islander Partnerships) (now part of DSDSATSIP [Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships]);

- DAF (Department of Agriculture and Fisheries);
- DTMR (Department of Transport and Main Roads);
- DHPW (Department of Housing and Public Works) (now DCHDE [Department of Communities, Housing and Digital Economy]);
- DCDSS (Department of Communities, Disability Services and Seniors) (now DSDSATSIP);
- DESBT (Department of Employment, Small Business and Training);
- Queensland Health;
- Queensland Treasury;
- Queensland Ambulance Service;
- Queensland Police Service;
- CFMEU;
- overlapping tenure holders (Arrow, South32 and Aquila Resources);
- Quarrico (operator of Winchester Quarry);
- infrastructure service providers (including Sunwater, Powerlink, Aurizon) and Ergon Energy and Yurika Pty Ltd (part of Energy Queensland); and
- nearby mining companies (BMA, South32, Pembroke, Peabody Energy, Stanmore, Jellinbah Group Pty Ltd and Aquila Resources).

Whitehaven WS continues to consult with relevant government agencies on a regular basis in relation to the Project.

The public consultation process has been undertaken cognisant of the requirements of *Preparing an Environmental Impact Statement: Guideline for Proponents* (DSDTI, 2020a).

A Public Consultation Report is provided in Attachment 4.

Consultation undertaken during development of the EIS has influenced the design of the Project. Key feedback from the consultation that has been incorporated into the design of the Project includes:

- targeting local employment and limiting the use of a FIFO workforce;
- encouraging the Project workforce to live locally;
- minimising the extent of the waste rock emplacement to avoid disturbance of MNES and MSES;
- minimising the surface disturbance associated with the Project (co-locating the ETL, raw water pipeline and mine access road within an infrastructure corridor);
- maximising feasible opportunities to backfill residual voids;
- constructing an overpass over the Norwich Park Branch Railway to avoid realignment of the railway and minimise surface disturbance;
- utilising existing accommodation options rather than constructing a temporary on-site accommodation camp for the construction workforce;
- maintaining operations at the existing on-site quarry (Winchester Quarry); and
- offsetting impacts to biodiversity.

In addition, a key concern of stakeholders was the potential for reduced availability, affordability and accessibility of housing and accommodation. To ensure the Project does not adversely affect the affordability and availability of housing and accommodation in local communities, Whitehaven WS is committed to increasing permanent housing stock through the construction of new housing stock and contributing to the Isaac Affordable Housing Trust and/or Emergency and Long-Term Accommodation Moranbah Inc.

Whitehaven WS is committed to establishing itself as a long-term community partner in the area which will make a positive contribution to community development.

Further, Whitehaven WS has developed a comprehensive Community and Stakeholder Engagement Plan which details Whitehaven WS' approach to engaging with potentially impacted communities and other Project stakeholders, and to establish constructive relationships that can continue throughout the life of the Project.

5.2 BACKGROUND

5.2.1 Referred Actions

The Project provides an opportunity to develop a predominantly metallurgical open cut coal mine and associated on-site and off-site infrastructure in an existing mining precinct for export of metallurgical coal products to the steel production industry and thermal coal for energy production.

The Project (described in Section 5.1.2) comprises the following key components in relation to assessment under the EPBC Act:

- An open cut coal mine located in MLA 700049, MLA 700050 and MLA 700051 including a mine access road connecting from Eagle Downs Mine Access Road through MLA 700065 to the Project MIA.
- A raw water supply pipeline connecting the Project MIA to the Eungella pipeline network through MLA 700065.
- An ETL connecting the Project MIA to Powerlink's Eagle Downs Substation through MLA 700065.

The Project, as three separate but related actions (mine site and access road, water pipeline and ETL), was referred to the Commonwealth Minister in May 2019 and are collectively referred to as the Proposed Actions:

- Winchester South Project Mine Site and Access Road (EPBC 2019/8460) – herein referred to as the Mine Site and Access Road Action.
- Winchester South Project Electricity Transmission Line (EPBC 2019/8458) – herein referred to as the ETL Action.
- Winchester South Project Water Pipeline (EPBC 2019/8459) – herein referred to as the Water Pipeline Action.

These Actions, when referred, captured large areas for each action, to allow for detailed planning and analysis to be undertaken. The more detailed planning resulted in subsequent reduction in impacts to MNES.

The EPBC Act defines a proposal that is likely to have a significant impact on a MNES as a "controlled action". MNES are set out in Part 3 of Chapter 2 of the EPBC Act as follows:

- world heritage properties;
- national heritage places;
- wetlands listed under the Ramsar Convention;
- listed threatened species and communities;
- listed migratory species;
- nuclear actions;
- the Commonwealth marine environment;
- the Great Barrier Reef Marine Park; and
- water resources, in relation to coal seam gas development and large coal mining developments.

5.2.2 Controlled Action Decision

On 17 and 18 July 2019, a delegate of the Commonwealth Minister determined each of the referred Actions as controlled actions under the EPBC Act, subject to the following controlling provisions:

- Mine Site and Access Road Action (EPBC 2019/8460):
  - listed threatened species and communities (sections 18 and 18A of the EPBC Act); and
  - a water resource, in relation to coal seam gas development and large coal mining development (the water trigger) (sections 24D and 24E of the EPBC Act).
- ETL Action (EPBC 2019/8458) – listed threatened species and communities (sections 18 and 18A of the EPBC Act).
- Water Pipeline Action (EPBC 2019/8459) – listed threatened species and communities (sections 18 and 18A of the EPBC Act).

The DEE (now DAWE) also advised that the Project will be assessed under the bilateral assessment agreement between the Commonwealth of Australia and the State of Queensland, in accordance with section 45 of EPBC Act.

Following receipt of the Coordinator-General's Evaluation Report, the Commonwealth Minister will consider the report when making the decision whether to grant approval under the EPBC Act.

5.2.3 Allocation of Disturbance

In accordance with the EPBC Act and the Terms of Reference, each Proposed Action is to be assessed individually as well as cumulatively.

As a result of more detailed mine planning and analysis undertaken since referral of the actions in 2019, there has been a significant reduction of the areas required for each action. An example of this is through the co-location of the ETL Action, Water Pipeline Action and access road component of the Mine Site and Access Road Action within a single consolidated corridor.

As described above, as all three Proposed Actions overlap and share common disturbance (to some extent), the following approach has been applied.

Figure 5-3 provides a graphical depiction of the indicative layout and overlap of all three Proposed Actions.

Mine Site and Access Road Action (EPBC 2019/8460)

The Mine Site and Access Road Action assesses all surface disturbance within MLA 700049, MLA 700050 and MLA 700051.

ETL Action (EPBC 2019/8458)

All three Proposed Actions that traverse MLA 700065 share a common disturbance corridor, including for construction (e.g. access tracks, laydown areas, construction disturbance, trenching, erosion control, water management, etc.) and operation.

The co-location of the three Proposal Actions within MLA 700065 is the outcome of various analyses intended to significantly reduce the disturbance footprint of the overall Project (i.e. all three Actions combined) compared to the Project referred to the Commonwealth Minster in 2019 (Section 5.2.1).

Therefore, the impacts from all three of the Proposed Actions (i.e. the facilitated impacts of the three Proposed Actions) within MLA 700065 associated with "*listed threatened species and communities*" are assessed against the ETL Action (EPBC 2019/8458) (Figure 5-3).

Figure 5-3 provides a graphical depiction of the indicative layout of all three Proposed Actions as well as a graphical depiction of MLA 700065 in which all disturbance is assessed against the ETL Action (EPBC 2019/8458).

Water Pipeline Action (EPBC 2019/8459)

As previously described, the Water Pipeline Action, ETL Action, and access road component of the Mine Site and Access Road Action are co-located within MLA 700065. This co-location is the outcome of various studies aimed at reducing the overall disturbance footprint of the Project's three Actions and to consolidate surface disturbance where possible, relating to each Action into a single corridor.

As the water pipeline is co-located within the same footprint as the ETL, all impacts associated with the Water Pipeline Action are facilitated (and assessed) by the ETL Action (i.e. EPBC 2019/8458 and EPBC 2019/8460). Table 5-1 provides a summary of the disturbance associated with each Proposed Action.

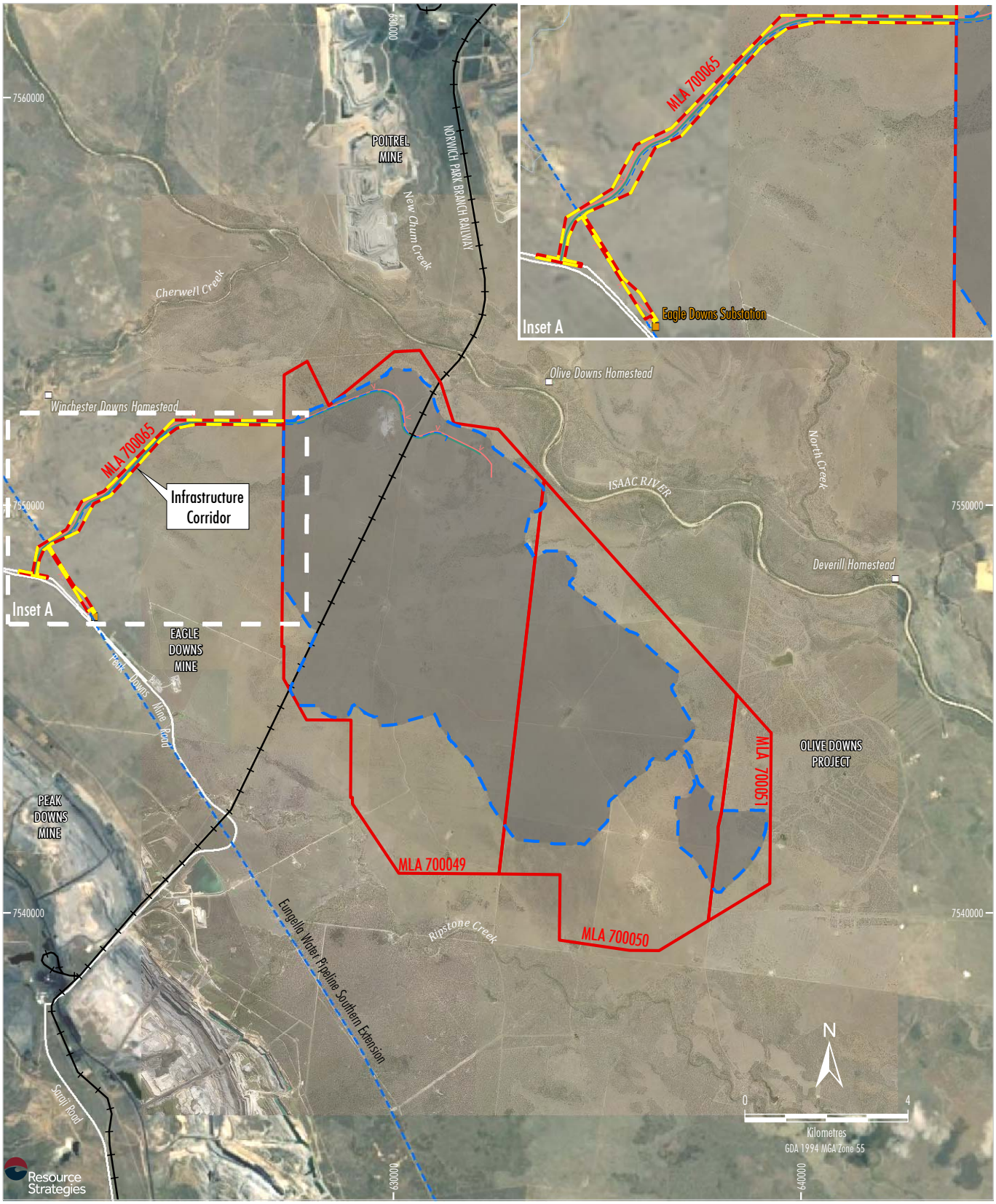
Table 5-1
Summary of Disturbance Areas

Proposed Action	Disturbance Area (ha)
Mine Site and Access Road Action (EPBC 2019/8460)	6,994
ETL Action (EPBC 2019/8458)	136
Water Pipeline Action (EPBC 2019/8459)	0

5.2.4 Commonwealth Requirements

A reconciliation of each of the Commonwealth requirements listed within the Terms of Reference for each Proposed Action and where each requirement is addressed in this EIS is provided in Table 5-2.

In addition, a reconciliation of the matters outlined in Division 5.2 of the EPBC Regulations to be addressed in this EIS and the IESC Information Guidelines (IESC, 2018) is provided in Tables 5-3 and 5-4, respectively.



LEGEND

Mining Lease Application Boundary

Substation

EPBC Proposed Actions - Indicative Layouts*

Mine Site and Access Road (EPBC 2019/8460) (Mine Site)

Mine Site and Access Road (EPBC 2019/8460) (Access Road)

Electricity Transmission Line (EPBC 2019/8458)

Water Pipeline (EPBC 2019/8459)

Note:

* Indicative layout shown based on current mine planning and is subject to change based on detailed mine planning with offsets provided prior to on-ground impacts.

EPBC Proposed Actions - Disturbance Extent#

Electricity Transmission Line (EPBC 2019/8458)

Mine Site and Access Road (EPBC 2019/8460)

Note:# Disturbance associated with the Electricity Transmission Line (EPBC 2019/8458), Water Pipeline (EPBC 2019/8459) and Mine Site and Access Road (EPBC 2019/8460) within MLA 700065 is assessed under the Electricity Transmission Line (EPBC 2019/8458).

Disturbance associated with the Electricity Transmission Line (EPBC 2019/8458), Water Pipeline (EPBC 2019/8459) and Mine Site and Access Road (EPBC 2019/8460) within MLA 700049, MLA 700050 and MLA 700051 is assessed under the Mine Site and Access Road (EPBC 2019/8460).

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

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WINCHESTER SOUTH PROJECT

EPBC Act Assessment Areas

Figure 5-3

Table 5-2
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Matters of National Environmental Significance (MNES)		
Background and Context		
11.141	On 13 May 2019, the proponent referred the project as three separate proposed actions for a 'controlled action' decision under the EPBC Act (EPBC 2019/8460 Mine Site and Access Road; EPBC 2019/8459 Water Pipeline; EPBC 2019/8458 Electricity Transmission Line). It is expected that the EIS will relate to all three proposed actions.	Noted
11.142	The Commonwealth Minister for the Environment may determine that the project will have or is likely to have a significant impact upon the following matters of national environmental significance under the EPBC Act: (a) For the Winchester South Mine Site and Access Road (EPBC 2019/8460): ▪ listed threatened species and communities (sections 18 and 18A) ▪ a water resource, in relation to coal seam gas and large coal mining (sections 24D and 24E). (b) For the Winchester South Water Pipeline (EPBC 2019/8459): ▪ listed threatened species and communities (sections 18 and 18A). (c) For the Winchester South Electricity Transmission Line (EPBC 2019/8458): ▪ listed threatened species and communities (sections 18 and 18A).	Noted
11.143	The EIS is to be prepared pursuant to the Bilateral Agreement. It must meet the impact assessment requirements under both Commonwealth and Queensland legislation. The projects will require approval from the responsible Commonwealth minister under Part 9 of the EPBC Act before they can proceed.	Sections 1.7, 4 and 5
11.144	Therefore, the EIS should include a stand-alone MNES chapter providing description and detailed assessment of the impacts for the proposed mine and access road (EPBC 2019/8460), the proposed water pipeline (EPBC 2019/8459) and the proposed electricity and transmission line (EPBC 2019/8458) separately, inclusive of any avoidance, mitigation and offset measures. All information relevant to the assessment of the above controlling provisions must be included in the MNES chapter and reference to other chapters in the EIS or appendices must be kept to a minimum.	Sections 5.2.3, 5.4, 5.5, 5.6, 5.7, 5.8 and 5.9
11.145	Once the EIS has been prepared to the satisfaction of the Coordinator-General and MNES addressed to the satisfaction of the Commonwealth Department of the Environment and Energy, the EIS will be made available for public comment.	Noted
11.146	The proponent may be required by the Coordinator-General or the Department of the Environment and Energy to provide additional material to address matters raised in submissions on the EIS.	Noted
11.147	At the conclusion of the environmental assessment process, the Coordinator-General will provide a copy of the report to the Commonwealth Minister for the Environment, in accordance with Part 13, section 36(2) of the State Development and Public Works Organisation Regulation 2010 (Qld).	Noted
11.148	After receiving the evaluation report and sufficient information about the relevant impacts of the actions, the Commonwealth Minister for the Environment has 30 business days to consider whether the impacts of the proposals are acceptable, or not, and to decide whether or not to approve each controlling provision.	Noted
11.149	The Commonwealth Minister's decision is separate to the approval decisions made by Queensland state agencies and other entities with jurisdiction on state or local matters.	Noted

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Background and Context (Continued)		
11.150	In accordance with the Bilateral Agreement, the EIS must: (a) assess all relevant impacts that each proposed action has, will have or is likely to have; (b) provide enough information on each proposed action and its relevant impacts to allow the Commonwealth Minister for the Environment to make an informed decision whether or not to approve the action under Part 9 of the EPBC Act; and (c) address the matters mentioned in Division 5.2 of the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) (EPBC Regulations).	Table 5-3; Sections 5.4, 5.5, 5.6 and 5.7; Section 2.1.1 of Appendix A; Section 2.1 of Appendix B; Sections 7 and 8.1 and Appendix G of Appendix D; Section 5.15 of Appendix E
11.151	A cross-reference to the relevant sections in the MNES chapter that addresses each of the matters mentioned in Division 5.2 of the EPBC Regulations should be provided.	Table 5-3
11.152	Consideration is to be given to any relevant information, advice, policy statements and guidelines (available at **www.environment.gov.au**) including but not limited to: (a) Significant impact guidelines 1.1 - Matters of National Environmental Significance (see Appendix 1) (b) Significant impact guidelines 1.3 - coal seam gas and large coal mining developments – impacts on water resources (see Appendix 1) (c) *Environment Protection and Biodiversity Conservation Act 1999* (d) EPBC Act Environmental Offsets Policy (see Appendix 1) (e) Species Profile and Threats (SPRAT) Database; and (f) any approved conservation advices, recovery plans and threat abatement plans (as relevant) for listed threatened species and ecological communities.	Sections 5.3.1, 5.3.2, 5.3.4, 5.3.5 and 5.4 to 5.9; Sections 2 and 7 of Appendix A; Section 2 of Appendix B; Sections 3.2, 7, 8.1, 10.2, 11 and Appendices D and G of Appendix D; Sections 3.6, 3.7, 3.10, 5.15 and 7 of Appendix E
11.153	The proposed mine and access road (EPBC 2019/8460), the proposed water pipeline (EPBC 2019/8459) and the proposed electricity and transmission line (EPBC 2019/8458) should each initially be assessed in their own right. How each proposed action relates to the other proposed actions should also be addressed.	Sections 5.2.3, 5.4, 5.5, 5.6 and 5.7; Section 8.1 of Appendix D; Sections 5.15.1, 5.15.2 and 5.15.3 of Appendix E
11.154	Predictions of the extent of threat (risk), impact and the benefits of any avoidance, mitigation and management measures proposed, must be scientifically robust, supported by relevant suitably qualified experts and/or supported by technical data. Reference all sources of information relied upon and provide an estimate of the reliability of predictions.	Sections 5.4, 5.5.6, 5.5.8, 5.5.9, 5.5.11, 5.6.6, 5.6.7, 5.6.8, 5.7.6, 5.7.7, 5.7.8, 5.8 and 9; Attachment 3; Sections 6, 7, 8, 9 and 10 and Appendices A1 to B of Appendix A; Sections 6, 7, 8, 9, 10, 11 and 12 and Appendices A to F of Appendix B; Sections 7, 8, 9, 10 and 13 and Appendices B to I of Appendix D; Sections 5.15, 6.8 and 9 and Appendices A to E of Appendix E
11.155	Any positive impacts on relevant MNES may be identified and evaluated.	Sections 5.4, 5.5, 5.6, 5.7 and 5.8; Sections 10.3, 10.4 and 11 of Appendix D; Sections 6.1, 6.2 and 6.8 of Appendix E

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Background and Context (Continued)		
11.156	The MNES chapter should describe any additional new field work, modelling or testing that, when used in conjunction with existing information, provides sufficient confidence in predictions so that well-informed decisions can be made. The extent of any new field work, modelling or testing should be commensurate with risk.	Sections 5.4, 5.5.6, 5.5.7, 5.5.8, 5.5.9, 5.5.11, 5.6.6, 5.6.7, 5.6.8, 5.7.6, 5.7.7, 5.7.8 and 5.8; Attachment 3; Sections 5 and 6 and Appendices A1 to B of Appendix A; Sections 6, 7, 8 and 9 and Appendices A to F of Appendix B; Section 3 and Appendices B, C, E, F and I of Appendix D; Sections 2, 3 and 4 of Appendix E
Assessment Requirements		
11.157	The MNES chapter is to provide background to each proposed action and describe in detail all aspects of each proposed action, including but not limited to, the construction, operational and (if relevant) decommissioning aspects, including: (a) the precise location of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of each aspect that may have impacts on any matter protected under each relevant controlling provision; and (b) details on how the works are to be undertaken (including stages of development and their timing) and design parameters for those parts of the structures or elements that may have relevant impacts.	Sections 5.5.1, 5.5.2, 5.6.1, 5.6.2, 5.7.1 and 5.7.2
11.158	The MNES chapter must also provide details on the current state of each proposed action as well as the consequences of not proceeding with each proposed action and the project as a whole.	Sections 5.5.3, 5.6.3, 5.7.3 and 5.9.4
11.159	Project alternatives must be discussed in accordance with Schedule 4, section 2.01(g) of the EPBC Regulations, including: (a) if relevant, the alternative of taking no action; (b) a comparative description of the impacts of each alternative on the triggered MNES protected by controlling provisions of Part 3 of the EPBC Act for the action; and (c) sufficient detail to make clear why any alternative or option is preferred to another.	Sections 5.5.4, 5.6.4, 5.7.4 and 5.9.4
11.160	The short, medium and long-term advantages and disadvantages of the alternatives must be discussed.	Sections 5.5.4, 5.6.4 and 5.7.4
Listed Threatened Species and Communities (Sections 18 and 18A)		
Existing Environment		
11.161	The MNES chapter must describe the listed threatened species and ecological communities identified below (including EPBC Act listing status, distribution, life history and habitat).	Sections 5.3.4 and 5.3.5; Sections 4.5, 5.3 and 5.4 Appendices D and G of Appendix D; Sections 3.6.1, 3.6.2, 3.7.1, 3.7.2 and 3.10 of Appendix E
11.162	Provide details of the scope, methodology, timing and effort of surveys for each proposed action (including areas outside of each proposed action area which may be impacted by each proposed action), and include details of: (a) the application of best practice survey guidelines; (b) how studies or surveys are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements.	Sections 5.3.4 and 5.3.5; Section 3 of Appendix D; Sections 1.2, 2.1, 2.1.2, 2.1.2.1, 2.1.2.2, 2.1.2.6 and 2.1.2.8 of Appendix E

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Existing Environment (Continued)		
11.163	The MNES chapter must include records identified from field surveys of the below listed threatened species and ecological communities within and/or adjacent to the project site for each proposed action. The records must include a description of the habitat in which the record was identified.	Sections 5.3.2, 5.3.4 and 5.3.5; Sections 4.4, 5.3, 5.4, 8.1 and Appendices B and C of Appendix D; Sections 3.7 and 3.10.1 of Appendix E
11.164	The MNES chapter must include known historical records of the below listed threatened species and ecological communities in the broader region. All known records must include the source (i.e. Commonwealth and State databases, published research, publicly available survey reports, etc.), the year of the record and a description of the habitat in which the record was identified.	Sections 5.3.2, 5.3.4, 5.3.5 and 5.4; Figures 9 and 19 and Appendix B of Appendix D
11.165	The MNES chapter must include a detailed habitat assessment for each of the below listed threatened species and ecological communities within the project site of each proposed action. The habitat assessments must: (a) consider habitat use requirements (e.g. denning, foraging, breeding, nesting, dispersal, etc.); (b) be informed by desktop analysis and field surveys; (c) be in accordance with a departmental, state or local government habitat quality assessment methodology, and be included in an appendix to the EIS, along with the justification for using the chosen methodology; (d) consider relevant departmental documents (e.g. approved conservation advices, recovery plans, draft referral guidelines and listing advices), the SPRAT Database; and (e) be supported by relevant published research (if required).	Sections 5.3.4, 5.3.5 and 5.4; Sections 5.3 and 8 and Appendices D and G of Appendix D; Sections 2.1.1, 2.1.2, 2.1.2.3, 2.1.2.8, 3.7, 3.10.1 and 9 of Appendix E
11.166	The MNES chapter must include the area (in hectares) and quality of all suitable habitats within each proposed action.	Sections 5.3.4 and 5.3.5; Sections 5.3, 8.1 and 11.1 of Appendix D; Sections 3.7, 3.10 and 5.15 of Appendix E
11.167	The MNES chapter must include detailed mapping of suitable habitat for the below listed threatened species and ecological communities within each proposed action, which must: (a) be specific to the habitat assessment undertaken for each listed threatened species and ecological community (Note: provision of Queensland Regional Ecosystems alone is not adequate); (b) include an overlay of the disturbance footprint; (c) include known records of individuals from desktop analysis and/or field surveys; and (d) be provided separately as attachments in a JPEG format.	Refer to Figures in Sections 5.3.4 and 5.3.5; Figure 8A to 8E and 13 to 18 of Appendix D; Refer to Maps in Sections 3.7, 3.10.1 and 5.15 of Appendix E
11.168	For each proposed action, describe and assess the impacts (direct, indirect and consequently) to each listed threatened species and ecological community identified below, and any others that are found to be or may potentially be present in areas that may be impacted by any stages of each proposed action in accordance with the Significant impact guidelines 1.1 - Matters of National Environmental Significance (see Appendix 1).	Sections 5.4.5, 5.5.9, 5.6.7 and 5.7.7; Sections 7 and 8.1 and Appendix G of Appendix D; Sections 5.5, 5.6, 5.10, 5.11 and 5.15 of Appendix E
11.169	Identify which aspect of each proposed action is of relevance to each listed threatened species or ecological community or if the threat of impact relates to consequential actions.	Sections 5.4, 5.5.6, 5.6.6 and 5.7.6; Section 8.1 and Appendix G of Appendix D; Section 5.15 of Appendix E

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Impact Assessment		
11.170	The MNES chapter must identify and address cumulative impacts, where potential project impacts are in addition to existing impacts of other activities (including known potential future projects by the proponent and/or other proponents in the region and vicinity).	Sections 5.4.6 and 5.5.10; Sections 7.13, 8 and Appendix G of Appendix D; Section 5.14 of Appendix E
11.171	The impacts must be assessed in accordance with relevant departmental policies and guidelines, and information provided in the SPRAT Database. Any technical data and other information used or needed to make a detailed assessment of the relevant impacts must be included as appendices to the EIS.	Sections 5.4, 5.5, 5.6 and 5.7; Appendices A, B, D, E and F
11.172	Where relevant, the MNES chapter is to demonstrate that each proposed action will have regard to any approved conservation advice.	Sections 5.3.4, 5.3.5 and 5.5.11; Sections 3.2, 8 and 10.2 and Appendix G of Appendix D; Section 3.7 of Appendix E
11.173	Where relevant, the EIS is to demonstrate that each proposed action will not be inconsistent with: (a) Australia's obligations under: iv. the Biodiversity Convention; v. the Convention on the Conservation of Nature in the South Pacific (Apia Convention);	Not relevant to the controlling provisions
	(b) any relevant recovery plans or threat abatement plans.	Sections 5.3.5, 5.4.2, and 5.4.3; Sections 3.2 and 10.4 and Appendix H of Appendix D
11.174	The MNES chapter must include detailed descriptions of measures proposed to be undertaken by the proponent to avoid, mitigate and manage relevant impacts of all stages of each proposed action on listed threatened species and communities. The proposed measures should be based on best available practices, appropriate standards and supported by scientific evidence. The MNES chapter must include: (a) proposed measures to be undertaken to avoid and mitigate the relevant impacts of each proposed action on listed threatened species and communities, including those required by other Commonwealth, State and local government approvals; (b) an assessment of the predicted effectiveness of the proposed measures; (c) any statutory or policy basis for the proposed measures, including reference to the SPRAT Database and relevant approved conservation advices, and a discussion on whether the proposed measures are not inconsistent with relevant recovery plans and threat abatement plans; (d) details of ongoing management, including monitoring programs to support an adaptive management approach and determine the effectiveness of the proposed measures; (e) details on measures, if any, proposed to be undertaken by State and local government, including the name of the agency responsible for approving each measure; and (c) information on the timing, frequency and duration of the measures to be implemented.	Sections 4.5.4, 5.5.11, 5.6.8, 5.7.8 and 5.8; Attachment 5; Section 10 of Appendix D; Section 6 of Appendix E
11.175	All proposed measures should consider the 'S.M.A.R.T' principle: (a) S – Specific (what and how); (b) M – Measurable (baseline information, number/value, auditable); (c) A – Achievable (timeframe, money, personnel); (d) R – Relevant (conservation advices, recovery plans, threat abatement plans, scientific evidence); and T – Time-bound (specific timeframe to complete.	Sections 4.5.4, 5.5.11, 5.6.8, 5.7.8 and 5.8; Attachment 5; Section 10 of Appendix D; Section 6 of Appendix E

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Mitigation Measures		
11.176	An outline of an Environmental Management Plan (EMP) that sets out the framework for management, mitigation and monitoring of relevant impacts of the proposed actions, including any provisions for independent environmental auditing, may be included as an appendix to the EIS.	Sections 5.4.2, 5.4.3, 5.5.11, 5.6.8 and 5.7.8; Section 10.4 of Appendix D
List of Potential Listed Threatened Species		
11.177	The MNES chapter is to address impacts on, but not limited to, the following listed threatened species for each proposed action: Bird (a) Red Goshawk (*Erythrotriorchis radiatus*) – vulnerable; (b) Squatter Pigeon (southern) (*Geophaps scripta scripta*) – vulnerable; (c) Painted Honeyeater (*Grantiella picta*) – vulnerable; (d) Star Finch (eastern) (*Neochmia ruficauda ruficauda*) – endangered; (e) Australian Painted Snipe (*Rostratula australis*) – endangered; (f) Curlew Sandpiper (*Calidris ferruginea*) – migratory, critically endangered; Fish (a) Murray Cod (*Maccullochella peelii*) – vulnerable; Mammal (a) Northern Quoll (*Dasyurus hallucatus*) – endangered; (b) Ghost Bat (*Macroderma gigas*) – vulnerable; (c) Corbens Long-eared Bat (*Nyctophilus corbeni*) – vulnerable; (d) Greater Glider (*Petauroides volans*) – vulnerable; (e) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)*) – vulnerable; Reptile (a) Southern Snapping Turtle (*Elseya albagula*) – critically endangered; (a) Fitzroy River Turtle (*Rheodytes leukops*) – vulnerable; (b) Yakka Skink (*Egernia rugosa*) – vulnerable; (c) Dunmall's Snake (*Furina dunmalli*) – vulnerable; (d) Allan's Lerista (*Lerista allanae*) – endangered; (e) Ornamental Snake (*Denisonia maculata*) – vulnerable; Flora (a) Marlborough Blue (*Cycas ophiolitica*) – endangered; (b) King Blue-grass (*Dichanthium queenslandicum*) – endangered; (c) Quassia (*Samadera bidwillii*) – vulnerable;	Sections 5.4.2, 5.4.6, 5.5.6, 5.6.6 and 5.7.6; Section 8.1 and Appendix G of Appendix D; Sections 3.7.1, 3.7.2, 3.10.1 and 5.15 of Appendix E
List of Potential Listed Threatened Ecological Communities		
11.178	The EIS is to address impacts on, but not limited to, the following listed threatened ecological communities for each proposed action: (a) Brigalow (*Acacia harpophylla* dominant and co-dominant) – endangered; and (b) Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – endangered. (c) Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions - endangered.	Sections 5.4.3, 5.4.6, 5.5.6, 5.6.6 and 5.7.6; Section 8.1 and Appendix G of Appendix D

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
A Water Resource, in Relation to Coal Seam Gas Development and Large Coal Mining Development		
11.179	The National Partnership Agreement on Coal Seam Gas and Large Coal Mining, to which Queensland is a signatory, specifies that all coal seam gas and large coal mining proposals that are likely to have a significant impact on water resources are to be referred to the Independent Expert Scientific Committee (IESC) for advice.	Noted
11.180	In relation to the proposed mine and access road (EPBC 2019/8460), the MNES chapter must provide details on the use and interference with the current state of groundwater and surface water in the region as well as any use of these resources.	Section 5.5.8; Section 5 of Appendix A; Sections 8, 9 and 10 of Appendix B; Section 5.15.1 of Appendix E
11.181	The MNES chapter is to describe and assess the impacts to water resources giving consideration to the Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (see Appendix 1).	Sections 5.3.7, 5.5.7, 5.5.8 and 5.5.9; Section 7 of Appendix A; Section 10 of Appendix B
11.182	The MNES chapter is to address the information requirements contained in the Information guidelines for proponents preparing coal seam gas and large coal mining development proposals and provide a cross-reference table to identify where each component of the guidelines has been addressed (see Appendix 1). Explanatory notes on the IESC information guidelines may assist in addressing the information requirements: (a) Information Guidelines explanatory note - Uncertainty analysis–Guidance for groundwater modelling within a risk management framework; (b) Information Guidelines explanatory note - Assessing groundwater-dependent ecosystems; and (c) Information Guidelines explanatory note - Deriving site-specific guideline values for physio-chemical parameters and toxicants.	Table 5-4; Sections 5.3.7, 5.3.8, 5.5.7, and 5.5.8; Sections 2.1.1 and 5 and Appendix B of Appendix A; Section 2.1 of Appendix B; Sections 3.2, 4, and 6 of Appendix F
Offsets		
11.183	For each of the proposed actions the MNES chapter must include an assessment of the likelihood of residual significant impacts occurring on listed threatened species and communities after avoidance, mitigation and management measures relating to the projects have been applied. If it is determined that a residual significant impact is likely, include a draft Offset Management Strategy (as an appendix to the EIS) that provides, at a minimum: (a) details of the environmental offset/s (in hectares) for residual significant impacts of the proposed action on relevant MNES, and/or their habitat; (b) details of how the environmental offset/s meets the requirements of the Department's EPBC Act Environmental Offsets Policy (2012) (EPBC Act Offset Policy), including the Offsets Assessments Guide, available at: **www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy**; (c) details of a strategy for the staging of environmental offset/s for each project stage (if proposed); (d) details of appropriate offset area/s (including a map) to compensate for the residual significant impact on relevant MNES, and/or their habitat; (e) information about how the proposed offset/s area provides connectivity with other relevant habitats and biodiversity corridors; and (f) details of the mechanism to legally secure the environmental offset/s (under Queensland legislation or equivalent) to provide protection for the offset area/s against development incompatible with conservation.	Section 5.8; Attachment 5

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Offsets (Continued)		
11.184	If available, include a draft Offsets Management Plan which also provides (where possible): (a) a field validation survey and baseline description of the current condition (prior to any management activities) of the offset area/s, including existing vegetation, for relevant MNES, and/or their habitat; (b) a description and map (including shapefiles) to clearly define the location and boundaries of the proposed offset area/s, accompanied by the offset attributes (e.g. physical address of the offset area/s, coordinates of the boundary points in decimal degrees, the MNES that the environmental offset/s compensates for, and the size of the environmental offset/s in hectares); (c) a description of the management measures (including timing, frequency and duration) that will be implemented in the offset area/s; (d) a discussion of how proposed management measures take into account relevant approved conservation advices and are consistent with the measures contained in relevant recovery plans and threat abatement plans; (e) completion criteria and performance targets for evaluating the effectiveness of the Offset Management Plan implementation, and criteria for triggering corrective actions; (f) a program to monitor, report on and review the effectiveness of the Offset Management Plan; (g) a description of potential risks to the successful implementation of the environmental offset/s, and contingency measures that would be implemented to mitigate against these risks; and (h) details of the mechanism to legally secure the environmental offset/s (under Queensland legislation or equivalent) to provide enduring protection for the offset area/s against development incompatible with conservation.	Attachment 5
11.185	The draft Offset Management Plan must be prepared by a suitably qualified person and in accordance with the Department's *Environmental Management Plan Guidelines* (2014), available at: **www.environment.gov.au/epbc/publications/environmental-managementplan-guidelines**.	Attachment 5
Project Proponent		
11.186	The MNES chapter is to include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: (a) the person proposing to take the action; and (b) for an action for which a person has applied for a permit, the person making the application.	Section 5.1.1
11.187	If the person proposing to take the action is a corporation—details of the corporation's environmental policy and planning framework must also be included.	Section 5.1.1
Social and Economic		
11.188	The social and economic impacts of each proposed action, both positive and negative are to be analysed. Matters of interest may include: (a) details of any public consultation activities undertaken, and their outcomes; (b) details of any consultation with Indigenous stakeholders; (c) projected economic costs and benefits of each proposed action, including the basis for their estimation through cost/benefit analysis or similar studies; and (d) employment and other opportunities expected to be generated by each proposed action (including construction and operational phases) and the project as a whole.	Sections 5.1.3 and 5.9; Attachment 4; Sections 2 and 6 of Appendix C; Sections 4 and 5 and Appendix C of Appendix K

Table 5-2 (Continued)
MNES Terms of Reference Reconciliation Table

Number	Assessment Requirement	EIS Reference
Social and Economic (Continued)		
11.189	Social and economic impacts should be considered at the local, regional and national levels. Details of the relevant cost and benefits of alternative options to each proposed action must also be included.	Sections 5.5.4, 5.6.4, 5.7.4, 5.9.3 and 5.9.4; Sections 2 and 6 of Appendix C; Sections 4 and 5 and Appendix C of Appendix K
Project Approvals Process		
11.190	The MNES chapter must include information on any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to each proposed action. This must include: (a) details of any local or State Government planning scheme, or plan or policy under any local or State Government planning system that deals with each proposed action, including: i. what environmental assessment of each proposed action has been, or is being, carried out under the scheme, plan or policy; and ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts; iii. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to each action; iv. a statement identifying any additional approval that is required; and v. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to each action.	Sections 1.7 and 5.3.1
Conclusion		
11.191	The MNES chapter is to include an overall conclusion for each proposed action as to the environmental acceptability of the proposed action on each relevant matter protected by the EPBC Act, including: (a) a discussion on the consideration with the requirements of the EPBC Act, including the objects of the EPBC Act, the principles of ecologically sustainable development and the precautionary principle; (b) reasons justifying undertaking each proposed action in the manner proposed, including the acceptability of the avoidance and mitigation measures; and (c) if relevant, a discussion of residual significant impacts and any offsets and compensatory measures proposed or required for residual significant impacts on relevant matters protected by the EPBC Act, and the relative degree of compensation and acceptability.	Sections 5.8 and 5.9; Attachment 5

Table 5-3
Division 5.2 of EPBC Regulations Reconciliation Table

Requirement	EIS Reference
1. General Information	
1.01 The background of the action including: *(a) the title of the action;*	Section 5.2.1
(b) the full name and postal address of the designated proponent;	Section 5.1.1
(c) a clear outline of the objective of the action;	Section 5.2
(d) the location of the action;	Sections 5.5.1, 5.6.1 and 5.7.1
(e) the background to the development of the action;	Section 5.2
(f) how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action;	Sections 5.2.3, 5.5.5, 5.6.5 and 5.7.5
(g) the current status of the action;	Sections 5.5.3, 5.6.3 and 5.7.3
(h) the consequences of not proceeding with the action.	Section 5.9.4
2. Description	
2.01 A description of the action, including: *(a) all the components of the action;*	Section 5.2.1
(b) the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts;	Sections 2.6, 5.5.1, 5.6.1 and 5.7.1
(c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts;	Sections 5.5.2, 5.6.2 and 5.7.2
(d) relevant impacts of the action;	Sections 5.4.2, 5.4.3, 5.4.4, 5.4.5, 5.4.6, 5.5.6, 5.5.8, 5.5.9, 5.5.10, 5.6.6, 5.6.7, 5.7.6 and 5.7.7
(e) proposed safeguards and mitigation measures to deal with relevant impacts of the action;	Sections 5.5.11, 5.6.8, 5.7.8 and 5.8; Attachment 5
(f) any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action;	Sections 1.7 and 5.3.1
(g) to the extent reasonably practicable, any feasible alternatives to the action, including: *(i) if relevant, the alternative of taking no action;* *(ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action;* *(iii) sufficient detail to make clear why any alternative is preferred to another;*	Sections 3, 5.5.4, 5.6.4 and 5.7.4
(h) any consultation about the action, including: *(i) any consultation that has already taken place;* *(ii) proposed consultation about relevant impacts of the action;* *(iii) if there has been consultation about the proposed action—any documented response to, or result of, the consultation;*	Section 5.1.3; Attachment 4; Appendix C
(i) identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.	

Table 5-3 (Continued)
Division 5.2 of EPBC Regulations Reconciliation Table

Requirement	EIS Reference
3. Relevant Impacts	
3.01 Information given under paragraph 2.01(d) must include: *(a) a description of the relevant impacts of the action;*	Sections 5.4, 5.5.6, 5.5.8, 5.5.9, 5.5.10, 5.6.6, 5.6.7, 5.7.6 and 5.7.7
(b) a detailed assessment of the nature and extent of the likely short term and long term relevant impacts;	Section 5.4
(c) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;	Section 5.9.2
(d) analysis of the significance of the relevant impacts;	Sections 5.4, 5.5.6, 5.5.8, 5.5.10, 5.6.6 and 5.7.6
(e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Appendices A, B, C, D, E, F, K and M
4. Proposed Safeguards and Mitigation Measures	
4.01 Information given under paragraph 2.01(e) must include: *(a) a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures;*	Sections 5.5.11, 5.6.8, 5.7.8 and 7; Attachment 5
(b) any statutory or policy basis for the mitigation measures;	Section 5.5.11; Attachment 5; Section 10 and Tables 25 and 26 of Appendix D
(c) the cost of the mitigation measures;	Sections 4.3.3 and 4.3.8 of Appendix K
(d) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing;	Sections 5.5.11, 5.6.8, 5.7.8 and 7; Sections 10.4 and 10.5 of Appendix D
(e) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program;	Section 5.3.1
(f) a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent.	Sections 5.5.11 and 7
5. Other Approvals and Conditions	
5.01 Information given under paragraph 2.01(f) must include: *(a) details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:* *(i) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy;* *(ii) how the scheme provides for the prevention, minimisation and management of any relevant impacts;*	Sections 1.7, 5.2.2 and 5.3.1
(b) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action;	Section 1.7
(c) a statement identifying any additional approval that is required;	Sections 1.7 and 5.3.1
(d) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Sections 1.7, 5.3.1 and 7

Table 5-3 (Continued)
Division 5.2 of EPBC Regulations Reconciliation Table

Requirement	EIS Reference
6. Environmental Record of Person Proposing to Take the Action	
6.01 Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: *(a) the person proposing to take the action; and* *(b) for an action for which a person has applied for a permit, the person making the application.* *6.02 If the person proposing to take the action is a corporation—details of the corporation's environmental policy and planning framework.*	Section 5.1.1
7. Information Sources	
7.01 For information given in a draft public environment report or environmental impact statement, the draft must state: *(a) the source of the information; and* *(b) how recent the information is; and* *(c) how the reliability of the information was tested; and* *(d) what uncertainties (if any) are in the information.*	Section 9; Attachment 3; Section 6.1.3 of Appendix A and Sections 5 and 6 of Appendix B of Appendix A; Sections 7.5 and 8.8 of Appendix B and Appendix B of Appendix B

Table 5-4
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Description of the Proposal	
▪ Provide a regional overview of the proposed project area including a description of the: – geological basin; – coal resource; – surface water catchments; – groundwater systems; – water-dependent assets; and – past, present and reasonably foreseeable coal mining and CSG developments.	Sections 5.3.3, 5.3.6, 5.3.7 and 5.3.8; Sections 3, 4 and 5 of Appendix A; Sections 1.2 and 4 of Appendix B; Sections 2.1 to 2.6 and 4.8 of Appendix D; Sections 1.4.1 to 1.4.5 and 3.8 of Appendix E; Section 4 of Appendix F
▪ Describe the statutory context, including information on the proposal's status within the regulatory assessment process and any applicable water management policies or regulations.	Sections 1.7, 5.2, 5.3.8 and 5.5.7; Section 2 of Appendix A; Section 2 of Appendix B
▪ Describe the proposal's location, purpose, scale, duration, disturbance area, and the means by which it is likely to have a significant impact on water resources and water-dependent assets.	Sections 2, 5.1.2, 5.2, 5.5, 5.6 and 5.7; Sections 1 and 7 of Appendix A; Sections 1, 5 and 10 of Appendix B; Sections 1.1, 7.5 and 7.6 of Appendix D; Sections 5.3 to 5.9 and 5.12 of Appendix E; Section 5 of Appendix F
▪ Describe how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.	Sections 1.7, 5.2, 5.3.1, 5.3.7 and 5.5.7; Section 2 of Appendix A; Section 2 of Appendix B

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Risk Assessment	
▪ Identify and assess all potential environmental risks to water resources and water-related assets, and their possible impacts. In selecting a risk assessment approach consideration should be given to the complexity of the project, and the probability and potential consequences of risks.	Section 5.4.7; Section 7 of Appendix A; Sections 7.5, 8, 9 and 10 and Appendix B of Appendix B; Sections 7.5 and 7.6 of Appendix D; Sections 5.3 to 5.9 and 5.12 of Appendix E; Section 5 of Appendix F; Section 4 of Appendix N
▪ Assess risks following the implementation of any proposed mitigation and management options to determine if these will reduce risks to an acceptable level based on the identified environmental objectives.	Section 5.4.7; Section 8 of Appendix A; Sections 10 and 11 of Appendix B
▪ Incorporate causal mechanisms and pathways identified in the risk assessment in conceptual and numerical modelling. Use the results of these models to update the risk assessment.	Section 5.4.7; Sections 5.7 and 6 of Appendix A; Section 10 of Appendix B
▪ The risk assessment should include an assessment of: – all potential cumulative impacts which could affect water resources and water-related assets; and – mitigation and management options which the proponent could implement to reduce these impacts.	Section 5.4.7; Sections 6.5, 7 and 8 of Appendix A; Section 10.6 of Appendix B
Groundwater	
Context and Conceptualisation	
▪ Describe and map geology at an appropriate level of horizontal and vertical resolution including: – definition of the geological sequence(s) in the area, with names and descriptions of the formations and accompanying surface geology, cross-sections and any relevant field data. – geological maps appropriately annotated with symbols that denote fault type, throw and the parts of sequences the faults intersect or displace.	Sections 5.3.6, 5.3.7 and 5.5.7; Section 4 of Appendix A
▪ Define and describe or characterise significant geological structures (e.g. faults, folds, intrusives) and associated fracturing in the area and their influence on groundwater – particularly groundwater flow, discharge or recharge. – Site-specific studies (e.g. geophysical, coring/wireline logging etc.) should give consideration to characterising and detailing the local stress regime and fault structure (e.g. damage zone size, open/closed along fault plane, presence of clay/shale smear, fault jogs or splays). – Discussion on how this fits into the fault's potential influence on regional-scale groundwater conditions should also be included.	Sections 5.3.6, 5.3.7 and 5.5.7; Section 5.2 of Appendix A
▪ Provide site-specific values for hydraulic parameters (e.g. vertical and horizontal hydraulic conductivity and specific yield or specific storage characteristics including the data from which these parameters were derived) for each relevant hydrogeological unit. In situ observations of these parameters should be sufficient to characterise the heterogeneity of these properties for modelling.	Section 5.5.7; Section 5.2 of Appendix A
▪ Provide time series level and water quality data representative of seasonal and climatic cycles.	Section 5.3.7; Appendix B of Appendix A
▪ Provide data to demonstrate the varying depths to the hydrogeological units and associated standing water levels or potentiometric heads, including direction of groundwater flow, contour maps, and hydrographs. All boreholes used to provide this data should have been surveyed.	Section 5.3.7; Sections 4 and 5.3 and Appendices A2 and A4 of Appendix A
▪ Provide hydrochemical (e.g. acidity/alkalinity, electrical conductivity, metals, and major ions) and environmental tracer (e.g. stable isotopes of water, tritium, helium, strontium isotopes, etc.) characterisation to identify sources of water, recharge rates, transit times in aquifers, connectivity between geological units and groundwater discharge locations.	Section 5.4 and Appendix A3 of Appendix A
▪ Describe the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.	Sections 5.3.7 and 5.5.7; Section 5.3 of Appendix A

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Groundwater (Continued)	
▪ Assess the frequency (and time lags if any), location, volume and direction of interactions between water resources, including surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.	Sections 5.3.7 and 5.5.7; Sections 5.3.5 and 5.6 of Appendix A
Analytical and Numerical Modelling	
▪ Provide a detailed description of all analytical and/or numerical models used, and any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Section 5.5.7; Section 6.1 and Appendix B of Appendix A
▪ Undertaken groundwater modelling in accordance with the *Australian Groundwater Modelling Guidelines* (Barnett et al. 2012), including independent peer review.	Section 5.5.7; Section 6 and Appendix B of Appendix A
▪ Calibrate models with adequate monitoring data, ideally with calibration targets related to model prediction (e.g. use baseflow calibration targets where predicting changes to baseflow).	Section 5.5.7; Section 6.1.3 and Appendix B of Appendix A
▪ Describe each hydrogeological unit as incorporated in the groundwater model, including the thickness, storage and hydraulic characteristics, and linkages between units, if any.	Sections 5.3.6, 5.3.7 and 5.5.7; Section 2 and Appendix B of Appendix A
▪ Describe the existing recharge/discharge pathways of the units and the changes that are predicted to occur upon commencement, throughout, and after completion of the proposed project.	Section 5.5.7; Sections 5.3, 5.7 and 6.6 of Appendix A
▪ Describe the various stages of the proposed project (construction, operation and rehabilitation) and their incorporation into the groundwater model. Provide predictions of water level and/or pressure declines and recovery in each hydrogeological unit for the life of the project and beyond, including surface contour maps for all hydrogeological units.	Sections 5.1.2, 5.5.2, 5.5.7 and 5.5.8; Section 6 and Appendix B of Appendix A
▪ Identify the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.	Section 5.5.8; Section 6.2 and Appendix B of Appendix A
▪ Undertake model verification with past and/or existing site monitoring data.	Sections 5.3.7, 5.5.7 and 5.5.8; Appendix B of Appendix A
▪ Provide an explanation of the model conceptualisation of the hydrogeological system or systems, including multiple conceptual models if appropriate. Key assumptions and model limitations and any consequences should also be described.	Sections 5.3.6, 5.3.7 and 5.5.7; Section 5.7 of Appendix A
▪ Consider a variety of boundary conditions across the model domain, including constant head or general head boundaries, river cells and drains, to enable a comparison of groundwater model outputs to seasonal field observations.	Section 5.5.7; Appendix B of Appendix A
▪ Undertake sensitivity analysis and uncertainty analysis of boundary conditions and hydraulic and storage parameters, and justify the conditions applied in the final groundwater model (see Middlemis and Peeters 2018).	Section 5.5.7; Appendix B of Appendix A
▪ Provide an assessment of the quality of, and risks and uncertainty inherent in, the data used to establish baseline conditions and in modelling, particularly with respect to predicted potential impact scenarios.	Section 5.5.7; Appendix B of Appendix A
▪ Undertake an uncertainty analysis of model construction, data, conceptualisation and predictions (see Middlemis and Peeters 2018).	Section 5.5.7; Appendix B of Appendix A
▪ Provide a program for review and update of models as more data and information become available, including reporting requirements.	Section 5.5.11; Section 8.2.4 of Appendix A
▪ Provide information on the magnitude and time for maximum drawdown and post-development drawdown equilibrium to be reached.	Section 5.5.8; Sections 6.3 and 6.6 of Appendix A

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Groundwater (Continued)	
Impacts to Water Resources and Water-dependent Assets	
▪ Provide an assessment of the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts. Consider and describe: – any hydrogeological units that will be directly or indirectly dewatered or depressurised, including the extent of impact on hydrological interactions between water resources, surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water. – the effects of dewatering and depressurisation (including lateral effects) on water resources, water-dependent assets, groundwater, flow direction and surface topography, including resultant impacts on the groundwater balance. – the potential impacts on hydraulic and storage properties of hydrogeological units, including changes in storage, potential for physical transmission of water within and between units, and estimates of likelihood of leakage of contaminants through hydrogeological units. – the possible fracturing of and other damage to confining layers. – For each relevant hydrogeological unit, the proportional increase in groundwater use and impacts as a consequence of the proposed project, including an assessment of any consequential increase in demand for groundwater from towns or other industries resulting from associated population or economic growth due to the proposal.	Sections 5.3.7, 5.3.8, 5.5.8 and 5.5.11; Sections 6 and 7 of Appendix A; Sections 7.5 and 7.6 of Appendix D; Section 5.12 of Appendix E; Section 5 of Appendix F
▪ Describe the water resources and water-dependent assets that will be directly impacted by mining or CSG operations, including hydrogeological units that will be exposed/partially removed by open cut mining and/or underground mining.	Sections 5.3.7, 5.3.8, 5.5.8 and 5.5.11; Section 7 of Appendix A: Sections 7.5 and 7.6 of Appendix D; Section 5.12 of Appendix E; Section 5 of Appendix F
▪ For each potentially impacted water resource, provide a clear description of the impact to the resource, the resultant impact to any water-dependent assets dependent on the resource, and the consequence or significance of the impact.	Sections 5.5.8 and 5.5.11; Section 7 of Appendix A Sections 7.5 and 7.6 of Appendix D; Section 5.12 of Appendix E; Section 5 of Appendix F
▪ Describe existing water quality guidelines, environmental flow objectives and other requirements (e.g. water planning rules) for the groundwater basin(s) within which the development proposal is based.	Sections 5.3.7, 5.3.8, 5.5.8 and 5.5.11; Sections 2 and 5.4 of Appendix A
▪ Provide an assessment of the cumulative impact of the proposal on groundwater when all developments (past, present and/or reasonably foreseeable) are considered in combination.	Sections 5.3.3, 5.5.8 and 5.5.10; Section 6.5 of Appendix A
▪ Describe proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	Sections 5.5.8 and 5.5.11; Section 8 of Appendix A
▪ Provide a description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	Sections 5.5.8 and 5.5.11; Section 8 of Appendix A; Section 6 of Appendix F
Data and Monitoring	
▪ Provide sufficient data on physical aquifer parameters and hydrogeochemistry to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes.	Section 5.3.7; Sections 5.2 and 5.3 of Appendix A
▪ Develop and describe a robust groundwater monitoring program using dedicated groundwater monitoring wells – including nested arrays where there may be connectivity between hydrogeological units – and targeting specific aquifers, providing an understanding of the groundwater regime, recharge and discharge processes and identifying changes over time.	Section 5.5.11; Section 5.1 of Appendix A
▪ Develop and describe proposed targeted field programs to address key areas of uncertainty, such as the hydraulic connectivity between geological formations, the sources of groundwater sustaining GDEs, the hydraulic properties of significant faults, fracture networks and aquitards in the impacted system, etc., where appropriate.	Section 5.5.11; Sections 5.1.1, 5.2, 5.5.1 and 5.6.1 of Appendix A

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Groundwater (Continued)	
▪ Provide long-term groundwater monitoring data, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.	Section 5.4 of Appendix A
▪ Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZG 2018) and relevant legislated state protocols (e.g. QLD Government 2013).	Section 5.5.11; Section 8.2.1 of Appendix A
Surface Water	
Context and Conceptualisation	
▪ Describe the hydrological regime of all watercourses, standing waters and springs across the site including: – geomorphology, including drainage patterns, sediment regime and floodplain features; – spatial, temporal and seasonal trends in streamflow and/or standing water levels; – spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals, metalloids and radionuclides); and – current stressors on watercourses, including impacts from any currently approved projects.	Sections 5.3.7 and 5.3.8; Sections 4 and 10 and Appendices A and F of Appendix B
▪ Describe the existing flood regime, including flood volume, depth, duration, extent and velocity for a range of annual exceedance probabilities. Provide flood hydrographs and maps identifying peak flood extent, depth and velocity. This assessment should be informed by topographic data that has been acquired using lidar or other reliable survey methods with accuracy stated.	Sections 5.3.7, 5.5.7 and 5.5.8; Section 9 and Appendix C of Appendix B
▪ Provide an assessment of the frequency, volume, seasonal variability and direction of interactions between water resources, including surface water/ groundwater connectivity and connectivity with sea water.	Sections 5.3.7, 5.5.7 and 5.5.8; Sections 5.3.5 and 5.6 of Appendix A
Analytical and Numerical Modelling	
▪ Provide conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.	Sections 5.3.7 and 5.5.7; Section 6 and Appendix C of Appendix B
▪ Use methods in accordance with the most recent publication of *Australian Rainfall and Runoff* (Ball et al. 2016).	Section C1 of Appendix C of Appendix B
▪ Develop and describe a program for review and update of the models as more data and information becomes available.	Section 5.5.11; Section 7.6 of Appendix B
▪ Describe and justify model assumptions and limitations, and calibrate with appropriate surface water monitoring data.	Sections 5.3.7 and 5.5.7; Section 6 and Appendix C of Appendix B
▪ Provide an assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios.	Section 7.5 of Appendix B
▪ Provide a detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Attachment 3; Section 7.5 of Appendix B

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Surface Water (Continued)	
Impacts to Water Resources and Water-dependent Assets	
▪ Describe all potential impacts of the proposed project on surface waters. Include a clear description of the impact to the resource, the resultant impact to any assets dependent on the resource (including water-dependent ecosystems such as riparian zones and floodplains), and the consequence or significance of the impact. Consider: – impacts on streamflow under the full range of flow conditions. – impacts associated with surface water diversions. – impacts to water quality, including consideration of mixing zones. – the quality, quantity and ecotoxicological effects of operational discharges of water (including saline water), including potential emergency discharges, and the likely impacts on water resources and water-dependent assets. – landscape modifications such as subsidence, voids, post rehabilitation landform collapses, on-site earthworks (including disturbance of acid-forming or sodic soils, roadway and pipeline networks) and how these could affect surface water flow, surface water quality, erosion, sedimentation and habitat fragmentation of water-dependent species and communities.	Section 5.5.8; Section 10.1 of Appendix B; Sections 7.5 and 7.6 of Appendix D, Section 5.11 of Appendix E; Section 5 of Appendix F
▪ Discuss existing water quality guidelines, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.	Section 5.3.7; Sections 3 and 4.4 of Appendix B; Sections 2.1.2.4, 2.1.2.5, 2.1.2.7, 3.2, 3.3 and 3.5 of Appendix E
▪ Identify processes to determine surface water quality guidelines and quantity thresholds which incorporate seasonal variation but provide early indication of potential impacts to assets.	Section 5.5.8; Section 7 of Appendix B
▪ Propose mitigation actions for each identified significant impact.	Section 5.5.11; Section 6.4 of Appendix B; Section 6 of Appendix E; Section 6 of Appendix F
▪ Describe the adequacy of proposed measures to prevent or minimise impacts on water resources and water-dependent assets.	Section 5.5.11; Sections 7, 8 and 10 of Appendix B; Section 6 of Appendix E; Section 6 of Appendix F
▪ Describe the cumulative impact of the proposal on surface water resources and water-dependent assets when all developments (past, present and reasonably foreseeable) are considered in combination.	Sections 5.5.8 and 5.5.10; Section 6.5 of Appendix A; Section 10.6 and Appendix F of Appendix B; Section 5.14 of Appendix E
▪ Provide an assessment of the risks of flooding (including channel form and stability, water level, depth, extent, velocity, shear stress and stream power), and impacts to ecosystems, project infrastructure and the final project landform.	Sections 5.5.7 and 5.5.8; Section 9 of Appendix B
Data and Monitoring	
▪ Identify monitoring sites representative of the diversity of potentially affected water-dependent assets and the nature and scale of potential impacts, and match with suitable replicated control and reference sites (BACI design) to enable detection and monitoring of potential impacts.	Section 5.5.11; Section 10.7 of Appendix B
▪ Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZG 2018) and relevant legislated state protocols (e.g. QLD Government 2013).	Section 5.5.11; Section 10.7 of Appendix B
▪ Identify data sources, including streamflow data, proximity to rainfall stations, data record duration and describe data methods, including whether missing data have been patched.	Sections 5.3.7 and 5.5.7; Sections 4.3 and 6.3 of Appendix B

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Surface Water (Continued)	
▪ Develop and describe a surface water monitoring program that will collect sufficient data to detect and identify the cause of any changes from established baseline conditions, and assess the effectiveness of mitigation and management measures. The program will: – include baseline monitoring data for physico-chemical parameters, as well as contaminants (e.g. metals); – comparison of physico-chemical data to national/regional guidelines or to site-specific guidelines derived from reference condition monitoring if available; and – identify baseline contaminant concentrations and compare these to national guidelines, allowing for local background correction if required.	Section 5.5.11; Sections 3, 4.4 and 10.7 and Appendix A of Appendix B
▪ Describe the rationale for selected monitoring parameters, duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor large-scale impacts.	Section 10.7 and Appendix F of Appendix B
▪ Develop and describe a plan for ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	Sections 5.5.11 and 7; Sections 10.5 and 10.7 of Appendix B; Section 10 of Appendix E
▪ Identify dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of the proposed project and beyond.	Section 5.5.11; Section 10.7 and Appendix F of Appendix B
Water-Dependent Assets	
Context and Conceptualisation	
▪ Identify water-dependent assets, including: – water-dependent fauna and flora and provide surveys of habitat, flora and fauna (including stygofauna) (see Doody et al. 2019). – public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource.	Sections 5.3.7 and 5.3.8; Sections 5.5 and 5.6 of Appendix A; Sections 2 and 3 of Appendix E; Section 4 of Appendix F
▪ Identify GDEs in accordance with the method outlined by Eamus et al. (2006). Information from the GDE Toolbox (Richardson et al. 2011) and GDE Atlas (CoA 2017a) may assist in identification of GDEs (see Doody et al. 2019).	Section 5.3.8; Section 5.6 of Appendix A; Section 4 of Appendix F
▪ Describe the conceptualisation and rationale for likely water-dependence, impact pathways, tolerance and resilience of water-dependent assets. Examples of ecological conceptual models can be found in Commonwealth of Australia (2015).	Section 5.3.8; Section 5.6 of Appendix A; Section 4 of Appendix F
▪ Estimate the ecological water requirements of identified GDEs and other water-dependent assets (see Doody et al. 2019).	Section 5.3.8; Section 5.6 of Appendix A; Section 4 of Appendix F
▪ Identify the hydrogeological units on which any identified GDEs are dependent (see Doody et al. 2019).	Sections 5.3.8 and 5.5.8; Section 5.6.1 of Appendix A; Section 4 of Appendix F
▪ Provide an outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.	Sections 5.3.8 and 5.5.8; Sections 6 and 7 of Appendix A; Section 3.2 of Appendix B Section 4 of Appendix F
▪ Describe the process employed to determine water quality and quantity triggers and impact thresholds for water-dependent assets (e.g. threshold at which a significant impact on an asset may occur).	Section 7 of Appendix A; Section 4.4 of Appendix B; Section 5 of Appendix F

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Water-Dependent Assets (Continued)	
Impacts, Risk Assessment and Management of Risks	
▪ Provide an assessment of direct and indirect impacts on water-dependent assets, including ecological assets such as flora and fauna dependent on surface water and groundwater, springs and other GDEs (see Doody et al. 2019).	Sections 5.3.8 and 5.5.8; Section 7.2 of Appendix A; Section 10 of Appendix B; Sections 7.5 and 7.6 of Appendix D; Section 5.12 of Appendix E; Section 5 of Appendix F
▪ Describe the potential range of drawdown at each affected bore, and clearly articulate of the scale of impacts to other water users.	Section 5.5.8; Section 7.2 of Appendix A
▪ Indicate the vulnerability to contamination (e.g. from salt production and salinity) and the likely impacts of contamination on the identified water-dependent assets and ecological processes.	Section 7.4 of Appendix A
▪ Identify and consider landscape modifications (e.g. voids, on-site earthworks, and roadway and pipeline networks) and their potential effects on surface water flow, erosion and habitat fragmentation of water-dependent species and communities.	Section 5.5.8; Section 10.4.2 of Appendix B; Sections 7.5 and 7.6 of Appendix D; Section 5.12 of Appendix E; Section 5 of Appendix F
▪ Provide estimates of the volume, beneficial uses and impact of operational discharges of water (particularly saline water), including potential emergency discharges due to unusual events, on water-dependent assets and ecological processes.	Sections 7 and 10 of Appendix B; Section 5 of Appendix F
▪ Assess the overall level of risk to water-dependent assets through combining probability of occurrence with severity of impact.	Sections 5.4.7 and 5.5.8; Sections 5.6 and 7 of Appendix A; Sections 4 and 5 of Appendix F
▪ Identify the proposed acceptable level of impact for each water-dependent asset based on leading-practice science and site-specific data, and ideally developed in conjunction with stakeholders.	Section 5.5.8; Section 7.2 of Appendix A; Section 5 of Appendix F
▪ Propose mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	Section 5.5.11; Section 8 of Appendix A; Section 6 of Appendix F
Data and Monitoring	
▪ Identify an appropriate sampling frequency and spatial coverage of monitoring sites to establish pre-development (baseline) conditions, and test potential responses to impacts of the proposal (see Doody et al. 2019).	Section 8.2 of Appendix A; Section 10.7 of Appendix B; Section 6 of Appendix F
▪ Consider concurrent baseline monitoring from unimpacted control and reference sites to distinguish impacts from background variation in the region (e.g. BACI design, see Doody et al. 2019).	Section 8.2 of Appendix A; Section 10.7 of Appendix B; Section 6 of Appendix F
▪ Develop and describe a monitoring program that identifies impacts, evaluates the effectiveness of impact prevention or mitigation strategies, measures trends in ecological responses and detects whether ecological responses are within identified thresholds of acceptable change (see Doody et al. 2019).	Section 5.5.11; Section 8.2.1 of Appendix A; Section 10.7 of Appendix B; Section 6 of Appendix F
▪ Describe the proposed process for regular reporting, review and revisions to the monitoring program	Section 5.5.11; Section 8.2.3 of Appendix A; Section 10.7 of Appendix B; Section 6 of Appendix F
▪ Ensure ecological monitoring complies with relevant state or national monitoring guidelines (e.g. the DSITI guideline for sampling stygofauna (QLD Government 2015)).	Section 5.5.11; Section 10.7 of Appendix B; Section 6.7 of Appendix E

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Water and Salt Balance, and Water Quality	
▪ Provide a quantitative site water balance model describing the total water supply and demand under a range of rainfall conditions and allocation of water for mining activities (e.g. dust suppression, coal washing etc.), including all sources and uses.	Section 5.5.7; Section 7 of Appendix B
▪ Describe the water requirements and on-site water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	Sections 2.7, 5.5.8 and 5.5.11; Sections 6.8 and 7.3 of Appendix B
▪ Provide estimates of the quality and quantity of operational discharges under dry, median and wet conditions, potential emergency discharges due to unusual events and the likely impacts on water-dependent assets.	Sections 5.5.8 and 5.5.11; Section 7 of Appendix B
▪ Provide salt balance modelling that includes stores and the movement of salt between stores, and takes into account seasonal and long-term variation.	Section 7.4 of Appendix B
Cumulative Impacts	
Context and Conceptualisation	
▪ Provide cumulative impact analysis with sufficient geographic and temporal boundaries to include all potentially significant water-related impacts.	Sections 5.5.8, 5.5.9 and 5.5.10; Section 6.5 of Appendix A; Section 10.6 of Appendix B
▪ Consider all past, present and reasonably foreseeable actions, including development proposals, programs and policies that are likely to impact on the water resources of concern in the cumulative impact analysis. Where a proposed project is located within the area of a bioregional assessment consider the results of the bioregional assessment.	Sections 5.5.8, 5.5.9 and 5.5.10; Section 6.5 and Appendix B of Appendix A; Section 10.6 of Appendix B
Impacts	
▪ Provide an assessment of the condition of affected water resources which includes: – identification of all water resources likely to be cumulatively impacted by the proposed development – a description of the current condition and quality of water resources and information on condition trends – identification of ecological characteristics, processes, conditions, trends and values of water resources – adequate water and salt balances and, – identification of potential thresholds for each water resource and its likely response to change and capacity to withstand adverse impacts (e.g. altered water quality, drawdown).	Sections 5.5.7, 5.5.8, 5.5.9 and 5.5.10; Sections 5, 6.5 and 7 of Appendix A; Sections 4 and 10.6 of Appendix B
▪ Assess the cumulative impacts to water resources considering: – the full extent of potential impacts from the proposed project, (including whether there are alternative options for infrastructure and mine configurations which could reduce impacts), and encompassing all linkages, including both direct and indirect links, operating upstream, downstream, vertically and laterally – all stages of the development, including exploration, operations and post closure/decommissioning – appropriately robust, repeatable and transparent methods – the likely spatial magnitude and timeframe over which impacts will occur, and significance of cumulative impacts and – opportunities to work with other water users to avoid, minimise or mitigate potential cumulative impacts.	Sections 3, 5.5.7, 5.5.8, 5.5.9 and 5.5.10; Sections 6.1, 6.5 and 7 of Appendix A; Sections 4 and 10.6 of Appendix B

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Cumulative Impacts (Continued)	
Mitigation, Monitoring and Management	
▪ Identify modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts. Evidence of the likely success of these measures (e.g. case studies) should be provided.	Sections 3 and 5.5.11; Sections 6.5 and 8 of Appendix A; Sections 10.6 and 10.7 of Appendix B
▪ Identify measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies.	Sections 3, 5.5.11 and 7; Sections 6.5 and 8 of Appendix A; Sections 10.6 and 10.7 of Appendix B
▪ Identify cumulative impact environmental objectives.	Sections 3, 4.1.3 and 5.5.11; Sections 6.5 and 8 of Appendix A; Sections 10.6 and 10.7 of Appendix B
▪ Describe appropriate reporting mechanisms.	Sections 3, 5.5.11 and 7; Sections 6.5 and 8 of Appendix A; Sections 10.6 and 10.7 of Appendix B
▪ Propose adaptive management measures and management responses.	Sections 3, 4.1.3, 5.5.11 and 7; Sections 6.5 and 8 of Appendix A; Sections 10.6 and 10.7 of Appendix B
Subsidence – Underground Coal Mines and Coal Seam Gas	
▪ Provide predictions of subsidence impact on surface topography, water-dependent assets, groundwater (including enhanced connectivity between aquifers) and the movement of water across the landscape (See CoA 2014b; CoA 2014c). Consider multiple methods of predictions and apply the most appropriate method. Consider the limitations of each method including the adequacy of empirical data and site-specific geological conditions and justify the selected method.	N/A
▪ Provide an assessment of both conventional and unconventional subsidence. For project expansions, an evaluation of past or current effects of geological structures on subsidence and implications for water resources and water-dependent assets should be provided.	N/A
▪ Describe subsidence monitoring methods, including the use of remote or on-ground techniques and explain the predicted accuracy of such techniques.	N/A
▪ Consider geological strata and their properties (strength/hardness/fracture propagation) in the subsidence analysis and/or modelling. Anomalous and near-surface ground movements with implications for water resources and compaction of unconsolidated sediment should also be considered.	N/A
Final Landforms and Voids – Coal Mines	
▪ Identify and consider landscape modifications (e.g. voids, on-site earthworks, and roadway and pipeline networks) and their potential effects on surface water flow, erosion, sedimentation and habitat fragmentation of water-dependent species and communities.	Sections 5.5.7 and 5.5.8; Section 7.4.3 of Appendix A; Sections 8 and 9 of Appendix B
▪ Assess the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.	Sections 5.5.7 and 5.5.8; Appendix B of Appendix A; Section 8 of Appendix B
▪ Provide an evaluation of stability of void slopes where failure during extreme events or over the long term (for example due to aquifer recovery causing geological heave and landform failure) may have implications for water quality.	Section 6.2.4
▪ Evaluate mitigating inflows of saline groundwater by planning for partial backfilling of final voids.	Sections 5.5.8 and 6.2.3; Section 7.4.3 of Appendix A

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
Final Landforms and Voids – Coal Mines (Continued)	
▪ Provide an assessment of the long-term impacts to water resources and water-dependent assets posed by various options for the final landform design, including complete or partial backfilling of mining voids. Assessment of the final landform for which approval is being sought should consider: – groundwater behaviour – sink or lateral flow from void. – water level recovery – rate, depth, and stabilisation point (e.g. timeframe and level in relation to existing groundwater level, surface elevation). – seepage – geochemistry and potential impacts. – long-term water quality, including salinity, pH, metals and toxicity. – measures to prevent migration of void water off-site.	Sections 2.2.6, 2.2.8, 4.1, 4.2, 6.2.5, 6.4.5 and 6.4.6; Sections 6.6, 7.4 and 8 of Appendix A; Sections 8.6, 8.7 and 10 of Appendix B; Section 5 of Appendix M
▪ For other final landform options considered sufficient detail of potential impacts should be provided to clearly justify the proposed option.	Section 3
▪ Assess the probability of overtopping of final voids with variable climate extremes, and management mitigations.	Section 5.5.8; Section 8.8 of Appendix B
Acid-forming Materials and Other Contaminants of Concern	
▪ Identify the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).	Section 7 of Appendix J; Section 3.2 of Appendix M
▪ Identify the presence and volume of potentially acid-forming waste rock, fine-grained amorphous sulphide minerals and coal reject/tailings material and exposure pathways.	Sections 5.5.2 and 5.5.8; Section 5.4.4 of Appendix A; Section 3.2 of Appendix M
▪ Identify other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.	Sections 5.3.7, 5.5.8 and 5.5.11; Sections 5.4.4 and 7.4 of Appendix A; Sections 3.3 and 4 of Appendix M
▪ Describe handling and storage plans for acid-forming material (co-disposal, tailings dam, and encapsulation).	Sections 5.5.8 and 5.5.11; Section 5 of Appendix M
▪ Assess the potential impact to water-dependent assets, taking into account dilution factors, and including solute transport modelling where relevant, representative and statistically valid sampling, and appropriate analytical techniques.	Sections 5.5.8 and 5.5.11; Section 5.4.4 of Appendix A
▪ Describe proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.	Sections 5.5.8 and 5.5.11; Section 8 of Appendix A; Section 5 of Appendix M
CSG Well Construction and Operation	
▪ Describe the scale of fracturing (number of wells, number of fracturing events per well), types of wells to be stimulated (vertical versus horizontal), and other forms of well stimulation (cavitation, acid flushing).	N/A
▪ Describe proposed measuring and monitoring of fracture propagation.	N/A
▪ Identify water source for drilling and hydraulic stimulation, and outline the volume of fluid and mass balance (quantities/volumes).	N/A
▪ Describe the rules (e.g. water sharing plans) covering access to each water source used for drilling and hydraulic stimulation and how the project proposes to comply with them.	N/A
▪ Quantify and describe the quality and toxicity of flowback and produced water and how it will be treated and managed.	N/A

Table 5-4 (Continued)
Cross Reference Table against the IESC Information Guidelines Requirements

Requirement	EIS Reference
CSG Well Construction and Operation (Continued)	
▪ Assess the potential for inter-aquifer leakage or contamination.	N/A
▪ The use of drilling and hydraulic fracturing chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent with Australian Government testing guidelines (see CoA 2012; MRMMC-EPHC-NHMRC 2009).	N/A
▪ Propose waste management measures (including salt and brines) during both operations and legacy after closure.	N/A
▪ List the chemicals proposed for use in drilling and hydraulic stimulation including: – names of the companies producing fracturing fluids and associated products – proprietary names (trade names) of compounds (fracturing fluid additives) being produced – chemical names of each additive used in each of the fluids – Chemical Abstract Service (CAS) numbers of each of the chemical components used in each of the fluids – general purpose and function of each of the chemicals used – mass or volume proposed for use – maximum concentration (mg/L or g/kg) of the chemicals used – chemical half-life data, partitioning data, and volatilisation data – ecotoxicology and – any material safety data sheets for the chemicals or chemical products used.	N/A
▪ Chemicals for use in drilling and hydraulic fracturing must be identified as being approved for import, manufacture or use in Australia (that is, confirmed by NICNAS as being listed in the Australian Inventory of Chemical Substances (see CoA 2017b).	N/A

5.3 EXISTING ENVIRONMENT AND BASELINE DATA

5.3.1 Relevant Legislation and Scope of Approvals Sought through the EIS Process

A description of the assessment pathway, approvals and monitoring, enforcement and review procedures relevant to matters of national environmental significance is provided below.

Assessment Pathway

As described in Section 5.2.1, the Project, as three separate but related actions (mine site and access road, water pipeline and ETL), was referred to the Commonwealth Minister in May 2019. A delegate of the Commonwealth Minister declared the Project components were controlled actions and, therefore, the Project requires approval under the EPBC Act.

The delegate of the Commonwealth Minister also advised that the Project will be assessed under the bilateral assessment agreement between the Commonwealth of Australia and the State of Queensland, in accordance with section 45 of EPBC Act.

The Bilateral Agreement accredits the Queensland assessment regime under Part 4 of the SDPWO Act. As that process is accredited, an assessment under Part 8 of the EPBC Act is not required for the Project.

The potential impacts of the Project on controlling provisions will be assessed in accordance with the Queensland accredited assessment process and will require approval under both the SDPWO Act and the EPBC Act.

The SDPWO Act provides for project proposals to be assessed through a public EIS process. The Coordinator-General coordinates whole-of-government environmental assessment of a coordinated project under Part 4 of the SDPWO Act.

This EIS has been submitted to the Office of the Coordinator-General for assessment. Once this EIS has been prepared to the satisfaction of the Coordinator-General, this EIS will be publicly notified in accordance with section 33 of the SDPWO Act. The EIS will be on public notification for a period of at least 28 days and the relevant notices would be placed in a newspaper circulating the Project region and the greater surrounds.

During this period the public will be able to comment on the EIS and make submissions to the Coordinator-General. All submissions made to the Office of the Coordinator-General on the EIS will then be made available to Whitehaven WS, which will have an opportunity to respond and provide the Coordinator-General with any additional information to the EIS.

The Coordinator-General will then evaluate the EIS, including the environmental effects of the Project and any other related matters, and produce an Evaluation Report considering all submissions made on the EIS during the public notification period. The Coordinator-General will also make recommendations about the suitability of the Project and state conditions for the Project approvals.

Following receipt of the Coordinator-General's Evaluation Report, the Commonwealth Minister will consider the report when making the decision whether to grant approval under the EPBC Act.

Key Approvals and Relevant Monitoring, Enforcement and Review Procedures

Key approvals required for the Project include:

- an environmental authority under the EP Act (administered by the DES);
- mining leases (MLA 700049, MLA 700050, MLA 700051 and MLA 700065) under the MR Act (administered by the DoR and Queensland Treasury); and
- approvals under section 133 of the EPBC Act for the Project components (i.e. EPBC 2019/8458, EPBC2019/8459 and EPBC 2019/8460).

Environmental Authority

The environmental authority for the Project would authorise mining activities associated with the Project, the take of overland flow water and the development of infrastructure over the upstream reaches of a watercourse as assessed by the Surface Water and Flooding Assessment and would include mitigation, monitoring, auditing and reporting requirements for the Project (such as annual compliance reports, surface water and groundwater quality monitoring and reporting, etc.).

Section 7.4 presents the proposed environmental authority conditions for the Project, which are generally consistent with the *Guideline – Model mining conditions* (DES, 2017a), the guideline *Structures which are dams or levees constructed as part of environmentally relevant activities* (DES, 2019h), and other relevant contemporary environmental authorities in Queensland for similar activities.

The conditions of the environmental authority as granted by the EPA Minister must include, and be consistent with, the stated conditions provided in the Coordinator-General's Evaluation Report.

Mining Leases

The mining leases for the Project would allow for the mining of the mineral(s) specified and purposes necessary to carry out mining or associated activities within MLA 700049, MLA 700050 and MLA 700051 and transportation of water, electricity and the Project workforce along MLA 700065.

The mining leases would also provide Whitehaven WS the right to take underground water (which is defined to be 'associated water'), where the taking or interference happens during the course of, or results from, the carrying out of activities authorised under the mining leases, provided the underground water management framework is complied with.

Whitehaven WS will be required to measure and report the volume of any 'associated water' taken.

EPBC Act Approvals

Approval for the Proposed Actions by DAWE under the EPBC Act allows for the commencement of all activities associated with the Proposed Actions and would include mitigation, monitoring, auditing and reporting requirements for each Proposed Action.

Other Relevant Approvals

Whitehaven WS will prepare a species management program in accordance with section 335 of the NC Animals Regulation for approval by the DES prior to undertaking any activities that would disturb animal breeding places. The species management plan would include mitigation measures to avoid or minimise potential long-term impacts and monitoring and reporting requirements.

5.3.2 Relevant Databases and Mapping

Various Government (Commonwealth and State) databases, publicly available records and survey reports and other databases were reviewed to assist in compiling baseline ecological data relevant to the Project. These include the:

- EPBC Act Protected Matter Search Tool (PMST);
- HERBRECS database;
- Wildlife Online database;
- WildNet database;
- Atlas of Living Australia (ALA) database;
- Protected Plants Survey Trigger Map;
- Regulated Vegetation Management Map and associated supporting map;
- Queensland Government Remnant Regional Ecosystem mapping;
- Queensland Government Vegetation Management watercourse and drainage feature mapping;
- DES biodiversity planning assessment mapping;
- map of environmentally sensitive areas;
- Bird Life Australia (BLA);
- Queensland Government Wetland Mapping; and
- existing ecological assessments for surrounding operations (where available).

5.3.3 Nearby Coal Mining and Coal Seam Gas Developments

Coal Mining Developments

The Project is located approximately 30 km south-east of Moranbah, in an existing mining precinct comprising several existing or approved nearby coal mining operations, including (Figure 5-1):

- Isaac Downs Project;
- Olive Downs Project;
- Eagle Downs Mine;
- Moorvale South Project;
- Peak Downs Mine;
- Daunia Mine;

- Poitrel Mine;
- Saraji Mine;
- Millennium Mine;
- Moranbah South Mine;
- Isaac Plains East Mine;
- Caval Ridge Mine;
- Carborough Downs Mine;
- Moorvale Mine; and
- Lake Vermont Mine.

Proposed coal mining projects in the region include (Figure 5-1):

- Saraji East Mining Lease Project;
- Lake Vermont Meadowbrook Project;
- Vulcan Project; and
- Isaac River Project.

Coal Seam Gas Developments

Land covered by ATP 1103 held by CH4 Pty Ltd (now Arrow) overlaps land within MLA 700049, MLA 700050 and MLA 700051. ATP 1103 is required for Arrow's Bowen Gas Project (Greater Peak Downs development region).

The Bowen Gas Project is a coal seam gas development targeting gas within the coal seams of the Rangal Coal Measures and Moranbah Coal Measures (Arrow, 2014). Gas would be sourced from approximately 4,000 production wells throughout the Bowen Gas Project development regions over the life of the project (up to 40 years) (Arrow, 2014).

Accordingly, Whitehaven WS has engaged with Arrow in accordance with the requirements of the MERCP Act. Arrow confirmed that Whitehaven WS has "right of way" and will decommission pilot wells located within land covered by the mining lease applications.

The existing and operating Central Queensland Gas Pipeline Project is located approximately 20 km to the north-west of the Project.

5.3.4 Threatened Flora and Ecological Communities

Desktop and Literature Review

A review of various desktop databases was completed by E2M (2021) to establish which flora species have been recorded within approximately 50 km of the Project mining lease application areas. Sources of database records reviewed include:

- ALA species search (ALA, 2020);
- BLA species search (BLA, 2020); and
- Wildlife Online Extract and WildNet data provided by the DES (DES, 2018f, 2020d).

Results of the desktop study indicated the following threatened flora species have been previously recorded within the desktop search extent:

- Marlborough Blue (*Cycas ophiolitica*);
- King Blue-grass (*Dichanthium queenslandicum*); and
- Quassia (*Samadera bidwillii*).

Additionally, the following threatened ecological communities were also identified occurring in the wider desktop search extent:

- Brigalow TEC;
- Natural Grasslands TEC; and
- *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* threatened ecological community (Semi-evergreen Vine Thickets TEC).

The above threatened flora and ecological communities identified in the desktop search are consistent with those listed for consideration in the Terms of Reference for the Project.

E2M (2021) further consolidated information from publicly available resources, mapping and aerial photography to ascertain any additional threatened flora which may be present within the Study Area. The results of these searches assisted with guiding field survey requirements. Sources of information reviewed include:

- PMST Database as issued by the DAWE (2020a);
- Queensland Remnant Regional Ecosystem mapping provided by DES (Version 11) (DES, 2018f) and associated Regional Ecosystem Description Database (Version 11.1) (Queensland Herbarium, 2019);
- DES Biodiversity Planning Assessment mapping (DES, 2018g);
- Map of ESAs for mining activities, provided by DES (DES, 2019g);
- Protected Plants Flora Survey Trigger Map (DES, 2019d);
- map of Queensland Wetland Environmental Values provided by DES (2020c);
- DES Wetland Systems Mapping (Version 5.0) (DES, 2020d);
- Regulated Vegetation Management Map issued by the DNRME (Version 11.0) (DNRME, 2020b);
- DNRME Vegetation Management watercourse and drainage feature mapping (Version 4.0) (DNRME, 2020c);
- a review of historical aerial photography from 1989 and 1990 to determine High Value Regrowth (DNRME, 2020d);
- DNRME Detailed Surface Geology Mapping (DNRME, 2018d) and Geoscience Australia 1:250,000 geology mapping series (Geoscience Australia, 2020a);
- Queensland Herbarium HERBRECS Specimen database (Queensland Herbarium, 2017);
- Geoscience Australia 1:100,000 drainage network of Queensland (Geoscience Australia, 2020b);
- Latest available aerial photography (NearMap, 2020);
- Groundwater Dependent Ecosystems Atlas (BOM, 2020b); and
- Ecological Assessment Reports for surrounding projects.

As a result of these searches, the following species listed under the EPBC Act were identified:

- Marlborough Blue (*Cycas ophiolitica*);
- *Dichanthium setosum;*
- King Blue-grass (*Dichanthium queenslandicum*);
- Black Ironbox (*Eucalyptus raveretiana*);
- Quassia (*Samadera bidwillii*);
- Curlew Sandpiper (*Calidris ferruginea*);
- Red Goshawk (*Erythrotriorchis radiatus*);
- Squatter Pigeon (southern species) (*Geophaps scripta scripta*);
- Painted Honeyeater (*Grantiella picta*);
- Star Finch (southern and eastern species) (*Neochmia ruficauda ruficauda*);
- Black-throated Finch (southern subspecies) (*Poephila cincta cincta*);
- White-throated Needletail (*Hirundapus caudacutus*);
- Australian Painted Snipe (*Rostratula australis*);
- Northern Quoll (*Dasyurus hallucatus*);
- Ghost Bat (*Macroderma gigas*);
- Corbens Long-eared Bat (*Nyctophilus corbeni*);
- Greater Glider (*Petauroides volans*);
- Koala (*Phascolarctos cinereus*);
- Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*);
- Ornamental Snake (*Denisonia maculata*);
- Yakka Skink (*Egernia rugosa*);
- Southern Snapping Turtle (*Elseya albagula*);
- Dunmall's Snake (*Furina dunmalli*);
- Allan's Lerista / Retro Slider (*Lerista allanae*); and
- Fitzroy River Turtle (*Rheodytes leukops*).

Likelihood of Occurrence Assessment

E2M (2021) conducted a Likelihood of Occurrence Assessment to evaluate the qualitative probability that a flora or fauna species could physically occupy the Study Area during all, or part, of its life cycle. The assessment evaluated (Appendix D):

- species-specific ecological and physiological requirements;
- previously recorded species observations;
- the resources and constraints present in the Study Area informed by the desktop assessment; and
- the resources and constraints present in the Study Area informed by the field surveys.

During the desktop assessment, the outcome of the Likelihood of Occurrence Assessment was used to guide the field design and planning phase. Threatened species that are known, likely, or have the potential, to occur in the Study Area were targeted during the field surveys (i.e. target species). Following the field surveys, the Likelihood of Occurrence Assessment was re-evaluated using the field data to modulate the target species list prior to further assessment (Appendix D).

The Likelihood of Occurrence Assessment criteria are detailed in Table 5-5, with the flora Likelihood of Occurrence Assessment detailed in Table 5-6.

Field Surveys

Field surveys were undertaken for the Project Study Area to identify and characterise the presence, extent and condition of contemporary ecological values.

Flora and fauna surveys were previously undertaken by EcoSM in 2011 and 2012 of the area within MLA 700049, MLA 700050 and MLA 700051. These surveys provided a good initial characterisation of the terrestrial ecology values.

E2M (2021) undertook additional detailed surveys in a "Study Area" encompassing the Project mining lease application areas (MLA 700049, MLA 700050, MLA 700051 and MLA 700065) and surrounds (approximately 13,746 ha).

The Study Area for E2M's detailed field surveys established suitable buffers from the Indicative Surface Disturbance Extent (Figure 5-2) to identify and characterise ecological values which extend away from the Project. At times, this buffer ranged from 100 m to 500 m at various locations around the MLA boundaries (i.e. where access was allowed for). Along the north-eastern extent of MLA 700049, MLA 700050 and MLA 700051, the Project is immediately adjacent to the approved Olive Downs Project.

The Olive Downs Project has approval to disturb habitat within an approximately 145 m wide corridor associated with a rail line and water supply pipeline (EPBC 2017/7868 and EPBC 2017/7870). This corridor associated with the Olive Downs Project runs the entire length of the north-eastern boundary of MLA 700049, MLA 700050 and MLA 700051 to the Norwich Park Railway. This corridor was excluded from field surveys because of this approved disturbance.
Surveys were conducted over two wet season periods and two dry season periods to account for the seasonal variation in species presence, abundance and habitat use.

Table 5-5
Likelihood of Occurrence Assessment Criteria

Likelihood of Occurrence	Criteria
Known to Occur	The species or population has been observed within the Study Area.
Likely to Occur	Suitable habitat for a species or population occurs within the Study Area and nearby records are present.
Potential to Occur	Suitable habitat for a species or population occurs within the Study Area but it is degraded or of limited extent, the species has never been recorded in the local area and/or habitat only support a portion of the species' life cycle.
Unlikely to Occur	A low to very low probability that a species or population uses/occurs within the Study Area due to the lack of potential habitat or the Study Area is outside the species known range.

Source: Appendix D.

Table 5-6
Likelihood of Occurrence Assessment – Flora

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Malborough Blue (*Cycas ophiolitica*)	Endangered	Endangered	*Cycas ophiolitic* grows on hills and slopes in sparse, grassy open forest, at altitude ranges from 80–400 m above sea level, between Marlborough and Rockhampton in central Queensland. Although this species prefers red clay soils near Marlborough, it is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite (DAWE, 2020b). The species occurs within Eucalypt woodland and open woodlands containing *Corymbia dallachiana, C. erythrophloia, Eucalyptus crebra, E. fibrosa* and *C. intermedia* (DAWE, 2020b).	**Unlikely to occur** The species has not been previously recorded in the desktop search extent and suitable habitat for the species was not recorded within the Study Area.
Blugrass (*Dichanthium setosum*)	Vulnerable	Least Concern	The species is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture (DAWE, 2020b). The extent to which this species tolerates disturbance is unknown (DAWE, 2020b).	**Potential to occur** The species has been previously recorded in natural grasslands on Tay Glen, approximately 27 km south of the Study Area (SKM, 2011). The Study Area was identified to contain suitable habitat in association with natural grasslands and open woodlands. However, despite extensive surveys by E2M (2021) in optimal conditions (wet season surveys), the species was not detected, reducing its likelihood of occurring.
King Blue-grass (*Dicanthium queenslandicum*)	Endangered	Vulnerable	The species typically occurs on black cracking clay in tussock grasslands mainly in association with other species of blue grasses (*Dichanthium* spp. and *Bothriochloa* spp.) but also with other grasses restricted to this soil type (DES, 2019d). The species is known to occur as a component of the Natural Grasslands TEC (DSEWPaC, 2013a). Other communities where *Dichanthium queenslandicum* can be found include *Acacia salicina* thickets in grassland and Eucalypt woodlands (i.e. *Corymbia dallachiana*, *C. erythrophloia*, *Eucalyptus orgadophila*) (DES, 2019d).	**Potential to occur** The species has been previously recorded within the desktop search extent, approximately 11 km south of the Study Area. Suitable habitat was observed in areas of RE 11.9.3 within the Study Area. However, despite extensive surveys by E2M (2021) in optimal conditions (wet season surveys), the species was not detected, reducing its likelihood of occurring.

Table 5-6 (Continued)
Likelihood of Occurrence Assessment – Flora

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Black Ironbox (*Eucalyptus raveretiana*)	Vulnerable	Least Concern	*Eucalyptus raveretiana* occurs between Rockhampton and Ayr in Queensland (DES, 2019d). The species occurs on the banks of rivers, creeks and other watercourses, on clayey or loamy soil (DES, 2019d). The species is usually a co-dominant canopy species, associated with *Melaleuca leucadendra*, *M. fluviatilis*, *Eucalyptus tereticornis*, *Corymbia tessellaris*. The species has been recorded within REs 11.3.25a, 11.3.11, 9.3.1 and 8.3.3 (DES, 2019d).	**Unlikely to occur** The Study Area is not in proximity to recorded populations with the closest record greater than 40 km north east of the Study Area.
Quassia (*Samadera bidwillii*)	Vulnerable	Vulnerable	The species commonly occurs in lowland rainforest often with *Araucaria cunninghamii* or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland, it is commonly found in areas adjacent to both temporary and permanent watercourses up to 510 m altitude (DES, 2019d). Commonly associated trees in the open forest and woodlands include *Corymbia citriodora, Eucalyptus propinqua, E. acmenoides, E. tereticornis, C. intermedia, E. siderophloia, E. moluccana, E. cloeziana* and *E. fibrosa* (DES, 2019d).	**Unlikely to occur** The species has not been previously recorded in the desktop search extent and suitable habitat for the species was limited within the Study Area.

Source: After Appendix D.

[1] Status under the EPBC Act as at February 2021.

[2] Status under the NC Act as at February 2021.

Field Survey Methodology

Flora surveys were conducted in accordance with relevant Commonwealth and State guidelines, including:

- *Methodology for Survey and Mapping Regional Ecosystems and Vegetation Communities in Queensland Version 5.1* (Neldner *et al.*, 2020);
- Conservation advice criteria for each threatened ecological community[1] (DotE, 2013a; DEWHA, 2008a; DEE, 2019c);
- *Random Meander Technique* (Cropper, 1993);
- *Flora Survey Guidelines – Protected Plants* (DES, 2020a); and
- *Guide to Determining Terrestrial Habitat Quality* (DES, 2020b).

Survey techniques included a combination of tertiary and quaternary vegetation surveys, ground-truthing of REs (regional ecosystems), BioCondition assessments, threatened ecological community assessments, targeted searches for threatened species and opportunistic observations (Appendix D).

Through the use of aerial imagery and regional ecosystem (RE) mapping, 476 suitable sites for the assessment of vegetation communities were selected within the Study Area. These sites were selected through the review of geological information, aerial imagery and RE mapping to stratify the Study Area, and to flag major vegetation and RE. Sites were then selected which best represented the Study Area.

Site selection was completed in accordance with the *Methodology for Surveying and Mapping Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al*., 2020).

The 476 assessment sites comprise:

- 318 quaternary assessments;
- 6 tertiary assessments;
- 54 BioCondition assessments; and
- 98 threatened ecological community assessments.

Tertiary surveys were conducted, where practicable and permittable (due to seasonal requirements), to record detailed floristic and structural information (Appendix D).

The random meander technique (Cropper, 1993) was used to survey for potential threatened flora throughout the Study Area (Appendix D). This technique is particularly suitable for locating species that typically occur at very low densities or that may be distributed in isolated clumps.

Targeted surveys for threatened species using the Cropper (1993) random meander technique were undertaken for:

- species identified within the Terms of Reference; and
- species identified from the desktop assessment and literature review conducted by E2M (2021) where potential habitat was identified within the Study Area.

Opportunistic observations were also conducted where not specifically targeted via other survey methods.

REs were assessed through the use of the latest available aerial photography (NearMap, 2020), Queensland Remnant Regional Ecosystem mapping data (DES, 2018f), and field assessment results.

Targeted surveys for threatened ecological communities known to occur, likely to occur or listed in the Terms of Reference were undertaken by E2M (2021).

Threatened Ecological Community Survey Results

The majority of the area that would be disturbed by the Project consists of improved/disturbed pastures dominated by non-native grasses and *Acacia harpophylla* regrowth shrublands, which have a long history of cattle grazing and the original habitats have been subject to past clearance and modification (Appendix D). Some pockets of remnant vegetation remain, as well as areas of regrowth (Appendix D).

[1] Note there is currently no approved conservation advice for the Semi-evergreen Vine Thickets TEC.

Three threatened ecological communities listed under the EPBC Act were recorded within the Study Area, namely (Figure 5-4):

- Brigalow TEC;
- Natural Grasslands TEC; and
- Poplar Box TEC.

Two of these threatened ecological communities are located within the Indicative Surface Disturbance Area of the Project, namely Natural Grasslands TEC and the Poplar Box TEC (Figure 5-4).

E2M (2021) surveyed for and did not identify Semi-evergreen Vine Thickets TEC during field surveys, nor was it identified by EcoSM (2013) in previous field surveys. Additionally, no suitable habitat has been identified within the Study Area.

Threatened ecological communities identified during field surveys are described below. Details including a description of the community, survey effort and the habitat assessment methodology undertaken are also provided.

Brigalow (Acacia harpophylla dominant and co-dominant)

The Brigalow TEC is listed as Endangered under the EPBC Act. Brigalow is the commonly accepted name for the species *Acacia harpophylla* and the vegetation in which this species is dominant or co-dominant. To qualify as the Brigalow TEC, an occurrence of Brigalow must meet minimum threshold conditions pertaining to patch size and weed encroachment (DotE, 2013c).

Several patches of Brigalow were recorded during the field survey (Figure 5-4). However, the majority of Brigalow surveyed did not meet the condition thresholds for the Brigalow TEC due to areas containing:

- regrowth (<15 years old); and
- a cover of exotic perennial species greater than or equal to 50% (particularly Buffel Grass [*Cenchrus ciliaris*], Indian Bluegrass [*Bothriochloa pertusa*] and Parthenium [*Parthenium hysterophorus*]).

No Brigalow TEC would be cleared for the Project.

A total of approximately 28.9 ha of Brigalow TEC was identified within the Study Area, however all Brigalow TEC is avoided by the Project (Figure 5-4). The Brigalow TEC is represented by a combination of RE 11.4.8 and RE 11.9.5.

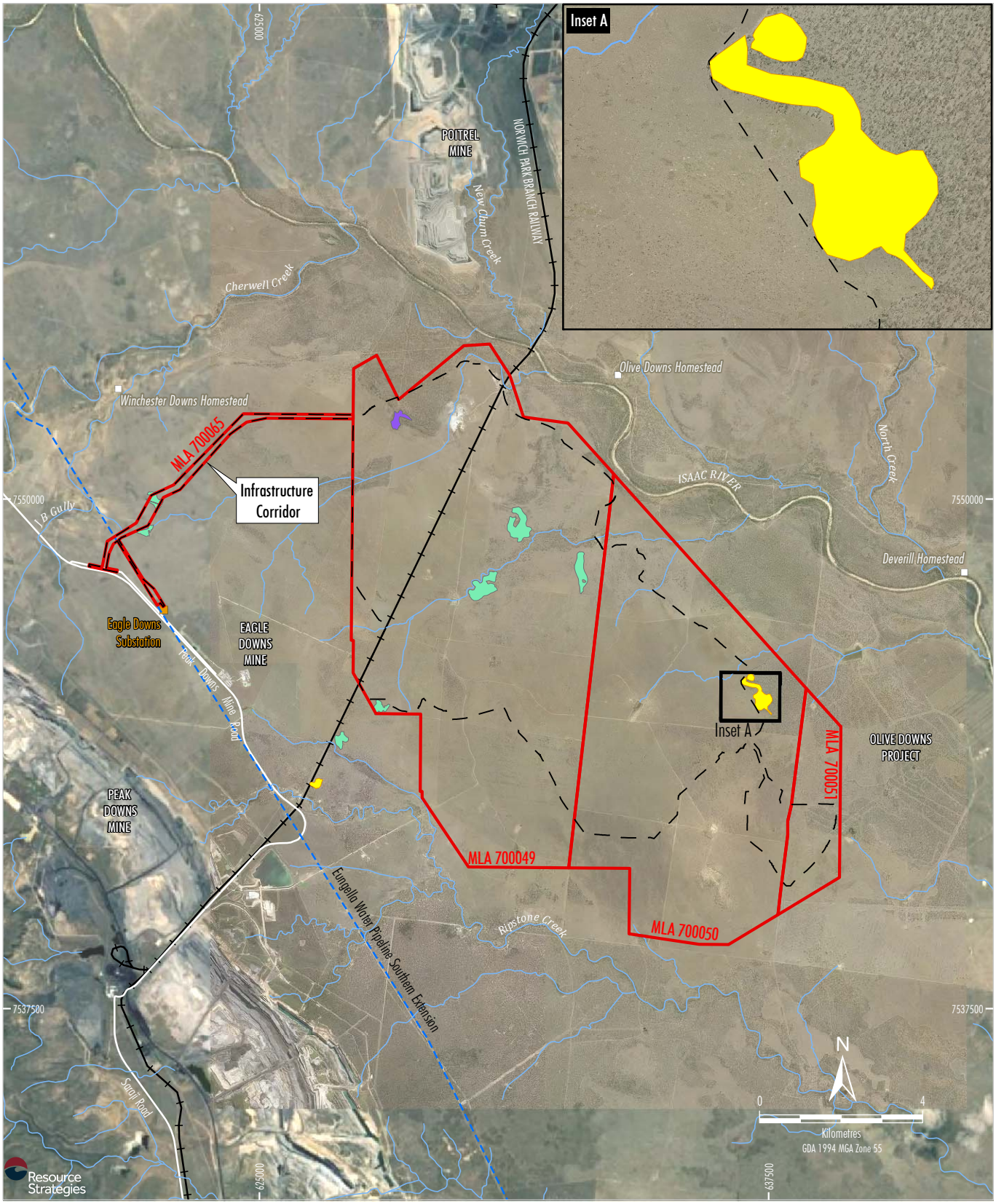
Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin

The Natural Grasslands TEC is listed as Endangered under the EPBC Act and comprises native perennial grass species with minimal cover of woody vegetation (DEWHA, 2008a).

Two condition classes, 'best quality' and 'good quality', are described for the TEC. Determination of the associated condition class is dependent on a variety of criteria including patch size, richness of specific native grass indicator species, tussock density, woody cover and cover of exotic species (DEWHA, 2008a).

A total of approximately 80.9 ha of Natural Grasslands TEC was identified within the Indicative Surface Disturbance Area of the Project, all of which is 'good quality' (Figure 5-4) (Plate 5-1). Due to the percentage foliage cover of non-native grasses (>5%), no 'best quality' Natural Grasslands TEC was identified within the Indicative Surface Disturbance Area of the Project (Appendix D).

Plate 5-1 – Natural Grasslands TEC within the Study Area
Source: E2M (2021).



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Railway
- Eungella Water Pipeline Southern Extension
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)
- Substation

Threatened Ecological Community

- Poplar Box Grassy Woodland on Alluvial Plains
- Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin
- Brigalow (*Acacia harpophylla* Dominant and Co-dominant)

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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MNES - Threatened Ecological Communities

Figure 5-4

Native grass indicator species recorded within the Natural Grasslands TEC areas included Feather-top Wiregrass (*Aristida latifolia*), White Speargrass (*Aristida leptopoda*), Bull Mitchell Grass (*Astrebla squarrosa*), Queensland Bluegrass (*Dichanthium sericeum*), Native Millet (*Panicum decompositum*), Yabila Grass (*Panicum queenslandicum*), Sago Grass (*Paspalidium globoideum*) and Cup Grass (*Eriochloa crebra*).

Poplar Box Grassy Woodland on Alluvial Plains

Poplar Box TEC is listed as Vulnerable under the EPBC Act. The Poplar Box TEC is typically a grassy woodland with a canopy dominated by *Eucalyptus populnea*. Three Condition Classes (Class A, B and C) are identified for the Poplar Box TEC and are based on the (DEE, 2019c):

- crown cover of canopy trees;
- percentage cover of native perennial vegetation in the ground layer;
- native species richness within the ground layer; and
- density of mature trees (>30 cm diameter at breast height).

A total of 9.6 ha of 'Good Quality' (Class B) Poplar Box TEC, comprising a single patch of RE 11.3.2, was identified within the Indicative Surface Disturbance Area of the Project (Figure 5-4) (Plate 5-2).

Plate 5-2 – Poplar Box TEC within the Study Area
Source: E2M (2021).

Poplar Box TEC within the area that would be disturbed by the Project is dominated by a native vegetation within the groundlayer (approximately 65%), including *Chrysopogon fallax*, *Aristida holathera*, Kangaroo Grass (*Themeda triandra*), Common Fringe-rush (*Fimbristylis dichotoma*), Comet Grass (*Perotis rara*), Yellow Buttons (*Chrysocephalum apiculatum*) and *Rostellularia adscendens*.

The density of mature trees was recorded at approximately 14 trees/ha. Due to the percentage foliage cover of non-native grasses (>30%), the 'Class A' Poplar Box TEC criteria was not met.

While other areas of RE 11.3.2 were recorded within the Study Area, these areas did not meet the Poplar Box TEC criteria due to:

- >50% cover of exotic pasture species; and/or
- <10 mature trees/ha.

Targeted Flora Survey Results

Targeted surveys for threatened flora species known to occur, likely to occur or listed in the Terms of Reference for the Project were undertaken by E2M (2021).

No threatened flora species under the EPBC Act were recorded by E2M (2021). The species listed in the Terms of Reference are described below.

Marlborough Blue (Cycas ophiolitica)

Marlborough Blue is listed as Endangered under both the NC Act and the EPBC Act.

Marlborough Blue grows on hills and slopes in sparse, grassy open forest, at altitude ranges between 80 m and 400 m above sea level. Its known distribution is between Marlborough and Rockhampton in central Queensland.

Although this species prefers red clay soils near Marlborough, it is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite (DAWE, 2020b). The species occurs within eucalypt woodland and open woodlands containing *Corymbia dallachiana, Corymbia erythrophloia, Eucalyptus crebra, Eucalyptus fibrosa* and *Corymbia intermedia* (DAWE, 2020b).

The species has not been previously recorded in the desktop search extent and was not recorded in the Study Area, despite targeted surveys.

King Blue-grass (Dichanthium queenslandicum)

King Blue-grass is listed as Vulnerable under the NC Act and as Endangered under the EPBC Act.

King Blue-grass is a perennial grass endemic to central and southern Queensland, occurring on fertile heavy black soils near within the Fitzroy Basin and regions within the northern Darling Downs district (Stanley & Ross, 1989; Threatened Species Scientific Committee [TSSC], 2013).

Within its distribution, King Blue-grass habitat includes native grasslands and open woodlands with a grassy understorey and a *Eucalyptus orgadophila*, *Corymbia erythrophloia*, *E. coolabah* tree layer. Within these habitats the species occurs in association mainly with other bluegrasses (*Dichanthium* spp. and *Bothriochloa* spp.) and other native grasses associated with heavy, black soil types (Simon, 1982).

King Blue-grass was reported by EcoSM (2013) as occurring in the Study Area. E2M (2021) undertook extensive surveys of the location in which the species was thought to have been previously recorded, including collecting samples of suspected King Blue-grass. It was concluded by the Queensland Herbarium that the samples collected were *Sehima nervosum*, and therefore the previous records are considered by E2M (2021) to be a case of misidentification. No King Blue-grass is known to be present in the Study Area.

Quassia (Samadera bidwillii)

Quassia is listed as Vulnerable under both the NC Act and the EPBC Act.

Quassia commonly occurs in lowland rainforest often with *Araucaria cunninghamii* or on rainforest margins, but it can also be found in other forest types such as open forest and woodland. It is commonly found in areas adjacent to both temporary and permanent watercourses up to 510 m altitude (DES, 2019d).

Commonly associated trees in the open forest and woodlands include *Corymbia citriodora, Eucalyptus propinqua, E. acmenoides, E. tereticornis, Corymbia intermedia, E. siderophloia, E. moluccana, E. cloeziana* and *E. fibrosa* (DES, 2019d).

The species has not been previously recorded in the desktop search extent and was not recorded in the Study Area, despite targeted surveys.

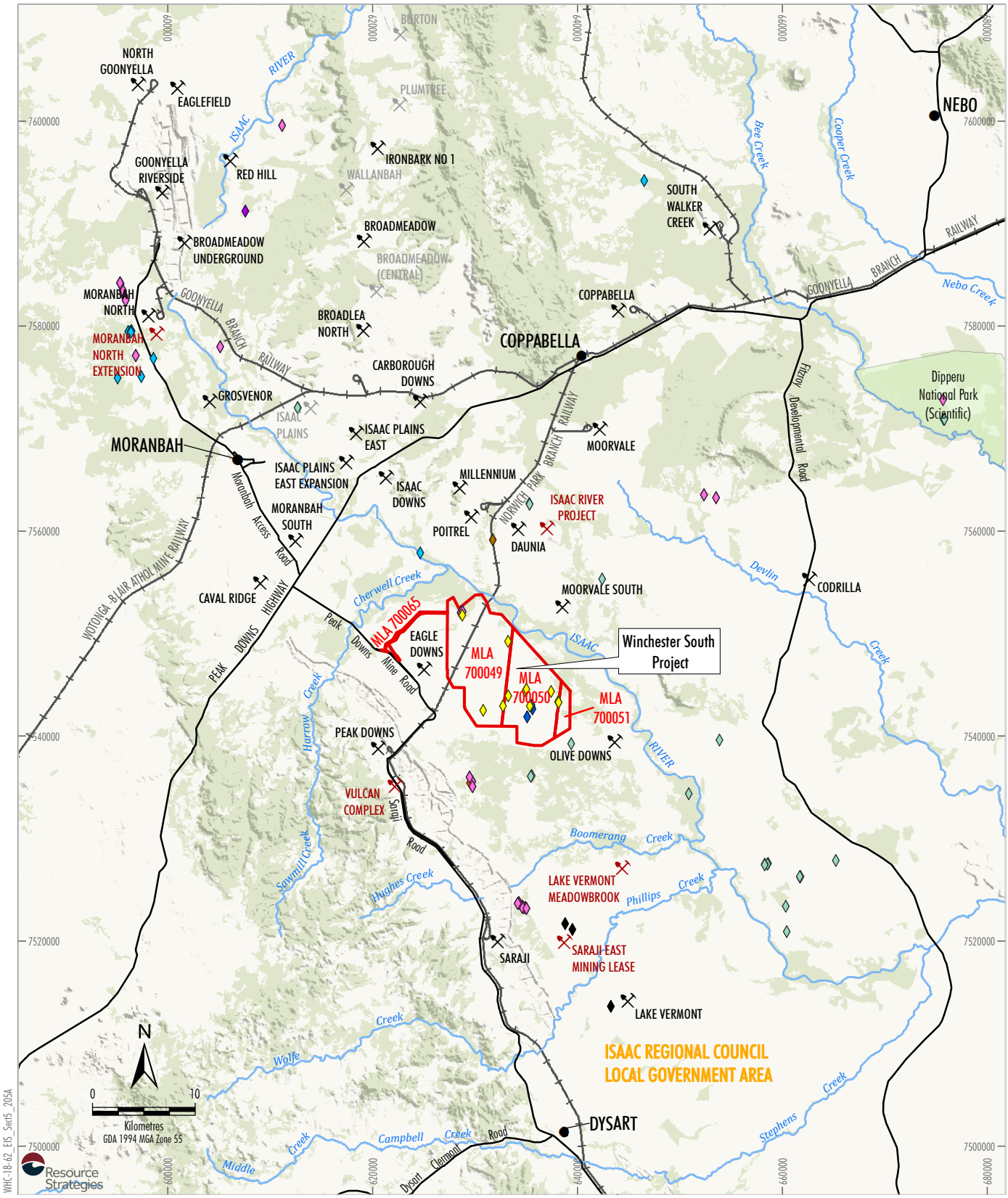
5.3.5 Threatened Fauna

Desktop and Literature Review

A review of various desktop resources was completed by E2M (2021) to establish which fauna species have been historically recorded within approximately 50 km of the Project mining lease application areas, are listed by the Terms of Reference or have been identified by the PMST and other publicly available information.

The Terms of Reference identify the following listed threatened species as being relevant to the Project:

- Reptiles (Figure 5-5):
  - Southern Snapping Turtle;
  - Fitzroy River Turtle;
  - Yakka Skink;
  - Dunmall's Snake;
  - Allan's Lerista/Retro Slider; and
  - Ornamental Snake.
- Birds (Figure 5-6):
  - Red Goshawk;
  - Squatter Pigeon (southern subspecies);
  - Painted Honeyeater;
  - Star Finch (Eastern);
  - Australian Painted Snipe; and
  - Curlew Sandpiper.
- Mammals (Figure 5-7):
  - Northern Quoll;
  - Ghost Bat;
  - Corben's Long-eared Bat;
  - Greater Glider; and
  - Koala (combined populations of Queensland, NSW and the ACT).
- Fish:
  - Murray Cod.



LEGEND

- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Railway
- Road

E2M (2021) Surveys

- Ornamental Snake

Previous Surveys

- Ornamental Snake (3D Environmental, 2012)
- Ornamental Snake (Atlas of Living Australia, 2020)
- Ornamental Snake (BMA, 2008)
- Ornamental Snake (DES, 2020e)
- Ornamental Snake (DPM Envirosciences, 2018b)
- Ornamental Snake (E & LAMR, 2006)
- Ornamental Snake (EcoSM, 2013)
- Ornamental Snake (SKM, 2011)
- Ornamental Snake (URS, 2013)

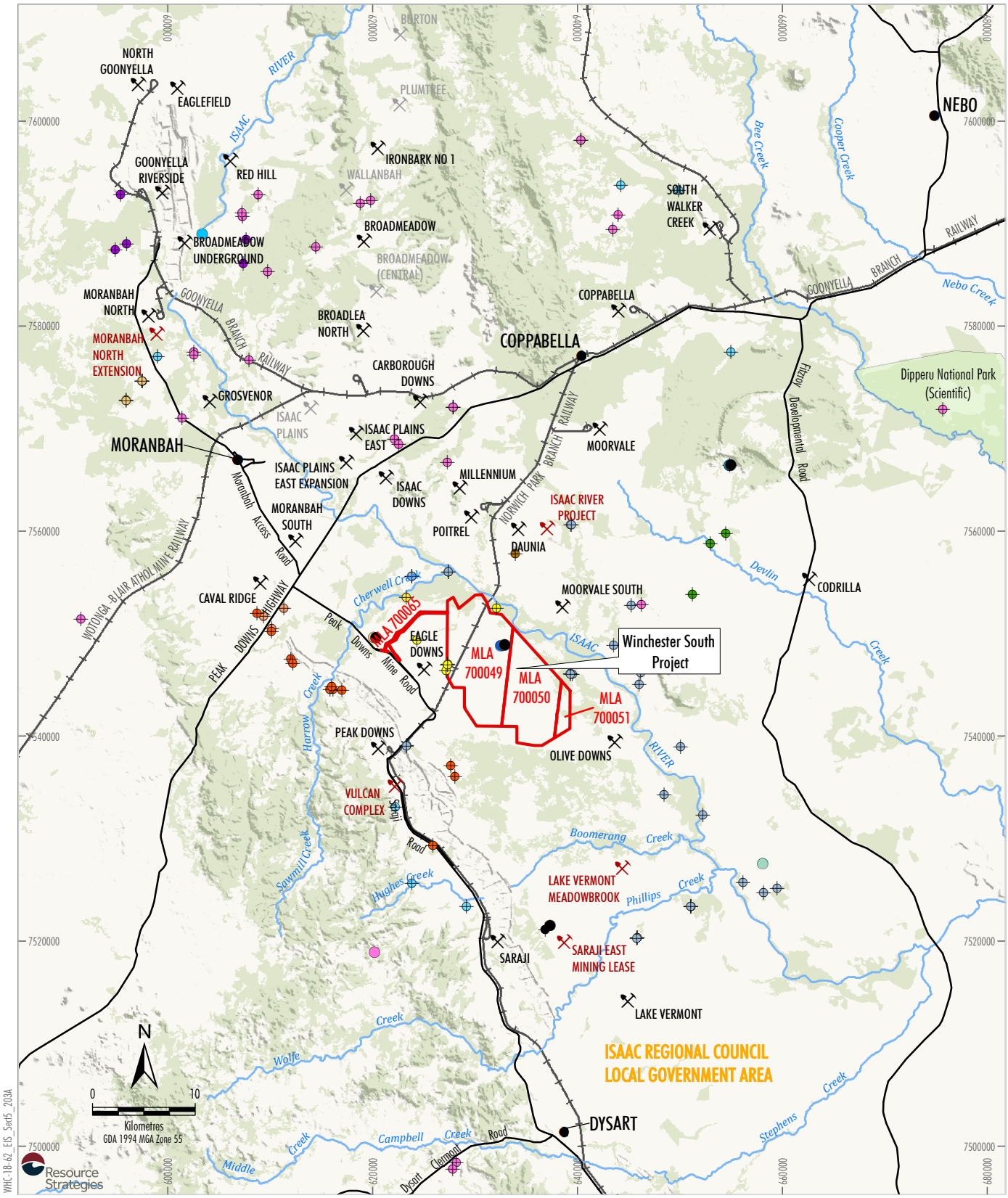
Source: The State of Queensland (2018 - 2020); E2M (2021); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Threatened Species Records (Reptiles)

Figure 5-5



LEGEND

- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Railway
- Road

E2M (2021) Surveys

- Squatter Pigeon (southern subspecies)

Previous Surveys

- Australian Painted Snipe (Atlas of Living Australia, 2020)
- Australian Painted Snipe (Birdlife Australia, 2020)
- Australian Painted Snipe (DES, 2020e)
- Australian Painted Snipe (DPM Enviros ciences, 2018b)
- Australian Painted Snipe (EcoSM, 2013)
- Australian Painted Snipe (SKM, 2011)
- Squatter Pigeon (Atlas of Living Australia, 2020)
- Squatter Pigeon (BAAM, 2009)
- Squatter Pigeon (BMA, 2008)
- Squatter Pigeon (Birdlife Australia, 2020)
- Squatter Pigeon (DES, 2020e)
- Squatter Pigeon (DPM Enviros ciences, 2018a)
- Squatter Pigeon (DPM Enviros ciences, 2018b)
- Squatter Pigeon (E & LAMR, 2006)
- Squatter Pigeon (Matrix Plus, 2009)
- Squatter Pigeon (SKM, 2011)
- Squatter Pigeon (URS, 2013)

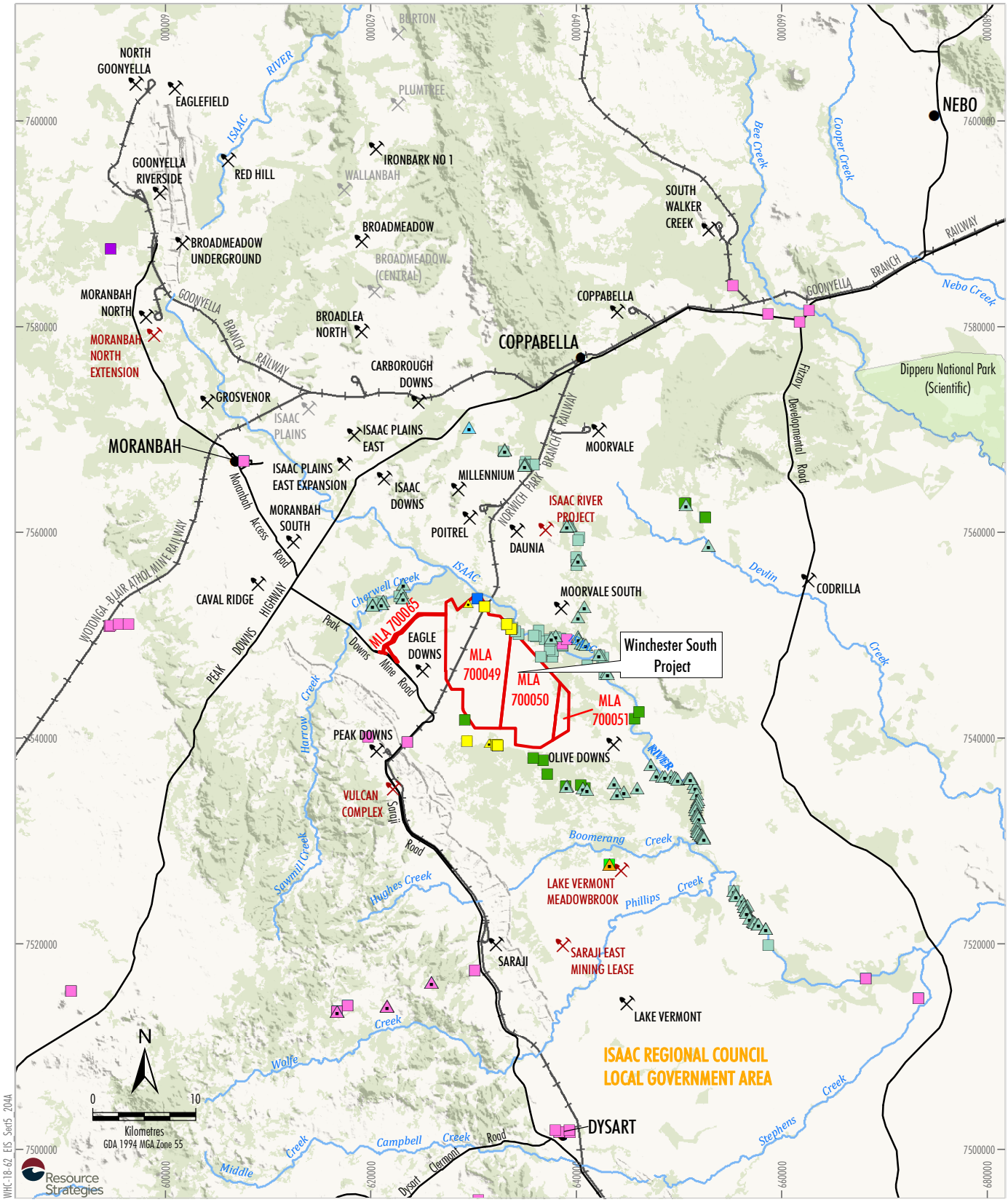
Source: The State of Queensland (2018 - 2020); E2M (2021); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Threatened Species Records (Birds)

Figure 5-6



LEGEND

- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Railway
- Road

E2M (2021) Surveys

- Greater Glider
- Koala

Previous Surveys

- Greater Glider (AARC Environmental Solutions, 2019)
- Greater Glider (Atlas of Living Australia, 2020)
- Greater Glider (DES, 2020e)
- Greater Glider (DPM Envirosciences, 2018b)
- Koala (AARC Environmental Solutions, 2020)
- Koala (Atlas of Living Australia, 2020)
- Koala (DES, 2020e)
- Koala (DPM Envirosciences, 2018a)
- Koala (DPM Envirosciences, 2018b)
- Koala (EcoSM, 2013)
- Koala (URS, 2013)

Source: The State of Queensland (2018 - 2020); E2M (2021); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Threatened Species Records (Mammals)

Figure 5-7

Historical records of the previously listed threatened species in the broader region are detailed in Appendix B of Appendix D of the EIS.

Additional species to those listed in the Terms of Reference were identified through the literature review undertaken by E2M. A consolidated list of these species and those listed in the Terms of Reference include:

- Marlborough Blue (*Cycas ophiolitica*);
- *Dichanthium setosum;*
- King Blue-grass (*Dichanthium queenslandicum*);
- Black Ironbox (*Eucalyptus raveretiana*);
- Quassia (*Samadera bidwillii*);
- Curlew Sandpiper;
- Red Goshawk;
- Squatter Pigeon (southern species);
- Painted Honeyeater;
- Star Finch (southern and eastern species);
- Black-throated Finch (southern subspecies);
- White-throated Needletail;
- Australian Painted Snipe;
- Northern Quoll;
- Ghost Bat;
- Corbens Long-eared Bat ;
- Greater Glider;
- Koala;
- Northern Hairy-nosed Wombat;
- Ornamental Snake;
- Yakka Skink;
- Southern Snapping Turtle;
- Dunmall's Snake;
- Allan's Lerista / Retro Slider; and
- Fitzroy River Turtle.

Likelihood of Occurrence Assessment

As described in Section 5.3.4, E2M (2021) conducted a Likelihood of Occurrence Assessment to evaluate the qualitative probability that a flora or fauna species could physically occupy the Study Area during all, or part, of its life cycle. The assessment evaluated (Appendix D):

- species-specific ecological and physiological requirements;
- previously recorded species observations;
- the resources and constraints present in the Study Area informed by the desktop assessment; and
- the resources and constraints present in the Study Area informed by the field surveys.

During the desktop assessment, the outcome of the Likelihood of Occurrence Assessment was used to guide the field design and planning phase. Threatened species that are known, likely, or have the potential, to occur in the Study Area were targeted during the field surveys (i.e. target species). Following the field surveys, the Likelihood of Occurrence Assessment was re-evaluated using the field data to modulate the target species list prior to further assessment (Appendix D).

The Likelihood of Occurrence Assessment criteria are detailed in Table 5-5, with the fauna Likelihood of Occurrence Assessment detailed in Table 5-7.

Targeted Searches for Terrestrial Threatened Fauna Species

Appendix D provides a comprehensive list of threatened fauna species identified by the Terms of Reference and through desktop and database searches for the Project. Each of the identified species were specifically targeted by E2M (2021) during field surveys.

Table 5-8 outlines the targeted survey methodologies employed by E2M (2021) for each identified threatened species including a reconciliation of the survey methods undertaken for each against the recommended State and Commonwealth survey methods.

Table 5-7
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Birds				
Curlew Sandpiper (*Callidris ferruginea*)	Critically Endangered, Marine, Migratory	Critically Endangered	In Australia, this species usually forages and roosts in intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms (DotE, 2015b).	**Unlikely to occur** The species has not been previously recorded within the desktop search extent. Potential habitat for the species within the Study Area (e.g. farm dams) was considered marginal.
Red Goshawk (*Erythrotiorchis radiatus*)	Vulnerable	Endangered	The species prefers landscapes containing a mosaic of habitats including coastal and sub-coastal tall open forest, woodland and rainforest edges (Marchant and Higgins, 1993; DERM, 2012; TSSC, 2015a). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotone between rainforest and sclerophyll forest) (DAWE, 2020b). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk habitat utilisation (DAWE, 2020b). The species generally avoids open habitats and is only rarely encountered over agricultural land (Marchant and Higgins, 1993). Nesting occurs in tall trees within one kilometre of permanent water, generally in open, biologically rich forest or woodland (Marchant and Higgins, 1993). The species is sparsely dispersed across approximately 15% of coastal and sub-coastal Australia. The species occurs at low densities occupying home ranges estimated between 50 to 220 km^2 (DAWE, 2020b).	**Unlikely to occur** The species has not been previously recorded within the desktop search extent. In addition, remnant woodland within the Study Area has undergone historical disturbance from clearing which reduces the habitat value for the species.
Squatter Pigeon (Southern Subspecies) (*Geophaps scripta scripta*)	Vulnerable	Vulnerable	The species is locally abundant within the northern part of its range (i.e. Brigalow Belt [North] and Desert Uplands Bioregions) (DAWE, 2020b). It is considered to be common in grazing country north of the Tropic of Capricorn (DAWE, 2020b). The species occurs in a wide range of habitats wherever there is a grassy understorey. It is often found within close proximity of water bodies (DAWE, 2020b).	**Known to occur** The species was recorded within the northern and western portions of the Study Area during field surveys (Appendix D). Suitable breeding and foraging habitat for the species was identified on suitable land zones within the Study Area.

Table 5-7 (Continued)
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Birds (Continued)				
Painted Honeyeater (*Grantiella picta*)	Vulnerable	Vulnerable	The species forages on mistletoes in eucalypt forests/woodlands, riparian woodlands of Black Box and River Red Gum, Box-Ironbark-Yellow Gum woodlands, Acacia-dominated woodlands, Paperbarks, Casuarinas, Callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes (DotE, 2015c).	**Potential to occur** The species has not previously been recorded within the desktop search extent; however, potentially suitable habitat for the species was identified within the Study Area.
Star Finch (Eastern) (*Neochmia ruficauda ruficauda*)	Endangered	Endangered	The species mainly occurs in grasslands and grassy woodlands that are located close to bodies of fresh water (DEWHA, 2008b). It also occurs in cleared or suburban areas such as along roadsides and in towns (DAWE, 2020b).	**Unlikely to occur** The species has not previously been recorded within the desktop search extent and the Study Area is outside of the current known distribution for the species.
Southern Black-throated Finch (*Poephila cincta cincta*)	Endangered	Endangered	Occurs mainly in grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water (DAWE, 2020b). Almost all recent records of the finch from south of the tropics have been in riparian habitat (Black-throated Finch Recovery Team, Department of Environment and Climate Change and Queensland Parks and Wildlife Service, 2007). The subspecies is thought to require a mosaic of different habitats in which it can find seed during the wet season (DAWE, 2020b).	**Unlikely to occur** The species has not been previously recorded within the desktop search extent. In addition, the Study Area is outside the current known distribution of the species.
White-throated Needletail (*Hirundapus cadacutus*)	Vulnerable, Marine, Migratory	Vulnerable	In Australia, this species is almost exclusively aerial (1 to 1,000 m above ground), yet occurs over a variety of habitats with a preference for wooded areas (DAWE, 2020b).	**Likely occurrence** Fork-tailed swifts are likely to forage within the air space above the Study Area. The species has previously been recorded within the desktop search extent.

Table 5-7 (Continued)
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Birds (Continued)				
Australian Painted Snipe (*Rostratula australis*)	Endangered, Marine	Endangered	Generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DAWE, 2020b). They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains (DAWE, 2020b). The species has been recorded to sometimes utilise areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant and Higgins, 1993). Breeding occurs in shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby, typically from or near small islands in freshwater wetlands (DAWE, 2020b).	**Known to occur** The species has been previously recorded along an unnamed drainage line in the northern extent of the Study Area and from nearby locations (SKM, 2011; EcoSM, 2013; DPM Envirosciences, 2018).
Red-tailed Tropicbird (*Phaethon rubricauda*)	Marine, Migratory	Vulnerable	Tropical and subtropical seas, pelagic, often far from land (Appendix D).	**Unlikely to occur** Suitable habitat for the species was not recorded within the Study Area. No previous records were detected within the desktop study extent.
Mammals				
Northern Quoll (*Dasyurus hallucatus*)	Endangered	Least Concern	The species occupies a diversity of habitats across its range including eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (TSSC, 2005). The species is also known to occupy non-rocky lowland habitats such as beachscrub communities in central Queensland (DAWE, 2020b). Rocky areas provide prime habitat for northern quolls (Hill and Ward, 2010).	**Unlikely to occur** Suitable habitat for the species was not recorded within the Study Area. The closest known historic record is located over 40 km from the Study Area.
Ghost Bat (*Macroderma gigas*)	Vulnerable	Endangered	The species occurs across a range of habitats, from arid Pilbara to tropical savanna woodlands and rainforests (TSSC, 2016a). During the daytime they roost in caves, rock crevices and old mines (TSSC, 2016a). Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23°– 28°C and a moderate to high relative humidity of 50–100% (TSSC, 2016a). The average foraging distance is approximately 2 km from the daytime roost (TSSC, 2016a).	**Unlikely to occur** Suitable habitat for the species was not recorded within the Study Area. No previous records were detected within the desktop study extent.

Table 5-7 (Continued)
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Mammals (Continued)				
Corben's Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	Vulnerable	Found in a wide range of inland woodland vegetation types (TSSC, 2015b). These include Box, Ironbark, Cypress Pine woodlands, Bulloak woodlands, Brigalow woodland, Belah woodland, Smooth-barked Apple woodland, River Red Gum forest, Black Box woodland, and various types of tree mallee (TSSC, 2015b). The species is more abundant in extensive stands of vegetation in comparison to smaller woodland patches (TSSC, 2015b).	**Unlikely to occur** The species has not previously been recorded within the desktop search extent, and the Study Area is located outside of the species known distribution.
Greater Glider (*Petauroides volans*)	Vulnerable	Vulnerable	The species is generally restricted to Eucalypt forests and woodlands, particularly favouring forest with a diversity of eucalypt species (TSSC, 2016b). During the day the species shelters in tree hollows, with a particular selection for large hollows in large, old trees (TSSC, 2016b). Modelling suggests that they require native forest patches of at least 160 km^2 to maintain viable populations (Eyre, 2002).	**Known to occur** The species was recorded within the Study Area during field surveys. In addition, the species had previously been recorded within 3 km of the Study Area (DPM Envirosciences, 2018). Known records were primarily located within vegetation in close proximity to the Isaac River and its tributaries (Appendix D).
Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)	Vulnerable	Vulnerable	Koalas occur in a variety of Eucalypt forests and woodland communities (Environmental Protection Agency, 2006). They feed almost entirely on eucalypt foliage with preferences varying regionally (Krockenberger *et al.*, 2012). Diet is thought to be a major determinant of habitat selection, with the species being able to use small remnants of original vegetation where suitable habitat is present (Krockenberger *et al.*, 2012). Koalas are also known to occur in modified or regenerating native vegetation communities, as well as urban and rural landscapes where food trees or shelter trees may be highly scattered (DAWE, 2020b).	**Known to occur** Koala scats were recorded within the Study Area during field surveys. In addition, the koala has been previously recorded immediately adjacent to the Study Area in association with the Olive Downs Project surveys (DPM Envirosciences, 2018). Records of the species were primarily associated with riparian vegetation (Appendix D).
Northern Hairy-nosed Wombat (*Lasiorhinus kreftftii*)	Critically Endangered	Endangered	The current distribution of the species is restricted to a single locality in Epping Forest National Park (DAWE, 2020b) approximately 165 km from the Project (Appendix D).	**Unlikely to occur** Suitable habitat for the species was not recorded within the Study Area. No previous records were detected within the desktop study extent.

Table 5-7 (Continued)
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Reptiles				
Ornamental Snake (*Denisonia maculata*)	Vulnerable	Vulnerable	The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in land zone 4, but also lake margins and wetlands (DAWE, 2020b). Gilgai formations are found where deep-cracking alluvial soils with high clay contents occur (DAWE, 2020b).	**Known to occur** The Study Area is known to contain habitat for Ornamental Snake (Appendix D). The species has previously been recorded from within the Study Area (EcoSM, 2013) and by previous surveys near the Study Area (DPM Envirosciences, 2018; SKM, 2011).
Yakka Skink (*Egernia rugosa*)	Vulnerable	Vulnerable	The species is known to occur in open dry sclerophyll forest, woodland and scrub (DotE, 2014b), including on land zones 3, 4, 5, 7, 9 and 10 (DAWE, 2020b). Common woodland and open forest types include *Acacia harpophylla, A. aneura, A. catenulata, A. shirleyi, Casuarina cristata, Eucalyptus populnea, Eucalyptus* spp. and *Callitris glaucophylla* (DAWE, 2020b).	**Potential to occur** The species has not previously been recorded within the desktop search extent; however, potentially suitable habitat for the species occurs within the Study Area.
Southern Snapping Turtle (*Elseya albagula*)	Critically Endangered	Critically Endangered	Prefers clear, flowing, well-oxygenated waters (DotE,2014c). The species does occur in non-flowing waters, but typically at much reduced densities (DotE, 2014c).	**Unlikely to occur** The species has not previously been recorded within the desktop search extent. Suitable habitat for the species was not recorded within the Study Area.
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	Vulnerable	The species has been found in a broad range of habitats, including forests and woodlands on black alluvial cracking clay and clay loams dominated by *Acacia harpophylla* (Brigalow), other wattles (*A. burowii, A. deanii, A. leiocalyx*), *Callitris* spp. or *Allocasuarina luehmannii;* and *Corymbia citriodora, Eucalyptus crebra, E. melanophloia, Callitris glaucophylla* and Bulloak open forest and woodland associations on sandstone derived soils (DotE, 2014d).	**Potential to occur** The species has not previously been recorded within the desktop search extent; however, potentially suitable habitat for the species occurs within the Study Area.

Table 5-7 (Continued)
Likelihood of Occurrence Assessment – Fauna

Species	EPBC Act Status[1]	NC Act Status[2]	Habitat	Likelihood of Occurrence
Reptiles (Continued)				
Allan's Lerista (*Lerista allanae*)	Endangered	Endangered	Found in association with *Eucalyptus orgadophila/E. erythrophloia* open woodlands and *Melaleuca bracteata* (DAWE, 2020b). It is currently associated with altered landscapes that have areas with leaf litter and friable surface soils beneath trees and shrubs. These sites were characterised by dark chocolate non-cracking clay-based soils which are mapped as RE 11.8.5 and 11.8.11 (DAWE, 2020b).	**Unlikely to occur** The species has not previously been recorded within the desktop search extent and the Study Area is outside of the current known distribution for the species.
Fitzroy River Turtle (*Rheodytes leukops*)	-	Vulnerable	Generally associated with instream habitats providing deep pool and riffle sequences, this species also prefers *Vallisneria* spp. (Ribbonweed) beds (DAWE, 2020b). Common riparian trees associated with the species habitat include *Eucalyptus tereticornis, Casuarina cunninghamiana, Callistemon viminalis* and *Melaleuca linariifolia* (DAWE, 2020b).	**Unlikely to occur** The species has not previously been recorded within the desktop search extent. Suitable habitat for the species was not recorded within the Study Area.

Source: After Appendix D.

[1] Status under the EPBC Act as at February 2021.

[2] Status under the NC Act as at February 2021.

Table 5-8
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Birds					
Curlew Sandpiper (*Calidris ferruginea*)	Critically Endangered, Marine, Migratory	Critically Endangered	No survey guidelines available for this species. Surveys between September and March in wetlands[6].	No species-specific guideline is provided, however general diurnal bird survey methods and effort are[4]: ▪ Six 5 – 10 min area searches within a 100 by 100 m survey site. ▪ Incidental detection of the species while conducting other surveys or moving across the overall survey site.	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). 12 hours of wetland / waterbody watches. Incidental detection of the species while conducting other surveys or moving across the overall survey site.
Red Goshawk (*Erythrotriorchis radiatus*)	Vulnerable	Endangered	Search for characteristic nests within patches of the tallest forest[5]. Driving slowly through woodland tracks and scanning groups of tall trees for nests[5]. The minimum effort required for area searches is 50 hours over 8 days for 50 ha[5].	No species-specific guideline is provided, however general diurnal bird survey methods and effort are six 5 – 10 min area searches within a 100 by 100 m survey site[4].	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). Incidental detection of the species while conducting other surveys or moving across the overall survey site.
Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)	Vulnerable	Vulnerable	Diurnal bird surveys (area or transect) of 15 hours over 3 days for areas less than 50 ha[5]. Drive surveys of all unsealed roads early morning and late afternoon[5].	No species-specific guideline is provided, however general diurnal bird survey methods and effort are[4]: ▪ Six 5 – 10 min area searches within a 100 by 100 m survey site. ▪ Incidental detection of the species while conducting other surveys or moving across the overall survey site.	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). Incidental detection of the species while conducting other surveys or moving across the overall survey site.

Table 5-8 (Continued)
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Birds (Continued)					
Painted Honeyeater (*Grantiella picta*)	Vulnerable	Vulnerable	There are no survey guidelines available for this species.	Area searches during breeding season involving searches for nesting habitat and listening for calls[7]. Surveys should be conducted on foot and target foraging habitat (i.e. mistletoes) and breeding habitat[7]. The minimum effort required for this method is 4 hours over 4 days[7].	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). Incidental detection of the species while conducting other surveys or moving across the overall survey site.
Star Finch (Eastern) (*Neochmia ruficauda ruficauda*)	Endangered	Endangered	Area searches or transect-point surveys in suitable habitat[5]. Playback surveys during the morning and evening[5]. Targeted searches and subsequent watches of waterholes during the dry season[5]. The minimum effort required for these methods is 15 hours over 5 days in areas of less than 50 ha for area searches; 15 hours over 3 days in areas of less than 50 ha for call playbacks; and 10 hours over 4 days for targeted surveys at waterholes[5].	No species-specific guideline is provided, however general diurnal bird survey methods and effort are[4]: ▪ Six 5 – 10 min area searches within a 100 by 100 m survey site. ▪ Incidental detection of the species while conducting other surveys or moving across the overall survey site.	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). Incidental detection of the species while conducting other surveys or moving across the overall survey site.
Australian Painted Snipe (*Rostratula australis*)	Endangered	Endangered	Targeted stationary observations at wetlands of 10 hours over 5 days[5]; or Land-based area searches or line transects at wetlands of 10 hours over 3 days for areas less than 50 ha[5].	No species-specific guideline is provided, however general diurnal bird survey methods and effort are[4]: ▪ Six 5 – 10 min area searches within a 100 by 100 m survey site. ▪ Incidental detection of the species while conducting other surveys or moving across the overall survey site.	189 hours of diurnal bird surveys (total combined effort in all fauna habitat types). 12 hours of wetland / waterbody watches. Incidental detection of the species while conducting other surveys or moving across the overall survey site.

Table 5-8 (Continued)
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Mammals					
Northern Quoll (*Dasyurus hallucatus*)	Endangered	-	In areas up to 5 ha in size[8]: ▪ Cage trapping and Elliott trapping surveys are recommended. ▪ The minimum effort required for these methods is 3 trap nights. ▪ Trapping should be concentrated in rocky denning habitat, with some consideration of non-rocky foraging and dispersal habitats.	No species-specific guideline is provided, however general terrestrial mammal survey methods and effort are[4]: ▪ Two 30 min spotlight searches within a 100 by 100 m survey site. ▪ Camera trapping with one camera per site for minimum of 4 nights. ▪ Hair tubes spaced 5 – 10 m apart in a linear or grid arrangement for a minimum of 4 nights, but preferably at least 2 weeks. ▪ Scat and sign search and incidental detection can coincide with the active searches.	45 cage trap nights (total combined effort in all fauna habitat types). 114 hours of spotlighting (total combined effort in all fauna habitat types). 153 hours of active searches (total combined effort in all fauna habitat types). 128 camera trap nights (total combined effort in all fauna habitat types). Incidental detection of the species while conducting other surveys or moving across the overall survey site.
Ghost Bat (*Macroderma gigas*)	Vulnerable	Endangered	No species-specific survey guidelines; recommended survey techniques for megabat species include mist nets, traps and visual surveys of roosting locations[10].	Active monitoring involving spotlighting, hand-held bat detectors and acoustic detection (due to their low-intensity calls, the bat must be <5 – 7 m from the microphone)[11]. Transects should be distributed to adequately represent the major habitat types within the Study Area[11]. Harp traps, mist nets and roost searches are also recommended[11]. The minimum effort required for these methods is 8 detector hours/4 nights for active monitoring; 8 trap nights/4 nights for harp traps; 8 mist net hours/4 nights for mist nets; 2 hours of roost searching per survey day[11].	101 hours of spotlighting. 60 nights of echolocation surveys with Anabat detectors (total combined effort in all fauna habitat types).

Table 5-8 (Continued)
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Mammals (Continued)					
Corben's Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	Vulnerable	Surveys between October and April[10]. Harp traps and mist nets are effective for this species[10]. Traps and nets should be distributed to represent major habitat types[10]. The minimum effort required for harp traps and mist nets, respectively, is 5 nights/20 traps and 5 nights/20 mist nets[10].	No species-specific guideline is provided, however harp trapping is recommended to determine the presence of bat species whose calls cannot be separated or identified using bat detectors[4]. The minimum effort required for this method is 2 trap nights per sampling site[4].	60 nights of echolocation surveys with Anabat detectors (total combined effort in all fauna habitat types).
Greater Glider (*Petauroides volans*)	Vulnerable	Vulnerable	No species-specific survey guidelines, however vehicle spotlighting and spotlighting transects may be used to detect gliders[8].	No species-specific guideline is provided, however general arboreal mammal survey methods and effort are[4]: ▪ Two 30 min spotlight searches within a 100 by 100 m survey site. ▪ Scat and sign search and incidental detection can coincide with the active searches.	61 hours of spotlighting.
Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)	Vulnerable	Vulnerable	Survey effort is not prescribed but several direct and indirect survey methods are prescribed including[9]: ▪ nocturnal spotlighting; and ▪ SAT surveys.	No species-specific guideline is provided, however general terrestrial mammal survey methods and effort are[4]: ▪ Two 30 min active nocturnal and/or spotlight searches within a 100 by 100 m survey site. ▪ Two sessions of call playback at midpoint of survey site. ▪ Scat and sign search and incidental detection can coincide with the active searches.	61 hours of spotlighting. 13 SAT surveys.

Table 5-8 (Continued)
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Reptiles					
Ornamental Snake (*Denisonia maculata*)	Vulnerable	Vulnerable	Surveys between late September and late March[1]. Diurnal searches. The minimum survey effort required for this method is 1.5 person-hours per ha over 3 days[1]. 1.5 hours of spotlighting per ha of potential habitat[1]. Opportunistic road surveys[1]. 2 pitfall /funnel trap lines within each habitat[1].	No species-specific guideline is provided, however general reptile survey methods and effort are[4]: ▪ Four pitfall trapping buckets at 7.5 m intervals in a T-shaped design with 45 m of drift fence over 4 nights. ▪ Six funnel traps 3 m in on distal ends of T-design with 45 m of fence over 4 nights. ▪ Two 30 person-min diurnal searches within two different 50 by 50 m quadrants of the survey site. ▪ Two 30 person-min nocturnal searches within the survey site.	115 hours of spotlighting. 75 hours of active searches. 120 pitfall trap nights. 174 funnel trap nights.
Yakka Skink (*Egernia rugosa*)	Vulnerable	Vulnerable	Surveys between late September and late March[1]. Active searches for burrow systems and communal defecation sites. The minimum survey effort required for this method is 1.5 person-hours per ha over 3 days[1, 2]. Species presence can be confirmed by trapping around the suspected burrows (1 Elliott trap and 1 cage trap), distant observation with binoculars or by shining a torch down the burrows at night[1,2].	Detectability increases with increased temperatures around mid-September to early October[3]. Diurnal searches and camera trapping are the most reliable methods of detecting species presence[3]. The minimum effort required varies per method, however 20 minutes of active searching per ha of potential habitat is recommended for active searches[3].	108 hours of active searches. 740 Elliott traps. 37 cage traps. 104 camera trap nights. 94 hours of spotlighting.
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	Vulnerable	Surveys between late September and late March[1]. Diurnal searches. The minimum survey effort required for this method is 1.5 person-hours per ha over 3 days[1]. None known to reliably detect the species, however active searching of sheltering sites (rocks, logs or human-made debris), pitfall trapping or road driving at night (particularly after wet weather) are recommended[2].	No species-specific guideline is provided, however general reptile survey methods and effort are[4]: ▪ Four pitfall trapping buckets at 7.5 m intervals in a T-shaped design with 45 m of drift fence over 4 nights. ▪ Six funnel traps 3 m in on distal ends of T-design with 45 m of fence over 4 nights. ▪ Two 30 person-min diurnal searches within two different 50 by 50 m quadrants of the survey site. ▪ Two 30 person-min nocturnal searches within the survey site.	148 pitfall trap nights. 213 funnel trap nights. 108 hours of active searches. 94 hours of spotlighting.

Table 5-8 (Continued)
Survey Methods Employed for Potentially Occurring Threatened Terrestrial Fauna Species

Species	Conservation status#		Prescribed Commonwealth Survey Methods and Effort	Prescribed Queensland Survey Methods and Effort	Survey Effort undertaken within the Potential Habitat ^
	EPBC Act	NC Act			
Reptiles (Continued)					
Allan's Lerista (*Lerista allanae*)	Endangered	Endangered	Surveys between late September and late March[1]. Active searches. The minimum survey effort required for this method is 1.5 person-hours per ha over 3 days[1, 2]. Raking surface soil and leaf litter under logs or at the base of bushes or trees and turning objects where they shelter in combination with pitfall trapping at a time of year when the species is most likely to be active[2]. Six 10 litre buckets spread along a 15 m fence adequate for detection[2].	No species-specific guideline is provided, however general reptile survey methods and effort are[4]: ▪ Four pitfall trapping buckets at 7.5 m intervals in a T-shaped design with 45 m of drift fence over 4 nights. ▪ Six funnel traps 3 m in on distal ends of T-design with 45 m of fence over 4 nights. ▪ Two 30 min diurnal searches within two different 50 by 50 m quadrants of the survey site. ▪ Two 30 min nocturnal searches within the survey site.	148 pitfall trap nights. 213 funnel trap nights. 108 hours of active searches. 94 hours of spotlighting.

Source: After E2M, 2021 (Appendix D).

^ Survey effort undertaken by E2M across four field surveys between the Dry Season 2019 (October) and the Wet Season 2020 (February) (Appendix D).

Conservation status under the EPBC Act and NC Act as at November 2020.

1 *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (DSEWPaC, 2011a).

2 *Survey Guidelines for Australia's Threatened Reptiles* (DSEWPaC, 2011c).

3 *Targeted Species Survey Guidelines – Yakka Skink (Egernia rugosa)* (Ferguson and Mathieson, 2014).

4 *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (DES, 2018a).

5 *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010b).

6 *Species Profile and Threats Database* (DAWE, 2020b).

7 *Targeted Species Survey Guidelines – Painted Honeyeater (Grantiella picta)* (Rowland, 2012).

8 *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC, 2011b).

9 *EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014a).

10 *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010a).

11 *Targeted Species Survey Guidelines – Ghost Bat (Macroderma gigas)* (Hourigan, 2011).

Field Surveys

Field surveys were undertaken for the Project to identify and characterise the presence, extent and condition of contemporary ecological values within the Study Area.

As described in Section 5.3.4, terrestrial flora and fauna surveys were previously undertaken by EcoSM in 2011 and 2012 of the area within MLA 700049, MLA 700050 and MLA 700051. These surveys provided a good initial characterisation of the terrestrial ecology values.

The Study Area for E2M's detailed field surveys established suitable buffers from the Indicative Surface Disturbance Extent to identify and characterise ecological values which extend away from the Project. At times this buffer ranged from 100 m to 500 m around the MLA boundaries (where access was allowed for). Along the north-eastern extent of MLA 700049, MLA 700050 and MLA 700051 the Project is immediately adjacent to the approved Olive Downs Project, which is approved to disturb habitat within an approximately 145 m wide corridor. This corridor runs the entire length of the north-eastern boundary of MLA 700049, MLA 700050 and MLA 700051 up to the Norwich Park Railway. This corridor was excluded from field surveys because of the approved disturbance.

E2M (2021) undertook fauna surveys across multiple seasons in accordance with relevant State and Commonwealth survey guidelines, including but not limited to:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (DES, 2018a);
- *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (DSEWPaC, 2011a);
- *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC, 2011b);
- *Survey Guidelines for Australia's Threatened Reptiles* (DSEWPaC, 2011c);
- *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010a);
- *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010b);
- SPRAT (Species Profile and Threats) Database (DAWE, 2020b);
- species approved conservation advice (DAWE, 2020c);
- species national recovery plans (DAWE, 2020d); and
- targeted species survey guidelines from the following sources:
  - *EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014a);
  - Koala (*Phascolarctos cinereus*) – Spot Assessment Technique (SAT) (Phillips and Callaghan, 2011);
  - *Targeted species survey guidelines – Yakka skink* (*Egernia rugosa*) (Ferguson and Mathieson, 2014);
  - *Targeted species survey guidelines – Painted honeyeater (Grantiella picta)* (Rowland, 2012); and
  - *Targeted species survey guidelines – Ghost bat (Macroderma gigas)* (Hourigan, 2011).

Field Survey Methodology

Field surveys were previously undertaken by EcoSM in 2011 and 2012 to prepare a baseline terrestrial flora and fauna study report for the Project. Four surveys were undertaken during 2011 and 2012, the results of which assisted in determining targeted field survey efforts by E2M (2021).

Field surveys for fauna species undertaken by E2M (2021) implemented various techniques, including:

- establishing systematic trap sites for catch and release of fauna;
- nocturnal spotlighting and call playback surveys;
- auditory and visual bird surveys conducted early morning and evening;
- Anabat detectors to detect and record the echolocation calls emitted by bats;
- diurnal active searches;
- fauna habitat surveys; and
- opportunistic observations.

Survey sites were selected in accordance with the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (DES, 2018a). Generic survey sites were identified through stratification of the Study Area based on desktop information (including aerial imagery and regional ecosystem mapping [DES, 2019d]).

A detailed description of each terrestrial fauna species targeted, and the relevant survey methods and effort is provided in Table 5-8.

Fauna Habitat Assessments

Habitat assessments mainly reported the abundance of macro and micro habitat features which are important to assist in determining the likelihood of occurrence of a threatened species.

Features recorded during habitat assessments included:

- abundance and composition of Koala food trees, habitat connectivity and movement corridors;
- depth and abundance of gilgai habitat, soil cracks, and presence of amphibians (prey food);
- presence and abundance of rocky outcrops;
- abundance and size of burrows;
- presence, abundance and size of trees and logs with hollows; abundance of leaf litter and ground cover; and
- type and degree of existing disturbance to the natural landscape.

Field Survey Results

E2M (2021) conducted fauna habitat assessments at 90 representative sites within the Study Area to characterise the suitability of various fauna habitats and to identify and/or refine threatened species habitat areas.

The results of these assessments identified 11 broad fauna habitat types, as depicted on Figure 5-8.

Habitat for the following conservation significant terrestrial fauna species were detected by E2M (2021) during field surveys within the Indicative Surface Disturbance Extent of the Project:

- Ornamental Snake (Figure 5-9);
- Squatter Pigeon (southern subspecies) (Figure 5-10);
- Koala (combined populations of Queensland, NSW and the ACT) (Figure 5-11); and
- Greater Glider (Figure 5-12).

The following threatened fauna species were recorded by E2M (2021) during field surveys:

- Ornamental Snake (Figure 5-9);
- Squatter Pigeon (southern subspecies) (Figure 5-10);
- Koala (combined populations of Queensland, NSW and the ACT) (Figure 5-11); and
- Greater Glider (Figure 5-12).

A description of each species and the habitat assessment undertaken for each is provided below.

Ornamental Snake (Denisonia maculata)

The Ornamental Snake is listed as Vulnerable under the EPBC Act. The Ornamental Snake is a small (approximately 500 mm in length), nocturnal, venomous snake predominately olive in colour with a black crown and distinctly barred lips.

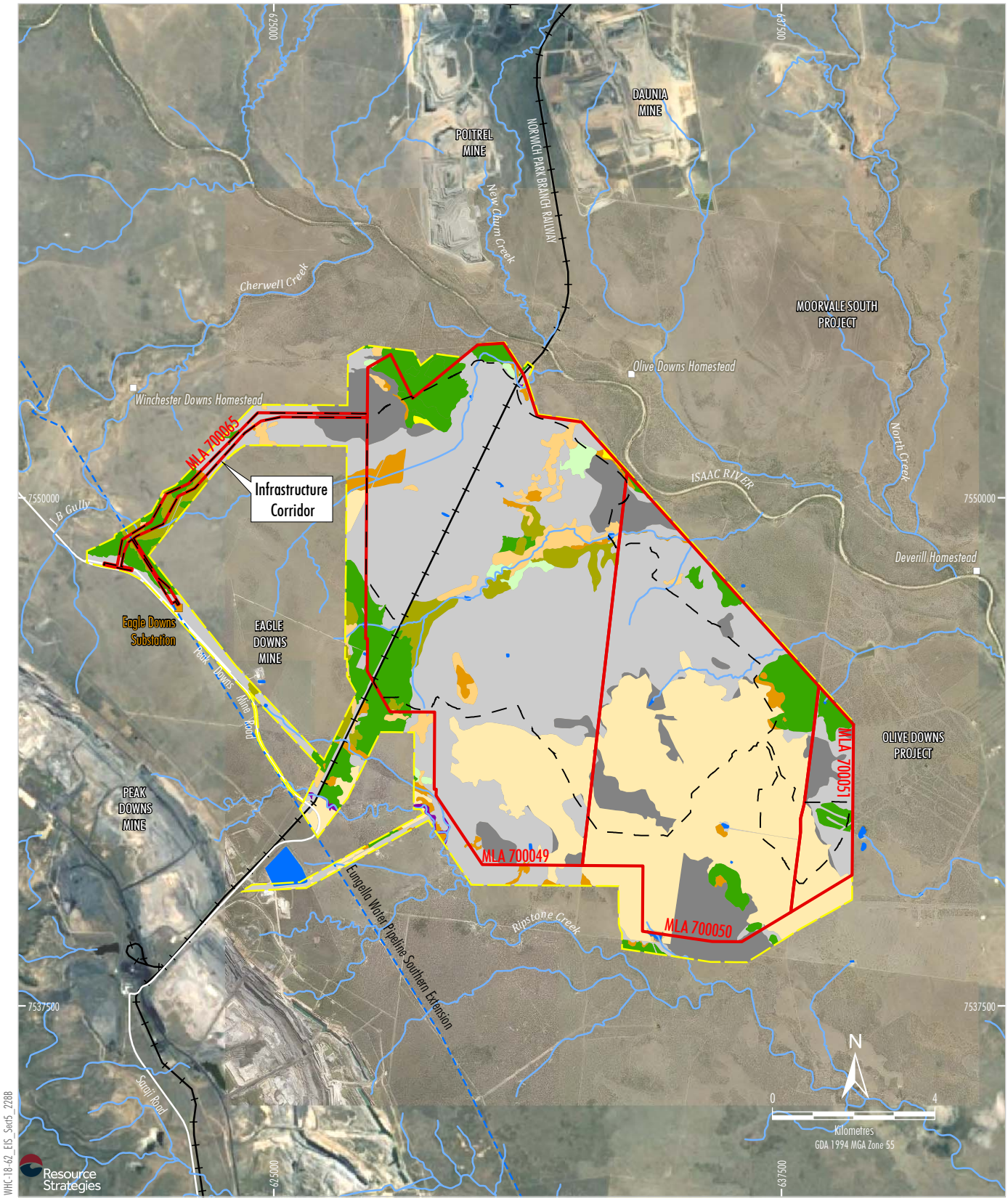
Habitat for the Ornamental Snake is closely associated with gilgai (deep cracking clay soils) or melon-holes (DSEWPaC, 2011a).

The Ornamental Snake was recorded throughout gilgai habitat within the Study Area (Figure 5-9).

Within the area associated with the Mine Site and Access Road Action (EPBC 2019/8460), Ornamental Snake habitat generally comprises remnant and regrowth Brigalow, Coolabah and pastureland-dominated vegetation communities that contains gilgai or ephemeral drainage lines. A number of these drainage lines have been modified by the construction of farm dams.

Ornamental Snake habitat within the area that would be disturbed by the Project comprises REs associated with the Ornamental Snake (RE 11.3.3, RE 11.4.8 and RE 11.4.9) (DSEWPaC, 2011a) (except for a single patch without suitable microhabitat features), a few patches of woodland with suitable microhabitat features (e.g. drainage features), Brigalow TEC and gilgai soils with suitable microhabitat features (Figure 5-9).

Ornamental Snake habitat within the Indicative Surface Disturbance Extent of the Project is mapped as 'known important habitat' as the species was recorded in these areas and habitat areas contain suitable microhabitat features.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Railway
- Eungella Water Pipeline Southern Extension
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)
- Substation

Habitat Type

- 1 - Coolabah Wetland
- 2a - Eucalypt Woodland
- 2b - Mature Regrowth / Disturbed Eucalypt Woodland
- 3a - Brigalow +/- *Eucalyptus spp.* Woodland
- 3b - Mature Regrowth / Disturbed Brigalow +/- *Eucalyptus spp.* Woodland
- 3c - Brigalow Regrowth (<2m tall)
- 4 - Riparian Blue Gum Open Forest
- 5 - Native Grassland
- 6a - Pastureland without Gilgai
- 6b - Pastureland with Gilgai
- 7 - Farm Dams

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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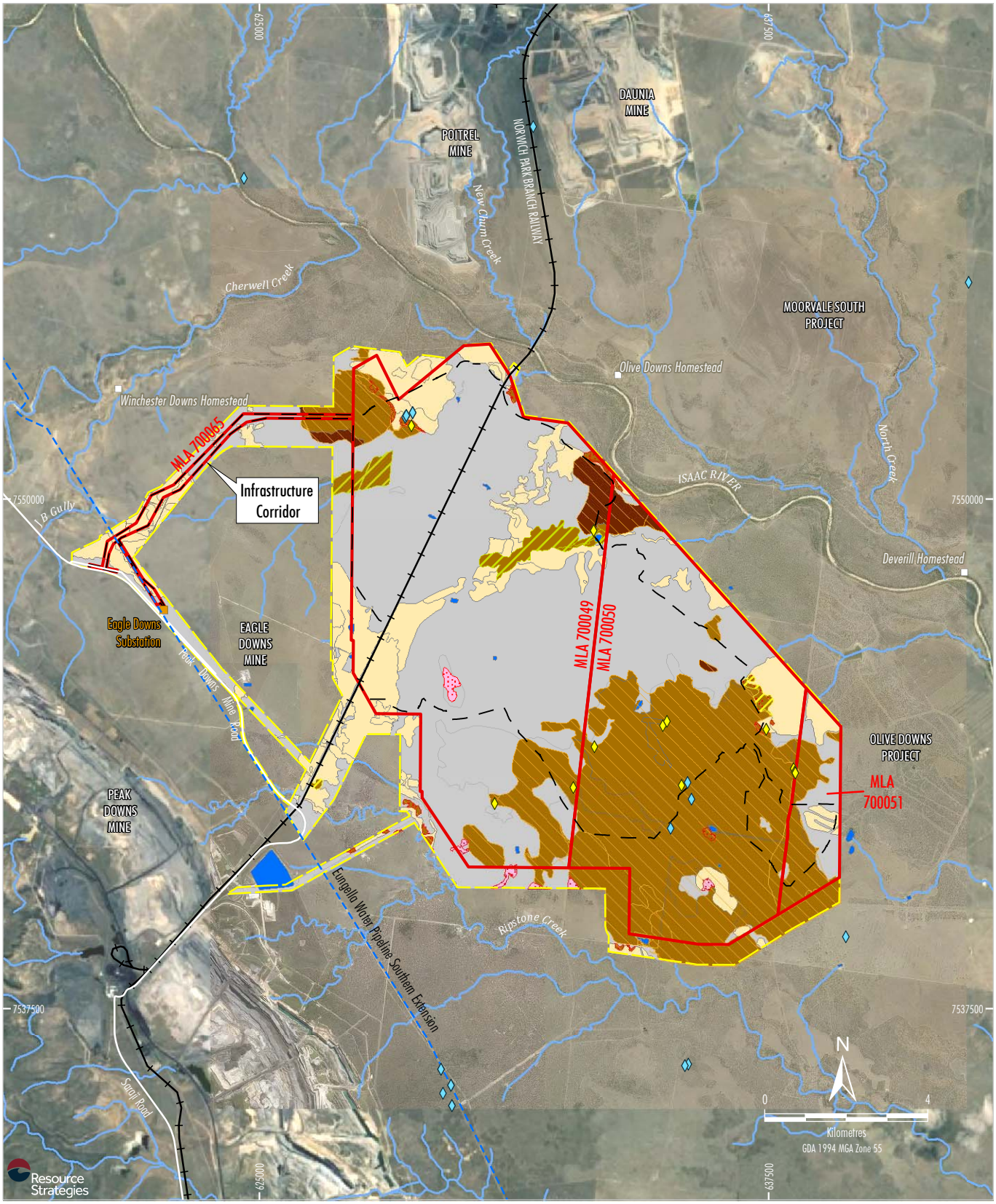
Broad Fauna Habitat Types

Figure 5-8



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

E2M (2021) Surveys
- Ornamental Snake

Previous Surveys
- Ornamental Snake

Potential Habitat
- Ornamental Snake Important Habitat

Other Mapping Units
- Remnant Regional Ecosystems Associated with the Ornamental Snake (REs 11.3.3c, 11.4.8 and 11.4.9)
- Woodland with Suitable Microhabitat
- Brigalow TEC
- Gilgai Soils
- Gilgai Soils without Suitable Microhabitat Features
- Remnant Regional Ecosystem Associated with the Ornamental Snake without Suitable Microhabitat Features
- Regional Ecosystem not Associated with the Ornamental Snake without Gilgai Soils
- Exotic Grasslands or Regrowth without Gilgai Soils
- Farm Dam
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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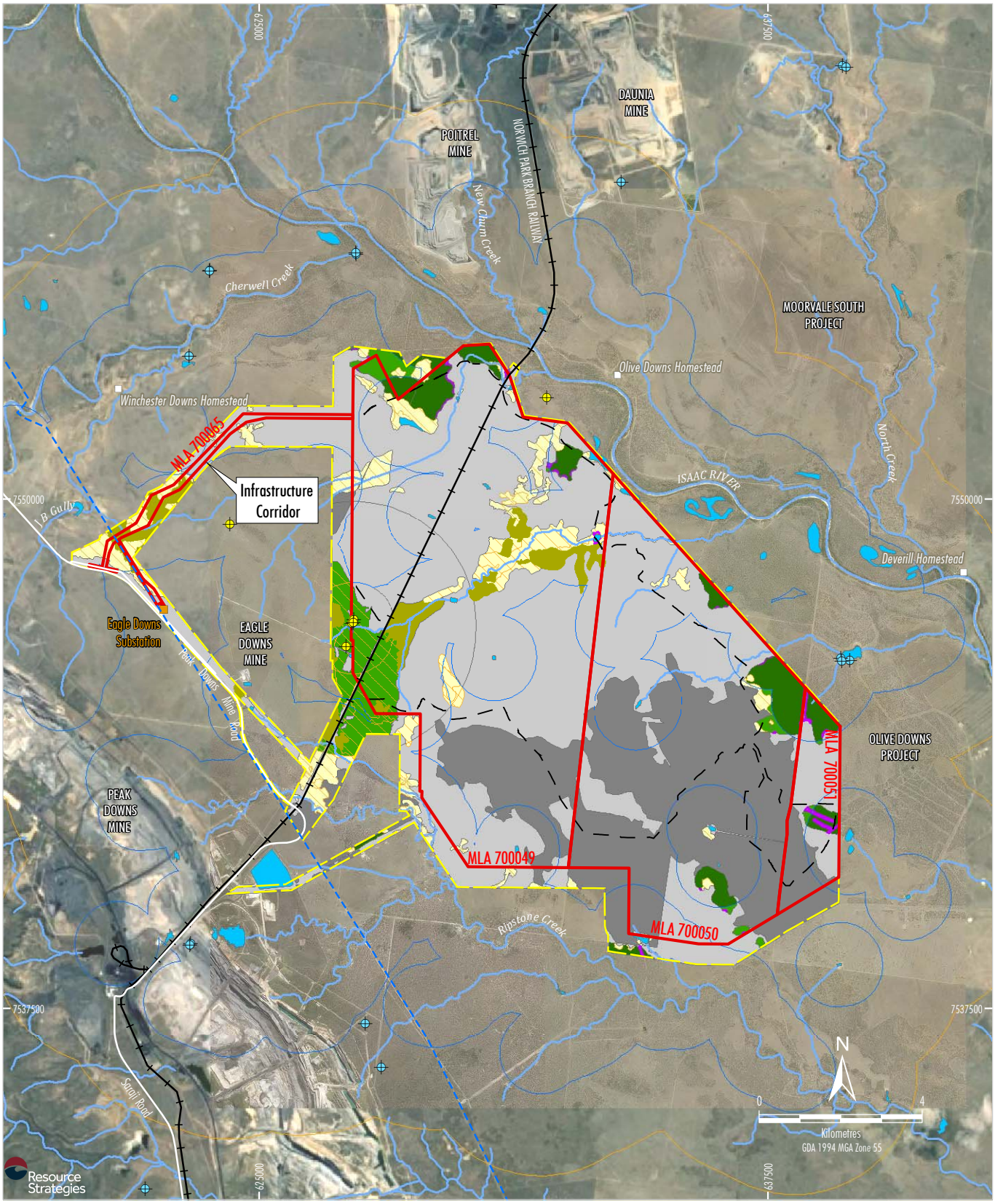
Threatened Species Habitat Mapping - Ornamental Snake

Figure 5-9



LEGEND

- Mining Lease Application Boundary
- Terrestrial Ecology Study Area Boundary
- Indicative Surface Disturbance Extent
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

E2M (2021) Surveys

- Squatter Pigeon (southern subspecies)

Previous Surveys

- Squatter Pigeon (southern subspecies)

Potential Habitat

- Squatter Pigeon Breeding and Foraging Habitat
- Squatter Pigeon Foraging Habitat
- Squatter Pigeon Dispersal Habitat

Other Mapping Units

- Exotic Grassland Pasture less than 100 m wide between Suitable Foraging or Breeding Habitat
- Woodland without Suitable Groundcover or not on Landzones Suitable for Breeding or Foraging
- Regrowth Woodland without Suitable Groundcover or not on Suitable Landzones for Breeding or Foraging
- Native Grassland Pasture greater than 100 m wide without Suitable Groundcover for Breeding or Foraging (REs 11.9.3 and 11.4.4)
- Exotic Grassland Pasture greater than 100 m wide between Suitable Foraging or Breeding Habitat
- 1 km Boundary from Watercourse/Waterbody
- 3 km Boundary from Watercourse/Waterbody
- Waterbody
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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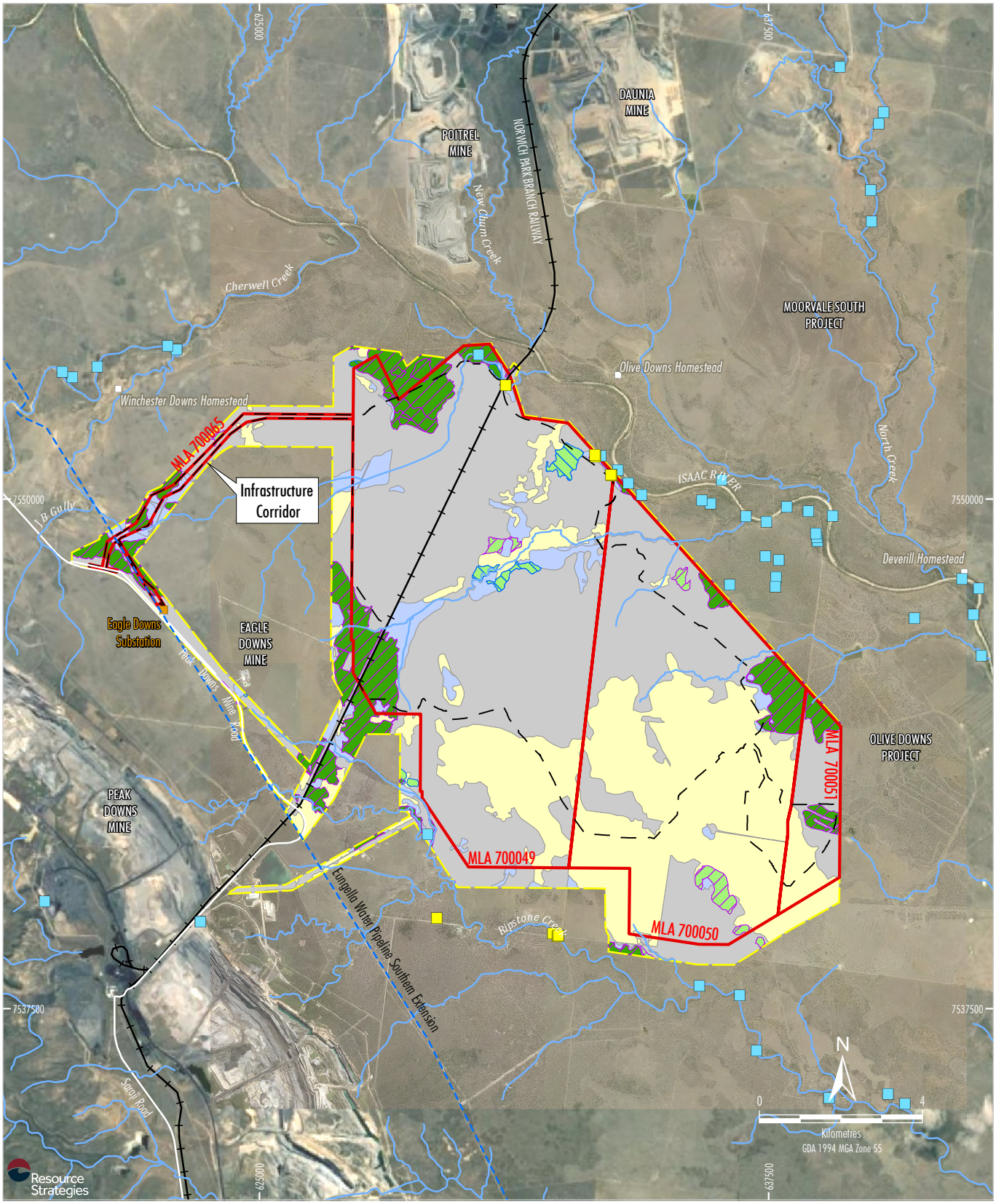
Threatened Species Habitat Mapping - Squatter Pigeon (southern subspecies)

Figure 5-10



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

E2M (2021) Surveys
- Koala

Previous Surveys
- Koala

Potential Habitat
- Koala Habitat (Potential Breeding and Foraging)

Other Mapping Units
- Remnant Eucalypt Woodland with Food Trees
- Regrowth Eucalypt Woodland with Food Trees
- Remnant Regional Ecosystems without Food Trees
- Regrowth Regional Ecosystems without Food Trees
- Exotic Grassland without Food Trees
- Degraded and Fragmented Eucalypt Woodland with Food Trees
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Source: The State of Queensland (2018 - 2020); Whitehaven (2021); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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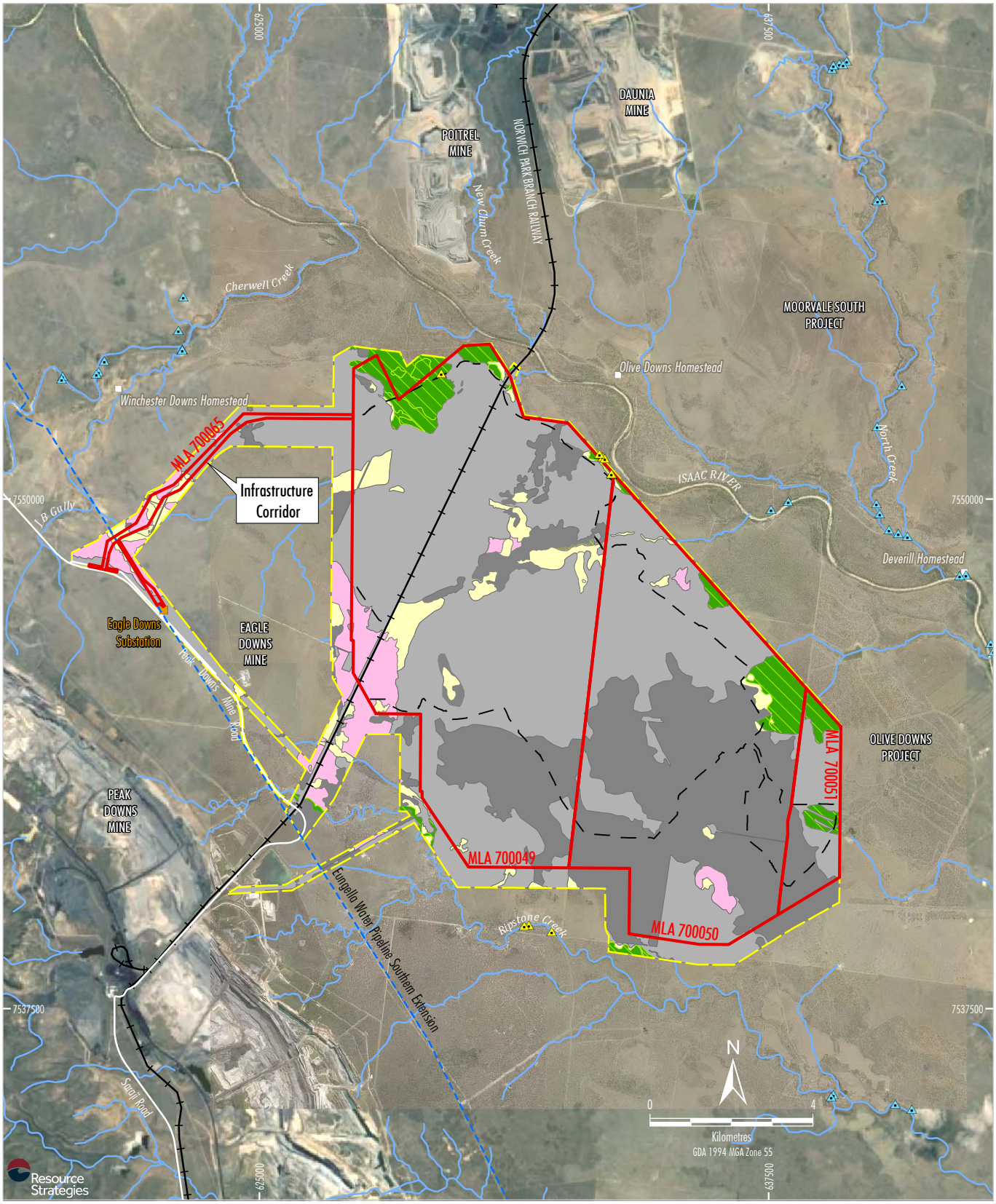
Threatened Species Habitat Mapping - Koala (combined populations of Queensland, NSW and the ACT)

Figure 5-11



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

E2M (2021) Surveys

- Greater Glider

Previous Surveys

- Greater Glider

Potential Habitat

- Greater Glider Habitat (Potential Breeding and Foraging)

Other Mapping Units

- Remnant Vegetation with Suitable Hollow Bearing Trees
- Remnant Vegetation without Suitable Hollow Bearing Trees
- Eucalypt Woodland without Suitable Hollow Bearing Trees
- Regrowth Vegetation without Suitable Hollow Bearing Trees
- Exotic Grassland without Suitable Hollow Bearing Trees
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021). Orthophoto: Google (2019); Whitehaven (2017).

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Threatened Species Habitat Mapping - Greater Glider

Figure 5-12

Squatter Pigeon (southern subspecies) (Geophaps scripta scripta)

The Squatter Pigeon (southern subspecies) is listed as Vulnerable under the EPBC Act.

The area that would be disturbed by the Project is located within the northern part of the Squatter Pigeon (southern subspecies)'s range (i.e. Brigalow Belt [North] and Desert Uplands Bioregions) (DAWE, 2020b).

The Squatter Pigeon (southern subspecies) is considered to be common in grazing country north of the Tropic of Capricorn (DAWE, 2020b). The Squatter Pigeon (southern subspecies) commonly occurs in a wide range of habitats wherever there is a grassy understorey. It is often found within close proximity of water bodies (DAWE, 2020b).

Squatter Pigeon (southern subspecies) breeding and foraging habitat consists of remnant or regrowth open-forest to sparse, open woodland or low-woodland dominated by *Eucalyptus, Corymbia*, *Acacia* or *Callitris* species on (Figure 5-10):

- well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills; and
- lateritic (duplex) soils on low 'jump-ups' and escarpments (Squatter Pigeon Workshop, 2011; DAWE, 2020b).

It is distinguished by ground-layer vegetation that:

- consists of patchy, native, perennial tussock grasses, or a mix of perennial tussock grasses and low shrubs or forbs; and
- does not cover more than 33% of the ground (Squatter Pigeon Workshop, 2011; DAWE, 2020b).

Foraging habitat is within 3 km of a suitable permanent or seasonal waterbody, while breeding habitat is located within 1 km of a suitable permanent or seasonal waterbody (Squatter Pigeon Workshop, 2011; DAWE, 2020b).

Dispersal habitat is any forest or woodland occurring between patches of foraging or breeding habitat which facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies. Dispersal habitat includes vegetation where the groundcover layer has been thinned through current land use practices in a way that suits the species (e.g. light cattle grazing) (Appendix D).

The species does disperse into highly modified or degraded habitats, including cleared areas which are within 100 m of remnant trees or patches of habitat. (Appendix D).

The Squatter Pigeon (southern subspecies) was recorded in multiple locations by E2M (2021), commonly in low abundance outside the Project mining lease application areas (Figure 5-10). The Squatter Pigeon (southern subspecies) was recorded at a single location on the western boundary of MLA 700049 (Mine Site and Access Road Action [EPBC 2019/8460]) within the vicinity of a farm dam (Appendix D).

All records of the species are outside the Indicative Surface Disturbance Extent of the Project (Figure 5-10).

Based on the SPRAT (DAWE, 2020b) definition of Squatter Pigeon (southern subspecies) habitat, the habitat surrounding the farm dam is not suitable for foraging, or breeding. However, due to the frequency of detection within this location, it has been considered that the areas of remnant woodland on land zone 9 within 3 km of the farm dam provides for suitable foraging habitat for the species.

Consistent with the habitat definition above and the SPRAT (DAWE, 2020b), foraging habitat within the Study Area consisted of suitable habitat within 3 km of a seasonal water source, and breeding habitat within 1 km of a seasonal water source.

Dispersal habitat within the Study Area was mapped as any vegetation community (remnant, or non-remnant) located between patches of foraging and/or breeding habitat (including exotic grassland pasture less than 100 m wide).

Koala (combined populations of Queensland, NSW and the ACT) (Phascolarctos cinereus)

The Koala (combined populations of Queensland, NSW and the ACT) is listed as Vulnerable under the EPBC Act.

The SPRAT (DAWE, 2020b) broadly defines Koala habitat as any forest, woodland or shrubland containing Koala food trees. Koala food trees are primarily Eucalyptus species supplemented by certain species in the genera of *Corymbia, Angophora* and *Lophostemon*.

In addition to the presence of food trees, the SPRAT (DAWE, 2020b) also references the value of shelter (non-food) trees for Koala thermoregulation as well as the importance of habitat connectivity.

Studies of Koala distribution, habitat utilisation and diet in central Queensland identified that *Eucalyptus populnea*, *E. coolabah, E. tereticornis* and *E. crebra or E. drepanophylla* were key diet species for Koalas in the region (Melzer *et al.*, 2014; Melzer *et al.*, 2018; Ellis *et al.*, 2018). *Eucalyptus camaldulensis* is also considered to be a primary food tree for Koalas in central Queensland (Australian Koala Foundation [AKF], 2015).

Nine REs within the Study Area are characterised by Eucalyptus species, comprising *E. populnea*, *E. coolabah*, *E. tereticornis*, *E. crebra* and *E. camaldulensis* with *Corymbia sp.,* and have potential to provide habitat for the Koala:

- RE 11.3.2;
- RE 11.3.25;
- RE 11.3.3c;
- RE 11.3.4;
- RE 11.4.8;
- RE 11.5.3;
- RE 11.5.9; and
- RE 11.9.2.

Within the Study Area, evidence of the species (scats and scratches) was recorded at two locations by E2M (2021) both associated with large intact areas of Eucalypt-dominated communities adjoining riparian areas. Previous records of Koala observations (approximately 72%) within a 20 km radius of the Study Area are located along watercourses, where there is a higher density of Koala food trees and habitat connectivity (Appendix D).

All records of the species are outside the Indicative Surface Disturbance Extent of the Project (Figure 5-11).

Potential habitat for the Koala in the Study Area is comprised of remnant and regrowth eucalypt woodland with food trees (Plate 5-3). Areas of remnant and regrowth Eucalypt woodland without food trees are also shown on Figure 5-11 and were not considered to be potential habitat for the Koala (Appendix D).

Plate 5-3 – Potential Koala Habitat within the Study Area
Source: E2M (2021).

The majority of regrowth areas within the Study Area were also not considered to be suitable Koala habitat due to the low abundance of Koala shelter trees and low canopy cover (Appendix D).

Although RE 11.4.8 is described as *Eucalyptus cambageana* woodland with *Acacia harpophylla* on Cainozoic clay plains, patches of this RE within the area associated with the Mine Site and Access Road Action (EPBC 2019/8460) were dominated by *Acacia harpophylla* with a very low abundance of *E. cambageana*. The lack of Koala food trees within RE 11.4.8 excluded it as Koala habitat (Figure 5-11).

Greater Glider (Petauroides volans)

The Greater Glider is listed as Vulnerable under the EPBC Act. Greater Glider habitat is largely restricted to Eucalypt forests and woodlands. The species' diet comprises mostly eucalypt leaves and sometimes eucalypt flowers (TSSC, 2016b).

During the day, Greater Gliders shelter in large tree hollows and a strong correlation exists between the number of large hollows and the abundance of Greater Gliders (Andrews *et al*., 1994).

There is no definition to distinguish breeding and foraging habitats within the SPRAT (DAWE, 2020b) or approved conservation advice (TSSC, 2016b), however their breeding and foraging habitat is likely the same or similar due to their dependence on eucalypt species and large hollows for both processes.

Greater Gliders are not known to disperse across land which does not contain suitable food and shelter trees (TSSC, 2016b).

Suitable Greater Glider habitat within the Study Area is shown on Figure 5-12 and consists of areas of five REs with low fragmentation and a high abundance of hollow-bearing trees, including:

- RE 11.3.2;
- RE 11.3.25;
- RE 11.3.3c;
- RE 11.3.4; and
- RE 11.3.5.

Areas of Eucalypt woodland, remnant vegetation and regrowth without hollows are mapped on Figure 5-12, and are not considered to be habitat for the Greater Glider (Appendix D).

All records of the species are outside the Indicative Surface Disturbance Extent of the Project (Figure 5-12).

Aquatic Ecology

Survey Methodology

An Aquatic Ecology and Stygofauna Assessment was undertaken for the Project, which included field surveys undertaken by ESP (2021) during May and October 2019 (i.e. in the late and early-wet seasons respectively).

Aquatic ecology surveys included an assessment of aquatic habitat conditions (in accordance with the AUSRIVAS habitat assessment protocol described in the *Sampling and Processing Manual* [DNRM, 2001]), water quality sampling (including sediment quality) and surveys of aquatic macroinvertebrates, vertebrates and plants.

A stygofauna assessment was also undertaken which comprised a desktop assessment, review of previous surveys and assessments undertaken in the region and field sampling within the Study Area (in accordance with the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* [DES, 2015]) undertaken by ESP (2021).

Targeted Threatened Aquatic Fauna Surveys

Threatened aquatic fauna species listed in the Terms of Reference, or considered likely to occur based on the results the desktop review, were targeted during field surveys undertaken by ESP (2021).

Targeted surveys sought to identify the presence of the following threatened species listed under the EPBC Act:

- Murray Cod;
- Fitzroy River Turtle; and
- Southern Snapping Turtle.

No potential habitat has been historically recorded for the above listed threatened turtle species within the broader region, nor within the area that would be disturbed by the Project based on the results of field surveys (e.g. lack of large deep pools associated with riffles), and as such each are considered unlikely to occur (Appendix E).

No listed threatened aquatic flora species were recorded during field surveys or were considered likely to occur based on known species distribution and habitat preferences (Appendix E).

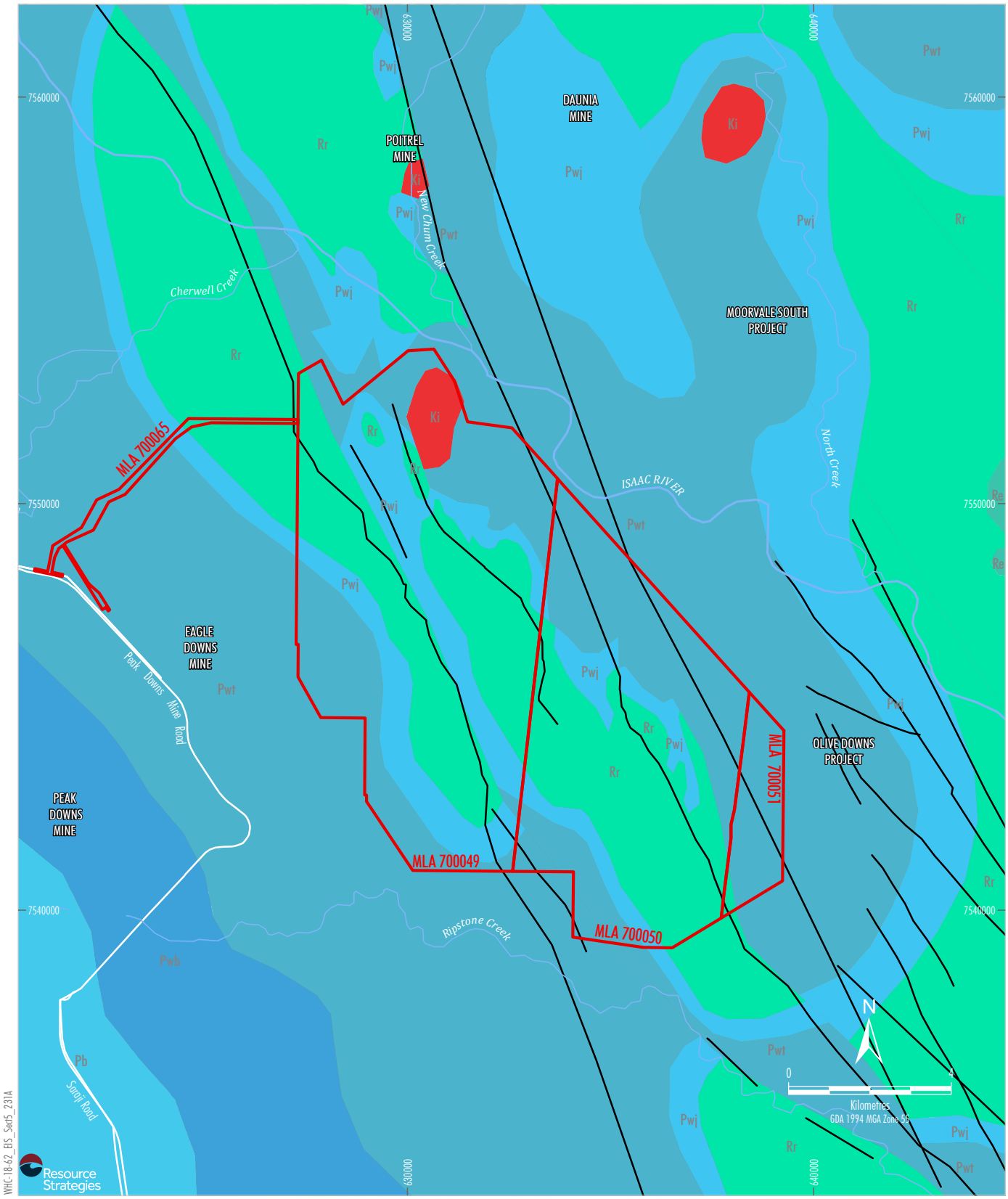
5.3.6 Geological Features and Coal Resource

Geological Features

The Project lies within the western part of the northern Bowen Basin, which contains sedimentary rocks, including coal measures, of Permian and Triassic age.

The regional outcrop geology mapping shows the Rangal Coal Measures (overlain by the Triassic Rewan Formation) and the Permian Fair Hill Formation/Fort Cooper Coal Measures and across the Project area (Figures 5-13 and 5-14).

The target mining area lies within the Winchester Syncline. The Winchester Syncline is the result of a later stage compressional event that created fold structures along north-south trending fold axes. Ongoing compression resulted in the over-steepening of some normal structures, creating high-angle thrusts and additional thrust structures. The major thrust structures appear to be located on anticline axes (Xenith, 2018).



LEGEND

- Mining Lease Application Boundary
- Modelled Fault

Rock Unit Name

- PB — Back Creek Group
- RE — Clematis Group
- Pwt — Fair Hill Formation, Fort Cooper Coal Measures
- Ki — Ki-CQ
- Pwb — Moranbah Coal Measures
- Pwj — Rangal Coal Measures, Bandanna Formation, Baralaba Coal Measures
- Rr — Rewan Group

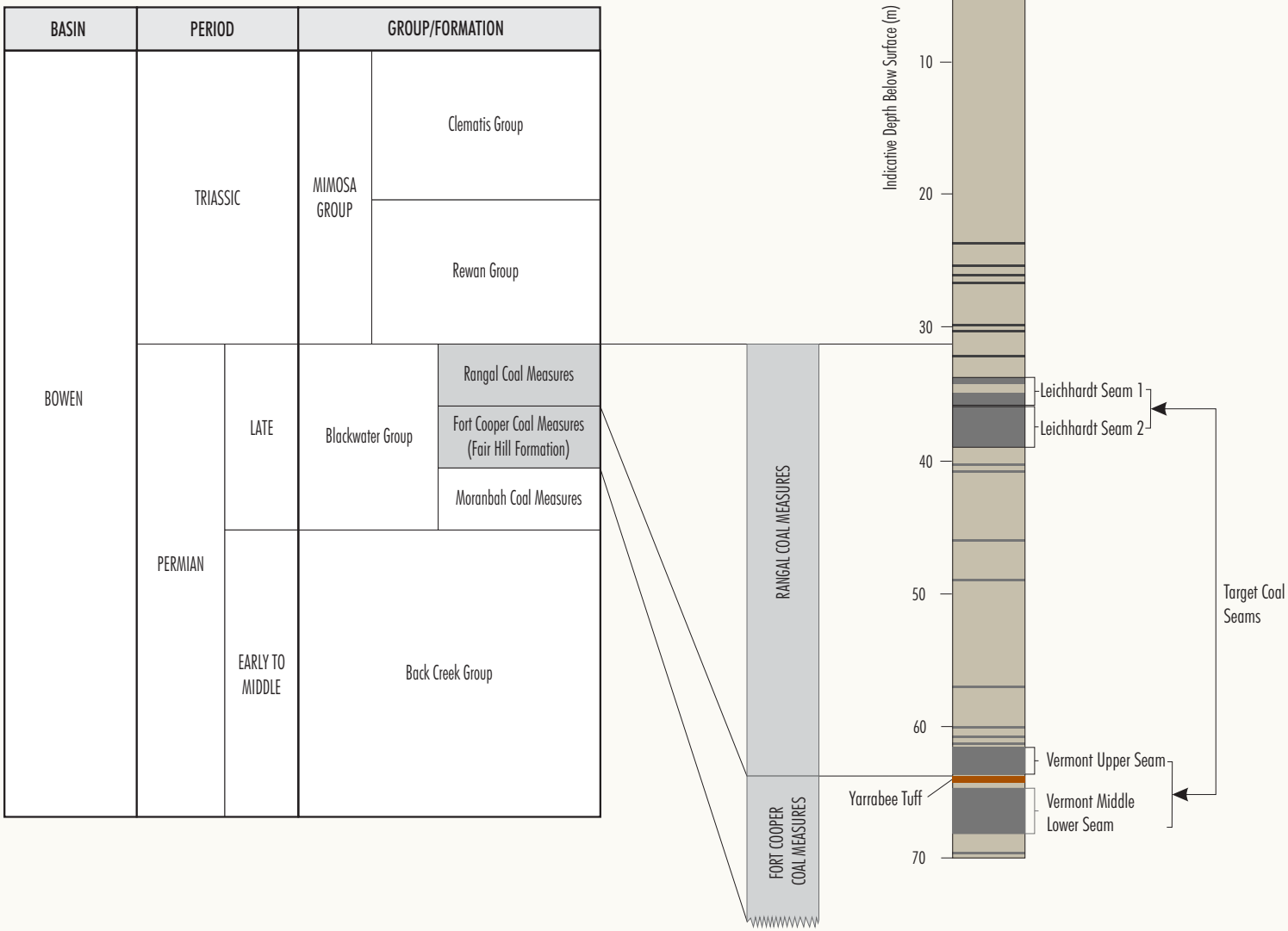
Source: The State of Queensland (2018 - 2020); SLR (2021).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Regional Geology

Figure 5-13



Source: Whitehaven (2020).

Note: Indicative depth only. Coal seam depth varies over the Project area.

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Stratigraphy of the Project Area

Figure 5-14

WHC-18-62_EIS_Sec5_003B

Resource Strategies

Geological features identified in the target mining area and surrounds include (Xenith, 2018):

- the Isaac Fault, located to the west, with a throw of approximately 100 m in the centre of the mining area, and a zone of more than 500 m wide in the northern part of the proposed mining area; and
- the Eastern Fault Zone, bounding the mining area to the east, with a maximum throw of more than 150 m in some areas.

The Eastern Fault comprises a set of thrust faults with east side up, and are less continuous than the Isaac Fault. These faults have an echelon-type nature, whereby when one fault decreases in displacement another fault slightly offset from it will be present, and its displacement will increase with distance away from the fault with decreased displacement (Xenith, 2018).

Coal Resource

The target coal seams are contained within the Rangal and Fort Cooper Coal Measures within the Late Permian Blackwater Group.

Above the Rangal Coal Measures lies the Rewan Formation, consisting of red-brown mudstones with fine- to coarse-grained greenish lithic sandstones.

The Rangal Coal Measures overlie the Fort Cooper Coal Measures and are up to 120 m thick within the Project area. The sequence is characterised by fine- to medium-grained sandstones and siltstones with coal seams at the base.

The Fort Cooper Coal Measures are approximately 350 m thick and contain variable brown to grey carbonaceous siltstone, mudstone and fine-grained sandstone with high ash coal. The top of the sequence is marked by the Yarrabee Tuff, a basin-wide tuffaceous claystone marker interval which separates the Upper Vermont and Vermont Middle Lower Seams.

The target coal seams within the open cut extent are as follows (Section 2.2.7):

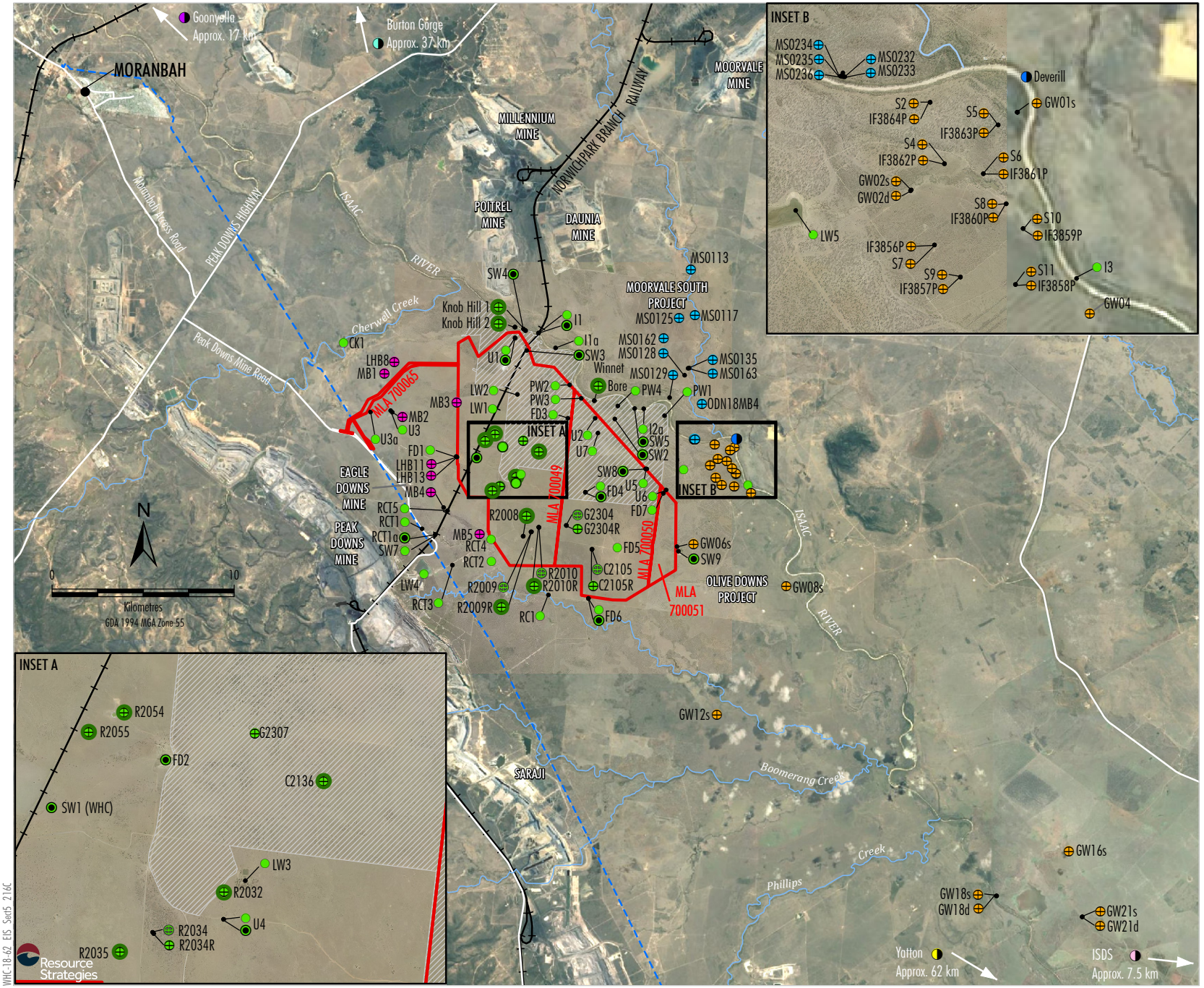
- the Leichhardt Seams (Leichhardt 1 and Leichhardt 2); and
- the Vermont Seams (Upper and Middle Lower Seams).

5.3.7 Existing Water Resources

Baseline Surface Water and Groundwater Data

A range of data sources have been used to describe the environmental values relevant to the Project. Water quality and water resources data have been collected and analysed from a number of different sources, including (Figures 5-15 and 5-16):

- rainfall and evaporation records from BoM and DRDMW weather stations;
- data from DRDMW gauging stations in the Isaac River catchment area;
- a range of recorded physico-chemical parameters, including continuous monitoring for select analytes, at the Deverill gauging station on the Isaac River (operated by DRDMW) (since 1964);
- continuous (sub-daily) logger records for pH, EC and temperature at the downstream ISDS gauging station on the Isaac River provided by Pembroke under the existing data sharing agreement;
- surface water quality results during the baseline sampling campaign for the Project including sites on:
  - the Isaac River (SW4 and SW5);
  - Ripstone Creek (SW6);
  - Ripplestone Creek (SW7); and
  - other unnamed drainage lines or water bodies (SW1, SW2, SW3, SW8 and SW9);
- surface water quality results during the aquatic ecology surveys conducted by ESP (2021), including sampling sites on the Isaac River, Ripstone Creek, Cherwell Creek, other unnamed watercourses and drainage lines and water bodies;
- groundwater quality sampling and groundwater resource monitoring undertaken as part of the groundwater investigation program at:
  - three alluvial standpipe installations, Knob Hill 1, Knob Hill 2 and Winnet Bore;
  - four standpipe installations monitoring the Vermont Seams;
  - three standpipe installations monitoring the interburden strata;
  - five standpipe installations monitoring the Leichhardt Seams;



LEGEND

- Mining Lease Application Boundary
- Watercourse
- Eungella Water Pipeline Southern Extension
- Approximate Extent of TEM Survey

Project Groundwater Monitoring Network

- Former Standpipe
- Standpipe
- Stygofauna Sampling Site

Project Surface Water Monitoring Network

- Surface Water Monitoring
- Aquatic Ecology Survey Site

DRDMW Monitoring Network

- ISDS
- Yatton Gauging Station
- Burton Gorge Gauging Station
- Deverill Gauging Station
- Goonyella Gauging Station

Neighbouring Groundwater Monitoring Network

- Eagle Downs Mine Standpipe
- Moorvale South Project Standpipe
- Olive Downs Project Standpipe

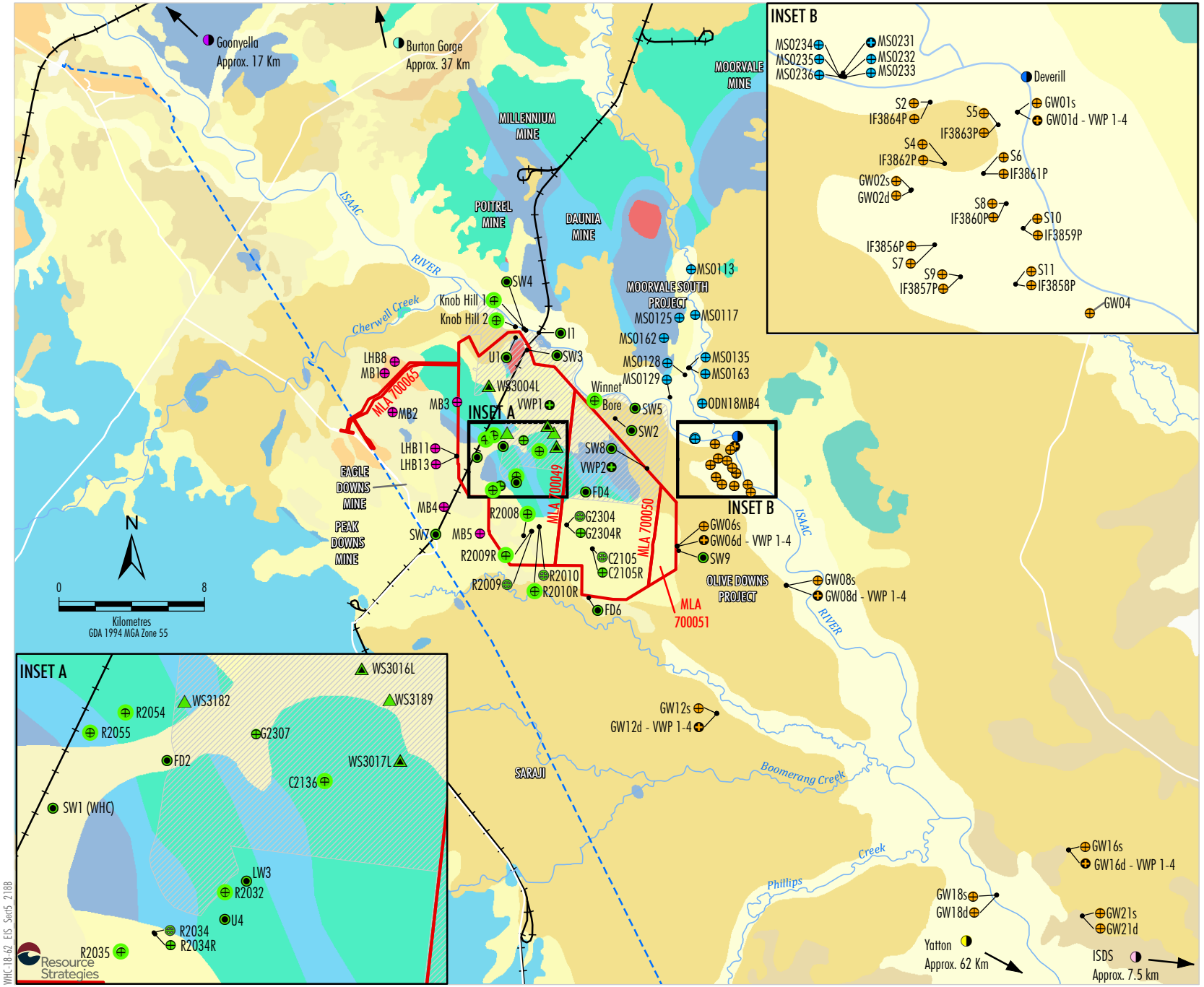
Source: The State of Queensland (2020); ESP (2021); SLR (2021); WRM (2021); Hydrogeologist.com.au (2020); Pembroke (2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Water Quality Monitoring - Baseline Data

Figure 5-15



LEGEND

- Mining Lease Application Boundary
- Approximate Extent of TEM Survey

Project Groundwater Monitoring Network

- Former Standpipe
- Standpipe
- VWP
- Stygofauna Sampling Site

Project Surface Water Monitoring Network

- Surface Water Monitoring

Project Testwork Sites

- Core Permeability Site
- Packer Testing Site

DRDMW Monitoring Network

- ISDS
- Yatton Gauging Station
- Burton Gorge Gauging Station
- Deverill Gauging Station
- Goonyella Gauging Station

Neighbouring Groundwater Monitoring Network

- Eagle Downs Mine Standpipe
- Moorvale South Project Standpipe
- Moorvale South Project VWP
- Olive Downs Project Standpipe
- Olive Downs Project VWP

Surface Geology

- Quaternary Alluvium
- Quaternary Regolith
- Qr\b-QLD
- Late Tertiary - Quaternary Alluvium
- Late Tertiary - Quaternary Regolith
- Duaringa Formation
- Ki-CQ
- Rewan Group
- Clematis Group
- Fort Cooper Coal Measures
- Rangal Coal Measures

Source: The State of Queensland (2020); ESP (2021); SLR (2021); WRM (2021); Hydrogeologist.com.au (2020); Pembroke (2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Water Resource Monitoring - Baseline Data

Figure 5-16

  - two VWP installations, VWP1 and VWP2; and
  - bore holes WS3189 (from 35 m to 61 m) and WS3182 (from 85 m to 95 m) (packer testing);
- horizontal and vertical core hydraulic conductivity testing (in laboratory) of the overburden and underburden of the coal seams samples;
- resistivity data from the TEM survey conducted by Groundwater Imaging (Appendix A);
- data from the groundwater monitoring and investigation program undertaken in the vicinity of the Project (Appendix A);
- data from the surrounding developments that Whitehaven WS has established data sharing agreements with (Appendix A);
- publicly available data from surrounding developments; and
- geomorphology surveys undertaken in the vicinity of the Project (Figure 5-17 and Appendix B).

The standpipes and VWPs included as part of the groundwater investigation program target a range of hydrostratigraphic units, including:

- Quaternary alluvium;
- Cainozoic sediments (regolith);
- Rewan Group (Triassic);
- coal seams, interburden and overburden material of the Rangal Coal Measures; and
- coal seams, interburden and overburden material of the Fort Cooper Coal Measures.

Extensive hydraulic testing was conducted on all major geological units. This included testing of core samples for vertical and horizontal hydraulic conductivity (anisotropy), slug testing (rising/falling head tests) and packer testing for horizontal hydraulic conductivity, as well as documented airlift yields (Appendix A).

To assist with further definition of alluvium in the vicinity of the Project, Groundwater Imaging (2019) completed a TEM survey. The TEM survey results are presented in Appendix A.

Extensive baseline groundwater monitoring and investigation programs previously undertaken for surrounding developments, for which Whitehaven WS has existing data sharing agreements, have also been used.

Regional Hydrology

The Project is located within the headwaters of the Isaac sub-catchment of the greater Fitzroy Basin (Figures 5-18 and 5-19). The major rivers and tributaries of the Fitzroy catchment include the Fitzroy, Dawson, Nogoa, Comet, Isaac and Mackenzie Rivers.

The Isaac River is the main watercourse that is east of the Project area and flows in a north-west to south-east direction, passing the township of Moranbah and the surrounding developments upstream of the Project (Appendix B).

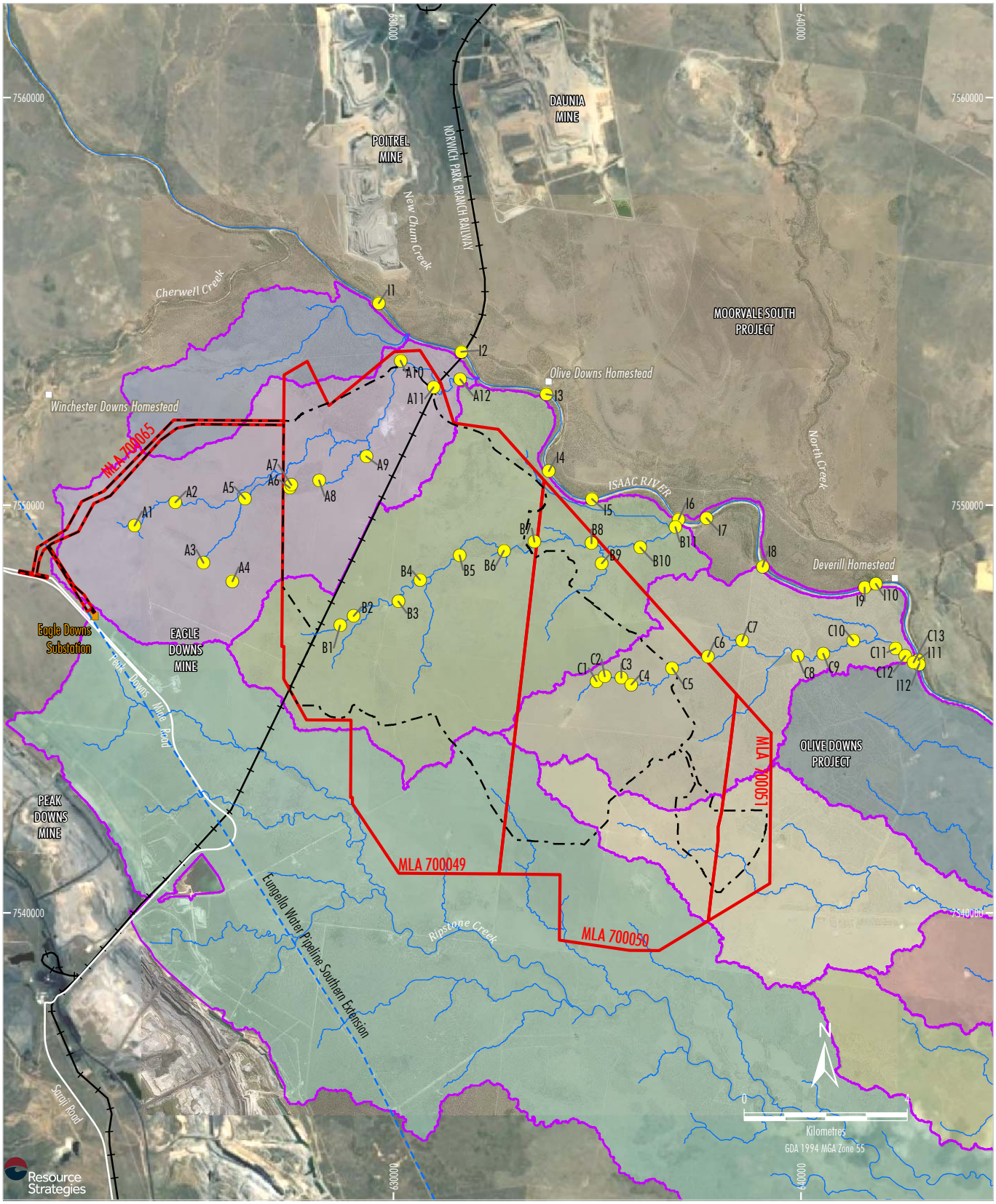
The Project is within the greater Isaac-Connors sub-catchment area, that is approximately 22,364 km^2 (to the Mackenzie River confluence). This sub-catchment represents approximately 15% of the overall Fitzroy River catchment (142,665 km^2) (Appendix B).

The catchment area of the Isaac River to the Project area is around 4,100 km^2. This represents around 2.9% of the overall Fitzroy River catchment and 18.3% of the Isaac-Connors sub-catchment (Appendix B).

The Isaac River is a seasonally flowing watercourse, typically with surface flows in the wetter months from November to April, reducing to shallow sub-surface flows from about May to October. All other waterways and drainage lines in the vicinity of the Project area are understood to be ephemeral and experience flow only after sustained or intense rainfall in the catchment (Appendix B).

Stream flows are highly variable, with most channels drying out during winter to early spring when rainfall and runoff is historically low, although with some pools expected to hold water for extended periods. Therefore, physical attributes, water quality, and the composition of aquatic flora and fauna communities are also highly variable over time (Appendix B).

The Project does not involve any mining activities or infrastructure in the Isaac River, and therefore there would be no diversion of the Isaac River.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Eungella Water Pipeline Southern Extension
- Railway
- Substation
- Geomorphology Survey Site
- Existing Drainage Network - Project Area
- Sub-Catchment Boundary

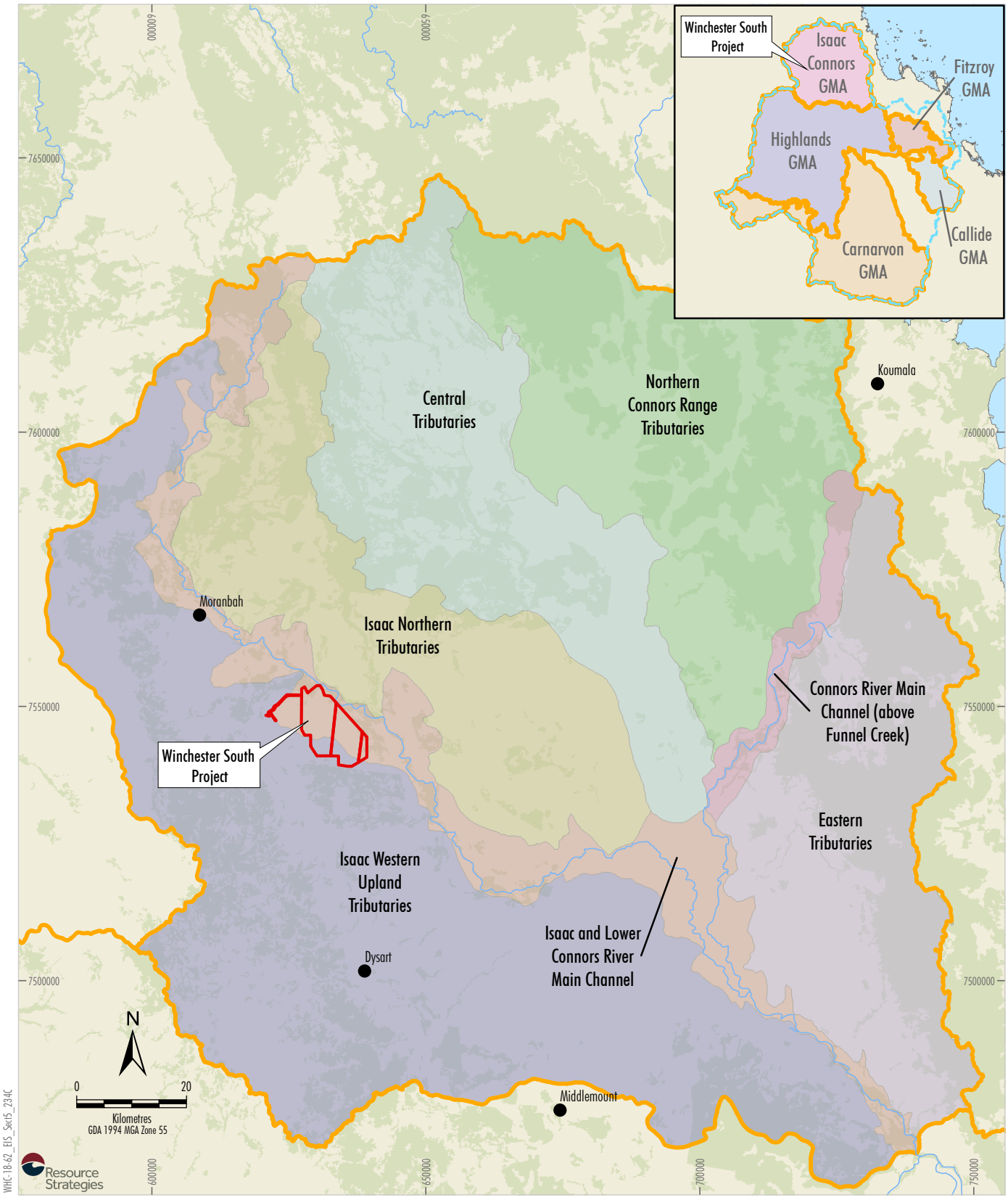
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Fluvial Systems (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Geomorphology Survey Sites

Figure 5-17



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LEGEND

- Mining Lease Application Boundary
- Fitzroy Basin Water Plan Area
- Groundwater Management Area
- Watercourse
- Road
- Railway

Sub-catchment Areas of the Isaac Connors GMA

- Central Tributaries
- Connors River Main Channel (above Funnel Creek)
- Eastern Tributaries
- Isaac and Lower Connors River Main Channel
- Isaac Northern Tributaries
- Isaac Western Upland Tributaries
- Northern Connors Range Tributaries

Source: The State of Queensland 2018 - 2020); Geoscience Australia (2018).

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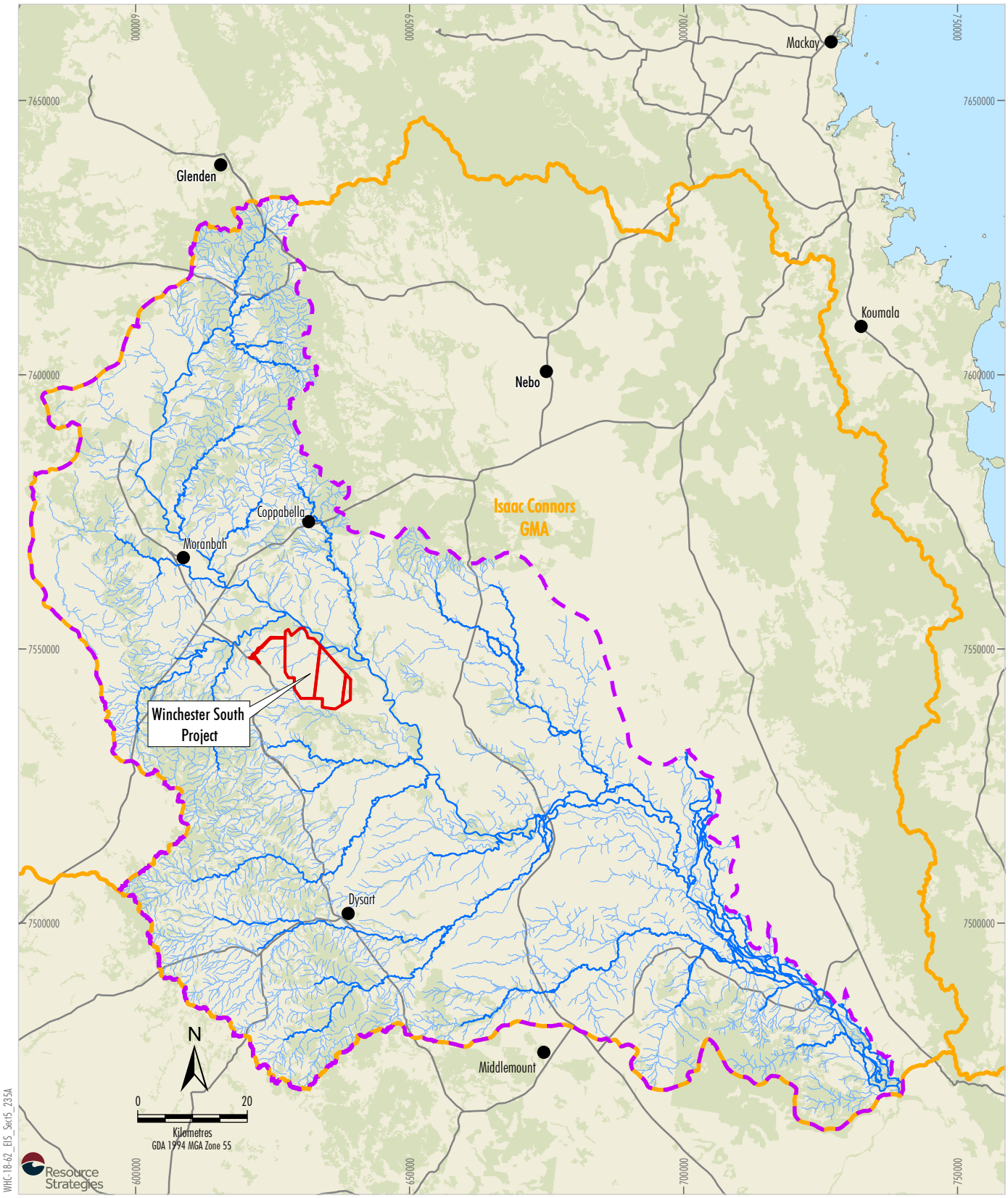
WINCHESTER SOUTH PROJECT

Groundwater Management Areas (GMAs) of the Fitzroy Basin - Isaac Connors GMA

Figure 5-18



WHC-18-62_EIS_Sect5_235A

LEGEND
- Mining Lease Application Boundary
- Groundwater Management Area
- Isaac River Sub-catchment Catchment Area
- Minor (Order 1 and 2)
- Major (Order 3 - 8)

Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Isaac River Catchment

Figure 5-19

Regional Surface Water Quality

The Isaac River is the surface water resource of regional relevance to the Project. Further downstream, the Isaac River converges with the Connors River and the Mackenzie River before ultimately joining the Fitzroy River and flowing to the eastern coast of Australia (i.e. Keppel Bay near Rockhampton).

Water quality data is available for the Isaac River at locations upstream, adjacent and downstream of potential influences of the Project.

Collation and comparison of available regional water quality data for the Isaac River at the Deverill and Yatton gauging stations (downstream of the Project), and further upstream at the Red Hill Mining Lease, are included in the Surface Water and Flooding Assessment (Appendix B).

DRDMW, formerly DNRME, has collected and published daily EC data at the Deverill and Yatton gauging stations in the Isaac River. The Deverill gauging station is located to the east of the Project (downstream) and would be representative of water quality in the vicinity of the Project. The Yatton gauging station is located downstream of the Connors River confluence but includes mining releases from all mines within the Isaac River catchment.

A time history of recorded instantaneous EC and stream flow for the Isaac River at the Deverill and Yatton gauging stations from 2011 is presented on Figure 5-20. The relationship between instantaneous flow and EC is also shown on Figure 5-20.

Water quality monitoring data collected by DNRME between 2011 and 2019 at the Deverill gauging station in the Isaac River indicate the following (Appendix B):

- The EC for high flows greater than 200 m^3/s are below the high flow WQO EC of 250 µS/cm for 100% of readings.
- The EC of instantaneous flows below 100 m^3/s vary significantly, from 50 µS/cm to 1,870 µS/cm, with many recorded values exceeding the low flow WQO EC of 720 µS/cm (5% of readings).
- The mean daily EC has exceeded the low flow WQO on a total of 22 days over this period (5% of readings) and all of these days experienced some flow (not stagnant flow).
- The stream flows are highly ephemeral with baseflows ceasing within a few days or weeks of a runoff event, or at least flowing below the top of the sandy bed.

Water quality monitoring data collected by DNRME between 1995 and 2019 at the Yatton gauging station in the Isaac River indicate the following (Appendix B):

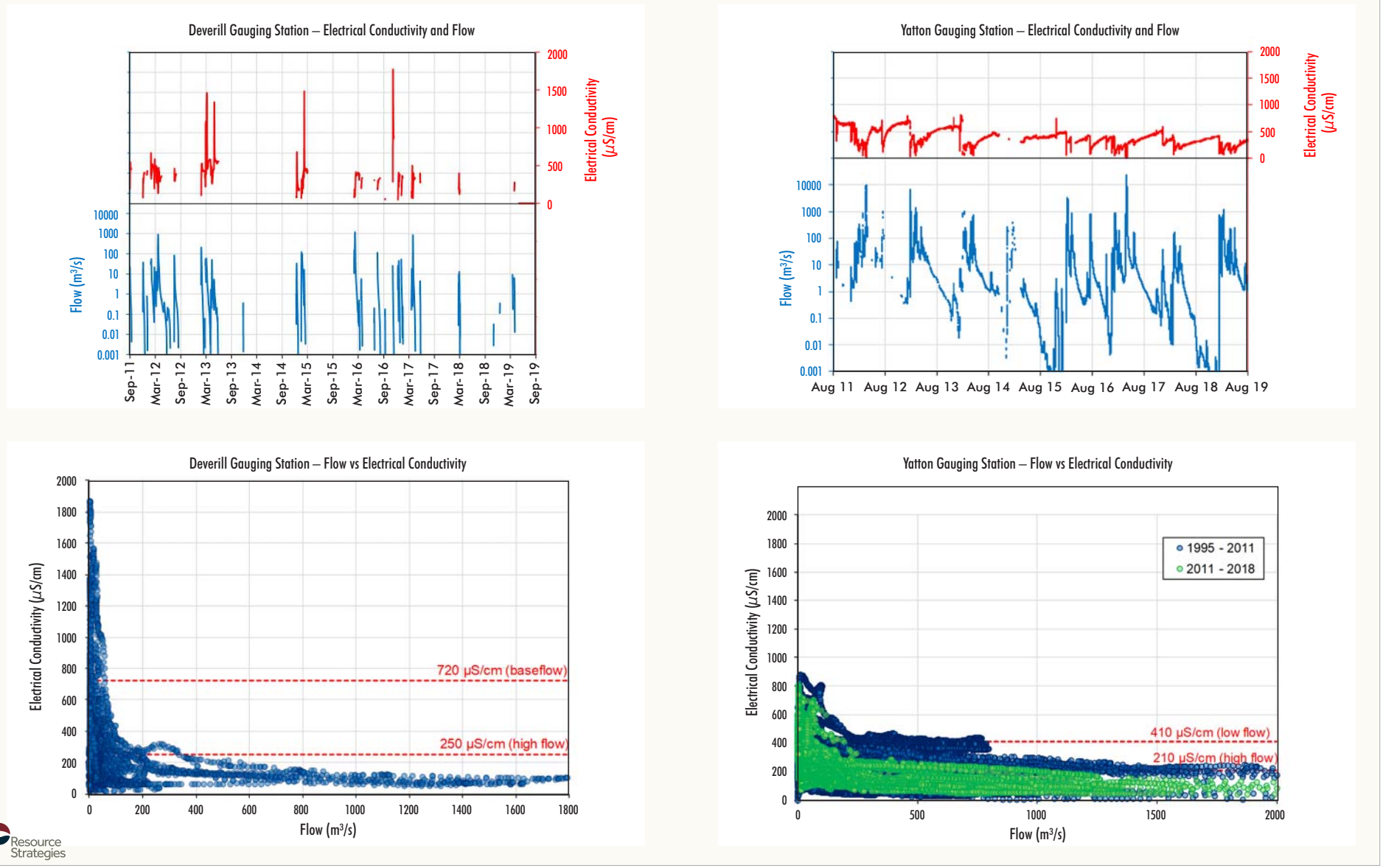
- The EC for high flows greater than 200 m^3/s varies much more than at Deverill gauging station but are generally below 410 µS/cm for 100% of readings.
- The high flow EC since 2011 has generally been below the high flow WQO (97% of readings).
- The low flow EC has frequently been above the low flow WQO of 410 µS/cm (35% of readings). Figure 5-20 shows that EC rises during extended baseflow periods, which would be associated with either the Connors River or an increase in baseflow in the reach between Deverill and Yatton gauging stations.
- The recorded low flow EC is generally less than at Deverill gauging station.

Local Hydrology

There are six waterways mapped in the vicinity of the Project area, including (Appendix B) (Figure 5-17):

- the Isaac River located to the east of the Project, with Strahler stream order of six;
- Cherwell Creek located to the north of the Project, with a Strahler stream order of five;
- Ripstone Creek located to the south of the Project, with a Strahler stream order of two/three; and
- three waterways with Strahler stream orders of one/two, one watercourse in the north of the Project area and two drainage features that drain through the Project area directly to the Isaac River.

The majority of the Project area drains directly to the Isaac River through various unnamed drainage features and minor tributaries. Other than the Isaac River, the closest local named watercourses are Cherwell Creek and Ripstone Creek (Figure 5-17).



Source: WRM (2021).

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WINCHESTER SOUTH PROJECT

Isaac River Water Quality and Flow

Figure 5-20

Ripstone Creek runs west to east, south of the Project. The Ripstone Creek pre-mining catchment area is approximately 286 km^2 with predominant land use within the catchment being stock grazing and open cut mining. The existing Peak Downs Mine has approval to release to Ripstone Creek upstream of the Project. The Olive Downs Project has approval to divert Ripstone Creek around an open cut mining area downstream of the Project.

Local Surface Water Quality

Local surface water quality sampling has been undertaken as a component of the baseline water quality assessments for the Project (Appendices A and B).

Analyses for a range of physico-chemical parameters were undertaken between March 2019 and June 2020 at sites SW1, SW2, SW3, SW4, SW5, SW7, SW8 and SW9 (SW6 was dry for all surveys) (Figure 5-15).

A number of the baseline water quality samples do not meet the DGVs for the region, in particular for the Isaac River (represented by the samples at SW4 and SW5). These background exceedances of the regional DGVs are also generally reflected in the other sampling locations along Ripstone Creek and the unnamed tributaries of the Isaac River (Appendix B).

Water quality monitoring has also been undertaken at various locations in the Isaac River and tributaries between July 2017 and March 2019 for the Olive Downs Project. Similar to the data collected for the Project, the water quality samples for the Olive Downs Project from the Isaac River show that a number of the baseline water quality samples do not meet the DGVs for the region (Appendix B).

Surface Water Users

Information regarding individual licences for Isaac River surface water users was obtained from DNRME (now DRDMW) (Appendix B). Details regarding the volume, source and purpose of the licences are presented in Appendix B.

Groundwater Regime

The hydrogeological regime relevant to the Project comprises the following hydrogeological units (Appendix A):

- Cainozoic sediments:
  - Quaternary alluvium – unconfined aquifer localised along Isaac River; and
  - regolith – unconfined and largely unsaturated unit bordering alluvium;
- Triassic Rewan Group – aquitard;
- Permian coal measures with:
  - hydrogeologically 'tight' interburden units; and
  - coal sequences that exhibit secondary porosity through cracks and fissures.

The indicative strata (not including Cainozoic sediments) over the Project area is shown in Figures 5-13 and 5-14 and the hydrogeological units are described below.

Alluvium

Alluvium is present outside of the Project area, to the north and east. The extent and thickness of the unconsolidated sediments was assessed using a TEM survey conducted in March 2019 and verified with site geological logs (Appendix A).

Drill-hole WSN206 occurs 3 km north-east of the Project within the mapped extent of the alluvium. The drill-hole log shows sand present, occurring from the surface to a depth of 22 m, where it overlies siltstone.

Drill-holes intercepting Isaac River alluvium around the Olive Downs Project indicate that it comprises a heterogeneous distribution of fine- to coarse-grained sands interspersed with lenses of clays and gravels (Appendix A).

These sediments, while spatially variable, generally comprise four main stratigraphic sequences:

- upper soil and clay layer (up to 13 m thick);
- sand and sandy clay unit (up to 24 m thick);
- sand and gravel unit (up to 8 m thick); and
- basal clay unit (up to 10 m thick).

Regolith

The surficial regolith material covering much of the Project area comprises Cainozoic (Quaternary to Tertiary) aged sediments, including alluvium and colluvium. Based on site geological logs, the regolith comprises a heterogeneous distribution of fine- to coarse-grained sand, clay, sandstone and claystone. The regolith material is generally 25 m thick and is all recorded as being highly weathered, with the depth of weathering extending to a maximum of 100 m below ground level, into the underlying coal measures (Appendix A).

Exploration drilling across the Project area indicates that the regolith is not commonly saturated. Groundwater monitoring conducted within the extent of the groundwater model at surrounding developments includes four monitoring bores intersecting the regolith (GW06s, GW12s, GW16s and GW21s), two of which have remained dry between June 2017 and February 2019 (GW06s and GW16s) (Appendix A).

Overall, the regolith is considered to be largely unsaturated, with the presence of water restricted to lower elevation areas along the Isaac River. Where the regolith is saturated, flow is likely a reflection of topography, flowing towards nearby drainage lines (Appendix A).

The regolith material comprises low permeability strata (i.e. clay and claystone), which likely restricts rainfall recharge. Groundwater discharge is likely to occur primarily via evapotranspiration, with some baseflow to streams from the regolith under wet climatic conditions. Vertical seepage through the regolith is likely to be limited by the underlying low-permeability Rewan Group and other aquitards (Appendix A).

Triassic (Rewan Group)

The Triassic sediments include an isolated pocket of Clematis Group approximately 7 km east of the Project area, and the more regionally extensive Rewan Group. The outcrop of Clematis Group is approximately 300 m thick and forms a localised topographic high at an elevation of around 450 mAHD (Appendix A).

Given its relative distance from the Project, this unit is not considered hydrogeologically relevant in terms of potential Project impacts.

Regionally, the Rewan Group unconformably overlies the Permian coal measures as in-fill material. The Rewan Group is largely absent where the Permian coal measures occur at outcrop and thickens towards the Isaac River. At the Project, the weathered Rewan Group unit occurs at the outcrop. Drill logs indicate the weathered Triassic strata has an average thickness of 25 m (Appendix A).

The closest bore to the Project screened within the Rewan Group is bore RN141383 (MB3), which is part of the Eagle Downs Mine groundwater monitoring network to the west of the Project. Also, a VWP (GW01d) that monitors the Rewan Group, which is part of the Olive Downs Project groundwater monitoring network, is approximately 5 km to the east of the Project (Appendix A).

In general, the occurrence of the Rewan Group can vary regionally, based on the structural setting and comprises low hydraulic conductivity lithologies, and is typically considered an aquitard (i.e. restricts groundwater flow) (Appendix A).

Groundwater elevations within the Rewan Group in the Project area and surrounds are above those recorded within the deeper Permian coal measures, indicating a downward hydraulic gradient. However, due to the low hydraulic conductivity of the Rewan Group, the unit is considered an aquitard (Appendix A).

Permian Coal Measures

The Permian coal measures underlie the Rewan Group and surficial cover, and outcrop along the ridgelines to the east and west of the Project area.

In increasing depth (age) order, the major Permian coal measures of the Blackwater Group in the area include:

- the Rangal Coal Measures;
- the Fort Cooper Coal Measures; and
- the Moranbah Coal Measures.

The shallowest Permian coal measures, the Rangal Coal Measures, has an average thickness of 60 m with a maximum thickness of 195 m at the Project. The depth of the Rangal Coal Measures ranges from 5 m to 310 m below ground level. The Rangal Coal Measures contain the target seams for the Project (i.e. Leichhardt Seam and Vermont Upper and Middle Lower Seams).

The Rangal Coal Measures comprise coal seams and non-coal portions including; light grey, cross-bedded, fine- to medium-grained, labile and well-cemented sandstones, grey siltstones, mudstones and shales.

The Yarrabee Tuff is a basin-wide marker bed comprising weak, brown tuffaceous claystone, and drill logs indicate the tuff has an average thickness of 0.7 m within the Project area (Appendix A).

The Fort Cooper Coal Measures conformably underlie the Rangal Coal Measures and occur at the subcrop within the Project area. Both the Rangal Coal Measures and Fort Cooper Coal Measures (e.g. Vermont Middle Lower Seam) contain the target seams for the Project. The transition between the Rangal Coal Measures and the Fort Cooper Coal Measures is marked by the Yarrabee Tuff which immediately overlies the Vermont Lower Seam (Appendix A).

The Moranbah Coal Measures conformably underlie the Fort Cooper Coal Measures. These Permian coal measures occur at the subcrop, west of the Project where they are targeted as part of the Peak Downs Mine and Saraji Mine (Appendix A).

Groundwater occurrence within the Permian coal measures is largely restricted to the more permeable coal seams that exhibit secondary porosity through fractures and cleats (Appendix A).

The water levels in the Permian coal measures within the Project area generally follow the downstream flow gradient of the Isaac River, with south-easterly trending hydraulic gradients. Groundwater elevations range from around 188 mAHD in the north-west, down to 155 mAHD in the south-east (Appendix A).

Groundwater within the Permian coal measures is confined and sub-artesian. For the shallower Permian coal measures, groundwater elevations are generally at or below groundwater elevations within the overlying unconfined sediments, indicating a downward hydraulic gradient. However, with increased depth of cover and pressure, the hydraulic gradient reverses (Appendix A).

Recharge to the Permian coal measures occurs at the subcrop. Due to the low hydraulic conductivity of the interburden material, groundwater largely flows horizontally within the Permian coal measures, along the bedding plane of the coal seams. Groundwater discharge occurs via evaporation and abstraction from extraction activities (Appendix A).

Groundwater Users

A search of the Queensland Government's Groundwater Bore Database and the BoM NGIS was carried out for registered bores within the extent of the groundwater model. The search indicated that there are 310 registered bores, of which 177 bores are used for groundwater monitoring and investigations, and 83 bores are used for water supply. The remainder of bores have an unknown use or resulted from exploration activities.

Two field bore censuses have previously been carried out within the extent of the groundwater model. The earlier survey, a field bore census of groundwater bores and wells within 20 km of the groundwater model was conducted from September to November 2017 as part of the groundwater assessment for the Olive Downs Project (HydroSimulations, 2018). A field bore census of groundwater bores and wells was also conducted for the Moorvale South Project (Golder Associates, 2019).

Across the two bore censuses, a total of 131 bore locations were assessed. Of the 131 bores:

- 47 bores were found to be existing and in use;
- 37 bores are existing but not in use;
- 8 bores were of unknown status (could not access); and
- 39 bores were abandoned and destroyed.

Of the existing and unknown bores with water use information available, 52 are used for stock water supply, 19 are used for groundwater monitoring and six are used for domestic water supply. For the existing and unknown bores with geological information available, 22 intersect alluvium, 10 are within regolith material and 30 intersect Permian coal measures (Rangal Coal Measures, Blackwater Group and Back Creek Group).

Groundwater Quality

An analysis of water quality attributes of groundwater within the Project area and surrounds is provided in Appendix A. Available water quality data has been compared to:

- Fitzroy Basin Zone 34 groundwater quality objectives for deep and shallow water under the Water Plan;
- ADWG (NHMRC, 2018); and
- ANZECC & ARMCANZ (2000) water quality guidelines for aquatic ecosystems, irrigation (long-term and short-term) and stock water supply.

The main geological units are discussed below and include alluvium, regolith and the Permian-aged coal measures (including sandstone/siltstone interburden).

Alluvium

While water within the Isaac River is largely fresh, water within the Isaac River alluvium ranges from fresh to moderately saline with an average TDS of 863 mg/L, ranging between 10 mg/L and 3,430 mg/L (Appendix A).

Spatial distribution of TDS depicts mostly fresh water quality localised along the Isaac River (with some observations of brackish to moderately saline water along the Isaac River and tributaries).

Alluvial monitoring bores for the Project show marginal to saline water along the Isaac River alluvium, further outlining the spatial variability of salinity within the Isaac River alluvium (Appendix A).

The water quality data for the alluvium typically shows an inverse correlation in EC to rainfall, with rising EC recorded during periods of declining/below average rainfall and vice versa (Appendix A).

Comparing the available data to relevant guideline levels, the results indicate that water within the Quaternary alluvium is generally suitable for stock water supply and short-term irrigation. However, the alluvial groundwater generally exceeds guideline levels for drinking water (i.e. TDS, chloride and sodium), freshwater aquatic systems and long-term irrigation (chromium, iron, and manganese). The alluvial groundwater also records concentrations of total and dissolved iron and manganese above the WQOs (Appendix A).

Regolith

Water within the regolith material is generally highly saline, however can be brackish to moderately saline with an average TDS of 10,510 mg/L, ranging between 1,460 mg/L and 18,600 mg/L (Appendix A).

Where water is present within the regolith material, it exhibits poorer quality compared to the alluvium and is not considered a suitable groundwater resource for livestock, irrigation, drinking water or aquatic ecosystems. The water within regolith material also exceeded the WQOs (Zone 34 – shallow) for EC, chloride, calcium, sodium, hardness, magnesium, sulfate, copper and manganese (Appendix A).

Coal Measures (Interburden and Coal)

The target coal seams are contained within the Permian coal measures, namely, the Rangal and Fort Cooper Coal Measures. Water within these Permian coal measures is generally saline. Coal seam units of the Permian coal measures record an average TDS of 6,212 mg/L, ranging between 923 mg/L and 16,400 mg/L.

The interburden units of the Permian coal measures record an average TDS of 3,436 mg/L, ranging between 421 mg/L and 18,400 mg/L (Appendix A).

Salinity within the Permian coal measures increases with depth. Bores within the Permian coal measures near the subcrop areas in the west generally record moderately saline water quality, which increases to saline quality where the Permian coal measures are deepest near the Isaac River. This corresponds with the Permian coal measures being largely recharged by rainfall where they subcrop (Appendix A).

Water within the interburden of the Permian coal measures is generally suitable for stock water supply at monitoring locations for the Project. The exception is R2034 which displays nickel (total and dissolved) and aluminium (total) concentrations above the guidelines for three of the sampling events. In contrast, groundwater within the coal seams generally exhibit a higher TDS, which is on average higher than the guideline level for beef cattle but below the guideline level for sheep (Appendix A).

Comparison of results to the guideline levels indicates the Rangal Coal Measures (interburden and coal) are not considered a suitable groundwater resource for irrigation, drinking water or aquatic ecosystems. Groundwater within the Permian coal measures (coal and interburden) record concentrations of bicarbonate above the WQOs (Zone 34 – deep) and fluoride above the WQO (Zone 34 – shallow and deep) (Appendix A).

Project Water Quality Objectives

Draft WQOs have been developed for the Project for each physical and chemical parameter, based on review and consideration of:

- the lowest WQO for each relevant environmental value; and
- the available baseline water quality datasets.

Where the available baseline water quality datasets demonstrate clearly that the lowest WQO could not be achieved, an alternative WQO has been derived.

Where there remains substantial ambiguity, the lowest WQO has been adopted as the default, until such time as ongoing baseline datasets are available to derive an alternative WQO.

The draft WQOs for the Project are presented in Table 5-9.

5.3.8 Water Dependent Assets

Environmental Values

A range of environmental values have been assigned broadly for the three mapped areas in the vicinity of the Project (Figure 5-21):

- Isaac western upland tributaries;
- Isaac and lower Connors River main channel; and
- Isaac northern tributaries.

All three mapped areas have been assigned the following environmental values:

- aquatic ecosystems;
- irrigation;
- farm supply/use;
- stock water;
- human consumption;
- primary recreation;
- secondary recreation;
- visual recreation;
- drinking water;
- industrial use; and
- cultural and spiritual values.

Only the Isaac western upland tributaries mapped areas have 'aquaculture' assigned as an environmental value.

Groundwater Dependent Ecosystems

GDEs are ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis for maintenance of the ecosystem (Richardson *et al*., 2011). GDEs are classified by Doody *et al.* (2019) into three broad types:

- aquifer and cave ecosystems (i.e. subterranean GDEs);
- ecosystems dependent on the sub-surface presence of groundwater (i.e. terrestrial GDEs, including some riparian vegetation communities); and
- ecosystems dependent on the surface-expression of groundwater (i.e. aquatic GDEs).

Table 5-9
Draft Water Quality Objectives for the Project

Physico-chemical Parameter	Draft WQO	Relevant Environmental Value
pH	6.5-8.5	Aquatic Ecosystem
Conductivity (EC) – Baseflow	< 720 µS/cm	Aquatic Ecosystem
Conductivity (EC) – High flow	< 250 µS/cm	Aquatic Ecosystem
Total Dissolved Solids	< 2,000 mg/L	Stock Watering
Total Hardness (as $CaCO_3$)	< 150 mg/L	Drinking Water
Suspended Solids	< 55 mg/L	Aquatic Ecosystem
Sodium	< 30 mg/L	Drinking Water
Sulfate	< 25 mg/L	Aquatic Ecosystem
Turbidity	< 50 NTU	Aquatic Ecosystem
Colour	50 Hazen Units	Drinking Water
Dissolved Oxygen	85-110% Saturation	Aquatic Ecosystem
	> 4 mg/L (at surface)	Drinking Water
Iron	< 10 mg/L	Irrigation
Manganese	< 10 mg/L	Irrigation
	< 1.9 mg/L	Aquatic Ecosystem
Aluminium	< 5 mg/L	Stock Watering
	< 0.055 mg/L	Aquatic Ecosystem
Boron	< 5 mg/L	Stock Watering
	< 0.37 mg/L	Aquatic Ecosystem
Zinc	< 5 mg/L	Irrigation
	< 0.008 mg/L	Aquatic Ecosystem
Lithium	< 2.5 mg/L	Irrigation
Fluoride	< 2 mg/L	Irrigation
Arsenic	< 2 mg/L	Irrigation
	< 0.5-5 mg/L	Stock Watering
	< 0.024 mg/L	Aquatic Ecosystem
Chromium	< 1 mg/L	Stock Watering
	< 0.001 mg/L	Aquatic Ecosystem
Copper	< 1 mg/L	Stock Watering (Cattle)
	< 0.0014 mg/L	Aquatic Ecosystem
Nickel	< 1 mg/L	Stock Watering
	< 0.011 mg/L	Aquatic Ecosystem
Beryllium	< 0.5 mg/L	Irrigation
Vanadium	< 0.5 mg/L	Irrigation
Cobalt	< 0.1 mg/L	Irrigation
	< 0.0014 mg/L	Aquatic Ecosystem
Lead	< 0.1 mg/L	Stock Watering
	< 0.0034 mg/L	Aquatic Ecosystem
Uranium	< 0.1 mg/L	Irrigation
Molybdenum	< 0.05 mg/L	Irrigation
Selenium	< 0.02 mg/L	Stock Watering
	< 0.005 mg/L	Aquatic Ecosystem

Table 5-9 (Continued)
Draft Water Quality Objectives for the Project

Physico-chemical Parameter	Draft WQO	Relevant Environmental Value
Cadmium	< 0.01 mg/L	Stock Watering
	<0.0002 mg/L	Aquatic Ecosystem
Mercury	< 0.002 mg/L	Irrigation
	< 0.00006 mg/L	Aquatic Ecosystem
Total Nitrogen	< 500 µg/L	Aquatic Ecosystem
Organic Nitrogen	< 420 µg/L	Aquatic Ecosystem
Oxidised Nitrogen	< 60 µg/L	Aquatic Ecosystem
Total Phosphorus	< 50 µg/L	Aquatic Ecosystem
Filterable Reactive Phosphorus	< 20 µg/L	Aquatic Ecosystem
Ammonia Nitrogen	< 20 µg/L	Aquatic Ecosystem
Chlorophyll a	< 5 µg/L	Aquatic Ecosystem

A review of desktop (BoM, 2020b) and site-specific data was undertaken to characterise the potential aquatic and terrestrial GDEs and stygofauna (Appendix F). Detailed descriptions of the site-specific data collected for the Project and the identification of GDEs and stygofauna in the vicinity of the Project are provided in Appendices A, B, D and E, and are summarised in Appendix F.

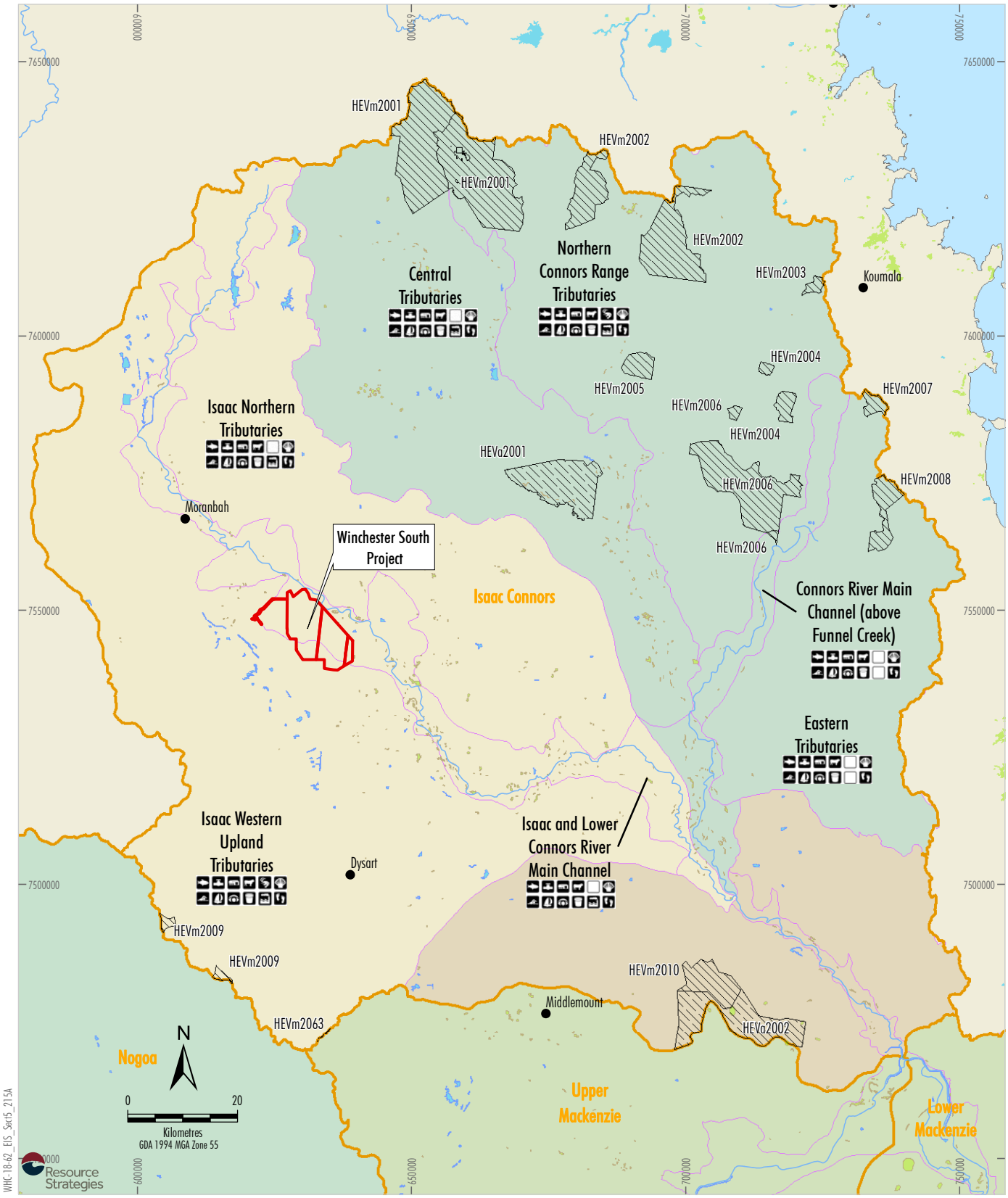
GDEs can require access to groundwater on a permanent (obligate) or intermittent (facultative) basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services (Doody *et al.*, 2019).

Obligate GDEs are made up of species that depend entirely on the groundwater (Doody *et al.*, 2019). Obligate GDEs tend to occupy areas of the landscape that optimise access to groundwater, such as on or below the lower banks of waterways. Species with an obligate dependence on groundwater may not require access to groundwater at all times; however, in order to survive long periods of drought, access to groundwater is essential (Appendix D).

Facultative GDEs are those that use groundwater optionally or opportunistically rather than solely (Doody *et al.*, 2019). Facultative GDEs can utilise groundwater when it is available; however, will survive without it (Eamus *et al.*, 2006). Facultative groundwater dependent species are usually located on the upper banks and floodplains of waterways (Eamus *et al.*, 2006; Roberts and Marston, 2000).

Representative examples of the potential aquatic and terrestrial GDEs identified within the vicinity of the Project are shown in Figure 5-22.

The aquatic in-stream ecosystems associated with the Isaac River and Cherwell Creek are largely not dependent on the surface-expression of groundwater. The wetlands and farm dams in the locality are not likely to be aquatic GDEs (Appendix F).



LEGEND

Mining Lease Application Boundary
Boundary of Waters Covered by the Scheduling Document
Isaac River Sub-basin Boundary
Watercourse

Environmental Values

Aquatic Ecosystems
Primary Recreation
Irrigation
Secondary Recreation
Farm Supply
Visual Recreation
Stock Water
Drinking Water
Aquaculture
Indsutrial Use
Human Consumer
Cultural & Spiritual Values

Water Types (Fresh Waters)

Connors River Catchment fresh waters
Lower Isaac River Catchment fresh waters
Lower Nogoa / Theresa Creek Sub-basin fresh waters
Mackenzie River Sub-basin fresh waters
Upper Isaac River Catchment fresh waters
Lakes / Reservoirs
Wetlands (Palustrine)

Management Intent

High Ecological Value Fresh Waters (Maintain)
High Ecological Value Fresh Waters (Achieve)

Source: The State of Queensland (2018 - 2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Environmental Values - Isaac River Sub-basin

Figure 5-21

Wet Season Survey

Plate 1: Isaac River Site I1
(Outside of Project Area)

Plate 3: Palustrine Wetland Site PW4
(Outside of Project Area)

Plate 5: Lacustrine Wetland Site LW3
(Farm Dam within Project Area)

Dry Season Survey

Plate 2: Isaac River Site I1
(Outside of Project Area)

Plate 4: Palustrine Wetland Site PW4
(Outside of Project Area)

Plate 6: Lacustrine Wetland Site LW3
(Farm Dam within Project Area)

WHC-18-62_Sect5_002A

Resource Strategies

Source: ESP (2021).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Representative Potential Aquatic and Terrestrial GDEs

Figure 5-22

5.4 SIGNIFICANT IMPACT ASSESSMENT

In accordance with the terms of reference each Proposed Action is to be assessed individually as well as cumulatively. This Section provides a significant impact assessment for threatened species and communities, known or likely to occur in the Project area. The outcomes of the assessment summarised in this Section are used to inform the assessments undertaken for each Action in Sections 5.5, 5.6 and 5.7. Detailed significant impact assessments for each threatened species and community known or likely to occur in the Project area are provided in Appendix D.

5.4.1 Introduction

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), a significant impact assessment has been completed for each threatened species and ecological community known, or likely, to occur within the Indicative Surface Disturbance Extent of the Project, or listed in the Terms of Reference (Section 5.3.5 and Appendices D and E) (Table 5-7). The results of these assessments are provided in Table 5-10.

Allocation of Disturbance

In accordance with the EPBC Act and the Terms of Reference, each Proposed Action is to be assessed individually as well as cumulatively.

As part of mine planning and analysis undertaken by Whitehaven, the actions referred to the Commonwealth Minister in 2019 have been refined to the areas required for the Project. These refinements have significantly reduced the areas for each action as compared to the 2019 referrals. An example of this is through the co-location of the ETL Action, Water Pipeline Action and access road component of the Mine Site and Access Road Action with a single consolidated corridor.

As described above, as all three Proposed Actions overlap and share common disturbance (to some extent), to avoid duplicating disturbance assessments the following approach has been applied.

Aquatic species are not predicted to be impacted (Appendix E).

5.4.2 Impacts to Threatened Species

Threatened species and ecological communities shaded in Table 5-10 (two threatened ecological communities, and four threatened fauna species[2]) were determined to have the potential to be impacted.

The following listed threatened species were detected during field surveys completed by E2M (2021) in a study area encompassing the Project (Section 5.3):

- Ornamental Snake;
- Squatter Pigeon (southern subspecies);
- Koala (combined populations of Queensland, NSW and the ACT); and
- Greater Glider.

Potential impacts on these species are described below.

Ornamental Snake (Denisonia maculata)

Potential Impacts

The Ornamental Snake was recorded during field surveys within the Indicative Surface Disturbance Extent of the Project (E2M, 2021) and surrounding habitat (Figure 5-9).

Approximately 1,834.2 ha of habitat for the Ornamental Snake would be disturbed (comprising 1,821.9 ha assessed against the Mine Site and Access Road Action [EPBC 2019/8460] and 12.3 ha assessed against the ETL Action [EPBC 2019/8458]).

Important habitat for the Ornamental Snake includes areas where the species has been recorded and contains suitable microhabitat features on which the species relies (gilgai depressions and mounds) (Appendix D). Due to presence of important habitat, E2M (2021) consider the population of Ornamental Snake to be important (after DotE, 2013b).

[2] The White-throated Needletail (*Hirundapus caudacutus*) is not considered in this section, as it is almost exclusively aerial. An assessment of potential impacts is provided in Appendix D.

Table 5-10
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species			
Bird			
Calidris ferruginea	Curlew Sandpiper	Critically Endangered, Marine, Migratory	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential habitat for the species was identified within the Study Area, however was considered marginal.
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Remnant woodland within the study area (required for the species) has undergone historic disturbance from clearing which reduces the habitat value for the species.
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	Vulnerable	**Potential Impact.** Justification: **Known to occur**. The Project would result in a significant impact on the Squatter Pigeon (southern subspecies) through the removal of approximately 261.2 ha of suitable breeding/foraging and foraging habitat, comprising 140.5 ha of breeding habitat and 120.7 ha of foraging habitat being assessed against the Mine Site and Access Road Action (EPBC 2019/8460) (Appendix D).
Grantiella picta	Painted Honeyeater	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential habitat for the species does occur within the Study Area. ▪ The species has not previously been recorded within the desktop search extent.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Bird (Continued)			
Hirundapus caudacutus	White-throated Needletail	Vulnerable, Marine, Migratory	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. **Likely to occur:** In Australia, the species is almost exclusively aerial. Therefore, the Project is considered unlikely to have any adverse or significant impacts on the species.
Neochmia ruficauda ruficauda	Star Finch (Eastern)	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The Study Area is outside of the current known distribution of the species. ▪ The species has not previously been recorded within the desktop search extent.
Peophila cincta cincta	Southern Black-throated Finch	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The Study Area is outside of the current known distribution of the species. ▪ The species has not previously been recorded within the desktop search extent.
Rostratula australis	Australian Painted Snipe	Endangered, Marine	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. **Likely to occur:** The Project is unlikely to result in a significant impact on the Australian Painted Snipe as no potential breeding habitat would be removed.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Fish			
Bidyanus bidyanus	Silver Perch	Critically Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Habitat for the species does not occur in the Study Area. ▪ The Study Area is outside of the natural distribution of the species. ▪ No known records of the species occur within the vicinity of the Project.
Maccullochella peelii	Murray Cod	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Habitat for the species does not occur in the Study Area. ▪ The Study Area is outside of the natural distribution of the species. ▪ No known records of the species occur within the vicinity of the Project.
Mammal			
Dasyurus hallucatus	Northern Quoll	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential Habitat for the species does occur within the Study Area. ▪ The species has not previously been recorded within the desktop search extent.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Mammal (Continued)			
Phascolarctos cinereus	Koala (combined populations of Queensland, NSW and the ACT)	Vulnerable	**Potential Impact.** Justification: **Known to occur:** The Project would result in a significant impact on the Koala (combined populations of Queensland, NSW and the ACT) through the removal of approximately 314.5 ha of known habitat, comprising 278.6 ha being assessed against the Mine Site and Access Road Action (EPBC 2019/8460) and 35.9 ha within the infrastructure corridor being assessed against the ETL Action (EPBC 2019/8458) (Appendix D).
Petauroides volans	Greater Glider	Vulnerable	**Potential Impact.** Justification: **Known to occur:** The Project would result in a significant impact on the Greater Glider through the removal of approximately 167.1 ha of known habitat, being assessed against the Mine Site and Access Road Action (EPBC 2019/8460) (Appendix D).
Macroderma gigas	Ghost Bat	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential Habitat for the species was not identified within the Study Area.
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential Habitat for the species was not identified within the Study Area.
Lasiorhinus krefftii	Northern Hairy-nosed Wombat	Critically Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. **Not recorded.** The species has not previously been recorded within the desktop search extent and the Study Area is outside of the current known distribution for the species.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Reptile			
Elseya albagula	Southern Snapping Turtle	Critically Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Habitat for the species does not occur in the Study Area. ▪ No known records of the species occur within the vicinity of the Project.
Rheodytes leukops	Fitzroy River Turtle	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Habitat for the species does not occur in the Study Area. ▪ No known records of the species occur within the vicinity of the Project.
Denisonia maculata	Ornamental Snake	Vulnerable	**Potential Impact.** Justification: **Known to occur:** The Project would result in a significant impact on the Ornamental Snake through the removal of approximately 1,834.2 ha of potential habitat, comprising 1,821.9 ha being assessed against the Mine Site and Access Road Action (EPBC 2019/8460) and 12.3 ha within the infrastructure corridor being assessed against the ETL Action (EPBC 2019/8458) (Appendix D).
Egernia rugosa	Yakka Skink	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential habitat for the species does occur within the Study Area. ▪ The species has not previously been recorded within the desktop search extent.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Reptile (Continued)			
Furina dunmalli	Dunmall's Snake	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential Habitat for the species does occur within the Study Area. ▪ The species has not previously been recorded within the desktop search extent.
Lerista allanae	Allan's Lerista/Retro Slider	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The Study Area is outside of the current known distribution of the species. ▪ The species has not previously been recorded within the desktop search extent.
Flora			
Cycas ophiolitica	Marlborough Blue	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Habitat for the species was not present within the Study Area. ▪ The species has not been previously recorded in the desktop search extent.
Dichanthium queenslandicum	King Blue-grass	Endangered	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The species has been previously recorded within the desktop search extent. ▪ Despite extensive surveys by E2M (2021) in optimal conditions (wet season surveys), the species was not detected, reducing its likelihood of occurring.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Scientific Species Name	Common Species Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Species (Continued)			
Flora (Continued)			
Dichanthium setosum	Bluegrass	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The species has been previously recorded within the desktop search extent. ▪ Despite extensive surveys by E2M (2021) in optimal conditions (wet season surveys), the species was not detected, reducing its likelihood of occurring.
Samadera bidwillii	Quassia	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ Potential habitat for the species was limited within the Study Area.
Eucalyptus raveretiana	Black Ironbox	Vulnerable	**No significant impact.** Justification: ▪ The species was not recorded during field surveys. ▪ The species has not previously been recorded within the desktop search extent. ▪ The Study Area is outside of the current known distribution of the species.

Table 5-10 (Continued)
Assessment of Threatened Species and Threatened Communities

Community Name	Conservation Status under the EPBC Act[1]	Assessment Summary
Threatened Ecological Communities		
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	**No significant impact.** Justification: **Confirmed present:** The Project would not significantly impact Brigalow TEC as the occurrence would be avoided and potential indirect impacts (e.g. weeds) would be managed.
Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin	Endangered	**Potential Impact.** Justification: **Confirmed present:** The Project would result in a significant impact 80.9 ha of 'good quality' Natural Grasslands TEC, comprising 74.4 ha being assessed against the Mine Site and Access Road Action (EPBC 2019/8460) and 6.5 ha along the infrastructure corridor being assessed against the ETL Action (EPBC 2019/8458) (Appendix D).
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	**Potential Impact.** Justification: **Confirmed present:** The Project would result in a significant impact on Poplar Box TEC through the removal of approximately 9.6 ha of Poplar Box TEC being assessed against the Mine Site and Access Road Action (EPBC 2019/8460). No Poplar Box TEC is present in the infrastructure corridor associated with the ETL Action (EPBC 2019/8458) (Appendix D).
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	**No significant impact.** Justification: ▪ The community was not detected during field surveys by E2M (2021). ▪ The community was not detected during previous field surveys. ▪ No suitable habitat has been identified within the Study Area.

Note: Shaded threatened species and ecological communities are considered to have the potential to be impacted.

[1] Conservation status under the EPBC Act as at November 2020.

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), E2M (2021) assessed the potential impacts on the Ornamental Snake and concluded the removal of important habitat is unlikely to:

- fragment an existing important population into two or more populations;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or
- introduce disease that may cause the species to decline.

However, clearing of identified habitat is considered by E2M (2021) to potentially:

- 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 at a local scale;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population at a local scale;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline at a local scale; and
- interfere substantially with the recovery of the species.

As such, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), the Project would result in a significant impact on the Ornamental Snake (Appendix D).

Avoidance, Mitigation and/or Management Measures

Whitehaven WS has undertaken an analysis to reduce impacts to threatened species, water resources and water dependent assets facilitated by the Project. The outcome of this analysis is that the key EPBC Actions are significantly smaller than those referred to the Commonwealth Minister in 2019 (Section 5.2.1).

Further, the analysis has resulted in the co-location of the Project ETL Action, Water Pipeline Action and access road component of the Mine Site and Access Road Action into a single corridor. This corridor avoids requiring separate disturbance areas and significantly reduces the potential for additional impacts to be facilitated by the Project.

Whitehaven WS would also implement species specific mitigation measures during construction to further assist in reducing the potential for further impacts to species.

The following mitigation measures would be implemented by Whitehaven WS to reduce potential adverse impacts to the Ornamental Snake (Appendix D):

- impact avoidance measures described in Section 5.5.11 and 5.6.8; and
- a MNES Management Plan outlining (amongst other things):
  - vegetation clearing measures (e.g. fauna spotters/catchers present during the clearing process as required); and
  - pest animal management measures.

The above measures are predicted to be effective in reducing potential adverse impacts on the Ornamental Snake associated with the Project (Appendix D). Each mitigation measure is focused on addressing the recognised threats to the Ornamental Snake and is consistent with the relevant threat abatement action (e.g. avoiding additional habitat loss and controlling introduced pests such as pigs [DotE, 2014e; DSEWPaC, 2011a; Ponce Reyes *et al*., 2016]).

A National or State recovery plan has not been prepared for the Ornamental Snake.

The impacts on the Ornamental Snake would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

Squatter Pigeon (southern subspecies) (Geophaps scripta scripta)

Potential Impacts

The species was recorded during field surveys within the Study Area, although not within the Indicative Surface Disturbance Extent of the Project (Figure 5-10).

Approximately 140.5 ha of breeding habitat, and 120.7 ha of foraging habitat for the Squatter Pigeon (southern subspecies) would be disturbed and assessed against the Mine Site and Access Road Action (EPBC 2019/8460).

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b) E2M (2021) assessed the potential impacts on the Squatter Pigeon. The Squatter Pigeon (southern subspecies) population within the area that would be disturbed by the Project is not considered an important population and removal of identified habitat is considered unlikely to (Appendix D):

- 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, 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; or
- introduce disease that may cause the species to decline.

As such, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), the Project is considered likely to result in a significant impact on the Squatter Pigeon (southern subspecies) due to the clearing of breeding and foraging habitat which could potentially interfere with the recovery of the species (Appendix D).

Avoidance, Mitigation and/or Management Measures

Whitehaven WS has undertaken an analysis to reduce impacts to threatened species, water resources and water dependent assets facilitated by the Project. The outcome of this analysis is that the key EPBC Actions are significantly smaller than those referred to the Commonwealth Minister in 2019 (Section 5.2.1).

Further, the analysis has resulted in the co-location of the Project ETL Action, Water Pipeline Action and access road component of the Mine Site and Access Road Action into a single corridor. This corridor avoids requiring separate disturbance areas and significantly reduces the potential for additional impacts to be facilitated by the Project.

Whitehaven WS would also implement species specific mitigation measures during construction to further assist in reducing the potential for further impacts to species.

The following mitigation measures would be implemented by Whitehaven WS to reduce potential adverse impacts to the Squatter Pigeon (southern subspecies) (Appendix D):

- impact avoidance measures described in Section 5.5.11 including an environmental management plans; and
- a MNES Management Plan outlining, amongst other things, vegetation clearing measures (e.g. fauna spotters/catchers present during the clearing process) and feral animal management measures.

The above measures are predicted to be effective in reducing potential adverse impacts on the Squatter Pigeon (southern subspecies) associated with the Project (Appendix D).

Each mitigation measure is focused on addressing the recognised threats to the Squatter Pigeon (southern subspecies) and is consistent with the relevant threat abatement action (e.g. avoiding additional habitat loss, and controlling predators and herbivores [TSSC, 2015b]).

A National or State recovery plan has not been prepared for the Squatter Pigeon (southern subspecies).

The impacts on the Squatter Pigeon (southern subspecies) breeding and foraging habitat would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

Koala (combined populations of Queensland, NSW and the ACT) (Phascolarctos cinereus)

Potential Impacts

The species was recorded during field surveys within the Study Area although not within the Indicative Extent of Surface Disturbance of the Project (Figure 5-11).

Approximately 314.5 ha of Koala habitat would be cleared (comprising approximately 278.6 ha assessed against the Mine Site and Access Road Action [EPBC 2019/8460] and approximately 35.9 ha assessed against the ETL Action [EPBC 2019/8458]).

The *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, NSW and the ACT)* (DotE, 2014a) are a species-specific extension of the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b). An assessment against the species-specific extension of the guidelines is provided below.

A Koala habitat assessment was completed for the Project in accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DotE, 2014a). The results of the assessment are summarised in Table 5-11.

Table 5-11
Koala Habitat Assessment

Attribute	Score
Koala Occurrence	+2
Vegetation Composition	+2
Habitat Connectivity	0 to +2
Key Existing Threats	+2
Recovery Value	0 to +2
Total	**6 to 10**

The Indicative Surface Disturbance Extent of the Project is known to contain Koala habitat including Koala food trees. The area that would be disturbed by the Project is located in an inland region, with less than 800 mm of annual rainfall.

The Project proposes to remove approximately 314.5 ha of Koala Habitat scored between 6 and 10.

As such, in accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, NSW and the ACT)* (DotE, 2014a), the Project is considered likely to result in a significant impact on the Koala (combined populations of Queensland, NSW and the ACT) due to the clearing of habitat critical to the survival of the species (score of 6 to 10) (after DotE, 2014a) (Appendix D).

Avoidance, Mitigation and/or Management Measures

Whitehaven WS has undertaken an analysis to reduce impacts to threatened species, water resources and water dependent assets facilitated by the Project. The outcome of this analysis is that the key EPBC Actions are significantly smaller than those referred to the Commonwealth Minister in 2019 (Section 5.2.1).

Further, the analysis has resulted in the co-location of the Project ETL Action, Water Pipeline Action and access road component of the Mine Site and Access Road Action into a single corridor. This corridor avoids requiring separate disturbance areas and significantly reduces the potential for additional impacts to be facilitated by the Project.

Whitehaven WS would also implement species specific mitigation measures during construction to further assist in reducing the potential for further impacts to species.

The following mitigation measures would be implemented by Whitehaven WS to reduce potential adverse impacts to the Koala (Appendix D):

- impact avoidance measures described in Section 5.5.11 including an environmental management plan;
- avoid clearing of riparian vegetation associated with the Isaac River;
- designated speed limits, and management of injured fauna to reduce vehicle strike;

- controlled operational lighting focusing on disturbed and active mining areas, and avoiding remnant habitat; and
- a MNES Management Plan for the Project outlining (amongst other things) vegetation clearing measures (e.g. presence of fauna spotters/catchers during clearance of Koala habitat).

The above measures are predicted to be effective in reducing potential adverse impacts on the Koala associated with the Mine Site and Access Road (EPBC 2019/8460) (Appendix D).

Each mitigation measure is focused on addressing the recognised threats to the Koala and is consistent with the relevant threat abatement action (e.g. avoiding additional habitat loss, and controlling predators [DotE, 2014a; DSEWPaC, 2012c; TSSC, 2012; DES, 2019e]).

A National or State recovery plan has not been prepared for the Koala.

The impacts on the Koala (combined populations of Queensland, NSW and the ACT) would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

Greater Glider (Petauroides volans)

Potential Impacts

The species was recorded during field surveys within the Indicative Surface Disturbance Extent and surrounding habitat (Figure 5-12).

Approximately 167.1 ha of suitable habitat for the Greater Glider would be cleared, assessed entirely against the Mine Site and Access Road Action (EPBC 2019/8460).

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), E2M (2021) assessed the potential impacts on the Greater Glider.

The Greater Glider population within the area that would be disturbed by the Project is not considered an important population and removal of identified habitat is considered unlikely to (Appendix D):

- 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;
- 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; or
- introduce disease that may cause the species to decline.

As such, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), the Project is considered likely to result in a significant impact on the Greater Glider due to the clearing of habitat that meets the definition of habitat critical to the survival of the species, which could potentially interfere with the recovery of the species (Appendix D).

Avoidance, Mitigation and/or Management Measures

The following mitigation measures would be implemented by Whitehaven WS to reduce potential adverse impacts to the Greater Glider (Appendix D):

- impact avoidance measures described in Section 5.5.11 including an environmental management plan;
- avoid clearing riparian vegetation associated with the Isaac River; and
- a MNES Management Plan outlining, amongst other things, vegetation clearing measures (e.g. fauna spotters/catchers).

The above measures are predicted to be effective in reducing potential adverse impacts associated with the Project on the Greater Glider (Appendix D).

Each mitigation measure is focused on addressing the recognised threats to the Greater Glider and is consistent with the relevant threat abatement action (e.g. avoiding additional habitat loss, and controlling predators and herbivores [TSSC, 2016b]).

A National or State recovery plan has not been prepared for the Greater Glider.

The impacts on the Greater Glider would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

5.4.3 Impacts to Threatened Ecological Communities

As discussed in Section 5.3.4, the following listed threatened communities were identified during field surveys completed by E2M (2021):

- Brigalow TEC;
- Natural Grasslands TEC; and
- Poplar Box TEC.

Potential impacts on these ecological communities are described below.

Brigalow (Acacia harpophylla dominant and co-dominant)

Potential Impacts

No disturbance to Brigalow TEC would occur due to the Project. A single patch of Brigalow TEC was identified adjacent to the area that would be disturbed by the Project, however following deliberate mine design, this patch has been avoided.

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), E2M (2021) assessed the potential impacts on the Brigalow TEC. E2M (2021) concluded that the Project would not significantly impact Brigalow TEC as the occurrence would be avoided and potential indirect impacts (e.g. weeds) would be managed.

Furthermore, the Project is considered unlikely to (Appendix D):

- reduce the overall extent of occurrence of the ecological community;
- fragment or increase fragmentation of the ecological community;
- adversely affect habitat critical to the survival of the ecological community;
- modify or destroy abiotic (non-living) factors necessary for the ecological community's survival;
- cause a substantial change in the species composition of the ecological community;
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community; or
- interfere with the recovery of the ecological community.

Avoidance, Mitigation and/or Management Measures

Refinements of the Mine Site and Access Road Action (EPBC 2019/8460) have avoided disturbance to a patch of Brigalow TEC.

Mitigation measures would be implemented to minimise potential adverse impacts to the threatened ecological community through an Environmental Management Plan. This plan would outline management of weeds on-site and defining boundaries of areas to be cleared, and those not to be cleared during construction and operation and is described in Section 5.5.11 (Appendix D).

Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin

Potential Impacts

Approximately 80.9 ha of the Natural Grasslands TEC would be cleared as a result of the Project (comprising 74.4 ha being assessed against the Mine Site and Access Road Action [EPBC 2019/8460] and 6.5 ha assessed against the ETL Action [EPBC 2019/8458]).

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), E2M (2021) assessed the potential impacts on the Natural Grassland TEC.

Three patches of Natural Grasslands TEC would be cleared as a result of the Mine Site and Access Road Action (EPBC 2019/8460), and two patches as a result of the ETL Action (EPBC 2019/8458).

These patches are, however, fragmented and do not meet the definition of 'best quality' Natural Grasslands TEC as described in the listing advice (TSSC, 2009).

The clearing of Natural Grasslands TEC is considered unlikely to (Appendix D):

- reduce the overall extent of occurrence of the community;
- adversely affect habitat critical to the survival of an ecological community;
- modify or destroy abiotic (non-living) factors necessary for the ecological community's survival for the retained patches;
- cause a substantial change in the species composition of the ecological community for the retained patches; or
- cause a substantial reduction in the quality or integrity of an occurrence of the retained ecological community.

However, clearing of this community is considered to (Appendix D):

- fragment a single patch of the ecological community;
- modify or destroy abiotic (non-living) factors of the single patch of the ecological community;
- cause a substantial change in the species composition of the ecological community in the single patch of the ecological community;
- cause a substantial reduction in the quality or integrity of an occurrence of the single patch of ecological community; and
- interfere with the recovery of the ecological community.

As such, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), the Project is considered likely to result in a significant impact on the Natural Grassland TEC due to the clearing of areas of the TEC which would interfere with the recovery of the community.

Avoidance, Mitigation and/or Management Measures

Refinements of the Mine Site and Access Road Action (EPBC 2019/8460) have avoided disturbance to a patch of Natural Grasslands TEC. Three remaining patches of threatened ecological community identified by E2M (2021) would be cleared due to the Mine Site and Access Road Action (EPBC 2019/8460).

Mitigation measures would be implemented to minimise potential adverse impacts to the Natural Grasslands TEC, including defining boundaries of areas to be cleared, and those not to be cleared during construction and operation, these are described in Section 5.5.11.

These measures are predicted to be effective in reducing potential adverse impacts associated with the Project on the Natural Grasslands TEC (Appendix D). Each mitigation measure is focused on addressing the recognised threats to the Natural Grasslands TEC and are consistent with the relevant threat abatement actions (e.g. avoiding additional habitat loss, and controlling weeds [DSEWPaC, 2012d; TSSC, 2009; DEWHA, 2008a]).

A National or State recovery plan has not been prepared for the Natural Grasslands TEC.

The impacts on the Natural Grasslands TEC would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

Poplar Box Grassy Woodland on Alluvial Plains

Potential Impacts

Approximately 9.6 ha of Poplar Box TEC would be cleared as a result of the Mine Site and Access Road Action (EPBC 2019/8460). No Poplar Box TEC would be cleared as a result of the ETL Action (EPBC 2019/8458).

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b) E2M (2021) assessed the potential impacts on the Poplar Box TEC.

The patch of Poplar Box TEC is noted to be of 'Class B' (good quality), however does not meet the requirements for 'Class A' (best quality) critical for the survival of the ecological community (DEE, 2019c).

The clearing of the Poplar Box TEC is considered unlikely to (Appendix D):

- reduce the overall extent of occurrence of the community;
- fragment or increase fragmentation of the ecological community;
- modify or destroy abiotic (non-living) factors necessary for the ecological community's survival;
- cause a substantial change in the species composition of the ecological community for the retained patches; or
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community for the retained patches.

However, clearing of this community is considered to (Appendix D):

- be potentially important in a regional and local context;
- cause a substantial change in the species composition of the ecological community in the single patch of the ecological community;
- cause a substantial reduction in the quality or integrity of an occurrence of the single patch of ecological community; and
- interfere with the recovery of the ecological community.

As such, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b) the Project is considered likely to result in a significant impact on the Poplar Box TEC due to the clearing of areas of the TEC which would interfere with the recovery of the community.

Avoidance, Mitigation and/or Management Measures

No mitigation measures are proposed for the Poplar Box TEC as the small occurrence within the Indicative Surface Disturbance Extent of the Project would be completely removed.

A National or State recovery plan has not been prepared for the Poplar Box TEC.

The impacts on the Poplar Box TEC would be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

5.4.4 Impacts to Water Resources and Water Quality

As described in Section 5.2.2, Mine Site and Access Road Action (EPBC 2019/8460) is subject to the following controlling provisions:

- listed threatened species and communities; and
- a water resource, in relation to coal seam gas development and large coal mining development.

The relevant controlling provisions for the ETL Action (EPBC 2019/8458) and Water Pipeline Action (EPBC 2019/8459) are listed threatened species and communities. As such, potential impacts to water resources and water quality are only considered for the Mine Site and Access Road Action (EPBC 2019/8460) and presented in Section 5.5.8.

5.4.5 Indirect and Consequential Impacts

As described in the Terms of Reference and *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DotE, 2013b), when considering whether or not an action is likely to have a significant impact on a MNES, it is relevant to consider all adverse impacts which result from the action, including indirect and consequential (off-site) impacts.

Potential indirect and consequential impacts of the Proposed Actions on fauna habitat and vegetation are described in the sub-sections below.

Indirect Impacts

Habitat Connectivity

Habitat connectivity within the Proposed Action Areas is low with a highly fragment landscape and disturbance present throughout from historical clearing of native vegetation and cattle grazing (Appendix D).

There are no well-defined fauna movement corridors being impacted by the Proposed Actions that need to be retained, and the post-mine landforms would be rehabilitated in a manner that results in patches of woodland in pasture areas (Appendix D).

Notwithstanding "connectivity" is a listed MSES under the Queensland *Environmental Offsets Regulation 2014* and has been assessed accordingly. The assessment is not included in this Section as it is not a MNES, however is detailed in Appendix D and Section 4.5.3.

Edge Effects

Edge effects occur when previously intact remnant vegetation is partially cleared, exposing a new boundary of vegetation to disturbance. The impact of edge effects on flora and fauna can alter habitat composition and quality, resulting in a reduction of the effective area of habitat and an increase in competition for resources with aggressive pest or edge species (Appendix D).

As described earlier, the habitat in the Proposed Action Areas is highly fragmented due to historical clearing of native vegetation and cattle grazing. As such, edge effects are likely to have already manifested in remaining vegetated areas and the Proposed Actions are unlikely to significantly increase the potential of edge effects in these areas (Appendix D).

Measures to mitigate and manage edge effects are described in Sections 5.5.11, 5.6.8 and 5.7.8.

Noise, Dust and Artificial Lighting

The Project would result in an increase in noise, dust, and artificial lighting within the surrounding landscape (Appendices D, G and H and Sections 4.7 and 4.8).

The landscape surrounding the Project is heavily cleared. Dust from the Project is unlikely to cause significant degradation to surrounding native vegetation given vegetation in the local area is already subjected to dust from exposed soils which have not led to any observed impacts on vegetation (Appendix D).

Furthermore, it is also likely that seasonal rainfall in the locality would help wash dust from the vegetation and/or encourage new growth (Appendix D).

Noise emissions from mining operations and the CHPP plant are expected to be continuous and steady state in nature (Appendix G). Fauna that inhabit areas affected by construction and operational activities are predominantly common species that are more tolerant to some disturbance (Appendix D).

Any fauna within the local area are expected to exhibit initial fright behaviour and either adapt to disturbance levels or temporarily move to similar habitats in the adjacent landscape (Appendix D).

Vehicular Strike

Vehicular traffic associated with construction and operational activities due to the Project have the potential to lead to fauna injury or mortality (Appendix D).

There are no well-defined fauna movement corridors being impacted by the Project nor would the Project infrastructure corridor cross any waterways.

Measures to manage vehicle strike are described in Sections 5.5.11, 5.6.8 and 5.7.8.

Changes to Natural Fire Regimes

Accidental ignitions in the Project area may occur if not appropriately managed (e.g. from machinery or hot works). These ignitions have the potential to cause uncontrollable fires that can have pronounced impacts on vegetation and habitat within and adjacent to the Project area (Appendix D).

Mitigation and management measures would be implemented for the Project to reduce the potential for adverse changes in natural fire regimes (Sections 5.5.11, 5.6.8 and 5.7.8). As such, it is unlikely that the Project would increase the bushfire potential within the surrounding landscape (Appendix D).

Leaks and Spills

There is limited potential for groundwater contamination to occur with relation to workshops and fuel/chemical storage areas as each would be developed in accordance with current Australian Standards (e.g. adequate bunding and equipped for immediate spill clean-up) (Sections 5.5.11, 5.6.8 and 5.7.8).

Furthermore, the PRA concluded that there is a 'low' risk of leaks and/or spills occurring during the life of the Project given the appropriate implementation of preventative and mitigation measures (e.g. surface water management plan, hazardous substances management, bunding of all chemical storage and use areas etc.) (Appendix N).

Where effective mitigation and management measures are in place, including management of hazardous chemicals and materials in accordance with Queensland and Commonwealth Government legislation or policy requirements (Section 2.5.11), the risk to the aquatic ecological values of the receiving environment is low (Appendix E).

Introduced Species

The presence and abundance of feral animals adversely impacts native fauna through increased competition of resources, predation and habitat degradation (Appendix D).

Mitigation and management measures would be implemented by Whitehaven WS to mitigate the potential increase of introduced species (Sections 5.5.11, 5.6.8 and 5.7.8). As such, it is unlikely that the Project would result in an increase in weeds and feral animals within the surrounding landscape (Appendix D and E).

Consequential Impacts

As defined in the *Environment Protection and Biodiversity Conservation Act 1999 Policy Statement – 'Indirect consequences' of an action: Section 527E of the EPBC Act* (DSEWPaC, 2013b), indirect consequences of an action may include:

> *(a) off-site impacts including, but not limited to:*
>
> *(i) downstream impacts (such as impacts on wetlands from chemicals discharged into upstream river systems); or*
>
> *(ii) upstream impacts (such as the extraction of raw materials which are used to undertake the action), and*
>
> *(b) actions taken by third parties, where the third party action is facilitated to a major extent by the primary action and the impacts of the third party action were reasonably foreseeable (as set out in sub-section 527E(e) of the EPBC Act).*

Off-site Impacts

Downstream Impacts

The Groundwater Assessment (Appendix A) and Surface Water and Flooding Assessment (Appendix B) for the Project concludes that:

- The site water management system has been designed such that controlled releases are only required rarely, and any such releases would have a negligible impact on receiving water quality.
- The loss of catchment flows in the Isaac River and Ripstone Creek during the Proposed Actions would be indiscernible. Therefore, the potential impact on water quantity in the Isaac River and Ripstone Creek due to the excision of catchment is considered to be negligible.
- The loss of catchment flows in the Isaac River and Ripstone Creek would be indiscernible, and as such the potential impact on water quantity in Isaac River and Ripstone Creek due to the final landform is considered negligible.

The increased seepage from the Isaac River to the alluvium due to the Project would be insignificant as the numerical groundwater model conservatively predicted the rate of seepage from the Isaac River to the underlying alluvium would increase by less than 4 ML/year over the life of the Project (the average flow of the Isaac River when flowing is 161,863 ML/year).

Further, it is considered that there is a 'low' risk of leaks and/or spills occurring during the life of the Project given the appropriate implementation of preventative and mitigation measures (e.g. surface water management plan, hazardous substances management, bunding of all chemical storage and use areas etc.) (Appendix N).

Upstream Impacts

Groundwater modelling for the Project indicates there would negligible drawdown in the alluvium along the Isaac River and Cherwell Creek, as well as no impacts to groundwater quality (Appendix A). Therefore, impacts to surface flows and subsequently aquatic ecosystems downstream of the Project are not expected (Appendix F).

Furthermore, no adverse impacts to riparian vegetation surrounding ephemeral wetlands or riparian vegetation on the Isaac Creek, Ripstone Creek and Cherwell Creek floodplains (outside of the wetlands) are predicted as there would be negligible impacts on groundwater quality and resources; negligible drawdown to the alluvium and no changes to groundwater quality within the alluvium (Appendix F).

In summary, the Project is not predicated to have any material impacts on potential or actual GDEs due to changes in groundwater quality of groundwater resources (Appendix F).

Inadvertent Impacts on Fauna

Fauna that are unable to disperse away from areas under active clearing are susceptible to injury or mortality. Measures to manage vegetation clearance are described in Sections 5.5.11, 5.6.8 and 5.7.8. Pre-clearance surveys would be required to identify fauna utilising vegetation and microhabitat sites to reduce the potential for impacts on fauna associated with construction activities.

Due to the highly fragmented local landscape, less agile fauna may not be able to relocate to similar habitats in adjacent areas. However, there are no populations of fauna that are likely to be restricted to the clearance areas and therefore it is unlikely that the Project would result in the local extinction of species surrounding the Project.

Other causes of injury or mortality include animals becoming trapped in excavations/ trenches. Measures to manage fauna in excavations/ trenches are described in Sections 5.5.11, 5.6.8 and 5.7.8.

Inadvertent Impacts on Flora

Vegetation clearance measures would be implemented for the Project (Sections 5.5.11, 5.6.8 and 5.7.8) and would minimise the risk of inadvertent impacts on adjacent habitat or native vegetation during the construction and operational phases of the Project, (e.g. clearance of vegetation outside the approved disturbance extent).

5.4.6 Cumulative Impacts

Land use in the Isaac Region consists primarily of mining, cattle grazing and grain production. The Project area comprises of patches of remnant and regrowth vegetation and agricultural land, primarily utilised for cattle grazing.

The Project is located in a mining precinct comprising several existing and approved coal mining operations, including:

- Olive Downs Project (adjacent to the east and south-east of the Project);
- Eagle Downs Project (adjacent to the west of the Project);
- Moorvale South Project (approximately 2 km north-east of the Project);
- Peak Downs (approximately 6 km west of the Project);
- Daunia (approximately 7.5 km north of the Project);
- Poitrel (approximately 8 km north of the Project);
- Millennium (approximately 10.5 km north-west of the Project);
- Isaac Downs Project (approximately 14 km north-west of the Project);
- Isaac Plains East (approximately 25 km north-west of the Project);
- Moorvale (approximately 19 km north of the Project);
- Saraji (approximately 19.5 km south of the Project);
- Lake Vermont (approximately 21 km south-east of the Project); and
- Goonyella Riverside and Broadmeadow Mines – coordinated project (approximately 50 km north-west of the Project).

The majority of these projects are required to provide offset areas for impacts associated with their mining operations in order to reduce the final impact on MNES and/or MSES (DERM, 2010, 2011c; DSDMIP, 2019; Department of Infrastructure and Planning [DIP], 2009, 2010; Environmental Protection Agency [EPA], 2005; Stanmore IP South, 2020).

The Project would result in the removal of 719.9 ha of remnant vegetation and 6,408.6 ha of non-remnant vegetation that provides habitat for flora and fauna to varying degrees. The native RE and fauna habitat types to be cleared during the life of the Project occur more widely in surrounding landscapes and subregions (Sections 5.4.2 and 5.4.3).

The majority, i.e. 90%, of vegetation within the area that would be disturbed by the Project has been historically cleared in favour of livestock grazing and agriculture and exists in a non-remnant state (Appendix D).

The 719.9 ha of remnant vegetation that would be distributed by the Project represents approximately 0.2% of the remaining remnant vegetation in the Northern Bowen Basin and Isaac-Comet Downs subregions (Appendix D).

The Project has been designed to avoid or minimise impacts to terrestrial environmental values, however, some residual impacts are likely. These residual impacts will be offset in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (Section 5.8 and Attachment 5).

The Project is predicted to have a negligible cumulative impact on surface water and groundwater quality and quantity (Appendices A and B). As such the Project is unlikely to result in a cumulative impact to the aquatic ecosystem resilience or aquatic flora and fauna of the Isaac River system, including floodplain wetlands, given the limited potential impacts associated with the Project and the mitigation and management measures summarised in Sections 4.5.4, 5.5.11 and Appendix E.

The Project's impact on the environment is additive to that from past and present grazing, agriculture, rural/urban development, industrial and mining activities within the Northern Bowen Basin and Isaac Comet subregions. Evaluating the Project's impact on the target MNES on an incremental scale inclusive of other local and regional disturbances is often more realistic than assessing the Project impacts in isolation.

The change in potential cumulative impacts on threatened species and communities arising from the Project is considered to be minimal because of the localised nature of the Project compared to the wider distribution of the species and associated habitats and communities in the surrounding landscapes and subregions.

The Project is likely to impact the following MNES: Poplar Box TEC, Natural Grasslands TEC, Koala, Greater Glider, Squatter Pigeon and Ornamental Snake.

The cumulative impact on the MNES identified within the Project area was determined by comparing the Project's direct impact to the area of habitat present within the Northern Bowen Basin and Isaac-Comet subregions. The available habitat for each MNES was calculated across the Northern Bowen Basin and Isaac-Comet subregions using similar habitat definitions applied on the Project area (Table 5-12).

Table 5-12
Target MNES Habitat Type

MNES	Qualifying RE/BVG*	Broad Vegetation Class
Poplar Box TEC	11.3.2, 11.3.17, 11.4.7 and 11.4.12	Remnant
Natural Grassland TEC	11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12 and 11.11.17	Remnant
Ornamental Snake	11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.3.3 and 11.5.16	Remnant and regrowth
Squatter Pigeon	11.5.1, 11.5.10, 11.5.12, 11.5.16, 11.5.17, 11.5.2, 11.5.20, 11.5.2a, 11.5.3, 11.5.3b, 11.5.5c, 11.5.8c, 11.5.9, 11.5.9a, 11.5.9b, 11.5.9c, 11.7.1, 11.7.2, 11.7.3 and 11.7.4	Remnant and regrowth woodland
Koala	8a, 9e, 10a, 11a, 12a, 13c, 13d, 16a, 16c, 17a, 17b, 18b, 19d and 34d	Remnant eucalypt dominated woodland
Greater Glider	8a, 9e, 10a, 11a, 12a, 13c, 13d, 16a, 16c, 17a, 17b, 18b, 19d and 34d	Remnant eucalypt dominated woodland

* BVGs used as surrogate habitat values, when applicable, for conciseness.

Species profiles and listing advice were used to identify REs and BVGs (Broad Vegetation Groups) within both subregions that provide suitable habitat for each MNES. Where potential habitat occurred within mixed polygons, the relevant percentage from the *Regional Ecosystem Description Database Version 11.1* (Queensland Herbarium, 2019) was applied to estimate the area for each patch.

For both the Poplar Box and Natural Grassland TEC, it was conservatively assumed that all remnant vegetation containing the relevant REs was of suitable quality and condition to meet the TEC criteria. For the threatened fauna species, it was conservatively assumed that all remnant vegetation contains the necessary microhabitat for each species. For Ornamental Snake and Squatter Pigeon, it was also conservatively assumed that mapped regrowth vegetation was also suitable as both of these species are tolerant of disturbed and regrowth vegetation.

Based on the analysis of Project-specific disturbance and the available habitat/area in the region (Table 5-13), the Project is predicted to have negligible cumulative impacts on terrestrial flora and fauna (Appendix D).

Accurate and complete information on all approved and/or existing disturbance in the region is not publicly available. Therefore, Table 5-13 is limited to Project-specific disturbance and regional government mapping. Notwithstanding, any approved or existing disturbance would be required to be managed, mitigated, rehabilitated and/or offset under various relevant legislation and environmental approvals.

The below text provides further discussion of this analysis.

Threatened Ecological Communities

Poplar Box TEC

Project development would result in the removal of approximately 9.6 ha (Figure 5-4). The removal of 9.6 ha of Poplar Box TEC conservatively equates to the loss of approximately 0.013% of the mapped Poplar Box TEC across the Northern Bowen Basin and Isaac-Comet subregions (72,618 ha).

Natural Grasslands TEC

Project development would result in the removal of approximately 80.9 ha (Figure 5-4). The removal of 80.9 ha of Grassland TEC conservatively equates to the loss of approximately 0.02% of the mapped Grassland TEC across the Northern Bowen Basin and Isaac-Comet subregions (40,2689 ha).

Threatened Species

Koala and Greater Glider

Suitable Koala and Greater Glider habitat is largely confined to the remnant eucalypt woodland paralleling the Isaac River and it's larger tributaries. The location of previous and recent Koala and Greater Glider records (Figures 5-11 and 5-12, respectively) represent, to a degree, how the species are likely utilising the watercourses as movement corridors throughout the landscape.

The Project development would result in the removal of approximately 315 ha of Koala habitat categorised as remnant and regrowth eucalypt woodland with Koala food trees (i.e. eucalyptus spp.) as well as approximately 167 ha of Greater Glider habitat defined as potential breeding and foraging remnant woodland with suitable hollow bearing trees.

In a regional context, the Project disturbance equates to a very small proportion of Koala and Greater Glider habitat (conservatively approximately 0.03% and approximately 0.02%, respectively) within the Northern Bowen Basin and Isaac-Comet subregions. Based on species habitat area available across the subregions, the proportion of habitat loss as a result of Project development equates to a relatively low cumulative impact.

As the Project is not expected to directly impact the remnant eucalypt woodland fringing the Isaac River thereby retaining Koala and Greater Glider habitat and movement corridors throughout the local landscape, the Project's cumulative direct impact on the local Koala and Greater Glider population is expected to be low.

Table 5-13
Cumulative Impacts to Relevant MNES in the Locality

Relevant MNES	Potential Habitat Available within the Northern Bowen Basin and Isaac-Comet Subregions[1]	Winchester South Project Habitat Clearance		Winchester South Project Habitat Clearance Relative to Potential Habitat Available in the Subregions	
Threatened Ecological Communities					
Natural Grasslands TEC	402,689 ha	80.9 ha		0.02%	
Poplar Box TEC	72,618 ha	9.6 ha		0.013%	
Threatened Species					
Ornamental Snake *(Denisonia maculata)*	111,103 ha[2]	1,834 ha[3]	204.5 ha[2]	1.65%[3]	0.18%[2]
Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)	431,721 ha	261.2 ha		0.06%	
Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)	1,052,403 ha	315 ha		0.03%	
Greater Glider (*Petauroides volans*)	1,052,403 ha	167 ha		0.02%	

1 After Appendix D.

2 Note regional mapping for the Ornamental Snake habitat has been based on REs associated with the species (DAWE, 2020b), and does not include consideration of habitat features, such as gilgai soils, which can be located within areas of non-remnant vegetation (approximately 85% of Ornamental Snake habitat within the Project area is located on gilgai soils within non-remnant vegetation). As such the Project habitat clearance presented provides a direct comparison to Ornamental Snake habitat in the subregions (i.e. based on remnant vegetation only).

3 Full Project clearance of Ornamental Snake habitat (i.e. including gilgai soils within non-remnant vegetation) for a conservative comparison.

Ornamental Snake

The Project development would result in the removal of approximately 1,834 ha of Ornamental Snake habitat located predominately within an unfragmented patch of regrowth brigalow (RE 11.4.8/11.4.9) situated in the southern half of the disturbance footprint (Figure 5-9). A number of Ornamental Snakes were recorded within the gilgai during the wet season and dry season surveys in addition to several previously recorded observations.

In the context of incremental habitat loss, the Project impact is conservatively approximately 1.65% of the Ornamental Snake habitat available in the Northern Bowen Basin and Isaac-Comet subregions (111,103 ha). As the potential habitat in the region presented in Table 5-13 does not include gilgai soils within non-remnant vegetation, the 1.65% is highly conservative and a more direct comparison is likely to be closer to 0.18% (Table 5-13).

Squatter Pigeon

Project development would result in the removal of approximately 261.2 ha of suitable breeding/foraging and foraging habitat Squatter Pigeon (southern subspecies) (Figure 5-10). The habitat areas to be disturbed by the Project are fragmented. Previous Squatter Pigeon observations are associated with farm dams and cattle troughs situated near the eastern boundary of the Project.

The removal of 261.2 ha of fragmented Squatter Pigeon habitat conservatively equates to the loss of approximately 0.06% of the Squatter Pigeon habitat across the Northern Bowen Basin and Isaac-Comet subregions.

5.4.7 Risk Assessment

The risk assessment workshop undertaken for the EIS identified a range of potential environmental risks associated with the Project (Appendix N). Key potential environmental risks identified relevant to water resources and water-dependent assets are summarised below:

- potential impacts to downstream surface water users due to the release of mine-affected water from the Project (uncontrolled and controlled);
- overtopping of water storage dams;
- impacts associated with an unexpected flooding events;
- release of hydrocarbons or other contaminants from the MIA;
- release of mine-affected water from the Project leads to potential impacts on downstream groundwater users; and
- potential impacts to the availability of water resources for private bores and the environment due to the Project.

The existing and proposed preventative and mitigating measures for the Project include the development of a range of management plans for implementation during the construction, operation and decommissioning phases of the Project. This includes development of Trigger Action Response Plans and construction and maintenance of temporary levees (design and inspections by a suitable quality person), consequence category assessment and regular inspections of temporary levees.

With the existing and proposed preventative and mitigating measures for the Project, the only two risks were assigned a residual risk ranking of 'Moderate' and were classified as 'As Low As Reasonably Practicable' (ALARP), and three risk were assigned a residual risk ranking of 'Low'.

The Groundwater Assessment, Surface Water and Flooding Assessment, Aquatic Ecology and Stygofauna Assessment and Integrated Assessment of Impacts on Groundwater Dependent Ecosystems have assessed potential environmental risks to water resources and water-related assets in accordance with the IESC Information Guidelines (IESC, 2018).

The risks included the potential for the Project to impact on the flooding characteristics of the Isaac River and Ripstone Creek and the potential for environmental risks associated with the residual voids. A summary of potential impacts on water resources and water-related assets is provided in Section 5.5.8, with the detailed assessments provided in Appendices A, B, E and F.

In summary:

- the Project would not directly intercept groundwater from the Quaternary alluvium, and therefore no direct take from Groundwater Unit 1 (aquifers of the Quaternary alluvium) would occur from the mining operations;
- all direct groundwater take predicted by the model (i.e. up to 352 ML/year) would be from Groundwater Unit 2 (sub-artesian aquifers) under the Water Plan;
- there would be negligible direct or indirect take from Groundwater Unit 1, and 104 ML/year of direct take from Groundwater Unit 2 under the Water Plan in the long-term, post-mining;
- there would be negligible drawdown within the Isaac River alluvium due to the Project;
- no privately-owned bores in the vicinity of the Project would experience more than 1 m drawdown;
- it is unlikely that sediment dam overflows would have a measurable impact on receiving water quality or environmental values;
- controlled releases would have a negligible impact on Isaac River water quality;
- the gradual increase in salinity of the residual void water body would not pose a risk to the surrounding groundwater regime or receiving environment as the residual voids would remain as groundwater sinks in perpetuity;
- it is considered unlikely that the Project would result in a significant impact to any stygofauna communities (if they were likely to occur); and
- the Project is not predicted to have any material impacts on potential or actual GDEs due to changes in groundwater quality or groundwater resources.

5.5 MINE SITE AND ACCESS ROAD ACTION (EPBC 2019/8460)

5.5.1 Location of the Action

The Mine Site and Access Road Action (EPBC 2019/8460) is located approximately 30 km south-east of Moranbah (Figure 5-1). The Mine Site and Access Road Action (EPBC 2019/8460) is bordered by the Isaac River to the north-east, Olive Downs Project to the east and Eagle Downs (Underground) Mine to the south-west.

The Mine Site and Access Road Action is wholly contained within MLA 700049, MLA 700050 and MLA 700051, with exception of part of the access road component of the Action which is co-located in MLA 700065 with the ETL Action and Water Pipeline Action to reduce and consolidate potential impacts into a single area.

Access to the Mine Site and Access Road Action (EPBC 2019/8460) would be from the Eagle Downs Mine Road which branches from the Peak Downs Mine Road approximately 10.5 km south of the intersection of the Peak Downs Mine Road and the Peak Downs Highway.

5.5.2 Description of the Action

The Mine Site and Access Road Action (EPBC 2019/8460) forms part of the Project. The greater action includes the Mine Site and Access Road Action (EPBC 2019/8460), the Water Pipeline Action (EPBC 2019/8459) and the ETL Action (EPBC 2019/8458).

The Mine Site and Access Road Action is wholly located within MLA 700049, MLA 700050 and MLA 700051, with exception of the access road component of the Action which is partly co-located within MLA 700065, with the ETL and Water Pipeline Actions.

Construction of the Mine Site and Access Road Action (EPBC 2019/8460) would commence in Year 1, with first coal expected to be extracted in Year 2[3], during construction activities. With open cut mining expected to occur for approximately 28 years, the Mine Site and Access Road Action (EPBC 2019/8460) has a total life of 30 years (three years for construction activities and one year for final landform shaping).

Project Stage – Construction

Pre-construction and construction of the Mine Site and Access Road Action (EPBC 2019/8460) would occur progressively prior to commencement of operations.

The major construction period of the Mine Site and Access Road Action (EPBC 2019/8460) is forecast to take place in the first 36 months of the Project with works commencing as soon as practicable after all relevant planning approvals, environmental authority and mining leases (where required) are granted.

Construction activities would be based on the development of the following key Project infrastructure:

- MIA (including the CHPP) and mine access road (including an overpass of the Norwich Park Branch Railway);
- rail spur and loop;
- water management infrastructure (including flood protection levees);
- water and electricity supply infrastructure;
- progressive development and augmentation of dams, sumps, pipelines, up-catchment diversions, storages and other water management equipment and structures;
- progressive development of haul roads, light vehicle access roads and services;
- construction and installation of ancillary infrastructure (e.g. electricity distribution infrastructure, explosives storage facilities, consumable storage areas, potable water supply, sewage treatment facilities, site communications, remote crib huts and security);
- replacement and/or upgrades to open cut mining and coal handling and processing machinery; and
- installation or replacement of environmental monitoring equipment.

Further detail regarding construction of the Mine Site and Access Road Action (EPBC 2019/8460) is provided in Section 2.4.

[3] Coal extraction may occur earlier, in Year 1.

Project Stage – Operation

Operation of the Mine Site and Access Road Action (EPBC 2019/8460) would include the construction period described previously and the activities described below:

- **Mining Operation Stage 1** – Initial establishment of operations to 15 Mtpa of ROM coal extracted at the Project from mining within the Railway Pit, Main Pit North and Main Pit South. The out-of-pit waste rock emplacements to the west of the Railway Pit and east of Main Pit North would be constructed and partially rehabilitated, with emplacing in the Main Pit South east out-of-pit waste rock emplacement commencing. In-pit emplacement of the Railway Pit, Main Pit North and Main Pit South would also commence.
- **Mining Operation Stage 2** – ROM coal extraction of approximately 15 Mtpa (and up to 17 Mtpa) from the Project. Mining within the Railway Pit is completed. The out-of-pit waste rock emplacement to the west of the Railway Pit and the Railway Pit itself would be rehabilitated, with in-pit emplacement of the Main Pit South and Main Pit North continuing with the progression of the open cut. A portion of the Railway Pit would be retained for Project water requirements.
- **Mining Operation Stage 3** – Steady ROM coal extraction from the Project. The east out-of-pit waste rock emplacement for Main Pit South would be established and partially rehabilitated. Rehabilitation of the Main Pit North and Main Pit South in-pit emplacement would progressively occur.
- **Mining Operation Stage 4** – Establishment of operations in North-West Pit, West Pit and South Pit, with ROM coal extraction steadily declining as mining in the Main Pit North and Main Pit South is completed. Emplacement within the Railway Pit, South Pit, North-West Pit and West Pit would progressively occur. Residual voids would be established in the North-West Pit, West Pit, Main Pit South and South Pit.

The above mining operation stages are based on the indicative mine schedule provided in Table 5-14.

Further detail regarding operation of the Mine Site and Access Road Action (EPBC 2019/8460) is provided in Section 2.5.

Project Decommissioning and Rehabilitation

In accordance with *Mined Land Rehabilitation Policy* (DEHP, DNRM and Queensland Treasury, 2017), the Mine Site and Access Road Action (EPBC 2019/8460) would be progressively rehabilitated to PMLUs or NUMAs as areas become available to minimise the risks of environmental impacts and reduce cumulative areas of disturbed land.

In accordance with the *Mined Land Rehabilitation Policy* (DEHP, DNRM and Queensland Treasury, 2017), portions of the Project would be progressively rehabilitated according to the Project schedule of works (Section 2.1.8) to achieve the objectives of the proposed low-intensity grazing PMLU (Section 6.6). Rehabilitation progress would be monitored against milestones and completion criteria to demonstrate successful rehabilitation of the Project (Section 6.6).

As part of progressive rehabilitation of the Mine Site and Access Road Action (EPBC 2019/8460), and prior to closure, the potential for new contamination would be assessed, along with any risks associated with existing and potential contamination. In accordance with the *EIS Information Guideline – Contaminated Land* (DES, 2020i), potentially contaminated land would undergo preliminary (Stage 1) and detailed (Stage 2) site investigations by a suitably qualified person to identify any existing land contamination.

As described in Table 5-14, mining operations would ramp down over the last three years. This ramp-down would provide opportunity to progressively decommission infrastructure components as they become redundant, while maintaining other infrastructure components as required.

All infrastructure associated with the Mine Site and Access Road Action (EPBC 2019/8460) would be assessed on an individual basis and either decommissioned and removed, or retained for future use as part of the PMLU.

Where infrastructure is decommissioned and removed, the land would be shaped, topsoiled, ripped and revegetated. Disturbed areas would be rehabilitated with an appropriate seed mix to enable revegetation.

Table 5-14
Indicative Mining Schedule

Project Year	Project ROM Coal Production (Mt)				Open Cut Waste Rock (Mbcm)	CHPP Coal Rejects (Mtpa)	Product Coal (Mtpa)
	Leichhardt Seams	Upper Vermont Seam	Vermont Middle Lower Seam	Total ROM Coal			
1	-	-	-	-	-	-	-
2	0.04	0.3	0.7	1.0	9.5	0.4	0.6
3	3.1	0.6	1.4	5.0	34.7	1.8	3.3
4	3.1	4.7	5.7	13.5	67.7	5.7	8.3
5	3.1	3.9	8.0	15.0	69.3	6.5	9.1
6	3.1	3.7	10.0	16.7	68.5	7.4	9.9
7	3.8	3.2	8.3	15.3	69.7	6.6	9.2
8	5.6	3.2	8.2	17.0	74.6	7.7	10.0
9	6.1	2.8	6.4	15.4	81.5	6.1	9.8
10	5.0	2.9	8.1	16.0	81.2	6.8	9.7
11	5.9	2.9	7.7	16.4	80.8	6.7	10.3
12	6.8	2.8	6.2	15.8	81.3	6.2	10.1
13	6.1	2.4	6.6	15.1	81.8	6.5	9.2
14	6.9	2.8	5.7	15.4	81.9	6.3	9.6
15	7.5	3.0	6.6	17.0	93.2	7.1	10.5
16	7.8	2.6	6.5	17.0	93.4	7.2	10.4
17	6.3	2.2	6.7	15.2	94.4	6.5	9.2
18	6.5	2.2	5.9	14.6	95.0	6.1	9.0
19	6.6	2.2	5.3	14.1	95.0	6.0	8.5
20	5.5	2.5	5.9	13.9	82.4	5.8	8.6
21	5.4	3.1	7.0	15.5	81.2	6.7	9.4
22	5.8	2.4	5.5	13.6	81.7	5.8	8.3
23	4.7	3.5	7.0	15.3	79.2	6.4	9.5
24	4.3	3.5	4.4	12.2	68.7	5.1	7.5
25	3.8	2.7	2.4	8.9	72.2	3.6	5.6
26	3.4	2.8	1.6	7.8	69.8	3.3	4.8
27	3.0	1.7	0.2	4.9	56.1	2.1	2.9
28	2.5	0.6	0.1	3.2	39.8	0.9	2.4
29	1.9	0.6	0.0	2.5	27.4	0.8	1.8
30	-	-	-	-	-	-	-
Total	**134**	**72**	**148**	**353**	**2,012**	**148**	**217**

Note: The combined total of product coal and coal reject material is greater than total ROM coal due to changes in moisture content (data are presented on an "as received" moisture basis).
Totals may not add exactly due to rounding. ROM extraction rate is based on indicative mining schedule.

Consistent with the *Guideline – Progressive rehabilitation and closure plans (PRC plans)* (DES, 2019b), where infrastructure is to be retained:

- it would be demonstrated to be safe, stable and not cause environmental harm; and
- an agreement would be secured with the landholder to which ownership of the infrastructure is being transferred.

A PRC Plan would be developed for the Mine Site and Access Road Action (EPBC 2019/8460) and would include proposed PMLUs and NUMAs, planning information relating to the progression of construction and operations, and rehabilitation goals, objectives, indicators and completion criteria.

A rehabilitation monitoring program would be developed as part of the PRC Plan for the Mine Site and Access Road Action (EPBC 2019/8460). The monitoring program would be designed to reflect the rehabilitation milestones and completion criteria to identify the requirement for intervention and/or remedial activities.

The rehabilitation monitoring program would require ongoing surveys targeted at the success of rehabilitation against the goals and objectives of the PRC Plan. Rehabilitation surveys would initially occur half-yearly during the first year, and then annually until after the following five years at which point the rehabilitation survey frequency would be determined based on monitoring results. Detailed rehabilitation monitoring reports would be prepared and would include a summary of previous monitoring results, results of the current years' monitoring and any recommended remedial works, if required.

5.5.3 Current Status of the Action

On 13 May 2019 Whitehaven WS referred the Mine Site and Access Road Action (EPBC 2019/8460) to the Commonwealth Minster. Subsequently, a delegate of the Commonwealth Minister determined the Mine Site and Access Road Action (EPBC 2019/8460) to be a 'controlled action' on 18 July 2019.

To date, no works have commenced associated with the Mine Site and Access Road Action (EPBC 2019/8460).

5.5.4 Alternatives Considered

Mining Method and Sequencing

Coal reserves are typically mined in one of two ways:

- open cut methods (whereby mining is conducted from the surface downwards to progressively expose the coal); or
- underground methods (whereby the coal seams are accessed by a surface opening to underground mining areas where generally only coal is extracted).

Whitehaven WS would seek to maximise resource recovery within geological, environmental and tenement constraints. The multiple, relatively shallow target coal seams across the Project area particularly lend themselves to recovery through open cut methods.

As such, Whitehaven WS considered underground methods to be unfeasible to access the coal reserves in the Rangal and Fort Cooper Coal Measures and therefore the Mine Site and Access Road Action (EPBC 2019/8460) would use open cut mining methods.

The currently proposed mine sequence has been refined to minimise potential environmental, social and economic impacts as follows:

- Completely mining the Railway Pit early in the mine life, so that it can be used to store water. This reduces the requirement to develop additional water storages for the Proposed Action in the long-term, minimising surface disturbance requirements.
- Progressively backfilling Railway Pit and Main Pit North, to feasibly backfill the voids to ground level to minimise the residual void area.
- Reducing potential short-term impacts to Winchester Quarry, by sequencing mining in consideration of the extent of already depleted reserves of hard rock.

Open Cut Extent and Waster Rock Emplacement Extent

The open cut extent was initially developed during the Project initial concept stage based on the available resource definition information to determine the optimum extent of the open cut within Whitehaven WS' existing tenements.

The open cut extent was then refined to:

- avoid the Winchester Quarry; and
- avoid existing surface infrastructure (e.g. Norwich Park Branch Railway).

This refined open cut extent, which also avoided extraction within the Isaac River alluvium, was included in the Project IAS (Mine Layout Option 1) (Figure 5-23).

Based on the outcomes of the environmental studies prepared for the EIS, the open cut extent was further refined, minimising potential short-term and long-term impacts to MNES (e.g. Ornamental Snake habitat and the Brigalow TEC) and potential impacts to agricultural land (Mine Layout Option 2).

The final open cut extent for the Project (Figure 5-2), has been designed to maximise economic extraction of the resource while minimising potential environmental, social and economic impacts.

In addition, the extent of the out-of-pit waste rock emplacements have been refined to minimise impacts. For example:

- the Project does not disturb any Brigalow TEC due to the north-eastern out-of-pit waste rock emplacement being designed to avoid the only patch that was initially within the footprint;
- impacts on habitat for the Ornamental Snake have been reduced by minimising the extent of out-of-pit waste rock emplacement; and
- the overall disturbance footprint has been reduced by optimising backfilling of the open cut.

Location of Mine Infrastructure Area

The location of the MIA within the Mine Site and Access Road Action (EPBC 2019/8460) was chosen through the consideration of a number of design constraints including:

- Resource sterilisation – the MIA should be located to not sterilise coal resources that could be economically mined.
- Safety – the MIA should be located at least 500 m from the crest of the open cut extent to provide an appropriate distance from blasting activities.
- Flood immunity – the MIA should be located outside the 1:100 AEP flood extent, wherever practicable.
- Access to rail infrastructure – the MIA should be located near to Norwich Park Branch Railway to minimise rail spur length and associated surface development area.
- Accessibility – the MIA should be located proximal to existing access roads to allow for efficient and practical access.
- Haul distance – the MIA should be located proximal to the open cut extent to reduce the haul distance for ROM coal, and thereby reduce potential noise and air quality impacts, and greenhouse gas emissions.
- Minimise surface development – the MIA should be designed to minimise its surface development area.
- Minimise vegetation clearance – the MIA should be located to minimise the clearance of vegetation as far as practicable.
- Minimise bulk earthworks – the MIA should be located on relatively flat ground to reduce the earthworks required to level the ground to construct infrastructure.

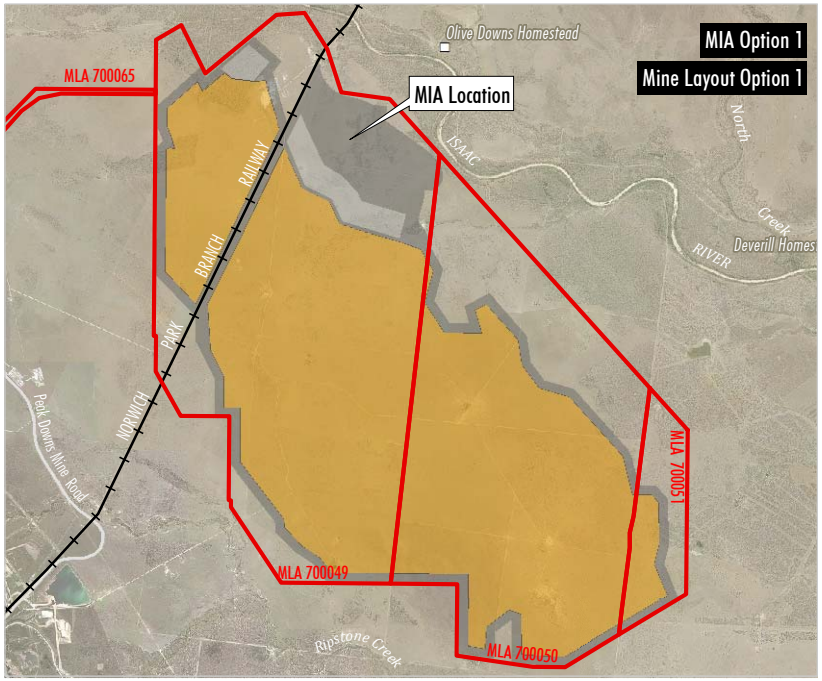
Whitehaven WS considered the two options with respect to the location of the MIA which met the design constraints listed above:

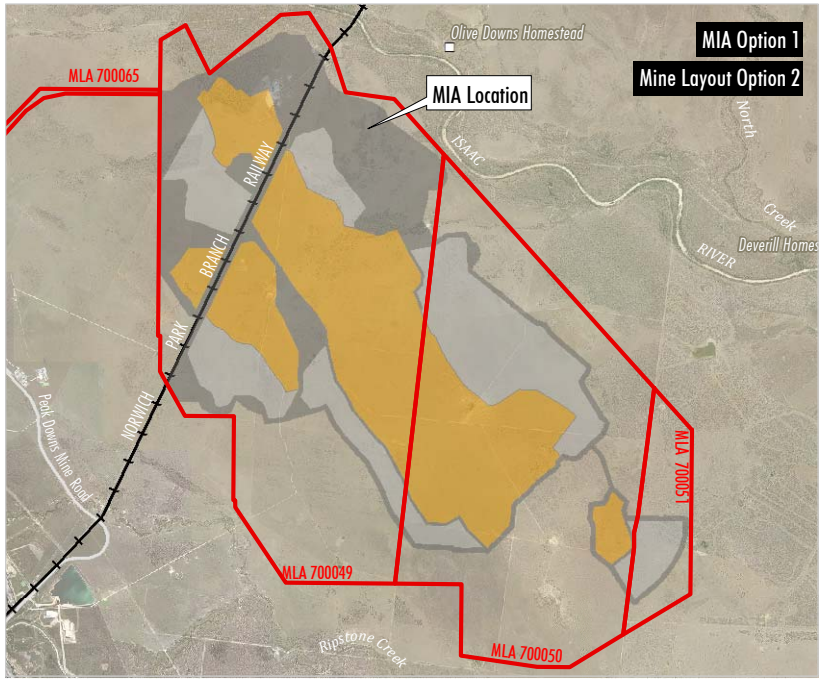
- Option 1 – northern part of the Project.
- Option 2 – south-west corner of the Project.

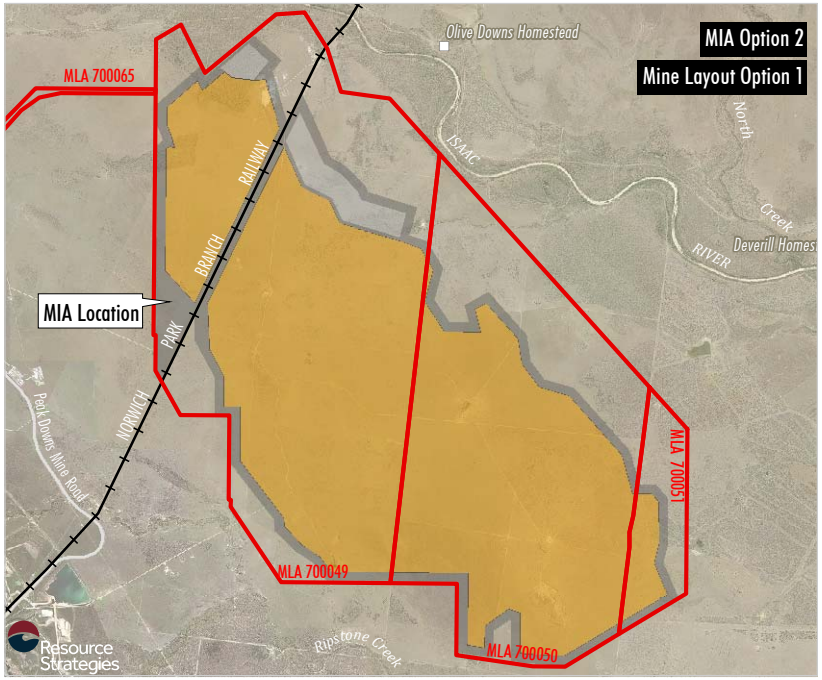
These options are shown on Figure 5-23.

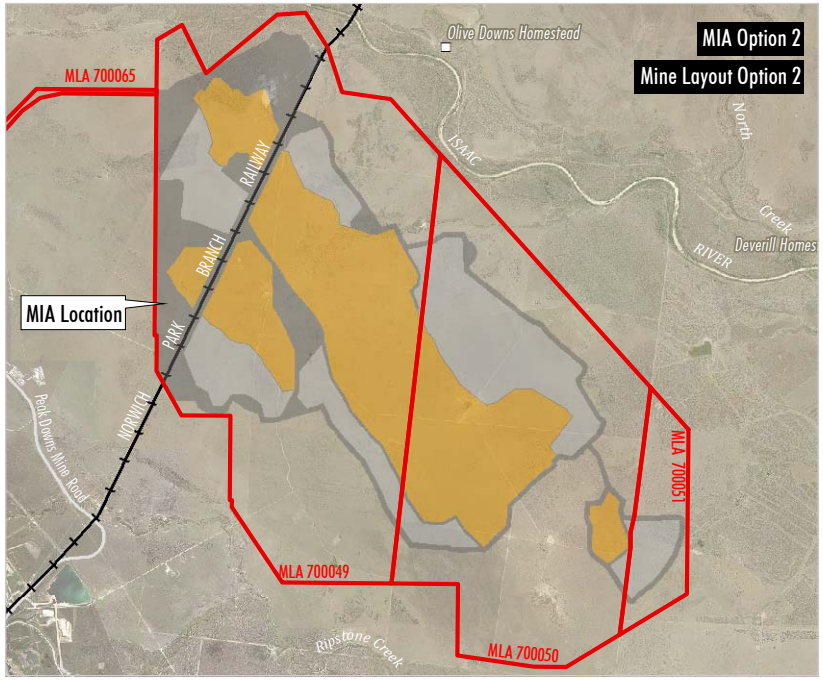
Considering the above, Whitehaven WS selected a northern option (Option 1) for the proposed MIA location based on the following:

- The Option 1 access road entrance on Eagle Downs Mine Access Road was preferred from a road safety perspective, i.e. would avoid a new intersection on Peak Downs Mine Road in the vicinity of the rail level crossing (Figure 5-24).
- The Option 2 access road and water supply pipeline may need to be relocated as they would connect to parts of the Peak Downs Mine Access Road and Eungella Pipeline Southern Extension which are approved to be realigned by BMA for the Peak Downs Mine (Figure 5-24).









LEGEND

- Mining Lease Application Boundary
- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Emplacement
- Railway

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Whitehaven (2019).

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Options Considered - MIA and Mine Layout

Figure 5-23

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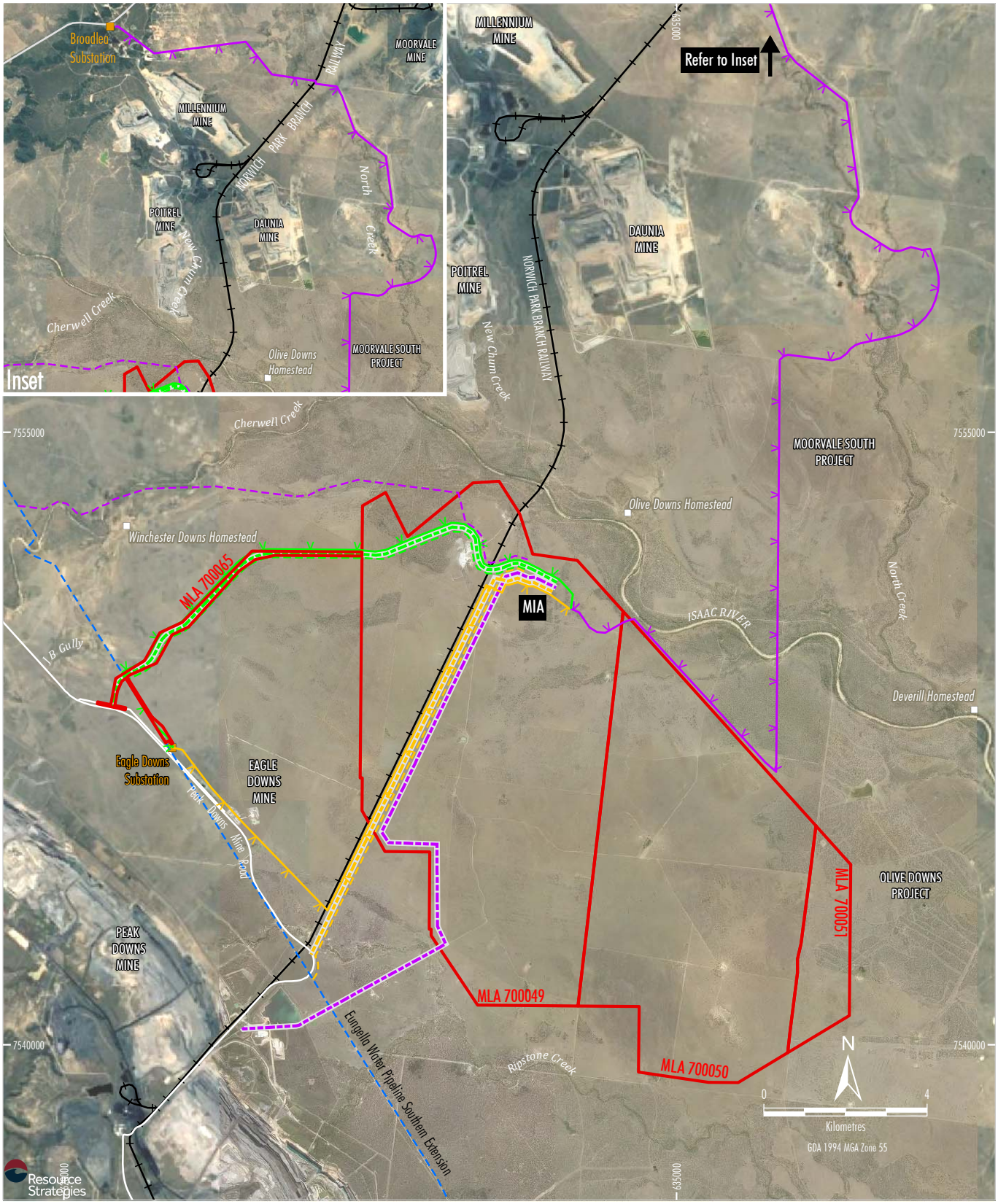

LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Infrastructure Corridor Options

Option 1	Option 2	Option 3
ETL	ETL	ETL
Mine Access Road	Mine Access Road	Mine Access Road
Raw Water Supply Pipeline	Raw Water Supply Pipeline	Raw Water Supply Pipeline

Source: The State of Queensland (2018 - 2019); Whitehaven (2020). Orthophoto: Google (2019); Whitehaven (2019).

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Options Considered - Infrastructure Corridors

Figure 5-24

- The Option 1 MIA would be located closer to the Winchester Quarry which would be utilised during construction for construction material (Figure 5-23).
- When combined with the access road Option 1, results in a significant reduction in the distance between the Project and the township of Moranbah. This is a relevant factor to employee safety and amenity (Figure 5-23).

Alignment of Access Road

Whitehaven WS considered the following options with respect to the alignment of the mine access road for the Project (Figure 5-24):

- Option 1 – Development of an access road via Eagle Downs Mine Access Road to the west.
- Option 2 – Development of an access road adjacent to the Norwich Park Branch Railway.
- Option 3 – Extension of the existing Winchester Access Road.

TTPP (2021) assessed two main access routes for the Project, with vehicular access for the Project via the Mine Access Road from Eagle Downs Mine Road or access for the Project via Winchester Access Road.

The preferred alignment of the access road component of the Mine Site and Access Road Action (EPBC 2019/8460) was determined based on the following considerations:

- minimise potential impacts to surrounding tenement holders, through the location of the corridors along tenement boundaries and geological features where practicable;
- minimises potential impacts by co-locating the Project ETL (Section 5.6) and the Project water supply pipeline (Section 5.7) within the same corridor;
- significantly reduces the overall Action Area from that referred to the Commonwealth Minister in 2019;
- minimise the length of the infrastructure corridor;
- avoids dwellings and existing/planned infrastructure;
- reduces traffic risk where possible (avoidance of a new intersection on Peak Downs Mine Road in the vicinity of the rail level crossing and reduces the travel distance between the Mine Site and Access Road Act [EPBC 2019/8460] and the township of Moranbah);
- minimise potential interaction with mining operations; and
- minimises impacts to existing stock routes.

Final Landform Design

A number of options were considered by Whitehaven WS with respect to the number and location of residual voids retained in the Project final landform. Options that were considered regarding rehabilitation of the Project include:

- Option 1 – partial backfill of Main Pit South, North-West Pit, West Pit and South Pit, with no residual voids in Railway Pit and Main Pit North. Four residual voids remain.
- Option 2 – retaining six residual voids in the final landform (i.e. no significant backfilling).
- Option 3 – complete backfill of all open pits so no residual voids remain in the final landform.

In all scenarios, the final landform for the Project would be safe, geotechnically stable and non-polluting.

Whitehaven WS estimates that the economic cost to backfill all six open pits (i.e. Option 3) would be in the order of $1.8 billion. In practice, the cost would likely be higher given the additional costs associated with sourcing and applying topsoil, seed and fertilisers to revegetate the landforms. This significant cost would render the Project commercially unfeasible (Sections 5.9 and 8).

Option 2 (retaining six residual voids) is the most cost effective. However, Whitehaven WS is committed to reducing the number and size of residual voids and therefore discounted this option. In addition, the Railway Pit was given priority for complete backfill, as is the closest pit to the Isaac River floodplain.

In consideration of this, the Project's mine sequence has been optimised to identify a feasible mine plan that minimises the number and extent of residual voids (Option 1), and avoids the creation of residual voids within the Isaac River floodplain.

The optimal mine plan adopted for the Project would result in no residual voids within Railway Pit and Main Pit North and partial backfilling of Main Pit South, North-West Pit, West Pit and South Pit. This option includes significant operational cost to the Project that would not otherwise be incurred for Option 2.

The four residual voids included in Option 1 would result in a reduction in the land available for grazing in the long-term. Deloitte Access Economics (2021) concluded that the foregone benefits associated with reduced income opportunities from grazing post-mining would be immaterial (Appendix K).

The four residual voids would also be safe, stable and non-polluting.

5.5.5 Relationship to Other Actions

The Mine Site and Access Road Action (EPBC 2019/8460) would form part of the greater action referred to as the Project. The Project comprises the following additional actions:

- ETL Action (EPBC 2019/8458); and
- Water Pipeline Action (EPBC 2019/8459).

Each of the above actions were determined to be controlled actions by a delegate of the Commonwealth Minister on 17 and 18 July 2019, respectively.

The design of the access road component of the Mine Site and Access Road Action (EPBC 2019/8460), for the most part, has been intended to enable co-location of the other Proposed Actions within the same consolidated corridor. This assists with optimising the Project and reducing potential social and environmental impacts facilitated by the Project.

Where located within MLA 700049 and MLA 700050, disturbance associated with the ETL Action (EPBC 2019/8458) and the Water Pipeline Action (EPBC 2019/8459) would be considered by the Mine Site and Access Road Action (EPBC 2019/8460). This is because both ETL and Water Pipeline Actions connect to the Project MIA located within the area associated with the Mine Site and Access Road Action (EPBC 2019/8460) (Figure 5-3).

Construction of the ETL Action (EPBC 2019/8458) and Water Pipeline Action (EPBC 2019/8459) are intended to occur concurrently with construction of the Mine Site and Access Road Action (EPBC 2019/8460) should the relevant approvals be granted. However, if timing permits, any one of these actions may commence in advance of the other.

5.5.6 Impacts on listed Threatened Species and Ecological Communities

As a consequence of the Mine Site and Access Road Action (EPBC 2019/8460), it is expected that there will be both direct (i.e. clearance of vegetation and fauna habitat) and indirect (e.g. noise and dust) impacts on listed threatened species and ecological communities.

As described in Section 5.4.6, a cumulative assessment of significance has been conducted for the Proposed Actions. As a result of this assessment four threatened species and two threatened ecological communities are required to be offset due to the Proposed Actions:

- Ornamental Snake;
- Squatter Pigeon (southern subspecies);
- Koala (combined populations of Queensland, NSW and the ACT);
- Greater Glider;
- Poplar Box TEC; and
- Natural Grasslands TEC.

In accordance with the Terms of Reference, an individual assessment of impacts on listed threatened species and ecological communities has been conducted for the Mine Site and Access Road Action (EPBC 2019/8460).

Each of the above listed threatened species and ecological communities have been determined to require offsetting due to impacts from the Project.

A summary of the proposed clearing of MNES habitat as a result of the Mine Site and Access Road Action (EPBC 2019/8460) is provided in Table 5-15.

5.5.7 Assessment Methodology for Water Resources and Water Quality

A Groundwater Assessment and Surface Water and Flooding Assessment have been prepared by SLR (2021) and WRM (2021), respectively, and are presented in Appendices A and B.

The Groundwater Assessment and Surface Water and Flooding Assessment have been peer reviewed by HydroAlgorithmics Pty Ltd (Dr Noel Merrick) and Hydro Engineering & Consulting Pty Ltd (Tony Marzsalek), respectively, with their review reports presented in Attachment 3.

The Groundwater Assessment and Surface Water and Flooding Assessment have been guided by the requirements of the Terms of Reference for the Project. The assessments have also been informed by the requirements of the following guidelines:

- *Australian Groundwater Modelling Guidelines* (Barnett *et al*., 2012).
- *Murray-Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline* (Middlemis *et al.*, 2001).
- IESC Information Guidelines (IESC, 2018) and associated explanatory notes, including:
  - *Uncertainty analysis—Guidance for groundwater modelling within a risk management framework* (Middlemis and Peeters, 2018).
  - *Assessing groundwater-dependent ecosystems* (Doody *et al.,* 2019).
- *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments— impacts on water resources* (Significant Impact Guidelines for Water Resources) (DotE, 2013c).
- *Guideline – Requirements for site-specific and amendment applications – underground water rights* (DES, 2016c).
- *Underground water impact reports and final reports* (DES, 2017e).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000).
- *Guideline – Model mining conditions* (DES, 2017a).
- *Environmental Protection (Water) Policy 2009 Fitzroy River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Fitzroy River Sub-basin* (DEHP, 2011).
- *Application requirements for activities with impacts to water* (DES, 2017b).
- *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a).
- *Guideline: Works that interfere with water in a watercourse for resource activity – watercourse diversions authorised under the Water Act 2000* (DNRME, 2019).

The Groundwater Assessment and Surface Water and Flooding Assessment have also considered the following legislation in relation to water resources:

- the EP Act;
- the EPBC Act;
- the Water Act and associated *Water Regulation 2016* and Water Plan;
- the Water and Wetland EPP; and
- the *Water Supply (Safety and Reliability) Act 2008*.

Calibrated Numerical Groundwater Flow Model

Whitehaven WS has data sharing agreements with the owners of the Olive Downs Project and Moorvale South Project, which allows for the sharing of data, models and documentation.

The existing 3D numerical groundwater flow model that was developed for the Olive Downs Project and Moorvale South Project, was adopted for the Project and updated with site-specific data (Appendix A).

The existing 3D numerical groundwater flow model was developed using MODFLOW-USG (Appendix A).

Table 5-15
MNES Habitat Clearance Summary – Mine Site and Access Road Action (EPBC 2019/8460)

Regional Ecosystem	MNES Habitat Clearance (ha)						
	Poplar Box TEC	Natural Grasslands TEC	Ornamental Snake	Squatter Pigeon (southern subspecies) #		Koala (combined populations of Queensland, NSW and the ACT)	Greater Glider
				Breeding	Foraging		
Remnant							
RE 11.3.1 (*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains)	0	0	64.5	0	0	0	0
RE 11.3.2 (*Eucalyptus populnea* woodland on alluvial plains)	9.6	0	0	0	0	9.6	9.6
RE 11.3.3c (*Eucalyptus coolabah* woodland to open woodland (to scattered trees) with a sedge or grass understorey)	0	0	6.9	0	0	6.9	6.9
RE 11.3.4 (*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains)	0	0	0	0	0	39.7	39.7
RE 11.4.4 (*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains)	0	45.6	0	0	0	0	0
RE 11.4.8 (*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla or Acacia argyrodendron* on Cainozoic clay plains)	0	0	2.4	0	0	0	0
RE 11.4.9 (*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains)	0	0	3.7	0	0	0	0
RE 11.5.3 (*Eucalyptus populnea +/- Eucalyptus melanophloia +/- Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces)	0	0	0	103.2	7.7	110.9	110.9
RE 11.9.2 (*Eucalyptus melanophloia +/- Eucalyptus orgadophila* woodland on fine-grained sedimentary rocks)	0	0	0	0	111.5	111.5	0
RE 11.9.3 (*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks)	0	28.8	0	0	0	0	0
Regrowth							
Regrowth	0	0	1,456.3	37.3	1.5	0	0
Non-Remnant							
Pastureland with Gilgai	0	0	288.1	0	0	0	0
Total	**9.6**	**74.4**	**1,821.9**	**140.5**	**120.7**	**278.6**	**167.1**

Note: Totals may not add exactly due to rounding.

The portion of the Mine Site Access Road Action (EPBC 2019/8460) which is located within MLA 700065 is assessed by the ETL Action (EPBC 2019/8458) (Section 5.6).

A conceptual hydrogeological model of the groundwater regime (Figure 5-25) was developed by SLR (2021) based on the available groundwater data, and the results of the groundwater investigation program and TEM survey (Groundwater Imaging, 2019).

The groundwater model is centred over the Project and is elongated in the north-west to south-east direction to follow geological strike. The groundwater model is approximately 65 km by 70 km at its widest extents (Figure 5-26). The model domain was selected based on the following considerations:

- The western and eastern boundaries are represented by the outcrop of the Back Creek Group, which is considered the regional low permeability basement for the purpose of this modelling and is expected to be outside the range of predicted Project-related drawdown.
- The northern boundary contains the primary aquifers being mined by the Project and is at least 10 km away from the proposed open cut pits and is expected to be outside the range of predicted Project-related drawdown.

The southern boundary is at least 35 km from the Project and is expected to be far outside the range of predicted Project-related drawdown.

The groundwater modelling results also validated the extent of the groundwater model was appropriate to predict the potential impacts of the Project.

Geological fault features are represented by mesh refinement in the model to allow for sensitivity analysis. Over the 14 model layers, the total active cell count for the model is 787,789 (Appendix A), with over 1,000,000 total cells (i.e. including pinch-out areas).

The model was calibrated and verified to existing groundwater levels, using reliable measurements from representative bores within the groundwater model domain. Both steady-state and transient calibration models have been developed:

- Steady-state model of average pre-2006 conditions.
- Transient model calibration based on temporal pre-mining data at quarterly time intervals from January 2006 to December 2019.

The objective of the calibration was to replicate the observed groundwater levels in accordance with the modelling guidelines developed by Barnett *et al.* (2012). The methodology to meet the objective included using available data and information obtained from the baseline datasets as part of the groundwater monitoring and investigation programs, as well as the sharing of baseline datasets with surrounding developments.

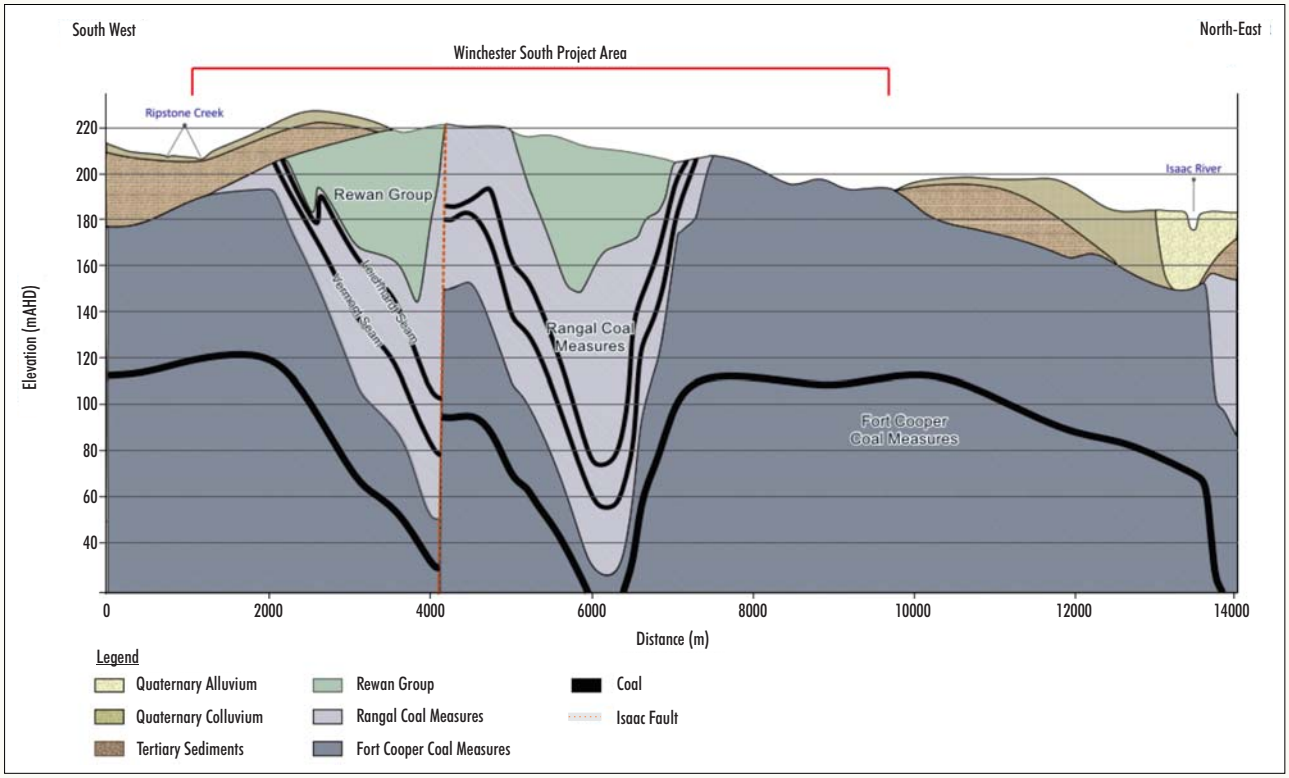
Utilising the available datasets, the steady-state and transient calibrations achieved 6.6% and 5.2% SRMS errors, respectively. This indicates a suitable calibration and is within the standard indicator of less than 10% SRMS (Middlemis *et al.*, 2001; Barnett *et al.*, 2012) (Appendix A).

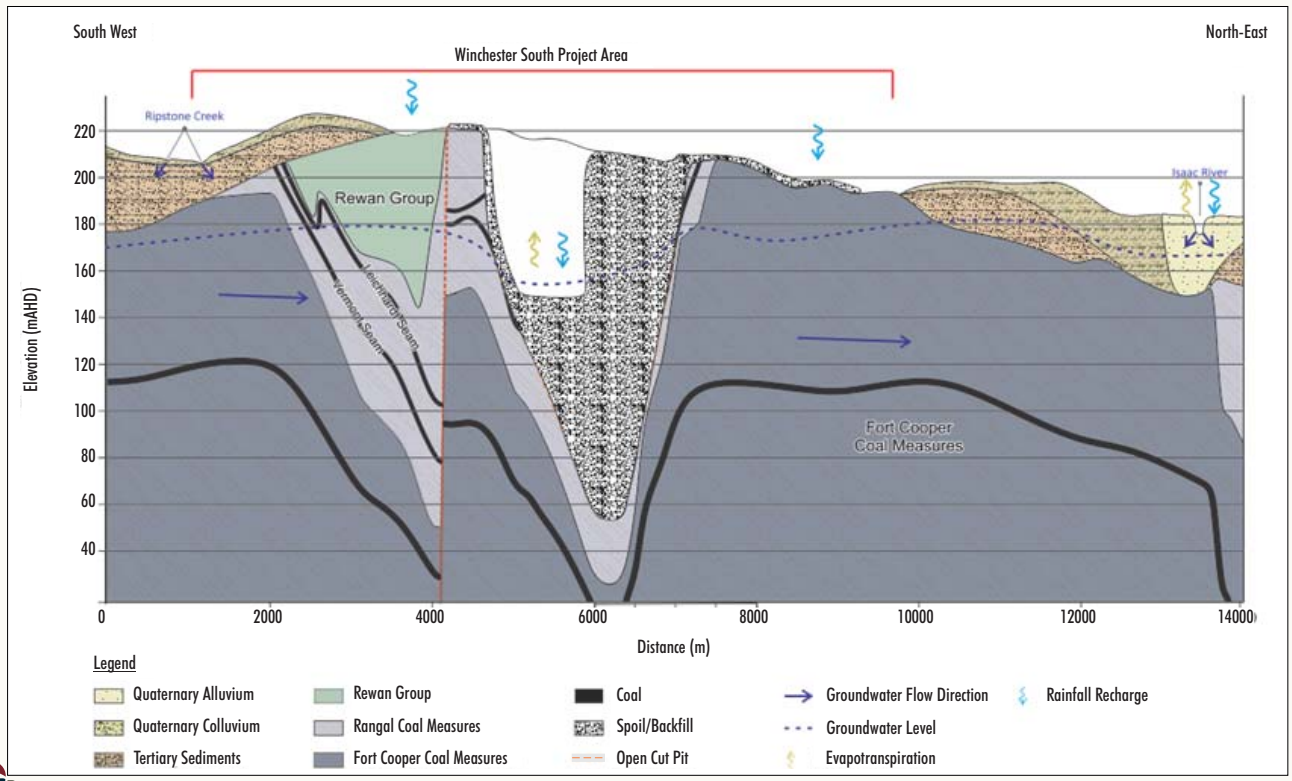
Under the earlier *Murray-Darling Basin Commission – Groundwater Flow Modelling Guideline* (Middlemis *et al.*, 2001), the numerical groundwater model is best categorised as an Impact Assessment Model of medium complexity. Middlemis *et al.* (2001) describe this model type as follows:

> *Impact Assessment model - a moderate complexity model, requiring more data and a better understanding of the groundwater system dynamics, and suitable for predicting the impacts of proposed developments or management policies.*

Barnett *et al*. (2012) also developed a system within the modelling guidelines to classify the confidence level for groundwater models. Models are classified as Class 1, Class 2 or Class 3 in order of increasing confidence based on key indicators such as available data, calibration procedures, consistency between calibration and predictive analysis and level of stresses. The numerical groundwater model for the Project would be classified as a Confidence Level 2 (Class 2) groundwater model.

Sensitivity analysis was conducted to understand how changes to a range of the groundwater model assumptions and variables might influence the model predictions. This included assessment of the influence of selected physical properties (hydraulic conductivity, specific yield and recharge).





Resource Strategies

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Source: SLR (2021).

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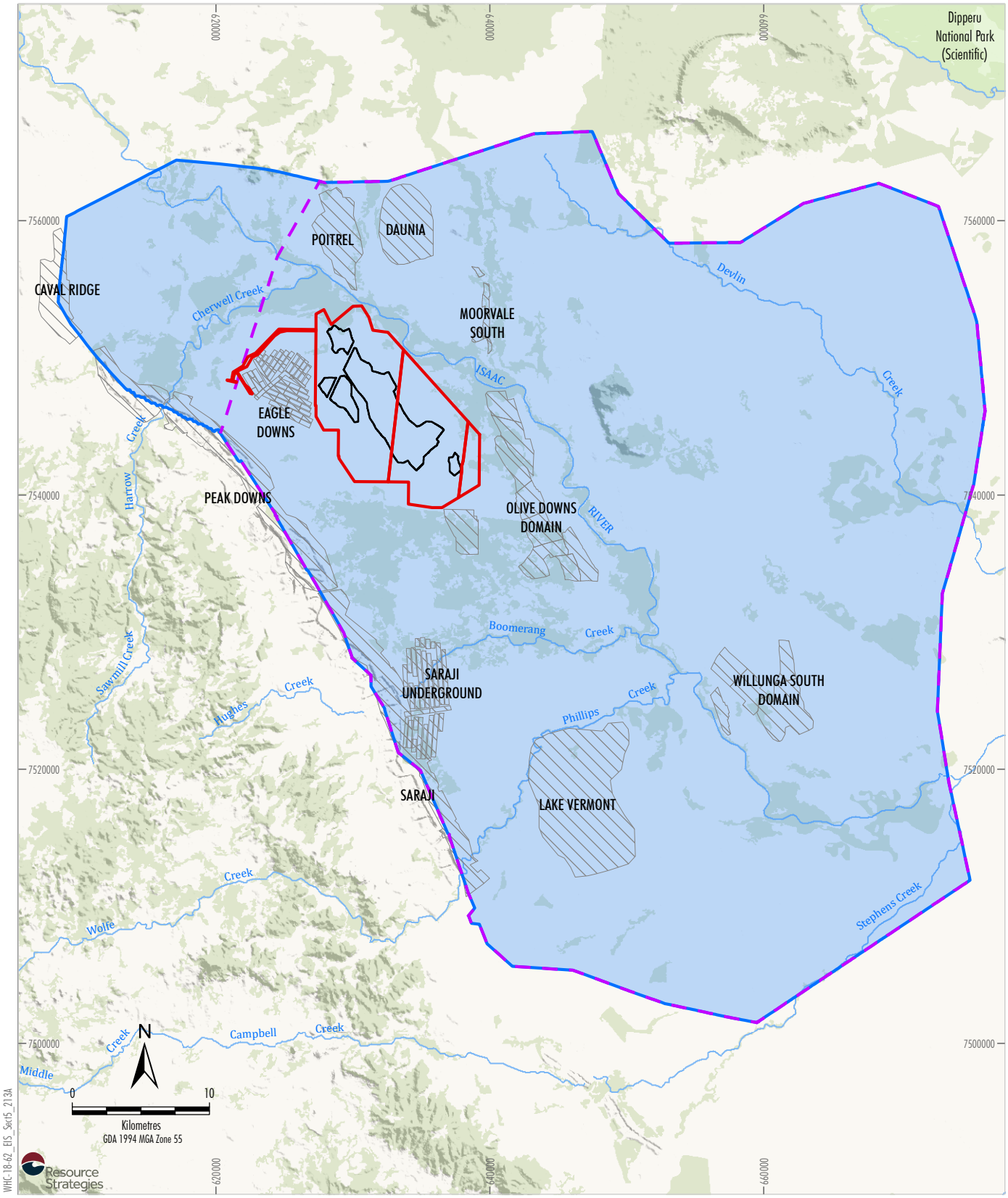
Conceptual Model of the Groundwater Regime (Pre-Mining and Post-Mining)

Figure 5-25



LEGEND
- Mining Lease Application Boundary
- Project Numerical Groundwater Model Extent
- Previous Numerical Groundwater Model Extent
- Surrounding Mining Operations
- Indicative Extent of Open Cut

Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018); SLR (2021).

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Numerical Groundwater Model Extent

Figure 5-26

A more complex Monte Carlo style uncertainty analysis was also undertaken where numerous model inputs were simultaneously changed, and presents the resulting probabilities for:

- predicted spatial drawdown extents (i.e. bores affected by more than 1 m drawdown or more);
- transient stream (enhanced) leakage; and
- alluvium water take (direct and indirect).

The results of the sensitivity analysis and uncertainty analysis are detailed in the Groundwater Assessment (Appendix A).

In relation to the groundwater numerical modelling, the peer reviewer, Dr Noel Merrick, noted:

The groundwater modelling has been conducted to a very high standard and a rigorous Monte Carlo uncertainty analysis offsets much of the uncertainty that is inherent in a groundwater model.

Model Layers and Geometry

The large spatial area of the model extent resulted in the need for an unstructured grid with varying cell sizes, and refinement in the areas of interest, in order to reduce the total cell count to a manageable size. The following features have been included in the grid design:

- The Isaac River is represented in the model with a 50 m Voronoi cell size constraint.
- Open cut mining for the Project is represented with a 100 m cell size constraint.
- Open cut mine areas for the Olive Downs Project have a 100 m Voronoi cell size constraint.
- Open cut mining at all other sites (Lake Vermont, Poitrel Mine, Daunia Mine, Caval Ridge Mine, Peak Downs Mine, Saraji Mine and the Moorvale South Project) have a maximum cell size of 200 m.
- Longwall mining at Eagle Downs Mine has an oriented regular grid of 350 m width squares to represent longwalls. Proposed mining at Saraji East is represented similarly by 400 m squares.
- Faults are represented using a 100 m Voronoi cell constraint.

The active cell count for a layer encompassing the entire model domain is 72,700, which would result in over 1,000,000 cells. However, over the 14 model layers, pinch-out areas (where a layer is not present) in Model Layers 3 to 14 bring the total active cell count of the groundwater model to 787,789.

Groundwater Model Layers

Topography within the groundwater model domain has been defined using numerous sources. High resolution (1 m) Digital Elevation Model (DEM) data was used to define local surface elevation within the Project area. The DEM data is centred over the Project, and at maximum extents, extends approximately 26 km north-south and 29 km east-west (Appendix A).

Outside the extents of the DEM dataset for the Project, LiDAR data from the Moorvale South Project and the Olive Downs Project were used to define surface elevation, where available. In areas where datasets overlap, priority was given to the LiDAR data from the Moorvale South Project. Public domain DEM data sourced from Geoscience Australia was used to define topography in the remainder of the model domain (Appendix A).

The groundwater model domain has been discretised into 14 model layers. Model layer extents (lateral and vertical) have been defined using data from the following sources (Appendix A):

- the Project site geological model;
- exploration drill-hole logs;
- the TEM surveys and slope break analysis;
- previous groundwater numerical models, including the Moorvale South Project and Olive Downs Project site geology models;
- CSIRO Regolith depth survey;
- Queensland Globe bore hole logs; and
- Queensland surface geology and basement geological maps.

Model Layer 1 is fully extensive across the model with an assumed depth of 3 m for colluvium. Model Layer 2 is also fully present across the model area with a minimum thickness of 1 m (Appendix A).

Base of weathering elevation from the site-specific geology model was used to define the elevation for base of Model Layer 2 at the Project. Elsewhere, the Moorvale South Project model was used to define the base of Model Layer 2. In the north-west model expansion, the base of Model Layer 2 was interpreted from CSIRO regolith survey depths and Queensland Globe bore log lithology data (Appendix A).

The underlying Triassic and Permian model layers are present only to their outcrop extents, with some inference made for the presence of older units beneath the surface outcrop due to folding and faulting. The Back Creek Group is considered the regional low-permeability basement for the purpose of this modelling and defines the base of the model, and the western and eastern model boundaries (Appendix A).

It is not possible to represent every individual coal seam (typically less than 1 m thick) in a regional groundwater model, therefore a "combined thickness" totalling the individual seam thicknesses for each relevant seam has been simulated (Appendix A).

Site specific information for the Leichhardt and Vermont Seams at the Project, Moorvale South Project and Olive Downs Project has been included in the model. Outside these sites, limited regional layer thicknesses information is available. The following values were used to define the combined seam thicknesses in the local geology at the Project (Appendix A):

- Leichhardt Seam has been assigned a thickness of 3.8 m.
- Vermont Seam has been assigned a thickness of 5.6 m.

Geological Faults

The modelling of faults has been updated from the previous groundwater numerical model at the Project area through the inclusion of major regional and local scale faults from the site-specific geology model. Mesh refinement (100 m) has been used along fault lines to allow for isolated changes of hydraulic properties along fault zones during calibration. Fault zones have been assigned to all model layers below Model Layer 2 (base of regolith) (Appendix A).

Model Stress and Boundary Conditions

Regional Groundwater Flow

The General Head Boundary (GHB) condition has been specified along the northern, eastern and southern model boundaries. A drain boundary condition was used along the western model boundary, as there is an abundance of open cut mining along the western boundary (Appendix A).

The GHB condition is used to represent the regional flow into and out of the model area and has been assigned using GHB cells in all layers. Groundwater would enter the groundwater model where the head set in the GHB is higher than the modelled head in the adjacent cell and would leave the groundwater model when the water level is lower in the GHB. GHB conductance is calculated using the hydraulic conductivity and dimensions of each GHB cell and therefore is variable in this groundwater model due to variable cell-size (Appendix A).

Watercourses

The Isaac River is the primary watercourse relevant to the Project. It is represented in the MODFLOW-USG model using the Stream (STR) package. All other watercourses are represented using the River (RIV) package. The rivers are set with the riverbed 1 to 11 m below the surrounding topography to represent the steep-banked incised channels (Appendix A).

Surveyed river stage data was available at several locations along the Isaac River. The closest gauging station to the Project (i.e. Deverill) records monthly water levels. The monthly water levels have been averaged for all available months (Appendix A), along with the annual average.

These averages were extrapolated to provide continuous stage elevations used for the calibration and predictive model periods. Simulated stage heights are variable with time and fixed for each model stress period (Appendix A).

Rainfall Recharge

Rainfall recharge was applied to the model using the MODFLOW-USG Recharge (RCH) package. The groundwater model distributed the recharge in zones across the model domain according to outcropping geology (Appendix A).

The groundwater model assigned a proportion of annual rainfall to each of these zones. The proportion of rainfall entering the model as recharge varied through the calibration process (Appendix A).

Evapotranspiration

The MODFLOW-USG Evapotranspiration (EVT) package was used to simulate evapotranspiration from the groundwater system. Extinction depths were set to 2 m below ground level across the model domain. Maximum potential rates were set using actual evapotranspiration values, with the average value (600 mm/year) used as the transient calibration evapotranspiration rate (Appendix A).

Groundwater Use

Private groundwater pumping bores have not been included in the groundwater model due to lack of information regarding abstraction rates. Due to low groundwater abstraction across the groundwater model area, it is likely that the bores would have localised drawdowns and would not significantly impact groundwater model results (Appendix A).

Mining

The MODFLOW-USG Drain (DRN) package is used to simulate mine dewatering in the model for the Project and surrounding developments. Boundary conditions for drain cells allow one-way flow of water out of the model. When the computed head drops below the stage elevation of the drain, the drain cells become inactive, and effectively represent removal of water seeping into a mine over time, with the actual removal of water being via pumping and evaporation (Appendix A).

To simulate open cut mines in the model, drain cells are applied to all active layers from the surface to the base of the lowest mined seam. The longwall extraction at Eagle Downs Mine and Saraji East is represented as drain cells in Model Layer 13 (combined Moranbah Coal Measures) and the fracture zone extended up to Model Layer 8. The drain cells representing the surrounding mines were based on mine schedule information available from relevant approval documentation and changes in aerial imagery over time (Appendix A).

For open cut mining, Hawkins (1998) and Mackie (2009) indicate that spoil and waste rock are more permeable than the undisturbed strata. Completed open cut mining areas would be backfilled with waste rock material as the mining progresses. Backfill material was assigned a uniform hydraulic conductivity of 0.2 metres per day, specific yield (Sy) of 0.05 and rainfall recharge set to 1% of average rainfall. In the transient calibration and predictive model, backfill properties are applied two years behind the active mining (Appendix A).

The hydraulic properties were varied with time using the Time-variant Materials (TVM) package of MODFLOW-USG Transport. For the underground mines, the hydraulic properties were changed with time in the goaf and overlying fractured zone directly above each longwall panel (Appendix A).

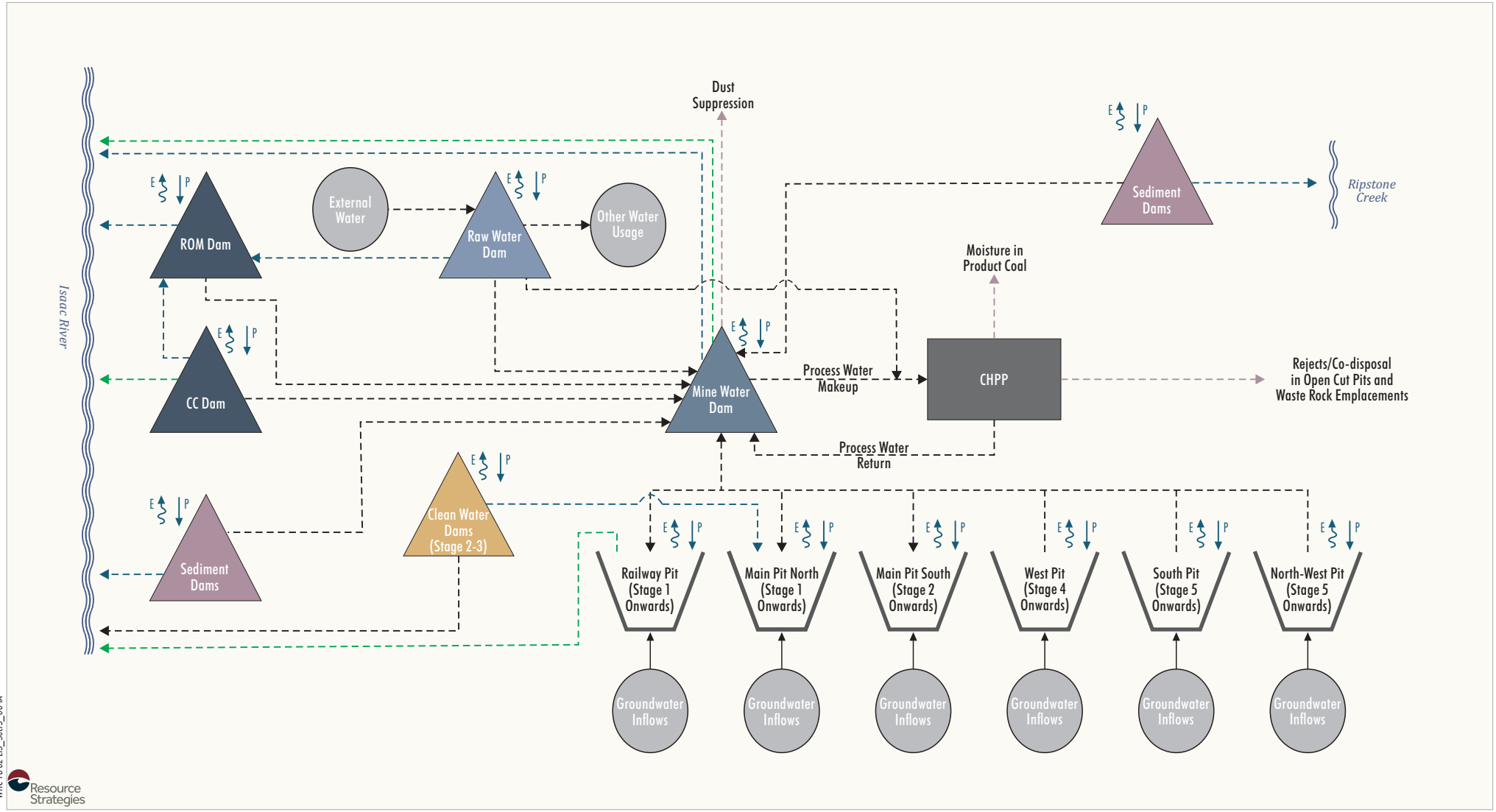
Site Water Balance

A computer-based operational simulation model (OPSIM) was used to assess the dynamics of the mine water balance under conditions of varying rainfall and catchment conditions throughout the development of the Project. The OPSIM model dynamically simulates the operation of the water management system and keeps complete account of all site water volumes and representative water quality on a daily time step (Appendix B).

The model has been configured to simulate the operations of all major components of the water management system. The model configuration and results are presented in detailed in Appendix B. The water management system schematic is shown on Figure 5-27.

The Project water management system will change over the approximate 30-year mine life, including changes in catchment areas, production profile and site water demands (Appendix B).

To represent the evolution of the mine layout over time, the Project was modelled in five discrete phases. Five- to seven-year representative periods have been selected to reflect the average conditions over the mine phase (Appendix B). The modelled mining phases are summarised in Table 5-16.



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Resource Strategies

LEGEND

- Evaporation
- Precipitation/Catchment Runoff
- Gravity Driven
- Pumped/Siphoned
- Controlled Release
- Overflow
- Other Water Flow

Notes

Overflow Direction: Good engineering practice is to include a stabilised spillway as a contingency for dam safety. This arrow does not indicate that these overflows will occur. The arrow is to show the direction of water flow (by gravity) should the dam water level exceed the dam spillway level.

All dams and pits receive rainfall runoff from their local catchment, and lose water via evaporation.

Railway Pit and Main Pit would be available for storage of mine-affected water from Stage 2 to Stage 4 and Stage 5 onwards, respectively. The Railway Pit would receive overflow from the Mine Water Dam when it is above its Maximum Operating Volume.

Sediment Dams would be progressively developed and decommissioned as mining progresses.

Source: WRM (2021); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Water Management Schematic

Figure 5-27

Table 5-16
Representative Mine Phases

Phase	Model Period	Representative Year	Duration (years)
Phase 1	Years 1 to 5	2026	5
Phase 2	Years 6 to 11	2032	6
Phase 3	Years 12 to 18	2038	7
Phase 4	Years 19 to 23	2045	5
Phase 5	Years 24 to 29	2049	6

Source: Appendix B.

In relation to the Surface and Flooding Assessment, the peer reviewer, Tony Marszalek, concluded:

> *… the assessment as it stands is sufficient and fit for purpose for the EIS…*

The results of the site water balance provide a statistical analysis of the performance of the water management system over the approximate 30 years of mine life, based on 103 simulated realisations (Appendix B).

The model climate dataset spans a 131-year period from January 1889 to July 2020. When running simulations using the water balance model, the long-term timeseries is automatically disaggregated into 103 "realisations" (or unique climate sequences) equal in length to the Project simulation duration (29 years). For example, the first realisation (or climate sequence) would be January 1889 to December 1917, the second January 1890 to December 1918, and so on (Appendix B).

Residual Voids Recovery

A GOLDSIM model (separate to the OPSIM model used for the site water balance) was used to assess the long-term water level behaviour of the residual voids. The historical rainfall and evaporation sequences (131 years) were repeated five times to create an indicative long-term climate record. The volume of water in the voids is calculated at each time step as the sum of direct rainfall to the water surface, catchment runoff and groundwater inflows, less evaporation losses (Appendix B).

The model configuration and results are presented in detail in Appendix B.

Calibrated Flood Model

Various flooding and surface water related reports in the Isaac River catchment were reviewed as part of the Surface Water and Flooding Assessment (Appendix B).

The calibrated flood model also includes data obtained from the surrounding developments which Whitehaven WS has established data sharing agreements with (i.e. Moorvale South Project, Olive Downs Project and Eagle Downs Mine).

The flood hydrology model includes the main branch and tributaries of the Isaac River including covering an approximate area of 4,000 km^2, with 104 sub-catchments ranging in size from 0.6 km^2 to 204 km^2 (Appendix B).

The hydrology model has been calibrated against data at the Deverill and Goonyella gauging stations for three historical flood events (i.e. February 2008, December 2010 and March 2017). The calibration results for the developed flood hydrology model were considered to be satisfactory (Appendix B).

Based on the review of past flood studies for surrounding developments, four existing or approved levees were identified in the region (i.e. Poitrel Mine, Daunia Mine, Moorvale South Project and Olive Downs Project) with the Lake Vermont levees located outside the extent of the hydraulic model (Appendix B).

The calibrated Isaac River hydraulic model was used to estimate design peak flood levels, depths, extents and velocities along the Isaac River and its tributaries for various events from a 5% AEP design event to the PMF.

The hydraulic model for Ripstone Creek was used to estimate design peak flood levels, depths, extents and velocities along Ripstone Creek and its tributaries for the 0.1% AEP design event. For the 0.1% AEP, ten temporal patterns were adopted from Jordan *et al*. (2005).

5.5.8 Impacts on Water Resources and Water Quality

Potential Impacts on Hydrological Characteristics

The Significant Impact Guidelines for Water Resources (DotE, 2013c) provide the following guidance on potential impacts of an action on hydrological characteristics:

> *A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:*
>
> *a) changes in the water quantity, including the timing of variations in water quantity*
>
> *b) changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large scale subsidence)*
>
> *c) changes in the area or extent of a water resource*
>
> *where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.*

Groundwater

Groundwater modelling completed for the Project indicates (Appendix A):

- **the Project would not directly intercept groundwater from the Quaternary alluvium under the Water Plan, and therefore no direct take from Groundwater Unit 1 (aquifers of the Quaternary alluvium) would occur from the mining operations;**
- **all direct groundwater take predicted by the model (i.e. up to 352 ML/year) would be from Groundwater Unit 2 (sub-artesian aquifers) under the Water Plan;**
- **there would be negligible direct or indirect take from Groundwater Unit 1, and 104 ML/year of direct take from Groundwater Unit 2 under the Water Plan in the long-term, post-mining;**
- **there would be negligible drawdown within the Isaac River alluvium due to the Project; and**
- **no privately-owned bores in the vicinity of the Project would experience more than 1 m drawdown.**

Surface Water Flow

Catchment Excision

During mining operations, the water management system would capture runoff from areas that would have previously flowed to the receiving waters of the Isaac River and Ripstone Creek. The estimated maximum captured catchment areas during the Project are provided in Table 5-17.

The maximum catchment areas excised by the Project represent:

- up to approximately 1.5% of the Isaac River catchment (to the confluence with Ripstone Creek); and
- up to approximately 6% of the Ripstone Creek catchment (to the confluence with the Isaac River).

Table 5-17
Maximum Captured Catchment Area

Phase (Project Year)	Maximum Captured Catchment Area (km²)	
	Isaac River (to Confluence with Ripstone Creek)	Ripstone Creek (to Confluence with Isaac River)
Phase 1 (Years 1 to 5)	16	-
Phase 2 (Years 6 to 11)	32	1
Phase 3 (Years 12 to 18)	62	9
Phase 4 (Years 19 to 23)	68	9
Phase 5 (Years 24 to 29)	76	16

Source: Appendix B.

The loss of catchment flows in the Isaac River and Ripstone Creek during the Project would be indiscernible. Therefore, the potential impact on water quantity in the Isaac River and Ripstone Creek due to the excision of catchment during the Project is considered to be negligible (Appendix B).

At the completion of mining, surface runoff from rehabilitated in-pit and out-of-pit waste rock emplacement areas would flow to the receiving environment.

An area of approximately 14 km^2 would report to the residual voids at the completion of mining. The changed topography following completion of the Project would have the following impacts on catchment areas:

- The catchment draining to the Isaac River (to the confluence of the Isaac River and Ripstone Creek) would reduce by approximately 14 km^2 (compared to pre-mining conditions), a decrease of less than 0.3%.
- The catchment draining to Ripstone Creek would reduce by around 8 km^2 (compared to pre-mining conditions), a decrease of less than 3%.

The loss of catchment flows in the Isaac River and Ripstone Creek would be indiscernible, and as such the potential impact on water quantity in Isaac River and Ripstone Creek due to the final landform is considered negligible (Appendix B).

Influence on Baseflow (Incidental Groundwater – Surface Water Interaction)

The Isaac River is ephemeral in nature, with flows following rainfall events that generate runoff.

The Isaac River is largely a losing system with seepage of surface water into the underlying alluvium (Appendix A). Changes to water levels induced by mining activities for the Project would increase the hydraulic gradient between the Isaac River and associated alluvium.

The numerical groundwater model conservatively predicted the rate of seepage from the Isaac River to the underlying alluvium would increase by less than 4 ML/year over the life of the Project (Appendix A).

When the Isaac River flows, an average of 161,863 ML/year of surface water is discharged downstream. Therefore, the increased seepage from the Isaac River to the alluvium due to the Project would be insignificant (Appendix A).

Flooding Regime

The Surface Water and Flooding Assessment (Appendix B) describes the current flood risk for a range of AEPs up to the PMF for potentially affected waterways, and assesses (through flood modelling) how the Project may potentially change flooding characteristics and be affected by floods.

Design flood hydrographs for events with AEPs of 5%, 1% and 0.1%, as well as the PMF, were developed based on design rainfalls and the calibrated hydrology model (Appendix B). The PMP was used to estimate the peak flow for the PMF in the Isaac River (Appendix B).

Three cases were modelled by WRM (2021) (Appendix B):

- the base case (pre-mining with existing and approved infrastructure);
- the developed case (during operations with all infrastructure); and
- the post-mining case (permanent stable landforms with temporary flood levees removed).

The impact of the Project on flood levels, flow velocity and stream geomorphology for each of the above cases has been evaluated (Appendix B) and is summarised below.

Temporary Flood Levees

The temporary flood levees for the Project would interact with the Isaac River floodplain during operation, preventing the inundation of the open cut pits. The results of the modelling indicate that the temporary flood levees would not interact with peak water levels up to and including the 5% AEP design event, and interaction with the Project would only occur for 1% AEP design events and higher (Appendix B).

During operations, the changes in flood levels due to the temporary flood levees for the 1% AEP and 0.1% AEP design events are generally localised within the Project area and off-site changes to flood levels would be negligible (Appendix B).

The Project would not result in any significant impacts on flow velocities in the Isaac River channel and floodplain (Appendix B).

The Project would only interact with the Isaac River for 1% AEP or higher design events. The impacts identified on the Isaac River floodplain for these rare events are generally localised and relatively small in magnitude.

As there would be no changes to Isaac River flood levels or velocities at any key infrastructure (e.g. residences, roads or rail), the Project would not result in any flooding impacts to key infrastructure (Appendix B).

There are no impacts on flood levels and velocities in Ripstone Creek, as the Project is located well outside of the Ripstone Creek floodplain (Appendix B).

Final Landform

The potential impacts as a result of the post-mining conditions landform configuration are generally minimal and would not greatly affect the natural channel morphology of Isaac River for events up to the 1% AEP. The Isaac River has minimal interaction with the final landform for the 1% AEP event (Appendix B).

During extreme events, such as the 0.1% AEP, impacts on the floodplain as a result of the landform configuration are minor and generally confined to within the Project area (Appendix B).

Peak velocities and water levels along the Isaac River and associated floodplain for the 0.1% AEP event, in the vicinity of the Project, are similar to existing conditions with some minor localised changes. These impacts dissipate well before reaching the surrounding operations and are not expected to cumulatively impact on the flooding regime in Isaac River (Appendix B).

The peak velocity along the interface between the flood extent and the final landform for the 0.1% AEP event is generally less than 0.3 m/s (Appendix B). Therefore, erosion potential of the 0.1% AEP event on the final landform is negligible.

The flood modelling results indicate that the residual voids would be outside the PMF design event, and therefore would not be inundated post-mining (Appendix B).

Stream Geomorphology

The Geomorphology Assessment (Appendix F of Appendix B of the EIS) prepared by Fluvial Systems (2020) assessed the potential impacts of the Project on the geomorphic characteristics of the Isaac River and Ripstone Creek, and concluded that potential impacts of the Project would be negligible.

Cumulative Impacts

The Surface Water and Flooding Assessment (Appendix B) considered any existing and approved structures that may affect flood behaviour, as well as structures proposed as part of the Project. WRM (2021) concluded that there are no known developments in the planning or development phases that might result in additional structures on the floodplain in the vicinity of the Project.

Cumulative impacts on flooding are not expected to lead to any adverse impacts on human populations, property or other environmental or social values (Appendix B).

Regulated Structures

The *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) defines the methodology and assessment criteria to determine if a structure associated with an ERA should be regulated under the EP Act. The *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) details the hydraulic design requirements for regulated structures and has been used as a reference in the preliminary design of the water management system and preliminary sizing of dams associated with the Project (Appendix B).

All proposed mine-affected water dams which overflow internally (i.e. do not discharge to the receiving environment) have been assigned a preliminary category of low consequence due to the low risk of significant consequence in the event of a failure to contain or dam break (Appendix B).

There are only two mine-affected water dams, that would be regulated structures, that can discharge to the receiving environment:

- MWD; and
- CC Dam.

These dams have been assessed against Table 1 of the *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) and have been assigned a low consequence category for the failure to contain criteria based on the predicted water quality results from the water balance model (Appendix B).

Potential Impacts on Water Quality

The Significant Impact Guidelines for Water Resources (DotE, 2013c) provide the following guidance on potential impacts of an action on water quality:

> *A significant impact on a water resource may occur where, as a result of the action:*
>
> *a) there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:*
>
> *i. creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality*
>
> *ii. substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality*
>
> *iii. causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment*
>
> *iv. seriously affects the habitat or lifecycle of a native species dependent on a water resource, or*
>
> *v. causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource, or*
>
> *b) there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or*
>
> *c) high quality water is released into an ecosystem which is adapted to a lower quality of water*

Surface Water Quality

Potential impacts of the Project on surface water quality are considered in the following sub-sections.

Geochemistry (Drainage and Seepage)

A Geochemistry Assessment was conducted by Terrenus Earth Sciences (2020) and is presented in Appendix M. The assessment was undertaken to evaluate the geochemical nature of potential waste rock and coal reject materials likely to be produced from the Project.

Approximately 148 Mt of coal rejects would be produced from the processing of ROM coal over the life of the Project. Coal rejects (coarse and fine) generated by the processing of ROM coal from the Project, based on Project coal samples, were assessed as part of the Geochemistry Assessment (Appendix M).

The coarse component of the reject material is typically expected to generate pH-neutral to alkaline, low-salinity surface water runoff and seepage following initial surface exposure. A small proportion of coarse reject samples have been classified as potentially acid forming with low acid-generating capacity (PAF-LC).

Coal rejects from the CHPP would be co-disposed with waste rock. Reject material would be co-disposed in locations such that any runoff or infiltration would report to the Project water management system for mine water. Reject material would be periodically sampled during the mine life to confirm geochemical characteristics and to enable the reject disposal strategy to be adjusted as necessary.

The Geochemistry Assessment also aimed to identify any environmental issues that may be associated with mining, handling and storing these materials. Based on the geochemical testwork, waste rock is expected to:

- be overwhelmingly NAF (i.e. 99% of samples) with excess ANC and have a negligible risk of developing acidic conditions; and
- generate relatively low to moderate salinity surface runoff and seepage with low soluble metals concentrations.

Overall, the geochemical assessment found that approximately 68% of potential coarse reject material was NAF, with the remaining coarse reject material having a relatively low degree of risk associated with potential acid generation. The material has a low sulphur (and sulphide) concentration and low metals/metalloids concentrations (Appendix M).

In consideration of the geochemical characteristics, it should be noted that coal reject is expected to comprise approximately 4% of all mineral waste generated at the Project. Therefore, coal reject generated by the Project would have a relatively low degree of environmental risk associated with potential acidity.

Runoff and Contaminants

Disturbance associated with mining activities has the potential to adversely affect the quality of surface runoff by increasing sediment loads.

Water management, erosion and sediment controls (e.g. sediment dams) and other land contamination controls that would be applied to the Project are described below.

The Project has been designed to minimise impacts on regional waterways and drainage paths by diverting flow corridors around surface disturbance areas (Appendix B).

The development of up-catchment diversions allows runoff from undisturbed upslope catchments to flow around the Project disturbance areas, minimising the impact on downstream environment and water users, while also minimising the potential volume of water captured into the mine water management system.

Two up-catchment diversions would be required for the Project, to allow the catchment to drain to a 'watercourse' as defined by the Water Act in the north of the Project and a drainage feature (e.g. considered not to be 'watercourse' as defined by the Water Act). No 'watercourses' or 'waterways' are required to be diverted for the Project.

Sediment dams would contain runoff from waste rock emplacements, as well as areas of initial and established rehabilitation. The sediment dams would allow for gravity settling of sediment prior to release off-site.

Sediment dams would be designed based on the *Best Practice Erosion and Sediment Control Guideline* (International Erosion Control Association [IECA], 2018) as described in Appendix B.

Sediment dams would be maintained until such time as vegetation within the catchment of the sediment dams successfully establishes and where runoff has similar water quality characteristics to areas that are undisturbed by mining activities. Sediment dams may be maintained in rehabilitated areas when site water demand requires it.

The water balance model was used to assess the risk of uncontrolled releases from the mine-affected water management system. The water balance model results indicate there would be no uncontrolled releases from the mine-affected water management system to the Isaac River for the climatic scenarios modelled over the life of the Project (Appendix B).

An uncontrolled overflow would only occur during an extreme rainfall event (i.e. greater than the modelled climatic conditions) which would also generate significant volumes of runoff from the surrounding undisturbed catchments, as well as in the receiving waterways. Therefore, it is very unlikely that uncontrolled overflows from the mine-affected water management system would have a measurable impact on receiving water quality and therefore the environmental values.

Controlled releases from the mine water management system would occur rarely and only when the water quality and flows of the Isaac River meet the proposed release trigger levels. Therefore, it is expected that these controlled releases would have negligible impacts on the Isaac River water quality (Appendix B).

To minimise the potential for mine-affected water releases, the Project would utilise the Railway Pit and Main Pit as in-pit water storages when available.

An Erosion and Sediment Control Plan would be developed and implemented throughout construction and operation of the Project. If implemented effectively, environmental risks from disturbed area runoff (i.e. sediment-laden runoff) are expected to be low (Appendix B).

In rainfall events below the design standard of the sediment dams, runoff from disturbed areas would be intercepted and treated by sediment dams. In larger events that exceed the design standards, these dams would overflow following a period of settlement (Appendix B).

Available geochemical information indicates that the runoff draining to the sediment dams would have low to moderate salinity. Overflows would only occur during significant rainfall events which would also generate large volumes of runoff from surrounding undisturbed catchments.

Therefore, it is unlikely that sediment dam overflows would have a measurable impact on receiving water quality or environmental values (Appendix B).

Progressive rehabilitation of disturbance areas and waste rock emplacements would minimise the potential generation of sediment-laden water on-site.

Rehabilitated Mine Landforms

Sediment dams would be retained until the revegetated surface of the waste rock emplacements are stable and runoff water quality reflects runoff water quality from similar undisturbed areas, at which time these controls would be removed and the areas would be free-draining.

Groundwater Quality

Workshops and Storages

There is limited potential for groundwater contamination to occur with relation to workshops and fuel/chemical storage areas as each would be developed in accordance with current Australian Standards (e.g. adequate bunding and equipped for immediate spill clean-up).

Out-of-Pit Waste Rock Emplacements

As the mine progresses, waste rock material would be placed within selected out-of-pit waste rock emplacement areas. The out-of-pit waste rock emplacement areas may produce seepage as a result of rainfall inundation.

Runoff from disturbed areas outside the open cut and infrastructure areas, such as out-of-pit waste rock emplacement areas (both active and under rehabilitation) would be captured in the sediment and mine-affected water dams and managed under the mine water management system. The system would be designed to capture and reuse water.

The Geochemistry Assessment (Appendix M) indicates that waste rock material is generally NAF, with the leachate generally being fresh (EC ranging between 110 µS/cm to 2,410 µS/cm) and low in sulfur content (<0.1%).

The Cainozoic sediments generally comprise surficial soil and clays, up to 10 m in thickness. Where the low permeability surficial clays are present, they would inhibit potential seepage from the out-of-pit waste rock emplacement to the underlying regolith and alluvium. Additionally, the groundwater modelling indicates that water would flow towards the residual voids (e.g. groundwater sinks) and therefore would limit potential seepage to the surrounding alluvium (Appendix A).

In-Pit Waste Rock Emplacements

The in-pit waste rock emplacements would be rehabilitated progressively as the mining operations progress. The Project would involve progressively backfilling the open cut pits as space becomes available with water levels within backfilled areas predicted to recover back towards pre-mining levels (Appendix A).

While the waste rock material leachate generally exhibits poorer water quality compared to the alluvium, groundwater levels within the in-pit waste rock emplacements would remain below the base of Isaac River alluvium. Therefore, a hydraulic gradient would not exist to enable interaction between water within the in-pit waste rock emplacements and the surrounding alluvium (Appendix A).

Residual Voids

Post-mining at the Project there would be four residual voids. Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff and groundwater (Appendix B).

The predicted equilibrated water levels within the residual voids are between approximately 20 m and 60 m below the pre-mining groundwater levels, and therefore the residual voids would act as sinks to groundwater flow (Appendix A).

The residual void modelling indicates that the expected water levels are below the total storage volume levels (e.g. level at which overflows would reach the receiving environment) for each residual void (Appendix B), and the residual voids would remain as long-term groundwater sinks (Appendix A).

Water within the residual voids would evaporate from the equilibrated water body surface and draw in groundwater from the surrounding strata and runoff from the residual void catchment areas. As the residual voids would act as sinks, evaporation from the equilibrated water body would, over time, concentrate salts.

The gradual increase in salinity of the residual void water body would not pose a risk to the surrounding groundwater regime or receiving environment as the residual voids would remain as groundwater sinks in perpetuity (Appendix A).

Regional Water Availability

A significant proportion of site water requirements would be sourced from water collected on-site, including rainfall runoff and groundwater inflows to the open cut pits. Collected water would be stored in the mine-affected water storages for recycling and reuse (Appendix B).

The results of the water balance modelling indicate there is greater than a 75% probability that an external water supply of 3,800 ML would be required in any year of the Project (Appendix B).

Whitehaven WS would source water from either an external water supplier (e.g. Sunwater) via a water supply pipeline or via water sharing with surrounding mining operations. Therefore, there would be no material impacts to regional water availability due to the Project.

Consideration of Cumulative Impacts

The Significant Impact Guidelines for Water Resources (DotE, 2013c) require the action to be:

> *…considered with other developments, whether past, present or reasonably foreseeable developments.*

Cumulative Impacts

Controlled water release conditions have been developed for potential controlled releases, if required, to the Isaac River, based on the *Guideline – Model mining conditions* (DES, 2017a).

The proposed controlled releases strategy comprises MWD, CC Dam and Railway Pit water storages, which would have the ability to discharge water to the Isaac River through a gravity pipe or pumping system. There would be three controlled release points for the Project.

An assessment of the dilution ratio of controlled releases to the Isaac River flow has been undertaken, where the dilution ratio is the daily volume of the Isaac River flow divided by the daily volume of controlled releases to the Isaac River (Appendix B).

The assessment indicated that the minimum modelled dilution ratio for all model iterations was 407, and therefore controlled releases would have a negligible impact on Isaac River water quality (Appendix B).

Mine-affected water from the Project would be managed through a water management system which is designed to operate in accordance with the *Guideline - Model mining conditions* and the *Model water conditions for coal mines in the Fitzroy basin*. That is, the controlled release conditions and in-stream trigger levels are aligned with the WQOs in the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*.

Mine-affected water releases from the Project would be managed within an overarching strategic framework for management of cumulative impacts of mining activities. Controlled releases from the Project are expected to have negligible impacts on the Isaac River water quality. Accordingly, the proposed management approach for mine-affected water from the Project is expected to have negligible cumulative impacts on surface water quality and associated environmental values (Appendix B).

The regional cumulative impacts of the Project on geomorphic characteristics of streams would also be negligible (Appendix B).

The Project would result in a loss of catchment to the Isaac River during operations and post-mining and the surface runoff volume lost from the catchment would generally be in proportion to the excision of the catchment area. The Project area is less than 1.5% of the catchment area of the Isaac River to the Isaac River/Ripstone Creek confluence, with approximately 70% proposed to be managed through the erosion and sediment control measures and then released to the downstream environment following treatment (Appendix B).

The cumulative impact assessment included mining operations within the Isaac River that are adjacent, upstream and downstream of the Project. The catchment of the Isaac River to the Stephens Creek confluence is around 7,782 km^2. There are approximately 17 existing coal mines upstream of the Project that also capture runoff from the Isaac River catchment (Appendix B).

The total estimated captured area of all these developments (including the Project) combined represents around of 9.8% of the Isaac River catchment to the Isaac River/Stephens Creek confluence. If the same percentage of erosion and sediment control measures for the Project is applied to the other mines, then the estimated captured catchment areas reduce to around 30% of the total area (around 2.9% of the Isaac River catchment to the Isaac River/ Stephens Creek confluence) (Appendix B).

In addition, these mines have licence to discharge which returns captured surface water, as well as groundwater collected in underground workings, to the Isaac River catchment and would reduce the impacts on water resources. When considering potential discharges from the operating mines in accordance with their current release rules, the overall loss of catchment area and associated stream flow is relatively small (Appendix B).

The regional cumulative impacts of the Project on geomorphic characteristics of streams would also be negligible (Appendix B).

Cumulative Groundwater Depressurisation and Drawdown

Cumulative impacts associated with approved and foreseeable open cut and underground coal mines surrounding the Project were modelled (Appendix A), including:

- Olive Downs Project;
- Moorvale South Project;
- Eagle Downs Mine;
- Daunia Mine;
- Poitrel Mine;
- Peak Downs Mine;
- Saraji Mine;
- Caval Ridge Mine; and
- Lake Vermont Mine.

The numerical groundwater model indicated that the contribution of the Project to the cumulative drawdowns in the Quaternary alluvium would be negligible (Appendix A).

The numerical groundwater model indicated that the zone of drawdown in the regolith from the Project would only interact with the zone of drawdown from the Eagle Downs Mine and Pit 9 at the Olive Downs Project located immediately west and south-east of the Project, respectively (Appendix A).

The numerical groundwater model indicated that the zone of drawdown in the Leichhardt and Vermont Seams from the Project would only interact with the zone of drawdown from Pit 9 at the Olive Downs Project located immediately south-east of the Project (Appendix A).

Based on the modelling results, cumulative groundwater drawdown extents from the Bowen Gas Project are predicted to be greater than depressurisation and drawdown produced by the Project alone (Appendix A).

Residual Voids

Post-mining at the Project there would be four residual voids. Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff and groundwater (Appendix B). The residual void modelling results show the following (Appendix B):

- North-west Void:
  - The water level reaches equilibrium between 152 mAHD and 162 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 47 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 215,500 µS/cm.

- West Void:
  - The water level reaches equilibrium between 115 mAHD and 128 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 74 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 163,700 µS/cm.
- Main Void:
  - The water level reaches equilibrium between 150 mAHD and 161 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 48 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 147,500 µS/cm.
- South Void:
  - The water level reaches equilibrium between 127 mAHD and 142 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 55 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 183,600 µS/cm.

The peak salinity for the residual voids reported were those observed during the modelling simulation period. As with all closed-system residual voids, the salinities would continue to increase over time until saturation limits are met.

The post-mining flood modelling identified that based on the final landform design, flood waters would not enter any of the residual voids in events up to and including the PMF event (Appendix B).

Additional analysis on the residual void behaviour was undertaken to assess extreme storm events with rainfall depths equivalent to the 1 in 100 AEP, 1 in 1,000 AEP and probable maximum precipitation (PMP) design events (Appendix B).

The analysis indicated that there would be minimal impact on the water level in the residual voids from such an event, with simulated water level increases in the order of 6 m to 12 m (well below the residual void overflow level).

The residual void modelling indicates that the expected water levels are below the total storage volume levels (e.g. level at which overflows would reach the receiving environment) for each residual void (Appendix B), and the residual voids would remain as long-term groundwater sinks (Appendix A).

Groundwater Dependent Ecosystems

The aquatic in-stream ecosystems associated with the Isaac River and Cherwell Creek are largely not dependent on the surface-expression of groundwater. The wetlands and farm dams in the locality are not likely to be aquatic GDEs (Appendix F).

Groundwater modelling for the Project indicates that there would be negligible increased leakage from surface flows of the Isaac River to the underlying alluvium (Appendix A). Therefore, impacts to surface flows and subsequently aquatic ecosystems downstream of the Project are not expected (Appendix F).

Any dependency on groundwater for riparian vegetation associated with the Isaac River and Cherwell Creek is likely to be facultative (i.e. intermittent) during dry times (Appendix F).

Groundwater modelling for the Project indicates that there would be negligible drawdown in the alluvium along the Isaac River and Cherwell Creek, as well as no impacts to groundwater quality (Appendix A). Therefore, there would be no adverse impacts to riparian vegetation associated with the Isaac River and Cherwell Creek (Appendix F).

Any dependency on groundwater for riparian vegetation surrounding ephemeral wetlands is likely to be facultative. These ephemeral wetlands are not likely to be aquatic GDEs as these wetlands do not receive groundwater discharge; rather, the clay-rich substrates of these wetlands are likely to hold surface water runoff for extended periods (Appendix F).

Further, as there would be no impacts on groundwater quality and resources, there would be no adverse impacts to riparian vegetation surrounding these ephemeral wetlands (Appendix F).

Any dependency on groundwater is likely to be facultative for the woodland vegetation dominated by RE 11.3.2 on the floodplains on the Isaac River, Ripstone Creek and Cherwell Creek (Appendix F).

The Project is not predicted to have any material impacts on potential or actual GDEs due to changes in groundwater quality or groundwater resources (Appendix F).

5.5.9 Indirect and Consequential Impacts

Indirect Impacts

Potential indirect impacts as result of the Mine Site and Access Road Action (EPBC 2019/8460) include (Section 5.4.5):

- reduced viability of adjacent habitat (habitat connectivity);
- reduced viability of adjacent habitat to the Proposed Action due to edge effects;
- impacts to fauna and habitat due to noise, dust and artificial lighting generated by the Proposed Action;
- groundwater contamination due to leaks and spills;
- transport of weeds and pathogens from the Project to adjacent vegetation;
- an increase in introduced species; and
- an increased risk of fire.

Measures to mitigate these potential indirect impacts are described in Section 5.5.11, and include vegetation clearance measures, weed and feral animal management measures, designated speed limits within the Mine Site and Access Road Action Area, bushfire prevention and management measures, etc.

Consequential Impacts

Potential consequential impacts as a result of the Mine Site and Access Road Action (EPBC 2019/8460) include (Section 5.4.5):

- off-site impacts, such as impacts to GDEs due to the extraction of coal and impacts to downstream water quality; and
- inadvertent impacts on flora and fauna.

No off-site impacts are predicted to occur as a result of the Mine Site and Access Road Action (EPBC 2019/8460).

Vegetation clearance measures to avoid and mitigate the potential for inadvertent impacts to flora and fauna are described in Section 5.5.11.

5.5.10 Cumulative Impacts

Cumulative impacts of the Project and approved foreseeable developments on water resources and water quality is considered as part of Section 5.5.8.

Assessment of potential cumulative impacts of the Project (including all three Proposed Actions) on threatened species and communities is provided in Section 5.4.

5.5.11 Impact Avoidance, Mitigation Measures and Management Plans

As a result of the Mine Site and Access Road Action facilitating residual impacts to MNES, Whitehaven WS has, where feasible, avoided unnecessary impacts through the consolation of Impact Areas. For example, through the co-location of the ETL Action, Water Pipeline Action and access road through a common corridor. This is further described in Section 5.2.1.

Where impacts cannot be avoided, Whitehaven WS proposes a suite of mitigation measures and management plans to assist with reducing potential adverse impacts facilitated by each Action.

This sub-section describes the avoidance, mitigation and management measures proposed by Whitehaven WS to assist with reducing facilitated impacts due to each of the Actions.

Impact Avoidance Measures

Although the location of the Project is determined by the presence of coal seams, Project elements have been located and designed to avoid or minimise potential biodiversity impacts where possible based on the outcomes of baseline survey work.

The following refinements to the mine design have resulted in significant reduction in the area contained within the Mine Site and Access Road Action (compared to that originally referred to the Commonwealth Minister in 2019 [Section 5.2.1]), and have aided in avoiding impacts on ecological values (including MNES) by:

- design of the Project to avoid the Brigalow TEC located adjacent to the Main Pit South out-of-pit waste rock emplacement;
- design of the Main Pit South western out-of-pit waste rock emplacement to avoid disturbance of Ornamental Snake habitat;
- avoiding creek crossings/waterways for the infrastructure corridor;
- consolidating disturbance required for the ETL Action, Water Pipeline Action and the access road component of the Mine Site and Access Road Action into a single corridor; and
- avoiding palustrine wetlands on the east of the Project by establishing a 50 m buffer on two of the wetlands.

Mitigation Measures

Mitigation measures proposed to be implemented for the Project relevant to MNES are detailed in Table 5-18. These measures are expected to be effective in reducing the facilitated impacts of the Mine Site and Access Road Action (EPBC 2019/8460) on MNES. The measures are focused on addressing the recognised threats to the relevant species and communities and are not inconsistent with the following documents:

- *Commonwealth Listing Advice on Brigalow (Acacia harpophylla dominant and co-dominant)* (TSSC, 2001);
- *Commonwealth Listing Advice on Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin* (TSSC, 2009);
- *Listing advice for* Phascolarctos cinereus *(Koala)* (TSSC, 2012);
- *Conservation Advice Geophaps scripta scripta (Squatter Pigeon [southern])* (TSSC, 2015b);
- *Conservation Advice Petauroides volans (Greater Glider)* (TSSC, 2016b);
- *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008c);
- *Draft referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPaC, 2011a);
- *Approved Conservation Advice* for Phascolarctos cinereus *(combined populations in Queensland, New South Wales and the Australian Capital Territory)* (DSEWPaC, 2012c);
- *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) Ecological Community* (DotE, 2013a);
- *Approved Conservation Advice for Denisonia maculata (Ornamental Snake)* (DotE, 2014e);
- *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, NSW and the ACT)* (DotE, 2014a);
- *Threat Abatement Plan for Predation by Feral Cats* (DotE, 2015a);
- *Threat Abatement Plan for Competition and Land Degradation by Rabbits* (DEE, 2016);
- *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEE, 2017);
- *Conservation Advice (including Listing Advice) for the Poplar Box Grassy Woodland on Alluvial Plains* (DEE, 2019c);
- *Koala-Sensitive Design Guideline - A Guide to Koala-Sensitive Design Measures for Planning and Development Activities* (DES, 2019e); and
- *Priority Threat Management for Imperilled Species of the Queensland Brigalow Belt* (Ponce Reyes *et al.*, 2016).

Table 5-18
MNES Impact Avoidance and Mitigation Measures

MNES	Avoidance/Mitigation Measure	Predicted Effectiveness
Brigalow TEC	Refinements to the Project have avoided the clearing of Brigalow TEC.	Highly effective – avoidance of impact.
Poplar Box TEC	Boundaries of areas to be cleared, and those not to be cleared, would be defined during construction and operation.	Highly effective – avoidance of impact.
Natural Grasslands TEC	Boundaries of areas to be cleared, and those not to be cleared, would be defined during construction and operation.	Highly effective – avoidance of impact.
Ornamental Snake (*Denisonia maculata*)	Fauna spotter / catchers to be on site during clearing in Ornamental Snake habitat.	Potentially effective. Ornamental Snake may be difficult to capture during clearing.
	Feral animal management.	Highly effective – standard management technique widely used.
Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)	Avoid clearing riparian vegetation associated with the Isaac River.	Highly effective – avoidance of impact.
	Experienced Koala spotters to be on site when clearing in Koala habitat.	Highly effective – standard management technique widely used.
	Minimise/target artificial directional lighting.	Highly effective – standard management technique widely used.
	Manage vehicle strike on roads (e.g. speed limit, signage, education).	Highly effective – standard management technique widely used.
	Feral animal management.	Highly effective – standard management technique widely used.
Greater Glider (*Petauroides volans*)	Avoid clearing riparian vegetation associated with the Isaac River.	Highly effective – avoidance of impact.
	Fauna spotter/catchers to be on site when clearing in Greater Glider habitat.	Potentially effective if hollow-bearing trees and limbs are carefully salvaged.
Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)	Fauna spotter/catchers to be on site during vegetation/habitat clearing.	Highly effective – standard management technique widely used.
	Feral animal management.	Highly effective – standard management technique widely used.

Source: After E2M (2021).

Water Resources and Water Quality

Water Management System

Key water quality related objectives of the Project water management system are to:

- maintain separation of clean, sediment-laden and mine-affected water within the limitations of operational requirements; and
- design and operate the mine water management system to minimise uncontrolled releases to the receiving environment.

Up-Catchment Diversions

A series of clean up catchment diversions are proposed to capture and divert catchment runoff water around the mining areas. Details of up-catchment diversion structures to be developed for the Project are discussed in Appendix B.

Surface Water Monitoring Program

Monitoring of surface water quality both within and external to the Project would form a key component of the surface water management system. Monitoring of upstream, on-site and downstream water quality would assist in demonstrating that the site water management system is effective in meeting its objective of minimal impact on receiving water quality. Monitoring would also allow for early detection of any impacts and appropriate corrective action.

The surface water monitoring protocols would:

- maintain compliance with the environmental authority for the Project;
- provide valuable information on the performance of the water management system; and
- facilitate adaptive management of water resources on-site.

Sediment Dam Monitoring

Sediment dams would be designed based on the *Best Practice Erosion and Sediment Control Guideline* (IECA, 2018) as described in Appendix B.

Sediment dams would contain runoff from waste rock emplacements, as well as areas of initial and established rehabilitation. The sediment dams would allow for gravity settling of sediment prior to release of water off-site.

Sediment dams would be maintained until such time as vegetation within the catchment of the sediment dams successfully establishes, and where runoff has similar water quality characteristics to areas that are undisturbed by mining activities. Sediment dams may be maintained in rehabilitated areas when site water demand requires it.

Surface runoff and seepage from waste rock emplacements, including any rehabilitated areas during operations, would be monitored for 'standard' water quality parameters, including but not limited to pH, EC, major anions, alkalinity, major cations, TDS and a broad suite of soluble metals/metalloids.

The sediment dam monitoring would be used to validate the anticipated quality of water runoff reporting to sediment dams and haul road runoff dams. Initially, the sediment dam monitoring would occur on a regular (e.g. quarterly) basis to demonstrate the water quality of stored waters is consistent with the relevant operating parameters to allow releases from sediment dams to occur when required. Subject to demonstrating the WQOs can be met, the frequency of monitoring and suite of parameters for the sediment dam monitoring would be reviewed and updated accordingly (e.g. to occur only when releases occur).

Controlled Releases

Conditions have been developed for potential controlled water releases to the Isaac River, based on the *Guideline - Model mining conditions* (DES, 2017a) and *Model water conditions for coal mines in the Fitzroy basin* (DES, 2013).

The proposed water release conditions are provided in Table 5-19, based on flow and EC monitoring at the Deverill gauging station on the Isaac River, and the proposed Project controlled release points (RP1, RP2 and RP3).

The proposed controlled releases strategy comprises MWD, CC Dam and Railway Pit water storages, which would have the ability to discharge water to the Isaac River through a gravity pipe or pumping system. There would be three controlled release points for the Project.

The release point dams are proposed to be turkey's nest type dams around 5 m deep (not including the Railway Pit water storage). A gravity discharge solution is preferred as it allows for an efficient discharge mechanism and can provide significant discharge capacity during the relatively short discharge opportunities for the Isaac River flow regime (with the exception of the Railway Pit that would use a pumping system). Potential pump solutions to supplement the gravity release system would be considered during the detailed design process.

Management and Monitoring of Waste Rock, ROM Coal and Coal Rejects (Drainage and Seepage)

Waste Rock Emplacements

Waste rock is expected to be overwhelmingly NAF with excess ANC (i.e. negligible risk of developing acidic conditions). Furthermore, waste rock is predicted to generate low to moderate salinity surface runoff and seepage with low soluble metal/metalloid concentrations (Appendix M).

Surface water runoff and seepage from waste rock emplacements, including any rehabilitated areas, would be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions, alkalinity, major cations, TDS and a broad suite of soluble metals/metalloids (Appendix M).

It is, however, noted that some waste rock materials may be sodic (to varying degrees) with potential for dispersion and erosion (to varying degrees) (Appendix M). Where highly sodic and/or dispersive waste rock is identified, it would not report to final landform surfaces and would not be used in construction activities, wherever practicable.

It may not be practical to selectively handle and preferentially emplace highly sodic and dispersive waste rock during operation of the Project. However, reasonable measures would be taken to identify and selectively place (or alternatively manage) highly sodic and dispersive waste rock.

Table 5-19
Proposed Controlled Release Conditions

Flow Rate	Receiving Water Flow Criteria (Isaac River*)	Maximum Release Rate (Controlled Release Points Combined Flows)	Electrical Conductivity Limit (At Release Point)
Medium	4 m^3/s	0.5 m^3/s	1,000 µS/cm
	10 m^3/s	1.0 m^3/s	1,200 µS/cm
High	50 m^3/s	2.0 m^3/s	4,000 µS/cm
	100 m^3/s	3.0 m^3/s	6,000 µS/cm
Very High	300 m^3/s	5.0 m^3/s	10,000 µS/cm

Source: Appendix B.

* Deverill Gauging Station.

Therefore, in the absence of such selective handling, waste rock emplacements would be designed to be short and low (shallow) slopes and progressively rehabilitated to minimise erosion. Where practical, and where competent rock is available, armouring of slopes would also be considered.

Where waste rock is used for construction activities, this would be limited (as far as practical and feasible) to unweathered Permian sandstone, as this material is widely accepted to be more suitable for construction and for use as embankment covering on final landform surfaces.

Regardless of the waste rock type, especially where engineering or geotechnical stability is required, laboratory testing and rehabilitation field trials would be undertaken to determine the propensity for dispersion and erosion of waste rock landforms.

With the implementation of the proposed management and mitigation measures, the waste rock is regarded as posing a low risk of environmental harm.

ROM Coal and ROM Pads

Surface water runoff and seepage from ROM pads would not report off-site and would be managed as part of the on-site mine water management system.
Project-specific data suggests that ROM coal is expected to have a low degree of risk associated with potential acid, salt and soluble metals generation.

Notwithstanding, surface water runoff from ROM coal stockpiles would be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions, major cations, TDS, acidity and a broad suite of soluble metals/metalloids.

Coal Rejects

The management of coal rejects generated by the Project is described in Section 5.5.8. Coal rejects from the CHPP would be co-disposed with waste rock. Reject material would be co-disposed in locations such that any runoff or infiltration would report to the Project water management system for mine water. Reject material would be periodically sampled during the mine life to confirm geochemical characteristics and to enable the reject disposal strategy to be adjusted as necessary.

As concluded in the Geochemistry Assessment (Appendix M), when placed amongst alkaline waste rock (overwhelming NAF) within in-pit emplacements, the overall risk of environmental harm and health-risk that emplaced coal rejects pose is very low.

Notwithstanding, a Waste Management Program would be developed, that would describe the handling and disposal of fine reject and coarse reject material for the Project.

Geochemical test-work validation for coal reject from the CHPP would be undertaken during development of the Project, particularly during the first two years of CHPP operation and whenever new seams/plies are being processed.

Test-work would comprise a broad suite of environmental geochemical parameters, such as pH, EC, acid-base account parameters and total and soluble metals/metalloids.

Groundwater Quality Monitoring

Groundwater quality sampling would continue at existing monitoring sites to detect any changes in groundwater quality during and post-mining.

Groundwater quality monitoring would continue to be undertaken on a quarterly basis. In addition to collecting field parameters (EC and pH), water samples would be submitted to a NATA-accredited laboratory for analysis of:

- physico-chemical indicators (TDS and TSS);
- major ions, hardness and ionic balance;
- total alkalinity as $CaCO_3$, HCO_3, CO_3;
- total and dissolved metals;
- nutrients; and
- organics.

It is also proposed that quarterly groundwater quality monitoring continue to be conducted on accessible privately-owned bores near to the Project.

Groundwater Quality Triggers and Data Review

Groundwater quality triggers would be established to monitor predicted impacts on both environmental values and predicted changes in groundwater quality. The groundwater quality triggers would be developed in consideration of *Using monitoring data to assess groundwater quality and potential environmental impacts* (DSITI, 2017), Water Plan WQOs, ANZECC and ARMCANZ (2000) criteria and site-specific conditions. Impact assessment criteria for the site would be documented within a Water Management Plan.

Groundwater quality triggers would be established for each groundwater unit potentially impacted by the Project, including alluvium, regolith and the Permian coal measures.

An annual review of groundwater quality trends would be conducted by a suitably qualified person. The review would assess the change in groundwater quality over the year, compared to historical trends and impact assessment predictions. The annual review would consider any groundwater trigger exceedances or where data trends show potential for environmental harm.

Groundwater Level and Pressure Monitoring

Monitoring of groundwater levels from existing monitoring bores and VWPs would continue and would enable natural groundwater level fluctuations (such as responses to rainfall) to be distinguished from potential groundwater level impacts due to depressurisation resulting from proposed mining activities. Several bores within the extent of proposed mining operations would continue to be monitored until they are no longer available due to mine progression.

Groundwater Level Triggers and Data Review

A groundwater monitoring program would be established and would continue throughout the life of the Project. Recording of groundwater levels from existing monitoring bores and VWPs would continue and would allow natural groundwater level fluctuations (such as responses to rainfall) to be distinguished from potential groundwater level impacts of the Project.

An annual review of groundwater level trends would be conducted by a suitably qualified person. The review would assess the change in groundwater levels over the year, compared to historical trends and impact assessment predictions. The annual review would discuss any groundwater trigger exceedances or where data trends show potential for environmental harm.

Auditing, Reporting, Corrective and Preventative Actions

Whitehaven would generally undertake the following process for any exceedance identified to the water quality or water resources:

1. Confirm the timing of the exceedance(s) and general location of the exceedance(s).
2. Report exceedances to the appropriate regulatory authorities within regulatory timeframes.
3. Confirm the climatic conditions at the time of the exceedance(s) (where relevant).
4. Identify any potential contributing factors, including consideration of current mine activities.
5. Assess the monitoring results for any anomalies or causes and develop appropriate mitigation and management strategies with assistance from appropriate specialists.
6. Implement the mitigation and management strategies, based on the results of the above investigations.
7. Review of follow up results and report the outcomes of the review to the appropriate regulatory authorities.

Groundwater Model Validation

Every five years, the validity of the groundwater model predictions would be assessed and, if the data indicates significant divergence from the model predictions, the groundwater model would be updated for simulation of mining.

Associated Water Take (Groundwater Licensing) and Underground Water Impact Report

Underground water rights would be exercised for the life of the Project. The aquifers potentially affected by the Project are partitioned according to the two units of the Isaac Connors GMA, as delineated in the Water Plan, and are:

- Isaac Connors Groundwater Unit 1 (containing aquifers of the Quaternary alluvium); and
- Isaac Connors Groundwater Unit 2 (sub-artesian aquifers).

Appendix A provides a summary of the predicted groundwater inflows (i.e. the associated water take). The predicted indirect take from the Isaac Connors Groundwater Unit 1 (alluvium) during the Project is considered negligible (i.e. less than 0.01 ML/year). Over the life of the Project, the associated water take from the Isaac Connors Groundwater Unit 2 (sub-artesian aquifers) would vary, with an allocation of up to 352 ML/year required (Appendix A).

Post-mining, there would be evaporation from the lakes that would form within the residual voids. The model predicted that there would be negligible direct or indirect take from Groundwater Unit 1 (alluvium), and 104 ML/year of direct take from Groundwater Unit 2 (sub-artesian aquifers) under the Water Plan in the long-term, post-mining.

Whitehaven WS would prepare an UWIR in accordance with Chapter 3 of the Water Act. The UWIR would be based on the information contained in the Groundwater Assessment (Appendix A), and would describe, make predictions about and manage the impacts of underground water extraction by the Project.

Water Supply and Licensing (Surface Water)

Whitehaven WS would seek to obtain adequate external water requirements through water sharing with surrounding mining operations or sourcing from an external water supplier (e.g. Sunwater).

Adaptive Management

The results of the Surface Water and Flooding Assessment (Appendix B) represent the application of the adopted mine water management system rules over the life of the Project.

Over the life of the Project, there would be numerous options for adaptive management of the mine water management system to accommodate climatic conditions. For example, temporary adjustments to pumping arrangements could be made to accommodate very wet or dry periods.

These alternative management approaches would be used to reduce the risks to the Project associated with climatic variability.

Management Plans

Offset Management Strategy

An outcome of the Project, including all three Proposed Actions, would be the establishment of an offset area to address the potentially significant impacts on threatened species and communities. The desired outcome of the proposed offset is that the extent and condition of the habitat values of threatened species and communities within the offset areas are protected and enhanced.

The Offset Management Strategy relevant to MNES is described in Section 5.8.

Matters of National Environmental Significance (MNES) Management Plan

Whitehaven WS would develop and implement an MNES Management Plan for the Project. The MNES Management Plan would outline measures to avoid, mitigate and manage impacts of each Action on threatened species and communities and their habitat.

The MNES Management Plan would:

- be prepared and/or reviewed by a suitably qualified ecologist;
- be prepared in accordance with the departments Environmental Management Guidelines; and
- include the following:
  - details of the measures, and timeframes for implementation, that will be taken in the project area to avoid, mitigate and manage impacts on the listed threatened species and community and their habitat during clearance, construction, operation and decommissioning of the action, including enforced vehicle speed limits of 60 kilometres/hour or less;

- details on the specific timing, frequency and duration of the measures to be implemented;
- evidence of how the measures are based on best available practices and appropriate standards;
- details on how the measures have been developed with consideration of the S.M.A.R.T principle; and
- evidence of how the measures take into account relevant approved conservation advices and are consistent with relevant recovery plans and threat abatement plans.

Environmental Management Plans

Whitehaven WS would develop and implement environmental management plans outlining (amongst other things) vegetation clearing measures, weed management and monitoring, animal pest management. These environmental plans would include mechanisms for periodic review of implemented measures including their level of success and mechanisms to implement further management measures should success levels not be satisfactory.

The environmental management plans would be developed in accordance with the requirements of the relevant legislation and local strategic plans, including:

- the *Biosecurity Regulation 2016*;
- the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012); and
- the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

The environmental management plans would include the following measures related to biosecurity:

- identification of feral animal populations and weed infestations;
- strategies for preventing spread of feral animals (i.e. maintaining a clean, rubbish-free environment) and weeds (i.e. machinery wash-down, boot scrubbing facilities, appropriate disposal of weed material);
- prioritisation of treatment of weed infestations or weed species and ongoing treatment measures (as necessary);
- appropriately qualified persons would be engaged to undertake pest animal monitoring and recommended feral animal control strategies (e.g. baiting and trapping) and weed removal strategies (including those appropriate for aquatic habitats); and
- feral animal and weed monitoring protocols and follow-up control methods and protocols.

Authorities Required under State Legislation

Development of the Project is predicted to result in disturbance of animal breeding places. Whitehaven WS will prepare a species management program in accordance with section 335 of the NC Animals Regulation for approval by the DES prior to undertaking any activities that would disturb animal breeding places (Sections 1.7.6, 5.3.1 and Table 1-5).

In addition, a protected plant clearing permit is required to clear *Solanum adenophorum* (Sections 1.7.2 and 5.3.1).

Rehabilitation

In accordance with the *Mined Land Rehabilitation Policy* (DEHP, DNRM and Queensland Treasury, 2017), the Project would be progressively rehabilitated as land becomes available.

General rehabilitation practices and measures that would be implemented for the Project are described in Section 6.4. These would include salvaging select habitat features (e.g. hollow-bearing trees, woody debris, logs and rocks) for use in rehabilitation to establish habitat for fauna.

Vegetation Clearance Measures

A range of measures relating to vegetation clearance would be developed and implemented for the Project to reduce potential impacts on terrestrial ecology. These measures would include the following (Appendix D):

- Pre-clearance fauna surveys would be undertaken by suitably experienced and qualified persons to identify individual fauna at direct risk from clearing activities.
- A suitably experienced and qualified fauna spotter/catcher would be present during the clearing of MSES and MNES habitat areas.

- Management of fauna identified during clearing and pre-clearance surveys would include relocating individuals to adjacent habitat or treating injuries.
- If a Koala is found, it would be left to move away from the clearance area on its own accord, if safe to do so.
- Boundaries of areas to be cleared, and those not to be cleared would be clearly defined during clearing activities.
- Select habitat features (e.g. hollow-bearing trees, woody debris, logs and rocks) would be salvaged for re-use in rehabilitation of the Project.
- Land clearing would be carried out progressively over the life of the Project to allow mobile fauna species the opportunity to disperse away from clearing areas.
- Directional clearing towards retained vegetation would be undertaken where practical to enable the movement of fauna into retained vegetation.
- During construction works, work areas and excavations (trenches) would be checked for fauna that may have become trapped.
- If trenches remain open after daily site works have been completed, fauna ramps would be put in place.

Weed and Feral Animal Management

Whitehaven WS would implement weed and pest management measures for the Project through an Environmental Management Plan. The Environmental Management Plan would outline various management measures for both weeds and feral animals identified at the Project (Appendices D and E).

Weed Management

During the life of the Project, the following management measures would be implemented, to mitigate the abundance and species of weeds in the Project area and surrounds and minimise the potential for weeds to spread into adjacent areas:

- Bi-annual surveying of tracks, revegetation (rehabilitation) areas and soil stockpiles, etc. (or more frequently as required), to identify weeds requiring control.
- Washdown of machinery and vehicles when moving to/from weed infested areas.
- Mechanical removal of identified weeds and/or the application of approved herbicides.
- Weed control methods in accordance with those specified by the DAF and the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).
- Weed monitoring protocols and follow-up weed control methods and protocols.

Feral Animal Management

During the life of the Project, the following feral animal management measures would be implemented (Appendix D):

- Maintaining a clean, rubbish-free environment to deter feral animals.
- Engaging appropriately qualified persons to undertake biannual pest animal monitoring in the Project mining lease areas, which may include coordination with adjoining mining operations/adjacent landowners.
- Feral animal control strategies (e.g. baiting and trapping) within the Project mining lease areas in accordance with relevant standards and the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).
- Feral animal monitoring protocols and follow-up control measures (if required).

Section 4.14.4 provides further information regarding feral animal management measures.

Vehicle Strike

Whitehaven WS would implement management measures to reduce impacts to fauna species due to vehicular strike such as (Appendix D):

- designating speed limits for the Project area;
- developing a process for the removal of roadkill to minimise the risk of attracting fauna to the roadway; and
- developing a process for the management of fauna injured by vehicle strike.

Bushfire Management

Bushfire prevention and management measures for the Project would be undertaken consistent with those described in Section 4.13.4.

Palustrine Wetlands

During the life of the Project, cattle would be excluded from two palustrine wetlands (i.e. within the 50 m buffer inside the MLAs) (Figure 5-8) (Appendix D). These two palustrine wetlands are located on privately owned land and land owned by Whitehaven WS, noting that both are proposed to be disturbed by a railway for the adjacent approved Olive Downs Project (EPBC 2017/7870) (Appendix D).

Excluding cattle from these wetlands is considered likely to have a positive influence on the condition and ecological value of these wetlands (noting that the aquatic ecological values of these wetlands are limited to times of inundation e.g. during floods, and the wetlands have terrestrial ecological value at other times) (Appendix D).

Receiving Environment Management Program

As described in Section 4.1.4, a REMP would be developed for the Project in accordance with the *Guideline - Model mining conditions* (DES, 2017a). The REMP would be implemented to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity.

Whitehaven WS would implement pest and weed control/management measures every six months, or as required during weather conditions which are conducive to the outbreak of weeds and feral animal populations.

Water Management Plan

A Water Management Plan would be prepared cognisant of the DES guideline for the *Preparation of water management plans for mining activities* (DERM, 2010) and would include:

- details of the potential sources of contaminants that could impact on water quality;
- a description of the water management system for the Project;
- measures to manage and prevent saline drainage and sodicity;
- measures to manage and prevent acid rock drainage;
- corrective actions and contingency procedures for emergencies; and
- a program for monitoring and review of the effectiveness of the Water Management Plan.

Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan would be developed and implemented throughout the construction and operation of the Project.

A 'best practice' approach would be adopted that is consistent with the IECA recommendations. The following broad principles would apply:

- minimise the area of disturbance;
- apply local temporary erosion control measures, where practical;
- intercept runoff from undisturbed areas and divert around disturbed areas; and
- where temporary measures are unlikely to be effective, divert runoff from disturbed areas to sedimentation basins prior to release from the site.

The Erosion and Sediment Control Plan would be implemented throughout the life of the Project to minimise erosion and the release of sediment to receiving waters, and for management of stormwater.

Receiving Environment Monitoring Plan

A REMP would be developed for the Project in accordance with the *Guideline - Model mining conditions* (DES, 2017a). The REMP would be implemented to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity.

Other Measures

Other measures Whitehaven WS would implement, which are relevant to reducing potential indirect impacts on biodiversity, include those relating to noise and air quality as described in Sections 4.7.4 and 4.8.4.

Furthermore, Whitehaven WS would implement artificial lighting in accordance with Australian Standards, and in a way that focuses on disturbance/work areas and minimises/avoids lighting of remnant vegetation (Appendix D).

5.6 ELECTRICITY TRANSMISSION LINE ACTION (EPBC 2019/8458)

The ETL Action, in part, is located within MLA 700049. As such, the facilitated impacts associated with the ETL Action within MLA 700049 are considered and assessed by the Mine Site and Access Road Action. The impact facilitated by the ETL Action where located within MLA 700065 is considered and assessed within Sections 5.6.1 to 5.6.8.

5.6.1 Location of the Action

The ETL Action (EPBC 2019/8458) would be located approximately 30 km south-east of Moranbah (Figure 5-1).

The ETL would be located, in part, within MLA 700065 abutting the Mine Site and Access Road Action (EPBC 2019/8460) (Section 5.5), and otherwise within MLA 700049 where it connects to the Project MIA. The ETL Action is co-located within the same corridor as the Water Pipeline Action and the access road component of the Mine Site and Access Road Action (i.e. MLA 700065).

The ETL Action (EPBC 2019/8458) would terminate at the existing Eagle Downs Substation (located adjacent to the Eagle Downs Mine Access Road). The alignment of the ETL Action (EPBC 2019/8458) would primarily traverse land used for agricultural purposes, however, some larger patches of remnant vegetation exist.

5.6.2 Description of the Action

The ETL Action (EPBC 2019/8458) forms part of the Project. The Project includes the Mine Site and Access Road Action (EPBC 2019/8460), the Water Pipeline Action (EPBC 2019/8459) and the ETL Action (EPBC 2019/8458).

Whilst the ETL Action, in part, is located within MLA 700049, the facilitated impacts associated with this Action within MLA 700049 are considered and assessed by the Mine Site and Access Road Action (Section 5.5) (Figure 5-3).

Construction of the ETL would commence in Year 1 of the Project, with construction expected to be completed within 12 months from commencement. The ETL Action (EPBC 2019/8458) would remain operational for the life of the Mine Site and Access Road Action (EPBC 2019/8460), and would be decommissioned and rehabilitated at the end of the Project life in accordance with the Project's approved PRC Plan.

Construction

Permanent electricity supply for the Project would be provided from the existing regional power network via construction of a 132 kV ETL from Powerlink's Eagle Downs Substation (located adjacent to Eagle Downs Mine Access Road) to an on-site 132 kV/22 kV substation located within the MIA.

The ETL would be co-located in a common infrastructure corridor which would also comprise the mine access road component of the Mine Site and Access Road Action (EPBC 2019/8460), and the Water Pipeline Action (EPBC 2019/8459) (Figure 5-3).

The ETL would be constructed through use of towers spaced approximately 200 m apart (although distance between towers may vary depending on changes in direction and topography), with a clearance width of approximately 10 m.

Maintenance access would be via the common infrastructure corridor which also allows for the co-location of the mine site access road and the water pipeline.

Operation

The maximum electricity demand for the Project when fully operational would be approximately 180,000 megawatt-hours per annum. Power supply at 22 kV would be required for the following operational areas of the Mine Site and Access Road Action (EPBC 2019/8460):

- MIA facilities (including offices and workshops);
- the on-site CHPP and associated coal handling facilities; and
- the train load-out facility.

As the Project ramps up to peak production, power demand would also increase in line with the product coal outputs for each year of the Project.

Decommissioning and Rehabilitation

At the end of the Project life the ETL would be assessed for possible decommissioning and rehabilitation, or for use by future landowners.

If it is determined that the ETL is to be removed, the area would be rehabilitated in accordance with the Project's PRC Plan, generally these areas would be topsoiled, ripped and seeded. All rehabilitation areas would be seeded with an appropriate seed mix to enable revegetation in line with the proposed PMLU.

5.6.3 Current Status of the Action

On 13 May 2019 Whitehaven WS referred the ETL Action (EPBC 2019/8458) to the Commonwealth Minister. Subsequently, a delegate of the Commonwealth Minister determined the ETL Action (EPBC 2019/8458) to be a controlled action on 17 July 2019.

To date, no works have commenced associated with the ETL Action (EPBC 2019/8458).

5.6.4 Alternatives Considered

During the pre-feasibility study, a number of alternative infrastructure corridors were investigated. The options are shown on Figure 5-24. The corridor was selected to minimise potential environmental, social and economic impacts through the following constraints:

- minimise impacts to surrounding tenement holders, through the location of the corridors along tenement boundaries and geological features where practicable;
- minimise surface development related impacts by co-locating the access road, water supply pipeline and ETL in a consolidated infrastructure corridor;
- minimise the length of the infrastructure;
- minimise potential interaction with mining operations;
- minimise impact to existing stock routes; and
- avoid dwellings and existing/planned infrastructure.

Whitehaven WS considered the following options with respect to the alignment of the ETL for the Project (Figure 5-24):

- Option 1 – connecting to the Eagle Downs Substation from the north.
- Option 2 – connecting to the Eagle Downs Substation from the south.
- Option 3 – connecting to the Broadlea Substation.

Option 1 (i.e. Eagle Downs Substation northern connection) was selected for the ETL Action (EPBC 2019/8458) as it would (in addition to the points above):

- provide potential for co-location of the ETL, mine access road and water pipeline, reducing the disturbance associated with the ETL Action and potential short-term and long-term impacts on MNES;
- be the shortest alignment, minimising capital costs and surface disturbance requirements; and
- avoid the Eagle Downs Mine subsidence zone (alignment follows a faulted zone, with minimal subsidence predicted to occur).

5.6.5 Relationship to Other Actions

The ETL Action (EPBC 2019/8458) forms part of the Project, which includes the Mine Site and Access Road Action (EPBC 2019/8460) and the Water Pipeline Action (EPBC 2019/8459) (Section 5.5).

As discussed in Section 5.2, the ETL Action (EPBC 2019/8458), Mine Site and Access Road Action (EPBC 2019/8460) and Water Pipeline Action (EPBC 2019/8459) were each separately referred to the Commonwealth Minister.

Whitehaven WS is the proponent for all three Proposed Actions.

As all three Proposed Actions overlap and share common disturbance, to some extent, the approach described in Section 5.2.3 has been undertaken.

This assessment approach allows for the facilitated impacts from the Mine Site and Access Road Action (EPBC 2019/8460) (where located within MLA 700049, MLA 700050 and MLA 700051) to be assessed separately to facilitated impacts from the ETL Action (EPBC 2019/8458), and Water Pipeline Action (EPBC 2019/8459) and access road component of the Mine Site and Access Road Action (EPBC 2019/8460) (where located within MLA 700065).

As the ETL Action (EPBC 2019/8458), Water Pipeline Action (EPBC 2019/8459) and access road component of the Mine Site and Access Road Action (EPBC 2019/8460) are co-located within the same corridor (i.e. within MLA 700065), facilitated impacts are considered only by the ETL Action (EPBC 2019/8458) for impacts within MLA 700065.

5.6.6 Impacts on listed Threatened Species and Ecological Communities

As described in Section 5.4.6, a cumulative assessment of significant impacts associated with the Project, in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b) has been conducted. As a result of this assessment four threatened species and two threatened ecological communities are required to be offset due to the Project.

In accordance with the Terms of Reference, an individual assessment of impacts on listed threatened species and ecological communities has been conducted for the ETL Action (EPBC 2019/8458).

Habitat for the following listed threatened species and ecological communities were identified within the area associated with the ETL Action (EPBC 2019/8458) and are of relevance:

- Ornamental Snake;
- Koala (combined populations of Queensland, NSW and the ACT); and
- the Natural Grasslands TEC.

A detailed assessment of significance for each of the above listed threatened species and threatened ecological communities has been conducted in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b). Additional detail is provided in Appendix D.

Each of the above listed threatened species and ecological communities would be required to be offset due to impacts resulting from the ETL Action (EPBC 2019/8458).

Although the impacts from the ETL Action (EPBC 2019/8458) may not alone necessarily result in a significant impact, as the ETL Action would not commence without the Mine Site and Access Road Action (EPBC 2019/8460) and the Water Supply Action (EPBC 2019/8459), the ETL Action (EPBC 2019/8458) cannot be assessed in isolation. As such, both individually and cumulatively the listed threatened species and ecological community listed above would require offset.

Notwithstanding, a summary of the proposed clearing of MNES habitat being assessed against the ETL Action (EPBC 2019/8458) is provided in Table 5-20.

5.6.7 Indirect, Consequential and Cumulative Impacts

Indirect Impacts

Potential indirect impacts as result of the ETL Action (EPBC 2019/8458) include (Section 5.4.5):

- reduced viability of adjacent habitat (habitat connectivity);
- reduced viability of adjacent habitat to the Proposed Action due to edge effects;
- impacts to fauna and habitat due to noise, dust and artificial lighting generated by the Proposed Action;
- transport of weeds and pathogens from the Project to adjacent vegetation;
- an increase in introduced species; and
- an increased risk of fire.

Measures to mitigate these potential indirect impacts are described in Section 5.6.8, and include vegetation clearance measures, weed and feral animal management measures, designated speed limits within the ETL Action Area, bushfire prevention and management measures, etc.

Table 5-20
MNES Habitat Clearance Summary – ETL Action (EPBC 2019/8458)

Regional Ecosystem	MNES Disturbance (ha)		
	Natural Grasslands TEC	Ornamental Snake	Koala (combined populations of Queensland, NSW and the ACT)
Remnant			
RE 11.9.2 (*Eucalyptus melanophloia +/- Eucalyptus orgadophila* woodland on fine-grained sedimentary rocks)	0	0	35.9
RE 11.9.3 (*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks)	6.5	0	0
Non-Remnant			
Pastureland with Gilgai	0	12.3	0
Pastureland without Gilgai	0	0	0
Total	**6.5**	**12.3**	**35.9**

Note: The portion of the ETL Action (EPBC 2019/8458) located within MLA 700049 and MLA 700050 is assessed by Mine Site and Access Road Action (EPBC 2019/8460) (Section 5.5).
Totals may not add exactly due to rounding.

Consequential Impacts

Potential consequential impacts as a result of the ETL Action (EPBC 2019/8458) include inadvertent impacts on flora and fauna (Section 5.4.5).

No off-site impacts are predicted to occur as a result of the ETL Action (EPBC 2019/8458) (i.e. no upstream or downstream impacts).

Vegetation clearance measures to avoid and mitigate the potential for inadvertent impacts to flora and fauna are described in Section 5.6.8.

Cumulative Impacts

Assessment of potential cumulative impacts of the Project (including all three Proposed Actions) on threatened species and communities is provided in Section 5.4.

5.6.8 Impact Avoidance, Mitigation Measures and Management Plans

As described in Section 5.5.11, a range of impact avoidance and mitigation measures would be implemented for the Project.

Key to these management and mitigation measures would be the implementation of an EMP. The EMP would outline ongoing management measures for the Project and include mechanisms for periodic review of implemented measures including their level of success.

Section 5.8 also describes the offset strategy relevant to the ETL Action (EPBC 2019/8458).

5.7 WATER PIPELINE ACTION (EPBC 2019/8459)

The Water Pipeline Action, in part, is located within MLA 700049. Facilitated impacts within this area are considered and assessed by the Mine Site and Access Road Action (Section 5.5).

The remaining part of the Water Pipeline Action is co-located within MLA 700065, with the ETL Action (Section 5.6). As such, facilitated impacts within this area are considered by the ETL Action (Section 5.6).

5.7.1 Location of the Action

The Water Pipeline Action (EPBC 2019/8459) would be located approximately 30 km south-east of Moranbah (Figure 5-1).

The water pipeline would be located, in part, within MLA 700065 abutting the Mine Site and Access Road Action (EPBC 2019/8460) (Section 5.5), and otherwise within MLA 700049 where it connects to the Project MIA. The Water Pipeline Action is co-located within the same corridor as the ETL Action and the access road component of the Mine Site and Access Road Action (i.e. MLA 700065).

The current water pipeline design (for the purpose of assessment) would terminate at the existing Eungella Water Pipeline Southern Extension network which runs generally north-south, approximately 5 km west of the Project.

The alignment of the water pipeline would be co-located within a common corridor with the ETL (Section 5.6) which primarily traverses land used for agricultural purposes, however, some patches of remnant vegetation exist.

5.7.2 Description of the Action

The Water Pipeline Action (EPBC 2019/8459) forms part of the Project. The Project includes the Mine Site and Access Road Action (EPBC 2019/8460), the Water Pipeline Action (EPBC 2019/8459) and the ETL Action (EPBC 2019/8458).

Whilst the Water Pipeline Action, in part, is located within MLA 700049, facilitated impacts within this area are considered and assessed by the Mine Site and Access Road Action (Section 5.5) (Figure 5-3). Where the Water Pipeline Action is co-located with the infrastructure corridor (MLA 700065), facilitated impacts are considered and assessed by the ETL Action (Section 5.6) (Figure 5-3).

Construction of the Water Pipeline Action (EPBC 2019/8459) would commence in Year 1 of the Project, with construction expected to be completed within 12 months from commencement. The Water Pipeline Action (EPBC 2019/8459) would remain operational for the life of the Mine Site and Access Road Action (EPBC 2019/8460), and would be decommissioned and rehabilitated at the end of the Project life in accordance with the Project's approved PRC Plan.

Construction

A water supply pipeline would be constructed to the Project MIA from the Eungella pipeline network (Figure 5-2).

Discussions with Sunwater (the provider of water through the Eungella pipeline network) indicates that availability exists within the Eungella network to satisfy Whitehaven WS' water requirements.

The water pipeline would be approximately 13 km in length, constructed to generally follow the mine access road to the MIA, and co-located in a common infrastructure corridor. The water pipeline would be buried in some parts.

Maintenance access would be via the common infrastructure corridor which also allows for the co-location of the Mine Site Access Road and the ETL.

Operation

Once constructed, the Water Pipeline Action (EPBC 2019/8459) would supply approximately 3,000 to 4,000 ML/year for construction and the initial establishment of operations for the Mine Site and Access Road Action (EPBC 2019/8460).

Until such time as the Water Pipeline Action (EPBC 2019/8459) is commissioned, water demands for construction would be met by:

- capture of incidental rainfall and runoff within the Project water management system as it is developed (i.e. stormwater and mine-affected water); and
- a temporary pipeline from the existing Eungella pipeline network.

Decommissioning and Rehabilitation

At the end of the Project life the water pipeline would be assessed for possible decommissioning and rehabilitation, or for use by future landowners.

If it is determined that the water pipeline is to be removed, the area would be rehabilitated in accordance with the Project's approved PRC Plan, generally these areas would be topsoiled, ripped and seeded. All rehabilitation areas would be seeded with an appropriate seed mix to enable revegetation in line with the proposed PMLU.

5.7.3 Current Status of the Action

On 13 May 2019 Whitehaven WS referred the Water Pipeline Action (EPBC 2019/8459) to the Commonwealth Minister. Subsequently, a delegate of the Commonwealth Minister determined the Water Pipeline Action (EPBC 2019/8459) to be a 'controlled action' on 17 July 2019.

To date, no works have commenced associated with the Water Pipeline Action (EPBC 2019/8459).

5.7.4 Alternatives Considered

A significant proportion of mine site water requirements would be sourced from water collected on the site, including rainfall runoff and groundwater inflows to the open cut pits which will be stored in the mine-affected water storages for recycling and reuse (Appendix B).

Whitehaven WS would preferentially source water from rainfall runoff and groundwater inflows, and would supplement the water supply with either an external water supplier (e.g. Sunwater) via a water supply pipeline or via water sharing with surrounding mining operations. Therefore, minimising potential impacts to water resource availability from the Isaac River or regional water availability due to the Project.

Whitehaven WS considered and engaged with neighbouring mining operations regarding utilising existing or proposed water infrastructure to supplement the Project's raw water supply requirements.

Whitehaven WS proposes to develop a stand-alone water supply pipeline for the Project as it reduces reliance on nearby water sources and provides certainty in water supply for continued operations.

Whitehaven WS considered the following options with respect to the alignment of the water supply pipeline for the Project (Figure 5-24):

- Option 1 – connecting to the Eungella pipeline network to the west.
- Option 2 – connecting to the Eungella pipeline network to the south.
- Option 3 – sharing the pipeline alignment proposed by the Olive Downs Project (not currently constructed) to the north-west.

The preferred alignment (i.e. western connection to the Eungella pipeline network, as shown on Figure 5-2) was selected for the Water Pipeline Action (EPBC 2019/8459) in consideration of the chosen location for the Project MIA, and as it would (in addition to minimising impacts to surrounding tenement holders, landholders and existing infrastructure):

- reduce cumulative surface disturbance (combined corridor with the ETL and access road);
- limit potential interaction with the Project open cut and out-of-pit waste rock emplacement areas;
- limit the number of easements or leases by co-locating the alignment with the ETL and access road; and
- provide timing certainty (Whitehaven WS could begin construction of the water supply pipeline after receiving approval for the Project) without being encumbered with another project.

5.7.5 Relationship to Other Actions

The Water Pipeline Action (EPBC 2019/8459) forms part of the Project, which includes the Mine Site and Access Road Action (EPBC 2019/8460) and the ETL Action (EPBC 2019/8458).

As discussed in Section 5.2, the Water Pipeline Action (EPBC 2019/8459), Mine Site and Access Road Action (EPBC 2019/8460) and ETL Action (EPBC 2019/8458) were each separately referred to Commonwealth Minister. Whitehaven WS is the proponent for all three Proposed Actions.

The Water Pipeline Action (EPBC 2019/8459) has a footprint of approximately 24.5 ha (including disturbance associated with construction of the pipeline [e.g. laydown areas]), which overlaps with the ETL Action (EPBC 2019/8458) and Mine Site and Access Road Action (EPBC 2019/8460).

As all three Proposed Actions overlap and share common disturbance, to some extent, the approach described in Section 5.2.3 has been undertaken. This assessment approach allows for the facilitated impacts from the Mine Site and Access Road Action (EPBC 2019/8460) (within MLA 700049, MLA 700050 and MLA 700051) to be assessed separately to facilitated impacts from the ETL Action (EPBC 2019/8458) and Water Pipeline Action (EPBC 2019/8459) (within MLA 700065).

However, as the ETL Action (EPBC 2019/8458), Water Pipeline Action (EPBC 2019/8459) and access road component of the Mine Site and Access Road Action (EPBC 2019/8460) are co-located within the same corridor (within MLA 700065), facilitated impacts are considered only by the ETL Action for impacts within MLA 700065.

5.7.6 Impacts on listed Threatened Species and Ecological Communities

All potential impacts which may be associated with the Water Pipeline Action (EPBC 2019/8459) have been accounted for in full by the Mine Site and Access Road Action (EPBC 209/8460) where located within MLA 700049 and MLA 700050 (Section 5.5), and by the ETL Action (EPBC 2019/8458) where located within MLA 700065 (Section 5.6).

No significant impacts are expected for the Water Pipeline Action (EPBC 2019/8459).

5.7.7 Indirect, Consequential and Cumulative Impacts

Indirect Impacts

Potential indirect impacts as result of the Water Pipeline Action (EPBC 2019/8459) include (Section 5.4.5):

- reduced viability of adjacent habitat (habitat connectivity);
- reduced viability of adjacent habitat to the Proposed Action due to edge effects;
- impacts to fauna and habitat due to noise, dust and artificial lighting generated by the Proposed Action;
- transport of weeds and pathogens from the Project to adjacent vegetation;
- an increase in introduced species; and
- an increased risk of fire.

Measures to mitigate these potential indirect impacts are described in Section 5.7.8, and include vegetation clearance measures, weed and feral animal management measures, designated speed limits within the Water Pipeline Action Area, bushfire prevention and management measures.

Consequential Impacts

Potential consequential impacts as a result of the Water Pipeline Action (EPBC 2019/8459) include inadvertent impacts on flora and fauna (Section 5.4.5).

No off-site impacts are predicted to occur as a result of the Water Pipeline Action (EPBC 2019/8459) (i.e. no upstream or downstream impacts).

Vegetation clearance measures to avoid and mitigate the potential for inadvertent impacts to flora and fauna are described in Section 5.7.8.

Cumulative Impacts

Assessment of potential cumulative impacts of the Project (including all three Proposed Actions) on threatened species and communities Is provided in Section 5.4.

5.7.8 Impact Avoidance, Mitigation Measures and Management Plans

As described in Section 5.5.11, a range of impact avoidance and mitigation measures would be implemented for the Project.

Key to these management and mitigation measures would be the implementation of an EMP. The EMP would outline ongoing management measures for the Project and include mechanisms for periodic review of implemented measures including their level of success.

No significant impacts are expected for the Water Pipeline Action (EPBC 2019/8459).

5.8 OFFSET STRATEGY RELEVANT TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Measures that are proposed to avoid and mitigate impacts from the Project on threatened species and ecological communities are described in Sections 5.5.11, 5.6.8 and 5.7.8.

The Project biodiversity Offset Management Strategy has been developed to address the potential residual impacts on biodiversity values associated with the Project in accordance the following Acts and policies:

- the EPBC Act;
- the EO Act*;*
- the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c); and
- the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (and supporting *Offsets Assessment Guide* [DSEWPaC, 2012b]).

Where the Project would result in a significant impact, Whitehaven WS would provide an environmental offset which may have a positive impact on the species. The offset summarised below is based on a land-based proposal driven offset, however in practice the offset may be satisfied in combination with a financial settlement offset.

Attachment 5 presents the biodiversity Offset Management Strategy for the Proposed Actions.

Offsets would be established in stages, accounting for the progressive disturbance of the Proposed Actions. Attachment 5 presents the disturbance associated with each of the proposed offset stages and incudes a breakdown of all potential MNES and MSES. This detail is summarised in Table 5-21.

The extent of disturbance associated with each of the offset stages is shown on Figure 5-28.

The Stage One Offset provides for disturbance associated with construction and operational activities up to and including approximately Project Year 9, with some additional areas allowing for operational flexibility.

Table 5-21
Summary of Impacts to MNES for the Proposed Actions

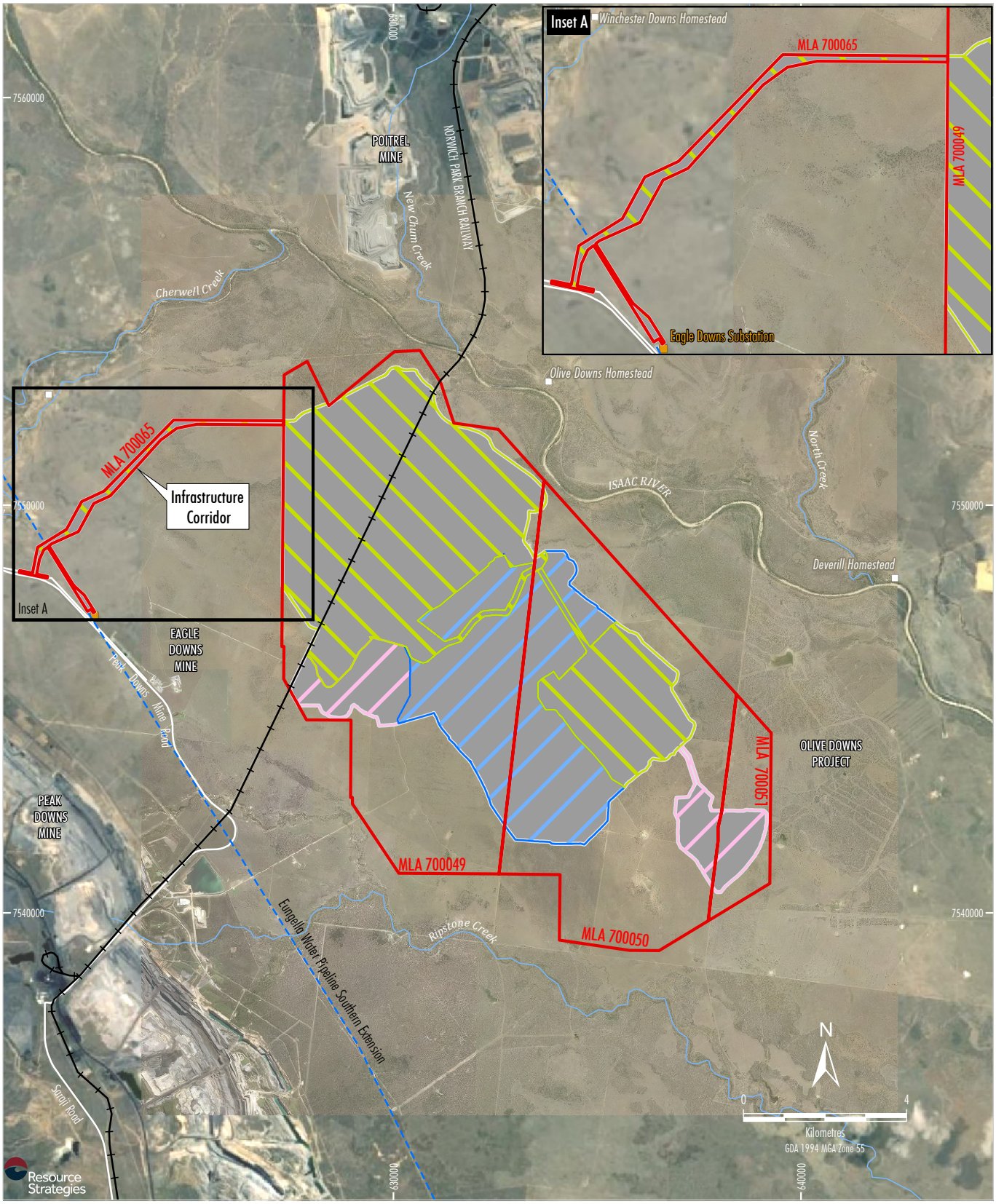
MNES		Disturbance Assessed Against the Mine Site and Access Road Action (EPBC 2019/8460)[1] (ha)				Disturbance Assessed Against the Electricity Transmission Line Action (EPBC 2019/8458)[2, 3] (ha)	Disturbance Assessed Against the Water Pipeline Action (EPBC 2019/8459)[2, 3] (ha)	Proposed Actions Total Disturbance (ha)			
		Stage 1	Stage 2	Stage 3	Total	Stage 1	Stage 1	Stage 1	Stage 2	Stage 3	Total
Natural Grasslands TEC		59.8	14.6	0	**74.4**	6.5	0	66.3	14.6	0	**80.9**
Poplar Box TEC		9.6	0	0	**9.6**	0.0	0	9.6	0	0	**9.6**
Ornamental Snake (*Denisonia maculata*)		790.5	770.4	261	**1,821.9**	12.3	0	802.8	770.4	261	**1,834.2**
Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)	Breeding Habitat	111.8	0	28.7	**140.5**	0	0	111.8	0	28.7	**140.5**
	Foraging Habitat	37.9	0	82.8	**120.7**	0	0	37.9	0	82.8	**120.7**
Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)		167.1	0	111.5	**278.6**	35.9	0	203	0	111.5	**314.5**
Greater Glider (*Petauroides volans*)		132.8	0	34.3	**167.1**	0	0	132.8	0	34.3	**167.1**

Note: Totals may not add exactly due to rounding.

1 Disturbance associated with the ETL Action (EPBC 2019/8458), Water Pipeline Action (EPBC 2019/8459) and Mine Site and Access Road Action (EPBC 2019/8460) within MLA 700049, MLA 700050 and MLA 700051 is assessed under the Mine Site and Access Road Action (EPBC 2019/8460).

2 Disturbance associated with the ETL Action (EPBC 2019/8458), Water Pipeline Action (EPBC 2019/8459) and Mine Site and Access Road Action (EPBC 2019/8460) within MLA 700065 is assessed under the ETL Action (EPBC 2019/8458).

3 The ETL Action (EPBC 2019/8458), Water Pipeline Action (EPBC 2019/8459) and Mine Site and Access Road Action (EPBC 2019/8460) within MLA 700065 are assessed entirely within Stage 1 of the Project.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Substation

Disturbance Associated with Offset Stages*

- Disturbance for Offset Stage 1
- Disturbance for Offset Stage 2
- Disturbance for Offset Stage 3

Note:

** Indicative layout shown based on current mine planning and is subject to change based on detailed mine planning with offsets provided prior to on-ground impacts.*

- The entirety of the Electricity Transmission Line (EPBC 2019/8458), Water Pipeline (EPBC 2019/8459), and the Access Road component of the Mine Site and Access Road (EPBC 2019/8460) is contained within the Disturbance Associated with Offset Stage 1.

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Biodiversity Offset Staging

Figure 5-28

5.9 CONCLUSION

As described in Section 5.2.1, the Project comprises three separate but related Proposed Actions.

Whitehaven WS has considered a number of alternatives to the Proposed Actions, including alternative mining methods, open cut extents, waste rock emplacement extent, mining sequence, final landform design and infrastructure alignments (Sections 5.5.4, 5.6.4 and 5.7.4).

The Project components have been refined to reduce the disturbance area compared to that originally referred to the Commonwealth Minister in 2019 and avoid impacts on ecological values (including MNES) (Section 5.5.11). The proposed mitigation measures are expected to be effective in reducing the facilitated impacts on MNES; focus on addressing the recognised threats to the relevant species and communities; and are not inconsistent with the relevant approved conservation and listing advice and threat abatement plans (Section 5.5.11).

In accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b), a significant impact assessment has been completed for MNES known, or likely, to occur within the Indicative Surface Disturbance Extent of the Project, or listed in the Terms of Reference (Sections 5.4, 5.5.6, 5.5.8, 5.6.6 and 5.7.6).

Where the Proposed Actions would result in a significant impact, Whitehaven WS would provide an environmental offset which may have a positive impact on the species (Section 5.8).

The biodiversity Offset Management Strategy has been developed to address the potential residual impacts on biodiversity values associated with the Proposed Actions in accordance with the EPBC Act, the EO Act, the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c) and the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (and supporting *Offsets Assessment Guide* [DSEWPaC, 2012b]).

The Project (the Proposed Actions) as described in this EIS is considered to be generally consistent with the objects of the EPBC Act and the principles of ecologically sustainable development (including the precautionary principle, social equity, conservation of biological diversity and ecological integrity and valuation) (Sections 5.9.1 and 5.9.2).

In addition, Section 5.9.3 presents the potential social and economic benefits and impacts, and Section 5.9.4 presents the consequences of not carrying out the Proposed Actions.

Construction, operation, and ultimate closure of the Proposed Action, both individually and collectively, is considered to be environmentally acceptable.

5.9.1 Consideration of the Actions against the Objects of the Environment Protection and Biodiversity Conservation Act 1999

Section 3 of the EPBC Act describes the objects of the EPBC Act as follows:

> *(a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and*
>
> *(b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and*
>
> *(c) to promote the conservation of biodiversity; and*
>
> *(ca) to provide for the protection and conservation of heritage; and*
>
> *(d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and*
>
> (e) *to assist in the co-operative implementation of Australia's international environmental responsibilities; and*
>
> *(f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and*
>
> *(g) to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.*

The Proposed Actions are considered to be generally consistent with the objects of the EPBC Act, as:

- They incorporate measures to protect the environment (including aspects of the environment that are of national significance), via the Project design (Sections 5.1.2, 5.5.11, 5.6.8 and 5.7.8) and the application of mitigation, offsets and other measures (Sections 5.5.11, 5.6.8, 5.7.8 and 5.8).

- The Proposed Actions would develop the State's mineral resources (i.e. coal resources) while incorporating relevant ecologically sustainable development considerations (Section 5.9.2).
- An assessment of potential biodiversity impacts has been undertaken, and the Proposed Actions include a proposal for offsetting unavoidable impacts on MNES (Sections 5.4 to 5.8 and Appendices D, E and F).
- The Proposed Actions under the EPBC Act would not have a significant impact on water resources in consideration of the guidance in the Significant Impact Guidelines for Water Resources (DotE, 2013c) (Section 5.5.8 and Appendices A and B).
- Whitehaven WS has sought to recognise and manage all cultural heritage within the area of the Proposed Actions and has an established respectful relationship with the local Barada Barna Aboriginal Corporation, including an approved CHMP, which underpins measures that are to be implemented to recognise and manage cultural heritage (Sections 4.4.5 and 4.12.3).
- A non-Indigenous cultural heritage assessment has been undertaken, which identifies relevant cultural values, and suitable mitigation measures for potential direct and indirect impacts have been incorporated into the Proposed Actions (Section 4.12 and Appendix L).
- Whitehaven WS would collaborate with the Barada Barna Aboriginal Corporation, DSDSATSIP, DESBT and other government agencies to design and implement programs (such as 'Skilling Queenslanders for Work') which support target groups such as youth and would ensure Indigenous cultural heritage surveys are fully funded and supported and undertaken by the rightful parties (Section 4.4.5).
- The Proposed Actions would be developed in a manner that incorporates engagement from the community, landholders and Indigenous peoples through the EIS consultation program (Attachment 4 and Appendix C), the public notification of the draft EIS document and the SDPWO Act assessment process.
- The EIS includes consideration of the Proposed Actions' contribution to maintaining Australia's international environmental responsibilities and the potential impact on these (e.g. consideration of greenhouse gas emissions) (Section 5.9.2). The Proposed Actions would not have a significant impact on migratory species under international agreements.

5.9.2 Ecologically Sustainable Development Considerations

Background

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report titled *Our Common Future*, which defined sustainable development as:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

In recognition of the importance of sustainable development, the Commonwealth Government developed a NSESD (Commonwealth of Australia, 1992) that defines ecologically sustainable development as:

> *…using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The NSESD was developed with the following core objectives:

- to enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential processes and life support systems.

In addition, the NSESD contains the following goal:

> *Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.*

In accordance with the core objectives and a view to achieving this goal, the NSESD presents private enterprise in Australia with the following role:

> *Private enterprise in Australia has a critical role to play in supporting the concept of ESD* [ecologically sustainable development] *while taking decisions and actions which are aimed at helping to achieve the goal of this Strategy.*

The Proposed Actions would require approval under both the SDPWO Act and the EPBC Act. In deciding whether or not to approve the Proposed Actions, the Commonwealth Minister must take into account the principles of ecologically sustainable development pursuant to section 136(2) of the EPBC Act.

The relevant definition of the principles of ecologically sustainable development is provided in section 3A of the EPBC Act:

> *The following principles are **principles of ecologically sustainable development**:*
>
> *(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;*
>
> *(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*
>
> *(c) the principles of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;*
>
> *(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;*
>
> *(e) improved valuation, pricing and incentive mechanisms should be promoted.*

The Proposed Actions also require approval under the EP Act. Consistent with the NSESD, section 3 of the EP Act defines ecologically sustainable development as:

> *…development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (**ecologically sustainable development**).*

Further, section 58 of the EP Act provides for the chief executive to consider the following principles in preparing an EIS Assessment Report:

- the precautionary principle;
- inter-generational equity; and
- conservation of biological diversity and ecological integrity.

Consideration of Ecologically Sustainable Development for the Proposed Actions

As part of the development of the Proposed Actions, Whitehaven WS carefully considered potential environmental, social and economic impacts as well as feedback provided by the local community, government agencies and other stakeholders.

The design, planning and assessment of the Proposed Actions has been carried out applying the principles of ecologically sustainable development, through:

- incorporation of risk assessment and analysis at various stages in the Proposed Actions' design, environmental assessment and decision-making;
- adoption of high standards for environmental and occupational health and safety performance;
- consultation with regulatory and community stakeholders;
- assessment of potential greenhouse gas emissions associated with the Proposed Actions; and
- optimisation of the economic benefits arising from the development of the Proposed Actions.

Assessment of potential medium and long-term impacts of the Proposed Actions was carried out during the preparation of this EIS on aspects of surface water and groundwater, agriculture, transport movements, air quality emissions (including greenhouse gas emissions), noise emissions, aquatic and terrestrial ecology, heritage and socio-economics.

In addition, it can be demonstrated that the Proposed Actions can be operated in accordance with ecologically sustainable development principles through the application of mitigation measures, compensatory measures and offset measures that have been developed based on conservative impact assumptions for the Proposed Actions.

The following sub-sections describe the consideration and application of the principles of ecologically sustainable development to the Proposed Actions.

Precautionary Principle

Environmental assessment involves evaluating the likely environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A PRA (Appendix N) was conducted to identify risks related to the Proposed Actions and develop appropriate mitigation measures and strategies.

The PRA addressed the key potential environmental impacts associated with the Proposed Actions, including long-term effects. In addition, potential long-term risks are considered by the specialist studies conducted in support of this EIS.

In the Groundwater, Surface Water and Flooding and Economic Assessments (Appendices A, B and K, respectively), risk and uncertainty have also been taken into account through sensitivity and/or uncertainty analysis. Other specialist studies have accounted for uncertainty by adopting conservative Project assumptions and/or prediction methodologies, such as the Noise and Vibration Assessment, Air Quality and Greenhouse Gas Assessment, Road Transport Assessment and Geochemistry Assessment (Appendices G, H, I and M).

Findings of these specialist assessments are presented in Section 5 and relevant appendices. Measures designed to mitigate potential environmental impacts arising from the Proposed Actions are also described in Section 5.

The specialist assessments and PRA have evaluated the potential for harm to the environment associated with the development of the Proposed Actions. A range of mitigation measures have been adopted as components of the Proposed Actions' design to minimise the potential for serious and/or irreversible damage to the environment, including the development of environmental management and monitoring programs, compensatory measures and ecological offsets based on conservative assumptions (Section 5). Where residual risks are identified, contingency controls have been considered (Section 5.8 and Attachment 5).

In addition, for key Project environmental assessment studies (i.e. Groundwater Assessment [Appendix A] and Surface Water and Flooding Assessment [Appendix B]), peer reviews by recognised experts have been undertaken (Attachment 3).

Social Equity

Social equity is defined by inter-generational and intra-generational equity. Inter-generational equity is the concept that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations, while intra-generational equity is applied within the same generation.

The principles of social equity are addressed through:

- assessment and mitigation as described in the SIA of the social and economic impacts of the Proposed Actions (Appendices C and K), including the distribution of impacts between stakeholders and consideration of the potential economic costs of greenhouse gas emissions (Appendix K);
- management measures to be implemented in relation to the potential impacts of the Proposed Actions on water resources, social values, biodiversity, noise, air quality, greenhouse gas emissions, transport, Aboriginal cultural heritage, land, economics and hazards and risks;
- implementation of environmental management and monitoring programs to minimise potential environmental impacts (which include environmental management and monitoring programs covering the life of the Proposed Actions);
- implementation of measures during the life of the Proposed Actions to offset potential localised impacts that have been identified for the development (Section 5.8 and Attachment 5); and
- implementation of significant financial and community commitments, including construction of new houses in Moranbah, to ensure the Proposed Actions do not adversely affect the affordability and availability of housing and accommodation in local communities, as reduced availability, affordability and accessibility of housing and accommodation was a key concern identified during consultation with stakeholders (Appendix C).

The Proposed Actions would benefit current and future generations through employment. It would also provide significant stimulus to local and regional economies and provide Queensland export earnings and royalties, thus contributing to future generations through social welfare, amenity and infrastructure.

The Proposed Actions incorporate a range of mitigation measures to minimise potential impacts on the environment, the costs of these measures would be met by Whitehaven WS and have been included in the Economic Assessment (Appendix K). The potential benefits to current and future generations have, therefore, been calculated in the context of the mitigated Proposed Actions.

Conservation of Biological Diversity and Ecological Integrity

Biological diversity or 'biodiversity' is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species, as well as diversity of ecosystems (Lindenmayer and Burgman, 2005).

For the purposes of this EIS, ecological integrity has been considered in terms of ecological health and ecological values.

The area associated with the Proposed Actions is located within a largely agricultural landscape, with grazing generally being the primary land use. As such, the majority of vegetation (approximately 90%) within the Project area has been historically cleared in favour of livestock grazing and agriculture and exists in a non-remnant state (Appendix D). Habitat connectivity is generally low due to high fragmentation and disturbance of native vegetation (Appendix D).

Surveys conducted for the Project have identified threatened ecological communities and habitat suitable for threatened flora and fauna species (Sections 4.5 and 5.3).

The environmental assessment in Section 4.5 describes the potential impacts of the Project on local and regional ecology in the context of MSES and associated mitigation and offset measures. While the environmental assessment in Section 5 describes the potential impacts of the Project (Proposed Actions) on ecological MNES and associated mitigation and offset measures.

In accordance with ecologically sustainable principles, the Proposed Actions address the conservation of biodiversity and ecological integrity by proposing an environmental management framework designed to conserve ecological values, where practicable, after consideration of potential impacts associated with the Proposed Actions as described in the sub-sections below.

Greenhouse Gas Emissions, Biological Diversity and Ecological Integrity

Many natural ecosystems are considered to be vulnerable to climate change. Patterns of temperature and precipitation are key factors affecting the distribution and abundance of species (Preston and Jones, 2006). Projected changes in climate would have diverse ecological implications. Habitat for some species would expand, contract and/or shift with the changing climate, resulting in habitat losses or gains, which could prove challenging, particularly for species that are threatened.

Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a key threatening process under the EPBC Act.

It is acknowledged that (subject to the efficacy of national and international greenhouse gas abatement measures) all sources of greenhouse gas emissions, irrespective of their scale, would contribute in some way towards the potential global, national, state and regional effects of climate change.

The Proposed Actions' contribution to global climate change would be proportional to its contribution to global greenhouse gas emissions. Consistent with the approach adopted for the *Greenhouse Gas Protocol* (WBCSD and WRI, 2015), the Proposed Actions' Scope 1 emissions would be attributed to Whitehaven WS, whereas the Proposed Actions' Scope 2 emissions and Scope 3 emissions are the Scope 1 emissions of another party (e.g. the Proposed Actions' Scope 2 emissions associated with purchased electricity would be the Scope 1 emissions of the power generator).

At the 21st meeting of the COP to the UNFCCC in 2015, the *Paris Agreement* was adopted by the COP. The goal of the *Paris Agreement* is to limit global temperature increases to well below 2°C above pre-industrial levels (Article 2[1][a]).

This is to be achieved by NDCs (Article 3), with parties aiming to reach peak global emissions as soon as possible, so as to achieve a "*balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century*" (Article 4[1]).

The *Paris Agreement* does not specify the ways in which global emission reductions are to be achieved. It requires parties to prepare, communicate and maintain NDCs and to pursue domestic measures to achieve the objectives of the NDCs (Article 4[2]). The NDCs are to be communicated every five years, with each successive NDC to represent a progression beyond the previous NDC (Article 4[3], [9]).

To date, 188 parties have ratified the *Paris Agreement* and 186 parties have submitted their first NDCs. Parties' second or updated NDCs are due to be submitted by 2020, currently two parties have submitted their second NDCs.

Australia's first NDC submitted to the UNFCCC in August 2015 sets an economy-wide greenhouse gas emission reduction target of 26 to 28% on 2005 levels by 2030 (Commonwealth of Australia, 2015).

A range of policies including the Emissions Reduction Fund, the Safeguard Mechanism, the Renewable Energy Target and the National Energy Productivity Plan have been implemented by the Commonwealth Government to help Australia meet the target in its NDC.

In addition, the Queensland Government has released the *Queensland Climate Transitional Strategy* (DEHP, 2017a), which outlines how Queensland will achieve its target of net-zero emissions by 2050. The Queensland Government also released its climate adaptation strategy (DEHP, 2017b) which provides a framework for ensuring an innovative and resilient Queensland that manages the risks and harnesses the opportunities of a changing climate.

The *Queensland Climate Adaptation Strategy* (DEHP, 2017b) introduces a "Sectors and System Pathway" to address the specific adaptation needs of Queensland's major economic sectors, in regards to climate change. It is noted that the Industry and Resources Sector Adaptation Plan for manufacturing, mining, energy and supporting services has not been developed at the time of writing.

As coal from the Proposed Actions is expected to be used overseas, emissions associated with the end use of Project coal would be accounted for and managed as Scope 1 greenhouse gas emissions under the NDCs of these countries, in accordance with the international legal framework under the UNFCCC, including the *Paris Agreement*.

A greenhouse gas assessment was undertaken by Katestone for the Proposed Actions (Appendix H) and provides an estimation of the potential greenhouse gas emissions associated with the Proposed Actions.

Measures to reduce the Proposed Actions' direct (Scope 1) greenhouse gas emissions are described in Appendix H. However, approximately 97% of the estimated total Scope 1, 2 and 3 emissions are associated with the end use of the Project product coal by customer organisations (i.e. primarily for steelmaking).

Valuation of potential impacts of greenhouse gas emissions has been incorporated in the Economic Assessment (Appendix K) for the Proposed Actions.

The potential implications of climate change on water resources are addressed in Appendices A and B.

Measures to Maintain or Improve the Biodiversity Values of the Surrounding Region

A range of measures would be implemented for the Proposed Actions to maintain or improve biodiversity values of the region in the medium to long-term. As summarised in Section 5, these measures include impact avoidance, minimisation, mitigation and offsets (for residual impacts).

Project elements have been located and designed to avoid or minimise potential biodiversity impacts where possible based on the outcomes of baseline survey work. Key measures to avoid or minimise impacts to vegetation and habitat disturbance and fauna species include:

- Design of the Proposed Actions to avoid the Brigalow TEC located adjacent to the Main Pit South out-of-pit waste rock emplacement.
- Design of the Main Pit South western out-of-pit waste rock emplacement to avoid disturbance of Ornamental Snake habitat.

- Avoiding creek crossings/waterways for the infrastructure corridor.
- Avoiding palustrine wetlands on the boundary of MLA 700049/MLA 700050 and establishing a 50 m buffer on two of the wetlands.
- Co-locating the mine access road, ETL and water pipeline within a single infrastructure corridor.

Section 5 summarises a number of measures that would assist in maintaining the biodiversity of the region, including measures such as clearance protocols, weed management and rehabilitation of disturbed areas.

Residual impacts of the Proposed Actions to biodiversity are also provided for by a biodiversity offset that would comply with the EO Act and the EPBC Act. All residual impacts have been conservatively assessed and an offset management strategy is proposed as part of the Proposed Actions to maintain or improve biodiversity values of the region in the medium to long-term (Attachment 5).

Valuation

One of the common broad underlying goals or concepts of sustainability is economic efficiency, including improved valuation of the environment. Resources should be carefully managed to maximise the welfare of society, both now and for future generations.

In the past, some natural resources have been misconstrued as being free or underpriced, leading to their wasteful use and consequent degradation. Consideration of economic efficiency, with improved valuation of the environment, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environmental considerations in decision-making, as required by ecological sustainable development.

While environmental costs have been considered to be external to project development costs historically, improved valuation and pricing methods attempt to internalise environmental costs and include them within project costing.

The Economic Assessment (Appendix K) undertakes an analysis of the Proposed Actions and incorporates environmental values via direct valuation where practicable (e.g. greenhouse gas emissions of the Proposed Actions). Furthermore, wherever possible, direct environmental effects of the Proposed Actions would be internalised through the adoption and funding of mitigation measures by Whitehaven WS to mitigate and offset potential environmental impacts (e.g. biodiversity offset costs).

The Economic Assessment (Appendix K) has been prepared in accordance with the *Economic Impact Assessment Guideline* (DSD, 2017) and the *Project Assessment Framework – Cost-benefit analysis* (Queensland Treasury, 2015).

Greenhouse gases directly generated by the Proposed Actions (i.e. Scope 1 emissions) on average are estimated to be approximately 506 kt CO_2-e per year (Appendix H). Indirect emissions associated with the on-site use of electricity (i.e. Scope 2 emissions) are estimated on average to be 50 kt CO_2-e per year (Appendix H).

The Economic Assessment in Appendix K indicates a net benefit of $576 million in NPV terms to the Queensland community would be forgone if the Proposed Actions are not implemented (i.e. net of the value of externalities including Scope 1 and 2 greenhouse gas emissions).

The demand for coal used in the manufacturing of steel (metallurgical coal) is expected to remain steady in the long-term as there are currently limited practicable substitutes available. International measures to 'decarbonise' global economies may alter the future demand for and/or supply of thermal coal.

Expected global trends are factored into coal price forecasts considered in the Economic Assessment (Appendix K). The Economic Assessment also includes sensitivity analysis for variations in export coal prices and the social cost per tonne of carbon emissions. The sensitivity analysis shows that the Proposed Actions would still generate a substantial net benefit to the Queensland community under the scenarios considered (Appendix K).

The value of externalities from indirect (Scope 3) greenhouse gas emissions are not considered in the net benefit calculation of the Proposed Actions' impacts on the Queensland community. This is consistent with economic assessment convention, where the potential negative and positive economic impacts of an activity are considered together, in the country where the activity takes place (e.g. economic positives and externalities of Japanese steel manufacturing or power generation in a customer facility, including the Scope 1 greenhouse gas emissions of that facility). This approach is consistent with the *Greenhouse Gas Protocol* and the *Paris Agreement* which seek to avoid double counting of emissions (WBCSD and WRI, 2015).

Notwithstanding, Scope 3 greenhouse gas emissions that may be emitted by other parties, such as from the use of the product coal produced by the Proposed Actions, are considered in this EIS. On average, over the life of the Proposed Actions, the indirect (i.e. Scope 3) emissions from these activities are estimated to be approximately 19 Mt CO_2-e per year (Appendix H).

These greenhouse gas emissions would be accounted for by customer country international greenhouse gas abatement obligations (e.g. under the *Paris Agreement*).

5.9.3 Social and Economic Benefits and Impacts

Engagement

Consultation with key Queensland Government agencies, specifically in relation to the Proposed Actions, has been conducted during preparation of the draft EIS.

Consultation has also been undertaken with the Isaac Regional Council, underlying landowners, neighbouring mining companies and numerous community and social organisations. Engagement with relevant stakeholders has included:

- briefings on the Proposed Actions;
- discussion of key assessment considerations;
- discussion of community and social impacts, including proposed accommodation and employment strategies;
- formation of land access agreements to conduct baseline environmental surveys and install environmental monitoring equipment;
- discussion of proposed final land uses;
- description of the environmental assessment process; and
- presentation of the findings of the environmental assessments and Project development schedules.

Whitehaven WS has consulted a wide range of stakeholders regarding the Proposed Actions and would continue to consult with these stakeholders during construction and operation of the Proposed Actions.

Whitehaven WS is committed to establishing itself as a long-term community partner that makes a positive contribution to community development.

Social and Economic Effects

The Isaac LGA stretches from the central Queensland coast to the Bowen Basin coalfields. This area includes the townships of Moranbah, Dysart, Middlemount, Coppabella, Nebo, Clermont and Glenden, all identified as 'nearby regional communities' for the Proposed Actions.

Mackay is approximately 180 km from the Proposed Actions by road and is the principal service centre for the broader region. It is anticipated that the Isaac and Mackay LGAs would be integral to the Proposed Actions as a source of employees, construction services, labour and equipment, supply of goods and services and supply of social infrastructure and services.

Based on views communicated during the social impact assessment consultation process, the residents of the local communities of Moranbah and Dysart agreed that their communities are resilient, family-orientated and cohesive. The results indicate a very strong sense of community spirit and pride.

The potential for the Proposed Actions to create increased local employment options and opportunities for local businesses were key benefits identified during local community and other stakeholder engagement.

The Social Impact Assessment provides a detailed assessment of the potential positive and adverse impacts of the Proposed Actions on the existing social environment, including on:

- employment;
- population;
- housing;

- social infrastructure;
- local business participation;
- community values;
- community wellbeing;
- cumulative impacts; and
- the potential impacts of Project closure.

SMEC (2021) concluded that the Proposed Actions would have various social impacts and benefits, primarily accruing in the Isaac LGA, but with employment opportunities and benefits for businesses extending to other regions including the Mackay LGA.

The key potential adverse direct and indirect socio-economic impacts associated with the Proposed Actions include:

- potential for social impacts due to uncertainties or concerns about amenity and health impacts for surrounding landholders and nearby communities; and
- the potential for increased demand or competition for rental housing and skilled labour, which would be managed through the SIMP for the Proposed Actions.

Whitehaven has a proven record of maximising local employment and actively supports members of the workforce at its NSW operations to live locally.

The SIMP also details other significant financial and community commitments to appropriately avoid or mitigate any potential adverse social impacts.

The Economic Assessment concluded the Proposed Actions would result in a total net benefit to the Queensland community of $756 million in net present value terms. This value is inclusive of estimated costs for environmental externalities and internalisation of environmental mitigation and management costs by Whitehaven WS.

The estimated net benefit of the Proposed Actions for Queensland in net present value terms consists of royalties of $563 million, company income tax of $136 million and net producer surplus of $79 million.

It is estimated that $4.9 billion in NPV terms would accrue to suppliers in Queensland as a result of the Proposed Actions.

In addition, the Proposed Actions would result in the following additional socio-economic benefits:

- Generation of approximately 500 new direct, long-term jobs, with a significant proportion of the Proposed Actions' workforce to be employed from the region (Isaac and Mackay LGAs).
- Indirect (flow-on) employment as the result of increased wages, and participation of regional businesses, including:
  - 285 FTEs in the local area;
  - 934 FTEs in the region; and
  - 1,894 FTEs in Queensland.
- Enhanced skills and capacities in local communities due to targeted training and skills development initiatives.
- Increased economic well-being in local communities through contributions to community development.

A critical part of assessing potential social impacts has been the development of a SIMP. One of the key considerations has been potential impacts and benefits of the Proposed Actions in relation to housing and accommodation. Key commitments made by Whitehaven WS with regard to housing and accommodation include:

- Facilitating the construction of a maximum of 34 new houses in Moranbah dedicated for Project employees.
- Providing a financial contribution of $500,000 over the Proposed Actions' life to the Isaac Affordable Housing Trust and/or Emergency and Long-Term Accommodation Moranbah Inc, for the construction of additional affordable housing in Moranbah.

- Providing subsidised housing costs for members of the workforce who choose to live locally.
- Providing high quality workforce accommodation to non-resident personnel and monitoring workforce satisfaction with the provided accommodation.
- Providing support to members of the workforce seeking to move to local communities (e.g. providing connections to local advice and support services).

The Proposed Actions include a significant biodiversity offset commitment that would result in a net increase in Queensland and Commonwealth biodiversity values.

5.9.4 Consequences of Not Carrying Out the Actions

An assessment for each Proposed Action is provided in Sections 5.4, 5.5, 5.6 and 5.7. Were the Proposed Actions not to proceed, the following consequences are inferred:

- approximately 500 direct, long-term operational employment opportunities would be foregone and the associated flow-on effects would not be created;
- the high-quality coal resource would remain available to be extracted by other means, however, the efficiencies associated with access to well-established infrastructure in the region may be lost;
- a net benefit of $756 million to the State of Queensland in NPV terms would be forgone;
- the potential environmental impacts described in this EIS would not occur;
- economic and social benefits to the region (including to the Isaac Regional Council and Mackay Regional Council) associated with the Proposed Actions would not be realised; and
- the incremental benefits of the Proposed Actions biodiversity offset strategy would not be realised.