

MIDDLEMOUNT COAL MINE

WESTERN EXTENSION PROJECT (EPBC 2017/8130)

EPBC Act Preliminary Assessment Documentation

Main Text

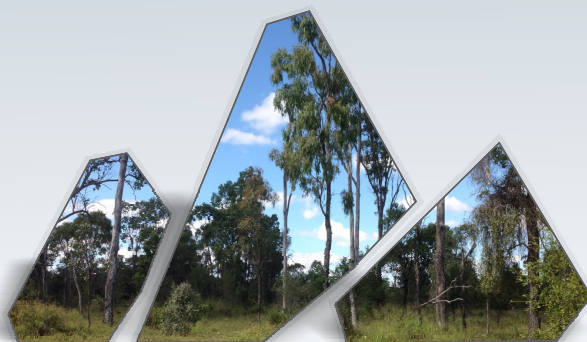


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Attachment H	Middlemount Coal Mine Environmental Authority EPML00716913 (21 May 2018) - Water Conditions
Attachment I	Western Extension Project Terrestrial Habitat Quality Data

EXECUTIVE SUMMARY

Middlemount Coal Pty Ltd (MCPL) owns and operates the Middlemount Coal Mine, an existing open cut coal mine located approximately 3 kilometres (km) to the south-west of the Middlemount Township, Queensland (Qld). The Western Extension Project (the Project) provides for the continuation of open cut coal mining operations at the Middlemount Coal Mine.

The Middlemount Coal Mine operates under Environmental Authority (EA) EPML00716913. MCPL is seeking approval of the Project through a major amendment of EA EPML00716913 in accordance with Chapter 5, Part 7 of the Qld *Environmental Protection Act, 1994* (EP Act). MCPL is also seeking approval of the Action under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) (EPBC 2017/8130). The Commonwealth Minister declared the Action to be a controlled action for the purposes of the EPBC Act, with the following controlling provisions:

- Listed threatened species and communities (sections 18 and 18A).
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E).

The purpose of the Preliminary Documentation is to enable the Commonwealth Minister and interested parties to understand the environmental consequences of the Action on Matters of National Environmental Significance.

Listed Threatened Species and Communities

Due to past and ongoing agricultural activities (e.g. clearing, grazing, logging, thinning), the Action area predominately comprises cleared land and vegetation in the early stage of regrowing from past clearance (approximately 66%, 380.5 hectares [ha]). The Action area contains approximately 190.5 ha of woodland, represented by Eucalypt woodlands (mostly Poplar Box woodlands) and small occurrences of Acacia dominated woodlands.

The native vegetation and habitat within the Action area and surrounding land has been surveyed on multiple occasions. Most recently, Biodiversity Australia Pty Ltd undertook flora surveys in the Action area during May and July 2017 and fauna surveys in the Action area during May, July and September 2017.

The flora and fauna surveys by Biodiversity Australia were undertaken in accordance with relevant Qld and Commonwealth survey guidelines in consideration of relevant listing advice and information on the *Species Profile and Threats Database*. All threatened species and communities listed under the EPBC Act which are known to be present, likely to be present or for whom suitable habitat existing in the action area were targeted during the surveys. Habitat assessments were undertaken to describe the quantity and quality of habitat for relevant threatened species and communities.

Three threatened species and one ecological community listed under the EPBC Act have been recorded in the Action area (Attachment C):

- Squatter Pigeon (southern) (*Geophaps scripta scripta*) (listed as 'Vulnerable' under the EPBC Act and *Nature Conservation Act, 1992* [NC Act]);
- Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (*Phascolarctos cinereus*) (listed as 'Vulnerable' under the EPBC Act and NC Act);

- Greater Glider (*Petauroides volans*) (listed as 'Vulnerable' under the EPBC Act and NC Act); and
- Brigalow (*Acacia harpophylla* dominant and co-dominant) Endangered Ecological Community (Brigalow EEC).

In addition to the above the Ornamental Snake (*Denisonia maculata*), listed as 'Vulnerable' under the EPBC Act and NC Act, has been previously recorded in the existing/approved mine area.

MCPL would minimise land clearance through the use of existing infrastructure and facilities (where possible) and minimising out-of-pit waste emplacements via backfilling of the open cut pit void. The existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced. For example, relevant impact mitigation measures include the use of a licensed spotter-catcher and/or carer during clearing activities and progressive rehabilitation of disturbance areas.

MCPL currently has a number of existing biodiversity offset areas on company-owned land which were established for various components of the Middlemount Coal Mine. A new biodiversity offset area is proposed for the Action (i.e. the Western Extension Commonwealth Offset Area). The Western Extension Commonwealth Offset Area adjoins existing and other proposed offset areas.

The Western Extension Commonwealth Offset Area has been developed in accordance with the Commonwealth EPBC Act Environmental Offsets Policy (and the EPBC Act Offsets Assessment Guide). The proposed offset area is approximately 1,220 ha in size, comprising approximately 752.5 ha of woodland vegetation and approximately 444 ha of derived grassland/regrowth, with the remainder of the area being mapped as cleared land. The biodiversity offset area provides for the enhancement and conservation of Brigalow EEC as well as habitat for the Ornamental Snake, Squatter Pigeon (southern), Koala and Greater Glider.

The Action would require a very small portion (approximately 1%, 32 ha) of the Middlemount Coal (Stage 2) Project Offset Area (EPBC 2010/5394) to be relocated (in a greater quantity) as described within this document.

Water Resources

The existing/approved Middlemount Coal Mine has effects on surface water and groundwater resources, for example through diversions of Thirteen Mile Gully and Roper Creek and groundwater drawdown associated with the open cut mining operations. Impacts on water resources are currently authorised under the Middlemount Coal Project Stage 2 Commonwealth approval (EPBC 2010/5394) and being regulated under the Qld EP Act (Middlemount Coal Mine operates under EA EPML00716913) and Qld *Water Act, 2000* (water licences). The Action provides for the continuation of open cut coal mining operations at the Middlemount Coal Mine, including a small realignment of the Thirteen Mile Gully Diversion and an incremental increase in groundwater drawdown associated with the open cut extension to the north-west of the authorised open cut mine extents.

Water-dependent assets (i.e. entities with characteristics having value and which can be linked directly or indirectly to a dependency on water quantity or quality) have been identified and the potential for the Action to impact water-dependent assets has been assessed. The assessment of potential surface water impacts from the Action is supported by the Surface Water Assessment. The assessment of potential groundwater impacts from the Action is based on the modelling and assessment conclusions presented in the Groundwater Assessment. The Groundwater Assessment has been peer reviewed by Dr Noel Merrick of HydroAlgorithmics Pty Ltd. The Groundwater Assessment was supported by a contemporary bore census of the surrounding locality by 4T Consultants Pty Ltd and the Biodiversity Assessment by Biodiversity Australia.

In summary, groundwater levels are generally in excess of 25 m below ground surface and separated from surface waters, limiting potential to support Groundwater Dependant Ecosystems. Further, the groundwater quality in the locality is brackish to saline and not suitable for stock or human consumption.

As part of the Action, MCPL proposes to realign the Thirteen Mile Gully Diversion to allow for access to additional coal resources within ML 70379 and provide additional surface footprint for out-of-pit waste rock emplacement. The realigned section of the Thirteen Mile Gully Diversion would still divert runoff following rainfall events from an unnamed drainage feature to Roper Creek as per the approved Thirteen Mile Gully Diversion. The southern portion of the Thirteen Mile Gully Diversion would remain unchanged.

As described above, the existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced. Mitigation measures relevant to water resources, include site water management, surface water monitoring and groundwater level and quality monitoring.

1 INTRODUCTION

Middlemount Coal Pty Ltd (MCPL) owns and operates the Middlemount Coal Mine, an existing open cut coal mine located approximately 90 kilometres (km) north-east of Emerald and approximately 3 km to the south-west of the Middlemount Township, Queensland (Qld) (Figures 1 and 2). The Western Extension Project (the Project) provides for the continuation of open cut coal mining operations at the Middlemount Coal Mine (Figure 3).

The Middlemount Coal Mine operates under Environmental Authority (EA) EPML00716913. MCPL is seeking approval of the Project through a major amendment of EA EPML00716913 in accordance with Chapter 5, Part 7 of the Qld *Environmental Protection Act, 1994* (EP Act). MCPL is also seeking approval of the Action under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) (EPBC 2017/8130).

On the 21 December 2017, MCPL lodged a referral for the Action with the Department of Environment and Energy (DEE) to determine whether the proposed Project needed formal assessment and approval under the EPBC Act (Attachment A). An action requires approval under the EPBC Act if the action is likely to have a significant impact on Matters of National Environmental Significance (MNES). On 8 February 2018, a delegate of the Commonwealth Minister declared the Action to be a controlled action for the purposes of the EPBC Act, with the following controlling provisions:

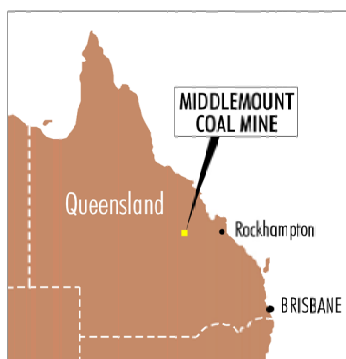
- Listed threatened species and communities (sections 18 and 18A).
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E).

The delegate of the Commonwealth Minister also determined the Action is to be assessed by preliminary documentation and further information was requested pursuant to section 95A of the EPBC Act. A copy of the request for preliminary documentation is provided in Attachment B.

The purpose of the preliminary documentation is to enable the Commonwealth Minister and interested parties to understand the environmental consequences of the Action on MNES.

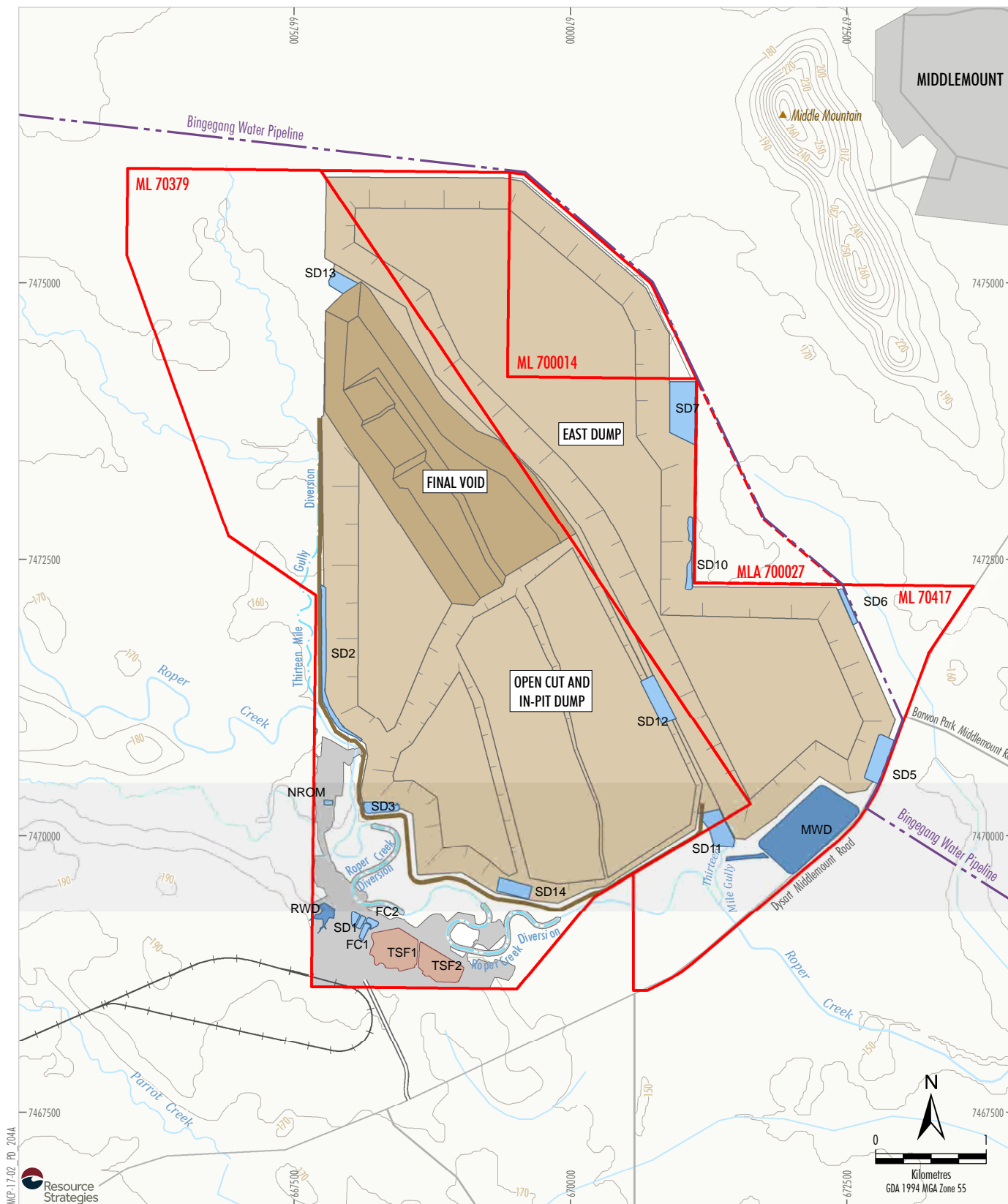
This Preliminary Documentation Report is structured as follows:

Section 1	Provides background to the Action and the assessment requirements.
Section 2	Provides the further information requested by DEE in regard to threatened species and communities.
Section 3	Provides the further information requested by DEE in regard to water resources.
Section 4	Provides the environmental outcomes.
Section 5	Provides consolidated existing and proposed mitigation measures.
Section 6	Provides the further information requested by DEE in regard to ecologically sustainable development.
Section 7	Provides the further information requested by DEE in regard to economic and social impacts.
Section 8	MCPL's environmental record.
Section 9	Provides a conclusion of the information provided in this document.
Section 10	Lists the references cited in this document.



WESTERN EXTENSION PROJECT
Regional Location

Figure 1



Source: MCPL (2018); Department of Natural Resources and Mines (2017); Environmental Authority (EPML00716913) MCPL

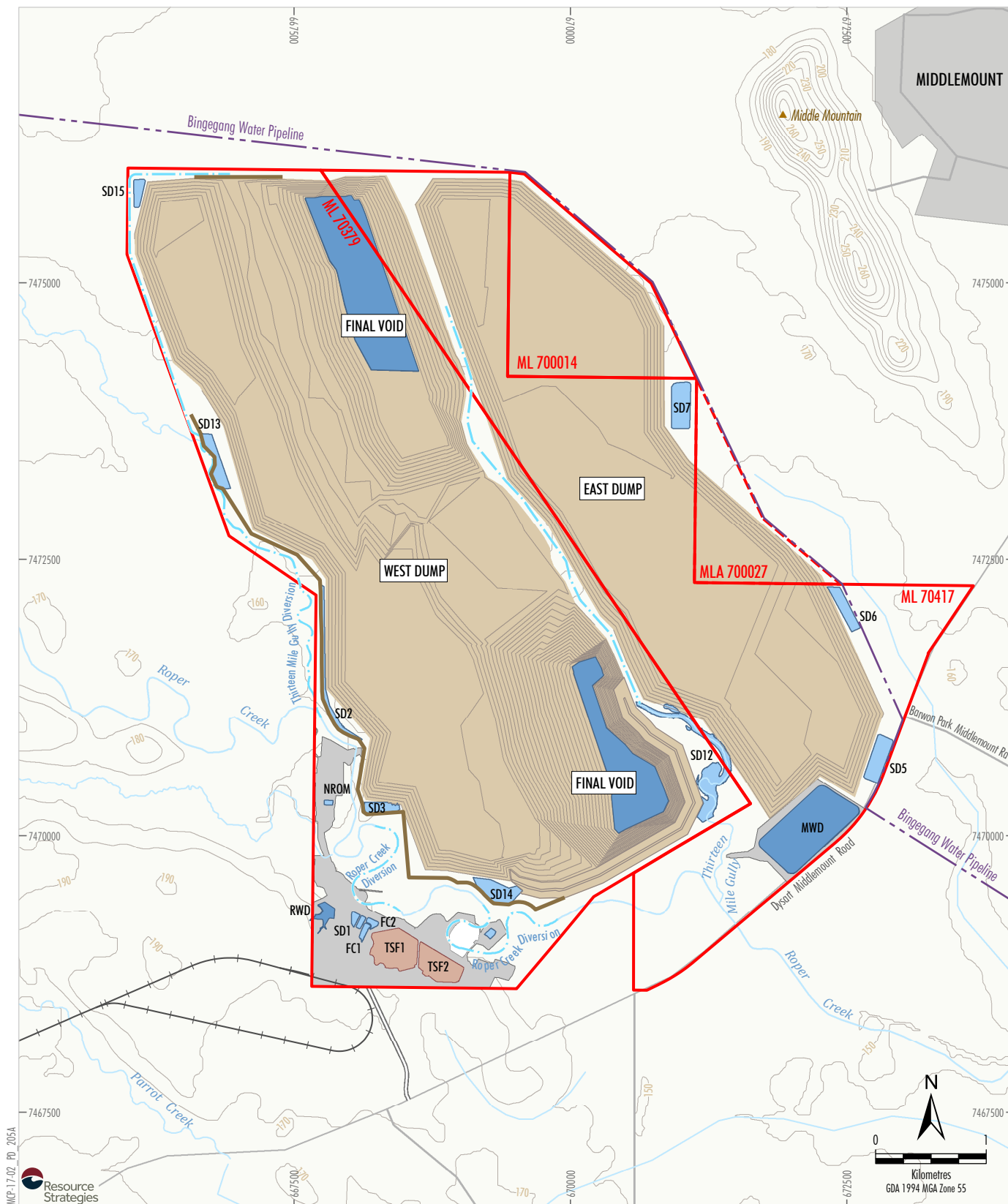
middlemount coal

WESTERN EXTENSION PROJECT

Existing/Approved Middlemount Coal Mine

General Arrangement

Figure 2



Source: MCPL (2018); Department of Natural Resources and Mines (2017)



WESTERN EXTENSION PROJECT Project General Arrangement

Figure 3

1.1 THE EXISTING MIDDLEMOUNT COAL MINE

Full scale operations at the Middlemount Coal Mine commenced July 2011. Middlemount Coal Mine extracts run-of-mine (ROM) coal using a conventional truck and shovel fleet supported by dozer mining. The currently approved general arrangement of the mine within Mining Lease (ML) 70379, ML 70417 and ML 700014 is shown on Figure 2.

Three primary seams of the Rangal Coal Measures are targeted for mining, specifically the Middlemount, Pisces and Tralee Seams. ROM coal is mined in a general west to east direction within ML 70379 and ML 70417. Overburden and interburden material is emplaced in-pit behind the advancing open cut operations, and within the East Dump, located within ML 70417 and ML 700014.

ROM coal is processed through a coal handling and preparation plant (CHPP) to produce approximately 4.1 million tonnes per annum (Mtpa) of pulverised coal injection (PCI) and coking coal for the export market. Product coal is transported by rail to the Dalrymple Bay Coal Terminal, Abbot Point Port or Wiggins Island Coal Export Terminal. The existing Middlemount Coal Mine will operate until approximately 2031.

As described in Section 1, the Middlemount Coal Mine operates under EA EPML00716913. The Middlemount Coal Mine also has two current EPBC Act approvals. The first EPBC Act approval is for the Middlemount Coal Project Stage 2 (EPBC 2010/5394). MCPL lodged a referral for the Middlemount Coal Project Stage 2 on 10 March 2010. On 16 April 2010, a delegate of the Commonwealth Minister declared Stage 2 to be a controlled action for the purposes of the EPBC Act, with the controlling provisions of listed threatened species and communities (sections 18 and 18A). On 7 September 2012, Middlemount Coal Project Stage 2 was approved under the EPBC Act with conditions relating to Brigalow (*Acacia harpophylla* dominant and co-dominant) Endangered Ecological Community (Brigalow EEC), Squatter Pigeon (southern) (*Geophaps scripta scripta*) and Ornamental Snake (*Denisonia maculata*).

The second EPBC Act approval is for the North-eastern Extension (an extension to the East Dump). MCPL lodged a referral for the North-eastern Extension on 6 June 2016 (EPBC 2016/7717). On 7 July 2017, a delegate of the Commonwealth Minister declared the North-eastern Extension to be a controlled action, with the controlling provisions of listed threatened species and communities (sections 18 and 18A). On 29 March 2017, the North-eastern Extension was approved under the EPBC Act with conditions relating to Squatter Pigeon (southern) and South-eastern Long-eared Bat (*Nyctophilus corbeni*).

The existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced.

1.2 PROPOSED ACTIONS AND ALTERNATIVES

1.2.1 Proposed Action

In May 2017, ML 70379 was extended to the north-west of currently approved operations at the Middlemount Coal Mine (via a realignment of the ML 70379 boundary) in an area previously covered by ML 1831, a lease held jointly by Anglo Coal (German Creek Pty Ltd), Mitsui German Creek Investment Pty Limited and Jena Pty Limited (collectively, Anglo Coal)¹.

¹ Anglo Coal's ML 1831 was for sub-surface rights only in the extended portion of ML 70379. In June 2018, MCPL intend to apply for surface rights in the extended portion of ML 70379.

The Action involves extension of operations within the extended portion of ML 70379 and extension of the East Dump within MLA 700027. The Action includes the following main activities:

- extension of the open cut pit within ML 70379 and ML 70417 to the north-west;
- placement of waste rock in existing emplacements, expanded emplacements (including the East Dump) and within the mined-out void;
- progressive development of sediment dams, pipelines and other water management equipment and structures (including levees and realignment of an existing diversion structure);
- progressive development of new haul roads and internal roads;
- continued development of soil stockpiles, laydown areas and borrow areas;
- continued use of existing and approved supporting mine infrastructure;
- extension of the approved mine life by approximately six years (to 2037); and
- a change to the final landform for the end of the mine life.

The approximate extents of the Action open cut mining components (including open cut pits, waste rock emplacements, coal rejects emplacement structures and final voids) are shown on Figure 3. The Action area is approximately 571 ha in size.

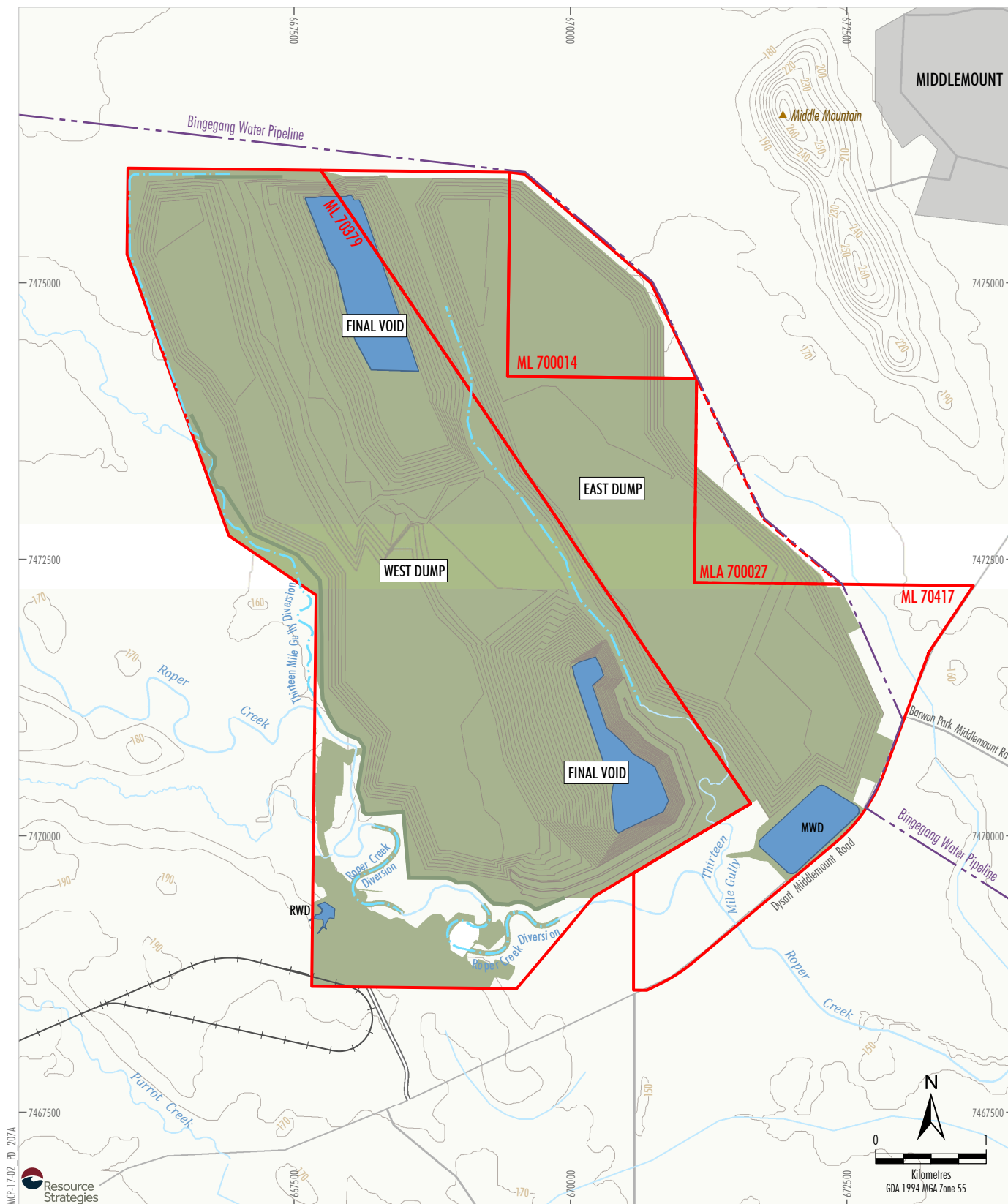
The ownership of land in the Action area and immediate surrounds is shown on Figure 4. The conceptual general arrangement post-mining is shown on Figure 5.

The EPBC Act referral for the Action is provided in Attachment A.

1.2.2 Alternatives Considered

There are no alternatives sought as part of the Action proposed. Alternatives to the proposed Action including the location and design elements were considered by MCPL, along with the option of not proceeding with the Action. An overview of some considerations is provided below:

- **Action location** – The presence of the existing open cut mining area, the extent of current mining tenements, land tenure and the presence of existing approved offset areas to the west of the Middlemount Coal Action determines the location of the Action.
- **Design elements** – The Action would result in changes to the existing final void in the northern area of the open cut extent, and creation of an additional final void in the southern area of the open cut extent, upon completion of mining operations (Figure 3). This proposed final void arrangement is generally in accordance with the MCPL Residual Void Study (MCPL, 2014) submitted to the Department of Environment and Heritage Protection (DEHP) (now Department of Environment and Science [DES]) in January 2015. Filling the final void was considered, however, the cost to rehandle spoil material from the out of pit emplacements to the final voids would be prohibitive and delay rehabilitation, and as such, it is not proposed as part of the Action.
- **No Action** – MCPL has considered not undertaking the Action. However, in the event that the Action is not developed, MCPL would forgo opportunities to improve mining efficiency and rehabilitation outcomes at the Middlemount Coal Mine. Were the Action not to proceed, the following consequences are inferred:
 - The existing Middlemount Coal Mine would continue to operate, as approved, until 2031.
 - An incremental net benefit of approximately \$202 million (M) (in net present value [NPV] terms) to MCPL would be foregone.



Source: MCPL (2018); AGE (2018); Department of Natural Resources and Mines (2017)



WESTERN EXTENSION PROJECT Conceptual General Arrangement Post-mining

Figure 5

- Additional tax revenue to the State of Qld of approximately \$97.5M (in NPV terms) would not be generated.
- The additional potential environmental impacts for the Action described would not occur.
- The additional surface development area would not be disturbed and therefore the additional biodiversity offset areas would not be established.

1.3 ASSESSMENT REQUIREMENTS

This section provides a reconciliation of the assessment requirements against this document.

1.3.1 Department of Environment and Energy Information Request

Table 1 provides the assessment requirements provided by the DEE (7 March 2018) (Attachment B) and the corresponding section in this document where the information is provided.

Table 1
Middlemount Coal – Department of Environment and Energy Information Request

Section	Comment	Section Reference
1	<p><i>Alternatives to the proposal</i></p> <p><i>This section must provide a full description of the action and describe, to the extent reasonably practicable, any prudent and feasible alternatives to the action. For each alternative listed, the proponent must provide the project details, impacts (positive and negative), location, scale, configuration and staging options. Sufficient detail must be provided to make clear why any alternative is preferred to another.</i></p>	Sections 1.2.1 and 1.2.2
2	<p><i>Addressing Matters of National Environmental Significance</i></p> <p><i>The project is considered likely to have impacts to:</i></p> <ul style="list-style-type: none"> • s 18 & s 18A - listed threatened species and communities • s24D & s24E - a water resource, in relation to coal seam gas development and large coal mining development <p><i>The information required by the Department regarding each matter is explained below.</i></p> <p><u>Listed threatened species and communities</u></p> <p><i>The project is considered likely to impact on, but is not limited to:</i></p> <ul style="list-style-type: none"> • Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) ecological community - endangered • Koala (<i>Phascolarctos cinereus</i>)(Combined populations of Queensland, New South Wales and the Australian Capital Territory) - vulnerable • Greater Glider (<i>Petauroides volans</i>) - vulnerable • Squatter Pigeon (southern)(<i>Geophaps scripta scripta</i>) - vulnerable • Ornamental Snake (<i>Denisonia maculata</i>) - vulnerable • Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) - vulnerable <p><i>In order to undertake an assessment of these impacts, the Preliminary Documentation must include</i></p> <ul style="list-style-type: none"> • consideration of all EPBC Act listed threatened species and communities known to be present, likely to be present or for whom suitable habitat exists within the project area • the survey effort undertaken for listed species and how these are consistent with Departmental survey guidelines <ul style="list-style-type: none"> - if Departmental survey guidelines are not available, details of what best practice guidelines have been used and how they have been applied • detailed mapping of the project site showing known and potential habitat for listed threatened species • the area (in hectares), quality and location of this habitat in relation to the proposed action disturbance area 	<p>Section 2</p> <p>Section 3</p> <p>Section 2</p> <p>Section 2, Attachment C</p> <p>Sections 2.1 to 2.5, Attachment C</p> <p>Figures 8 to 10, 12 to 16</p> <p>Sections 2.1 to 2.5, Table 8, Attachment C</p>

Table 1 (Continued)
Middlemount Coal – Department of Environment and Energy Information Request

Section	Comment	Section Reference
	<p><i>The impacts, including direct, indirect and consequential to listed threatened species and their habitat and endangered ecological community must be assessed in accordance with the relevant departmental policy and guidelines.</i></p> <p><u>Cumulative impacts</u></p> <p><i>The Preliminary Documentation must identify and address potential and likely cumulative impacts resulting from the project. Cumulative impacts include where potential project impacts are in addition to existing impacts of other activities (including known potential future expansions or developments by the proponent and other proponents in the vicinity). Where relevant to the potential impact, risk assessment must be conducted and documented. The risk evaluation must also include known potential future expansions or developments by the proponent and other proponents in the vicinity of the proposed action.</i></p> <p><u>Avoidance, safeguards and mitigation measures for impacts to listed threatened species and communities</u></p> <p><i>The Preliminary Documentation must provide information on avoidance measures, proposed safeguards and mitigation measures to minimise the impacts to listed threatened species and communities posed by the project. Specific and detailed descriptions of proposed measures must be provided and substantiated, based on best available practices. The current best available practices used to inform your mitigation measures should be named within the Preliminary Documentation.</i></p> <p><u>A water resource, with respect to coal seam gas and large coal mines</u></p> <p><u>Modelling</u></p> <p><i>Modelling (including conceptual modelling) must be undertaken to provide an understanding of the potential impacts to groundwater and surface water resources. Models should be developed at an appropriate spatial (local vs regional) and temporal (life-of-project or longer if impacts are predicted) scale to fulfil a specific purpose such as understanding potential impacts to a particular water resource or water-dependent asset. This purpose should inform the model design and assumptions which should be clearly described and justified in the Preliminary Documentation. Any model should be constructed in accordance with the conceptual model, and calibrated and verified with appropriate baseline data. Modelling of groundwater and final voids must consider the characteristics of the Jellinbah Fault.</i></p> <p><u>Surface Water/Groundwater assessment</u></p> <p><i>The project is considered likely to have impacts to a water resource as a result of groundwater drawdown and the diversion of a water course. Depending on the nature and characteristic of the fault at this location, the fault may introduce a high risk to groundwater resources, providing a conduit/ preferential pathway for the movement of final void water into surrounding groundwater.</i></p> <p><i>Adequate geological surveys including fault characterisation, risk assessment and groundwater modelling, including the impact of hydraulic loading, need to be undertaken to assess and determine the level of risk.</i></p> <p><i>The Preliminary Documentation must also include an assessment of the direct, indirect and consequential impacts to surface water resources. This assessment must take account of all impacts to downstream users of this resource, as a result of the construction, operation and decommissioning of the Middlemount Coal Mine - Western Extension Project.</i></p> <p><i>Further, the Preliminary Documentation must also include an assessment of the direct, indirect and consequential impacts to all groundwater resources as a result of groundwater drawdown, as well as impacts to groundwater and surface water connectivity.</i></p> <p><i>You must also include an assessment of the design of final voids and how the design will minimise impacts, as well as an assessment of the water quality of those voids. Your assessment of voids must take into account any changes that will be made to the approved northern final void as a result of this extension.</i></p> <p><u>Groundwater Dependent Ecosystems</u></p> <p><i>Under the EPBC Act, you must consider impacts to all listed groundwater dependent ecosystems (GDEs). This assessment must include an assessment of direct, indirect and consequential impacts to GDEs. You must consider both surface water and groundwater impacts to GDEs within the proposed action area and beyond the project boundary, such as GDEs that may be downstream of the proposed action but impacted by the action regardless of proximity to it.</i></p>	<p>Sections 2.1 to 2.5</p> <p>Sections 2.1 to 2.5 and 2.8</p> <p>Section 2.9</p> <p>Section 3.7, Attachments D, E and F</p> <p>Sections 3.2, 3.3 and 3.9, Attachments D, E and F</p> <p>Section 3.2, Attachments E and F</p> <p>Sections 3.9 and 3.10, Attachment D</p> <p>Sections 3.9 and 3.10, Attachments E and F</p> <p>Section 3.8.3, Attachments E and F</p> <p>Sections 3.6.2 and 3.8.2, Attachments E and F</p>

Table 1 (Continued)
Middlemount Coal – Department of Environment and Energy Information Request

Section	Comment	Section Reference
	<p><u>Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development</u></p> <p>The project will require submission to the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC). The Information Guidelines for Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals (Guidelines) outlining the requirements for submission to the IESC can be found at the website below.</p> <p>http://www.iesc.environment.gov.au/publications/information-guidelines-independent-expertscientific-committee-advice-coal-seam-gas</p> <p>The responses you provide to our request for information form part of the IESC submission. You must complete the checklist in the Guidelines to ensure that the information requirements for the IESC review have been addressed in the Preliminary Documentation. The IESC will provide advice to the Department and the Department will forward the advice to you.</p> <p>You must include the IESC advice and your response to that advice in the Preliminary Documentation package that will be published for public comment.</p> <p><u>Cumulative impacts</u></p> <p>The Preliminary Documentation must identify and address potential and likely cumulative impacts resulting from the project. Cumulative impacts include where potential project impacts are in addition to existing impacts of other activities (including known potential future expansions or developments by the proponent and other proponents in the vicinity). Where relevant to the potential impact, risk assessment must be conducted and documented. The risk evaluation must also include known potential future expansions or developments by the proponent and other proponents in the vicinity of the proposed action.</p> <p><u>Avoidance, safeguards and mitigation measures for impacts to a water resource</u></p> <p>The Preliminary Documentation must provide information on avoidance measures, proposed safeguards and mitigation measures to minimise the impacts to a water resource posed by the project. Specific and detailed descriptions of proposed measures must be provided and substantiated, based on best available practices. The current best available practices used to inform your mitigation measures should be named within the Preliminary Documentation.</p>	<p>Refer to Table 2, Attachments D, E and F</p> <p>Section 3.10, Attachments D, E and F</p> <p>Section 3.11, Attachments D, E and F</p>
3	<p><u>Environmental Outcomes</u></p> <p>The Preliminary Documentation should provide information on the outcomes that will be achieved for matters of national environmental significance (MNES). Outcomes need to be specific, measurable and achievable and must be based on robust baseline data.</p> <p>Outcomes must be developed in consideration of the <u>Outcomes-based Conditions Policy 2016</u> and <u>Outcomes-based Conditions Guidance 2016</u>, with suitable justification for consideration identified in the policy and guidance. To allow for application of outcomes-based conditions, the Preliminary Documentation should include:</p> <p>(a) The specific environmental outcomes to be achieved, and how they relate to relevant Recovery plans, Conservation advices and Threat Abatement Plans.</p> <p>(b) For each proposed outcome:</p> <ul style="list-style-type: none"> • Demonstrated willingness and capability to achieve the outcome, as well as the risks associated with that success • The measurability of the outcome, including all suitable performance measures • Appropriate baseline data upon which the outcome has been defined and justified • The likely impacts that the proposed outcome will address • Commitments to independent and periodic audits of performance towards achieving outcomes • Details of proposed management to achieve the outcome including, but not limited to, performance indicators, periodic milestones, proposed monitoring and adaptive management and record keeping, publication and reporting processes 	<p>Section 4</p>

Table 1 (Continued)
Middlemount Coal – Department of Environment and Energy Information Request

Section	Comment	Section Reference
4	<p><i>Consolidated Migration Measures and Environmental Management Plans</i></p> <p><i>The Preliminary Documentation must include:</i></p> <p>(a) <i>A consolidated list of mitigation measures proposed to be undertaken to avoid, minimise or compensate for the relevant impacts of the action, including:</i></p> <ul style="list-style-type: none"> <i>a description of proposed safeguards and mitigation measures to address relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent</i> <i>assessment of the expected or predicted effectiveness of the mitigation measures</i> <i>any statutory or policy basis for the mitigation measures</i> <p><i>The consolidated list should address all MNES impacted by this project.</i></p> <p>(b) <i>A detailed outline of an Environmental Management Plan (EMP) that sets out the framework for management, mitigation and monitoring of relevant impacts of the action, including any provisions for independent environmental auditing.</i></p> <p><i>The EMP needs to address the project phases (construction, operation, decommissioning) separately. It must state the environmental objectives, performance criteria, monitoring, reporting, corrective action, responsibility and timing for each environmental issue.</i></p> <p><i>The EMP should also describe contingencies for events such as failure of sewerage systems or levee systems, heavy or prolonged rainfall or saltwater intrusion into groundwater.</i></p> <p><i>The EMP must be prepared in accordance with the Department's Environmental Management Plan Guidelines (2014).</i></p> <p>http://www.environment.gov.au/epbc/publications/environmental-management-planguidelines</p> <p>(c) <i>The name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.</i></p> <p><i>If you provide this information in an EMP then the plan must set out the framework for management, mitigation and monitoring of relevant impacts, including any provisions for independent environmental auditing.</i></p> <p><i>Where you are indicating commitment to taking an action within your mitigation measures or Environmental Management Plans, the language used should state 'will' and 'must' and avoid 'could', 'would', 'should', 'possibly' and 'where practicable'.</i></p>	Section 5
5	<p><i>Environmental Offsets</i></p> <p><i>The Preliminary Documentation must include an Offset Management Plan. The Offset Management Plan must include:</i></p> <ul style="list-style-type: none"> <i>details of the location of the offset areas proposed to compensate for the loss of habitat for listed threatened species</i> <i>a description of the current condition (prior to any management activities) of the proposed offset area, including existing vegetation (the baseline condition) and value as habitat for listed threatened species</i> <i>a map to clearly define the location and boundaries of the offset area, including the offset attributes and a shapefile</i> <i>details of how the offset areas provide connectivity with other relevant habitats and biodiversity corridors</i> <i>a description of the management measures that will be implemented, including a timeline for when management measures will be implemented</i> <i>a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria</i> <i>details of the tenure proposed for the offset area to ensure it is protected in perpetuity</i> <p><i>Offsets for listed threatened species must be in accordance with the Department's Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act) Environmental Offsets Policy (October 2012) and Offsets Assessment Guide, available at http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy-2.pdf</i></p>	Sections 2.8 to 2.11

Table 1 (Continued)
Middlemount Coal – Department of Environment and Energy Information Request

Section	Comment	Section Reference
6	<p><i>Ecologically Sustainable Development (ESD)</i></p> <p><i>Please include a brief discussion of how the proposal will conform to the principles of Ecological Sustainable Development. To assist you, the National Strategy for Ecologically Sustainable Development (1992) is available on the following web site:</i></p> <p><i>http://www.environment.gov.au/resource/national-strategy-ecologically-sustainabledevelopment</i></p>	Section 6
7	<p><i>Economic and Social Matters</i></p> <p><i>The economic and social impacts of the action, both positive and negative, must be analysed. Matters of interest may include:</i></p> <ul style="list-style-type: none"> <i>details of any public consultation activities undertaken and their outcomes</i> <i>details of any consultation with Indigenous stakeholders</i> <i>projected economic costs and benefits of the project, including the basis for their estimate through cost/benefit analysis or similar studies</i> <i>employment opportunities expected to be generated by the project (including construction and operational phases)</i> <p><i>Economic and social impacts should be considered at the local, regional and national levels.</i></p>	Section 7
8	<p><i>Environmental Record of person(s) proposing to take the action</i></p> <p><i>Please include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:</i></p> <ul style="list-style-type: none"> <i>the person proposing to take the action</i> <i>for an action for which a person has applied for a permit, the person making the application</i> 	Section 8

1.3.2 IESC Guideline Cross Reference Table

This report also provides a reference list of the requirements outlined in the *Information Guidelines for the Independent Expert Scientific Committee Advice on Coal Seam Gas and Large Coal Mining Development Proposals* (Independent Expert Scientific Committee [IESC], 2018) and the corresponding section of this report where the requirements are addressed (Table 2).

Table 2
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
Description of the Proposal	
Provide a regional overview of the proposed project area including a description of the:	
• geological basin;	Section 3.2, Attachment E
• coal resource;	Section 3.2
• surface water catchments;	Section 3.1, Attachment D
• groundwater systems;	Section 3.3, Attachment E
• water-dependent assets; and	Section 3.4, Attachments D and E
• past, present and reasonably foreseeable coal mining and CSG developments.	Section 3.5
Describe the statutory context, including information on the proposal's status within the regulatory assessment process and any applicable water management policies or regulations.	Section 3

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
<i>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.</i>	Sections 1.1 and 1.2, Attachments C and D
<i>Describe how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.</i>	Sections 3 and 3.1
Risk Assessment	
<i>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.</i>	Sections 3.4, 3.8 and 3.9, Attachments D, E and F
<i>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.</i>	Sections 3.8 and 3.9, Attachments D and E
<i>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.</i>	Section 3.7, Attachments D and E
<i>The risk assessment should include an assessment of:</i> <ul style="list-style-type: none"> <i>all potential cumulative impacts which could affect water resources and water-related assets; and</i> <i>mitigation and management options which the proponent could implement to reduce these impacts.</i> 	Sections 3.8 to 3.11, Attachments D and E
Groundwater – Context and Conceptualisation	
<i>Describe and map geology at an appropriate level of horizontal and vertical resolution including:</i> <ul style="list-style-type: none"> <i>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.</i> <i>geological maps appropriately annotated with symbols that denote fault type, throw and the parts of sequences the faults intersect or displace.</i> 	Section 3.2, Attachment E
<i>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.</i> <ul style="list-style-type: none"> <i>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).</i> <i>Discussion on how this fits into the fault's potential influence on regional-scale groundwater conditions should also be included.</i> 	Sections 3.2, 3.3 and 3.8, Attachment E
<i>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.</i>	Sections 3.3, 3.6 and 3.7.3, Attachment E
<i>Provide time series level and water quality data representative of seasonal and climatic cycles.</i>	Section 3.6, Attachments D and E
<i>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.</i>	Section 3.7.3, Attachment E
<i>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.</i>	Sections 3.6 and 3.7, Attachments D and E
<i>Describe the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.</i>	Section 3.7, Attachments D and E
<i>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.</i>	Section 3.7, Attachments D and E
Groundwater – Analytical and Numerical Modelling	
<i>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.</i>	Section 3.7, Attachments E and F

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
<i>Undertaken groundwater modelling in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al. 2012), including independent peer review</i>	Section 3.7.3, Attachment E
<i>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).</i>	Section 3.7, Attachment E
<i>Describe each hydrogeological unit as incorporated in the groundwater model, including the thickness, storage and hydraulic characteristics, and linkages between units, if any.</i>	Section 3.7.3, Attachment E
<i>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.</i>	Sections 3.7 and 3.8, Attachment E
<i>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.</i>	Section 3.9, Attachment E
<i>Identify the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.</i>	Section 3.8, Attachment E
<i>Undertake model verification with past and/or existing site monitoring data.</i>	Section 3.7, Attachment E
<i>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.</i>	Sections 3.6 and 3.7, Attachment E
<i>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</i>	Section 3.7, Attachment E
<i>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 [in press]).</i>	Section 3.7, Attachment E
<i>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.</i>	Sections 3.6 and 3.7, Attachment E
<i>Undertake an uncertainty analysis of model construction, data, conceptualisation and predictions (see Middlemis and Peeters [in press]).</i>	Section 3.7, Attachment E
<i>Provide a program for review and update of models as more data and information become available, including reporting requirements.</i>	Section 3.11, Attachment E
<i>Provide information on the magnitude and time for maximum drawdown and post-development drawdown equilibrium to be reached.</i>	Section 3.8, Attachment E
Groundwater – Impacts to Water Resources and Water-dependent Assets	
<i>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:</i> <ul style="list-style-type: none"> <i>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, interaquifer connectivity and connectivity with sea water.</i> <i>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.</i> <i>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.</i> <i>the possible fracturing of and other damage to confining layers.</i> <i>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.</i> 	Sections 3.8 and 3.10, Attachment E
<i>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.</i>	Sections 3.4, 3.8 and 3.10, Attachment E
<i>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.</i>	Sections 3.4, 3.8 and 3.10, Attachment E

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
<i>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.</i>	Sections 3.6, 3.7 and 3.11, Attachment E
<i>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.</i>	Section 3.10.2, Attachment E
<i>Describe proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.</i>	Section 3.11, Attachment E
<i>Provide a description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.</i>	Section 3.11, Attachment E
Groundwater – Data and Monitoring	
<i>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.</i>	Section 3.6, Attachment E
<i>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.</i>	Section 3.11.4, Attachment E
<i>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.</i>	Sections 3.6, 3.7 and 3.11, Attachment E
<i>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.</i>	Section 3.6, Attachment E
<i>Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZECC/ARMCANZ 2000) and relevant legislated state protocols (e.g. Qld Government 2013).</i>	Section 3.6, Attachment E
Surface Water – Context and Conceptualisation	
<i>Describe the hydrological regime of all watercourses, standing waters and springs across the site including:</i> <ul style="list-style-type: none"> • 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 3.1, 3.6 and 3.7, Attachment D
<i>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.</i>	Sections 3.1 and 3.7, Attachment D
<i>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.</i>	Sections 3.3 and 3.6, Attachments D and E
Surface Water – Analytical and Numerical Modelling	
<i>Provide conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.</i>	Section 3.7, Attachment D
<i>Use methods in accordance with the most recent publication of Australian Rainfall and Runoff (Ball et al. 2016).</i>	Section 3.7.2, Attachment D
<i>Develop and describe a program for review and update of the models as more data and information becomes available.</i>	Section 3.11, Attachment D
<i>Describe and justify model assumptions and limitations, and calibrate with appropriate surface water monitoring data.</i>	Section 3.7, Attachment D
<i>Provide an assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios.</i>	Section 3.11.2, Attachment D
<i>Provide a detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.</i>	Sections 3.7.1, Attachment D

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
Surface Water – 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: <ul style="list-style-type: none"> 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. 	Sections 3.3, 3.9 and 3.10, Attachment D
Discuss existing water quality guidelines, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.	Section 3.4, Attachment D
Identify processes to determine surface water quality guidelines and quantity thresholds which incorporate seasonal variation but provide early indication of potential impacts to assets.	Sections 3.4 and 3.11, Attachment D
Propose mitigation actions for each identified significant impact.	Section 3.11, Attachment D
Describe the adequacy of proposed measures to prevent or minimise impacts on water resources and water-dependent assets.	Section 3.11, Attachment D
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.	Section 3.10, Attachment D
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.	Section 3.8.1, Attachment D
Surface Water – 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 3.6, Attachment D
Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZECC/ARMCANZ 2000) and relevant legislated state protocols (e.g. Qld Government 2013).	Section 3.6, Attachment D
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 3.6 and 3.7, Attachment D
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: <ul style="list-style-type: none"> 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. 	Sections 3.6 and 3.11, Attachment D
Describe the rationale for selected monitoring parameters, duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor largescale impacts.	Sections 3.6 and 3.11, Attachment D
Develop and describe a plan for ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	Not Required
Identify dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of the proposed project and beyond.	Sections 3.6 and 3.11, Attachment D

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
Water-dependent Assets – Context and Conceptualisation	
Identify water-dependent assets, including: <ul style="list-style-type: none"> water-dependent fauna and flora and provide surveys of habitat, flora and fauna (including stygofauna) (see Doody et al. [in press]). public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource 	Section 3.4, Attachment D
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. [in press]).	Sections 3.6.2 and 3.8.2, Attachments D and E
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).	Sections 3.4 and 3.8.2, Attachments D and E
Estimate the ecological water requirements of identified GDEs and other water-dependent assets (see Doody et al. [in press]).	Sections 3.6.2 and 3.8.2, Attachments D and E
Identify the hydrogeological units on which any identified GDEs are dependent (see Doody et al. [in press]).	Sections 3.6.2 and 3.8.2, Attachments D and E
Provide an outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.	Sections 3.4 and 3.8.2, Attachments D and E
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).	Sections 3.4, 3.6 and 3.11, Attachments D and E
Water-dependent Assets – 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. [in press]).	Sections 3.4, 3.6 and 3.9, Attachments D and E
Describe the potential range of drawdown at each affected bore, and clearly articulate of the scale of impacts to other water users.	Section 3.8.2, Attachments D and E
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 3.9.2, Attachment E
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.	Sections 3.8 and 3.9, Attachments D and E
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 3.8 and 3.9, Attachments D and E
Assess the overall level of risk to water-dependent assets through combining probability of occurrence with severity of impact.	Sections 3.9 and 3.10
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.	Sections 3.4, 3.6, 3.8 and 3.9, Attachments D and E
Propose mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	Section 3.11, Attachments D and E
Water-dependent Assets – 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. [in press]).	Sections 3.6 and 3.11, Attachments D and E

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
<i>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. [in press]).</i>	Sections 3.6 and 3.11, Attachments D and E
<i>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. [in press]).</i>	Sections 3.6 and 3.11, Attachments D and E
<i>Describe the proposed process for regular reporting, review and revisions to the monitoring program</i>	Sections 3.6 and 3.11, Attachments D and E
<i>Ensure ecological monitoring complies with relevant state or national monitoring guidelines (e.g. the DSITI guideline for sampling stygofauna (Qld Government 2015)).</i>	Sections 3.6 and 3.11, Attachments D and E
Water and Salt Balance, and Water Quality	
<i>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.</i>	Section 3.7.1, Attachment D
<i>Describe the water requirements and on-site water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.</i>	Section 3.7.1, Attachment D
<i>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.</i>	Section 3.8, Attachment D
<i>Provide salt balance modelling that includes stores and the movement of salt between stores, and takes into account seasonal and long-term variation.</i>	Section 3.9, Attachment D
Cumulative Impacts – Context and Conceptualisation	
<i>Provide cumulative impact analysis with sufficient geographic and temporal boundaries to include all potentially significant water-related impacts.</i>	Section 3.10, Attachments D and E
<i>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.</i>	Section 3.10, Attachments D and E
Cumulative Impacts – Impacts	
<i>Provide an assessment of the condition of affected water resources which includes:</i> <ul style="list-style-type: none"> <i>identification of all water resources likely to be cumulatively impacted by the proposed development;</i> <i>a description of the current condition and quality of water resources and information on condition trends;</i> <i>identification of ecological characteristics, processes, conditions, trends and values of water resources;</i> <i>adequate water and salt balances; and,</i> <i>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).</i> 	Sections 3.4, 3.6, 3.8, 3.9, 3.10 and 3.11, Attachments D and E
<i>Assess the cumulative impacts to water resources considering:</i> <ul style="list-style-type: none"> <i>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;</i> <i>all stages of the development, including exploration, operations and post closure / decommissioning;</i> <i>appropriately robust, repeatable and transparent methods;</i> <i>the likely spatial magnitude and timeframe over which impacts will occur, and significance of cumulative impacts; and,</i> <i>opportunities to work with other water users to avoid, minimise or mitigate potential cumulative impacts.</i> 	Sections 3.8 to 3.11, Attachments D and E

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
Cumulative Impacts – Mitigation, Monitoring and Management	
<i>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.</i>	Sections 3.10 and 3.11, Attachments D and E
<i>Identify measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies.</i>	Sections 3.10 and 3.11, Attachments D and E
<i>Identify cumulative impact environmental objectives.</i>	Sections 3.10 and 3.11, Attachments D and E
<i>Describe appropriate reporting mechanisms.</i>	Sections 3.10 and 3.11, Attachments D and E
<i>Propose adaptive management measures and management responses.</i>	Sections 3.10 and 3.11, Attachments D and E
Subsidence – Underground Coal Mines and Coal Seam Gas	Not applicable.
Final Landforms and Voids – Coal Mines	
<i>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.</i>	Section 3.8.3, Attachments D and E
<i>Assess the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.</i>	Sections 3.7 to 3.9, Attachments D, E and F
<i>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.</i>	Section 3.8.3, Attachment E
<i>Evaluate mitigating inflows of saline groundwater by planning for partial backfilling of final voids.</i>	Section 3.8.3, Attachment E
<i>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:</i> <ul style="list-style-type: none"> • 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. <i>For other final landform options considered sufficient detail of potential impacts should be provided to clearly justify the proposed option.</i>	Sections 3.4, 3.8 and 3.9, Attachments D and E
<i>Assess the probability of overtopping of final voids with variable climate extremes, and management mitigations.</i>	Section 3.8.3, Attachment D
Acid-forming Materials and Other Contaminants of Concern	
<i>Identify the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).</i>	Section 3.9, Attachments D and E
<i>Identify the presence and volume of potentially acid-forming waste rock, fine-grained amorphous sulphide minerals and coal reject/tailings material and exposure pathways.</i>	Section 3.9, Attachments D and E
<i>Identify other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.</i>	Section 3.9, Attachments D and E
<i>Describe handling and storage plans for acid-forming material (co-disposal, tailings dam, and encapsulation).</i>	Section 3.9, Attachments D and E

Table 2 (Continued)
IESC Guideline Cross Reference Table

Specific Information Needs	Section Addressed
<i>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.</i>	Section 3.9, Attachments D and E
<i>Describe proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.</i>	Section 3.9 and 3.11, Attachments D and E
CSG Well Construction and Operation	Not applicable.

2 LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

Regional and Local Setting

The Project area is located in the Isaac-Comet Downs subregion of the Brigalow Belt North Bioregion. This bioregion extends from Townsville in Qld to the south of Dubbo in central-western NSW. The nearest protected area is Junee National Park which occurs approximately 30 km to the east. Bundoora State Forest is located approximately 25 km to the south-west of the Action area.

In a local context, the Action area is situated predominantly in the Roper Creek catchment within the Fitzroy Basin, which drains an area of approximately 150,000 square kilometres (km²) (Section 3.1). Clearing for cattle grazing in the region has been extensive, and, as such, the Action area contains cleared areas that are currently grazed or have been grazed in the past. Cattle grazing has also resulted in the establishment of fences and stock dams within the Action area (Attachment C).

Terrestrial Ecology Surveys

The terrestrial flora and fauna in the Action area and surrounds has been subject to multiple studies since 2009. The first surveys were undertaken by Parsons Brinkerhoff (2010a) for the Middlemount Coal Mine Stage 1 Project in November 2009 and February/March 2010. These surveys have since been supplemented by surveys over the existing biodiversity offset areas undertaken by Ecology and Heritage Partners (2012) in July and August 2012, and across the Action area and adjacent offset areas by Naturecall Environmental (Naturecall) (2014a; 2015a) in July 2014 and October 2015. Naturecall (2013, 2014, 2015b, 2016a, 2017a) has also conducted annual monitoring in the existing MCPL offset areas to the west of the Action, which provides additional information on the likely occurrence of flora and fauna in the Action area.

Most recently, Biodiversity Australia undertook additional flora and fauna surveys in a study area covering the Action area and surrounds (Attachment C). Flora surveys were undertaken in May and July 2017 and the fauna surveys were undertaken in May, July and September 2017 (Attachment C).

A comprehensive desktop study was carried out prior to the field survey as detailed in Attachment C which identified potentially occurring threatened species and communities under the EPBC Act.

The flora surveys were undertaken in accordance with the Qld Herbarium vegetation survey methods described in Neldner *et al.* (2017). Survey techniques included a combination of secondary and quaternary surveys, ground-truthing of regional ecosystems (REs), identification of threatened ecological communities under the EPBC Act, targeted searches for conservation significant species listed under the *Nature Conservation Act, 1992* (NC Act) and EPBC Act and random meanders. Terrestrial habitat quality data was also collected in accordance with the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a).

The fauna surveys were conducted in consideration of the relevant Qld and Commonwealth survey guidelines. Survey methods included trapping (i.e. harp traps), bat detection devices, herpetofauna surveys, passive infrared detection cameras, spotlighting, diurnal bird surveys, active searches, call playback, searches for scats and other signs and habitat assessments (Attachment C). Targeted searches for threatened fauna species listed under NC Act and EPBC Act were also conducted (Attachment C).

Fauna surveys were conducted in accordance with the following guidelines:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre *et al.*, 2014).
- *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC], 2011a).
- *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC, 2011b).
- *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010a).
- *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010b).
- *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Qld, NSW and the Australian Capital Territory)* (Department of the Environment [DotE], 2014).
- *EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles* (DSEWPaC, 2011c).
- *Species Profile and Threats Database* (DEE, 2018).

Due to past and ongoing agricultural activities (e.g. clearing, grazing, logging, thinning), the Action area predominately comprises cleared land and vegetation in the early stage of regrowing from past clearance (approximately 66 percent [%], 380.5 hectares [ha]) (Figure 6) (Attachment C).

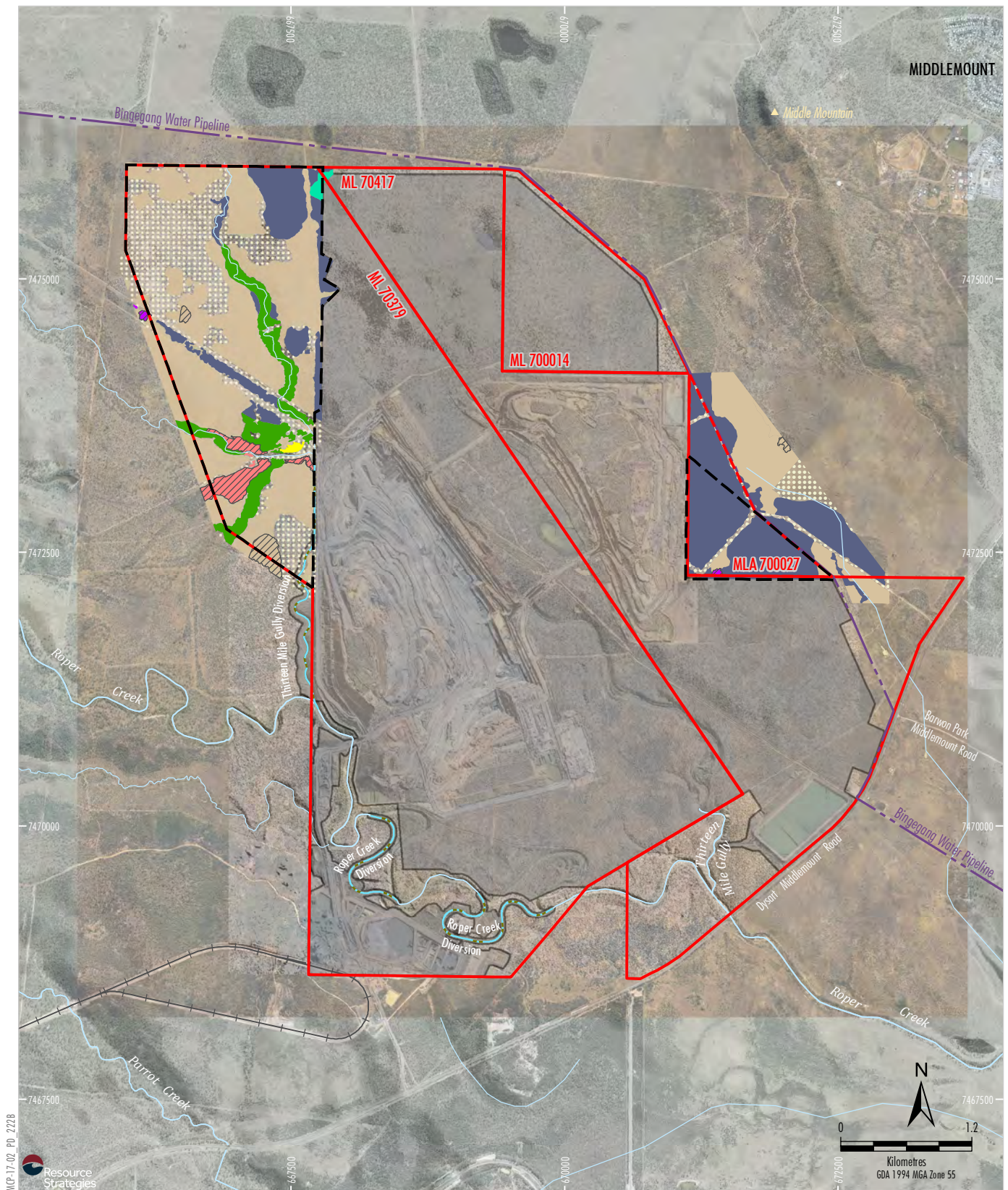
The Action area is approximately 571 ha in size, comprising approximately 190.5 ha of woodland vegetation. A total of six individual vegetation communities were ground-truthed within the Action area (Figure 6; Table 3), represented by Eucalypt woodlands (mostly Poplar Box woodlands) and small occurrences of acacia dominated woodlands (Attachment C). The most predominant vegetation type is Poplar Box (*Eucalyptus populnea*) Woodland (128 ha) (Attachment C). A detailed description of each vegetation community is provided in Attachment C.

Three threatened species and one ecological community listed under the EPBC Act have been recorded in the Action area (Attachment C):

- Squatter Pigeon (southern) (listed as 'Vulnerable' under the EPBC Act and NC Act);
- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) (listed as 'Vulnerable' under the EPBC Act and NC Act);
- Greater Glider (listed as 'Vulnerable' under the EPBC Act and NC Act); and
- Brigalow EEC.

In addition to the above, the Ornamental Snake, listed as 'Vulnerable' under the EPBC Act and NC Act has been previously recorded by Parsons Brinkerhoff (2010a) in the existing/approved mine area. The Middlemount Coal Project Stage 2 was approved under the EPBC Act with conditions relating to the Ornamental Snake among other matters (Section 1.1).

The above listed threatened species and one ecological community are listed threatened species and communities known to be present, likely to be present or for whom suitable habitat exists within the Action area as discussed further in Sections 2.1 to 2.5. The relevance of the Grey-headed Flying-fox (*Pteropus poliocephalus*) and South-eastern Long-eared Bat is discussed further in Sections 2.6 and 2.7.



MP-17-02_PD_222B
Resource Strategies

- LEGEND**
- Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Middlemount Rail Spur and Loop
 - Approved Disturbance Footprint
 - Diversion Structure
 - Western Extension Project
 - Approximate Extent of Additional Surface Disturbance

Regulated Vegetation
(Biodiversity Australia, 2018)

- 11.3.1
- 11.3.2
- 11.3.2/11.3.4
- 11.3.27d
- 11.4.9
- 11.5.3
- Non-remnant (vegetation in the early stages of regrowth from past clearance)
- Cleared land (cleared without regrowth)
- Threatened Ecological Community (Biodiversity Australia, 2018)
- Brigalow

Source: MCPL (2018); Biodiversity Australia (2018); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT
Ground-truthed Regional Ecosystem Mapping
- Mine Site

Figure 6

Table 3
Clearance of Regional Ecosystems

Regional Ecosystem	Short Description	Vegetation Clearance (ha)	Ornamental Snake Habitat	Squatter Pigeon (southern) Habitat	Koala Habitat	Greater Glider Habitat
RE 11.3.1*	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	15	15	15	-	-
RE 11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	43.5	-	43.5	43.5	43.5
RE 11.3.2/11.3.4	<i>Eucalyptus populnea</i> woodland on alluvial plains / <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains.	1.5	-	1.5	1.5	1.5
RE 11.3.27d	<i>Eucalyptus camaldulensis</i> and/or <i>E. tereticornis</i> woodland	1.9	-	1.9	1.9	1.9
RE 11.4.9*	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	0.5	0.5	0.5	-	-
RE 11.5.3	<i>Eucalyptus populnea</i> ± <i>E. melanophloia</i> ± <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.	128	-	128	128	128
Sub-total		190.5[^]	15.5	190.5[^]	175[^]	175[^]
Vegetation in the early stage of regrowing from past clearance		249.5	0	198	0	0
Total		440	15.5	388.5	175	175
Cleared Land		131	-	-	-	-

Source: Appendix D.

* Brigalow EEC (not including an extra 6.5 ha of regrowth).

[^] Number has been rounded.

BVG = Broad Vegetation Group

2.1 BRIGALOW (*ACACIA HARPOPHYLLA* DOMINANT AND CO-DOMINANT)

2.1.1 Targeted Survey Effort

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for Brigalow EEC in the Action area in consideration of the *Approved Conservation Advice for the Brigalow EEC* (DotE, 2013a) and the *Species Profile and Threats Database* (DEE, 2018). Both remnant and regrowth forms of the Brigalow EEC were mapped and described (Attachment C).

A habitat quality assessment was undertaken using the survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a). The condition data was used to justify the inputs in to the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) applied by Biodiversity Australia (2019b) (Attachment I).

2.1.2 Presence of Brigalow EEC in the Action Area and Surrounds

The extent of Brigalow EEC in the Action area and immediate surrounds mapped by Biodiversity Australia (2019a) (Attachment C) is shown on Figure 6. There is approximately 22 ha of Brigalow EEC in the Action area (represented by 15 ha of RE 11.3.1 [Plate 1], 0.5 ha of RE 11.4.9 [Plate 2] as well as 6.5 ha of regrowth).

The Brigalow EEC in the Action area has been fragmented by past clearance for agricultural activities as can be seen on Figure 6. Despite this, the patches of remnant Brigalow EEC in the Action area are generally in good condition with occasional Buffel Grass (*Cenchrus ciliaris*) and Harrisia Cactus (*Harrisia* sp.) (Attachment C). The regrowth Brigalow EEC (i.e. the patches of Brigalow EEC that have regrown from past clearance) in the Action area occurs as a dense layer of Brigalow to approximately 6 m in height and spares shrub and grass layer. The Brigalow EEC in the Action area is adjacent to the existing Thirteen Mile Gully Diversion.



Source: Attachment C

Plate 1 Brigalow EEC (RE 11.3.1)



Source: Attachment C

Plate 2 Brigalow EEC (RE 11.4.9)

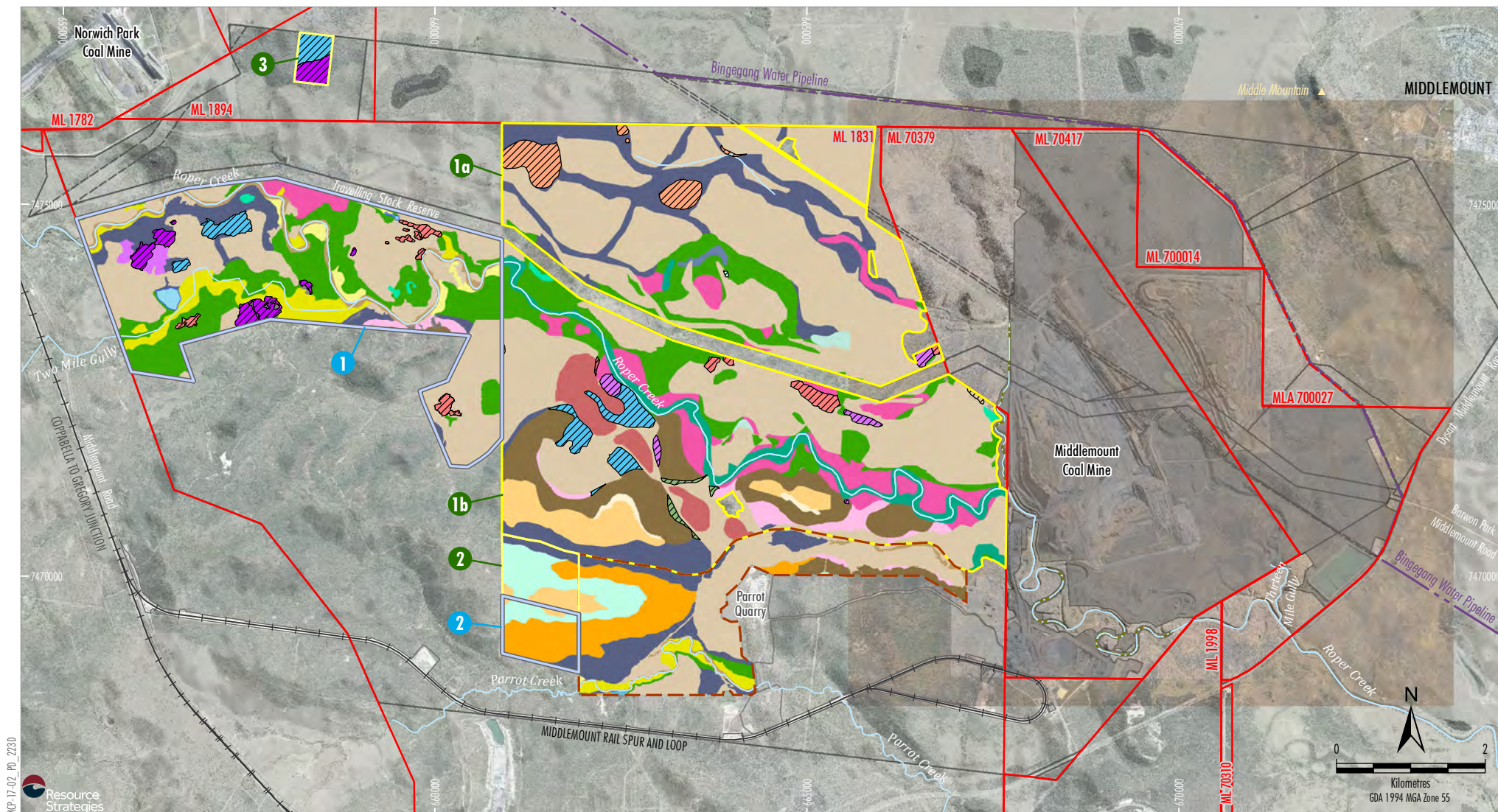
Biodiversity Australia (2019a) (Attachment C) also mapped Brigalow EEC extending outside, but adjacent to, the south-western extent of the Action area (Figure 6). This Brigalow EEC would be conserved and managed within the Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (Section 2.1.5). Management measures include control of weeds, animal pests and grazing livestock.

Brigalow EEC also occurs more widely in the locality, for example there is approximately 244.5 ha of Brigalow EEC in the proposed offset areas (Section 2.1.5) (Figures 6 and 7).

2.1.3 Direct, Indirect and Cumulative Impacts

The Action would result in the direct clearance of a total of approximately 22 ha of Brigalow EEC in the Action area (of which approximately 6.5 ha is regrowth). The Brigalow EEC would be cleared to enable the realignment of the Thirteen Mile Gully Diversion and provide additional surface footprint for out-of-pit waste rock emplacement.

In regard to potential indirect impacts, as described above, the Brigalow EEC in the Action area is in good condition despite construction of the existing Thirteen Mile Gully Diversion. It is expected that the construction of the realigned section of the Thirteen Mile Gully Diversion would also result in negligible indirect impacts (from threats such as weeds [DEE, 2018] and potentially dust) on the adjacent Brigalow EEC. The Brigalow EEC is not dependant on groundwater and would not be adversely impacted by changes to local hydrology (Attachment C).



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA)
- Middlemount Coal Owned Land
- Railway
- Approved Disturbance Footprint

Source: MCPL (2018); Biodiversity Australia (2019); Naturecall Environmental (2014, 2017); Parsons Brinkerhoff (2010); (Department of Natural Resources and Mines (2017); © State of Queensland (Department of Science, Information Technology and Innovation, 2017)

Orthophoto: MCPL (June 2017, 2012)

Existing/Approved Offset Areas

- North-eastern Extension Commonwealth Offset Area (EPBC 2016/7717)
- Proposed Offset Areas
- Modified Middlemount Coal (Stage 2)
- Project Commonwealth Offset Area (EPBC 2010/5394)
- Western Extension Commonwealth Offset Area (EPBC 2017/8130)

Regional Ecosystem Mapping

- | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.3.1 | 11.4.3 High value re | 11.7.2 |
| 11.3.2 | 11.4.8 | 11.7.4 |
| 11.3.25 | 11.4.9 | 11.9.1 |
| 11.3.27 | 11.4.9a | Non-remnant (vegetation in the early stages of regrowth from past clearance) |
| 11.3.27b | 11.5.18 | Dam |
| 11.3.27d | 11.5.18 with cerbera | Cleared Land (cleared without regrowth) |
| 11.3.4 | 11.5.2a | Disturbed/Erosion/Bare Ground |
| 11.3.4a | 11.5.3 | Threatened Ecological Community |
| 11.3.7 | 11.5.3b | Brigalow |
| 11.4.3 | 11.5.9 | |



WESTERN EXTENSION PROJECT

Ground-truthed Regional Ecosystem Mapping - Offset Areas

Figure 7

The Action is not likely to result in significant impacts from edge effects on potential habitat for this species outside of the Action area given the potential habitat is poorly connected to the Action area due to the existing fragmentation. Newly exposed edges created by clearing works may be subject to higher levels of weed invasion, however, weed management measures would apply to the existing offset area and the mining lease. Further, the realigned section of the Thirteen Mile Gully Diversion (Figure 3) would be established and revegetated early in the mine life (by Year 6), thus limiting the time the habitat edges are exposed.

In regard to fragmentation impacts, the potential habitat for this species is patchy and fragmented and do not provide strong connectivity to adjacent habitats. The action would not isolate any external habitats and only marginally increase fragmentation in an already highly fragmented landscape.

The Middlemount Coal Mine is currently approved to remove approximately 4 ha of Brigalow EEC as part of the Middlemount Coal Project Stage 2 (EPBC 2010/5394) (Parsons Brinkerhoff, 2010a). Considering the clearance required for the Action, the Middlemount Coal Mine (inclusive of EPBC 2010/5394 and EPBC 2017/8130) would result in the cumulative total clearance of approximately 26 ha of Brigalow EEC. This is, however, offset by a greater area of Brigalow EEC as described in Section 2.1.5.

2.1.4 Avoidance, Safeguards and Mitigation Measures

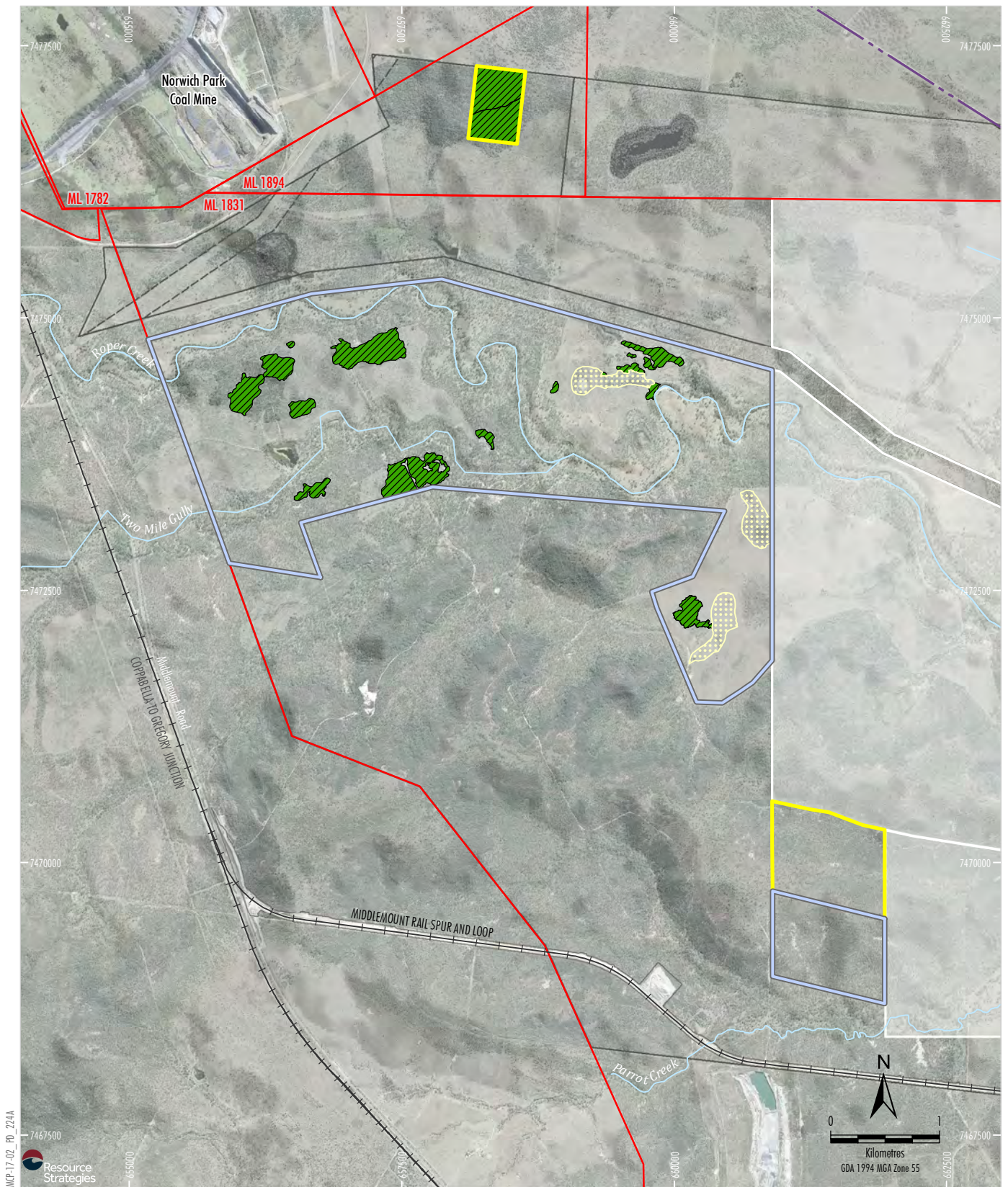
The Brigalow EEC in the Action is not able to be avoided as the Thirteen Mile Gully Diversion is required to be realigned to allow for access to additional coal resources within ML 70379. Potential impacts to Brigalow EEC would be minimised through implementation of the following measures:

- Boundaries of Brigalow EEC areas to be cleared, and those not to be cleared, would be defined before and during clearing activities.
- Weed management techniques would continue to be implemented within the mining lease (e.g. weed control [spraying] and washdown of machinery when moving from weed infested areas).
- The revegetation species list for the realigned section of the Thirteen Mile Gully Diversion would include species characteristic of the Brigalow EEC.

2.1.5 Offset

The Western Extension Commonwealth Offset Area contains approximately 76 ha of Brigalow EEC (represented by RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.4.9a) (Section 2.10.2.2) (Figure 8). The condition of the Brigalow EEC in the offset areas is generally good (ranging from average to high condition) (Appendix 15 in Attachment C).

In relation to cumulative impact, the Middlemount Coal Mine (including EPBC 2010/5394 and EPBC 2017/8130) would result in the cumulative clearance of approximately 26 ha of Brigalow EEC and the cumulative conservation of approximately 244.5 ha of Brigalow EEC. In addition, the offset areas include areas of regrowth vegetation that a portion of would likely regrow into Brigalow Woodland as pre-clear mapping indicates that the areas were formerly Brigalow Woodland (Attachment C).



LEGEND

- Mining Lease Boundary (ML)
- Middlemount Coal Owned Land
- Railway
- Existing Offset Area
- Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
- Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
- Brigalow Threatened Ecological Community
- Cleared Land Likely to be Formally Brigalow Woodland (RE11.3.1)

Source: MCPL (2018); Biodiversity Australia (2018, 2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT Brigalow Woodland Threatened Ecological Community - Proposed Offset Areas

Figure 8

2.1.6 Conclusion/Consequential Impact

The Action would result in the clearance of approximately 22 ha of Brigalow EEC in the Action area (of which approximately 6.5 ha is regrowth) (Figure 6). Indirect impacts would be minimised through mitigation measures. Overall, a greater area of Brigalow EEC (approximately 76 ha) would be enhanced and conserved in the Western Extension Commonwealth Offset Area (Section 2.10.2.2) (Figure 8).

2.2 ORNAMENTAL SNAKE

The general distribution and habitat requirements for the Ornamental Snake are described in Attachment C.

2.2.1 Targeted Survey Effort

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for the Ornamental Snake and assessed potential habitat for the species in accordance with the *Survey Guidelines for Australia's Threatened Reptiles* (DSEWPaC 2011a), *EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles* (DSEWPaC 2011c) and the *Species Profile and Threats Database* (DEE, 2018). The survey methods used to detect the Ornamental Snake were spotlighting and active searching (herpetofauna searches) (Attachment C).

A habitat quality assessment was undertaken using the survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a). The condition data was used to justify the inputs in to the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) applied by Biodiversity Australia (2019b) (Attachment I). Further to this, the predicted future habitat quality scores with and without the offset is also provided in Attachment I.

2.2.2 Presence of the Species and its Habitat in the Action Area and Surrounds

The Ornamental Snake has not been recorded in the Action area, despite targeted searches. However, the Ornamental Snake has been previously recorded by Parsons Brinkerhoff (2010a) in the Middlemount Coal Mine Stage 1 Project area (Figure 9) in Brigalow Woodland (RE 11.3.1) so it has been conservatively considered as potentially occurring within the Action area.

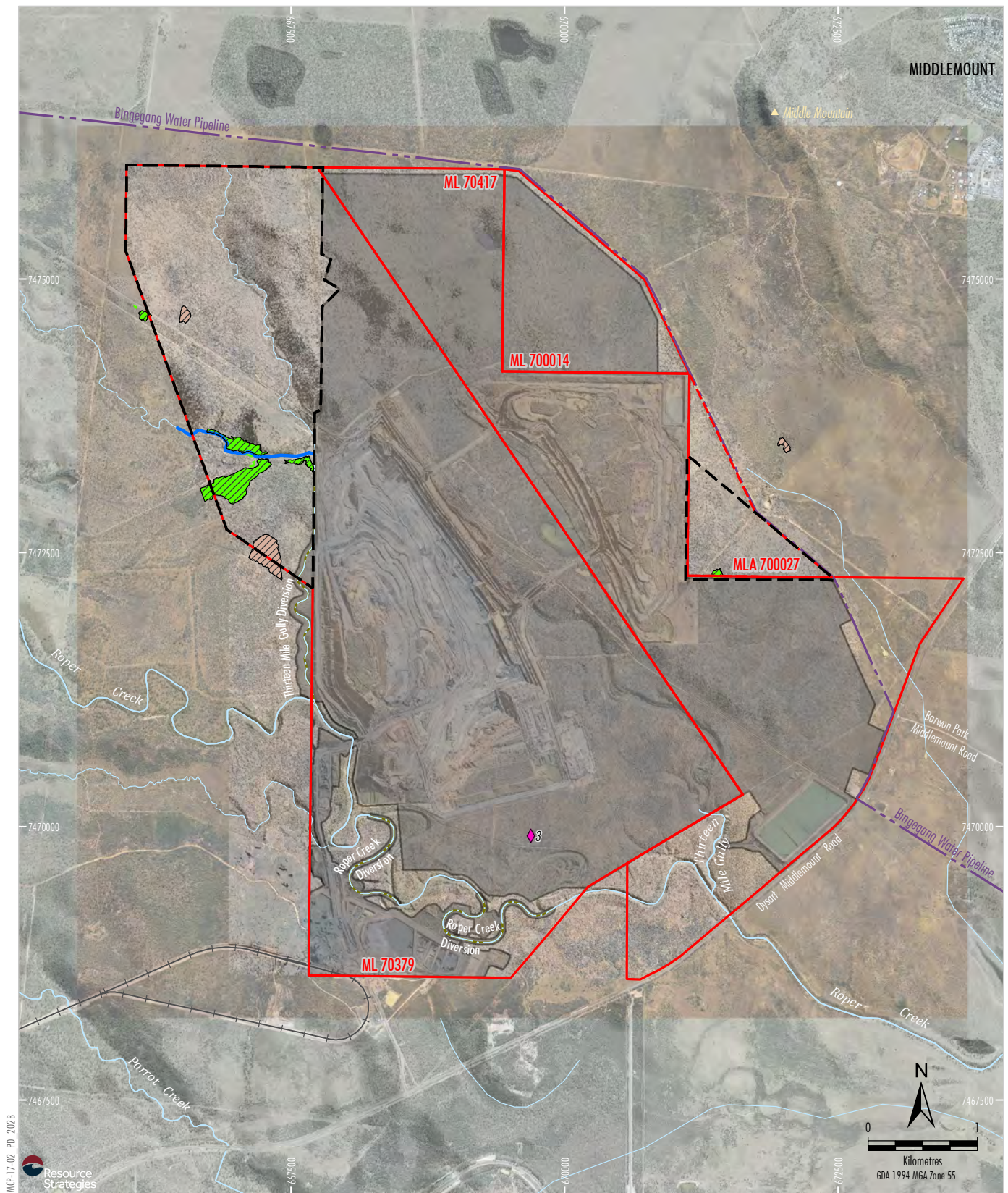
Table 4 provides a detailed description of potential habitat for the Ornamental Snake in the Action Area and proposed Western Extension Commonwealth Offset Area.

Table 4
Ornamental Snake Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Potential Habitat	<p>The Ornamental Snake habitat is defined by DEE as:</p> <ul style="list-style-type: none"> any habitat within, or close to, habitat that is favoured by prey – frogs. Particular attention should be paid to riparian zones, as well as any areas of the Brigalow threatened ecological community; open-forests to woodlands associated with gilgai formations and wetlands. These are commonly mapped as QLD REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred; and any additional vegetation communities the Ornamental Snake has been recorded from at the project site. 	<p>Limited potential habitat for this species exists within the Action area, comprising a 0.5 ha patch of RE 11.4.9 (Brigalow) on the edge of the approved mine footprint and approximately 15 ha of RE 11.3.1 (Brigalow) in three patches (i.e. a total of approximately 15.5 ha in four patches) (Figure 9).</p> <p>The <i>Species Profile and Threats Database</i> (DEE, 2019) recognises RE 11.4.9 (Brigalow on gilgai soils) as habitat for this species but does not list RE 11.3.1 (Brigalow on alluvial soils). Given the Ornamental Snake was previously recorded in RE 11.3.1 (Brigalow) elsewhere in the mine site (Parsons Brinkerhoff, 2010a) and it provides suitable microhabitat for the species (e.g. woody debris, ground litter and gilgai), this RE is considered to provide potential habitat.</p> <p>As shown in Figure 9 some of this habitat occurs along an ephemeral drainage line, which at times would provide preferred habitat for this species (i.e. habitat within, or close to, habitat that is favoured by its prey – frogs [DEE, 2019]). It is noted, however, that the <i>Species Profile and Threats Database</i> (DEE, 2019) states that: ‘the species presumed preference for riparian areas is questionable.’</p> <p>It is noted that this species often use gilgai or cracking soils on cleared land, however, the regrowth Brigalow TEC in the Action area (6.5 ha) (Figure 9) does not provide habitat for the Ornamental Snake as it does not have gilgai or sufficient microhabitat requirements (e.g. fallen timber) for shelter and prey species. It is also located further away from the seasonal drainage line.</p>	<p>The Western Extension Commonwealth Offset Area contains approximately 76 ha of potential suitable habitat for the Ornamental Snake (represented by RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.4.9a) (Section 2.10.2.2) (Figure 10).</p> <p>Consistent with the proposed clearance area (Section 2.2.2), given the Ornamental Snake was previously recorded in RE 11.3.1 (Brigalow) (Parsons Brinkerhoff, 2010a) and it provides suitable microhabitat for the species (e.g. woody debris, ground litter, cracking clay soils and gilgai), this RE is considered to provide potential habitat.</p> <p>As shown in Figure 10, Roper Creek and Two Mile Gully traverse the Western Extension Commonwealth Offset Area providing habitat that is favoured by its prey – frogs (DEE, 2019).</p> <p>The offset area contains 30 ha of cleared land likely to have been formerly potential habitat (i.e. Brigalow RE 11.3.1) (Figure 10). These areas currently do not have sufficient microhabitat requirements (e.g. fallen timber) for shelter and prey species. These cleared areas are currently not considered habitat for the species.</p>
Preferred Habitat	<p>The <i>Species Profile and Threats Database</i> (DEE, 2019) states: ‘The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in Queensland Regional Ecosystem Land Zone 4, but also lake margins and wetlands’</p>	<p>There is no preferred habitat within the Action area.</p>	<p>RE 11.4.8, RE 11.4.9 and RE 11.4.9a with the Western Extension Commonwealth Offset Area are preferred habitat (approximately 59.5 ha).</p>

Table 4 (Continued)
Ornamental Snake Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Suitable Habitat	The <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011c) recognises suitable habitat as: <i>'open-forests to woodlands associated with gilgai formations and wetlands. These are commonly mapped as QLD REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred.'</i>	All of the potential habitat in the Action area (described above) is suitable habitat for this species.	All of the potential habitat in the Western Extension Commonwealth Offset Area (described above) is suitable habitat for this species.
Known Important Habitat	As defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011c), suitable habitat for any one of the listed Brigalow Belt reptiles is considered important if it is: <ul style="list-style-type: none"> • habitat where the species has been identified during a survey; • near the limit of the species' known range; • large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations); or • a habitat type where the species is identified during a survey, but which was previously thought not to support the species. 	No suitable habitat in the action area is considered important as defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011c) as: <ul style="list-style-type: none"> • The species has not been recorded in the habitat in the Action area, despite targeted surveys; • The Action area is not near the limit of the species' known range (after DSEWPac 2011c); • The Action area does not contain large patches of contiguous, suitable habitat and viable landscape corridors as the habitat is instead small and fragmented (Figure 9); and/or • The Action area does not contain a unique habitat type containing known records of the species. 	No suitable habitat in the action area is known to be important as defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011c) as: <ul style="list-style-type: none"> • The species has not been recorded in the habitat in the Western Extension Commonwealth Offset Area; • The Western Extension Commonwealth Offset Area is not near the limit of the species' known range (after DSEWPac 2011c); • The Western Extension Commonwealth Offset Area does not contain large patches of contiguous, suitable habitat and viable landscape corridors as the habitat is instead small and fragmented (Figure 10); • The Western Extension Commonwealth Offset Area does not contain a unique habitat type containing known records of the species.
	Conclusion	The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide: <ul style="list-style-type: none"> • the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Ornamental Snake); • a greater area of potential habitat (approximately 15.5 ha in the Action area verse 76 ha in the offset area); • larger patches of potential habitat (refer Figures 9 and 10); and • opportunity to re-establish approximately 30 ha of potential habitat in cleared land (mapped as 'cleared land likely to be formerly potential habitat' on Figure 10) (resulting is a total of approximately 106 ha). 	



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA)
- Middlemount Rail Spur and Loop
- Approved Disturbance Footprint
- Approved Diversion Structure
- Western Extension Project
- Approximate Extent of Additional Surface Disturbance

Habitat

- Ornamental Snake Potential Suitable Habitat
- ◆ Ornamental Snake Recorded Location
- Other Map Units
- Seasonal Waterbody Associated with Potential Habitat
- Brigalow Threatened Ecological Community
- Vegetation in the Early Stages of Regrowth from Past Clearing without Suitable Microhabitat

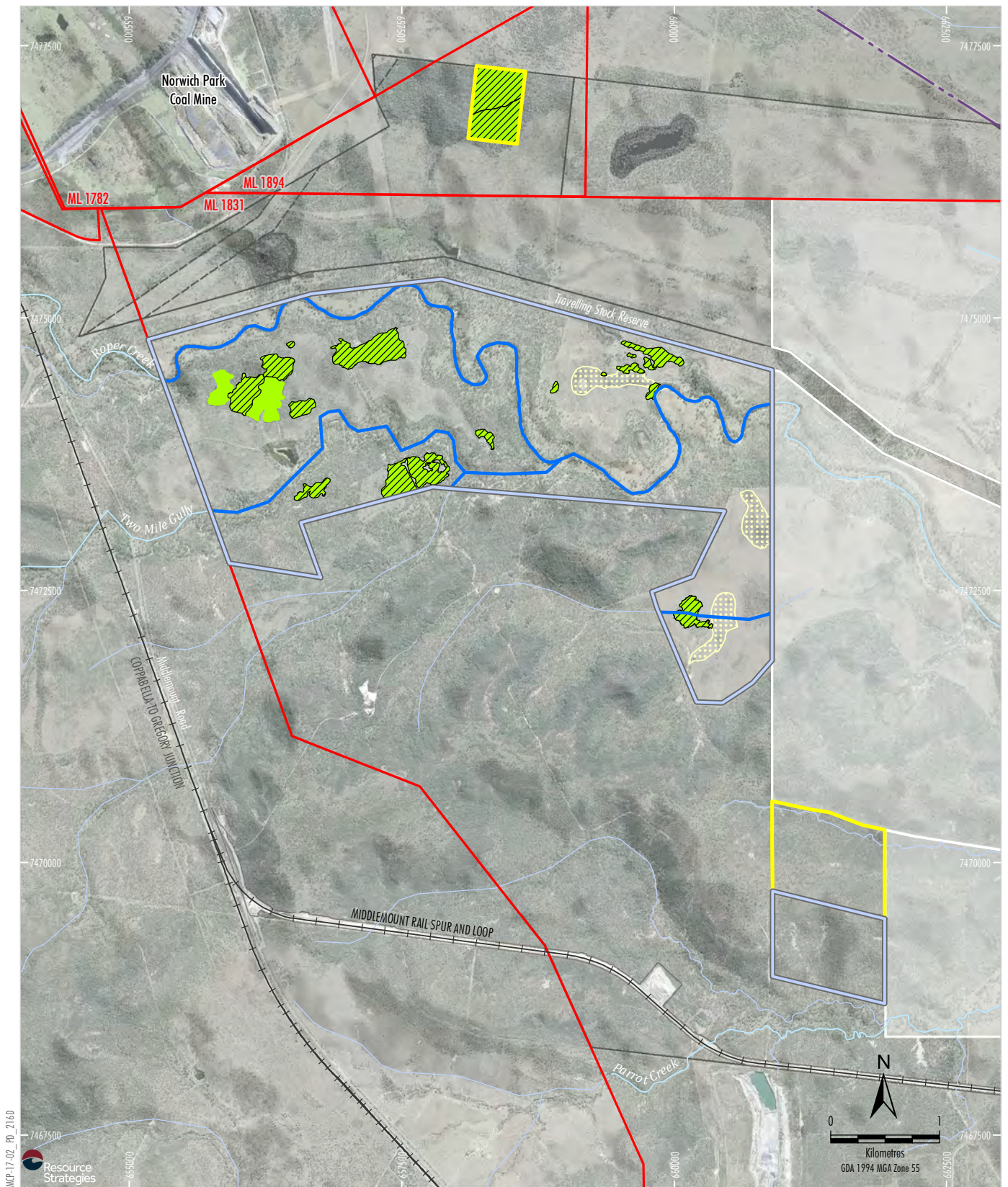
Reference: 3 Parsons Brinkerhoff (2010)
Note: There are no references 1 and 2 on this figure.

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT Ornamental Snake Habitat Mapping - Mine Site

Figure 9



LEGEND

- Mining Lease Boundary (ML)
- Middlemount Coal Owned Land
- Railway
- Existing Offset Area
- Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
- Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

Potential Habitat

- Ornamental Snake Potential Suitable Habitat
- Other Map Units
- Seasonal Waterbody
- Brigalow Threatened Ecological Community
- Cleared Land Likely to be Formerly Potential Habitat (Brigalow Woodland - RE11.3.1)

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT Ornamental Snake Potential Habitat Mapping - Proposed Offset Areas

Figure 10

2.2.3 Direct, Indirect and Cumulative Impacts

The Ornamental Snake has not been recorded in the Action area. The Action would result in the direct clearance of a total of approximately 15.5 ha of potential habitat for the Ornamental Snake. The potential habitat would mainly be cleared to enable the realignment of the Thirteen Mile Gully Diversion and provide additional surface footprint for out-of-pit waste rock emplacement.

Although some potential habitat for this species would be cleared, the area to be cleared is not considered material nor crucial to the viability of the local population of this species. Biodiversity Australia (2019a) (Attachment C) consider that the Action is unlikely to have a significant impact on the Ornamental Snake (after DEWHA, 2013) as there is a low chance of the snake occurring in the Action area given disturbance history and lack of preferred habitat.

The Action is not likely to indirectly impact this species through an increase in feral animals, weeds or adverse alteration of hydrology in potential habitat. Further, the vibrations from blasting associated with the Action (for the additional six years of the mine life) is not likely to impact the Ornamental Snake due to the occasional and short period of blasts.

The Action is not likely to result in significant impacts from edge effects on potential habitat for this species outside of the Action area given the potential habitat is poorly connected to the Action area due to the existing fragmentation. Newly exposed edges created by clearing works may be subject to higher levels of weed invasion, however, weed management measures would apply to the existing offset area and the mining lease. Further, the realigned section of the Thirteen Mile Gully Diversion (Figure 3) would be established and revegetated early in the mine life (by Year 6), thus limiting the time the habitat edges are exposed.

In regard to fragmentation impacts, the potential habitat for this species is patchy and fragmented and do not provide strong connectivity to adjacent habitats. The action would not isolate any external habitats and only marginally increase fragmentation in an already highly fragmented landscape.

The Middlemount Coal Mine is currently approved to remove approximately 47 ha of potential habitat for the Ornamental Snake as part of the Middlemount Coal Project Stage 2 (EPBC 2010/5394) (Parsons Brinkerhoff, 2010a). Considering the clearance required for the Action, the Middlemount Coal Mine (inclusive of EPBC 2010/5394 and EPBC 2017/8130) would result in the cumulative total clearance of approximately 62.5 ha of habitat for the Ornamental Snake.

2.2.4 Avoidance, Safeguards and Mitigation Measures

Potential impacts to the Ornamental Snake would be minimised through implementation of the following measures:

- Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species.
- MCPL would use a licensed spotter-catcher and/or carer during clearing activities.
- Weed management techniques would continue to be implemented within the mining lease (e.g. weed control [spraying] and washdown of machinery when moving from weed infested areas).
- Continuation of the feral animal control measures within the mining lease, including the control of European Red Fox and Feral Cat (recognised threats to this species), biannually for the life of the mine.

- Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. the revegetation species list for the realigned section of the Thirteen Mile Gully Diversion would include species characteristic of the Brigalow EEC [potential habitat for this species]).

A National or State recovery plan has not been prepared for this species. The above measures are predicted to be effective in reducing potential adverse impacts on the Ornamental Snake because they are focused on addressing the recognised threats to the species that would occur (e.g. clearing) or could otherwise occur (e.g. feral animal incursion) as a result of the Action.

2.2.5 Offset

Table 4 provides a detailed description of potential habitat for the Ornamental Snake in the Action Area and proposed Western Extension Commonwealth Offset Area.

In relation to cumulative impact, the Middlemount Coal Mine (including EPBC 2010/5394 and EPBC 2017/8130) would result in the cumulative clearance of approximately 62.5 ha of habitat for the Ornamental Snake and the cumulative conservation of approximately 1,768.5 ha of habitat for the Ornamental Snake in relevant Commonwealth Offset Areas².

2.2.6 Conclusion/Consequential Impact

The Ornamental Snake has not been recorded in the Action area and it is considered unlikely to be significantly impacted by the Action (Attachment C). The Action would require the clearance of approximately 15.5 ha of potential habitat for this species (Figure 9) and the Western Extension Commonwealth Offset Area contains approximately 76 ha of potential habitat for this species (Figure 10). The Western Extension Commonwealth Offset Area provides the opportunity to re-establish approximately 30 ha of potential habitat in cleared land (mapped as 'cleared land likely to be formerly potential habitat' on Figure 10) (resulting in a total of approximately 106 ha).

2.3 SQUATTER PIGEON (SOUTHERN)

The general distribution and habitat requirements for the Squatter Pigeon (southern) are described in Attachment C.

2.3.1 Targeted Survey Effort

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for the Squatter Pigeon (southern) and assessed potential habitat for the species in accordance with the *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010a) and the *Species Profile and Threats Database* (DEE, 2018). The survey methods used to detect the Squatter Pigeon (southern) were diurnal bird surveys (Attachment C). These methods successfully detected the species.

A habitat quality assessment was undertaken using the survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a). The condition data was used to justify the inputs in to the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) applied by Biodiversity Australia (2019b) (Attachment I). Further to this, the predicted future habitat quality scores with and without the offset is also provided in Attachment I.

² Approximately 1,692.5 in the Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area and approximately 76 ha in the Western Extension Commonwealth Offset Area.

2.3.2 Presence of the Species and its Habitat in the Action Area and Surrounds

The Squatter Pigeon (southern) was recorded in the Action area (Figure 11). Table 5 provides a detailed description of habitat for the Squatter Pigeon (southern) in the Action Area and proposed Western Extension Commonwealth Offset Area.

Table 5
Squatter Pigeon (Southern) Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Known Habitat		<p>The Squatter Pigeon (southern) was recorded in the Action area by Naturecall (2017, 2014) and Parsons Brinkerhoff (2010a) (Figures 11 and 12).</p> <p>Habitat for the Squatter Pigeon (southern) in the Action area is considered to comprises all remnant and regrowth habitat with a suitable groundcover.</p> <p>The Action Area contains approximately 388.5 ha of potential habitat for the Squatter Pigeon (southern), comprising approximately 190.5 ha of woodland and 198 ha of vegetation in the early stage of regrowing from past clearance (Figure 11).</p>	<p>The Squatter Pigeon (southern) has been recorded adjacent to the proposed offset areas (Figure 13) in habitat which is contiguous with the proposed offset areas. Given the nearby records, the presence of potential habitat and nature of the species, it is highly likely that the Squatter Pigeon (southern) would use habitat in the proposed offset area.</p> <p>Habitat for the Squatter Pigeon (southern) in the Action area is considered to comprises all remnant and regrowth habitat with a suitable groundcover.</p> <p>Western Extension Commonwealth Offset Area contains approximately 1,155 ha of potential habitat for the Squatter Pigeon (southern), comprising approximately 749.5 ha of woodland and 405.5 ha of vegetation in the early stage of regrowing from past clearance (Figure 13).</p> <p>The offset area is suitably located (on the same property) to benefit the same local population of this species that would use habitat within the Action area.</p>
Breeding Habitat*	<ul style="list-style-type: none"> • Land Zones 5 & 7 and 3, 4 & 10) <ul style="list-style-type: none"> ○ <i>Remnant or regrowth open-forest to sparse, open-woodland or low-woodland dominated by Eucalyptus, Corymbia, Acacia or Callitris species within one kilometre of a suitable, permanent or seasonal waterbody. It is distinguished by ground-layer vegetation that:</i> <ul style="list-style-type: none"> ▪ <i>consists of patchy, native, perennial tussock grasses, or a mix of perennial tussock grasses and low shrubs or forbs; and</i> ▪ <i>does not cover more than 33% of the ground.</i> ○ <i>These preferred ground-layer vegetation conditions tend to occur on well-draining, sandy or gravelly soils low, gently sloping, flat to undulating plains and foothills, lateritic (duplex) soils on low 'jump-ups' and escarpments.</i> 	<p>The habitat in the Action area is within 1 km of seasonal waterbodies (ephemeral unnamed drainage lines) and therefore all of the potential habitat mapped on Figure 11 is considered to be potentially used for breeding. Noting, however, this species has not been observed breeding in the Action Area.</p> <p>Some areas of vegetation in the early stage of regrowing from past clearance (approximately 198 ha) has been identified as suitable breeding habitat for the Squatter Pigeon (southern). These areas contain a high percentage of native grass species that would provide food resources for the Squatter Pigeon (southern).</p> <p>The remaining portion of the vegetation in the early stage of regrowing from past clearance (approximately 51.5 ha) is not considered potential habitat for this species because the dominant ground cover composition is exotic grasses with native grasses and herbs being less common.</p>	<p>As shown in Figure 13, Roper Creek and Two Mile Gully traverse the Western Extension Commonwealth Offset Area such that most of the potential habitat for this species is within 1 km of these watercourses and therefore potential breeding habitat.</p> <p>Similar to the Action area, some vegetation in the early stage of regrowing from past clearance (approximately 405.5 ha) is not considered potential habitat for this species because the dominant ground cover composition is exotic grasses with native grasses and herbs being less common (Figure 13).</p> <p>The Western Extension Commonwealth Offset Area is providing the equivalent type of habitat to that within the Action area.</p> <p>Note that RE11.7.2 was excluded as potential habitat for this species due to very rocky or bare ground with low native grass cover.</p>

Table 5 (Continued)
Squatter Pigeon (Southern) Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Foraging Habitat*	<ul style="list-style-type: none"> • Land Zones 5 & 7 and 3, 4 & 10) <ul style="list-style-type: none"> ○ <i>Remnant or regrowth open-forest to sparse, open-woodland or low-woodland dominated by Eucalyptus, Corymbia, Acacia or Callitris species within three kilometres of a suitable, permanent or seasonal waterbody. It is distinguished by ground-layer vegetation that:</i> <ul style="list-style-type: none"> ▪ <i>consists of patchy, native, perennial tussock grasses, or a mix of perennial tussock grasses and low shrubs or forbs; and</i> ▪ <i>does not cover more than 33% of the ground.</i> ○ <i>These preferred ground-layer vegetation conditions tend to occur on well-draining, sandy or gravelly soils low, gently sloping, flat to undulating plains and foothills, lateritic (duplex) soils on low 'jump-ups' and escarpments.</i> 	The breeding habitat described above would also provide foraging resources for this species (Figure 11).	The breeding habitat described above would also provide foraging resources for this species (Figure 13).
Dispersal Habitat*	<ul style="list-style-type: none"> ○ <i>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.</i> ○ <i>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). The species does disperse into highly modified or degraded habitats, including cleared areas which are within 100 metres of remnant trees or patches of habitat.</i> 	<p>The breeding habitat described above would also provide dispersal habitat for this species.</p> <p>There are no additional areas of forest or woodland which would specifically aid the dispersal of the Squatter Pigeon (southern).</p> <p>There are very small areas of cleared land between patches of habitat (less than 100 m apart) as mapped on Figure 11. These largely comprise of cleared tracks and a pipeline easement. Hence, these areas are not considered 'dispersal habitat' for the species.</p>	<p>The breeding habitat described above would also provide dispersal habitat for this species.</p> <p>There are no additional areas of forest or woodland which would specifically aid the dispersal of the Squatter Pigeon (southern).</p> <p>There are very small areas of cleared land between patches of habitat (less than 100 m apart) as mapped on Figure 13. These are not considered 'dispersal habitat' for the species.</p>
	Conclusion	<p>The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide:</p> <ul style="list-style-type: none"> • the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Squatter Pigeon [southern]); • a greater area of potential habitat (approximately 388.5 ha in the Action area verse 1,155 ha in the offset area); • larger patches of potential habitat (refer Figures 11 and 13); and • opportunity to re-establish approximately 405.5 ha of woodland/forest as part of the existing potential breeding habitat (i.e. in areas of regrowth). 	

* Habitat Descriptions Provided by the Department of the Environment and Energy.

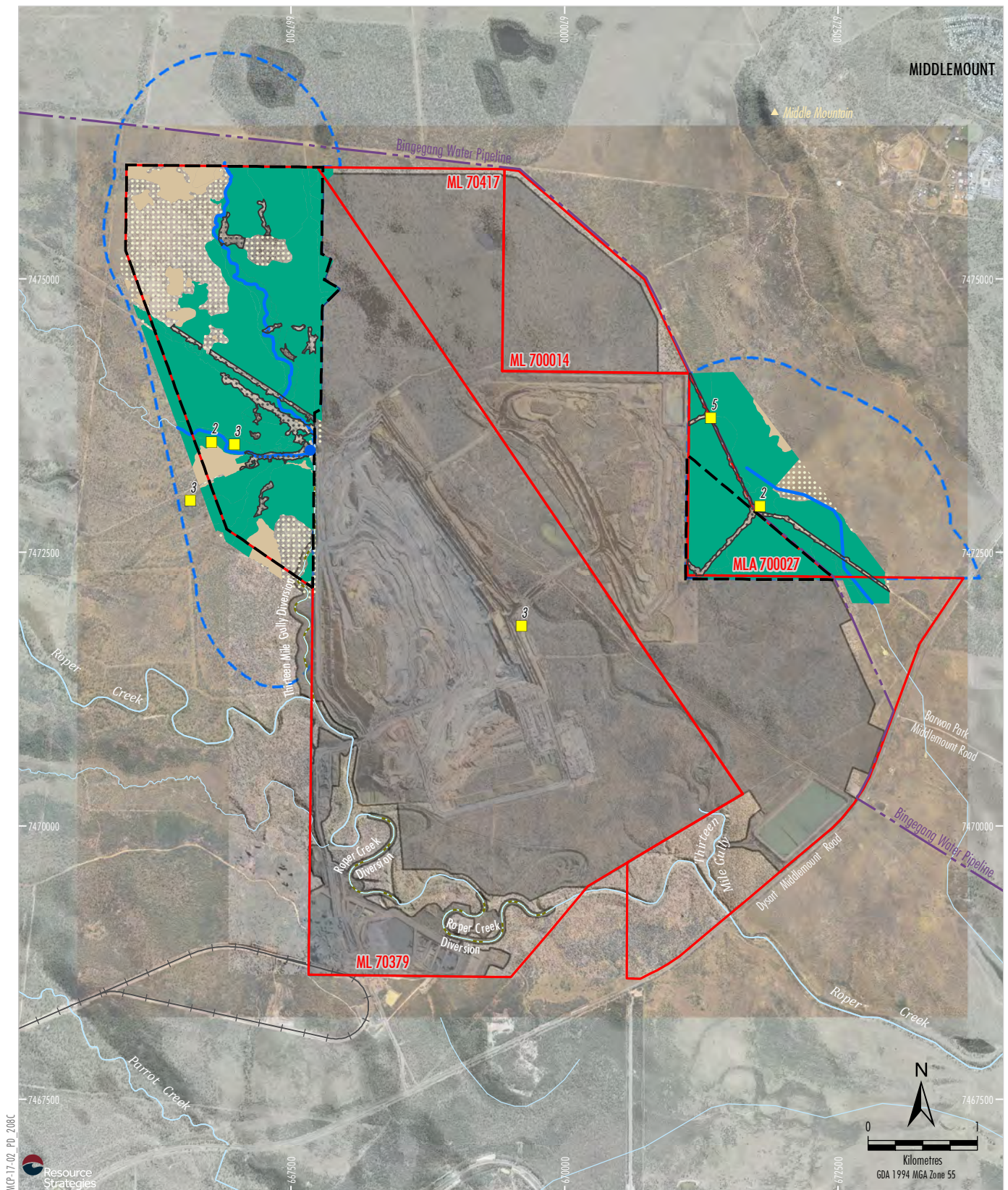
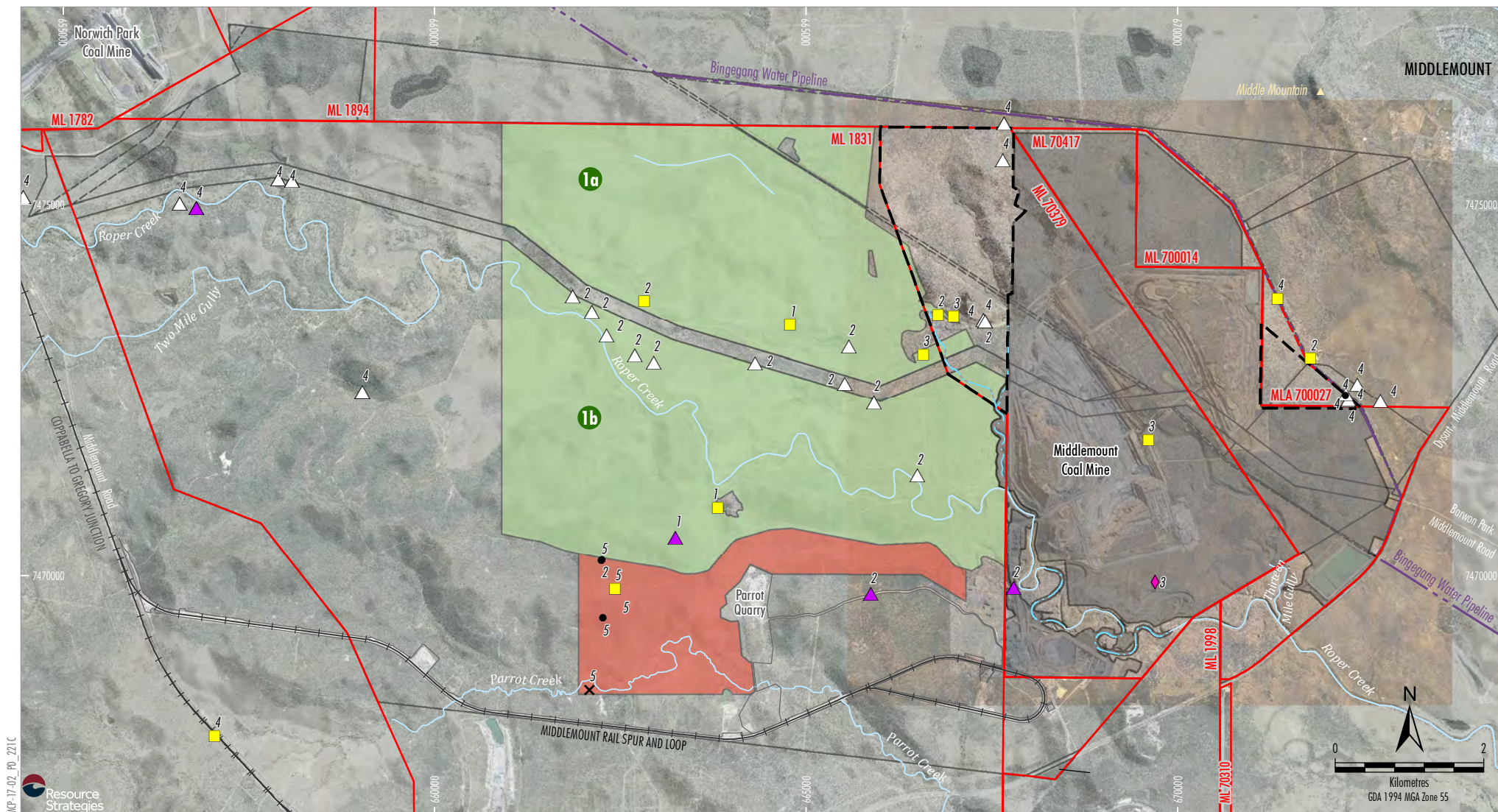


Figure 11



- LEGEND**
- Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Middlemount Coal Owned Land
 - Railway
 - Approved Disturbance Footprint
 - Diversion Structure
 - Western Extension Project
 - Approximate Extent of Additional Surface Disturbance

- Existing/Approved Offset Areas**
- Middlemount Coal (Stage 2 Project)
 - Commonwealth Offset Area (EPBC 2010/5394)
 - North-eastern Extension Commonwealth Offset Area (EPBC 2016/7717)

- Threatened Species Records**
- Squatter Pigeon (southern)
 - Ornamental Snake
 - Greater Glider
 - Koala
 - Koala Scats
 - Koala Scratches

- Reference:**
- 1 Ecology and Heritage Partners (2012)
 - 2 Naturecall Environmental (2014)
 - 3 Parsons Brinkerhoff (2010)
 - 4 Biodiversity Australia (2018)
 - 5 Naturecall Environmental (2017)

Note: Additional Greater Glider records occur within the extent of this figure, however coordinates were not recorded (Naturecall, 2017).

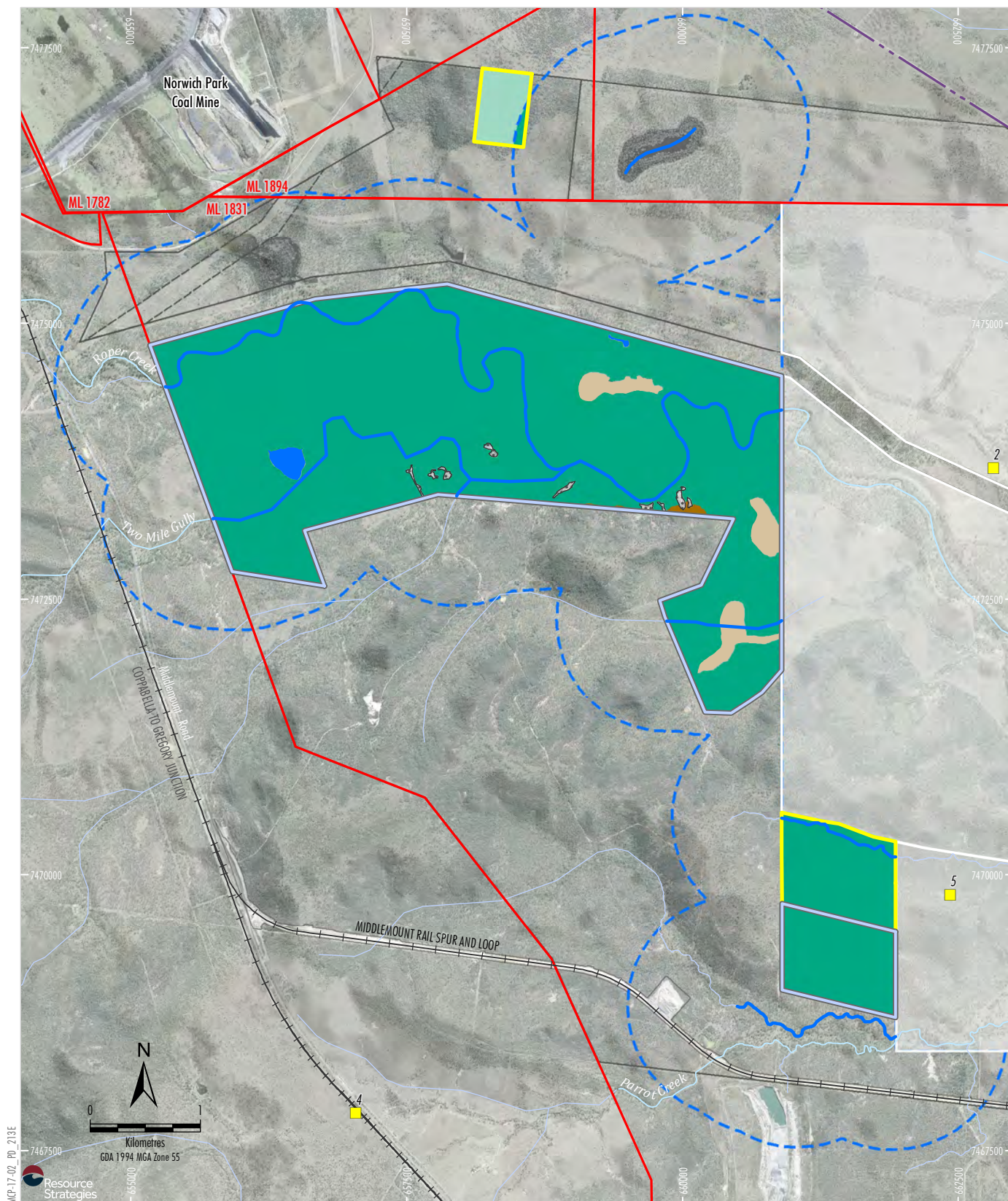
Source: MCPL (2018); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT

Threatened Species Records

Figure 12



- LEGEND**
- Mining Lease Boundary (ML)
 - Middlemount Coal Owned Land
 - Railway
 - Existing Offset Area
 - Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
 - Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

Reference: 2 Naturecall Environmental (2014)
4 Biodiversity Australia (2018)
5 Naturecall Environmental (2017)

Note: There are no references 1 and 3 on this figure.

- Habitat**
- Squatter Pigeon (Southern) Potential Breeding Habitat
 - Squatter Pigeon (Southern) Potential Foraging Habitat
 - Squatter Pigeon (Southern) Recorded Location
- Other Map Units**
- Dam
 - Seasonal Waterbody Associated with Habitat
 - 1 km Boundary from Seasonal Waterbody
 - Vegetation in the Early Stages of Regrowth from Past Clearing without a Suitable Groundcover
 - Area of Cleared Land Between Patches of Habitat (less than 100 m apart)
 - RE 11.7.2 Excluded due to Unsuitable Groundcover

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT
Squatter Pigeon (Southern) Habitat Mapping
- Proposed Offset Areas

Figure 13

2.3.3 Direct, Indirect and Cumulative Impacts

The Action would result in the direct clearance of a total of approximately 388.5 ha of known and potential habitat for the Squatter Pigeon (southern), comprising approximately 190.5 ha of woodland vegetation (RE 11.3.1, RE 11.3.2, RE 11.3.2/11.34, RE 11.3.27d, RE 11.4.9 and RE 11.5.3) and 198 ha of vegetation in the early stage of regrowing from past clearance (Figure 11).

The area to be cleared is not considered material nor crucial to the viability of the local population of this species. Biodiversity Australia (2019a) (Attachment C) consider that the Action is unlikely to have a significant impact on the Squatter Pigeon (southern) (after DEWHA, 2013) given large home range of this species, its high mobility and the presence of extensive alternative habitat in the locality.

The Action is not likely to result in significant impacts from edge effects on potential habitat for this species outside of the Action area given the potential habitat is poorly connected to the Action area due to the existing fragmentation.

In regard to fragmentation impacts, the potential habitat for this species is patchy and fragmented and do not provide strong connectivity to adjacent habitats. The action would not isolate any external habitats and only marginally increase fragmentation in an already highly fragmented landscape. Post-mine landforms are proposed to be progressively rehabilitated to include woodland habitat, ultimately resulting in a greater coverage of woodland habitat.

The Middlemount Coal Mine is currently approved to remove approximately 1,100 ha of potential habitat for the Squatter Pigeon (southern) as part of the Middlemount Coal Project Stage 2 (EPBC 2010/5394) (Parsons Brinkerhoff, 2010a) and 181 ha of potential habitat as part of the North-eastern Extension. Considering the clearance required for the Action, the Middlemount Coal Mine (inclusive of EPBC 2010/5394 and EPBC 2017/8130) would result in the cumulative total clearance of approximately 1,669.5 ha of habitat for the Squatter Pigeon (southern).

2.3.4 Avoidance, Safeguards and Mitigation Measures

Potential impacts to the Squatter Pigeon (southern) would be minimised through implementation of the following measures:

- Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species.
- MCPL would use a licensed spotter-catcher and/or carer during clearing activities.
- Continuation of the feral animal control measures within the mining lease, including the control of European Red Fox (*Vulpes vulpes*) and Feral Cat (*Felix catus*), biannually for the life of the mine.
- All roads in the Action area would be limited to a 40 kilometres per hour (km/h) speed limit which would reduce the risk of vehicle strike.
- Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).

A National or State recovery plan has not been prepared for this species. The above measures are predicted to be effective in reducing potential adverse impacts on the Squatter Pigeon (southern) because they are focused on addressing the recognised threats to the species that would occur (e.g. clearing) or could otherwise occur (e.g. feral animal incursion) as a result of the Action.

2.3.5 Offset

Table 5 provides a detailed description of habitat for the Squatter Pigeon (southern) in the Action Area and proposed Western Extension Commonwealth Offset Area.

In relation to cumulative impact, the Middlemount Coal Mine (including EPBC 2010/5394, EPBC 2016/7717 and EPBC 2017/8130) would result in the cumulative clearance of approximately 1,669.5 ha of habitat for the Squatter Pigeon (southern) and the cumulative conservation of approximately 5,005 ha of habitat for the Squatter Pigeon (southern) in relevant Commonwealth Offset Areas³.

2.3.6 Conclusion/Consequential Impact

The Squatter Pigeon (southern) is commonly recorded in fragmented landscapes in the Brigalow Belt South Bioregion. Habitat resources for the Squatter Pigeon (southern) (e.g. drinking sources, woodland and vegetation in the early stage of regrowing from past clearance for potential foraging and breeding habitat) would remain outside of the Action area, such that the species is likely to persist in the landscape. An outcome of the Action would be approximately 1,155 ha of potential habitat for the Squatter Pigeon (southern) would be enhanced and conserved as part of the Western Extension Commonwealth Offset Area.

2.4 KOALA

The Koala is listed as 'Vulnerable' under the EPBC Act. The 'Vulnerable' listing of the Koala under the EPBC Act applies to populations of Qld, New South Wales and the Australian Capital Territory. The general distribution and habitat requirements for the Koala are described in Attachment C.

2.4.1 Targeted Survey Effort

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for the Koala and assessed potential habitat for the species in accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala (combined Qld, NSW and the Australian Capital Territory)* (DoE, 2014) and the *Species Profile and Threats Database* (DEE, 2018). The survey methods used to detect the Koala were spotlighting, call playback, SAT surveys, and scat and sign searches (Attachment C). These methods successfully detected the species.

A habitat quality assessment was undertaken using the survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a). The condition data was used to justify the inputs in to the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) applied by Biodiversity Australia (2019b) (Attachment I). Further to this, the predicted future habitat quality scores with and without the offset is also provided in Attachment I.

2.4.2 Presence of the Species and its Habitat in the Action Area and Surrounds

Biodiversity Australia (2019a) (Attachment C) identified a Koala scat just on the boundary of the Action area in habitat (RE 11.5.3) which continues into the Action area (Figure 14). In addition, the Koala has been recorded within approximately 5 km of the Action area by previous surveys (Naturecall, 2014a).

³ Approximately 3,318 ha in the Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area, approximately 532 in the North-eastern Extension Commonwealth Offset Area and approximately 1,155 in the Western Extension Commonwealth Offset Area.

Given the limited number of survey records in the wider locality, it appears that a very low density Koala population may be present in the habitat surrounding the Action area. Given the low nutrient soils and scarcity of preferred foraging trees, Koala home ranges would be very large (Attachment C).

Despite the above, it is recognised that the habitat present meets the definition of 'Critical Habitat' for the Koala as defined in the *EPBC Act Referral Guidelines for the Vulnerable Koala (combined Qld, New South Wales and the Australian Capital Territory)* (DotE, 2014) (Attachment C).

2.4.3 Direct, Indirect and Cumulative Impacts

The Action would remove approximately 175 ha of known and potential habitat for the Koala (RE 11.3.2, RE 11.3.2/11.3.4, RE 11.3.27d and RE 11.5.3). Biodiversity Australia (2019a) (Attachment C) consider that lower quality habitat would be removed that would only form part of the marginal home range of a Koala due to limited abundance of preferred food trees (secondary foraging habitat) and poor soils. The habitat within the study area is unlikely to support Koala breeding given the low density of preferred food trees and existing habitat fragmentation.

The vegetation in the early stages of regrowing from past clearance (Figure 6) is not suitably advanced to be foraging or dispersal habitat for the Koala.

Better quality potential habitat for the Koala is more widespread in the landscape outside the Action area (e.g. more abundant important Koala food trees [Queensland Blue Gum – *Eucalyptus tereticornis*] occur along the watercourses to the south-west of the Middlemount Coal Mine) (Naturecall, 2016b). Koalas mainly feed on the foliage of *Eucalyptus* spp. however they may also feed on related genera such as *Corymbia* spp.. Queensland Blue Gum and River Red Gum (*Eucalyptus camaldulensis*) are recognised as important for the species in the northern part of their range (Van Dyck and Strahan, 2008).

The potential indirect impacts on the Koala associated with the Action (e.g. vehicle strike, noise, vibration, artificial lighting and/or the introduction of introduced species) are considered to be minimal and would only incrementally increase the likelihood of existing indirect impacts associated with the existing mining operations.

The change in cumulative impact on the Koala in the locality as a result of the Action (considering impacts from other surrounding developments and the Action) is considered to be minimal because of the localised nature of the Action compared to the wider distribution of this species, especially when considering the biodiversity offsets which have been (or would be) provided.

2.4.4 Avoidance, Safeguards and Mitigation Measures

Potential impacts to the Koala would be minimised through implementation of the following measures:

- Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species.
- MCPL would use a licensed spotter-catcher and/or carer during clearing activities. If a Koala is present in the proposed clearing area, it would be left to move away from the clearance area on its own accord.
- Continuation of the feral animal control measures within the mining lease, including the control of Wild Dog (which is a recognised threat to the Koala [DotE, 2014]), biannually for the life of the mine.
- All roads in the Action area would be limited to a 40 km/h speed limit which would reduce the risk of vehicle strike.

- Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).

2.4.5 Offset

Approximately 664.5 ha of known and potential habitat for the Koala would be enhanced and conserved as part of the Western Extension Commonwealth Offset Area (Figure 15). The following REs in the Western Extension Commonwealth Offset Area represent potential habitat for the Koala: RE 11.3.2, RE 11.3.25, RE 11.3.4, RE 11.3.4a, RE 11.3.7, RE 11.3.27d, RE 11.5.2a, RE 11.5.9 and RE 11.7.4.

Similar to the action area, the vegetation in the early stages of regrowing from past clearance (Figure 7) is not suitably advanced to be current foraging or dispersal habitat for the Koala (Figure 15). However, these areas would continue to regrow as part of the offset such that the current level of fragmentation would decrease overtime.

The offset area is suitably located to benefit the same local population of this species that would use habitat within the Action area. The Koala has been recorded within the Western Extension Commonwealth Offset Area during a spotlighting survey (Figure 15). The Koala was recorded within a Qld Blue Gum within vegetation equivalent to RE 11.3.4.

Roper Creek with riparian vegetation comprising Queensland Blue Gum (a primary feed tree for the Koala) (RE 11.3.25) traverses the Western Extension Commonwealth Offset Area (Figures 7 and 15). The habitat for the Koala in the offset area would also meet the definition of 'Critical Habitat' for the Koala as defined in the *EPBC Act Referral Guidelines for the Vulnerable Koala (combined Qld, New South Wales and the Australian Capital Territory)* (DotE, 2014).

2.4.6 Conclusion/Consequential Impact

The Action would remove approximately 175 ha of known/potential habitat for the Koala with a limited abundance of preferred food trees (secondary foraging habitat). An outcome of the Action would be approximately 664.5 ha of known and potential habitat for the Koala would be enhanced and conserved as part of the Western Extension Commonwealth Offset Area. The proposed regeneration of habitat in the offset area would provide a net gain in habitat for this species.

2.5 GREATER GLIDER

The general distribution and habitat requirements for the Greater Glider are described in Attachment C.

2.5.1 Targeted Survey Effort

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for the Greater Glider and assessed potential habitat for the species (in consideration of Threatened Species Scientific Committee, 2016). The survey methods used to detect the Greater Glider were spotlighting, call playback, passive infrared cameras, and scat and sign searches (Attachment C). These methods successfully detected the species.

A habitat quality assessment was undertaken using the survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017a). The condition data was used to justify the inputs in to the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) applied by Biodiversity Australia (2019b) (Attachment I). Further to this, the predicted future habitat quality scores with and without the offset is also provided in Attachment I.

2.5.2 Presence of the Species and its Habitat in the Action Area and Surrounds

The Greater Glider was recorded on numerous occasions by Biodiversity Australia (2019a) (Attachment C) during spotlighting (Figure 16). This species is locally common and has also been recorded on numerous occasions within the wider locality (Naturecall, 2014; Parsons Brinkerhoff, 2010a) (Figure 12).

Table 6 provides a detailed description of habitat for the Greater Glider in the Action Area and proposed Western Extension Commonwealth Offset Area.

Biodiversity Australia (2019a) (Attachment C) describe that previous observations of this species on MCPL owned-land have noted that it prefers Eucalypt woodlands and open forest associated with major creeks (which do not occur in the Action area) and drainage lines (Plate 3).



Plate 3 Example Drainage Line in the Action Area

Table 6
Greater Glider Habitat within the Action Area and Offset Area

Habitat Component/ Description*	Action Area	Offset Area
<ul style="list-style-type: none"> <i>Eucalypt forests and woodlands containing trees with hollows suitable for denning.</i> <i>Any additional vegetation communities the Greater Glider has been recorded from at the project site.</i> 	<p>The Greater Glider was recorded on numerous occasions during spotlighting (Figure 16). This species is locally common and has also been recorded on numerous occasions within the wider locality (Naturecall, 2014; Parsons Brinkerhoff, 2010a).</p> <p>Approximately 175 ha of known and potential habitat for the Greater Glider occurs in the Action area represented by all Eucalypt forests and woodlands present as these contain trees with hollows suitable for denning. Hollow-bearing trees and stags are common and a range of hollow-sizes are present i.e. <5 cm to >20 cm diameter cavities.</p> <p>In the Action area, the Greater Glider was recorded within Poplar Box Woodland (RE 11.5.3 and RE 11.3.2). Previous observations of this species on MCPL owned-land have noted that it prefers Eucalypt woodlands and open forest associated with major creeks (which do not occur in the Action area) and drainage lines, equivalent to RE types 11.3.25, 11.3.2, 11.3.4 and 11.3.7. It has also been occasionally noted in Poplar Box woodland equivalent to RE 11.5.3. Based on these previous observations, preferred forage species appear to be Moreton Bay Ash (<i>E. tessellaris</i>), Silver-leaved Ironbark (<i>E. melanophloia</i>) and Poplar Box.</p>	<p>Greater Gliders were observed during a spotlighting survey within the north of the Western Extension Commonwealth Offset area (Figure 17). The Greater Gliders were recorded in open woodland habitats near Roper Creek equivalent to RE 11.5.3 and RE 11.3.7.</p> <p>Approximately 575 ha of known and potential habitat for the Greater Glider occurs in the Western Extension Commonwealth Offset Area represented by all Eucalypt forests and woodlands present as these contain trees with hollows suitable for denning (Figure 17). Hollow-bearing trees and stags are common and a range of hollow-sizes are present i.e. <5 cm to >20 cm diameter cavities.</p> <p>The Western Extension Commonwealth Offset Area also contains approximately 400 ha of cleared land likely to have been formerly potential habitat (i.e. Eucalypt forests and woodlands).</p> <p>Note that RE 11.5.2a and 11.5.9 were excluded as potential habitat for this species as the tree canopy was generally sparse, the community was exposed and very dry and hollow-bearing trees were rare.</p>
Conclusion	<p>The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide:</p> <ul style="list-style-type: none"> the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Greater Glider); a greater area of potential habitat (approximately 175 ha in the Action area verse 575 ha in the offset area); larger patches of potential habitat (refer Figures 16 and 17); and opportunity to re-establish approximately 400 ha of foraging habitat within areas of vegetation in the early stages of regrowth from past clearing (Figure 17), resulting in 975 ha of habitat in the offset area. 	

* Habitat Descriptions Provided by the Department of the Environment and Energy.

2.5.3 Direct, Indirect and Cumulative Impacts

The Action would remove approximately 175 ha of known/potential habitat for the Greater Glider, comprising open woodlands RE 11.3.2, RE 11.3.2/11.3.4, RE 11.3.27d and RE 11.5.3 (Figure 16). The condition of the habitat is reduced by past disturbances (e.g. logging), but the Greater Glider is likely to use the habitat for both foraging and denning/breeding within remaining hollow-bearing trees. Similar and better habitat known to be used by the Greater Glider is more widespread in the landscape outside the Action area. The records within offset areas are shown on Figure 17.

The potential indirect impacts on the Greater Glider associated with the Action (e.g. vehicle strike, noise, vibration, artificial lighting and/or the introduction of introduced species) are considered to be minimal and would only incrementally increase the likelihood of existing indirect impacts associated with the existing mining operations.

The Action is not likely to result in significant impacts from edge effects on potential habitat for this species outside of the Action area given the potential habitat is poorly connected to the Action area due to the existing fragmentation.

In regard to fragmentation impacts, the potential habitat for this species is patchy and fragmented and does not provide strong connectivity to adjacent habitats. The action has potential for some minor isolation of external habitats and will increase fragmentation. Post-mine landforms are proposed to be progressively rehabilitated to include woodland habitat, ultimately resulting in a greater coverage of woodland habitat.

The change in cumulative impact on the Greater Glider as a result of the Action will be high at the local scale, however in consideration of the wider distribution of the species, extent of remaining habitat and the biodiversity offsets which have been (or would be provided), the cumulative impact in the locality is likely to be minimal.

2.5.4 Avoidance, Safeguards and Mitigation Measures

Potential impacts to the Greater Glider would be minimised through implementation of the following measures:

- Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species.
- MCPL would use a licensed spotter-catcher and/or carer during clearing activities.
- Where possible, timing of clearing habitat for this species would avoid the breeding season (i.e. April to June).
- Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).

A National or State recovery plan has not been prepared for this species. The above measures are predicted to be effective in reducing potential adverse impacts on the Greater Glider because they are focused on addressing the recognised threats to the species that would occur as a result of the Action (e.g. clearing).

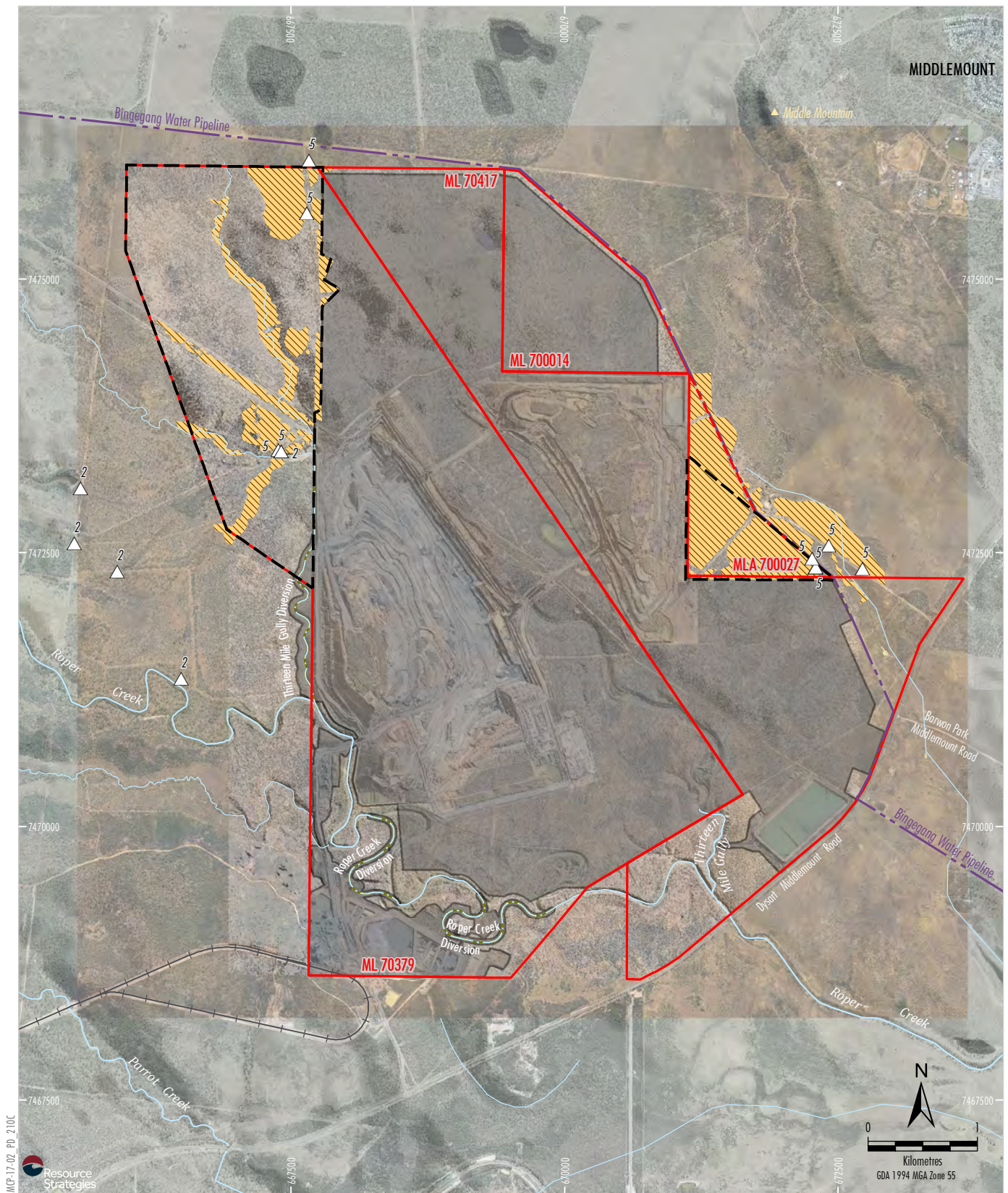
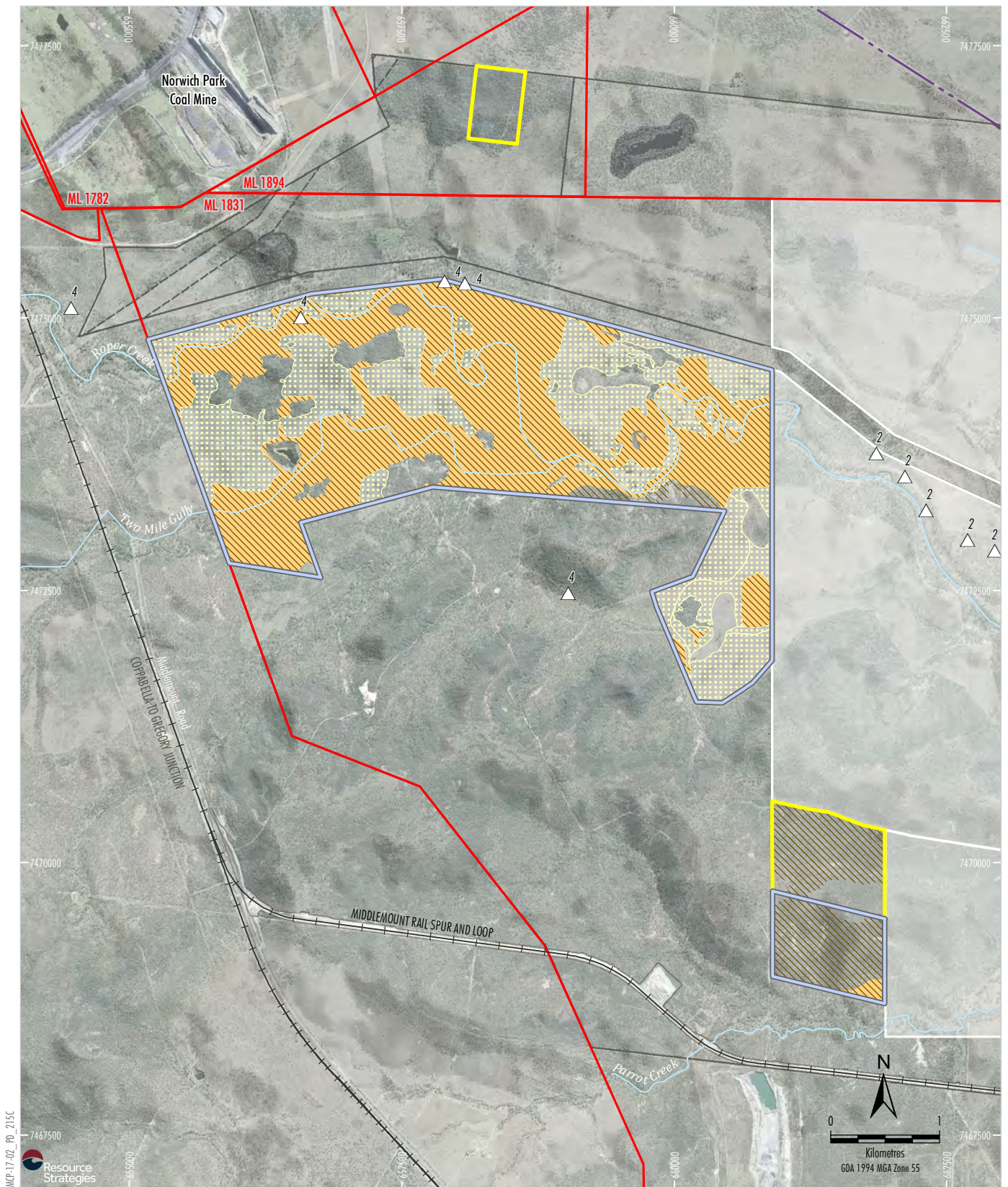


Figure 16



LEGEND

- Mining Lease Boundary (ML)
- Middlemount Coal Owned Land
- Railway
- Existing Offset Area
- Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
- Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

Potential Habitat

- Greater Glider Potential Habitat (Eucalypt Forests and Woodlands with Tree Hollows)
- Greater Glider Recorded Location
- Other Map Units
- Eucalypt Forests and Woodlands
- Cleared Land Likely to be Formerly Potential Habitat (Eucalypt Forests and Woodlands)

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)

Reference: 2 Naturecall Environmental (2014)
4 Biodiversity Australia (2019)
Note: There are no references 1 and 3 on this figure.



WESTERN EXTENSION PROJECT Greater Glider Potential Habitat Mapping - Proposed Offset Areas

Figure 17

2.5.5 Offset

Three Greater Gliders were observed during a spotlighting survey within the north of the Western Extension Commonwealth Offset area. The Greater Gliders were recorded in open woodland habitats near Roper Creek (Plate 4) equivalent to RE 11.5.3 and RE 11.3.7.

Table 6 provides a detailed description of habitat for the Greater Glider in the Action Area and proposed Western Extension Commonwealth Offset Area.



Plate 4 Roper Creek within the Western Extension Commonwealth Offset Area

2.5.6 Conclusion/Consequential Impact

The Greater Glider is commonly recorded in wider locality, including existing and proposed offset areas. Habitat resources for the Greater Glider would remain outside of the Action area, such that the species is likely to persist in the landscape. An outcome of the Action would be approximately 575 ha of known and potential habitat for the Greater Glider would be enhanced and conserved as part of the Western Extension Commonwealth Offset Area. The Western Extension Commonwealth Offset Area provides the opportunity to re-establish approximately 400 ha of foraging habitat within areas of vegetation in the early stages of regrowth from past clearing (Figure 17), resulting in 975 ha of habitat in the offset area.

2.6 GREY-HEADED FLYING FOX

The Grey-headed Flying Fox has not been recorded during any survey work undertaken to date (Section 2) within the Action area, Middlemount Mine or offset areas. If present, the Grey-headed Flying Fox would have been detected during daytime surveys, scat searches and night-time searches consistent with DEWHA (2010b).

There are no known Grey-headed Flying Fox camps in the Action area or surrounds. It is recognised that there is a DES monitored flying-fox camp at Middlemount township (DEHP, 2016), approximately 3 km north-east of the Action. In 2014, the Grey-headed Flying Fox was recorded at the flying-fox camp. There have been no subsequent Grey-headed Flying Fox records since this one in August of 2014.

Biodiversity Australia (2019a) (Attachment C) ground-truthed vegetation within the Action area, and there are no tall closed forests near streams, rivers or estuaries that would provide attractive habitat for the Grey-headed Flying Fox. As such, the species is considered unlikely to occur in the Action area in a roosting capacity due to the absence of roosting habitat. At very most, the species may use the Action area as a minute portion of a much larger foraging range hence any potential impacts from the Action would be minute (Attachment C). The *Species Profile and Threats Database* (DEE, 2018) recognises foraging areas are usually within 15 km of a roost (but could be up to 50 km of a roost). If there was a flying-fox camp at Middlemount township (which there has not been since 2014), the Action Area would provide 175 ha of potential foraging habitat and the offset area would provide 638 ha of potential foraging habitat (based on a summary of all Eucalypt woodland/forest present).

The Grey-headed Flying Fox is not considered likely to occur in the Action Area (Attachment C) and the Action is unlikely to have a significant impact on the species (after DEWHA, 2013). It is also noted that the Grey-headed Flying Fox was not deemed to be significantly impacted by the Middlemount Coal Stage 2 Project (EPBC 2010/5394) or North-eastern Extension (EPBC 2017/8130). Despite this, the Western Extension Commonwealth Offset Area may provide potential foraging habitat for this species were it to roost within range of the Action or offset.

2.7 SOUTH-EASTERN LONG-EARED BAT

Biodiversity Australia (2019a) (Attachment C) undertook targeted surveys for the South-eastern Long-eared Bat and assessed potential habitat for the species. The survey methods used to detect the South-eastern Long-eared Bat were Anabat surveys and harp trapping (Attachment C).

The South-eastern Long-eared Bat has not been confirmed within the Action area or surrounds during any previous survey work. The nearest confirmed database record for this species is located greater than 250 km to the south-west of the Action area (Atlas of Living Australia [ALA], 2017). A *Nyctophilus* sp. was recorded during surveys⁴ for the North-eastern Extension (Naturecall, 2016). The North-eastern Extension was approved under the EPBC Act with conditions relating to the South-eastern Long-eared Bat based on the unconfirmed record of the genus.

The South-eastern Long-eared Bat is not considered likely to occur in the Action Area (Attachment C) and the Action is unlikely to have a significant impact on the species (after DEWHA, 2013).

2.8 CUMULATIVE IMPACTS

Cumulative impacts are considered to be the total impact (direct and indirect) on the environment that would result from the incremental impacts of the Action added to other existing impacts.

Removal of vegetation and habitat for the Action would add to cumulative loss of vegetation from past landuses and clearing associated with the existing/approved Middlemount Coal Mine. The Action would also contribute to the cumulative impacts of vegetation clearance associated with a number of operational mines within the wider locality, these include:

- German Creek East – located approximately 5 km south of the Action area;
- Foxleigh – located approximately 15 km south-east of the Action area;
- Lake Lindsay – located approximately 15 km south south-east of the Action area; and
- Norwich Park – located approximately 20 km north-west of the Action area.

⁴ *Nyctophilus* sp. calls recorded via bat recording devices were identified to genus level only as calls could not be distinguished from other potential occurring bat species.

At a site level, the proposed clearance associated with the Action would result in an increase in woodland vegetation clearance of approximately 43% when compared to the existing/approved Middlemount Coal Mine (Attachment C). Approximately 440 ha of native vegetation is approved to be cleared for the Middlemount Coal Mine, however, the loss of vegetation associated with the approved mining operations has already been offset.

On a larger scale, the native vegetation communities to be cleared during the life of the Action all occur more widely in surrounding landscapes and subregions (after Accad *et al.*, 2017). The Action would result in the loss of approximately 0.03% of vegetation remaining within the Isaac Comet Dows Subregion (Accad *et al.*, 2017) (Attachment C).

The proposed offset areas for the Action would significantly increase the area of protected habitat that would be managed for conservation (bringing the total to 5,861 ha). The existing and proposed offset areas provide habitat for a number of common and threatened species as demonstrated from monitoring surveys and their continued regeneration would help offset biodiversity losses from the Middlemount Coal Mine. In addition, the progressive rehabilitation of mining areas over the life of the Action would provide habitat in the medium to long term. The cumulative impacts and offsets for the Ornamental Snake, Squatter Pigeon (southern), Koala and Greater Glider are described in Sections 2.1 to 2.5.

The target coal seams for the Action are the Middlemount and Pisces coal seams of the Rangal Coal Measures. These coal seams continue to the north and south of ML 70379 held by MCPL, however mining operations at the Middlemount Coal Mine are constrained by mining tenure and land ownership. MCPL do not own the land to the south of ML 70379 or much past the northern boundary of ML 70379 (Figure 4). Also, MCPL do not have mining tenure over the coal seams outside of ML 70379 and MDL 282. The mining tenure to the south, north and west of ML 70379 is held by Anglo Coal (Figure 4) and the petroleum tenure to the north of ML 70379 is held by New South Oil Pty Ltd (Arrow Energy Pty Ltd [Arrow Energy]). It is outside of MCPL's control to know future expansion or development plans by other proponents in the vicinity of the action.

Given the above, Biodiversity Australia (2018) concluded that the additional clearance associated with the Action is considered to represent only a minor increase in cumulative vegetation loss. Accordingly, the Action is not anticipated to have a significant cumulative impact on terrestrial ecology.

2.9 SUMMARY OF AVOIDANCE, SAFEGUARDS AND MITIGATION MEASURES FOR THREATENED SPECIES AND COMMUNITIES

MCPL would minimise land clearance through the use of existing infrastructure and facilities (where possible) and minimising out-of-pit waste emplacements via backfilling of the open cut pit void. The existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced. For example, relevant impact mitigation measures include the use of a licensed spotter-catcher and/or carer during clearing activities and progressive rehabilitation of disturbance areas.

Table 7 provides a summary of avoidance, safeguards and mitigation measures for threatened species and communities. The measures are predicted to be effective in reducing potential adverse impacts on the threatened species and Brigalow EEC because they are focused on addressing the recognised threats to the species and Brigalow EEC (DEE, 2018) in consideration of the following best practise sources such as threat abatement plans (DotE, 2015; DEWHA, 2008) and Qld Government species management program under section 332 of the *Nature Conservation [Wildlife Management] Regulation, 2006*.

Table 7
Summary of Avoidance, Safeguards and Mitigation Measures for Threatened Species and Communities

Species	Avoidance, Safeguards and Mitigation Measures
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	<p>Potential impacts to Brigalow EEC would be minimised through implementation of the following measures:</p> <ul style="list-style-type: none"> Boundaries of areas to be cleared, and those not to be cleared, would be defined before and during clearing activities. Weed management techniques would continue to be implemented within the mining lease (e.g. weed control [spraying] and washdown of machinery when moving from weed infested areas). The revegetation species list for the realigned section of the Thirteen Mile Gully Diversion would include species characteristic of the Brigalow EEC.
Ornamental Snake (<i>Denisonia maculata</i>)	<p>Potential impacts to the Ornamental Snake would be minimised through implementation of the following measures:</p> <ul style="list-style-type: none"> Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species. MCPL would use a licensed spotter-catcher and/or carer during clearing activities. Continuation of the feral animal control measures within the mining lease, including the control of European Red Fox and Feral Cat, biannually for the life of the mine. Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (the revegetation species list for the realigned section of the Thirteen Mile Gully Diversion would include species characteristic of the Brigalow EEC [potential habitat for this species]).
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)	<p>Potential impacts to the Squatter Pigeon (southern) would be minimised through implementation of the following measures:</p> <ul style="list-style-type: none"> Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species. MCPL would use a licensed spotter-catcher and/or carer during clearing activities. Continuation of the feral animal control measures within the mining lease, including the control of European Red Fox and Feral Cat, biannually for the life of the mine. All roads in the Action area would be limited to a 40 km/h speed limit which would reduce the risk of vehicle strike. Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).
Greater Glider (<i>Petauroides volans</i>)	<p>Potential impacts to the Greater Glider would be minimised through implementation of the following measures:</p> <ul style="list-style-type: none"> Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species. MCPL would use a licensed spotter-catcher and/or carer during clearing activities. Where possible, timing of clearing habitat for this species would avoid the breeding season (i.e. April to June). <p>Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).</p>
Koala (<i>Phascolarctos cinereus</i>)	<p>Potential impacts to the Koala would be minimised through implementation of the following measures:</p> <ul style="list-style-type: none"> Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including this species. MCPL would use a licensed spotter-catcher and/or carer during clearing activities. If a Koala is present in the proposed clearing area, it would be left to move away from the clearance area on its own accord. Continuation of the feral animal control measures within the mining lease, including the control of Wild Dog, biannually for the life of the mine. All roads in the Action area would be limited to a 40 km/h speed limit which would reduce the risk of vehicle strike. Progressive rehabilitation of disturbance areas to progressively provide habitat resources during and post-mining (e.g. overburden revegetated with species characteristic of Poplar Box Woodland).

2.10 PROPOSED BIODIVERSITY OFFSET PACKAGE

2.10.1 Existing Offset Areas

MCPL currently has a number of existing biodiversity offset areas on company-owned land which were established for various components of the Middlemount Coal Mine (Figure 18).

A summary of the area of each of these existing biodiversity offset areas is provided in Table 8.

Table 8
Existing Middlemount Coal Mine Offset Areas

Offset Area	Source of Offset Requirement	Size (ha)	Security
Middlemount Coal (Stage 2) Project Commonwealth Offset Area	EPBC 2010/5394	3,280	Declared Area Map 2013/003919
Rail Loop and Spur Offset Area	Decision Notice IC0410MKY003 Deed of Agreement	84.6	
Parrot Quarry Offset Area	DERM Permit number: 2010/003611 Deed of Agreement	15.4	
Thirteen Mile Gully Diversion Offset Area	SPA and EPBC 2010/5394*	31	
North-eastern Extension Commonwealth Offset Area	EPBC 2016/7717	532	Security due March 2019
North-eastern Extension State Offset Area	EPML00716913	181	
Total		4,124	

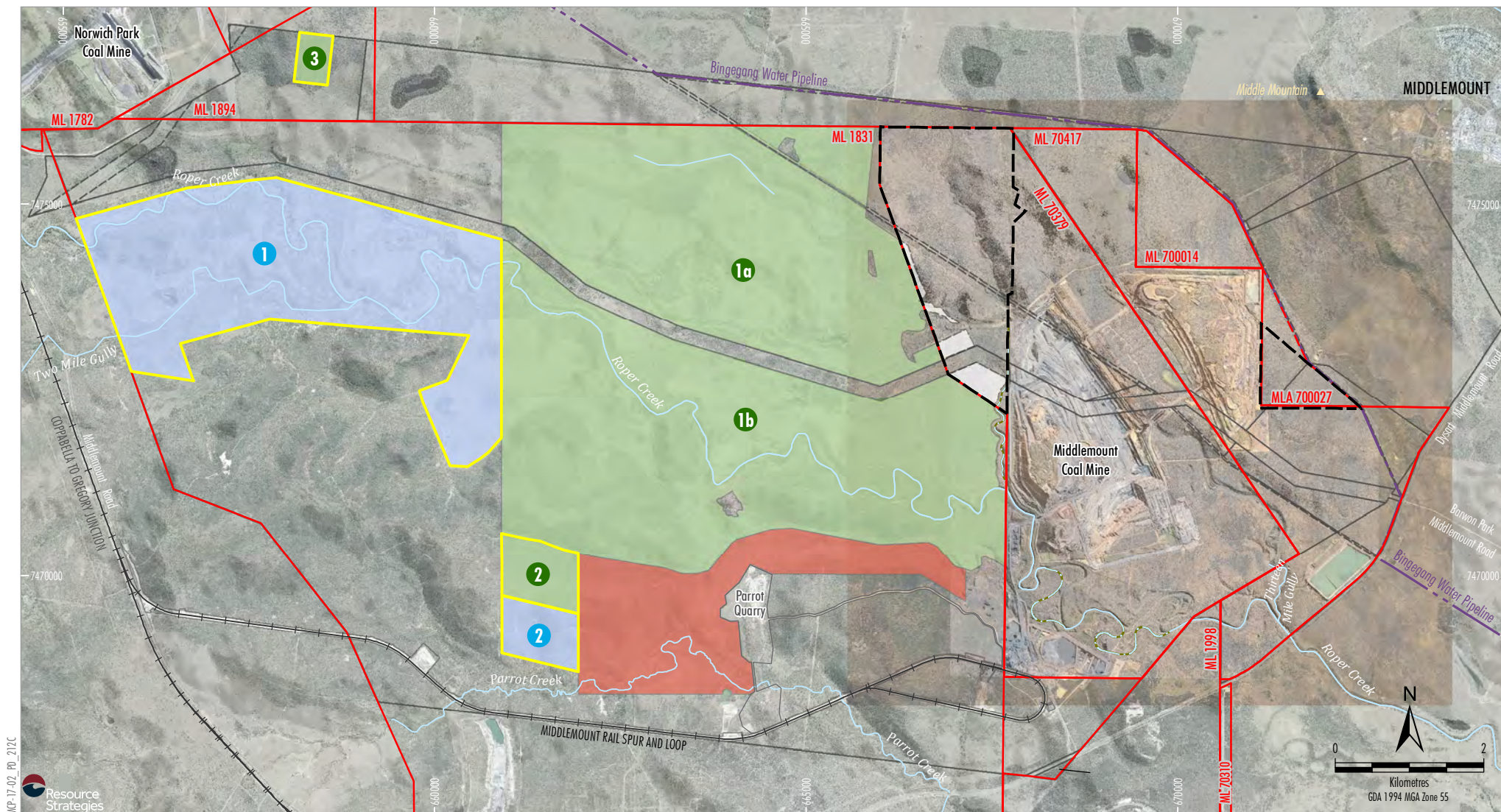
All of the existing biodiversity offset areas (except the North-eastern Extension Offset Areas) are secured via a voluntary declaration of an area of high nature conservation value (VDec) under the Qld *Vegetation Management Act, 1999* (VM Act) (Declared Area Map 2013/003919).

2.10.2 Proposed Biodiversity Offset Strategy

A proposed biodiversity offset strategy to address residual significant impacts from the Action (and impacts of the Western Extension Project on Matters of State Environmental Significance) is described in this section. The offset strategy has been developed to meet requirements under the EO Act (and subordinate legislation) and the EPBC Act.

2.10.2.1 Proposed Middlemount Coal Mine Offset Areas

The offset areas are proposed approximately 10 km south-west of the Middlemount township (Figure 18; Table 9). All of the proposed offset areas occur within the Isaac-Comet Downs subregion of the North Brigalow Belt Bioregion, within the Fitzroy catchment and are adjacent to (or in close proximity to) the existing biodiversity offset areas. The closest State Government reserves are Bundorra State Forest located approximately 10 km south-west and Junee National Park located approximately 20 km north-east.



MP-17-02, p. 212C



- LEGEND**
- Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Middlemount Coal Owned Land
 - Railway
 - Approximate Extent of Additional Surface Disturbance

- Existing/Approved Offset Areas**
- North-eastern Extension Commonwealth Offset Area (EPBC 2016/7717)
- Removed Offset Portions**
- Portion of the Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
- Proposed Offset Areas**
- Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
 - Western Extension Commonwealth Offset Area (EPBC 2017/8130)

Source: MCPL (2018); Department of Natural Resources and Mines (2017); © State of Queensland (Department of Science, Information Technology and Innovation, 2017)
 Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT

Existing and Proposed
Commonwealth Offset Areas

Figure 18

Table 9
Proposed Middlemount Coal Mine Offset Areas

Offset Area	Overall Size (ha)	Additional Area (ha) (Figure 18)
Western Extension Commonwealth Offset Area (EPBC 2017/8130)	1,220	1,220
Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)	3,318	115
Western Extension State Offset Area	454	454
Modified Rail Loop and Spur State Offset Area	110	45
	5,102	1,834

* Highlighting indicates offset areas relevant to the EPBC Act

MCPL has a registered interest in the land on which the offset areas are proposed (Table 10) and there are no other relevant parties with registered interests under the Qld *Land Act, 1994* or the Qld *Land Title Act, 1994*.

Table 10
Relevant Offset Area Details

Reference	Landholder Details
Registered Owner on Title	Middlemount Coal Pty Ltd
Real Property Description	Lot 2, SP 210524 [part of]

Biodiversity Australia (2019b) (Appendix 15 of Attachment C) undertook flora and fauna surveys in accordance with contemporary Qld and Commonwealth survey guidelines to assess the suitability of the proposed offset areas. Field surveys were undertaken in July and November 2017.

The flora surveys were undertaken in accordance with the Qld Herbarium vegetation survey methods described in Neldner *et al.* (2017). Survey techniques included a combination of secondary and quaternary surveys, identification of Threatened Ecological Communities, targeted searches for conservation significant species and random meanders.

Habitat Quality Assessments were also conducted across the offset areas in accordance with the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DEHP, 2017b), including an assessment of required number of sampling sites, site condition assessment, site context assessment and fauna species habitat assessment. The field survey methodologies are further described in detail in Appendix 15 of Attachment C.

2.10.2.2 Western Extension Commonwealth Offset Area (EPBC 2017/8130)

The proposed Western Extension Commonwealth Offset Area is located to the west and south of the existing Middlemount Coal (Stage 2) Project Commonwealth Offset Area, thus provides connectivity to existing conserved habitat (Figure 18). The Western Extension Commonwealth Offset Area is approximately 1,220 ha in size, comprising approximately 752.5 ha of woodland vegetation and approximately 444 ha of derived grassland and vegetation in the early stage of regrowing from past clearance, with the remainder of the area being mapped as cleared land.

The Western Extension Commonwealth Offset Area would offset the clearance of 22 ha of Brigalow EEC (represented by 15.5 ha of RE 11.4.9 and RE 11.3.1 as well as 6.5 ha of regrowth). The Western Extension Commonwealth Offset Area contains approximately 76 ha of Brigalow EEC (represented by RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.4.9a) (Figure 7).

The Western Extension Commonwealth Offset Area provides an offset for the four threatened species. Two threatened species, the Koala and Greater Glider, were recorded by Biodiversity Australia (2019b) (Appendix 15 of Attachment C) within the Western Extension Commonwealth Offset Area (Figure 18). The other two threatened species, the Ornamental Snake and Squatter Pigeon (southern) have both been recorded in the general locality and both are considered likely to occur within the Western Extension Commonwealth Offset Area (Figure 12).

Table 11 provides a reconciliation of the area (in ha) of each MNES being impacted by the Action and the area of land which would be included in the Western Extension Commonwealth Offset Area. The *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) was applied by Biodiversity Australia (2019b) (Attachment I).

Table 11
Suitability of the Western Extension Commonwealth Offset Area for Relevant MNES

Species/Community	Clearance Area (ha)	Component in the Offset Area	Offset Area (ha)	Percentage (%) of Impact that is Offset
Squatter Pigeon (southern)	190.5 ha remnant and 198 ha of regrowth	Woodland/Forest Habitat	749.5	45.47
		Regrowth Habitat	405.5	61.5
		Total	1,155	106.97
Koala	175	Woodland/Forest Habitat	664.5	89.49
		Cleared Land Not Currently Habitat	400	80.81
		Total	1,064.5	170.3
Greater Glider	175	Woodland/Forest Habitat	575	38.72
		Cleared Land Not Currently Habitat	400	80.81
		Total	975	119.53
Ornamental Snake	15.5	Woodland/Forest Habitat	76	115
		Cleared Land Not Currently Habitat	30	68.43
		Total	106	183.43
Brigalow Woodland TEC	22 (of which 6.5 ha is regrowth)	Woodland/Forest Habitat	76	70.15
		Cleared Land Not Currently Habitat	30	55.38
		Total	106	125.53

Regional Ecosystems ground-truthed by Biodiversity Australia (2019b) (Appendix 15 of Attachment C) within the Western Extension Commonwealth Offset Area are listed in Table 12 and shown on Figure 7.

Table 12
Regional Ecosystems - Western Extension Commonwealth Offset Area

Regional Ecosystem	Short Description	Vegetation (ha)	Ornamental Snake Habitat	Squatter Pigeon (southern) Habitat	Koala Habitat	Greater Glider Habitat
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	16.5	16.5	16.5	-	-
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	281	-	281	281	281
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	57	-	57	57	57
11.3.27d	<i>Eucalyptus camaldulensis</i> and/or <i>E. tereticornis</i> woodland. A range of sedges and grasses occur in the ground layer including <i>Fimbristylis vagans</i> , <i>Myriophyllum striatum</i> , <i>Nitella pseudoflabellata</i> and <i>Pseudoraphis</i> sp. Occurs fringing large lakes. Palustrine wetland (e.g. vegetated swamp)	4	-	4	4	4
11.3.4/11.3.4a	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains; and <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	117.5	-	117.5	117.5	117.5
11.3.7	<i>Corymbia</i> spp. woodland on alluvial plains	29	-	29	29	29
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	17	17	17	-	-
11.4.9/11.4.9a	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains; <i>Corymbia tessellaris</i> woodland. On alluvial sandridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict. Occurs on deep, loose neutral to alkaline red or pale uniform sand or non-sodic texture contrast soil. This unit has very low subsoil salinity in all profiles. Floodplain (other than floodplain wetlands)	42.5	42.5	42.5	-	-
11.5.2a	<i>Allocasuarina luehmannii</i> low tree layer with or without emergent woodland	52.5	-	52.5	52.5	-
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	86.5	-	86.5	86.5	86.5
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces	23.5	-	23.5	23.5	-
11.5.18	<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains and/or remnant surfaces	9	-	9	-	-
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	3	-	-	-	-
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust	13.5	-	13.5	13.5	-
Sub-total		752.5	76	749.5	664.5	575
Regrowth		444	0	405.5	0	0
Total		1,196.5	76	1,155	664.5	575
Cleared Land		23.5	-	-	-	-

Source: Biodiversity Australia (2019b) (Appendix 15 of Attachment C)

A reconciliation of the Western Extension Commonwealth Offset Area against the Commonwealth offset principles is presented in Table 13.

Table 13
Reconciliation of the Western Extension Commonwealth Offset Area against the Commonwealth Offset Principles

Offset Principles ¹	Elements of the Proposed Biodiversity Offset Package that Address these Requirements
<i>Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the action.</i>	The proposed offset area is specifically tailored to the relevant protected matters (i.e. Brigalow, Ornamental Snake, Squatter Pigeon [southern], Koala and Greater Glider) and to deliver an overall conservation outcome that improves or maintains the viability of each protected matter.
<i>Be built around direct offsets but may include other compensatory measures.</i>	The Commonwealth offset requirements would be satisfied by the Western Extension Commonwealth Offset Area (Figure 18).
<i>Be in proportion to the level of statutory protection that applies to protected matters.</i>	The size and scale of the Western Extension Commonwealth Offset Area provides for greater than 100% of the offset requirements for each protected matter relevant to the Action. This was determined by applying the <i>EPBC Act Offsets Assessment Guide</i> (DSEWPac, 2012b).
<i>Be of a size and scale proportionate to the impacts on the protected matter.</i>	The size and scale of the Western Extension Commonwealth Offset Area provides for greater than 100% of the offset requirements for each protected matter relevant to the Action. This was determined by applying the <i>EPBC Act Offsets Assessment Guide</i> (DSEWPac, 2012b). Given this, it is determined that the Western Extension Commonwealth Offset Area is of a suitable size and scale proportionate to the impacts of each protected matter.
<i>Effectively account for and manage the risks of the offset not succeeding.</i>	The <i>EPBC Act Offsets Assessment Guide</i> (DSEWPac, 2012b), which was applied to the Action accounts for the risk of the offset not succeeding. In addition, measures to manage the Western Extension Commonwealth Offset Area would provide for ongoing adaptive management in the unlikely event that the offset is not succeeding. The implementation of the offset strategy is likely to be a condition of Environmental Approval.
<i>Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.</i>	The implementation of the offset strategy is beyond existing requirements, in that it is not part of any private conservation reserve system. The enduring protection that would be applied to the Western Extension Commonwealth Offset Area are new and additional under duty of care or any environmental planning laws.
<i>Be efficient, effective, transparent, proportionate, scientifically robust and reasonable.</i>	<p>The Western Extension Commonwealth Offset Area would efficiently and effectively compensate for the impacts on the protected matters and help maintain the viability of the protected matters.</p> <p>Flora and fauna surveys of the Western Extension Commonwealth Offset Area have already been, undertaken to determine:</p> <ul style="list-style-type: none"> the area of the offset in comparison to the area of impact; the nationally threatened fauna and flora species present (or predicted to occur) and their conservation status; the connectivity and condition of the native vegetation/fauna habitat; and management actions and security for the Western Extension Commonwealth Offset Area.
<i>Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.</i>	Consistent with the existing offset area, MCPL would seek to secure the proposed offset area through a VDec under the VM Act.

¹ SEWPaC, 2012a.

2.10.2.3 Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

The Middlemount Coal (Stage 2) Project Commonwealth Offset Area covers an area of approximately 3,280 ha (Figure 18). This offset area was established for the following MNES:

- Brigalow EEC;
- Squatter Pigeon (southern); and
- Ornamental Snake.

The Action would result in the removal of a small portion (approximately 32 ha, 1%) of the Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394). Based on consultation with DEE in July 2017, April and May 2018, MCPL is proposing to:

- modify (and increase) and Middlemount Coal Project Stage 2 Commonwealth Offset Area (EPBC 2010/5394); and
- offset the impact on the values (within the footprint) as part of the Western Extension Commonwealth Offset Area (EPBC 2017/8130).

The proposed Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394) is shown on Figure 18. Two additional areas are proposed to be added to the offset area (Parts 2 and 3), located to the north-west, and south of the Middlemount Coal (Stage 2) Project Commonwealth Offset Area (Figure 18).

The *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012b) was applied by Biodiversity Australia (2019b) (Attachment I). With the additional offset areas, the existing requirement under the Commonwealth Approval (EPBC 2010/5394) is exceeded.

Table 14 provides a reconciliation of the area of MNES within the Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area against the requirements of EPBC 2010/5394.

Table 14
Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area

Matters of National Environmental Significance	Original Clearance Required for the Stage 2 Project (ha)*	Offset Requirement (EPBC 2010/5394) (ha)	Revised Commonwealth Middlemount Coal Project Stage 2 Offset Area (ha)	Additional Area Provided Exceeding Requirement (EPBC 2010/5394)(ha)
Brigalow EEC	6	150	168.5	18.5
Ornamental Snake	47	1,670	1,692.5	22.5
Squatter Pigeon (southern)	1,100	3,280	3,318	38

* Parsons Brinckerhoff (2010a).

2.10.3 Offset Security

MCPL has consulted with the Qld Department of Natural Resources, Mines and Energy (DNRME) regarding the long-term security of the proposed offset areas. Consistent with the existing offset area, MCPL would seek to secure the proposed offset area through a VDec under the VM Act. It is intended that the VDec would cover the proposed offset areas.

2.10.4 Offset Management

Consistent with the existing/approved offset areas, the primary method for regenerating the proposed offset area would be through the management of threatening processes that inhibit natural regeneration. In this regard, the likely management measures that would be developed for the proposed offset area include (but are not limited to) the following:

- On-ground set up of the proposed offset area (e.g. fencing where relevant, installing locked gates, signage, access tracks).
- Weed Management Strategy.
- Vertebrate Pest Management Strategy.
- Fire management.
- Management of livestock.

In the unlikely event that natural regeneration is not readily occurring or species composition is poor, active seeding/planting would be undertaken as needed.

MCPL will fence the 'cleared land likely to be formerly potential habitat' (Brigalow Woodland – RE11.3.1) on Figure 10 to exclude grazing livestock within a year after approval to enhance the habitat for the Ornamental Snake.

2.11 OFFSET MANAGEMENT PLAN

The existing/approved *Middlemount Coal Mine Offset Management Plan/Vegetation Management Plan* (MCPL, 2013a) (covering all existing/approved offset areas except north-eastern extension offset areas [Table 8]) has been reviewed and revised to include all of the existing and proposed offset areas.

The revised *Middlemount Coal Mine Offset Management Plan/Vegetation Management Plan* is provided in Attachment G. The revised plan provides the following for the Western Extension Commonwealth Offset Area:

- details of the location of the Western Extension Commonwealth Offset Area (Section 2 of Attachment G);
- a description of the current condition (prior to any management activities) of the Western Extension Commonwealth Offset Area, including existing vegetation (the baseline condition) and value as habitat for listed threatened species (Section 2 of Attachment G);
- a map to clearly define the location and boundaries of the Western Extension Commonwealth Offset Area (Figure 4 of Attachment G);
- details of how the Western Extension Commonwealth Offset Area provide connectivity with the other existing and proposed offset areas (Section 2 of Attachment G);
- a description of the management measures that would be implemented for the Western Extension Commonwealth Offset Area, including a timeline for when management measures would be implemented (Section 3 of Attachment G and the management schedule in Section 3.13 of Attachment G);
- a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria (Section 5 of Attachment G); and
- details of the tenure proposed for the Western Extension Commonwealth Offset Area (i.e. Vdec) (Section 1.3 of Attachment G).

Shape files of the boundaries of the Western Extension Commonwealth Offset Area can be provided separately to DEE.

3 WATER RESOURCES

As described in Section 1, the Middlemount Coal Mine is an existing mine and full-scale operations commenced in July 2011. The existing/approved Middlemount Coal Mine already impacts surface water and groundwater resources, for example through diversions of Thirteen Mile Gully and Roper Creek and groundwater drawdown associated with the open cut mining operation. These impacts are authorised under the Middlemount Coal Project Stage 2 Commonwealth approval (EPBC 2010/5394). The Action provides for the continuation of open cut coal mining operations at the Middlemount Coal Mine, including a small realignment of the authorised Thirteen Mile Gully Diversion and an incremental increase in groundwater drawdown associated with the open cut extension to the north-west of the authorised open cut mine extents.

Authorised impacts on water resources are currently being regulated under the Qld EP Act (Middlemount Coal Mine operates under EA EPML00716913) and Qld *Water Act, 2000* (water licences). The water resource conditions from EA EPML00716913 are provided in Attachment H. Noting, however, that MCPL is seeking approval of the Project through a major amendment of EA EPML00716913 in accordance with Chapter 5, Part 7 of the EP Act so it is anticipated that the water resource conditions in Attachment H will be updated by the Qld Government to incorporate the Project (which would cover the Action activities).

The assessment of potential surface water impacts from the Action is supported by the Surface Water Assessment (WRM Water and Environment [WRM], 2018) and is included in Attachment D. The assessment of potential groundwater impacts from the Action is based on the modelling and assessment conclusions presented in the Groundwater Assessment (Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), 2018), and is included in Attachment E.

The Surface Water Assessment (WRM, 2018) (Attachment D) relevantly includes:

- an assessment of the site water management system (including site water balance modelling and final void recovery modelling) (Section 5 in Attachment D);
- design and assessment of the Thirteen Mile Gully Diversion realignment (including hydraulic and geomorphic characteristics) (Section 6 in Attachment D);
- flood modelling and assessment (including levees and final landforms) (Section 7 in Attachment D);
- consideration of past geochemical assessments and reviews by RGS Environmental Pty Ltd (RGS) (2013; 2016), including current management practices outlined in the *Mine By-Products Management Plan and Mining By-Product In-Pit Disposal Site Practice* at the Middlemount Coal Mine (Section 2.4 in Attachment D); and
- assessment of cumulative impacts (Section 8.6 in Attachment D).

The Groundwater Assessment (AGE, 2018) (Attachment E) relevantly includes:

- a conceptual groundwater model, based on available geological and topographical maps, geological information from exploration bores, groundwater level and quality data and results from previous hydrogeological investigations (Section 6, and Appendices D & E in Attachment E);
- a bore census report, prepared by 4T Consultants Pty Ltd (4T) (2017) (Appendix C in Attachment E);

- a numerical modelling report (Appendix F in Attachment E), including:
 - model confidence level classification;
 - model calibration and verification;
 - groundwater fate modelling; and
 - uncertainty analysis.
- groundwater dependent ecosystems (GDE) assessment (Section 6.8 in Attachment E); and
- stygofauna assessment (Section 6.9 in Attachment E); and
- groundwater management strategy/program (Section 9 in Attachment E).

The Groundwater Assessment (AGE, 2018) has been peer reviewed by Dr Noel Merrick of HydroAlgorithmics Pty Ltd and the peer review letter is included in Attachment F. Dr Noel Merrick concluded the Groundwater Assessment (Attachment E) addressed the objectives satisfactorily, the model underpinning the Groundwater Assessment is “fit for purpose”, and the proposed mitigation and monitoring measures are satisfactory (HydroAlgorithmics, 2018) (Attachment F).

The following subsections have been largely re-produced based on these assessments, considering the impact of the Action on water resources, and if these impacts are significant according to the *Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments - Impacts on Water Resources* (DotE, 2013b). A detailed reconciliation against the IESC Information Guidelines (IESC, 2018) checklist of specific information needs relating to groundwater and surface water resources is presented in Section 1.3.2, as well as the Surface Water Assessment (WRM, 2018) and Groundwater Assessment (AGE, 2018). Upon receipt of the IESC advice, a response will be provided and relevant updates made accordingly in this Preliminary Documentation.

3.1 TOPOGRAPHY, LANDFORM AND SURFACE WATER CATCHMENTS

The natural topography is relatively flat, with an elevation ranging from approximately 160 to 170 m Australian Height Datum (AHD). Approximately 1.5 km to the east of the Action, Middle Mountain rises to an elevation of approximately 280 m AHD (Figure 3). The Action is located within the Roper Creek catchment, within the Mackenzie River Sub-basin of the greater Fitzroy Basin. The Action lies within the plan area of the *Water Plan (Fitzroy Basin) 2011* (within the Upper Mackenzie Sub-catchment). Local drainage in the vicinity of the Action includes (Figure 19):

- Roper Creek including its approved diversions;
- The Thirteen Mile Gully Diversion (including associated upstream drainage features) which diverts the upstream sub-catchments of Thirteen Mile Gully (north and west of the ML 70379 boundary) to Roper Creek; and
- An unnamed tributary of Roper Creek located immediately east of the Action, which joins Roper Creek about 4.2 km downstream of Dysart Middlemount Road.

Roper Creek is an ephemeral watercourse that flows for short periods following rainfall. The catchment commences about 35 km to the west of the Action area. Roper Creek flows into the Mackenzie River some 40 km to the south-east of the Action.

The total catchment area of Roper Creek to the downstream boundary of the Middlemount Coal Mine tenements, including the Thirteen Mile Gully catchment, is approximately 389 km². The upstream sub-catchments of Thirteen Mile Gully were diverted along the eastern boundary of ML 70379 in late 2014. A licence to divert the flow of water of Thirteen Mile Gully was issued under the Qld *Water Act, 2000* in May 2013 and a Qld *Sustainable Planning Act, 2009* (SPA) approval was granted in June 2013. The existing Thirteen Mile Gully Diversion is shown on Figure 19.



Figure 19

Upstream of the diversion, the sub-catchments of Thirteen Mile Gully are drained via two drainage features: Drainage Line 1 (to the north-west); and Drainage Line 2 (to the north) (Figure 19). The DNRME confirmed that these drainage lines are not watercourses, but rather drainage features defined under the Qld *Water Act, 2000* that facilitates overland flow (DNRM, 2017).

A small portion of Thirteen Mile Gully (approximately 1 km) remains in its pre-mining location to the south-east of the Action, which drains south directly to Roper Creek.

3.2 GEOLOGY AND COAL RESOURCE

The coal resource at the Middlemount Coal Mine is located within the Permian age Rangal Coal Measures of the Bowen Basin. The Rangal Coal Measures form a relatively narrow (approximately 3 km wide) structure, striking from the north-northwest to south-southeast within and adjacent to the mine tenements. In the locality, a veneer of more recent Tertiary geology and Quaternary geology typically overlies the Bowen Basin strata.

The geological understanding has been informed by the following data sources:

- geological logs, geophysical logs, and data compiled from exploration drilling across the Middlemount Coal Mine area;
- geological model surfaces for the Middlemount Coal Mine;
- geological data from registered bores held on the DNRME groundwater database (GWDB); and
- publicly available geological mapping (St Lawrence 1:250,000 map sheet) and geological reports.

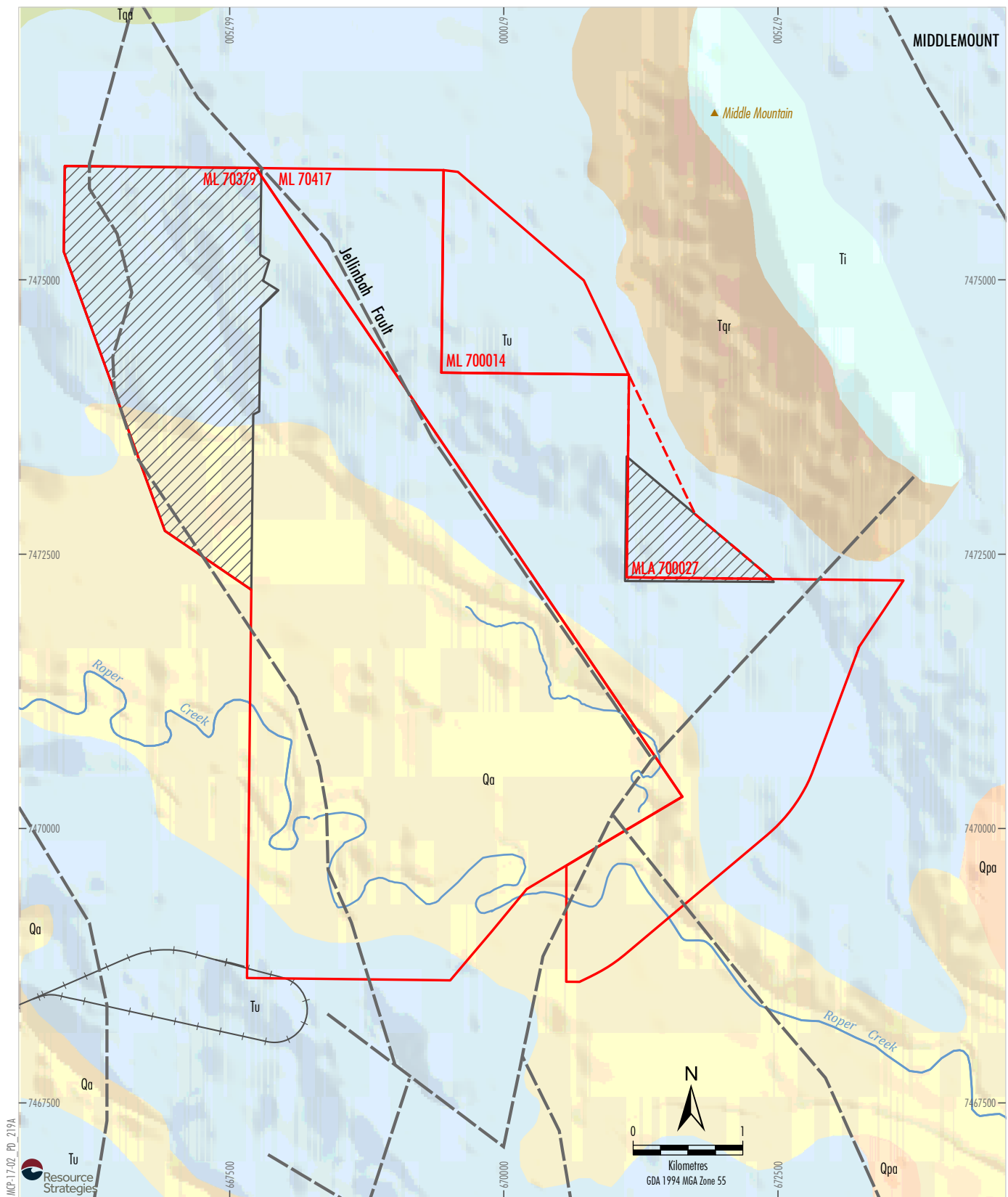
MCPL has undertaken exploration drilling across the Middlemount Coal Mine tenements. However, targeted exploration continues to be undertaken to better define product coal structure and quality within the proposed expansion area. Exploration drilling has confirmed the geological units present in the ML areas and in the surrounds. MCPL has developed geological models from the exploration drilling data, which has been used to interpolate the stratigraphy and distribution of geological units across the Middlemount Coal Mine and immediate vicinity.

The target coal seams for the Action are the Middlemount and Pisces coal seams of the Rangal Coal Measures. These coal seams dip to the east-northeast at between 3 and 7 degrees, where they are truncated by the Jellinbah Fault, which is mapped to be generally coincident with the north-eastern boundary of ML 70379 (Figure 20). More detail on delineation of the Jellinbah Fault and how it is considered in the groundwater model is provided in Section 3.7.3 and AGE (2018) (Attachment E).

The additional target coal resource for the Action (in the north-west of ML 70379) has been estimated at approximately 24.5 million tonnes (Mt), comprising approximately 21 Mt of recoverable coal.

Hydraulic Influence of Faults on Groundwater Flow

The regional tectonic setting of the Bowen Basin is largely compressive and as a consequence faults and folds are more likely to be hydraulic barriers than conduits to lateral groundwater flow (Arrow Energy, 2012). Some faults may also limit flow by vertical displacement of strata (aquifers with aquitards) or by infilling within the fractures. The Stage 2 Environmental Impact Statement (EIS) (MCPL, 2011) surmised the Jellinbah Fault as being a barrier to groundwater flow east of the fault (and mining area) as a result of the 300 m displacement.



Source: MCPL (2018); Department of Natural Resources and Mines (2017)

- LEGEND**
- Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Middlemount Rail Spur and Loop
 - Western Extension Project
 - Approximate Extent of Additional Surface Disturbance
- GEOLOGY MAPPING**
- Bowen Basin Structure
 - Lithology Summary**
- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> Qa Qpa Tqa Tqr Ti Tu | <ul style="list-style-type: none"> Mud, sand and minor gravel; alluvium Clay, silt, sand, gravel; flood plain alluvium on high terraces Clay, silt, sand and gravel; high-level alluvium and colluvium Clay, silt, sand, gravel, soil; colluvial and residual deposits Intrusive rhyolite, trachyte and microsyenite Mudstone, sandstone, conglomerate, siltstone, oil shale, lignite, basalt |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- Age**
- QUATERNARY
 - PLEISTOCENE
 - TERTIARY - QUATERNARY
 - LATE TERTIARY - QUATERNARY
 - EARLY TERTIARY
 - EARLY TERTIARY

WESTERN EXTENSION PROJECT
Surface Geology and Structures

Figure 20

Fault delineation drilling by MCPL in 2017 included 36 boreholes drilled along the Jellinbah Fault which intersected sedimentary units from both the Rangal Coal Measures and Fort Cooper Coal Measures. Groundwater was intersected at 17 sites within either the base of the Tertiary sediments or the underlying Permian coal measures. Generally minor groundwater flows were intersected with measurable flows up to 0.2 litres per second (L/s). Two boreholes that did intersect higher groundwater yields (0.4 L/s and 1.8 L/s) were considered to be associated with localised fracture zones of limited groundwater storage.

It is generally agreed amongst hydrogeologists that faults should not necessarily be represented in a groundwater flow model if there is evidence that they do not act as a barrier to groundwater flow. In the natural groundwater system, for example, a fault may appear to act as a barrier to groundwater flow where the vertical offset results in coal seams (i.e. the main groundwater conduit) being truncated against lower-permeability interburden. However, where the vertical offset results in one coal seam being fully or partially connected to another coal seam, the hydraulic connection across the fault may be unimpeded with the potential for groundwater seepage (hydraulic loading) from the adjacent offset coal measures.

Hence, groundwater flow within the Permian coal measures may, or may not, be influenced by the hydraulic parameters of the Jellinbah Fault and the associated secondary faulting to the east and west as part of this thrust complex. These faults are orientated northwest-southeast, with the Middlemount Coal Mine open pit located south-west of the Jellinbah Fault.

Based on the above, it is assessed that vertical displacements along the Jellinbah Fault alignment has resulted in the Rangal Coal Measures coal seams being truncated against lower permeability Fort Cooper Coal Measures interburden. That is, groundwater flow/movement to the east across the Jellinbah Fault is not halted, rather it is slowed as a result of the lower permeability Fort Cooper Coal Measures sediments (AGE, 2018) (Attachment E). As described in Section 3.7.3, the numerical groundwater model provides for a lateral, horizontal hydraulic connection across the Jellinbah Fault where different layers are juxtaposed on the eastern and western sides of the fault plane. The groundwater modelling results demonstrate that drawdown propagates up to 3 km north and north-east of the mining lease, east of the Jellinbah Fault.

3.3 GROUNDWATER SYSTEM

A conceptual hydrogeological model of the groundwater regime was developed by AGE (2018) based on publicly available geological and topographical maps, geological information from exploration bores drilled in the vicinity of the mine, groundwater level and quality data from monitoring bores and results from previous hydrogeological investigations.

The hydrogeological regime of the Middlemount Coal Mine comprises a Quaternary and Tertiary age sequence overlying older Permian age coal measures (Figure 20). These geological units can be separated into three key hydro-stratigraphic units based on their hydraulic properties and lithology. From youngest to oldest, these units are (AGE, 2018):

- Quaternary aged units:
 - Alluvial aquifer: consists of localised stream channel deposits and associated flood plain deposits. These units comprise a temporary (rainfall dependent) aquifer that is limited to the immediate vicinity of Roper Creek, Thirteen Mile Gully and drainages within the mining tenements. Neither Roper Creek nor Thirteen Mile Gully is targeted for water supply within the near vicinity of the Middlemount Coal Mine.

- Tertiary aged units:
 - Duaringa Formation: consists of thick clay-rich laterite which is sourced from highly weathered Permian sandstones and siltstones, and occasional basalt. The Duaringa Formation is not typically targeted for agricultural water supply and is (at best) a low yielding aquifer that would more commonly be regarded as an aquitard.
- Permian aged units:
 - Interburden/overburden: the bulk of the Permian coal measure strata is sandstone, siltstone, and mudstone that typically have low permeability and generally form aquitards.
 - Coal seams (principally the Middlemount and Pisces Seams): form low to moderate yielding aquifers confined by interburden / overburden units.

Each of the hydrogeological units are described further in Sections 3.6.2 and 3.7.3. Additional details are provided in AGE (2018) (Attachment E).

3.4 WATER-DEPENDENT ASSETS

Water-dependent assets are entities with characteristics having value and which can be linked directly or indirectly to a dependency on water quantity or quality (IESC, 2018).

No water resource development, such as dams or major irrigation infrastructure, is located within the Roper Creek catchment (WRM, 2018). Advice from the Qld Government indicates that there are no licensed surface water users along Roper Creek. That is, there are no users with an extraction volume issued under the provisions of the *Water Act, 2000* (WRM, 2018). Further discussion of surface water users in the vicinity of the Middlemount Coal Mine is provided in Section 3.6.1 and WRM (2018) (Attachment D).

Groundwater levels are generally in excess of 25 m below ground surface and separated from surface waters, limiting potential to support GDEs. Further, the groundwater quality in the locality is brackish to saline and not suitable for stock or human consumption (AGE, 2018). Further discussion of groundwater users in the vicinity of the Middlemount Coal Mine is provided in Section 3.6.2 and WRM (2018).

The EP Act seeks to protect Qld's water resources while allowing ecologically sustainable development through the *Environmental Protection (Water) Policy, 2009* (EPP Water). The EPP Water achieves this within a framework that includes:

- identifying EVs for aquatic ecosystems and for human uses; and
- determining water quality guidelines (WQGs) and water quality objectives (WQOs) to enhance or protect the EVs.

The environmental values relevant to surface water and groundwater within the Action area and surrounds have been identified with consideration of the DES Guideline *Application Requirements for Activities with Impacts to Water (ESR/2015/1837)* (DES, 2018). The relevant environmental values relevant to the Action are summarised below and more detail is provided in Attachment D (WRM, 2018) and Attachment E (AGE, 2018).

Environmental Values – Surface Water

Environmental values for surface waters are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. Roper Creek is located within the Mackenzie River north-western tributaries region and is classified as a ‘fresh’ water source (DEHP, 2011). As discussed above, advice from the Qld Government indicates that there are no licensed surface water users along Roper Creek. That is, there are no users with an extraction volume issued under the provisions of the *Water Act, 2000* (WRM, 2018).

Notwithstanding, the environmental values identified for protection include (WRM, 2018):

- aquatic ecosystem protection (level 2 – disturbed ecosystems, Qld Water Quality Guidelines 2009b);
- stock watering;
- human consumption;
- primary, secondary and visual recreation;
- drinking water;
- industrial use; and
- cultural and spiritual values.

Environmental Values – Groundwater

Environmental Values – Aquatic Ecosystems

Regionally, groundwater flow within the underlying aquifers is towards the south-east of the Action. Groundwater levels are generally in excess of 25 m below ground level (mbgl) and separated from surface waters, limiting potential to support GDEs. There are no springs from these deep confined aquifers within the Action area or surrounds that would support GDEs (AGE, 2018).

Water quality in Roper Creek is characterised by high and variable turbidity, moderate and variable EC and low dissolved oxygen concentrations at times. Nutrient levels are generally low with the exception of total nitrogen (WRM, 2018).

Environmental Values – Irrigation and Farm Supply/Use

4T undertook a bore census of nearby groundwater users on privately owned lands surrounding the Action in September 2017 (4T, 2017). Groundwater is not used for irrigation or farm supply within the Action area or neighbouring properties. There are no known irrigation bores located within 10 km of the Action area. During the course of the bore census, it was noted that dryland cropping activities in the vicinity of the Action do not rely upon groundwater as the quality is considered brackish to saline (4T, 2017).

Environmental Values – Stock Water

There is no significant groundwater usage within the Action area or neighbouring properties. The primary agricultural purpose of land within and surrounding the Action area has previously been low intensity stock (cattle) grazing (AGE, 2018). The existing groundwater quality data recorded for TDS at the site monitoring bores identifies this water would be unsuitable for stock watering based on the naturally elevated TDS levels (i.e. averaging 13,071 mg/L in Tertiary aquifers and 9,758 mg/L in Permian aquifers) when compared to the tolerance of livestock to TDS in drinking water (AGE, 2018).

Environmental Values – Drinking Water

Groundwater is not used for drinking water purposes within the Action area or neighbouring properties, and was confirmed during the bore census (4T, 2017). Groundwater quality data collected from the site monitoring bores indicates that groundwater quality in the Action area is brackish to saline and not suitable for human consumption (AGE, 2018).

Environmental Values – Industrial Use

Groundwaters intercepted and used for the Action would provide a beneficial industrial use at the mine (AGE, 2018).

Environmental Values – Cultural and Spiritual Values

There are no known environmental values in relation to cultural and spiritual values of groundwater within the Action area (AGE, 2018).

3.5 OTHER COAL MINING AND CSG DEVELOPMENTS

The numerical groundwater model developed by AGE (2018) (Attachment E) was used to assess the cumulative impact between the Action and nearby operational and closed mines which include German Creek East, Foxleigh, Foxleigh Plains, and Norwich Park Mine as well as Coal Seam Gas (CSG) production as part of the Bowen Gas Project (Arrow Energy, 2012). The approximate locations of the surrounding mines and gas project cumulatively modelled are shown on Figure 21.

WRM (2018) (Attachment D) considered the Capcoal Complex (e.g. German Creek), Foxleigh Mine, Norwich Park Mine and Oaky Creek Mine in the cumulative assessment of surface water impacts for the Action.

3.6 BASELINE DATA AND WATER USERS

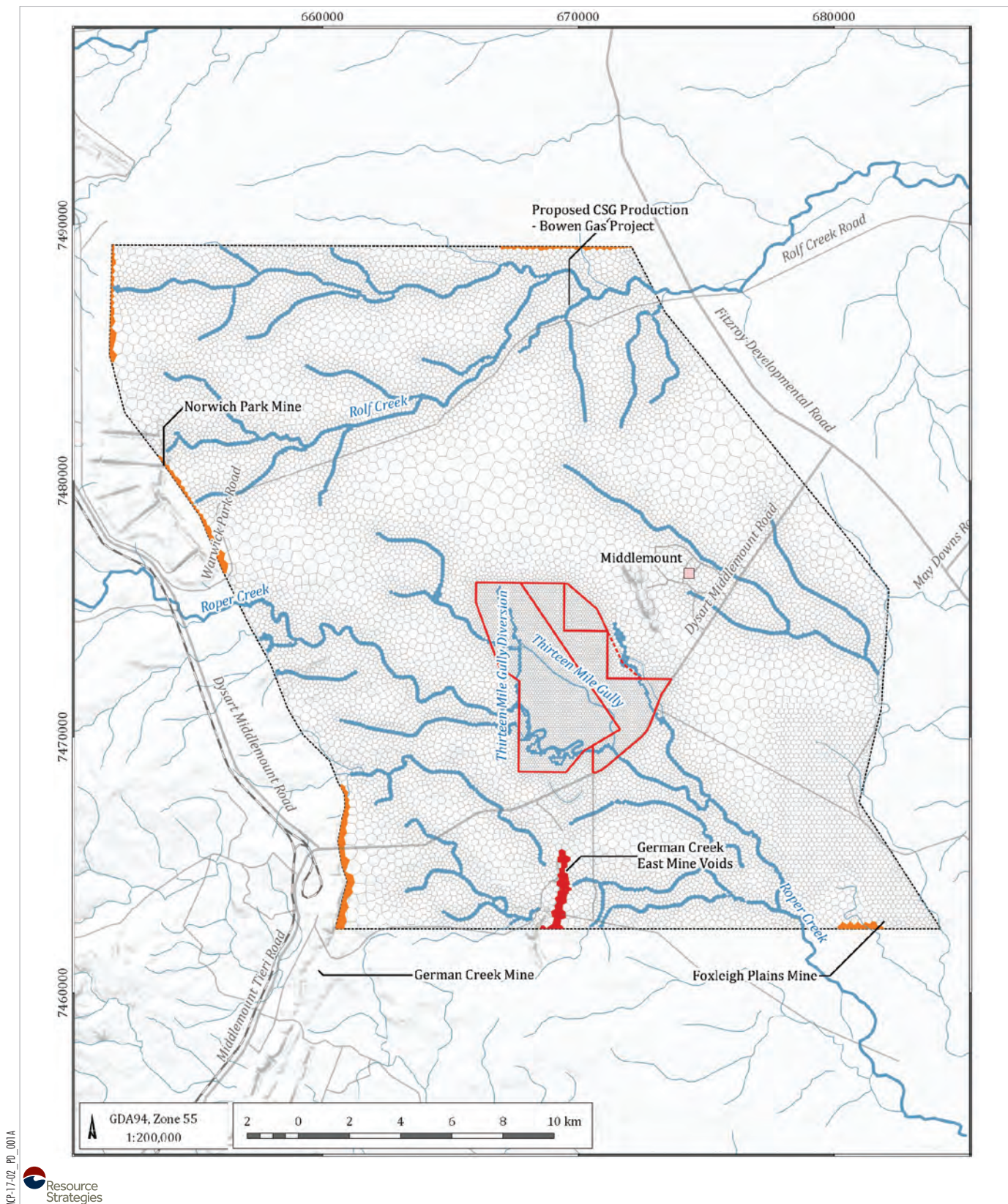
3.6.1 Surface Water

Catchment Water Quality

The background water and sediment quality data for Roper Creek and the downstream catchment is described in the *Middlemount Coal Mine Receiving Environment Monitoring Plan* (REMP) (MCPL, 2016b). Water quality in Roper Creek is characterised by high and variable turbidity, moderate and variable EC and low dissolved oxygen concentrations at times. Nutrient levels are generally low with the exception of total nitrogen which exceeded the trigger value at most sites (WRM, 2018).

The concentrations of most metals were very low within Roper Creek and did not exceed the EA trigger values, with the exception of aluminium. The results however demonstrated the natural variability in metals and nutrients in Roper Creek.

MCPL (2016b) found that the macroinvertebrate community of Roper Creek exhibited signs of stress. Given the ephemeral nature of waterways in central Qld and the low rainfall in the region in the preceding years (i.e. 2014 to 2015), this was to be expected. Given the lack of discharges from the Middlemount Coal Mine, there had been no indication of impacts from Middlemount Coal Mine operations on the macroinvertebrate community of Roper Creek.



Source: AGE (2018)



WESTERN EXTENSION PROJECT
Groundwater Model Domain
Including Cumulative Mines/Projects

Figure 21

Given the ephemeral nature of the upstream sub-catchments of Thirteen Mile Gully, no water quality data is available for Drainage Line 1 and Drainage Line 2 (WRM, 2018).

On-Site Water Quality

Water quality data has been collected from the on-site water storages since May 2010. The locations of the existing monitoring of on-site water storages are shown on Figure 19.

The monitoring parameters tested have been defined by the Qld Government to cover the range of constituents that could impact on the environmental values of the receiving waters (WRM, 2018).

Summaries of water quality results for the on-site water storages at the Middlemount Coal Mine, including supporting discussion of the water quality results, are provided in Section 3.4 of WRM (2018).

Surface Water Flow

From 1971 to 1988, the Qld Government operated a stream flow gauge on Roper Creek at Barwon Park (Station No. 130107A), located approximately 28 km downstream of the Action. The total catchment area draining to the Barwon Park stream flow gauge is 2,126 km². The maximum recorded flow rate at this station was 922 cubic metres per second (m³/s) in December 1973 (WRM, 2018).

MCPL operates a gauging station (Ref 1) in Roper Creek, located just upstream of the confluence with the Thirteen Mile Gully Diversion (Figure 19). The Ref 1 gauging station was installed in December 2012. Stream flow data from this gauging station is presented for the period between July 2014 and August 2017 on Figure 22. This shows only periodic flows are recorded in Roper Creek which are in response to rainfall runoff flow events. These flows are then separated by long periods up to 11 months, of essentially zero flow within the creek (AGE, 2018).

Surface Water Users

As described in Section 3.4, advice from the Qld Government indicates that there are no licensed surface water users along Roper Creek. That is, there are no users with an extraction volume issued under the provisions of the Qld *Water Act 2000* (WRM, 2018).

There are two registered Self-Assessed Riparian Access Works located on Roper Creek which authorise stock and domestic supplies only. Section 20 of the Qld *Water Act 2000* provides that an owner of land adjoining a watercourse may take water for domestic and stock purposes without the need for a permit or licence (WRM, 2018).

Release Events

Water quality monitoring of three release events from sediment dams has occurred in the months:

- January 2013 – SD1 (uncontrolled release);
- January 2013 – SD3 (controlled release); and
- February 2014 – SD2 (controlled release).

Further details of the release events are provided in the Surface Water Assessment (WRM, 2018) and in letters provided by MCPL to the DEHP (now the DES) following these events (MCPL, 2013a; 2013b; 2014a).

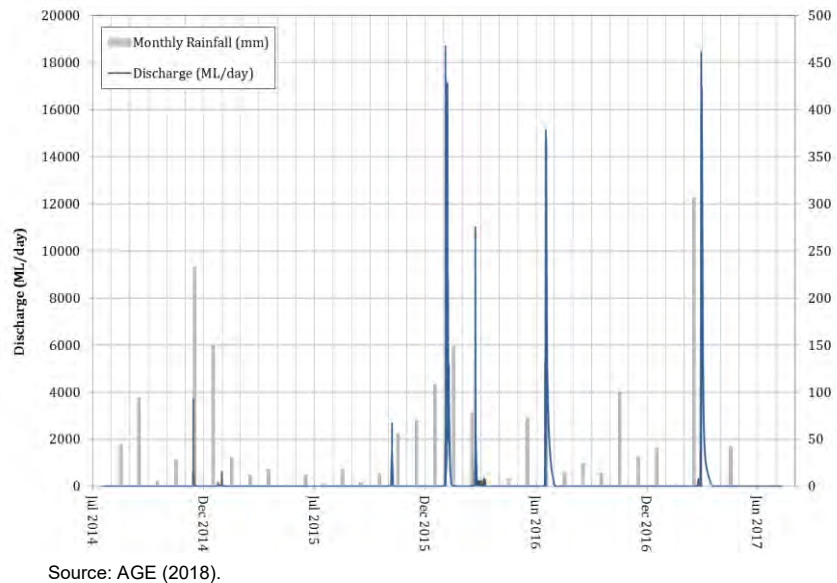


Figure 22 MCPL Roper Creek Gauging Station (Ref 1)

A permit to take water from Roper Creek, Connors River, Murray Creek, Lotus Creek, Clive Creek and an unnamed tributary of Isaac River (Eungy Waterhole) has also been issued under the provisions of the Qld *Water Act, 2000*. Such permits are typically granted to a corporate entity, such as local government, for temporary supply of water to construction or similar projects. A total entitlement of 8.5 megalitres (ML) per water year is attached to this permit. The above information indicates that there is currently minimal use of surface water from Roper Creek (WRM, 2018).

3.6.2 Groundwater

Groundwater Levels, Pressure, Pathways and Quality

Quaternary Alluvium

Within the study area, the Quaternary alluvial floodplain deposits unconformably overlie the Duaringa Formation. The alluvial flood plain deposits are confined to present day stream alignments and floodplains (AGE, 2018).

The Quaternary alluvium is estimated to have a highly variable range of hydraulic conductivity values owing to its variable lithology of sand, clay, and occasional gravel bands. The sandy to gravelly creek beds are expected to have higher values of hydraulic conductivity compared to the floodplain deposits, because the latter would be expected to have a more clayey nature (AGE, 2018).

Where saturated, recharge to the alluvium would occur either (AGE, 2018):

- via direct rainfall on to the alluvium; or
- via seepage through the stream bed, when the creeks are flowing.

Stream gauging data for Roper Creek indicates surface water flow dissipates quickly after flow events. Therefore recharge from stream flow would occur over short time periods as the water infiltrates relatively rapidly into the alluvium. When saturated, the groundwater flow direction in the Quaternary alluvium would be expected to be generally from north-west to south-east, following the regional topography and drainage network (AGE, 2018).

In the vicinity of the Middlemount Coal Mine, discharge could occur from the alluvium via seepage to the underlying Tertiary sediments. However, this would only occur in areas where the alluvium is saturated and a downward vertical hydraulic gradient to the underlying strata occurs.

The Quaternary alluvium is not targeted by landholders as a groundwater supply within the study area which supports the general understanding that the Quaternary alluvium is not a productive aquifer in the vicinity of the Middlemount Coal Mine (AGE, 2018) (Attachment E).

Groundwater quality data is not available for the Quaternary alluvium within the vicinity of the Middlemount Coal Mine, as it is understood the regional groundwater table is below the depth of the alluvial sediments (i.e. greater than 10 mbgl) within the Middlemount Coal Mine mining leases (AGE, 2018).

Further details of the Quaternary alluvial aquifer are provided in AGE (2018).

Tertiary Duaringa Formation

Tertiary sediments of the Duaringa Formation cover large areas of the Middlemount Coal Mine and surrounds. The Duaringa Formation consists of deeply weathered mudstone, sandstone, pebbly sandstone/conglomerate and siltstone, gravel, and some interbedded oil shale and basalt. This formation unconformably overlies the Permian coal measures.

The thickness of the Duaringa Formation in the study area ranges from 0 m to 60 m and generally ranges between 25 m and 35 m within the MLs (Parsons Brinkerhoff, 2010b). Within the south-west portion of ML 70379, the Duaringa Formation is lateritised with a hard caprock that forms a topographic high in this area.

Recharge to the Tertiary formation occurs via direct infiltration from rainfall in areas where the unit crops out and via seepage from the overlying Quaternary where present. However, recharge is expected to be low due to the predominately clayey nature of the formation (AGE, 2018).

The regional groundwater flow direction in the Tertiary Duaringa Formation is expected to be coincident with the regional surface drainage, being towards the south-east (AGE, 2018).

Middlemount Coal Mine monitoring bores installed within the Duaringa Formation indicate depth to water in the monitoring bores ranges from 7.7 mbgl (MW14A) to 28.9 mbgl (MW9A), with an average depth of 20.4 mbgl (AGE, 2018).

Monitoring data indicates that the Tertiary aquifer water quality is:

- slightly acidic to alkaline with field pH values ranging from 6.5 to 8.5;
- dominated by sodium and chloride; and
- brackish to saline with total dissolved solids ranging from 900 mg/L to 25,700 mg/L, with the majority of samples being saline.

The results of the bore census (4T, 2017) (Appendix C in Attachment E) indicate that no other registered or existing bores are screened within the Duaringa Formation within the 10 km search radius of the Middlemount Coal Mine (AGE, 2018).

Further details of the Tertiary formation aquifer/aquitard are provided in AGE (2018).

Triassic Rewan Formation

The Triassic Rewan Formation does not outcrop within the study area, but does sub-crop within the study area beneath the Tertiary cover east of the Middlemount township, and south-east of the current mine footprint. Details of the Rewan Formation are provided in AGE (2018) (Attachment E).

Permian Coal Measures

The Permian strata includes coal seams interbedded with less permeable rock units such as sandstone, siltstone, and mudstones that are typically 'tight' and low yielding.

The target seams at the Middlemount Coal Mine are the Middlemount, Tralee, and Pisces coal seams of the Rangal Coal Measures, a faulted and folded Permian sequence of calcareous sandstone, shale, mudstone, and coal. In the mine area, the Rangal Coal Measures dip gently to the north-east, underlain conformably by the Permian Fort Cooper Coal Measures/Burngrove Formation (herein referred to as the Fort Cooper Coal Measures). The Fort Cooper Coal Measures are Late Permian age sedimentary rocks that comprise feldspathic and lithic sandstone, siltstone, carbonaceous mudstone, siliceous siltstone, banded coal seams, and tuff. These rocks do not outcrop within the site and have only been encountered in the exploration boreholes.

Recharge of the Permian coal measures occurs in areas where they sub-crop beneath the Tertiary cover. The coal seams all sub-crop within the western portions of the Middlemount Coal Mine MLs.

Bores do not commonly access the Permian aquifer due to the depth of water bearing strata and the typical high salinity of this type of water. However, where more attractive shallower aquifers do not exist, bores are installed on occasion into the Permian coal measures where yield and water quality meet the intended purpose (AGE, 2018).

Monitoring bores have been installed by MCPL to monitor groundwater drawdown in the Permian to the Middlemount Coal Mine (AGE, 2018).

Further details of the Permian Coal Measures are provided in AGE (2018) (Attachment E).

Groundwater Users

The bore census (4T, 2017) (Appendix C in Attachment E) identified that there is limited groundwater use of brackish to saline groundwater in the locality. The bore census (4T, 2017) assessed six privately-owned properties, the Middlemount landfill and the Middlemount Jockey Club in a study area covering approximately 457 km² surrounding the Middlemount Coal Mine.

The bore census indicated a total of five landholder water supply bores on two of the privately-owned lands. All five bores are located in excess of 5 km from the Middlemount Coal Mine (including the Action area). The bore census also confirmed three groundwater monitoring bores located at the Middlemount Landfill established for the landfill operation. All three monitoring bores were dry when assessed for the bore census (4T, 2017).

No landholder water supply bores are located within the predicted drawdown/depressurisation extents attributable to the proposed mine plan for the Action (refer to Section 3.8.2).

Groundwater Dependent Ecosystems

The Action is not predicted to impact any aquatic or terrestrial GDEs since GDEs are assessed as being unlikely to occur within and surrounding the Action area. GDE mapping across the Action area (Bureau of Meteorology [BoM], 2018) indicates:

- Terrestrial vegetation associated with watercourses (Roper Creek) and a drainage line (Drainage Line 1) is mapped as having a high potential to be associated with subsurface presence of groundwater.
- Aquatic habitat associated with watercourses (Roper Creek) and a drainage line (Drainage Line 1) is mapped as having a moderate potential to be reliant on surface expression of groundwater.
- Terrestrial vegetation and aquatic habitat associated with palustrine wetlands outside of ML 70417 and ML 70379 is mapped as having a high potential to be associated with subsurface presence of groundwater.

All other terrestrial vegetation (REs mapped by Department of Science, Information Technology and Innovation [DSITI] [2017]) is broadly mapped as having a low to moderate potential of being associated with subsurface presence of groundwater (BoM, 2018).

The accuracy of the desktop GDE mapping (BoM, 2018) of the Action locality has been reviewed by AGE (2018) (Attachment E) and Biodiversity Australia (2019a) (Attachment C), with the following conclusions made in relation to the presence/absence of GDEs based on detailed site surveys and assessments:

- The majority of the terrestrial vegetation associated with Roper Creek (upstream and downstream of the Action) and Drainage Line 1 within the maximum zone of groundwater drawdown is unlikely to be dependent on groundwater. The vegetation along drainage features also occurs more widely across the landscape and is not restricted to areas where it could potentially access groundwater (Attachment C). There are small areas of RE 11.3.25 along Roper Creek which contains Queensland Blue Gum (*Eucalyptus tereticornis*) and River Oak (*Casuarina cunninghamiana*) which are in other locations reliant on access to groundwater, however, the groundwater levels adjacent to Roper Creek range between 18.9 m below ground level (mbgl) and 22.7 mbgl (AGE, 2018). Based on the depth to groundwater surrounding Roper Creek being around 20 mbgl it is unlikely that these communities would be reliant on access to groundwater (Attachment C).
- Aquatic habitat associated with Roper Creek and Drainage Line 1 is unlikely to be dependent on groundwater given the ephemeral nature of the drainage features.
- Terrestrial vegetation and aquatic habitat associated with palustrine wetlands north of ML 70417 and ML 70379 could potentially be reliant on groundwater given the RE mapped in these areas by DSITI (2017). DSITI (2017) has mapped these areas as RE 11.3.27, which contains River Red Gum (*Eucalyptus camaldulensis*) and Queensland Blue Gum, both species that could be reliant on subsurface expression of groundwater to some degree. However, given groundwater levels in this area have been identified as being in excess of 12 mbgl, it is likely that these communities would have limited reliance on groundwater (Attachment C).
- All other terrestrial vegetation is unlikely to be dependent on groundwater given that there is no evidence that any vegetation surrounding the Action area has experienced any impacts (i.e. dieback) from the existing operations at the Middlemount Coal Mine.

Stygofauna

The presence of stygofauna in groundwater within the Action area was assessed from a desktop review of optimal conditions for stygofauna habitat and results of sampling. The review concluded that the potential for optimal stygofauna habitat at Middlemount Coal Mine is unlikely given to average salinity in both the Tertiary and Permian aquifers being in excess of 20,000 $\mu\text{S}/\text{cm}$, and the average depth to groundwater in the Permian aquifer being greater than 30 m below ground surface (AGE, 2018) (Attachment E).

The Project is not predicted to significantly impact stygofauna considering the Project would only incrementally increase the groundwater drawdown from the approved mine, the groundwater aquifer (similar stygofauna habitat) is extensive outside of the maximum zone of drawdown, and the sampling indicates there is a low diversity of stygofauna in and outside the maximum zone of drawdown.

3.7 NUMERICAL MODELLING

3.7.1 Site Water Balance

Some minor updates to the existing water management system are proposed for the Action, including the progressive installation of up-catchment diversion and highwall dams and the development of additional sediment dams. The existing Middlemount Coal Mine OPSIM water balance model was therefore reviewed and updated to incorporate the Action to assess the performance of the proposed mine affected water management system (WRM, 2018).

Calibration of the Middlemount Coal Mine water balance model was undertaken against recorded site data (including water storage volumes) over the period from January 2016 to August 2017. The model was configured to reflect the site operations during this period, with appropriate transfer rates, system configuration and water inflows and outflows. Site rainfall data was used for the calibration (WRM, 2018).

Calibration of the site water balance model was undertaken against the recorded combined inventory for the MWD and the mining pit. To achieve a satisfactory calibration outcome, changes to a number of the previously adopted AWBM rainfall runoff parameters were required (WRM, 2018). Further details of the water balance model calibration are provided in WRM (2018) (Attachment D).

The updated OPSIM model was used to predict the performance of the following (WRM, 2018):

- overall water balance – the average inflows and outflows of the water management system for a number of representative realisations;
- mine water inventory – the risk of accumulation (or reduction) of the overall mine water inventory;
- in-pit storage – the risk of accumulation of water in the mining pit, and the associated water volumes;
- external water demand – the risk and associated volumes of requiring imported external water (via the Anglo Coal pipeline) to supplement site mine water supplies;
- uncontrolled spillway discharges – the risk of uncontrolled discharge from the site storages to the receiving environment; and
- controlled releases – the risk and associated volumes of controlled release water to the receiving environment.

3.7.2 Calibrated Flood Model

A Unified River Basin Simulator (URBS) hydrological model and a TUFLOW two-dimensional hydraulic model were developed by WRM (2018) to simulate the flood behaviour of Roper Creek and Thirteen Mile Gully in the vicinity of the Action. The URBS and TUFLOW models were calibrated to recorded water levels and surveyed peak flood levels for the January 2013 ex tropical Cyclone Oswald flood event. Descriptions of the development and calibration of the models and the design discharges and flood levels under existing conditions are given in WRM (2018) (Attachment D).

The calibrated existing conditions TUFLOW model was reconfigured to represent:

- approved (Stage 2) mine conditions;
- proposed mine conditions (including the Action); and
- final landform conditions (post-mining) (including the Action).

The peak food levels, extents and depths were determined for the 5% and 1% AEP events for the approved and proposed mine conditions models. These events were used to assess the flood impacts of the Action.

The 0.1% AEP design flood was used to define the crest height of the proposed flood protection levees for the proposed mine conditions and the Probable Maximum Flood (PMF) was used to assess and confirm the immunity of the final void under the final landform conditions.

The ensemble approach described in Australian Rainfall and Runoff (ARR) (Ball *et al.*, 2016) was used to estimate design discharges.

3.7.3 Calibrated Numerical Groundwater Flow Model

A three-dimensional numerical groundwater flow model was developed for the Action and was designed to account for the current and proposed mine plan. The objective of modelling this groundwater system was to simulate the progressive development of the proposed open pit and provide a tool to predict potential groundwater level drawdown, aquifer depressurisation, and groundwater inflow to the open cut pits. The groundwater model has also been used to simulate the cumulative progression of the Action and the existing Middlemount Coal Mine, and the neighbouring mines. The numerical groundwater flow model is described in detail in AGE (2018) (Appendix F of Attachment E).

The predictive groundwater model scenarios have been designed to estimate:

- ranges of groundwater inflow to the Project (including the Action) area as a function of mine position and timing, for operational and post mining phases for each aquifer;
- the extent of the zone of aquifer depressurisation due to:
 - the incremental impacts associated with the Project (including the Action); and
 - the combined impacts associated with the Project (including the Action), CSG operations and nearby existing mines.
- the level and rate of groundwater level drawdown (incremental and cumulative) surrounding the final voids; and
- incremental and cumulative impacts to the interaction of groundwater with surface water such as baseflow within Roper Creek.

Barnett *et al.* (2012) 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. Under these guidelines, the numerical groundwater model used to assess the Action would be classified between a Class 2 and Class 3 groundwater model (AGE, 2018).

A pseudo Null-space Monte Carlo uncertainty analysis was also undertaken to quantify the magnitude of uncertainty in the future impacts predicted by the model. The results of the uncertainty analysis are detailed in AGE (2018) (Appendix F of Attachment E).

Model Design and Hydraulic Parameters

Where appropriate, natural hydrogeological boundaries such as geological units and regional catchment boundaries, have been adopted in the groundwater model. The groundwater model was developed to include the proposed mine plan and potential for cumulative impact from nearby operational mines such as German Creek East, Foxleigh, Foxleigh Plains, and Norwich Park Mine (Figure 22). CSG production as part of the Bowen Gas Project (Arrow Energy, 2012) within the Rangal Coal Measures approximately 7 km to the north of the Action in 2034 is also incorporated into the groundwater model.

The groundwater model represents the key geological units within the model domain as 17 layers (Table 15), and extends approximately 30 km from north-west to south-east, and 21 km from north-east to south-west, and was divided into variable sized cells comprising up to 19,412 cells per layer (AGE, 2018) (Figure 22).

The model cell dimensions have been optimised to replicate the historical and future mining progressions and associated groundwater level responses. Grid spacing across the model domain is variable, with refinement around the mine site and locations of groundwater level observations. The model cell size becomes larger away from these key areas. Layers 4 to 17 pinch out where these layers sub-crop beneath the weathered zone, or are truncated by the Jellinbah Fault. Cell sizes range from 100 m by 100 m within the mining area and up to 700 m by 700 m outside the Action area (AGE, 2018).

The vertical discretisation of the model is described by the geological layers. Geological surfaces have been developed for the Middlemount Coal mining area from the mine geology model, and have been extrapolated across the entire proposed numerical model extent from interpretation of the regional geological mapping and layering for the Bowen Gas Project (Arrow Energy, 2012). The model layering is similar to the 2010 numerical model, and includes the Quaternary alluvium as a separate layer to represent recharge from ephemeral surface water flows and rainfall in these areas (AGE, 2018).

Jellinbah Fault

Layers 1 to 3 occur stratigraphically above the geology displaced by the Jellinbah Fault and as such are not assessed to be impacted by this fault, and are therefore consistent across the model domain. However, Layers 4 to 17 includes replicated layers to represent strata (i.e. Rangal Coal Measures and Fort Cooper Coal Measures) displaced east and west of the Jellinbah Fault northwest–southeast strike alignment (AGE, 2018).

Table 15
Summary of Numerical Groundwater Model Layers

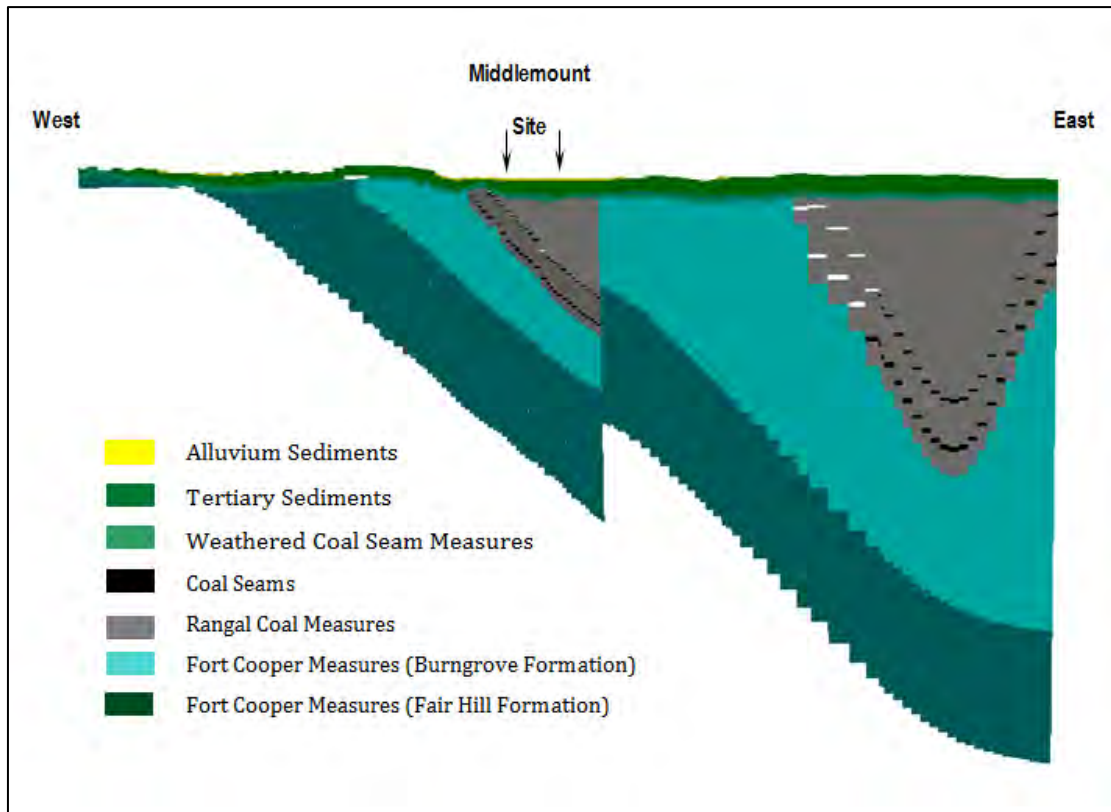
Layer	Layer name	Hydraulic conductivity (K) (m/day)			Specific storage (m ⁻¹)	Specific yield
		Horizontal (Kh)	Vertical (Kv)	Depth dependency		
Model Domain						
1	Alluvium	0.75	6.37E-02	No	6.40E-05	2.00E-02
2	Tertiary	0.75	5.47E-02	No	1.76E-05	2.00E-02
3	Weathered Zone (Rangal Coal Measures)	0.1	1.30E-02	No	5.00E-05	1.00E-02
Permian Geology West of Jellinbah Fault						
4	Rangal Coal Measures – overburden	1.00E-04	2.10E-05	No	1.00E-06	1.00E-02
5	Rangal Coal Measures – Middlemount coal seam	0.22 to 1.00E-05 [#]	1.48E-01	Yes	1.00E-06	1.00E-02
6	Rangal Coal Measures – interburden	6.03E-06	3.24E-08	No	1.00E-06	1.00E-02
7	Rangal Coal Measures – Permian Pisces coal seam	0.09 to 1.00E-05 [#]	1.29E-01	Yes	1.00E-06	1.00E-02
8	Rangal Coal Measures – strata underlying Pisces coal seam	5.43E-05	4.18E-06	No	1.00E-06	1.00E-02
9	Fort Cooper Coal Measures – Burngrove Formation	7.20E-05	6.48E-05	No	8.42E-05	1.00E-02
10	Fort Cooper Coal Measures – Fair Hill Formation	3.59E-04	2.06E-05	No	8.21E-05	1.00E-02
Permian Geology East of Jellinbah Fault						
11	Rewan Formation	1.00E-04	2.10E-05	No	1.00E-06	1.00E-02
12	Rangal Coal Measures – Leichhardt coal seam	0.18 to 1.00E-05 [#]	1.48E-01	Yes	1.00E-06	1.00E-02
13	Rangal Coal Measures – interburden	6.03E-06	3.24E-08	No	1.00E-06	1.00E-02
14	Rangal Coal Measures – Vermont coal seam	0.06 to 1.00E-05 [#]	1.29E-01	Yes	1.00E-06	1.00E-02
15	Rangal Coal Measures – strata underlying the Vermont coal seam	5.43E-05	4.18E-06	No	1.00E-06	1.00E-02
16	Fort Cooper Coal Measures – Burngrove Formation	7.20E-05	6.48E-05	No	8.42E-05	1.00E-02
17	Fort Cooper Coal Measures – Fair Hill Formation	3.59E-04	2.06E-05	No	8.21E-05	1.00E-02

Source: AGE (2018).

[#] Range of horizontal hydraulic conductivity (Kh) values based on the depth dependence equations used for each coal seam.

The Jellinbah Fault is the main structural feature within the model domain, and is represented by offsetting the Rangal Coal Measures against the underlying Fort Cooper Coal Measures where this geology strata has been vertically displaced east of the Middlemount Mine area. Whilst there is likely to be other minor faults within the model domain, the specific nature of these faults is unknown and therefore have not been incorporated into the groundwater model to slow or halt groundwater flow/movement. This approach in conjunction with the available model inputs, has necessitated simplifications to the numerical model that are considered to create conservative predictions of the impacts from groundwater depressurisation. This simplified conceptualisation and representation of the groundwater model is presented in the cross section in Figure 23.

Hence, the numerical model provides for a lateral, horizontal hydraulic connection across the Jellinbah Fault where different layers are juxtaposed on the eastern and western sides of the fault plane as represented in Figure 23. This was achieved using the Algomesh software to hydraulically connect model cells (nodes) within the different model layers positioned on either side of the Jellinbah Fault (AGE, 2018).



Source: AGE (2018).

Figure 23 Section through Groundwater Model Showing Layer Design

Further details regarding how the Jellinbah Fault is considered in the numerical groundwater model is provided in AGE (2018) (Appendix F of Attachment E). A summary of the influence of hydraulic faults on groundwater flow is provided in Section 3.2.

Calibration

The model was calibrated and verified to existing groundwater levels, using reliable measurements from representative bores within the model domain. A detailed description of the calibration method is provided in AGE (2018) (Attachment E).

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 transient calibration successfully achieved an 8.6% scaled root mean square (SRMS) error, which is less than the 10% SRMS error (maximum) suggested by the modelling guidelines as constituting a calibrated model.

Comparison of the predicted and observed hydrographs (refer to Appendix F1 in Attachment E) shows a good qualitative match in groundwater level trends (AGE, 2018).

3.7.4 Final Voids Recovery Modelling

The Action would result in the creation of a northern and southern void at the completion of mining (Figure 3). Once mining operations cease, groundwater inflows to the final voids would no longer be collected and pumped out, and as a result, the final voids would gradually begin to partly fill with groundwater.

Inflows into the final voids would comprise incident rainfall, runoff within the final void catchment area and groundwater (including spoil dump infiltration). The catchment area of the final voids would be minimised and is defined by the surrounding landform including safety bunds and/or upslope diversion channels. Further details regarding the final voids (including justification for the design of the final voids) is provided in Section 3.8.3.

A GOLDSIM model was prepared by WRM (2018) and used to assess the likely long-term water level behaviour of the final voids. Model predicted groundwater inflows (post-mining) to the north and south voids were provided by AGE (2018). The historical rainfall and evaporation sequences (128 years) were repeated five times to create an indicative long-term climate record. Further details of the final void modelling configuration is provided in WRM (2018).

3.8 PREDICTED CHANGES TO WATER RESOURCES

3.8.1 Surface Water

Surface Water Management System and Releases to the Receiving Environment

As described in Section 3.7.1, the existing Middlemount Coal Mine OPSIM water balance model was reviewed and updated to incorporate the Action to assess the performance of the proposed mine affected water management system. The key outcomes from the revised water balance are (WRM, 2018):

- Minor on-site water accumulation is generally predicted for most of the mine life (i.e. from 2021 onwards), increasing towards the end of the Project (including the Action) as the total mine catchment increases and dust suppression demands reduce.
- The groundwater inflows based on the calibrated model predictions by AGE (2018) are generally consistent between Stage 1 and Stage 4, with a reduction towards the end of the Project (including the Action) in Stage 5.
- Average annual external water supply requirements vary between 510 to 750 ML/annum over the life of the Project (including the Action).
- There were no modelled spillway overflows from the mine water system over the life of the Project (including the Action).
- The Action would have minimal impact on the overall water balance for the Middlemount Coal Mine. The key change is an increase in overall catchment runoff volumes associated with the additional catchment area captured within the mine water management system.

The water balance model prepared by WRM (2018) (Attachment D) shows that there are no modelled uncontrolled discharges from the mine affected water dams over the simulation period. Therefore, the Action would continue to achieve the assessment criteria objective of a less than 10% chance of uncontrolled offsite discharges from the mine affected water dams (WRM, 2018).

The water balance model prepared for the Action simulates releases from the MWD to Roper Creek based on the conditions of the EA EPML00716913 (Attachment H). WRM (2018) concluded:

- There are opportunities to release water from the MWD to Roper Creek around 50% of the time, in any year during the Action. These opportunities are based on the flow in Roper Creek, the modelled salinity in MWD and the inventory in MWD being above 500 ML.
- For very wet climatic conditions (1%ile), the model simulated between 363 ML and 2,093 ML of controlled releases from MWD each year.

- For wet climatic conditions (10%ile), the model simulated between 181 ML and 1,192 ML of controlled releases from MWD each year.
- For median climatic conditions (50%ile), the model simulated between 0 ML and 181 ML of controlled releases from MWD each year.
- For the dry (90%ile) and very dry (99%ile) climatic conditions, there were no modelled releases from MWD.

Controlled releases would continue to be undertaken at Middlemount Coal Mine for the Action in accordance with the EA EPML00716913 (Attachment H). The predicted annual controlled release volumes are provided in WRM (2018). The controlled release point at the MWD is shown on Figure 19. Although controlled releases can be made from other storages, it is only made from the MWD under the current mine affected water management system.

Existing surface water trigger levels presented in the EA (Attachment H) would continue to be used for the Action.

Surface Water Flow Regimes

The Action would result in changes to flows in local drainages/creeks due to the progressive extension of open cut mining operations to the north-west and associated subsequent capture and re-use of drainage from operational catchment areas.

The additional surface disturbance area associated with the Action would excise a maximum of 495.1 ha during operations from the catchment area of the former Thirteen Mile Gully and other associated drainage features, and 77.9 ha from the catchment area of an unnamed drainage line to the east of the East Dump. This represents approximately 9% of the total catchment area of the former Thirteen Mile Gully (approximately 5,600 ha) (of which the majority has already been diverted to Roper Creek by the existing/approved Thirteen Mile Gully Diversion) and approximately 4% of the total catchment area of the unnamed drainage line to the east of the Action (approximately 1,920 ha) (WRM, 2018).

At the completion of mining, the majority of the disturbed area will be rehabilitated and allowed to drain back to Roper Creek. Only the residual catchment of the final voids, which will be about 7.4 km², will reduce catchment flows at the completion of mining. This represents only 1.9% of the Roper Creek catchment to the downstream boundary of the Action, and as such the loss of catchment flows in Roper Creek is considered negligible (WRM, 2018).

Conceptual Design of Drainage Feature Diversions

The Action would require realignment of the existing Drainage Line 1 and the upper reach of the Thirteen Mile Gully Diversion shown on Figure 2. The new alignment is shown in Figure 3 and would be constructed prior to 2023.

Although Drainage Line 1 is not a watercourse, the proposed diversion realignment has been designed in accordance with the key principles and outcomes outlined in the Queensland Watercourse Diversion Guidelines (DNRM, 2014) (WRM, 2018).

The existing hydraulic and geomorphic characteristics of Drainage Line 1 (downstream of the proposed diversion realignment) has been used as the 'template' for the design of the proposed diversion realignment. Therefore, the proposed diversion realignment is expected to perform in a similar manner during runoff events to the existing drainage feature and be stable in the long-term (WRM, 2018).

Further details of the existing and proposed diversions are provided in Section 3.11.1 and WRM (2018) (Attachment D).

External Water Supply

Runoff captured in the mine water management system is preferentially used within the CHPP or used for haul road and stockpile dust suppression.

To supplement the water supply requirements, MCPL have a Water Supply Agreement with Anglo Coal to supply excess water from the German Creek Mine located south of the Middlemount Coal Mine. Water is pumped from the German Creek Mine on an 'as needed' basis and placed in the RWD, STD and MWD, up to a limit of 250 megalitres (ML) per month and 1,800 ML per year.

Modelling results from WRM (2018) shows that the existing mine water management system (including the external water supply via the Anglo Coal pipeline from the German Creek Mine) can meet all mine site demands over the mine life.

The water balance modelling results indicates that around 700 ML/year will be required from the external supply (Anglo pipeline), under median climatic conditions (WRM, 2018). This is a reduction from previous modelling results undertaken as part of the North-eastern Extension Surface Water Assessment (WRM, 2016a), which predicted around 1,000 ML/year would be required under median climatic conditions.

This reduction is due to a combination of higher modelled predicted groundwater inflows, the increase in overall catchment area, as well as changes to the adopted CHPP and dust suppression demands.

As the external water supply is sourced from the mine affected water reserves of a neighbouring mine, the external supply requirements will have no impact on regional water availability (WRM, 2018).

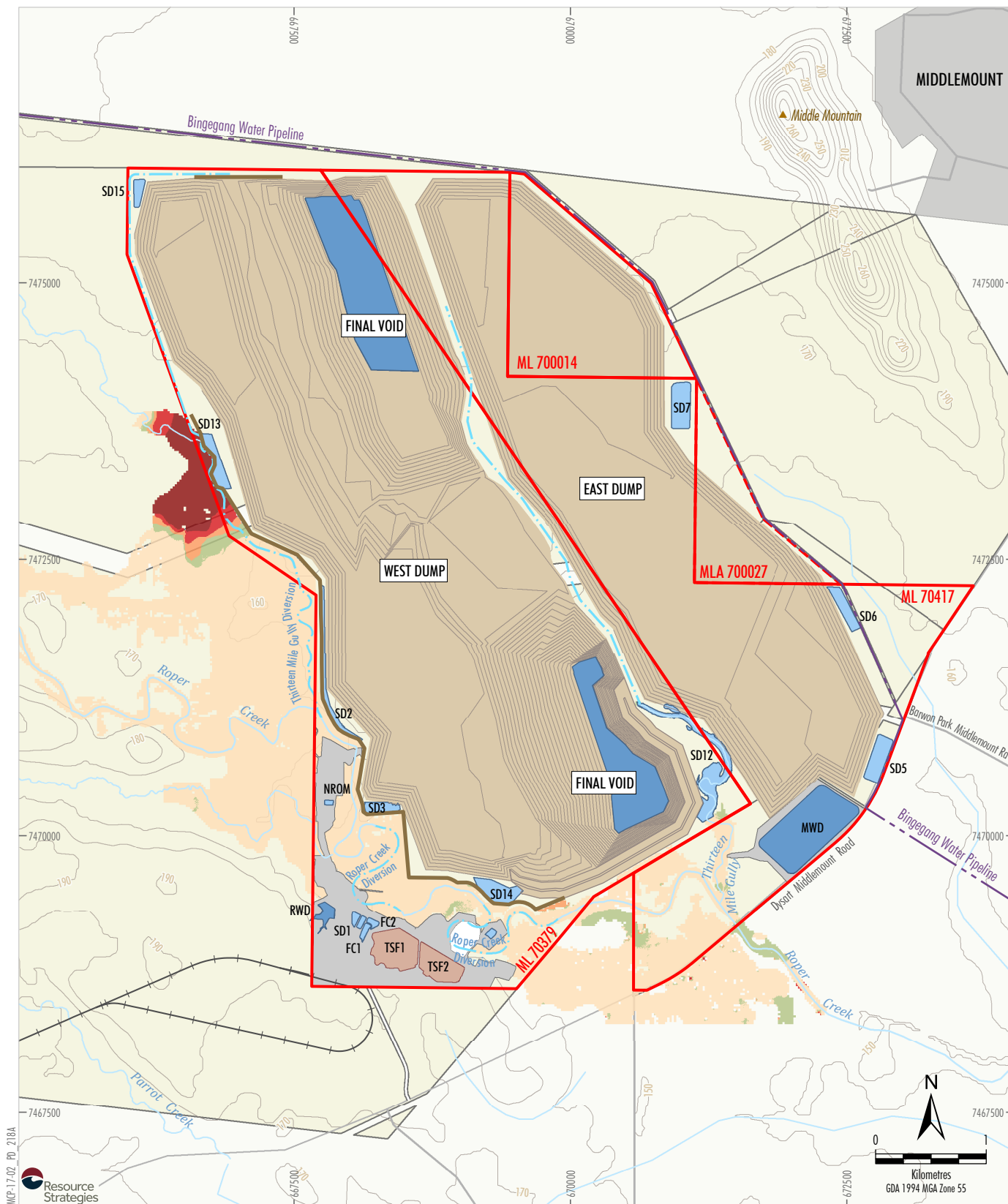
Flooding

Flood modelling results (WRM, 2018) indicate that for the 100 year Average Recurrence Interval (ARI) event, peak flood levels for the Action are effectively unchanged relative to approved conditions except along the realigned portion of the Thirteen Mile Gully Diversion, where predicted flood levels are up to 0.2 m higher (Figure 24).

The flood model was also used to determine the bed shear stress, stream power and velocity of the Thirteen Mile Gully Diversion channel for a typical bank full event.

Consistent with the approved/existing mine, the flood protection levee that would exist during mining operations would be removed and/or incorporated into the waste rock emplacement to form a stable and self-sustaining landform that does not require long-term maintenance. This final landform would be designed to be considerably higher than the PMF level.

The stability of the final landform in this location (and batters) would be enhanced by incorporating erosion resistant material (e.g. rock gabion) into the batter slope to approximately 2 m high (the PMF Level) and rehabilitating the surface of the landform with rock mulch and seeding/planting with tree, shrub and grass species characteristic of RE 11.5.3 (*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces). Native vegetation cover between the final landform and Roper Creek would be retained.



Source: MCPL (2018); Department of Natural Resources and Mines (2017); WRM (2018)



WESTERN EXTENSION PROJECT 100 Year ARI Flood Impact Due to the Project

Figure 24

3.8.2 Groundwater

Direct Groundwater Inflows/Interception (Water Licensing)

The average predicted pit inflow rate for the Project (including the Action) (i.e. from 2018) is approximately 2.1 ML/day (766.5 ML/annum), and ranges between approximately 0.7 ML/day and 2.8 ML/day (266 ML/annum and 1,030 ML/annum) (AGE, 2018).

In comparison, the average daily pit inflows over the last five years (2013 to 2017) has been predicted in the groundwater model to be approximately 2.3 ML/day (AGE, 2018) and is generally consistent with the estimated monthly groundwater inflow ranges between approximately 1 ML/day and 5 ML/day during a 10 month period which included data assessed for October 2015, May 2016 and between February and September 2017 (WRM, 2017).

Groundwater Drawdown (Impacts on Groundwater Users)

No landholder water supply bores are located within the predicted drawdown/depressurisation extents attributable to the proposed mine plan for the Action (AGE, 2018).

The predicted drawdown extents due to the Action in the shallow Tertiary and Weathered Permian layers in the groundwater model is shown on Figure 25. The drawdown extent generally decreases within the underlying layers, which is not unexpected given the presence of lower permeability interburden strata (aquitards) between these geological units (AGE, 2018).

The zone of depressurisation within the deeper Rangal Coal Measures and Fort Cooper Coal Measures from the Project (including the Action) is predicted to extend beyond the ML boundaries to a maximum of up to 1.4 km to the north-west and south-east of the Action (AGE, 2018). The extent of drawdown within the Rangal Coal Measures (Middlemount and Pisces Seams) is constrained by the limited lateral extents of the coal measures.

Drawdown contours for each of the groundwater model layers are presented in AGE (2018).

The Action is not predicted to impact any aquatic or terrestrial GDEs, since GDEs are assessed as being unlikely to occur within and surrounding the Action area (Section 3.6.2).

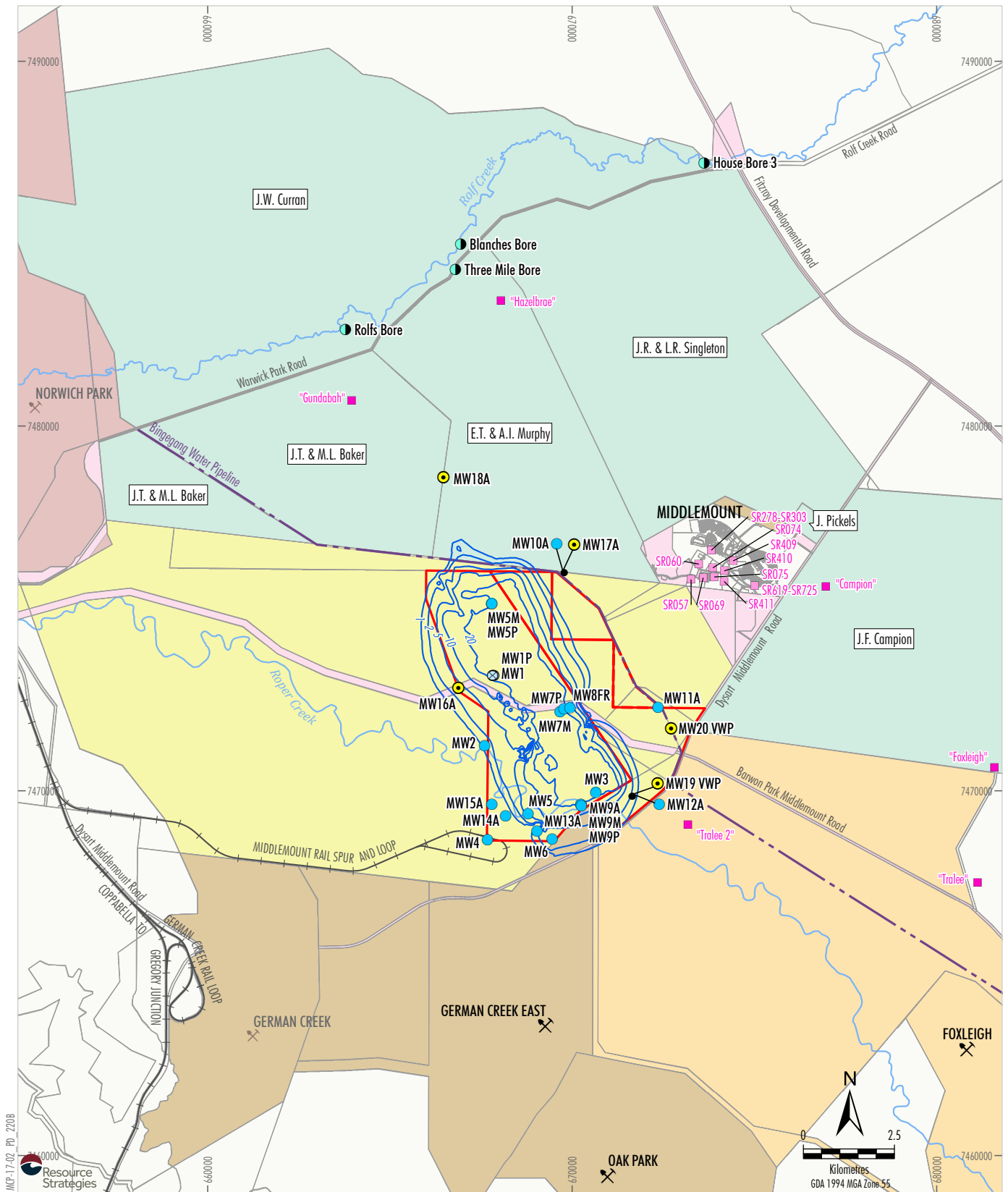
3.8.3 Final Voids

Final Void Design

The Action also requires two final voids located at either end of the mine path (Figure 5), instead of a single final void as currently approved (Figure 2).

The proposed north void is 373 ha in area and the south void area is 222 ha. The basement rock in the void would be the same as the approved final void (i.e. base of the extracted coal seams) with the differences in void depth reflecting the change in position in the landscape (i.e. the northern void depth is 120 mbgl and the southern void depth is 240 mbgl).

A summary of water quality in the final voids is provided in Section 3.9.2 and further detail is provided in AGE (2018). The influence of hydraulic faults on groundwater flow is summarised in Section 3.2 and provided in AGE (2018) (Attachment E).



- LEGEND**
- Middlemount Coal Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Cadastral Boundary
 - Railway
 - ✂ Active Coal Mine
 - ✂ Inactive Coal Mine
 - LANDHOLDER**
 - Middlemount Coal Owned Land
 - Anglo Coal (Capcoal Management) Pty Limited
 - BHP Coal Pty Ltd; QCT Mining Pty Ltd; Mitsubishi Development Pty Ltd; QCT Investment Pty Ltd; BHP Queensland Coal Investments Pty Ltd; Umal Consolidated Pty Ltd; QCT Resources Pty Limited
 - Foxleigh Land Pty Ltd
 - Crown Land
 - Relevant Private Landholder
 - Owner not Referenced

- Private Landholder Bores
- Bore Identified During Bore Census
- Middlemount Coal Groundwater Monitoring Bores
- Proposed Additional Bore
- Existing Bore
- Bore Abandoned/Destroyed
- Maximum Zone of Groundwater Drawdown
- Drawdown Contour (m)

Source: MCPL (2018); AGE (2018); Department of Natural Resources and Mines (2017)



WESTERN EXTENSION PROJECT

Maximum Zone of Groundwater Drawdown (Tertiary and Weathered Permian)

Figure 25

A description of the options explored to minimise the final void areas and volumes is provided below, along with a description of the final void flood protection measures, pit wall stability considerations and other post closure management measures.

Options to Minimise the Final Void Areas and Volumes

The *Residual Void Study* was prepared by MCPL in 2014 to address Condition F22 of EA EPML00716913. The *Residual Void Study* (MCPL, 2014b) identified a need for two final voids located at either end of the mine path. Through detailed mine planning MCPL found that the location of the approved final void was sub-optimal because:

- the southern portion of the mine path, which would need to be mined first, has a higher strip ratio of coal, this presents the following issues:
 - ex-pit dump space would be consumed prior to mining to the final south pit highwall being completed, necessitating either additional ex-pit dumping (footprint or height) or early cut-off of mining in the south to provide an in-pit dump location, forgoing a significant portion of the coal resource; and
 - higher operational costs.
- the southern portion of the mine path would need to be mined to a final high wall, and then backfilled preventing access to any future potential coal resources to the south from the pit void (subject to relevant approvals).

The *Residual Void Study* (MCPL, 2014b) identified that the preferred option was to locate a final void at either end of the mine path and this finding remains applicable to the Action. The key reasons for this final void arrangement are to:

- maximise resource utilisation (e.g. preferential extraction of low strip ratio coal);
- produce a higher Project NPV; and
- avoid coal sterilisation as it enables access to potential coal resources to the north and south from the residual voids.

The design of the final landform has taken into consideration the disposal of waste rock in-pit to minimise the size of the final voids where reasonable and practicable. It is not reasonable or practical to further fill in the voids because:

- the cost to rehandle spoil material from the out of pit emplacements to the final voids (to fill the voids or make them smaller) would be prohibitive; and
- rehandling spoil material from the out of pit emplacements (e.g. East Dump) (Figure 3) to the final voids (to fill the voids or make them smaller) would delay rehabilitation.

Final Void Flood Protection

The northern final void is located well beyond the current floodplain of Roper Creek.

The southern final void is located partially on the pre-mine floodplain of Roper Creek (WRM, 2018) (Attachment D). At the completion of mining the operational flood protection levee in the south would be removed and/or incorporated into the final landform to provide flood immunity up to the PMF level from Roper Creek consistent with Condition F21 of EA EPML00716913.

The conceptual final landform south of the final void would be incorporated into the rehabilitated final landform to form a self-sustaining structure that does not require long term maintenance (WRM, 2018). There is at least 150 m of out-of-pit overburden area between the floodplain and the final void, which WRM (2018) has assessed as more than adequate to prevent floodwater from entering the final void.

As described above, it is not reasonable or practical to further fill in the southern final void because:

- the cost to rehandle spoil material from the out of pit emplacements to the final voids (to fill the voids or make them smaller) would be prohibitive; and
- rehandling spoil material from the out of pit emplacements to the final voids (to fill the voids or make them smaller) would delay rehabilitation.

Final Void Pit Wall Stability

The *Residual Void Study* (MCPL, 2014b) included a *Residual Void Slope Stability Study* by Geotechnical Consulting Services (2014). The study included an investigation of geotechnical stability of highwall and low wall slopes, environmental stability and provides an indication of the remedial measures needed to achieve geotechnical stability.

The target coal seams are truncated by the Jellinbah Fault, which is mapped to be generally coincident with the north-eastern boundary of ML 70379. It is recognised that geological faults, such as the Jellinbah Fault, can create instability where the highwall is cut in proximity to the Jellinbah Fault (Geotechnical Consulting Services, 2014). For this reason, MCPL would stand off mining from the Jellinbah Fault leaving a sufficiently thick buttress of undisturbed material. Noting, however, that the Action would not result in a change to the eastern extent of the currently approved pit in the location of the fault.

Post Closure Management

A safety bund wall consisting of competent rock and/or fencing would be constructed to limit human and livestock/animal access to the final void. The bund wall would have a minimum height of 2 m, with a minimum base width of 4 m and be located at least 10 m beyond the area potentially affected by any instability of the open cut pit edge.

Consistent with Conditions F26 and 27 of EA EPML00716913, a Post Closure Management Plan would be prepared for the site prior to final coal processing and implemented for at least 30 years. The Post Closure Management Plan would include monitoring the integrity and stability of the final void.

Final Void Recovery Modelling Results

Post closure conditions were simulated for a period of 500 years by WRM (2018) to predict the void lake recovery levels following cessation of mining. The final voids configuration and contributing catchments (which were minimised with the use of upslope diversions), were used for the simulation along with model predicted groundwater inflows provided by AGE (2018), varying with depth/recovery heights.

Based on the modelled predictions, the North and South voids would gradually fill over time from direct rainfall occurring across each void and groundwater seepage before reaching an equilibrated level well below the pre-mining groundwater levels. The final void modelling indicates the following for the north void (WRM, 2018):

- The water level reaches equilibrium between 60 m AHD and 65 m AHD relatively quickly and varies between these levels and empty throughout the simulation.
- The maximum modelled water level is around 95 m below the north void full supply level.

The final void modelling indicates the following for the south void (WRM, 2018):

- The water level reaches equilibrium between -70 m AHD and -25 m AHD relatively quickly and generally remains at these levels throughout the simulation.
- The maximum modelled water level is around 175 m below the south void full supply level.

The final void recovery modelling also indicates that there would no interaction between the long-term water levels within the northern and southern voids.

3.9 PREDICTED CHANGES TO WATER QUALITY

3.9.1 Surface Water

Uncontrolled Releases

The results of the water balance modelling conducted by WRM (2018) (Attachment D) indicate that, under the current model assumptions and configuration, there are no uncontrolled spills of mine affected water from the site to the receiving environment.

Some overflow of water from sediment dams may occur during wet periods that exceed the design standard of the sediment control system (WRM, 2018). The additional disturbance footprint associated with the Action will also increase the volume of stormwater requiring to be contained and managed on the mine site. Notwithstanding, the on-site stormwater management system will remain generally unchanged (i.e. continued collection of runoff from the overburden dumps) for the Action with augmentations as necessary.

On this basis, it is unlikely that overflows from sediment dams will have a measurable impact on receiving water quality.

Controlled Releases

A review of the water quality parameters tested in both the local waterways and on the mine found that EC varied the most from the WQOs, with no significant differences measured in metal toxicants between mine runoff and regional water quality (WRM, 2018). Therefore, EC would potentially have the greatest impact on the environmental values downstream of the Action and accordingly EC has been used as an indicator of water quality impacts of controlled releases.

Downstream modelling of EC in Roper Creek conducted by WRM (2018) indicates:

- The minimum EC in Roper Creek on a controlled release day is around 255 $\mu\text{S}/\text{cm}$.
- There is a 50% chance that the downstream Roper Creek EC will be greater than 400 $\mu\text{S}/\text{cm}$ during a controlled release.
- There is a 10% chance that the downstream Roper Creek EC will be greater than 540 $\mu\text{S}/\text{cm}$ during a controlled release.
- The EC in Roper Creek is below the receiving water contaminant trigger level of 700 $\mu\text{S}/\text{cm}$ on all release days.
- The EC in Roper Creek would be affected by passive or active releases from the site for around 11% of all Roper Creek flow days.

On this basis, the modelling demonstrates that the implementation of the water management system will mitigate any impacts of the Action on downstream water quality or impact on the environmental values of the downstream waterway (WRM, 2018).

There are no proposed changes to the current releases conditions as prescribed in Condition C5 of EA EPML00716913 (Attachment H).

Geochemistry (Drainage and Seepage)

The overburden and interburden within the Action area includes the same types of sedimentary units that occur within the current Middlemount Coal Mine area, and as such are considered to have the same geochemistry characteristics. Therefore, no additional geochemical assessment has been undertaken for the Action area, with the existing geochemical assessments considered valid for the overburden and interburden sequences that will be mined in the Action portion of the site (AGE, 2018).

Geochemical assessment (RGS Environmental, 2013) identified the majority of coal and mining waste materials (overburden and interburden) are classified as non-acid forming, have excess acid buffering capacity, and a high factor of safety with respect to potential for acid generation. Heavy metal concentrations in all overburden samples tested for the Stage 2 project (Parsons Brinkerhoff, 2010b) were below environmental investigation levels. The excavation and dumping of overburden was predicted to have a low risk of producing heavy metal contamination from leachate seepage or surface water runoff from the overburden dumps (AGE, 2018).

To support this, water quality monitoring in mine affected water storages shows that runoff and seepage from the coal stockpiles, mining pits and TSF is brackish with moderate sulphate concentrations and pH levels have historically fluctuated from acidic to alkaline. However, all recent samples taken since late 2012 have been generally neutral to moderately alkaline, and not shown any evidence of acid generation (WRM, 2018).

Surface water runoff from overburden dumps is fresh to brackish with lower sulphate levels than those recorded in mine affected water dams and pH levels are moderately alkaline. Again, there has not been any evidence of acid generation, which supports the above geochemical assessment conclusions (WRM, 2018).

It is recognised that salinity levels in the mine water management system may increase over time due to evapo-concentration (e.g. due to the large evaporative surface of the MWD) of on-going salt loads from coal and mining waste rock materials (WRM, 2018).

Water quality of the final voids is discussed in Section 3.9.2.

3.9.2 Alteration of Groundwater Quality

Although the majority of overburden could be managed as non-acid forming material, there is a risk that some of the coal rejects may have a capacity to generate acid over time if left unmanaged during mining operations (RGS Environmental, 2016). Therefore, coal rejects would continue to be placed with overburden within the open cut pits and progressively rehabilitated during mining. Surface water runoff and accumulated rainfall seepage would drain towards the voids, and local groundwater would flow from the surrounding geological units towards the voids (AGE, 2018).

There is limited potential for groundwater contamination to occur as a result of hydrocarbon and chemical contamination with provision for immediate clean-up of spills. All chemicals would be transported, handled and stored in accordance with relevant Australian Standards. These controls represent standard practice and a legislated requirement at mine sites for preventing the contamination (AGE, 2018).

The Groundwater Assessment predicts the final voids will act as long-term groundwater sinks post mining, with pit void water levels expected to recover to a quasi-equilibrium level that below the pre-mining groundwater level for the north and south voids respectively. This will result in the long-term water quality within the final voids being affected by evaporative concentration and becoming more saline. However, flow of this water into the groundwater systems will be prevented as a consequence of the lower water level within the voids (AGE, 2018).

3.10 CUMULATIVE IMPACTS ON WATER RESOURCES

As described in Section 3.5, the Surface Water Assessment (WRM, 2018) (Attachment D) and the Groundwater Assessment (AGE, 2018) (Attachment E) considered surrounding operational and closed mines, as well as CSG production as part of the Bowen Gas Project (Arrow Energy, 2012) (Figure 22).

3.10.1 Surface Water

The Action does not require any additional raw water allocations and therefore does not contribute to cumulative impacts in relation to extraction of surface water resources from the catchment (WRM, 2018).

The Action would locally impact flows in Roper Creek and its minor tributaries due to water being captured within the site water management system (as described above), however no other projects have been identified which would further increase these localised impacts.

WRM (2018) (Attachment D) also concluded that given the Middlemount Coal Mine affected water releases are being managed within an overarching strategic framework for management of cumulative impacts of mining activities, the proposed management approach for mine affected water from the Action is expected to have negligible cumulative impact on surface water quality and associated environmental values.

3.10.2 Groundwater

The numerical groundwater model was used to assess the cumulative impact between the Action and nearby operational and closed mines which include German Creek East, Foxleigh, Foxleigh Plains, and Norwich Park as well as CSG production as part of the Bowen Gas Project (Arrow Energy, 2012) (Figure 22).

Modelling indicates that drawdown in the Tertiary and Weathered Permian due to the Action (Figure 25) does not overlap with drawdowns from any other nearby mines or CSG operations (AGE, 2018). Depressurisation/drawdown in the deeper Middlemount and Pisces seams has some (albeit limited) interaction with depressurisation/drawdown effects from other mines and CSG production. The cumulative drawdown extents are presented in the Groundwater Assessment (AGE, 2018) (Attachment E).

3.11 SUMMARY OF AVOIDANCE, SAFEGUARDS AND MITIGATION MEASURES FOR WATER RESOURCES

3.11.1 Surface Water Management System

A suite of existing management plans and protocols are used during operations at the Middlemount Coal Mine for the purposes of water management including:

- *Middlemount Coal Mine Environmental Management Plan* (MCPL, 2017a);
- *Middlemount Coal Mine Water Management Plan* (WRM, 2016b);
- *Middlemount Coal Mine Site Water Balance* (WRM, 2014) (revised by WRM, 2018);
- *Receiving Environment Monitoring Design Plan* (MCPL, 2017c); and
- *Erosion and Sediment Control Plan* (MCPL, 2016a).

The general principles to manage surface water for the site include (WRM, 2018):

- The separation of clean, dirty, mine affected, tailings and contaminated water runoff.
- Minimise the area of surface disturbance, thus minimising the volume of dirty or contaminated runoff.
- Collect and contain on site all potential mine affected water pumped from the open cut pits in dedicated mine water storages. The mine water storages will be used as the primary water source for the CHPP and for dust suppression.
- Retain and reuse on site any dirty water runoff that has high sediment concentrations whenever possible. If not, release it in a controlled manner in accordance with the EA EPML00716913.
- Maximise the use of on-site water and thus minimise the need for importing external water.
- Prioritise the use of poorer quality water over better quality water.
- Flood mitigation works to provide a minimum of 1,000 year Average Recurrence Interval (ARI) immunity from Thirteen Mile Gully and Roper Creek floods.

The existing water management systems at the existing/approved Middlemount Coal Mine would be progressively augmented as water management requirements change over the life of the Action. The updated water management system is described below and further detail is provided in WRM (2018) (Attachment D).

Up-Catchment Runoff Control

Consistent with the existing water management strategy, runoff from undisturbed areas would be diverted around mining activities (where possible) via a series of up-catchment diversion structures (e.g. bunds and drains) and temporary dams.

As part of the Action, two new dams (Highwall Dam 1 [HWD1] and Highwall Dam 2 [HWD2]) would be constructed by 2023 to capture overland flows which would otherwise enter the open cut pit. The water captured in these dams would be either be pumped through a water transfer pipeline or free drained by a temporary drain. By 2028, HWD2 would be mined through as a new permanent drain would be constructed to divert the overland flow from the north of the mining area. This up-catchment diversion structure would remain a feature at the end of mining.

Thirteen Mile Gully Diversion

The Thirteen Mile Gully Diversion was constructed to divert water from an unnamed drainage feature (upstream of Thirteen Mile Gully) to Roper Creek (Figure 2). The Thirteen Mile Gully Diversion was approved under the Qld SPA in July 2013 as it mostly occurs outside of the former boundary of ML 70379 (Development Permit 608153).

As part of the Action, MCPL proposes to realign the Thirteen Mile Gully Diversion to allow for access to additional coal resources within ML 70379 and provide additional surface footprint for out-of-pit waste rock emplacement (Figure 3).

The realigned section of the Thirteen Mile Gully Diversion would still divert runoff following rainfall events from an unnamed drainage feature (confirmed by DNRME to not be a watercourse defined under the Qld *Water Act, 2000*) to Roper Creek as per the approved Thirteen Mile Gully Diversion. The southern portion of the Thirteen Mile Gully Diversion would remain unchanged (Figure 3).

WRM (2018) (Attachment D) has prepared a conceptual design for the realigned section of the Thirteen Mile Gully Diversion. A detailed design for the realigned section of the Thirteen Mile Gully Diversion would be prepared which would consider the recommendations of White et al. (2014).

Roper Creek Diversions

Two diversions of Roper Creek are approved at the Middlemount Coal Mine. The locations of the approved (yet to be constructed) Roper Creek diversions are shown on Figure 3. These diversions would remain unchanged for the Action.

Sedimentation Control

Sedimentation control for the existing Middlemount Coal Mine involves the construction of sediment dams to manage runoff from waste rock emplacements. Sediment generation is also controlled by timely progressive rehabilitation and vegetation establishment on disturbed areas (e.g. completed sections of waste rock emplacements) to minimise the area exposed to erosion.

Existing and proposed sediment dams that would be required for the Action are listed in Table 16. The sediment dams have been sized in accordance with the *Best Practice Erosion and Sediment Control Guidelines* (International Erosion Control Association Australasia [IECA], 2008). Consistent with the existing water management strategy, runoff collected in the sediment dams would be released to the downstream environment or pumped back into the mine water system to maintain capacity.

It is noted that sediment dams SD9 and SD10 would be no longer required by 2023 and 2028 respectively and are not shown on Figure 3⁵.

⁵ The locations of these dams are shown in Attachment D (WRM, 2018).

Table 16
Sediment Dams for the Action

Sediment Dam	Easting (MGA94)	Northing (MGA94)	Receiving Waters
SD1	668,008	7,469,218	Roper Creek
SD2	668,093	7,470,858	Roper Creek
SD3	668,457	7,470,213	Roper Creek
SD5	672,771	7,470,669	An unnamed drainage feature
SD6	672,488	7,472,021	An unnamed drainage feature
SD7	671,125	7,474,067	An unnamed drainage feature
SD9	669,506	7,473,118	Thirteen Mile Gully
SD10	670,870	7,472,707	An unnamed drainage feature
SD12	671,261	7,470,516	Thirteen Mile Gully
SD13	666,826	7,473,281	Thirteen Mile Gully Diversion
SD14	669,367	7,469,428	Roper Creek
SD15	666,116	7,475,874	Thirteen Mile Gully Diversion

* Note: Sediment dam numbering follows that previously used at the mine. There are currently no sediment dams labelled SD 4, SD 8, and SD11. These would be replaced with the re-designed SD12 (Figure 3).

Flood Management

A flood protection levee is progressively constructed at the Middlemount Coal Mine as mining advances (Figure 2). The flood protection levee is designed to prevent clean floodwater from Roper Creek and Thirteen Mile Gully from entering the mine water management system. The flood protection levee is designed to at least 1,000 year ARI as per the DEHP (now DES) guideline *Structures which are Dams or Levees Constructed as Part of Environmentally Relevant Activities* (DEHP, 2017d).

The northern section of the existing flood protection levee would be realigned and extended as part of the Action (Figure 3). The extended flood protection levee would be designed and constructed in accordance with accepted engineering standards, and hazard assessed by a Registered Professional Engineer of Qld against the DES guidelines (DEHP, 2017d).

A sufficient flood protection capacity (i.e. for a 1,000 year ARI flood event) would be provided as per engineered design flood protection.

Tailings Water Management System

There are two approved TSFs at the Middlemount Coal Mine (TSF1 and TSF2) (Figure 2). TSF2 has been divided into four flocculation cells with a further two cells (FC1 and FC2) providing emergency capacity, which have not been required to date. All tailings facilities are constructed with earthen embankments on all sides and do not receive runoff from external catchments.

Fine rejects from the CHPP are comprised mostly of fine silt, clay, water and coal material. The fine rejects are pumped to the flocculation cells and flocculant is added prior to deposition. Decant water is pumped to TSF1 then returned to the CHPP and Raw Water Dam (RWD) for reuse.

The tailings return water management system would remain unchanged for the Action.

Mine Affected Water Release Points, Sources and Receiving Waters

Mine affected water is released in accordance with water quality and flow requirements in EA EPML00716913 (Attachment H).

Transfer dams (such as the STD) are located in the vicinity of the mining pit and used to transfer mine water to the RWD or MWD and as a source of water for dust suppression. The transfer dams are of turkey's nest or sump type construction with no external catchment area. The transfer dams discharge to the mining pit.

The mine affected water release points, sources and receiving waters would remain unchanged for the Action.

3.11.2 Surface Water Monitoring and Management Plan Updates

Surface water quality monitoring for receiving waters would continue to be undertaken in accordance with the EA EPML00716913. The development of any site-specific surface water contaminant trigger investigation levels in EA EPML00716913 would consider the guidelines *How to Derive Site-specific Guideline Values for Physical and Chemical Parameters: IESC Information Guidelines Explanatory Note* (Huynh and Hobbs, 2018).

An operation and monitoring plan would be developed for the proposed realignment of the Thirteen Mile Gully Diversion as part of detailed design. This plan would be consistent with the monitoring programme developed for the existing Thirteen Mile Gully Diversion.

The Water Management Plan (WRM, 2016b) would be updated to reflect any changes to the water management system and monitoring locations resulting from the Action.

The water balance model developed by WRM (2018) for the Action is based on the best information currently available and is expected to provide a reasonable representation of the performance of the mine water management system. The model will be updated and validated in the future when more suitable site-specific data becomes available. The performance of the actual system may differ from the model predictions for a variety of reasons, including different climatic sequences and hydrologic behaviour of catchments, as well as variations in operating procedures due to potential equipment failure or operation system error (WRM, 2018).

The Middlemount Coal Mine Residual Void Hydrology Study (WRM, 2015) would be updated to reflect the Action and would include consideration of increasing salinity in the final voids.

The Water Management Plan would include accounting and reporting of water in consideration of the Water Accounting Framework (Mineral Council of Australia, 2014).

3.11.3 External Water Supply

The results of the updated Middlemount Coal Mine OPSIM water balance model concluded the existing water management system (including the external supply via the pipeline) can meet all mine site demands over the mine life (WRM, 2018).

Potable water is supplied via truck from Middlemount township to the Middlemount Coal Mine.

In addition to the above, if required, MCPL also have water allocations from the Bingegang Pipeline (Figure 2), which runs between the Bingegang Weir and the town of Dysart.

The existing water supply arrangements would continue for the Action.

3.11.4 Groundwater Monitoring Network and Trigger Values

A groundwater monitoring network has been established at the Middlemount Coal Mine, which includes groundwater level and quality monitoring locations within and surrounding the mine site, in accordance with the EA and relevant state and national monitoring guidelines. The locations of groundwater monitoring bores are shown on Figure 25.

With the updates to the mine plan, some of the monitoring bores would be mined through over the life of the Action. The existing bores would provide a good indication of groundwater response to mining and should be monitored while they are accessible.

Installation of additional bores (MW16A, MW17A, MW18A, MW19VWP, and MW20VWP)⁶ outside of the current mine area (Figure 22) will provide groundwater data within the:

- Tertiary/Weathered Permian strata west of the proposed extension area (MW16A);
- Tertiary/Weathered Permian strata adjacent to MW10A where groundwater levels have declined below the base of MW10A (MW17A);
- Tertiary/Weathered Permian strata to the north-west of the proposed extension area overlying the deeper coal measures subject to depressurisation (MW18A); and
- long-term groundwater drawdown response within the Fort Cooper Coal Measures east of the Jellinbah Fault (MW19VWP and MW20VWP).

The installation of these additional bores would serve to capture additional groundwater monitoring where data gaps within the current monitoring network have been identified (including the peer review comments on the Groundwater Assessment). These monitoring bores would be used to verify predicted groundwater model drawdown responses in these areas that are attributable to mining once sufficient groundwater monitoring data has been collected.

MCPL would conduct opportunistic hydrogeological testwork in the future (e.g. hydraulic conductivity and specific storage testing) that would assist to confirm the hydrogeological parameters adopted in the groundwater model and characterisation of the Jellinbah Fault.

The results of any future monitoring and hydrogeological testwork would be described in the Water Management Plan.

Furthermore, a review of the groundwater model would be undertaken within five years of commencement of the Project by a suitably qualified hydrogeologist. Any subsequent updates to the groundwater model (e.g. changes to how the Jellinbah Fault is modelled) would also consider additional groundwater monitoring and hydrogeological testwork conducted in the future.

All groundwater monitoring, water level measurements and sample collection, storage and transportation would be undertaken in accordance with the procedures outlined by the Murray Darling Basin Commission (1997) and the DES (2018b).

Groundwater Levels

Groundwater level monitoring would continue to be undertaken at an appropriate frequency (e.g. quarterly or as defined in the conditions of EA EPML00716913 [Attachment H]), to develop a long-term dataset, and would be extended to the additional bores proposed upon installation.

⁶ MW17A, MW18A, MW19VWP, and MW20VWP were installed prior to December 2018 and groundwater monitoring data is now being collected at these locations. MW16A has not been installed at the time of writing (December 2018).

Water level loggers would also be installed in select monitoring bores to record groundwater level measurements at regular intervals. These would also enable continuous measurement of groundwater level fluctuations for determining to what extent these are attributable to rainfall recharge or from potential water level declines from depressurisation resulting from open cut mining.

Groundwater Triggers – Levels

Table 17 presents groundwater level trigger thresholds as defined in Table C10 of EA EPML00716913 for the existing monitoring bores, outside of normal seasonal fluctuations. These are provided either as a change in water level per year, or as a total change in the groundwater elevation (m AHD) as determined from the total predicted drawdown from the initial water level at bores MW3, MW5 and MW9A.

Bore MW4 has not been included in Table 17, as AGE (2017a) recommends that this bore should not be subject to groundwater level change restrictions (in EA Table C10) as it is not screened in the Tertiary unit (i.e. it should be removed from the EA).

Groundwater level triggers for the proposed monitoring bores would be determined after these bores are installed, and their locations and aquifer intersected confirmed.

When groundwater level monitoring results are compared to the groundwater level trigger thresholds, if the results:

- do not exceed the level trigger thresholds then no further action is required; or
- exceed the level thresholds, an exceedance investigation and response would be initiated in accordance with the EA EPML00716913 conditions.

Table 17
Amended Groundwater Level Trigger Thresholds

Monitoring Location	Trigger Level Threshold*	Predicted Maximum Drawdown (m)*
MW2	> 2 m per year	3.8
MW3^	Total groundwater level of < 115.39 mAHD	11.8
MW5	Total groundwater level of < 140.4 mAHD	17.3
MW6	> 2 m per year	8.2
MW9A	Total groundwater level of < 118.17 mAHD	13.5
MW10A	> 2 m per year	0.0
MW11A	> 2 m per year	0.0
MW12A	> 2 m per year	6.6
MW13A	> 2 m per year	0.0

* The level trigger threshold is equal to the groundwater level drawdown observed within each monitoring bore measured from the commencement of mining.

^ MW3 will continue to be monitored until mine progression prevents monitoring. MW9A installed as a replacement well for MW3.

Groundwater Quality

Groundwater quality sampling of the existing monitoring bores (and proposed bores once installed, with the exception of vibrating wire piezometers [VWPs]) would continue in accordance with EA conditions (i.e. monitoring frequency and suite of parameters) in order to provide long-term groundwater quality dataset, and to detect any changes in groundwater quality during and post mining.

Groundwater Triggers – Quality

Groundwater quality triggers are defined in Table C8 of the EA EPML00716913 and presented in Table 18.

Table 18
Amended Groundwater Investigation Trigger Levels

Parameter	Unit	Trigger value	Limit type
pH	pH units	6.5-8.5	Minimum/ Maximum
Electrical Conductivity	µS/cm	35,000	Median
Total Dissolved Solids	mg/L	24,000	Median
Calcium	mg/L	1,000	Median
Magnesium	mg/L	2,000	Median
Sodium	mg/L	6,700	Median
Potassium	mg/L	43	Median
Chloride	mg/L	12,700	Median
Sulfate (SO ₄)	mg/L	2,000	Median
Carbonate (CO ₃)	mg/L	7.7	Median
Bicarbonate (HCO ₃)	mg/L	800	Median
Iron	mg/L	14	Median
Mercury	mg/L	0.002	Median
Total Petroleum Hydrocarbons (C10-C14)	µg/L	50	Median
Total Petroleum Hydrocarbons (C15-C28)	µg/L	185	Median
Total Petroleum Hydrocarbons (C29-C36)	µg/L	90	Median

Review of the EA EPML00716913 triggers (AGE, 2017b) identified several inappropriate or unsuitable conditions in relation to the groundwater triggers, and recommended changes that would ensure a greater level of compliance, while maintaining the protection of environmental values.

Recommendation was provided for adopting the median-type trigger value for all other parameters (except pH) as this would be more appropriate for eliminating false exceedances that are isolated occurrences.

The most recent review of recent trigger exceedances (AGE, 2017b) included analysis of the potential causes of the exceedances and the potential for any resultant environmental harm, and indicated the exceedances in relation to:

- TDS and sodium were a result of naturally occurring fluctuations that were most likely attributable to changes in climate that would have no change in the environmental values of the groundwater.
- Silver and selenium were related to sample dilution and at very low concentrations.

TPH were short term that were probably not represent of petrogenic hydrocarbons linked to mining activities, and therefore were false exceedances that would probably be removed using the silica-gel clean-up method recommended by Australian Laboratory Services Pty Ltd (ALS code EP071-SG). This was subsequently confirmed with the groundwater monitoring undertaken in December 2017 (AGE, 2018) (Attachment E).

The report concluded that the exceedances in these parameters were not expected to have any impact on the potential groundwater use or environmental values, and provided recommendation for:

- removing silver as there is no ANZECC/ARMCANZ guideline for this parameter⁷;
- removing selenium as the water is unsuitable for stock watering due to high TDS; and
- keeping the EC and total dissolved solids (TDS) trigger values at their current levels but amending these to median instead of maximum limit types.

The assessment also recommended rounding off the trigger levels for TDS, carbonate, bicarbonate, iron and total petroleum hydrocarbons. These recommendations are also provided in Table 18.

Mine Groundwater Inflows

MCPL currently assesses groundwater pit inflows through review of pumping records of pit de-watering and the site water balance model to identify inflow/seepage rates. Water samples would also be collected of any pumped seepage and include laboratory analysis for same suite of parameters for the groundwater monitoring bores.

The groundwater pit inflow monitoring program would include:

- recording of any unexpected or significantly increased groundwater inflows directly to the pits;
- measurement of water pumped from the pits;
- sampling of water quality pumped from the pits; and
- monitoring of rainfall (to allow for correlation with pumping/pit inflow records).

3.11.5 Annual Groundwater Reporting

Annual monitoring reports would continue to be prepared for the Action and would include:

- records of groundwater levels and quality in the monitoring bores of the approved groundwater monitoring network; and
- details of any review undertaken of the groundwater model since the previous annual monitoring report.

3.11.6 Water Licensing

Under the *Qld Water Act, 2000*, the Action would require an associated water licence for the EA amendment. The purpose of an associated water licence is provided in section 1250C, Division 2 of the *Water Act, 2000* which states:

An associated water licence authorises the taking of or interference with underground water in the area of a mining tenure if the taking or interference happens during the course of, or results from, the carrying out of an authorised activity for the tenure.

MCPL will apply separately for an associated water licence for the authorised take for the Action.

⁷ This recommendation was accepted in a minor amendment to EA EMPL 00716913 on 21 May 2018.

4 ENVIRONMENTAL OUTCOMES

MCPL are not requesting outcomes-based conditions, yet as required by the request for preliminary documentation, this section describes the outcomes that would be achieved for MNES. The outcomes are described in consideration of the DEE *Outcomes-based Conditions Policy 2016* (DotE, 2016a) and *Outcomes-based Conditions Guidance 2016* (DotE, 2016b). MCPL discussed the information required to be included in this document with DEE during May 2018 and the below information is a result of that discussion.

Threatened Species and Communities Outcomes

An outcome of the Action would be the enhancement and security of the Western Extension Commonwealth Offset Area (as described in Section 2.10) to address the potentially significant residual 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 land in the offset areas will be enhanced so as the currently degraded areas reach remnant status⁸ through increasing the structural integrity and extent of vegetation in the area.

As described in Section 2.10.1, MCPL currently has a number of existing biodiversity offset areas on company-owned land which were established for various components of the Middlemount Coal Mine, which demonstrates MCPL's willingness and capability to achieve the outcome.

Water Resource Outcomes

Authorised impacts on water resources are currently being regulated under the Qld EP Act (Middlemount Coal Mine operates under EA EPML00716913) and Qld *Water Act, 2000* (water licences). The water resource conditions from EA EPML00716913 are provided in Attachment H. Noting, however, that MCPL is seeking approval of the Project through a major amendment of EA EPML00716913 in accordance with Chapter 5, Part 7 of the EP Act so it is anticipated that the water resource conditions in Attachment H will be updated by the Qld Government to incorporate the Project (which would cover the Action activities).

Rehabilitation Outcomes

The rehabilitation goal for the existing Middlemount Coal Mine is to rehabilitate all land subject to mining activities to a non-polluting, safe, stable and self-sustaining landform in accordance with EA EPML00716913.

⁸ For non-remnant vegetation to achieve woody vegetation remnant status the dominant canopy must have greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

5 CONSOLIDATED MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN OUTLINE

This section provides a consolidated summary of proposed environmental management commitments, including mitigation measures and relevant management plans.

The existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced.

Existing management plans and programs include:

- Environmental Management Plan;
- Rehabilitation Management Plan;
- Water Management Plan;
- Offset Management Plan/Vegetation Management Plan; and
- Species Management Program.

MCPL would continue to implement the existing plans and programs and where necessary, review, revise and build on them. A summary of these measures and the management plans is provided in Table 19.

Table 19
Summary of Mitigation Measures and Management Plans

Mitigation Measures	Management Plans	Source of Management Plan Requirement
<i>Threatened Species and Communities</i>		
Education of staff, including contractors, in relation to the risks to fauna and how to manage animals which are injured or displaced, including threatened species.	Environmental Management Plan	Company commitment.
All roads in the Project area would be limited to a 40 km/h speed limit which would reduce the risk of vehicle strike.	Environmental Management Plan	
Boundaries of areas to be cleared, and those not to be cleared, would be defined before and during clearing activities.	Environmental Management Plan	
Weed management techniques would continue to be implemented within the mining lease (e.g. weed control [spraying] and washdown of machinery when moving from weed infested areas).	Environmental Management Plan	
MCPL would use a licensed spotter-catcher and/or carer during clearing activities.	Environmental Management Plan and Species Management Program	NC Act
Progressive rehabilitation of disturbance areas.	Rehabilitation Management Plan	Middlemount Coal Mine EA EPML00716913 (21 May 2018)
Management of the existing and proposed offset areas.	Offset Management Plan/Vegetation Management Plan	Various (Section 2.11)

Table 19 (Continued)
Summary of Mitigation Measures and Management Plans

Mitigation Measures	Management Plans	Source of Management Plan Requirement
Water Resources		
Site water management and monitoring would be conducted in accordance with a revised Water Management Plan.	Water Management Plan	Middlemount Coal Mine EA EPML00716913 (21 May 2018)
Surface water quality monitoring would continue to be undertaken for receiving waters when applicable and additional locations monitored.	Water Management Plan	
Ongoing groundwater level and quality monitoring within and surrounding the mine site.	Water Management Plan	
Expansion of existing groundwater level and quality monitoring program to include additional bores outside of the current mine area.	Water Management Plan	

6 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

6.1 OVERVIEW

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 *National Strategy for Ecologically Sustainable Development* (NSED) (Commonwealth of Australia, 1992) that defines Ecologically Sustainable Development (ESD) 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 NSED was developed with the following core objectives:

- enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- provide for equity within and between generations; and
- protect biological diversity and maintain essential processes and life support systems.

In addition, the NSED 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 NSED 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 while taking decisions and actions which are aimed at helping to achieve the goal of this Strategy.

In accordance with the DEE Preliminary Documentation Information Request (Attachment B), an assessment of the consistency of the Action with section 3A of the EPBC Act has been undertaken. The principles of ESD as outlined in section 3A of the EPBC Act are as follows:

- (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 principle 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 design, planning and assessment of the Action has been carried out applying the principles of ESD, through:

- incorporation of risk assessment and analysis at various stages in the detailed design, environmental assessment and decision-making processes;
- adoption of high standards for environmental and workplace health and safety performance;
- consultation with relevant regulatory and community stakeholders; and
- consideration of social and economic benefits to the community arising from the development of the Action.

In addition, it can be demonstrated that the Action can be operated in accordance with ESD principles through the application of mitigation and management measures to minimise environmental impacts of the Action. The following sub-sections describe the consideration and application of the principles of ESD to the Action.

6.2 LONG-TERM AND SHORT-TERM CONSIDERATIONS

The integration of long-term and short-term economic, environmental, social and equitable considerations is recognised as a principle of ESD in section 3A(a) of the EPBC Act.

Assessment of potential short and long-term impacts of the Action have been carried out during the preparation of this assessment on aspects of land, surface water and groundwater, ecology, air quality, noise emissions and socio-economics.

The Action also includes offset measures to maintain or improve biodiversity values in the surrounding region in the medium to long-term (Section 2.10).

The assessments undertaken for the Action also included other environmental considerations (Section 4), socio-economic considerations (Section 7) and social equity considerations (Section 6.4).

6.3 PRECAUTIONARY PRINCIPLE

The precautionary principle (i.e. where 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) is recognised as a principle of ESD in section 3A(b) of the EPBC Act.

Environmental assessment involves predicting what the environmental outcomes of a development are likely to be. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A range of mitigation measures have been adopted as components of the Action design to minimise the potential for serious impacts to the environment, including the continuation of environmental management and monitoring programmes and compensatory measures.

Minimal uncertainty regarding the information used in these specialist assessments is expected given:

- the number of site-based surveys and assessments conducted at the Middlemount Coal Mine, surrounding offset areas and for the Action;
- the comprehensive nature of the assessments; and
- the consultation process conducted with key stakeholders (Section 7.2).

6.4 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 is 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 of the social and economic impacts of the Action, including the distribution of impacts between stakeholders (Section 7);
- management measures to be implemented in relation to the potential impacts of the Action on relevant MNES (Section 2);
- implementation of environmental management and monitoring programmes (Sections 2.9 and 2.10) to minimise potential environmental impacts (which include environmental management and monitoring programmes covering the life of the Action); and
- implementation of compensatory measures over the life of the Action to compensate for potential localised impacts that have been identified for the development, such as the offset strategy described in Section 2.10.2.

In addition, the Action would benefit current and future generations through the maintenance of employment. It would also provide continued significant stimulus to local and regional economies, thus contributing to future generations through social welfare, amenity and infrastructure.

6.5 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

The consideration of the conservation of biological diversity and ecological integrity in decision-making is recognised as a principle of ESD in section 3A(d) of the EPBC Act.

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 assessment, ecological integrity has been considered in terms of ecological health and ecological values.

A range of impact avoidance, mitigation and offset measures would be implemented for the Action to maintain or improve the biodiversity values of the surrounding region in the medium to long-term, as described below.

Section 2.9 summarises a number of measures that would assist in maintaining the biodiversity of the region. A biodiversity offset package has been developed to address the potential residual impacts on biodiversity values associated with the Action (Section 2.10).

In addition, the disturbance areas associated with the Action would be progressively rehabilitated. The rehabilitation goal for the existing Middlemount Coal Mine is to rehabilitate all land subject to mining activities to a non-polluting, safe, stable and self-sustaining landform in accordance with EA EPML00716913.

6.6 VALUATION

The adoption and promotion of improved valuation, pricing and incentive mechanisms is recognised as a principle of ESD in section 3A(e) of the EPBC Act.

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 environment considerations in decision making, as required by ESD.

While historically, environmental costs have been considered to be external to development costs, improved valuation and pricing methods attempt to internalise environmental costs and include them within development costing. The economic benefit associated with the Action has, where possible, considered the environmental costs (e.g. biodiversity offset costs) associated with the Action.

7 ECONOMIC AND SOCIAL IMPACTS

7.1 COSTS AND BENEFITS ASSOCIATED WITH THE ACTION AND EMPLOYMENT OPPORTUNITIES

The Project would:

- extend the approved mine life by approximately six years (to 2037) to recover an additional 21 Mt of coal from the Middlemount and Pisces seams;
- provide job security for local mine employees and contractors;
- result in an incremental net benefit of approximately \$202 million (M) (in net present value [NPV] terms);
- result in additional tax revenue to the State of Qld of approximately \$97.5 M (in NPV terms);
- stimulate demand in the local and regional economy; and
- result in the establishment of additional biodiversity offset areas.

7.2 STAKEHOLDER CONSULTATION

Consultation has been conducted with relevant stakeholders during the preparation of this document. A summary of this consultation is provided below. It is anticipated that consultation with these stakeholders will continue during the assessment of the Project by the Qld and Commonwealth Governments.

Department of Environment and Science

MCPL met with DEHP (now DES) on 20 July 2017 to discuss the Project and approval process prior to submission of the EA amendment application and the Section 226 Consideration Report (MCPL, 2017b). MCPL subsequently met with DES on 22 February and 2 March 2018 to discuss the Project, environmental studies and scope for this EAR. MCPL met with DES for the Environmental Assessment Report pre-lodgement meeting on the 27 June 2018.

Department of Natural Resources, Mines and Energy

MCPL has existing Qld and Commonwealth approved biodiversity offset areas under an existing VDec under the VM Act (Declared Area Map 2013/003919), and new biodiversity offset areas are proposed as part of the Project.

MCPL consulted with the DNRME in February 2018 regarding the security of the offset areas under a new VDec.

Commonwealth Department of the Environment and Energy

MCPL met with the Commonwealth Department of the Environment and Energy (DEE) in July 2017 for an EPBC Act referral pre-lodgement meeting. An EPBC Act referral for the Project was lodged on 7 January 2018. A controlled action decision was received on 8 February 2018 (EPBC 2017/8130) and assessment is to be via Preliminary Documentation assessed by the Commonwealth Government.

MCPL hosted representatives from the DEE for a site visit on 23 May 2018.

Isaac Regional Council

The Barwon Park - Middlemount Road traverses the Middlemount Coal Mine. This is an unformed road that is mapped as a travelling stock reserve (Figure 2). MCPL has previously reached compensation agreements with the Isaac Regional Council to close part of the travelling stock reserve within ML 70379 and ML 70417.

MCPL met with the Isaac Regional Council in February 2018 regarding the Project and seek to reach a similar compensation agreement with the Isaac Regional Council in relation to the part of the travelling stock reserve that traverses ML 70379 within the Project area. An agreement is expected to be executed in August 2018.

Aboriginal Community

Cultural Heritage Management Plans (CHMPs) are in place with the Barada Barna People and BBKY #4, and cover the majority of the Project area. MCPL met with the Barada Barna People in February 2018 regarding the Project and a new CHMP was executed in June 2018 for the area of the Project (approximately 75 ha) that is not covered by the existing CHMPs.

8 MCPL'S ENVIRONMENTAL RECORD

There are no past or present proceedings under a Commonwealth or State law for the protection of the environment or the conservation and sustainable use of natural resources against the person proposing to take the action, or for an action for which a person has applied for a permit, the person making the application.

MCPL has a strong record of compliance with its environmental obligations. MCPL has established and is committed to continuing open and constructive dialogue with the local community and stakeholders regarding environmental management as part of their operations.

Our Aim

At Middlemount Coal, we are committed to maintaining a sustainable balance between economic development and the protection of the natural environment. Our goal is to not only meet our environmental and cultural heritage obligations, but strive to exceed in all facets, therefore ensuring the protection of our environmental values within the Middlemount Mine as well as our surrounding communities.

Our Objectives

Our Environment and Cultural Heritage Management System includes but is not limited to:

- Planning work activities so as to meet all environmental, sustainability and cultural heritage legislation and guidelines.
- Operating an environmentally sound and cultural aware business.
- Reporting and recording environmental practices, including greenhouse gas emissions, as part of our environmental and quality management system.
- Reviewing and auditing our environmental procedures to enable continual improvement.

Our Commitment

Middlemount Coal is committed to:

- Comply with legislation concerned with the production, minimisation and disposal of waste and the control of hazardous substances, dust and industrial noise.
- Comply with government acts and requirements for the protection of our cultural heritage.
- Comply with legislation and regulations concerned with energy efficiency and greenhouse gas emissions.
- Act with due regard for the requirements and expectations of our key stakeholders.
- Encourage employee education and participation in improving environmental awareness and practice.
- Encourage employee education in cultural heritage awareness.
- Implement an environmental audit and reporting system, to continually improve our environmental management system.
- Minimise waste generation and dispose of waste responsibly.

- Identify opportunities to reduce energy use and greenhouse gas emissions and the subsequent implementation of operational changes in response to opportunities that have been identified.
- Rehabilitate areas no longer required for mining processes.

A copy of the Middlemount Coal Mine Environment and Cultural Heritage Policy is available on the Middlemount Coal Mine website.

9 CONCLUSION

This Preliminary Documentation addresses the information requirements of the DEE, to enable assessment and approval of the Action under the EPBC Act.

Listed Threatened Species and Communities

Three threatened species and one ecological community listed under the EPBC Act have been recorded in the Action area, namely the Squatter Pigeon (southern), Koala, Greater Glider and Brigalow EEC. Further, the Ornamental Snake has been previously recorded in the existing/approved mine area.

Potential impacts on these MNES as a result of the Action have been investigated within this document.

MCPL would minimise potential impacts on threatened species and the Brigalow EEC through the use of existing infrastructure and facilities (where possible) and minimising out-of-pit waste emplacements via backfilling of the open cut pit void. The existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced. Relevant impact mitigation measures include the use of a licensed spotter-catcher and/or carer during clearing activities and progressive rehabilitation of disturbance areas.

A new offset area is proposed which provides for the enhancement and conservation of Brigalow EEC and habitat for the Ornamental Snake, Squatter Pigeon (southern), Koala and Greater Glider. The Western Extension Commonwealth Offset Area is approximately 1,220 ha in size, comprising approximately 752.5 ha of woodland vegetation and approximately 444 ha of derived grassland and regrowth vegetation, with the remainder of the area being mapped as cleared land.

Water Resources

The existing/approved Middlemount Coal Mine has effects on surface water and groundwater resources, for example through diversions of Thirteen Mile Gully and Roper Creek and groundwater drawdown associated with the open cut mining operation. Impacts on water resources are currently authorised under the Middlemount Coal Project Stage 2 Commonwealth approval (EPBC 2010/5394) and being regulated under the EP Act (Middlemount Coal Mine operates under EA EPML00716913) and Qld *Water Act, 2000* (water licences). The Action provides for the continuation of open cut coal mining operations at the Middlemount Coal Mine, including a small realignment of the Thirteen Mile Gully Diversion and an incremental increase in groundwater drawdown associated with the open cut extension to the north-west of the authorised open cut mine extents.

Water-dependent assets (i.e. entities with characteristics having value and which can be linked directly or indirectly to a dependency on water quantity or quality) have been identified and the potential for the Action to impact water-dependent assets has been assessed.

In summary, groundwater levels are generally in excess of 25 m below ground surface and separated from surface waters, limiting potential to support GDEs. Further, the groundwater quality in the locality is brackish to saline and not suitable for stock or human consumption.

The realigned section of the Thirteen Mile Gully Diversion would still divert runoff following rainfall events from an unnamed drainage feature to Roper Creek as per the approved Thirteen Mile Gully Diversion. The southern portion of the Thirteen Mile Gully Diversion would remain unchanged.

As described above, the existing environmental management systems at the Middlemount Coal Mine include environmental management plans and programs that have been developed and implemented since operations commenced. Mitigation measures relevant to water resources, include site water management, surface water monitoring and groundwater level and quality monitoring.

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ATTACHMENT A

EPBC ACT REFERRAL FOR THE MIDDLEMOUNT COAL MINE WESTERN
EXTENSION PROJECT

ATTACHMENT B

REQUEST FOR PRELIMINARY DOCUMENTATION

ATTACHMENT C
ECOLOGY ASSESSMENT

ATTACHMENT D

SURFACE WATER ASSESSMENT

ATTACHMENT E

GROUNDWATER ASSESSMENT

ATTACHMENT F

GROUNDWATER ASSESSMENT PEER REVIEW LETTER

ATTACHMENT G

MIDDLEMOUNT COAL MINE OFFSET MANAGEMENT PLAN/VEGETATION MANAGEMENT PLAN

ATTACHMENT H

MIDDLEMOUNT COAL MINE
ENVIRONMENTAL AUTHORITY EPML00716913 (21 MAY 2018) -
WATER CONDITIONS

Water

- C1 Contaminant release
Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority
- C2 The release of mine affected water to waters must only occur from the release points specified in Table C1: Mine Affected Water Release Points, Sources and Receiving Waters and depicted in Attachment B, attached to this environmental authority.

Table C1: Mine Affected Water Release Points, Sources and Receiving Waters

Release point (RP)	Easting (GDA94)	Northing (GDA94)	Mine affected water source and location	Monitoring point	Receiving waters description
RP 1	667,725	7,469,370	Raw Water Dam	Spillway/pipe	Roper Creek
RP 2	671,743	7,469,842	Mine Water Dam	Spillway/pipe	Roper Creek
SD 1	668,008	7,469,218	Sediment Dam 1	Spillway/pipe	Roper Creek
SD 2	668,093	7,470,858	Sediment Dam 2	Spillway/pipe	Roper Creek
SD 3	668,457	7,470,213	Sediment Dam 3	Spillway/pipe	Roper Creek
SD 7	671,125	7,474,067	Sediment Dam 7	Spillway/pipe	Roper Creek
NROM	667,858	7,470,294	North ROM Dam	Spillway/pipe	Roper Creek

- C3 The release of mine affected water to internal water management infrastructure that is installed and operated in accordance with a water management plan that complies with Conditions C26 to C27 inclusive is permitted.
- C4 The release of mine affected water to waters in accordance with Condition C2 must not exceed the release limits stated in Table C2: Mine Affected Water Release Limits when measured at the monitoring points specified in Table C1: Mine Affected Water Release Points, Source and Receiving Waters for each quality characteristic.

Table C2: Mine Affected Water Release Limits

Quality Characteristic	Release Limits	Monitoring Frequency	Comments
Electrical Conductivity (µS/cm)	Release limits specified in Table C4 for variable flow criteria	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
pH (pH units)	6.5 (minimum) 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
Turbidity (NTU)	No limit	Daily during release** (first sample within 2 hours of commencement of release)	Turbidity is required to assess ecosystems impacts and can provide instantaneous results.
Suspended Solids (mg/L) (80 th percentile ¹ of reference ²)	Flow <2m ³ /s 562 mg/L	Daily during release** (first sample within 2 hours of commencement of release)	Suspended solids are required to measure the performance of sediment and erosion control measures.
	Flow >2m ³ /s 1062 mg/L		

Sulphate (SO ₄ ²⁻) (mg/L)	Release limits specified in Table C4 for variable flow criteria	Daily during release* (first sample within 2 hours of commencement of release)	Drinking water environmental values from NHMRC 2006 guidelines or ANZECC
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- C5 The release of mine affected water to waters from the release points must be monitored at the locations specified in Table C1: Mine Affected Water Release Points, Sources and Receiving Waters for each quality characteristic and at the frequency specified in Table C2: Mine Affected Water Release Limits and Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants.

Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants

Quality characteristic	Trigger levels (µg/L)	Comment on trigger level	Monitoring frequency
Aluminium	55	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Arsenic	13	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Cadmium	0.2	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Chromium	1	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Copper	2	For aquatic ecosystem protection, based on LOR for ICPMS	Commencement of release and thereafter weekly during release
Iron	300	For aquatic ecosystem protection, based on low reliability guideline.	Commencement of release and thereafter weekly during release
Lead	4	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Mercury	0.2	For aquatic ecosystem protection, based on LOR for CV FIMS	Commencement of release and thereafter weekly during release
Nickel	11	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Zinc	8	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Boron	370	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Cobalt	90	For aquatic ecosystem protection, based on low reliability guideline	Commencement of release and thereafter weekly during release
Manganese	1,900	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	Commencement of release and thereafter weekly during release
Selenium	10	For aquatic ecosystem protection, based	Commencement of release

		on LOR for ICPMS	and thereafter weekly during release
Silver	1	For aquatic ecosystem protection, based on LOR for ICPMS	Commencement of release and thereafter weekly during release
Uranium	1	For aquatic ecosystem protection, based on LOR for ICPMS	Commencement of release and thereafter weekly during release
Vanadium	10	For aquatic ecosystem protection, based on LOR for ICPMS	Commencement of release and thereafter weekly during release
Ammonia	900	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Nitrate	1,100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN	Commencement of release and thereafter weekly during release
Petroleum hydrocarbons (C6-C9)	20		Commencement of release and thereafter weekly during release
Petroleum hydrocarbons (C10-C36)	100		Commencement of release and thereafter weekly during release
Fluoride (total)	2,000	Protection of livestock and short term irrigation guideline	Commencement of release and thereafter weekly during release
Sodium	To be provided to the administering authority via an amendment to the environmental authority by 31 August 2020		Commencement of release and thereafter weekly during release

Note:

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metals/metalloids apply if dissolved results exceed trigger.
2. The quality characteristics required to be monitored as per Table C3 can be reviewed once the results of two years monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from Table C3, by amendment.
3. SMD – slightly moderately disturbed level of protection, guideline refers ANZECC & ARMCANZ (2000).
4. LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical methods required to achieve LOR.

- C6 If quality characteristics of the release exceed any of the trigger levels specified in Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants during a release event, the environmental authority holder must compare the downstream results in the receiving waters to the trigger values specified in Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants and:
1. where the trigger values are not exceeded then no action is to be taken; or
 2. where the downstream results exceed the trigger values specified in Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites and;
 - a) if the result is less than the background monitoring site data, then no action is to be taken; or
 - b) if the result is greater than the background monitoring site data, complete an investigation into the potential for environmental harm and provide a written report to the administering authority within 90 days of receiving the result, outlining:
 - (i) details of the investigations carried out; and
 - (ii) actions taken to prevent environmental harm.
- Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C6 2(b) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.
- C7 If an exceedance in accordance with Condition C6 2(b) is identified, the holder of the environmental authority must notify the administering authority in writing within 24 hours of receiving the result.
- C8 Mine affected release events
The holder must ensure an automatic stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table C4: Mine Affected Water Release During Flow Events.
- C9 The release of mine affected water to waters in accordance with Condition C2 must only take place during periods of natural flow events in accordance with the receiving water flow criteria for discharge specified in Table C4: Mine Affected Water Release During Flow Events for the release point(s) specified in Table C1: Mine Affected Water Release Points, Sources and Receiving Waters.
- C10 The release of mine affected water to waters in accordance with Condition C2 must not exceed the Electrical Conductivity and Sulphate release limits or the Maximum Release Rate (for all combined release point flows) for each receiving water flow criteria for discharge specified in Table C4: Mine Affected Water Release During Flow Events when measured at the monitoring points specified in Table C1: Mine Affected Water Release Points, Sources and Receiving Waters.
- C11 The daily quantity of mine affected water released from each release point must be measured, recorded and provided to the administering authority on request.
- C12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.

C13

The environmental authority holder must notify the administering authority via WaTERS within 24 hours after commencing to release mine affected water to the receiving environment. Notification must include the submission of written advice to the administering authority of the following information:

- a) Release commencement date and time
- b) Details regarding the compliance of the release with the conditions of Department interest: Water of this environmental authority (that is, contaminant limits, natural flow, discharge volume)
- c) Release point/s
- d) Release rate
- e) Release salinity
- f) Receiving water/s including the natural flow rate

Table C4: Mine Affected Water Release During Flow Events

Receiving waters /stream	Release point (RP)	Gauging station	Gauging station Easting, (GDA94)	Gauging station Northing, (GDA94)	Receiving water flow recording frequency	Receiving water flow criteria for discharge	Maximum release rate (for all combined RP flows)	Electrical conductivity and sulphate release limits
Roper Creek	RP1 RP2 SD1 SD2 SD3 SD7 NROM	Ref 1	667,484	7,471,112	Continuous (minimum daily)	<u>Low Flow</u> For a period of 28 days after natural flow events that exceed 2m ³ /s	0.4 m ³ /s	Electrical conductivity (µS/cm) 700. Sulphate (SO ₄ ²⁻): 250 mg/L
						<u>Medium flow</u> > 2 m ³ /s	1.12 m ³ /s	Electrical conductivity (µS/cm) 1500. Sulphate (SO ₄ ²⁻): 250 mg/L
						<u>High flow</u> > 10 m ³ /s	5.6 m ³ /s	Electrical conductivity (µS/cm) 1500. Sulphate (SO ₄ ²⁻): 250 mg/L
						>10 m ³ /s	>1.6 m ³ /s	Electrical conductivity (µS/cm) 3500. Sulphate (SO ₄ ²⁻): 300 mg/L
						<u>Very High Flow</u> >25 m ³ /s	2.1 m ³ /s	Electrical conductivity (µS/cm) <6000. Sulphate (SO ₄ ²⁻): 500 mg/L

- C14 The environmental authority holder must notify the administering authority via WaTERS within 24 hours after cessation of a release event) of the cessation of a release notified under condition C13 and within 28 days provide the following information in writing:
- Release cessation date and time
 - Natural flow rate in receiving water
 - Volume of water released from each release point
 - Details regarding the compliance of the release with the conditions of Department interest; water of this environmental authority (i.e. contaminant limits, natural flow, discharge volume)
- C15 Notification of release event exceedance
If the release limits defined in Table C2: Mine Affected Water Release Limits are exceeded, the holder of the environmental authority must notify the administering authority via WaTERS within twenty-four (24) hours of receiving the results.
- C16 The environmental authority holder must, within 28 days of a release that is not compliant with the conditions of this environmental authority, provide a report to the administering authority via WaTERS detailing:
- The reason for the release
 - The location of the release
 - The total volume of the release and which (if any) part of this volume was non-compliant
 - The total duration of the release and which (if any) part of this period was non-compliant
 - All in situ and any water quality monitoring results (including all laboratory analyses)
 - Identification of any environmental harm as a result of the non-compliance
 - Any other matters pertinent to the water release event.
- C17 Receiving environment monitoring and contaminant trigger levels
The quality of the receiving waters must be monitored at the locations specified in Table C6: Receiving Water Upstream Background Sites and Downstream Monitoring Points for each quality characteristic and at the monitoring frequency stated in Table C5: Receiving Waters Contaminant Trigger Levels.
- C18 If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table C5: Receiving Waters Contaminant Trigger Levels during a release event, the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and:
- where the downstream result is the same or a lower value than the upstream value for the quality characteristic, then no action is to be taken; or
 - where the downstream results exceed the upstream results, complete an investigation into the potential for environmental harm and provide a written report to the administering authority at CRWaters@ehp.qld.gov.au within 3 months, outlining:
 - details of the investigations carried out; and
 - actions taken to prevent environmental harm.

Table C5: Receiving Waters Contaminant Trigger Levels

Quality characteristic	Trigger level	Monitoring frequency
pH	6.5 – 8.5	Daily during the release
Electrical Conductivity (µS/cm)	700	
Suspended Solids (mg/L) (80th percentile* of reference**)	562	
	Flow <2m ³ /s 1062	

- C23 Water general
All determinations of water quality and biological monitoring must be performed by an appropriately qualified person.
- C24 The release of any contaminants as permitted by this environmental authority, directly or indirectly to waters, other than internal water management infrastructure that is installed and operated in accordance with a water management plan that complies with Conditions C26 to C27 inclusive:
a) must not produce any visible discolouration of receiving waters; and
b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.
- C25 Annual water monitoring reporting
The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return:
a) the date on which the sample was taken;
b) the time at which the sample was taken;
c) the monitoring point at which the sample was taken;
d) the measured or estimated daily quantity of the mine affected waters released from all release points;
e) the release flow rate at the time of sampling for each release point;
f) the results of all monitoring and details of any exceedance with the conditions of this environmental authority; and
g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.
- C26 Water Management Plan
A Water Management Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities.
The Water Management Plan must be reviewed, updated and submitted to the administering authority at an interval no greater than 3 years from the previous submission of a Water Management Plan.
- C27 A copy of the Water Management Plan must be provided to the administering authority on request.
- C28 Saline drainage
The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline drainage.
- C29 Acid rock drainage
The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of acid rock drainage.

C30 Stormwater and water sediment controls

An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.

The Erosion and Sediment Control Plan must be reviewed, updated and submitted to the administering authority at an interval no greater than 3 years from the previous submission of an Erosion and Sediment Control Plan.

C31 Stormwater, other than mine affected water, is permitted to be released to waters from:

- a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by Condition C30; and
- b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with Conditions C26 to C27 inclusive, for the purpose of ensuring water does not become mine affected water.

C32 The holder of this environmental authority must provide to the administering authority, via an environmental authority amendment application, a sodium value in Table C3: Release Contaminant Trigger Investigation Levels Potential Contaminants, by 31 August 2020.

C33 Groundwater

Groundwater affected by the mining activities must be monitored at the locations and frequencies specified in Table C7: Groundwater Monitoring Locations and Frequency for the parameters identified in Table C8: Groundwater Investigation Trigger Levels.

C34 The groundwater investigation trigger levels limit type 'Median" referred to in Table C8: Groundwater Investigation Trigger Levels must be determined on the most recent three (3) consecutive routine monitoring samples.

Table C7: Groundwater Monitoring Locations and Frequency

Monitoring points	Easting (GDA 94)	Northing (GDA 94)	Monitoring frequency
Monitoring Point MW2	667,603	7,471,239	Quarterly
Monitoring Point MW3 ^a	670,647	7,469,955	
Monitoring Point MW4	667, 683	7,468,659	
Monitoring Point MW5	668,786	7,469,364	
Monitoring Point MW6	669,452	7,468,670	
Monitoring Point MW9A	670,246	7,469,610	
Monitoring Point MW10A	669,783	7,475,981	
Monitoring Point MW11A	672,355	7,472,275	
Monitoring Point MW12A	671,640	7,469,853	
Monitoring Point MW13A	669,032	7,468,890	

Note:

a) MW3 will continue to be monitored until pit progression prevents monitoring. MW9A installed as a replacement well for MW3.

- C35 Subject to requirements of Condition C33, if the groundwater investigation trigger levels defined in Table C8: Groundwater Investigation Trigger Levels are exceeded then the environmental authority holder must complete an investigation into the potential for environmental harm and notify the administering authority within twenty-eight (28) days of receiving the analysis results.
- C36 Groundwater levels affected by the mining activities must be monitored at the locations and frequencies defined in Table C9: Groundwater Levels.
- C37 In the event that groundwater fluctuations exceed the groundwater level trigger values defined in Table C10: Groundwater Level Trigger Values at the groundwater monitoring locations nominated in Table C9: Groundwater Levels, an investigation must be undertaken within fourteen (14) days of detection to determine if the fluctuations are a result of:
- (a) mining activities;
 - (b) pumping from licensed bores; or
 - (c) seasonal variation.
- C38 If the results of the investigation undertaken in accordance with Condition C37 identify that the groundwater fluctuations are a result of mining activities, the holder of the environmental authority must notify the administering authority and provide a copy of a report detailing the findings and outcomes of the investigation within seven (7) days of completing the investigation.

Table C8: Groundwater Investigation Trigger Levels

Parameter	Unit	Trigger Levels	Limit Type
pH	pH Units	6.5 – 8.5	Minimum/Maximum
Electrical Conductivity	µS/cm	35,000	Maximum
Total Dissolved Solids	mg/L	23,548	Maximum
Calcium	mg/L	1,000	Median
Magnesium	mg/L	2,000	Median
Sodium	mg/L	6,700	Median
Potassium	mg/L	43	Median
Chloride	mg/L	12,700	Median
SO ₄	mg/L	2,000	Median
CO ₃	mg/L	7.65	Median
HCO ₃	mg/L	798	Median
Iron	mg/L	13.984	Maximum
Mercury	mg/L	0.002	Maximum
Selenium	mg/L	0.034	Maximum
Total Petroleum Hydrocarbons (C10-14)	µg/L	50	Maximum
Total Petroleum Hydrocarbons (C15-28)	µg/L	184.8	Maximum
Total Petroleum Hydrocarbons (C29-36)	µg/L	89.2	Maximum

Table C9: Groundwater Levels

Monitoring points	Easting (GDA94)	Northing (GDA94)	Surface RL(m)	Frequency
MW2	667,603	7,471,239	162.54	Quarterly
MW3 ^a	670,647	7,469,955	155.44	Quarterly
MW4	667,683	7,468,659	183.11	Quarterly
MW5	668,786	7,469,364	157.68	Quarterly
MW6	669,452	7,468,670	158.26	Quarterly
MW5M ^b	667,790	7,475,131	174.52	Quarterly
MW5P ^b	667,796	7,475,130	174.66	Quarterly
MW7M ^b	669,668	7,472,167	161.15	Quarterly
MW7P ^b	669,777	7,472,247	163.87	Quarterly
MW8FR ^b	669,941	7,472,277	164.33	Quarterly
MW9A	670,246	7,469,610	156.32	Quarterly
MW9M	670,243	7,469,619	156.36	Quarterly
MW9P	670,251	7,469,592	156.26	Quarterly
MW10A	669,783	7,475,981	175.75	Quarterly
MW11A	672,355	7,472,275	156.21	Quarterly
MW12A	671,640	7,469,853	158.28	Quarterly
MW13A	669,032	7,468,890	162.79	Quarterly

Notes:

a. MW3 will continue to be monitored until pit progression prevents monitoring. MW9A installed as a replacement well for MW3;

b. To be monitored until pit progression prevents monitoring.

Table C10: Groundwater Level Trigger Values

Monitoring points	Trigger Level Threshold
MW2	>2 metres per year
MW3a	total groundwater level of <115.39 metres
MW4	>2 metres per year
MW5	total groundwater level of <140.4 metres
MW6	>2 metres per year
MW9A	total groundwater level of <118.17 metres
MW10A	>2 metres per year
MW11A	>2 metres per year
MW12A	>2 metres per year
MW13A	>2 metres per year

Notes:

a. MW3 will continue to be monitored until pit progression prevents monitoring. MW9A installed as a replacement well for MW3;

- C39 The groundwater monitoring data must be reviewed on an annual basis. The review must include the assessment of groundwater levels and quality data, and the suitability of the monitoring network. The assessment must be submitted to the administering authority within twenty-eight (28) days of receiving the report.

- C40 Groundwater monitoring
The following information must be recorded in relation to all water sampling:
(a) the date on which the sample was taken;
(b) the time at which the sample was taken;
(c) the monitoring point at which the sample was taken;
(d) the results of all monitoring;
(e) groundwater levels; and
(f) sampling methodology.
- C41 The method of water sampling required by this environmental authority must comply with that set out in the latest edition of the administering authority's Water Quality Sampling Manual.
- C42 Sewage Treatment
The daily operation of the sewage treatment plant and pollution control equipment must be carried out by a person(s) with appropriate experience and/or qualifications to ensure the effective operation of that treatment system and control equipment.
- C43 Treated effluent from the sewage treatment plant must only be discharged from the authorised discharge points, as specified in Table C11: Effluent Discharge Locations.

Table C11: Effluent Discharge Locations

Authorised discharge points	Location
STP Discharge Point 1	Tailings Storage Facility

- C44 Treated effluent must not be released to land, or used for irrigation or dust suppression.
- C45 Treated effluent must not be released from the site to any waters or the bed and banks of any waters.
- C46 Water or stormwater contaminated by sewage treatment activities must not be released to any waters or the bed and banks of any waters.
- C47 Biosolids
Biosolids produced by the activity for re-use must be:
(a) sampled, analysed, graded and classified according to the procedures specified in the administering authorities systems and standard; and
(b) re-used under a relevant approval issued by the administering authority.

ATTACHMENT I

WESTERN EXTENSION PROJECT TERRESTRIAL HABITAT QUALITY DATA