

Chapter 18
Flora and fauna

ESMERALDA GRAPHITE PROJECT

aarc ENVIRONMENTAL SOLUTIONS
APEM Group

GRAPHINEX

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Glossary, acronyms and abbreviations

Acronym or Abbreviation	Meaning
AARC	AARC Environmental Solutions Pty Ltd
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ANZG	Australian and New Zealand Guidelines
APC	Australian Plant Census
AS	Australian Standard
BOM	Bureau of Meteorology
CAMBA	China–Australia Migratory Bird Agreement
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DAF	Department of Agriculture and Fisheries
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Energy and Climate
DEHP	Department of Environment and Heritage Protection
DES	Department of Environment and Science
DESI	Department of Environment, Science and Innovation
DETSI	Department of the Environment, Tourism, Science and Innovation
DEWHA	Department of the Environment, Water, Heritage and the Arts
DNRM	Department of Natural Resources and Mines
DNRME	Department of Natural Resources, Mines and Energy
DNRMMRRD	Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development
DoEE	Department of the Environment and Energy
DPI	Department of Primary Industries
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DSITI	Department of Science, Information Technology and Innovation
EA	Environmental Authorities

Acronym or Abbreviation	Meaning
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EO Act	*Environmental Offsets Act 2014*
EO Regulation	Environmental Offsets Regulation 2014
EP Act	*Environmental Protection Act 1994*
EP Regulation	Environmental Protection Regulation 2019
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPP	Environmental Protection Policy
ERA	Environmental Relevant Activity
EV	Environmental Values
GAB	Great Artesian Basin
GBF	Global Biodiversity Framework
GDE	Groundwater Dependent Ecosystems
GES	General Ecological Significance
HES	High Ecological Significance
IBRA	Interim Biogeographic Regionalisation of Australia
JAMBA	Japan–Australia Migratory Bird Agreement
LWP	Leaf water potential
ML	Mining Lease
MLA	Mining Lease Application
MLES	Matters of Local Environmental Significance
MNES	Matters of National Environmental Significance
MP Act	*Marine Parks Act 2004*
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
NRM	Natural Resource Management
NSW	New South Wales
NZS	New Zealand Standard
PMST	Protected Matters Search Tool
PRCP	Progressive Rehabilitation and Closure Plan
QEOP	Queensland Environmental Offsets Policy

Acronym or Abbreviation	Meaning
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
SMP	Species Management Program
SPP	State Planning Policy
SRI	Significant Residual Impact
TEC	Threatened Ecological Communities
TOR	Terms of Reference
TSF	Tailings Storage Facilities
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999*
WA EPA	Western Australian Environmental Protection Authority
WONS	Weed of National Significance
WPA	Wetland Protection Areas
WQO	Water Quality Objectives

18 Flora and Fauna

This chapter describes the assessment of potential impacts on flora and fauna, encompassing terrestrial and aquatic ecological values, including groundwater dependent ecosystems (GDE) and stygofauna. The chapter has been prepared to address the specific flora and fauna of the ToR, generally by:

- characterising the existing environment and define environmental values that may be impacted by the project, supported by site specific and relevant baseline information sufficient to identify seasonal and long-term variations at a scale relevant to the project.
- Identifying the project's relevant impacts and analyse their significance by considering the sensitivity of the relevant environmental value, the extent, intensity, duration, cumulative effect and irreversibility of the impact, the risk of environmental harm, and the effectiveness of proposed mitigation measures.
- Providing detailed mitigation measures and strategies to protect or enhance relevant environmental values.

To assess the potential impacts on flora and fauna, the following assessments were undertaken:

- a Terrestrial Ecology Baseline Report by AARC Environmental Solutions Pty Ltd (Appendix E);
- an Aquatic Ecology Baseline Report by AARC Environmental Solutions Pty Ltd (Appendix D);
- a Groundwater Dependent Ecosystem Assessment by Watermark Ecohydrology Pty Ltd (Watermark Eco) (Appendix G);
- a Stygofauna Survey by Eco Logical Australia (Eco Logical) (Appendix F);
- a Groundwater Impact Assessment by Hydrogeologist.com.au (Appendix L); and
- a Surface Water Impact Assessment by Engeny Australia Pty Ltd (Appendix K).

The assessment considered the following guidelines:

- EIS Guideline–Terrestrial Ecology (ESR/2020/5309);
- EIS Guideline–Matters of National Environmental Significance (ESR/2020/5304);
- EIS Information Guideline – Water (ESR/2020/5312);
- EIS Guideline–Aquatic Ecology (ESR/2020/5309);
- EIS Guideline–Groundwater-dependent Ecosystems (ESR/2020/5301);
- EIS Guideline–Biosecurity (ESR/2020/5297).
- Queensland Government, Business Queensland, Fish salvage (website), available at: https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/development/waterways/salvage
- Queensland Government, Policy for Vegetation Management, VEG/2014/1084
- Queensland Government, Waterway Barrier Works (website), available at: https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/development/waterways/barriers

Various other applicable guidelines have also been utilised and referenced throughout the technical reports.

The Project is 'not a controlled action' under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC Referral 2025/10140) on 23 June 2025.

18.1 Environmental objectives

The detailed assessment presented in this chapter and the relevant appendices demonstrates that the Project will achieve the requirements of the ToR and, through this, the requirements of Schedule 8, Part 3, Division 1 and Division 2 of the EP Regulation.

Specifically, the Project will achieve item 2 of the performance outcomes for each flora and fauna objective in satisfaction of section 2(4) of Schedule 8 of the EP Regulation because the Project will be operated in a way that achieves all of the following:

- Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land.
- Areas disturbed will be rehabilitated or restored to achieve sites:
    - that are safe and stable;
    - where no environmental harm is being caused by anything on or in the land; and
    - that are able to sustain an appropriate land use after rehabilitation or restoration.
- The Project will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants.
- The application of water or waste to the land will be sustainable and managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.
- Areas of high conservation values and special significance likely to be affected by the proposal will be identified and evaluated, and any adverse effects on these areas will be minimised (including any edge effects on the areas), and critical design requirements will prevent emissions having an irreversible or widespread impact on adjacent areas.
- The Project and its components will be carried out on the site in a way that prevents or minimises adverse effects on the use of surrounding land and allows for effective management of the environmental impacts of the Project.

Related to flora and fauna, the Project will achieve the performance outcomes for the water environmental objective of section 2(4) of Schedule 8 of the EP Regulation because:

- any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland; and
- the activity will be managed so that adverse effects on environmental values are prevented or minimised.

Related to flora and fauna, the Project will achieve the performance outcome item 2 for the wetlands environmental objective of section 2(4) of Schedule 8 of the EP Regulation because the Project will be managed in a way that prevents or minimises adverse effects on wetlands.

Related to flora and fauna, the Project would achieve item 2 of the performance outcomes for the groundwater environmental objective of section 2(4) of Schedule 8 of the EP Regulation because the activity would be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.

Assessment of water quality aspects, not relating to flora and fauna, is provided in Chapter 14, Water Resources.

18.2 Legislation and guidelines

This section details the relevant legislation, regulations and instruments to be addressed to manage flora and fauna.

18.2.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth EPBC Act provides a framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places, which are defined in the EPBC Act as MNES. The EPBC Act applies to nine MNES:

- world heritage properties;
- national heritage places;
- wetlands of international importance (Ramsar wetlands);
- nationally listed threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mines); and
- a water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act requires assessment and approval for any activity that has, or is likely to have, a significant impact on an MNES. The Project was determined as a 'not a controlled action' (EPBC reference 2025/10140) under the EPBC Act on 23 June 2025. As the Commonwealth Government has made a decision on this Project, the assessment refers to the outcome of the decision, where relevant; considers guidelines and conservation listings relevant to the EPBC Act, where they provide context to characterising the biodiversity values.; and discusses MNES where relevant to the ToR.

18.2.2 Agreements for migratory species and international conventions

Australia has signed or ratified nearly one hundred environmental treaties that serve as sources of environmental legal obligations (PCA 1999). Providing critical habitat for millions of migratory birds each year, Australia is party to international conventions and agreements to protect migratory species. These include the:

- China–Australia Migratory Bird Agreement (CAMBA);
- Japan–Australia Migratory Bird Agreement (JAMBA);
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Bird species listed within the appendices/annexes of these agreements/conventions are subsequently listed as migratory species under the EPBC Act.

Other international biodiversity conventions to which Australia is party to, include the:

- Convention on Biological Diversity (CBD);
    - Kunming-Montreal Global Biodiversity Framework (GBF);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);

- Convention on Conservation of Nature in the South Pacific (Apia Convention); and
- The Convention Concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention).

Australia demonstrates its commitment to these international conventions by reforming its national biodiversity strategy and action plan, outlined in 'Australia's Strategy for Nature 2024–2030', 'Threatened Species Strategy 2021 – 2031' and 'Australian Weeds Strategy 2017–2027', and committed to its National Biodiversity Targets.

The Project has been designed to align with and support these national commitments by:

- avoiding impacts to threatened species, vegetation and habitats where practicable;
- committing to the rehabilitation and restoration of disturbed environment following operations; and
- implementing weeds and pest management measures consistent with the latest Commonwealth and State strategies.

18.2.3 Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* (Qld) (EP Act) and its associated regulations and policies is to protect Queensland's environment while allowing for 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. This principle is commonly referred to as ecologically sustainable development. The EP Act addresses the following areas that are relevant to the Project:

- notifiable activities, as listed in Schedule 3 of the EP Act;
- environmental protection policies for water and wetland biodiversity, noise and air which are intended to enhance or protect Queensland's environment and list relevant environmental outcomes and performance criteria;
- Prescribed Environmentally Regulated Activities defined within the EP Act and listed in schedule 2 of the Environmental Protection Regulation 2019;
- The EP Act defines resource activities listed in schedule 21 part 1 of the Planning Regulation 2017 for exempt clearing work;
- Environmental Authorities (EAs) required to carry out an Environmental Relevant Activity (ERA) including a resource activity, and which will include conditions that will regulate the Project; and
- duties of care associated with environmental harm.

18.2.4 Vegetation Management Act 1999

The *Vegetation Management Act 1999 (Qld)* (VM Act) is part of the framework to manage native vegetation in Queensland.

The VM Act does not apply to mining activities undertaken on MLs, as the consideration of impacts on native vegetation is addressed in the EIS process and regulated by the conditions of the EA. However, although the VM Act does not apply to clearing vegetation within the ML, the scientific basis for biodiversity conservation under the VM Act is still valid (including the conservation status categories of each RE) and used to assess the conservation significance of the vegetation communities.

The purpose of the VM Act is to regulate the clearing of vegetation in a way that:

- conserves remnant vegetation that is an Endangered, Of Concern, or Least Concern Regional Ecosystem (RE);
- conserves vegetation in declared areas;

- ensures the clearing does not cause land degradation;
- prevents the loss of biodiversity;
- maintains ecological processes;
- manages the environmental effects of the clearing to achieve the matters mentioned in the above bullet points;
- reduces greenhouse gas emissions; and
- allows for sustainable land use.

The status of each RE identified within Queensland is described in the Regional Ecosystem Description Database (REDD) (V13.1) (DESI 2024).

Remnant vegetation means vegetation that is either an Endangered, Of Concern, or Least Concern RE and the predominant canopy of the vegetation:

- covers more than 50% of the undisturbed predominant canopy;
- averages more than 70% of the vegetation's undisturbed height; and
- is composed of species characteristic of the vegetation's undisturbed dominant canopy.

An RE is defined as a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil (Neldner et al. 2019). Under the VM Act, each RE is classed as either Endangered, Of Concern or Least Concern.

Schedule 21 of the Planning Regulation lists exemptions for the Vegetation Management framework, including a resource activity as defined under Section 107 of the *Environmental Protection Act* – a mining activity.

The VM Act classes are used to determine offset requirements for significant residual impacts on regional ecosystems under the provisions of the *Environmental Offsets Act 2014*. Projects assessed by EIS would have to assess any clearing of regulated vegetation under the environmental offsets framework.

The biodiversity status is an additional classification assigned to REs by the Queensland Government. The biodiversity status assigned to each RE is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the VM Act. This includes other threatening processes, such as reduction in biodiversity, weed invasion, grazing pressures, inappropriate fire management, fragmentation and infrastructure development. While the biodiversity status is not applicable under the VM Act, it is used for a range of planning and management applications. REs are classified as either Endangered, Of Concern or as No Concern at present under the biodiversity status.

18.2.5 Nature Conservation Act 1992

The Queensland *Nature Conservation Act 1992* (NC Act) and its associated regulations provide a framework for creating and managing protected areas (such as National Parks), and protecting native and threatened species. The regulations include the *Nature Conservation (Animals) Regulation 2020* and the *Nature Conservation (Plants) Regulation 2020.*

The *Nature Conservation (Animals) Regulation 2020* and the *Nature Conservation (Plants) Regulation 2020* prescribe the following classes of protected wildlife[1]:

[1] Under the NC Act the term wildlife refers to any native taxon or species of an animal, plant, Protista, procaryote or virus.

- Extinct;
- Extinct in the wild;
- Critically Endangered;
- Endangered;
- Vulnerable;
- Near Threatened; and
- Least Concern.

The *Nature Conservation (Animals) Regulation 2020* prescribes Least Concern wildlife as Special Least Concern wildlife for the following species:

- Short-beaked Echidna (*Tachyglossus aculeatus*).
- Platypus (*Ornithorhynchus anatinus*).
- A Least Concern bird to which any of the following agreements apply: China-Australia Migratory Bird Agreement, Japan-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement or the Convention on the Conservation of Migratory Species of Wild Animals.

Under the NC Act, a Regulation may prescribe a Least Concern plant as a Special Least Concern plant if the taking or use of the plant is at risk of not being ecologically sustainable.

Permits and licences are required to authorise impacts to, or the handling of, native flora and fauna and their breeding habitat. Permits that may be relevant to the proposed activities during the life of the Project are:

- Protected Plant Clearing Permit: required under the Nature Conservation (Plants) Regulation 2020 for the clearing of Endangered, Vulnerable, or Near Threatened plants protected under the NC Act.
- Species Management Program (SMP): required under the Nature Conservation (Animals) Regulation 2020 requirements for tampering with a breeding place for a protected animal that is classified as extinct in the wild, critically endangered, endangered, vulnerable, near threatened, special least concern, colonial breeder or least concern. An SMP is only required where an animal breeding place has been identified and activities are required to tamper with the breeding place in order to complete the scope of works.

Damage Mitigation Permit: required under the Nature Conservation (Animals) Regulation 2020 for the take wildlife to minimise damage or loss of property or to protect human health or wellbeing. There are three types of damage and mitigation permit, one applicable to the proposed activities, being the removal and relocation of protected animals. This permit allows the safe and humane removal of native animals that pose a threat to human health or wellbeing, such as removing a venomous snake from a working area.

18.2.6 Fisheries Act 1994

The main purpose of the Queensland *Fisheries Act 1994* (Fisheries Act) is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of (and promote) Ecologically Sustainable Development. The Fisheries Act provides for:

- managing and protecting fish habitats;
- managing commercial, recreational, and indigenous fishing; and
- managing aquaculture.

Fisheries resources, including declared fish habitat areas, contribute to environmental values of waterways and wetlands.

The Fisheries Act also regulates waterway barrier works where waterway crossings are constructed or upgraded. However, this provision of the Fisheries Act does not apply to mining developments occurring within the boundaries of the relevant mining lease.

18.2.7 Environmental Offsets Act 2014

The Queensland environmental offsets framework consists of the *Environmental Offsets Act 2014* (EO Act), *Environmental Offsets Regulation 2014*, and the 'Queensland Environmental Offsets Policy (Version 1.17)'.

Under the EO Act, an environmental offset cannot be considered until it has been demonstrated that all reasonable avoidance and mitigation measures have been, or will be, undertaken. The mitigation hierarchy 'avoid - mitigate - offset' applies to prescribed activities that impact prescribed environmental matters. This means that in designing or planning the prescribed activity, impacts on prescribed environmental matters should, in the first instance, be reasonably avoided wherever possible. For impacts that cannot be avoided, the extent of those impacts should be carefully managed and mitigated to the greatest possible extent. However, if there is still a significant impact to a prescribed environmental matter then an offset may be required.

The offsets framework requires environmental offsets to be delivered where an activity is likely to result in a significant residual impact on a prescribed environmental matter. The 'Significant Residual Impact Guideline' (DEHP 2014) is used to assess whether the Project would result in a significant residual impact.

Prescribed environmental matters include:

- matters of national environmental significance (MNES);
- matters of state environmental significance (MSES); and
- matters of local environmental significance (MLES).

The Queensland Environmental Offsets Policy establishes an environmental offset hierarchy to avoid duplication of offset conditions between jurisdictions. State and local governments may only impose an offset condition if 'the same, or substantially the same, impact and the same, or substantially the same, matter' has not been subject to assessment under the Commonwealth.

These prescribed environmental matters are outlined in the *Environmental Offsets Regulation 2014*.

MSES comprise:

- regulated vegetation (determined under VM Act), including:
    - Endangered and Of Concern prescribed REs[2] listed under the VM Act;
    - Prescribed REs that intersect areas shown as wetlands on the VM Act Wetlands map;
    - Prescribed REs located within a defined distance from the defining banks of a relevant watercourse or relevant drainage feature; and
    - Prescribed REs mapped as essential habitat for Endangered and Vulnerable flora and fauna listed under the NC Act;
- areas that provide connectivity and maintain ecosystem functioning;

[2] Prescribed regional ecosystem means a regional ecosystem, other than a regional ecosystem mentioned in the Vegetation Management Act 1999, section 8(b), located in a category B area on the regulated vegetation management map, to the extent the ecosystem contains remnant vegetation.

- wetlands and watercourses, including:
  - a wetland in a wetland protection area;
  - a wetland of high ecological significance shown on the map of Queensland wetland environmental values; and
  - a wetland or watercourse in high ecological value waters.
- designated precincts in a strategic environmental area under the *Regional Planning Interests Regulation 2014;*
- protected wildlife habitat for Critically Endangered wildlife, Endangered wildlife or Vulnerable wildlife or a special least concern animal (referring only to an echidna (*Tachyglossus aculeatus*) or a platypus (*Ornithorhynchus anatinus*));
- protected areas and highly protected zones of State marine parks;
- fish habitat areas;
- waterways providing for fish passage;
- marine plants; and
- legally secured offsets.

18.2.8 Water Act 2000

The *Water Act 2000* (Qld) (Water Act) provides the framework for sustainably managing Queensland's water resources and quarry material, by establishing a system for planning, allocating and using water, and allocating quarry material and riverine protection. The purpose of the Water Act also includes securing water supply and managing demand for the south-east Queensland region and other designated regions and managing impacts on underground water caused by exercising underground water rights by the resource sector.

Under the Water Act, a person must not take or interfere with water unless authorised under the Water Act, or another act. There are a number of declared watercourses that intersect the Project area that are subject to the provisions of the Water Act.

A riverine protection permit may be required where vegetation is a watercourse will be destroyed; material will be excavated; or fill is required to be placed in a watercourse, such as for bank stabilisation. An exemption may apply where the holder has an environmental authority (for a resource activity) under the EP Act, and the area of disturbance is less than 0.5 ha. An approximate 1.8 km long permanent diversion that would include an excavated drainage channel, with a channel base width of approximately 5 m, and low flow channel depth of one metre is proposed as part of the Project. The diversion design area of 0.75 ha would exceed the exempt disturbance area.

18.2.9 Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The EPP (Water and Wetland Biodiversity) is subordinate legislation under the EP Act. The EPP (Water and Wetland Biodiversity) seeks to protect the quality of natural waters in Queensland while supporting sustainable development.

In particular, the EPP (Water and Wetland Biodiversity) provides a framework for:

- identifying environmental values (EVs) for Queensland waters, and deciding WQOs to protect or enhance those EVs; and
- including the identified EVs and WQOs under Schedule 1 of the EPP (Water and Wetland Biodiversity).

The EPP (Water and Wetland Biodiversity) is relevant to the Project with regard to the protection of EVs occurring in the Norman River drainage basin and associated tributaries.

18.2.10 Planning Regulation 2017

The proposed activities included in this report are limited to the Project MLAs. Clearing work is considered exempt under Schedule 21, Part 1 of the *Planning Regulation 2017* within an ML, and would therefore be exempt once the ML is granted.

However, clearing on-lease may require a development approval if the clearing is for activities not authorised by the Mineral Resources Act or another mining-related Act.

18.2.11 Croydon Shire Planning Scheme

The Project area is in the Croydon Shire Planning Scheme (Croydon Shire Council 2019). The relevant planning scheme can identify matters of local environmental significance (MLES) to be addressed under the EO Act. There are no MLES identified in the planning scheme.

The traditional owners of the majority of land within the Shire are the Tagalaka People, who have determined Native Title rights over large areas of land within the Shire. The Tagalaka Aboriginal Corporation also own freehold property within the township of Croydon, and numerous Aboriginal reserves exist throughout the Shire.

18.3 Regional and local Setting

The Project is located in the Croydon Shire, within the inland area of the Gulf Plains Bioregion. The inland vegetation of the Gulf Plains bioregion is dominated by grasslands, Eucalypt woodlands, Melaleuca and Acacia. They cover the landscape of plains and river channels, comprising clay and alluvial soils (DEHP 2015).

The subdued landscape of the Carpentaria basin consists of flat plains, gently dipping east to west, with elevations ranging between 120 m and 140 m Australian Height Datum (AHD).

The Project is located within the Gulf Savannah natural resource management (NRM) region, with land surrounding and underlying Project site used for low-intensity cattle grazing and resource exploration activities (DESI 2023). Queensland Land Use Mapping classifies the Project site and surrounding area as ‘Grazing Native Vegetation’ (DNRMMRRD 2025a).

The Project is not located within the designated precincts in a strategic environmental area under the Regional Planning Interests Regulation 2014.

The Project does not intersect any biodiversity offset areas approved by the State or Australian governments.

There are no World Heritage areas within 150 km of the Project.

There are the following protected areas located within 100 km of the Project (Figure 18-1):

- Tagalaka National Park (also listed as Littleton Resources Reserve);
- Rungulla National Park;
- several Nature Refuges (state protected areas established under the NC Act); and
- Esmeralda Nature Refuge is located over 40 km west of the Project.

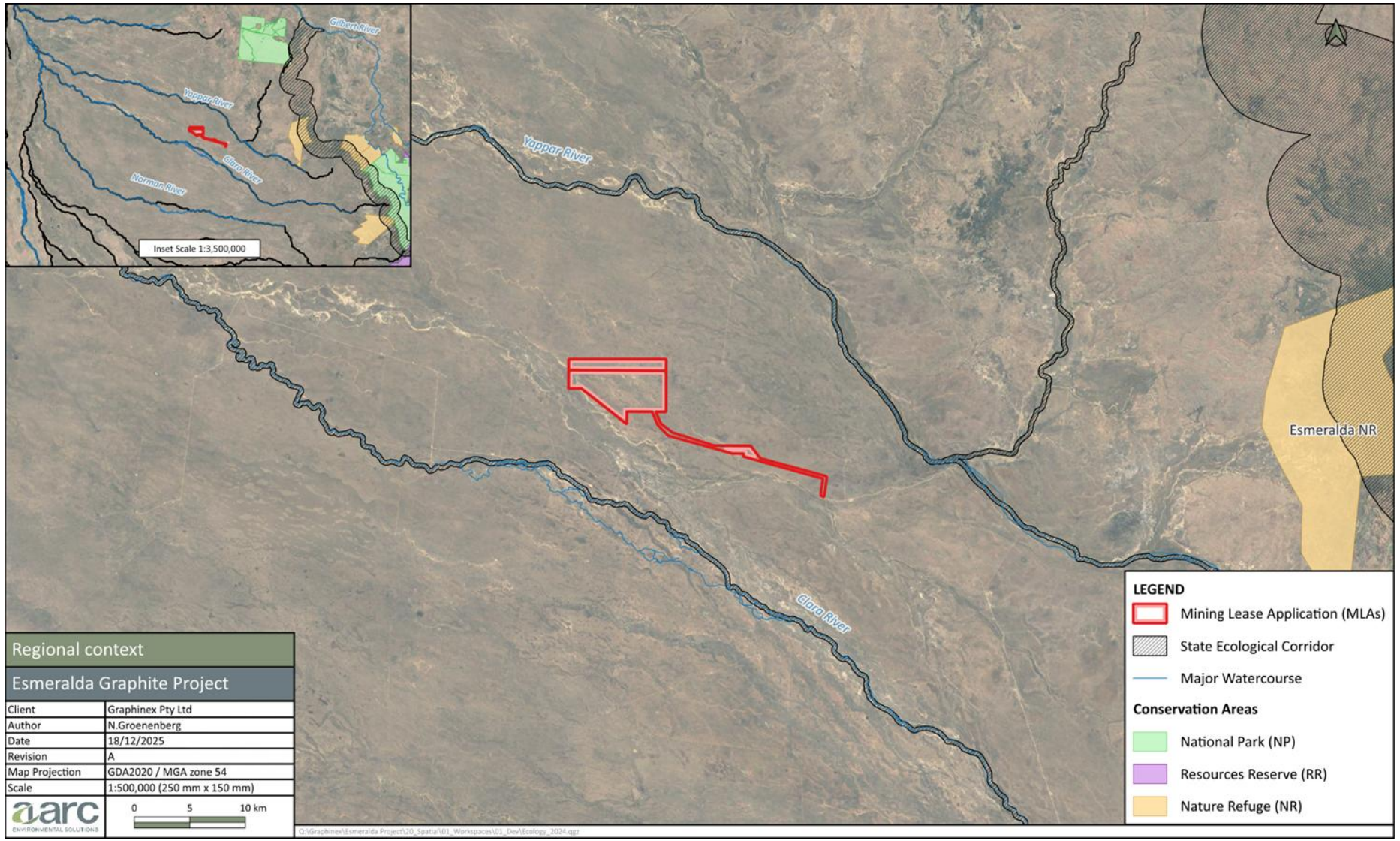


Figure 18-1: Protected areas in the vicinity of the Project

18.3.1 Surface water context

The braided sandy channels of Warrigal Creek and Borer River flow immediately south of the Project area, and a minor unnamed tributary of Warrigal Creek passes through the Project area. These braided watercourses are part of a much larger system of rivers and streams that dissect the surface deposits of the Carpentaria Basin, flowing east to west as they enter the Norman River and flow into the Gulf of Carpentaria. The Norman River is a major river in the Gulf Country, originating in the Gregory Range and flowing 420 km north-west to the Gulf of Carpentaria. Three major tributaries join the Norman River along its course: the Carron, Clara and Yappar Rivers.

The Project is located between the Clara and Yappar Rivers, approximately seven north of the Clara River and eight kilometres south-west of the Yappar River, at its closest point. The landscape is characterised by the braided channels with significant overland flooding, and extensive breakout flooding from the Warrigal Creek and Yappar Rivers downstream of the site.

18.3.2 Groundwater context

The hydrogeology of the Project area is described in detail in Appendix L, Groundwater Impact Assessment Report (Hydrogeologist 2026). The Project site lies within the northern extent of the Great Artesian Basin hydrostratigraphic units. The groundwater hosting units are described as:

- **Cainozoic cover:** The Carpentaria Basin strata are overlain by a covering of unconsolidated Quaternary alluvium, and by the semi-consolidated Tertiary sediments of the Claraville Beds. The alluvium is clay, silt, sand, and gravel deposits that form active flood plain alluvium deposits. The thickness of the Tertiary sediments, including the Claraville Beds, is approximately 10m in the Project area (AARC, 2025), and is thought to be largely unsaturated.
- **Gilbert River Formation:** Lying underneath the Claraville Beds, though not outcropping at the surface, the Gilbert River Formation is considered a moderate to high permeability formation and a regional aquifer. Recently installed monitoring bores indicate that the water table is sub-artesian, with a potentiometric surface that lies between approximately 6.6 to 12.5 mbgl, with salinity values ranging from 854 to 1130 µS/cm. Artesian conditions exist approximately 4 km west of the Project area, where groundwater is expressed at the surface.
- **Bedrock:** The ore hosting Croydon Volcanics and Esmerelda granite likely forms a low transmissivity and low hydraulic conductivity fractured rock aquifer, and there are no connected aquifers known to be associated with this geological formation.

18.3.3 Climate

The region's climate is sub-tropical with monsoonal influence, characterised by a winter dry season and summer wet season. Long-term climate data (1960 to 2025) was retrieved from Queensland Government SILO LongPaddock (DEC 2025) for - 18.85 °S, 142.25 °E (Figure 18-2).

Rainfall records indicate annual rainfall is approximately 668 mm/year. Most rainfall occurs during the wet season (November to March), with dry conditions prevailing for most of the year. The mean annual evaporation within the Project area is approximately 2,625 mm, about four times higher than the average rainfall. The mean monthly maximum temperature is highest in November (38°C, with the highest recorded temperature of 44.3°C) and lowest in June (13.8°C). The mean monthly minimum temperature is highest in December (24.5°C) and lowest in July (12.7°C).

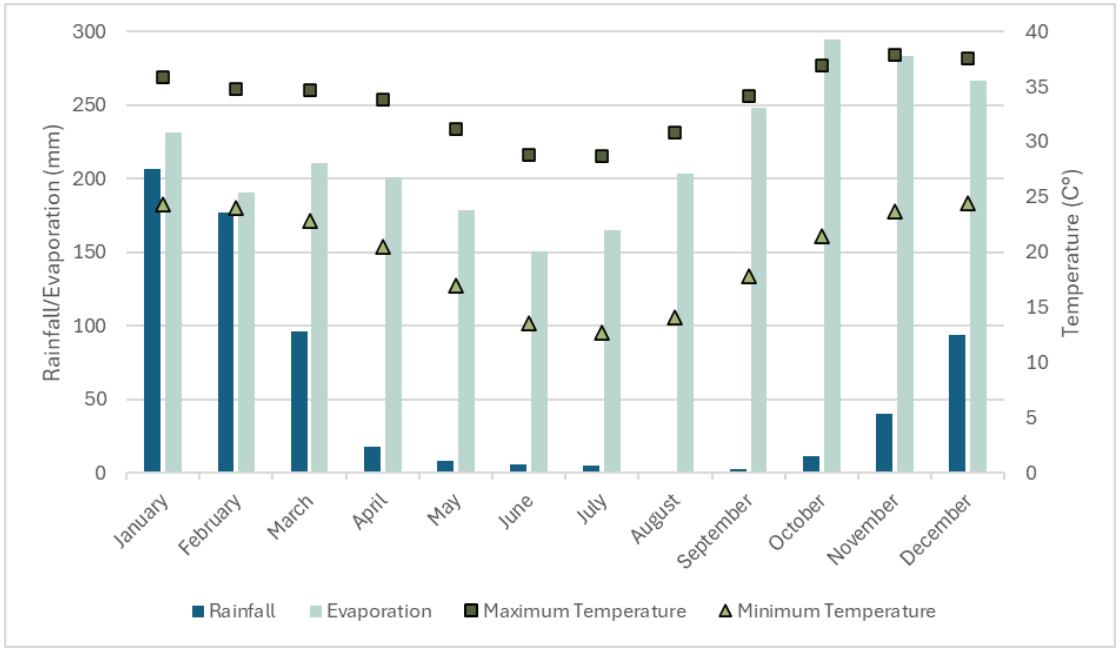


Figure 18-2: Project climate data (1950 to 2025) (SILO Long Paddock)

18.4 Assessment methodology

This section outlines the study area and assessment methodology undertaken for each component of the flora and fauna assessment — terrestrial ecology, aquatic ecology, groundwater dependent ecosystems (GDEs) and stygofauna.

This EIS refers to the nationally accepted taxonomy for flora from the Australian Plant Census (APC 2023), and the nomenclature for fauna follows the Australian Biological Resources Study Faunal Directory (ABRS 2022).

18.4.1 Terrestrial ecology

To describe the biodiversity and natural environmental values of the Project, an assessment of terrestrial ecology values for the Project area was undertaken by AARC (Appendix E, Terrestrial Ecology Assessment). The objectives of the Terrestrial Ecology Assessment (AARC 2026) were to assess the potential impacts of the Project on terrestrial ecology values of the Project area and surrounding areas.

The study area for the assessment was MLA 100430 and MLA 100431, and was assessed for environmental values, including significant flora and fauna potentially found in the area and surrounds.

18.4.1.1 Desktop assessment

A desktop assessment was undertaken to identify and present the ecological values mapped within the terrestrial ecology study area and surrounds. Government databases were reviewed, which included publicly available information and searches based on a 50 km buffer. A likelihood of occurrence desktop assessment was conducted for all threatened ecological communities and species of conservation value identified through the desktop analysis. The desktop analysis informed the terrestrial ecology assessment methods and field survey design, ensuring a robust assessment of conservation significant flora and fauna potentially inhabiting the Project site.

18.4.1.2 Field survey

The terrestrial ecology surveys have been undertaken by suitably qualified ecologists in accordance with all required permits and approvals. Seasonal field surveys were undertaken between August 2024 to August 2025, during the following dates:

- 13 to 19 August 2024;
- 14 to 27 November 2024;
- 11 to 15 February 2025; and
- 26 to 2 September 2025 (flora only).

The survey timing was chosen to account for temporal and seasonal changes in faunal assemblages while avoiding the hottest and coldest months, as per the 'Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (V4.0)' (Eyre et al. 2022). Further information on the weather conditions of the surveys is available in Appendix E.

Aerial imagery and Government RE maps were used to inform the selection of representative sites for the various flora and fauna survey methods applied within the study area. Sites were selected to provide a representative sample set for each vegetation community. Site selection was adjusted in the field to account for site specific factors and variations observed by expert ecologists.

Field surveys were designed based on the survey guidelines published by the Australian Government and Queensland Government, including:

- Commonwealth Guidelines:
    - 'Survey guidelines for Australia's threatened reptiles' (DSEWPaC 2011a).
    - 'Survey guidelines for Australia's threatened birds' (DEWHA 2010a).
    - 'Survey guidelines for Australia's threatened mammals' (DSEWPaC 2011b).
    - 'Survey guidelines for Australia's threatened bats' (DEWHA 2010b).
    - 'Draft referral guideline for 14 migratory birds listed under the EPBC Act' (DoE 2015a).
- Queensland Government Guidelines:
    - Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland (V7.0)' (Neldner et al. 2023).
    - 'Flora Survey Guidelines - Protected Plants (V2.03)' (DETSI 2025).
    - 'Management of endangered plants' (Cropper 1993).
    - 'Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (V4.0)' (Eyre et al. 2022).

Vegetation communities were mapped on the ground in accordance with the 'Methodology for surveying and mapping regional ecosystems'(RE) and vegetation communities in Queensland (V7.0)' (Neldner et al. 2023). All REs were described in accordance with the Queensland Regional Ecosystem Description Database (DESI 2024) classification system. Based on the field results, the submitted map change request was accepted by the Queensland Herbarium in March 2026. The accepted RE mapping has been adopted as the field verified vegetation map in this report. These changes affect the assessment of VM Act wetland areas only partially; as outlined in the *Environmental Offsets Regulation 2014*, a prescribed regional ecosystem is a MSES if it is "a regional ecosystem that intersects with an area shown as a wetland on the vegetation management wetlands map (to the extent of the intersection)". Although the RE mapping has changed the composition of REs in the study area, the extent of wetlands in the vegetation management wetlands map remains the same.

A comprehensive flora species list, including native and introduced species, was compiled for the study area.

A total of 24 vegetation transect sites, 230 quaternary sites, and rapid observations and incidental observations; were surveyed in accordance with the 'Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland (V7.0)' (Neldner et al. 2023) and the BioCondition Manual (Eyre et al. 2015).

A total of 149 rapid habitat assessments were completed in the study area. These assessments were used to support the description of the habitat and microhabitat present within the study area, informing the selection of fauna survey site locations and assisting with mapping of habitat. Fauna survey sites were located in representative areas of the five major habitat types occurring within the study area: Eucalypt woodland fringing creeks, Paperbark woodland, Annual tussock grassland, *Corymbia* woodland on sand plains and seasonal swamp. The fauna survey methods utilised by the study were consistent with relevant Commonwealth and State fauna survey guidelines, including the 'Terrestrial Vertebrate Fauna Survey Guidelines for Queensland' (Eyre et al. 2022).

The total fauna survey effort summary is provided in Table 18-1.

Table 18-1: Fauna survey effort summary

Survey method	**Survey effort**			**Total survey effort**
	August 2024	**November 2024**	**February 2025**	
Fauna trapping sites				
Elliott trapping	4 sites x 20 traps x 4 nights = 320	4 sites x 20 traps x 4 nights = 320	N/A*	80 Elliot traps over 8 nights
Pitfall trap lines	4 sites x 4 pitfalls x 4 nights = 64	4 sites x 4 pitfalls x 4 nights = 64	N/A*	16 pitfalls over 8 nights
Funnel trapping	4 sites x 6 funnels x 4 nights = 96	4 sites x 6 funnels x 4 nights = 96	N/A*	24 funnels over 8 nights
Automated camera trapping	2 sites x 1 camera x 4 nights + 2 sites x 1 camera x 1 nights = 10	3 sites x 1 camera x 4 nights + 3 sites x 1 camera x 6 nights + 1 sites x 1 camera x 2 nights = 32	N/A*	42 nights of camera trapping
Bird surveys	1 person-hour x 3 sites + 1.5 person-hours x 1 sites + 0.5 person-hours x 2 sites = 5.5 person-hours	1 person-hour x 4 sites + 0.5 person-hours x 1 site = 4.5 person-hours	N/A*	10 person-hours of bird surveying
Spotlight searches	1 person-hour x 4 sites + 0.5 person-hours x 2 sites = 5 person-hours	1 person-hour x 5 sites = 5 person-hours	N/A*	10 person-hours of spotlighting
Call playback sessions	1 session per site x 6 sites = 6 sessions	1 session per site x 4 sites = 4 sessions	N/A*	10 sessions of call playback
Habitat searches	1 person-hour x 4 sites + 0.5 person-hour x 2 sites = 5 person-hours	1 person-hour x 4 sites + 0.5 person-hour x 1 site = 4.5 person-hours	N/A*	9.5 hours of habitat searches
Echolocation call detection	1 bat detector per site x 3 nights x 4 sites = 12 detection nights	1 bat detector per site x 3 nights x 2 sites + 1 bat detector x 2 nights x 2 sites + 1 bat detector x 1 night x 2 sites + 1 bat detector x 4 nights x 1 site + 1 bat detector x 10 nights x 1 site = 26 detection nights	N/A*	38 detection nights

Survey method	Survey effort			Total survey effort
	August 2024	November 2024	February 2025	
Supplementary survey sites				
Bird surveys incl. waterbirds	~6.5 person-hours of bird surveying	~15 person-hours of bird surveying	~5.5 person-hours	27 person-hours of bird surveying
Habitat searches	Not relevant. Completed as part of the fauna trapping sites.	~8 hours of habitat searches	~3 person-hours	11 person-hours of habitat searches
Spotlight searches	Not relevant. Completed as part of the fauna trapping sites.	~4 hours of spotlighting	N/A*	4 person-hours of spotlighting
Automated Camera trapping	Not relevant. Completed as part of the fauna trapping sites.	~8 nights of camera trapping	N/A*	8 nights of camera trapping

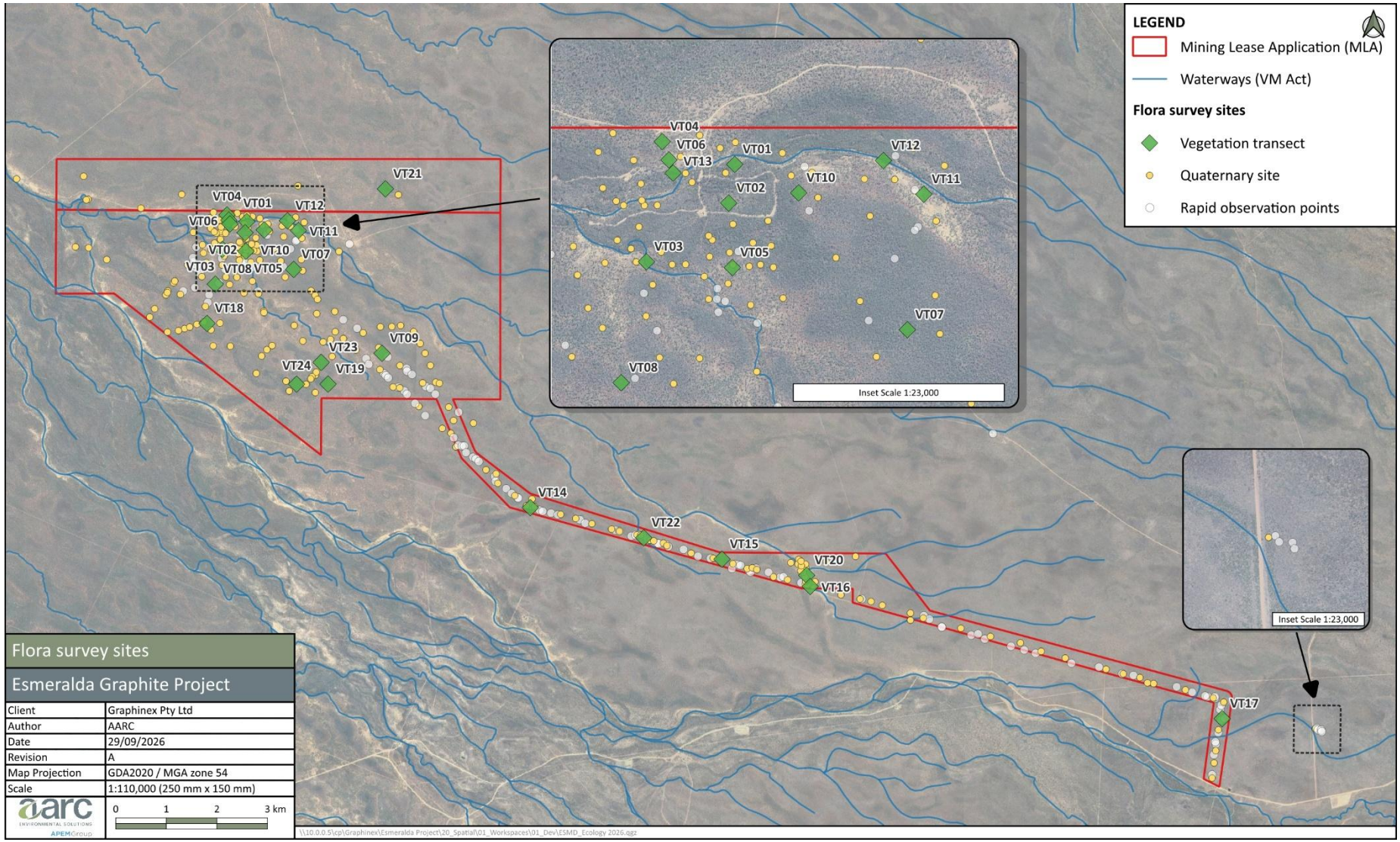


Figure 18-3: Terrestrial flora study area including the location of flora survey sites

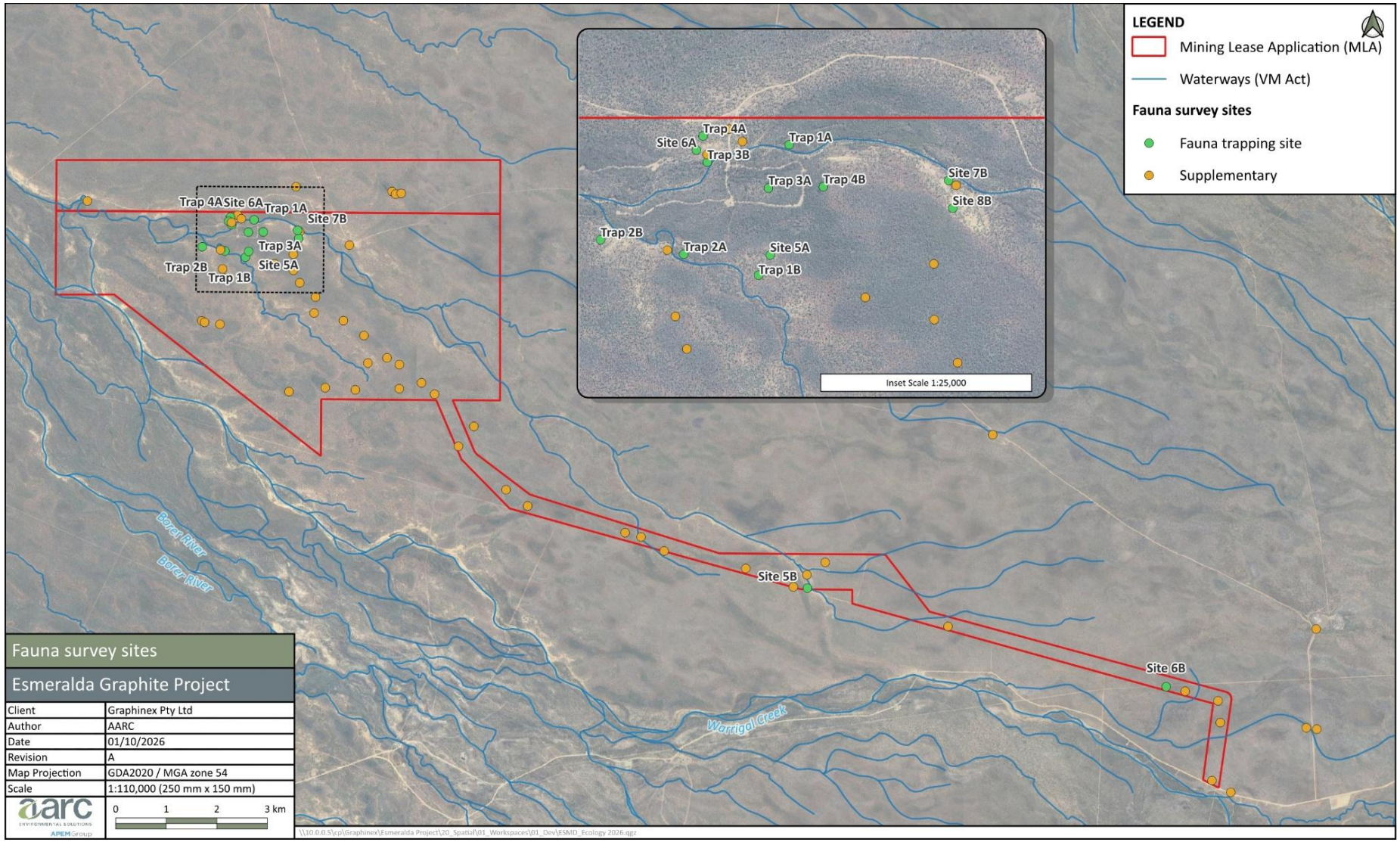


Figure 18-4: Terrestrial fauna study area including the location of flora survey sites

18.4.2 Aquatic ecology

To describe the aquatic ecology values of the Project, an aquatic ecology assessment was undertaken by AARC (Appendix D, Aquatic Ecology Assessment). The objectives of the assessment were to assess the potential impacts of the Project on aquatic ecology values.

The Aquatic Ecology assessment was conducted in MLA 100430 and MLA 100431. The study area covered waterways, specifically field validating prescribed environmental matters within the proposed disturbance area. Efforts were made to ensure the assessment was representative of the MLAs.

18.4.2.1 Desktop assessment

A desktop assessment was undertaken to collate information on the aquatic ecological values within the Project area and surrounds. The assessment used government search reports and publicly available databases of species records to identify conservation significant species relevant to the assessment. A likelihood of occurrence desktop assessment was conducted for species of conservation value identified through the desktop analysis. The likelihood assessment considered the desktop assessment results, prior to field surveys and was based on the knowledge of ecologists, species' records distribution, potential habitat suitability, known records, and scientific literature.

18.4.2.2 Field survey

The aquatic ecology field surveys were undertaken by suitably qualified ecologists in accordance with the relevant guidelines including:

- EIS Guideline–Aquatic Ecology (DESTSI 2026);
- Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009 (DES 2018);
- Queensland Australian River Assessment System (AusRivAS) Sampling and Processing Manual (DNRM 2001);
- Australian River Assessment System (AusRivAS) Physical Assessment Protocol (Parsons et al. 2002);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).

An aquatic ecology survey was conducted for the Project between 13 to 19 February 2025 with all samples collected on 14 and 15 February. Suitable aquatic survey sites were identified during the desktop assessment from publicly available spatial databases and aerial imagery. Sites were selected to:

- target potential habitat for listed threatened species;
- achieve spatial distribution across the Project area to capture aquatic values; and
- capture entry and exit points of waterways traversing the Project area, to enable the collection of suitable baseline data for 'reference' and 'receiving' sites that could be utilised as part of longer-term monitoring programs.

A total of nine standard aquatic ecology monitoring sites were assessed during the February 2025 survey. Three additional sites were assessed in subsequent surveys. Supplementary surveys were conducted on 12 December 2025 and 22 January 2026 — they were designed to support the assessment of creek morphology and suitability for fish passage, and consisted of site visual observations, general descriptions of creek morphology, photographic observations and surface water and stream sediment sampling, where conditions were suitable.

Macroinvertebrates were adopted as the standard biological indicators of aquatic ecosystem health, with water quality, to assess the condition of each waterway. Habitat bioassessments were performed at relevant sites using a modified version of the AusRivAs protocols provided in the Queensland AusRivAS Sampling and

Processing Manual (DNRM 2001). The assessment considered the morphological characteristics of waterways, including the broad habitat type, channel pattern, water level and flow, substrate character and cover, bed and bank stability, and riparian cover at each survey site. A condition assessment was undertaken to evaluate the possible impacts to aquatic environmental values caused by major disturbances within the waterway.

Any aquatic flora observed at each of the survey site was recorded. Quaternary flora assessments were conducted at the survey sites as part of the terrestrial ecology assessment, which included identifying flora species with aquatic characteristics, where relevant (AARC 2026).

Survey site locations are in Figure 18-5, and parameters assessed at each site in Table 18-2.

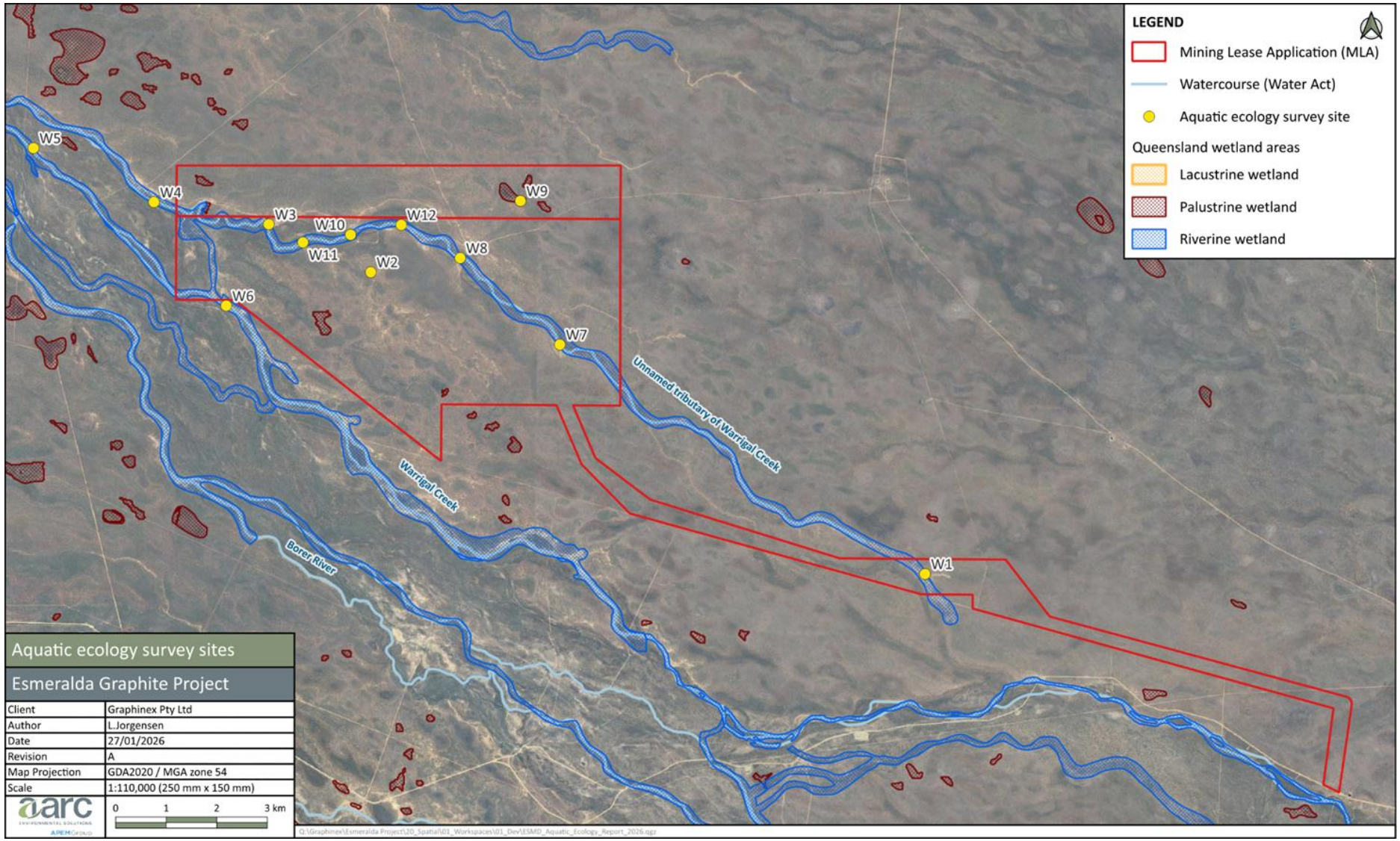


Figure 18-5: Aquatic ecology survey site locations

Table 18-2: Aquatic ecology and water quality survey sites

Site	Location	Latitude	Longitude	Aquatic habitat assessment	Water sampling	Stream sediment sampling	Macroinvertebrate monitoring		Cast netting	Quaternary vegetation assessment	Supplementary creek morphological assessment
							Bed	Edge			
Upstream of the proposed mining area (reference site)											
W1	Unnamed tributary of Warrigal Creek (drainage feature)	-18.87817	142.3255	Yes	Yes	Yes	Yes	Yes	Unsuitable – narrow stream with debris	Yes	Yes
W6	Warrigal Creek	-18.8311	142.19394	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
W7	Unnamed tributary of Warrigal Creek	-18.83765	142.25662	Yes	Yes	Yes	Yes	No	Unsuitable – narrow stream with debris	Yes	Yes
W8	Unnamed tributary of Warrigal Creek	-18.82229	142.23781	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
W9	Palustrine wetland	-18.81202	142.24905	Yes, partial assessment	Yes	Yes	No	No	Unsuitable – shallow water with debris	Yes	NA
Within/adjacent to proposed mining area											
W2	Unnamed tributary of Warrigal Creek (drainage feature)	-18.82494	142.22103	Yes	Yes	Yes	Yes	No	Unsuitable – narrow stream with debris	Yes	Yes
W10*	Unnamed tributary of Warrigal Creek	-18.81827	142.21720	No	No	Yes	No	No	No	No	Yes

Site	Location	Latitude	Longitude	Aquatic habitat assessment	Water sampling	Stream sediment sampling	Macroinvertebrate monitoring		Cast netting	Quaternary vegetation assessment	Supplementary creek morphological assessment
							Bed	Edge			
W11*	Unnamed tributary of Warrigal Creek	-18.81971	142.20826	No	No	Yes	No	No	No	No	Yes
W12*	Unnamed tributary of Warrigal Creek	-18.81646	142.22670	No	No	Yes	No	No	No	No	Yes
Downstream of the proposed mining area (receiving site)											
W3	Unnamed tributary of Warrigal Creek	-18.81649	142.20182	Yes	Yes	Yes	Yes	No	Suitable but unavailable due to weight restrictions	Yes	Yes
W4	Unnamed tributary of Warrigal Creek	-18.81268	142.18024	Yes	Yes	Yes	Yes	No	Suitable but unavailable due to weight restrictions	Yes	Yes
W5	Warrigal Creek	-18.80317	142.15756	Yes	Yes	Yes	Yes	No	Suitable but unavailable due to weight restrictions	Yes	Yes

18.4.3 Groundwater dependent ecosystems

A groundwater-dependent ecosystem (GDE) assessment was undertaken to assess the potential impact of the Project, as a result of project related groundwater drawdown. The study area was MLA 100430 and MLA 100431 and surrounding areas, that may be susceptible to groundwater changes resulting from the proposed mining activities.

18.4.3.1 Desktop assessment

A desktop assessment of the BoM GDE Atlas was undertaken to identify areas of high, moderate and low potential terrestrial GDEs associated with riparian vegetation of watercourses in the Project area. A review of ecohydrological function of savannah woodland trees and shrubs was undertaken.

18.4.3.2 Field survey

A field survey was undertaken to determine the likely moisture sources utilised by terrestrial vegetation, including both biophysical and hydro-chemical assessments. The study followed methods recommended in the GDE Toolbox (Richardson et al., 2011) and Doody et al. (2019). The survey was undertaken between 25 August to 4 September 2025, during an optimal sampling window, to provide an optimal basis for a dry season impact assessment.

The field survey focused on areas identified as either aquatic or terrestrial GDEs within the GDE Atlas (BOM, 2025). Identifying surface expression of groundwater is fundamental for assessing aquatic GDEs. Where aquatic GDEs are mapped in association with deep-rooted woody vegetation, terrestrial GDEs could also be expected to occur.

The field survey methods to assess groundwater-dependence of the surveyed vegetation community included:

- leaf water potential;
- soil moisture potential; and
- stable isotope analyses of:
    - soil moisture;
    - xylem water; and
- water sampling from a modified overflow wetland feature at GDE Assessment Area 3.

Full details of the field methodology and laboratory analyses are provided in Appendix G, Groundwater Dependent Ecosystem Assessment.

A total of ten sites were sampled. The sampling localities, relative to mapped GDEs is indicated in Figure 18-6, and a summary of the purpose of individual GDE assessment sites is in Table 18-3.

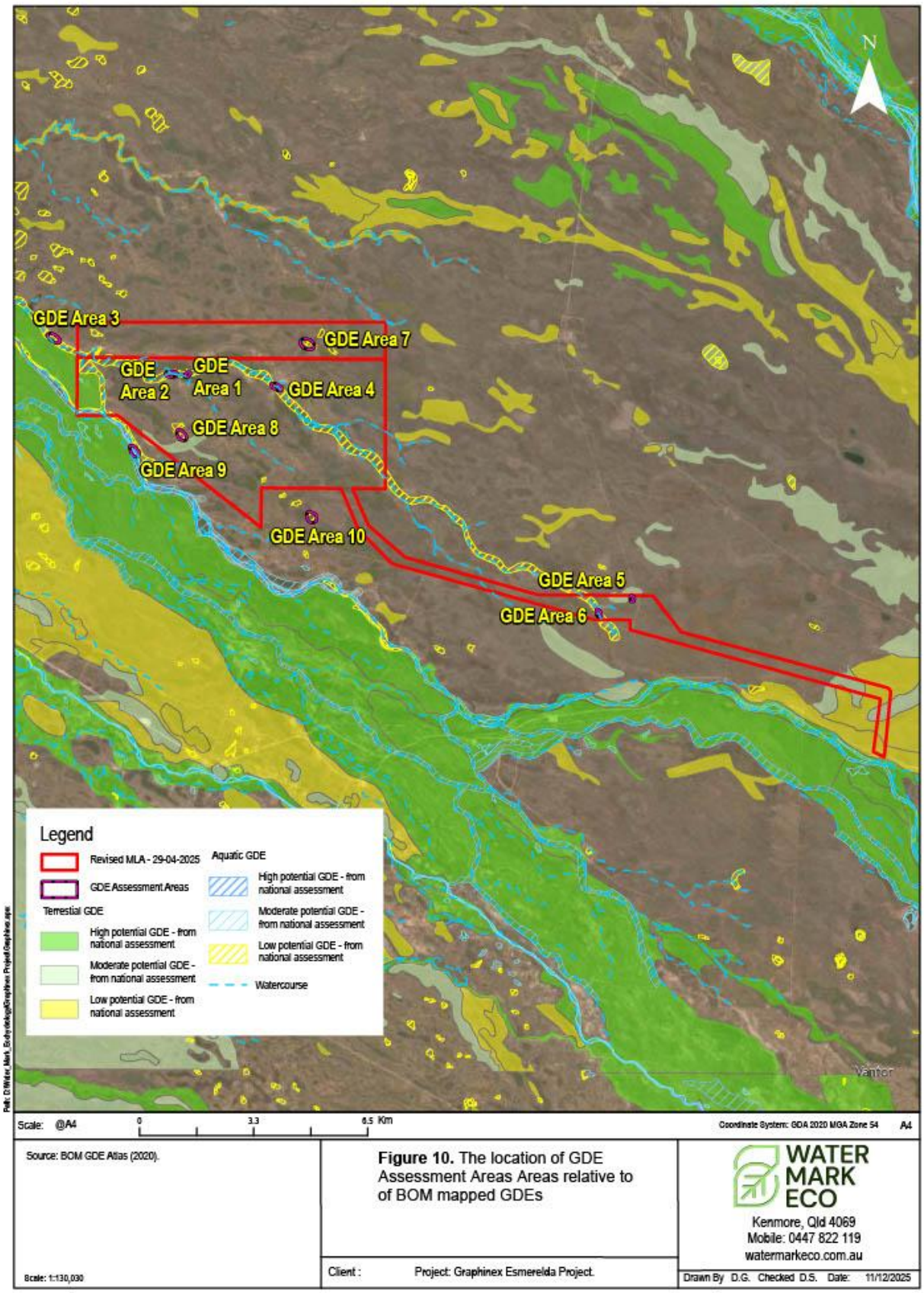


Figure 18-6: GDE Assessment areas relative to mapped GDEs

Table 18-3: GDE assessment sites and purpose

GDE Assessment Area	Landform	Purpose	Targeted RE
1, 2, 4, 9	Sandy braided drainage channel / watercourse associated with Warrigal Creek and Tributaries	Sampling of Low Potential Aquatic / Terrestrial GDEs associated with riparian woodland and open forest,	2.3.26a/2.3.26c
3	Residual clay to sandy clay soils associated with floodplain woodland and associated floodplain overflow wetland (modified)	Sampling of Low Potential Aquatic and Terrestrial GDE associated with the Warrigal Creek floodplain.	2.3.42b
5	Flat to gently undulating residual plain.	Assessment of a Moderate Potential Terrestrial GDE associated with a eucalypt woodland.	2.5.28
6	Open drainage depression / drainage line formed on a residual plain.	Assessment of Low Potential Aquatic and Terrestrial GDE associated with seasonal drainage feature / depression.	2.3.29b
7, 8, 10	Closed wetland depression on residual soils.	Investigation of a Low Potential Aquatic GDE within a closed wetland depression on an undulating residual plain.	2.3.55d

18.4.4 Stygofauna

To describe the stygofauna values of the Project, an assessment was undertaken by Ecological Australia (Appendix F, Stygofauna Assessment). The objectives of the Stygofauna Assessment were to assess the potential impacts of the Project on stygofauna values. The study area encompassed the groundwater of the Gilbert River Formation in the surrounding area of MLA 100430 and MLA 100431.

18.4.4.1 Assessment methodology

The assessment followed the Queensland Government Guideline for the Environmental Assessment of Subterranean Aquatic Fauna (DSITI 2015), and guidelines from other states, including the Risk Assessments Guidelines for Groundwater Dependent Ecosystems (NSW Office of Water 2012), the Technical Guidance-Subterranean fauna surveys for environmental impact assessment (WA EPA 2021) and the Information Guidelines Explanatory Note for Assessing Groundwater-Dependent Ecosystems (Doody et al. 2019).

For instances where there are no known stygofauna from an area, or there is limited suitable habitat, one survey is sufficient (DSITI 2015). This report includes the results from the initial survey for stygofauna and is deemed suitable for the project location and geology and the low potential to find stygofauna.

Fourteen monitoring bores and four landowner production bores were visited during sampling at Esmeralda. Not including Rowe 1, the bores sampled are shown in (Figure 18-7). Seven of the monitoring bores were dry. All but one of these had total depths less than 12 m, the exception being ESMB7S with a total depth of 54 m (Table 18-4). All of the monitoring and production bores sampled entered the Gilbert River Formation.

The monitoring bores were sampled using a specifically designed net, lowered to the bottom and slowly retrieved. Net contents were emptied at the top of each haul until a total of six hauls were completed. The production bores (and also most monitoring bores) were sampled by way of collecting 100 litres of water and passing it through a 63 µm-mesh sieve, with the sieve contents collected for assessment. At each bore, water was collected prior to net sampling, and physico-chemical parameters were measured using a calibrated meter. All stygofauna samples were returned to the ELA laboratory for sorting and identification using a Leica M80 dissecting microscope.

Table 18-4: Details of bores monitored for stygofauna

Bore ID	Bore type	Total Depth	Depth of screened interval (mbgl)	Age at sampling date	Was the bore sampled?	Sampling effort
ESMB01D	Monitoring	55.71	49-55	> 1 year	Yes	6 net, 100 L
ESMB01S	Monitoring	12	8.5-11.5	> 1 year	No (dry)	-
ESMB02D	Monitoring	55.75	49-55	> 1 year	Yes	6 net
ESMB02S	Monitoring	11.26	7-10	> 1 year	No (dry)	-
ESMB3	Monitoring	10	7-10	3 months	No (dry)	-
ESMB4D	Monitoring	51.1	46-49	3 months	Yes	6 net
ESMB4S	Monitoring	10	7-10	3 months	No (dry)	-
ESMB5D	Monitoring	53	49-52	3 months	Yes	6 net, 60 L
ESMB5S	Monitoring	10	7-10	3 months	No (dry)	-
ESMB6D	Monitoring	51	47-50	3 months	Yes	6 net, 100 L
ESMB6S	Monitoring	10	7-10	3 months	No (dry)	-
ESMB7D	Monitoring	82.8	77.8-83.8	3 months	Yes	6 net, 100 L
ESMB7S	Monitoring	54	47-50	3 months	No (dry)	-
ESMB17	Monitoring	50	47-50	3 months	Yes	6 net, 70 L
ROWE2	Production	NA	NA	> 1 year	Yes	100L
ROWE3	Production	NA	NA	> 1 year	Yes	100L
Pelican Bore	Production	NA	NA	> 1 year	Yes	100L
NW bore	Production	NA	NA	> 1 year	Yes	100L

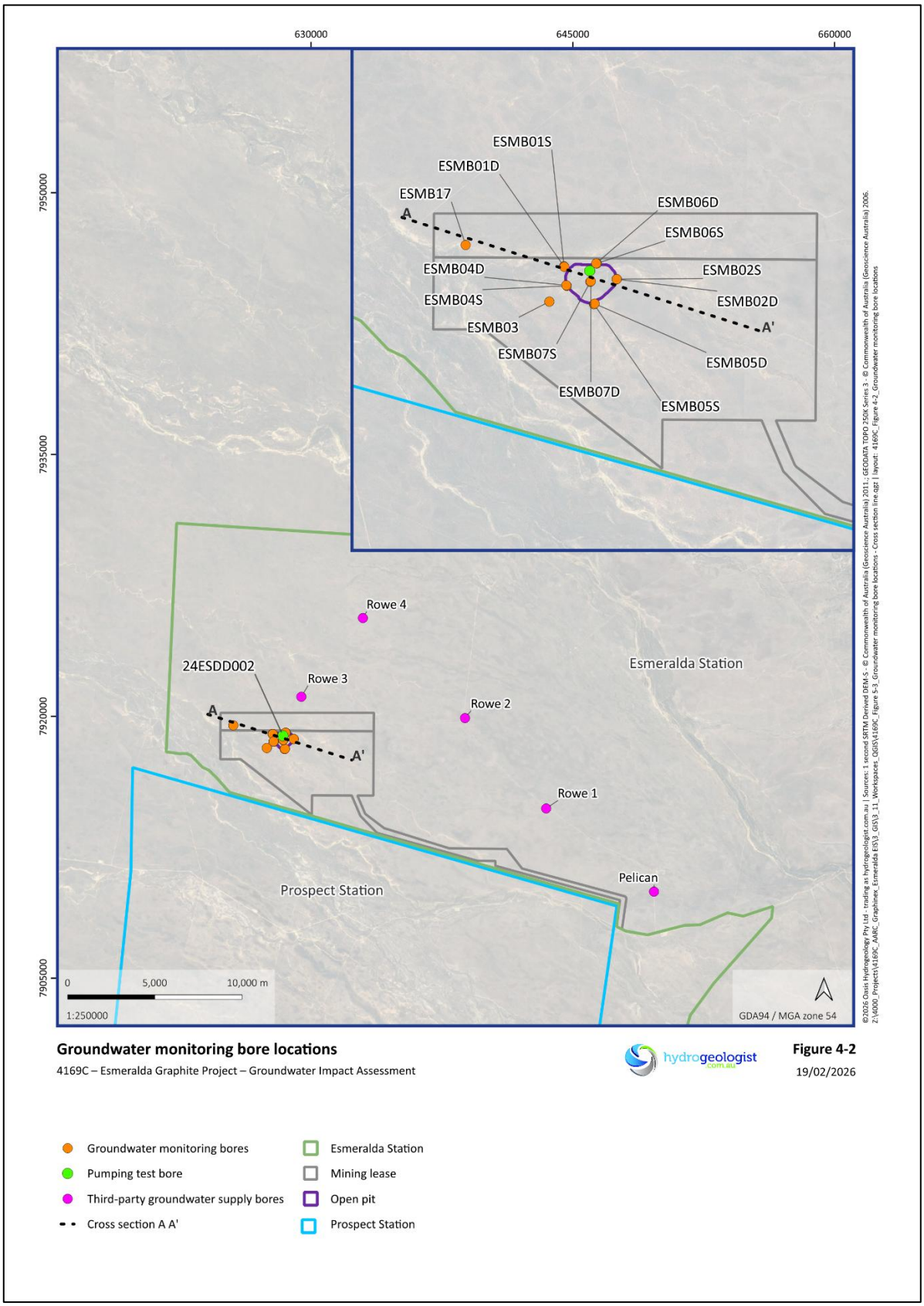


Figure 18-7: Groundwater bores monitored for stygofauna

18.5 Existing environment

This section outlines the terrestrial ecology values identified for the Project, as detailed in Appendix E Terrestrial Ecology Assessment, Appendix D Aquatic Ecology Assessment, Appendix E Stygofauna Assessment, and Appendix G Groundwater Dependent Ecosystem Assessment.

18.5.1 Terrestrial ecology values

18.5.1.1 Regional ecosystems

The entire study area is vegetated with remnant vegetation. No areas of high-value regrowth or non-remnant vegetation were identified. The field verified regional ecosystems (REs) are summarised in Table 18-5. The accepted RE mapping (Queensland Herbarium reference MAR_3594) has been adopted as the field-verified vegetation in Figure 18-8, Figure 18-9, Figure 18-10, Figure 18-11, and Figure 18-12. This accepted RE mapping includes two heterogeneous polygons. The Queensland Herbarium decided to classify these polygons as heterogeneous, in line with the official "Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland 7.0" (Neldner *et al* 2023).

Table 18-5: Field-verified regional ecosystems in the study area

RE	Description	VM Act status	Biodiversity status[2]
RE 2.3.22	Long-fruited Bloodwood (*Corymbia polycarpa*) and *Melaleuca* spp. woodland on sandy channels and levees	Least concern	Of concern
RE 2.3.26a	River Red Gum (*Eucalyptus camaldulensis*) woodland to low woodland, with *Melaleuca* spp., on fringes and in channels of minor watercourses	Least concern	Of concern
RE 2.3.26a / 2.3.50a	River Red Gum (*Eucalyptus camaldulensis*) low woodland, with *Melaleuca* spp., fringing minor watercourses, with areas of bare sand and rock, and scattered vegetation in channels	Least concern	Of concern
RE 2.3.26c	River Red Gum (*Eucalyptus camaldulensis*) low woodland, with Broad-leaved Paperbark (*Melaleuca viridiflora*), on fringes of minor watercourses in broad sand sheets	Least concern	Of concern
RE 2.3.29b	*Melaleuca* spp. low open woodland to low woodland on alluvial plains and drainage depressions	Least concern	No concern at present
RE 2.3.41	Annual tussock grassland on alluvial plains	Least concern	Of concern
RE 2.3.42b	Coolibah (*Eucalyptus microtheca*) low open woodland to woodland on alluvial plains	Least concern	Of concern
RE 2.3.55d	Seasonal swamp (wooded). Broad-leaved Paperbark (*Melaleuca viridiflora*) low woodland in shallow closed depressions on sand sheets	Least concern	Of concern
RE 2.3.61c	Seasonal swamp (wooded). Coolibah (*Eucalyptus microtheca*) and Broad-leaved Paperbark (*Melaleuca viridiflora*) woodland in closed depressions on alluvial plains	Least concern	No concern at present
RE 2.5.14a	Broad-leaved Paperbark (*Melaleuca viridiflora*) low open woodland to low woodland on sand sheets	Least concern	No concern at present
RE 2.5.14a / 2.5.17b / 2.3.29b / 2.3.51	Mixed community of *Melaleuca* spp. low open woodland to low woodland on fringes of alluvial plains and sand sheets, with seasonal swamps of River Red Gum (*Eucalyptus camaldulensis*) woodland	Least concern	No concern at present

RE	Description	VM Act status	Biodiversity status[2]
RE 2.5.17b	Gulbarn (*Melaleuca citrolens*) low open woodland to low woodland on broad sand sheets	Least concern	No concern at present
RE 2.5.18a	Rough-leaved Bloodwood (*Corymbia setosa*) low open woodland to woodland on broad sand sheets	Least concern	No concern at present
RE 2.5.28a	Long-fruited Bloodwood (*Corymbia polycarpa*) woodland on broad plains of reworked sand deposits	Least concern	No concern at present

1 Status may be: Endangered; Of concern; or Least concern. 2 Status may be: Endangered; Of concern; or No concern at present.

18.5.1.2 Matters of National Environmental Significance

EPBC Act listed threatened and migratory species

Database searches did not identify any flora species listed as Critically Endangered, Endangered or Vulnerable under the EPBC Act (within a 50 km search area) (Refer to Appendix E Terrestrial Ecology Assessment).

EPBC Act Threatened Ecological Communities

The Protected matters search results identified one Endangered TEC (EPBC Act), potentially occurring in the broader Project area. 'The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin' TEC, is associated with springs within the Great Artesian Basin discharge area that are the natural surface discharge points of aquifers in the Triassic, Jurassic and Cretaceous sedimentary sequence of the Great Artesian Basin (DCCEEW 2024-2025a). Desktop search results indicate that the nearest springs, active or inactive, have been mapped approximately 28 km and 30 km north east of the study area (DNRMMRRD 2025b). The desktop review of regional ecosystems mapping and historic satellite imagery provided no indication of vegetation communities likely to be associated with springs, seeps or groundwater soaks in the Project area. Refer to Section 18.5.3 for further information related to GDE springs.

Consultations with representatives of the Tagalaka People and extensive heritage surveys were undertaken separately as part of the cultural heritage assessment for the Project. The aim of the consultations and heritage surveys included understanding the traditional knowledge that may indicate the presence of 'The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin' TEC within the vicinity of the Project area, including undocumented springs and soaks.

Heritage surveys completed from 12 to 17 May 2025, found no evidence of the community of native species dependent on natural discharge of groundwater or identifiable springs from the Great Artesian Basin was identified during the surveys.

18.5.1.3 Flora species of conservation significance

No conservation significant flora species listed under the EPBC Act or NC Act are considered likely to occur in the study area. The complete post survey likelihood assessment is provided in Appendix E, Terrestrial Ecology Assessment.

18.5.1.4 Flora species of cultural significance

No flora species of cultural significance to the Tagalaka People were identified during the desktop assessment or field assessments. No evidence of flora species of cultural significance was identified during consultations with representatives of the Tagalaka People and extensive heritage surveys undertaken separately as part of the cultural heritage assessment for the Project.

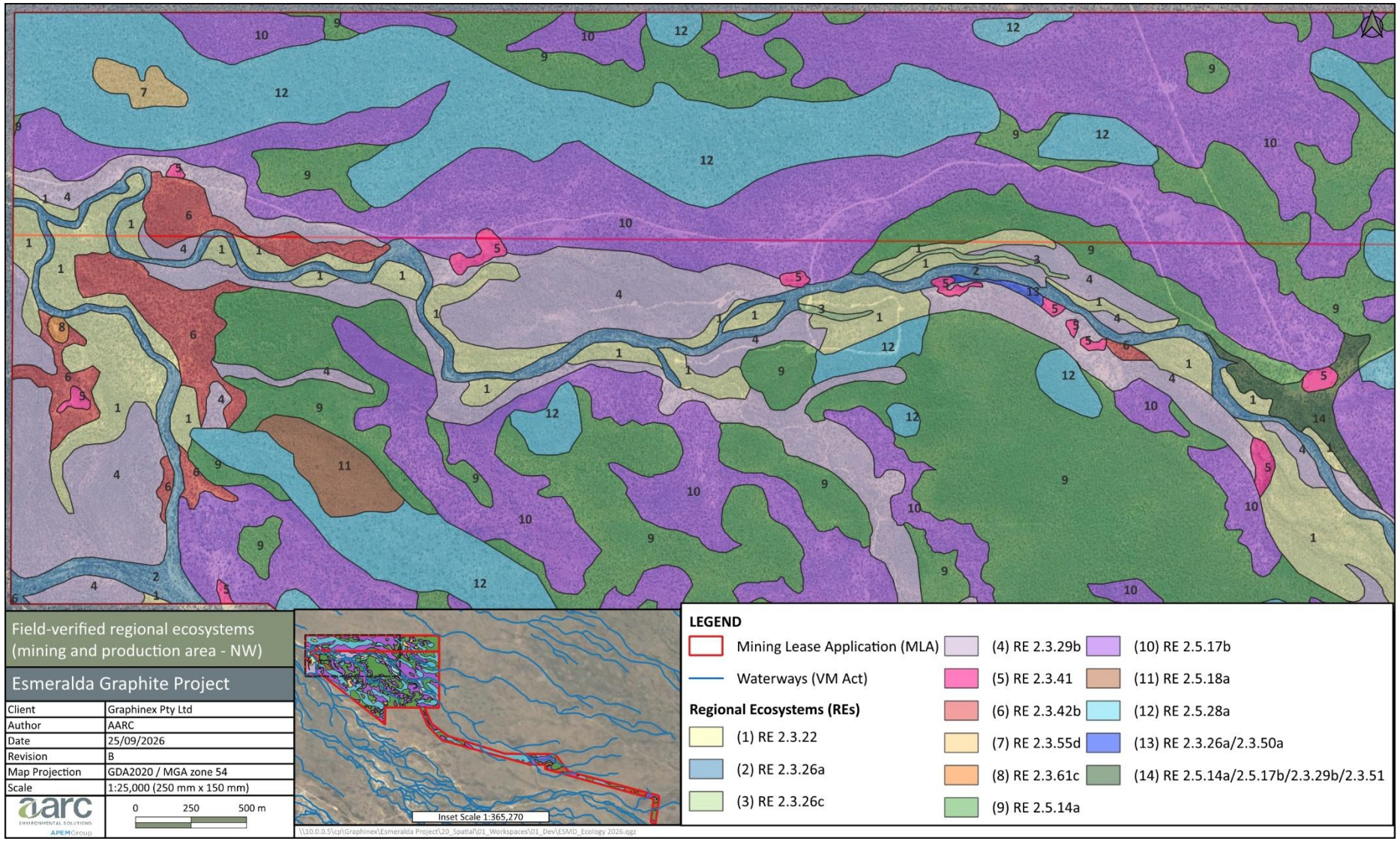


Figure 18-8: Field-verified regional ecosystems (mining and production area - NW)

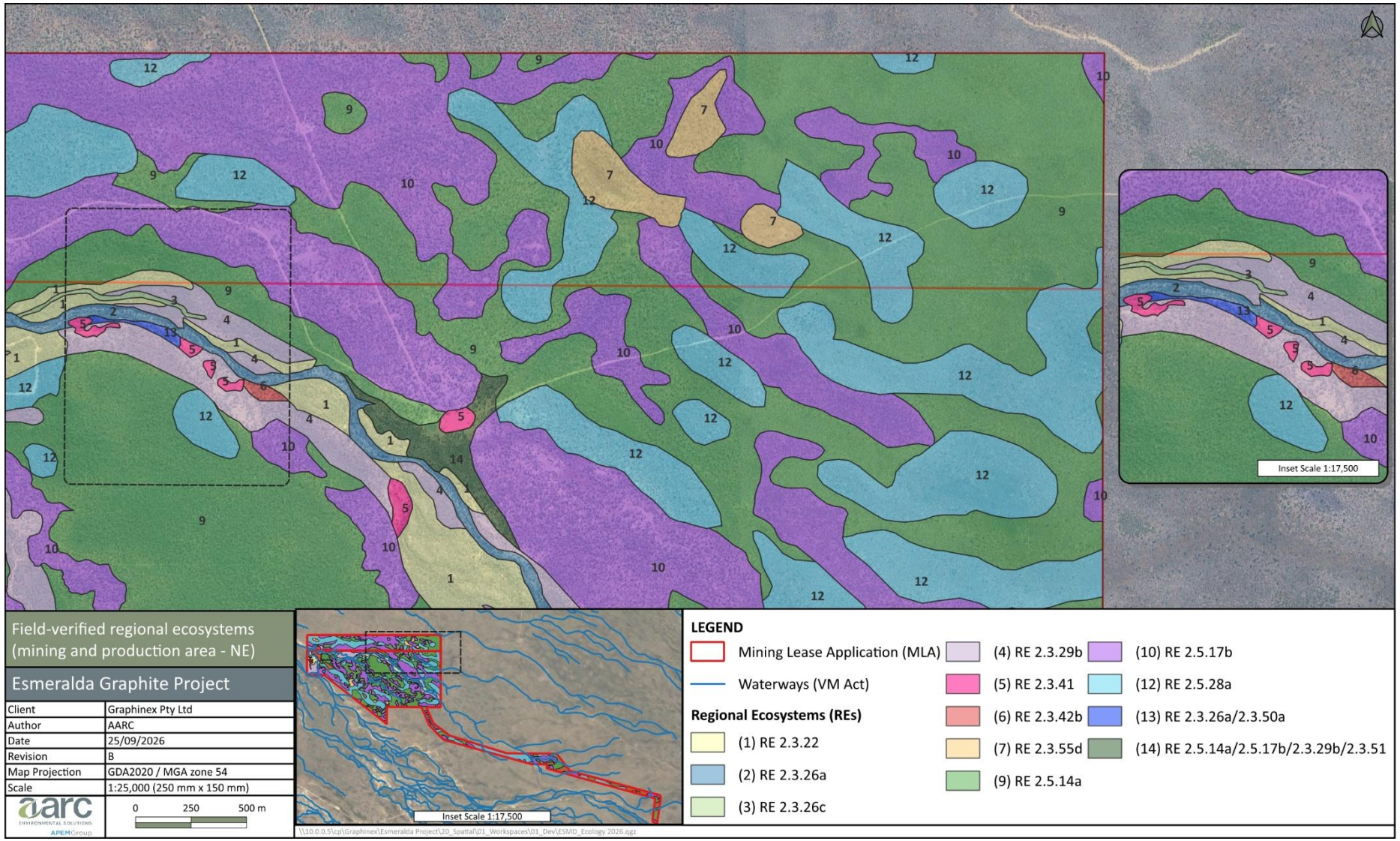


Figure 18-9: Field-verified regional ecosystems (mining and production area - NE)

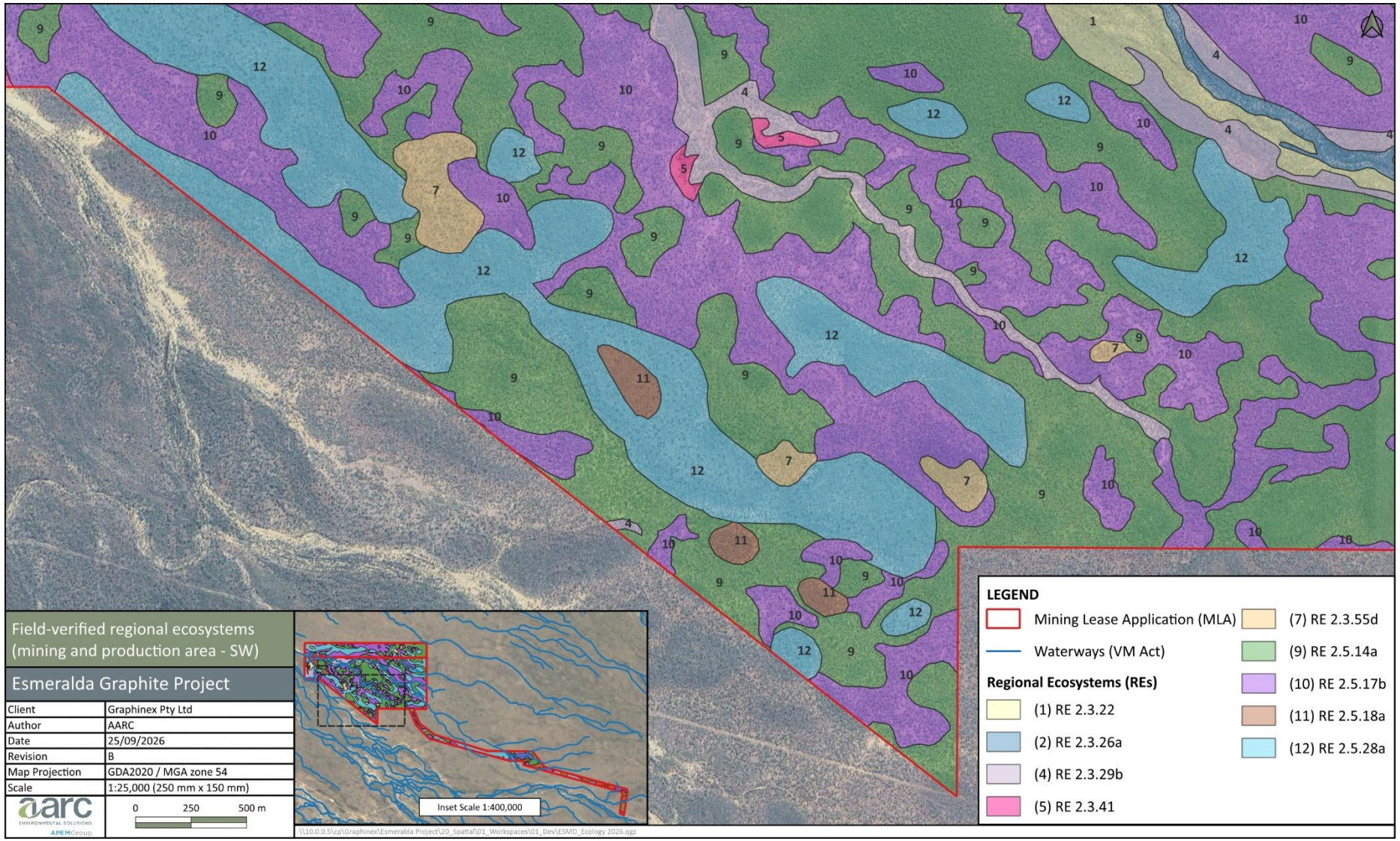


Figure 18-10: Field-verified regional ecosystems (mining and production area - SW)

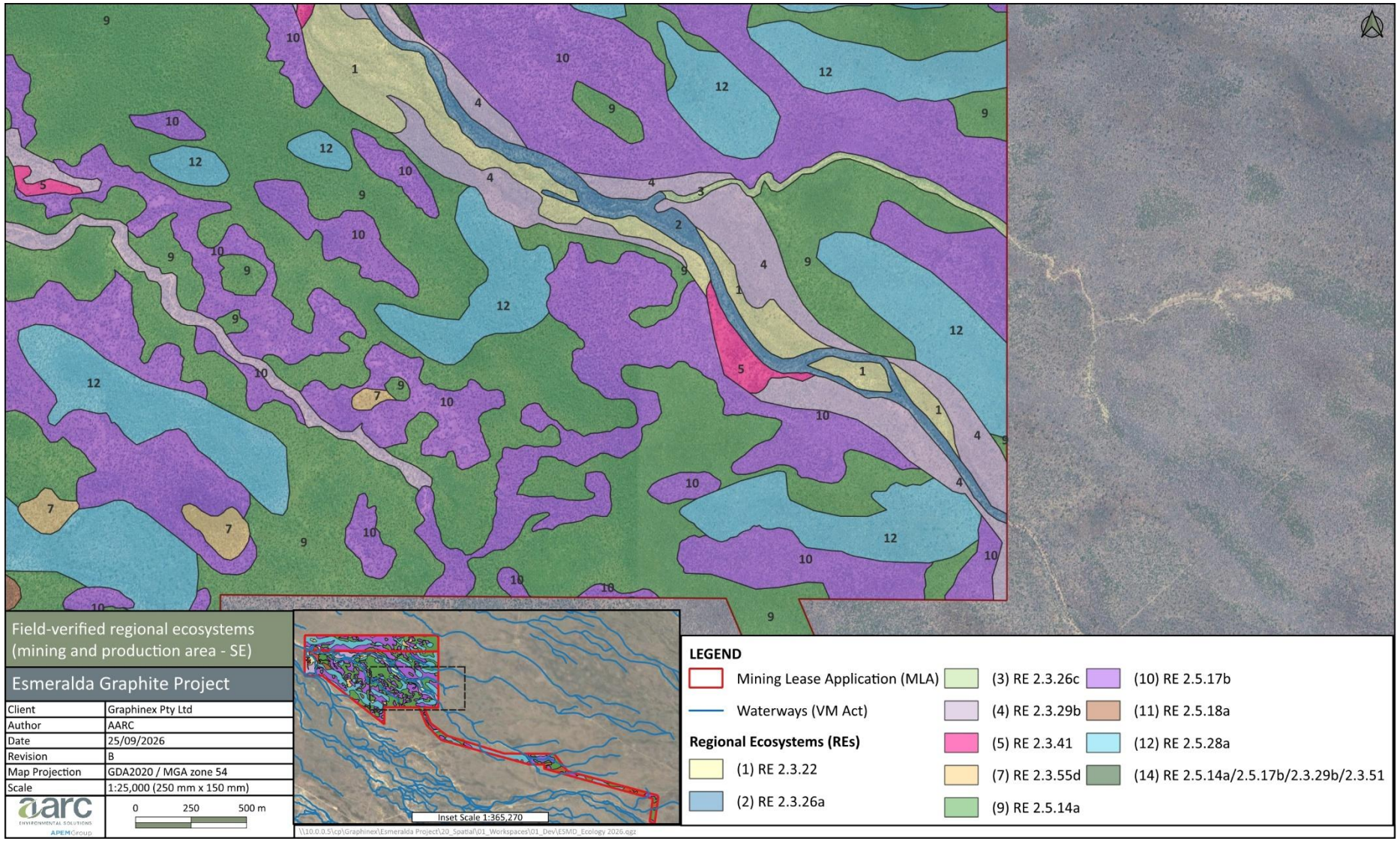


Figure 18-11: Field-verified regional ecosystems (mining and production area - SE)

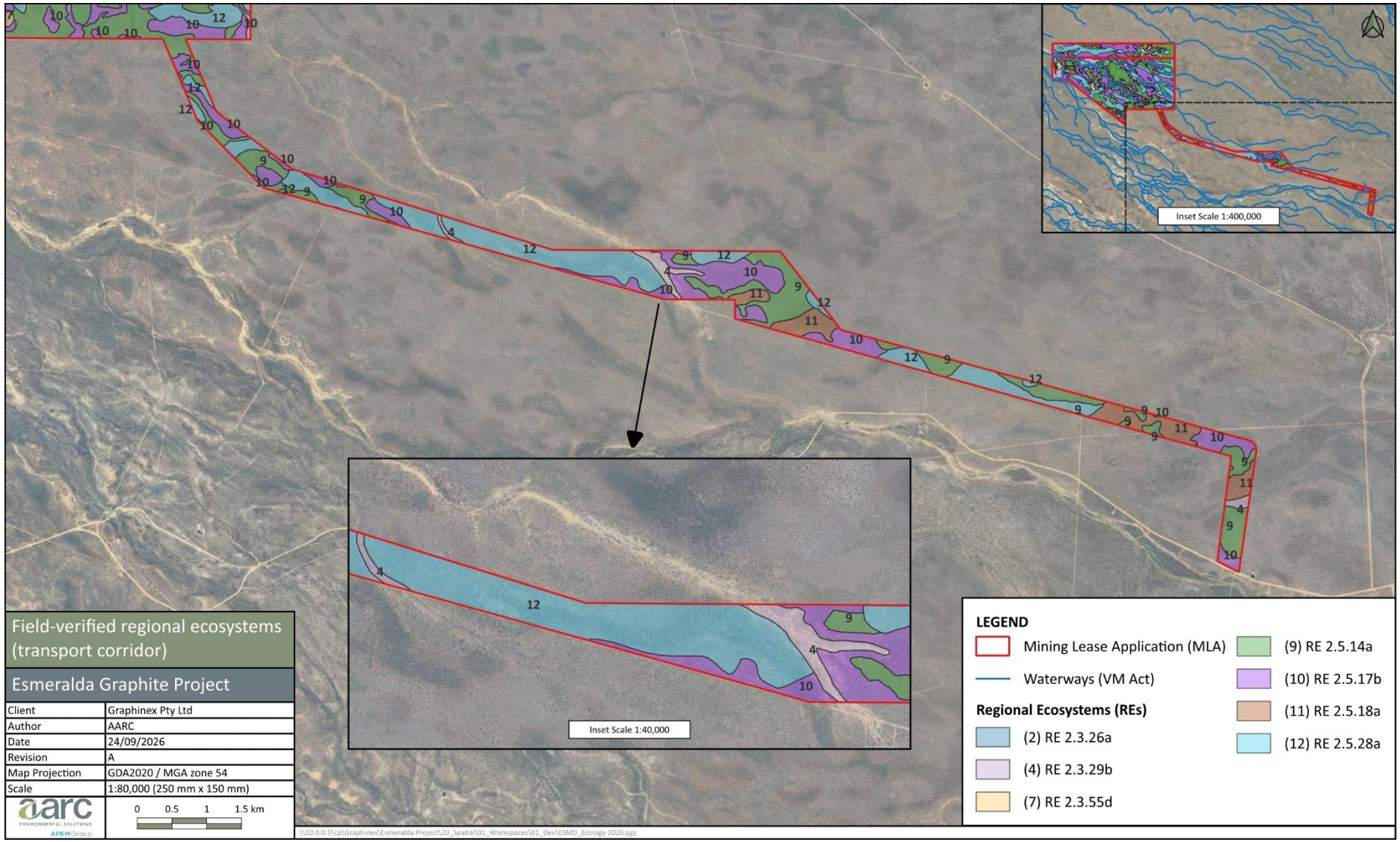


Figure 18-12: Field-verified regional ecosystems (transport corridor)

18.5.1.5 Fauna habitat types

Field surveys identified five major habitat types for fauna in the study area (Figure 18-13 and Figure 18-14):

- **Eucalypt woodland along creeks** — Key characteristics for this habitat type include shelter and breeding habitat in the form of occasional small hollow-bearing trees and exposed roots, leaf litter and logs, and occasional tussock grass. Hollow-bearing trees may be utilised by a diverse range of birds, arboreal mammals, and microbat species for roosting and breeding habitat. Logs, leaf litter, exposed roots and tussock grasses provide shelter and foraging habitat for amphibians, reptiles, and ground-dwelling mammals.
- **Paperbark woodland**—Key habitat features include a diverse range of shelter types across various vegetation communities, such as tree hollows, fallen logs, leaf litter, and dense grass cover. These provide essential shelter, breeding, and foraging grounds for birds, amphibians, reptiles, and arboreal mammals. Areas of periodic inundation in some locations provide favourable habitat for amphibians.
- **Annual tussock grassland** — Key characteristics of this habitat include an abundance of tussock grasses that fringe shallow depressions, offering shelter and foraging opportunities for amphibians, reptiles, and small ground-dwelling mammals. The scattered shallow depressions also serve as shelter, breeding, and foraging sites for amphibians, particularly during and after rain events. While this habitat was observed to have minimal leaf litter and fallen woody debris, occasional small hollows (<10 cm) were noted.
- **Corymbia woodland on sand plains** —Key habitat characteristics include abundant leaf litter, termite mounds and occasional fallen Torulosa Wattle individuals, which all provide shelter and foraging habitat for amphibians, reptiles, and small ground-dwelling mammals. Tussock grass is sparse with occasional patches throughout the area, which have the potential to be utilised by small amphibians and reptiles. Nesting for small woodland birds has been noted in the Torulosa Wattle and larger nests were found in the Rough-leaved Bloodwoods. Evidence of moderate grazing was identified in this habitat type.
- **Seasonal swamp**— Key habitat characteristics include minimal leaf litter and occasional fallen logs which provide shelter and foraging habitat for amphibians, reptiles, and small ground-dwelling mammals. An abundance of tussock grass and sedges ranging from 20% to 40% cover have the potential to be utilised by small amphibians and reptiles. Within the study area, this community was observed to be dry during all survey events. Standing water was observed on the surface at one location, within the community, north-east of the study area (outside the MLA area) during the February 2025 survey. This standing water provides habitat for amphibians, reptiles, birds, small mammals, and freshwater crustaceans. Periodic inundation has resulted in a higher proportion of bare ground recorded within this habitat type, ranging from 30% to 55%. Nesting activity for common Grey-crowned Babblers and Honeyeaters was recorded within the vegetation community, along with burrows, including from monitor lizards (most likely the Yellow-spotted Monitor (*Varanus panoptes*)).

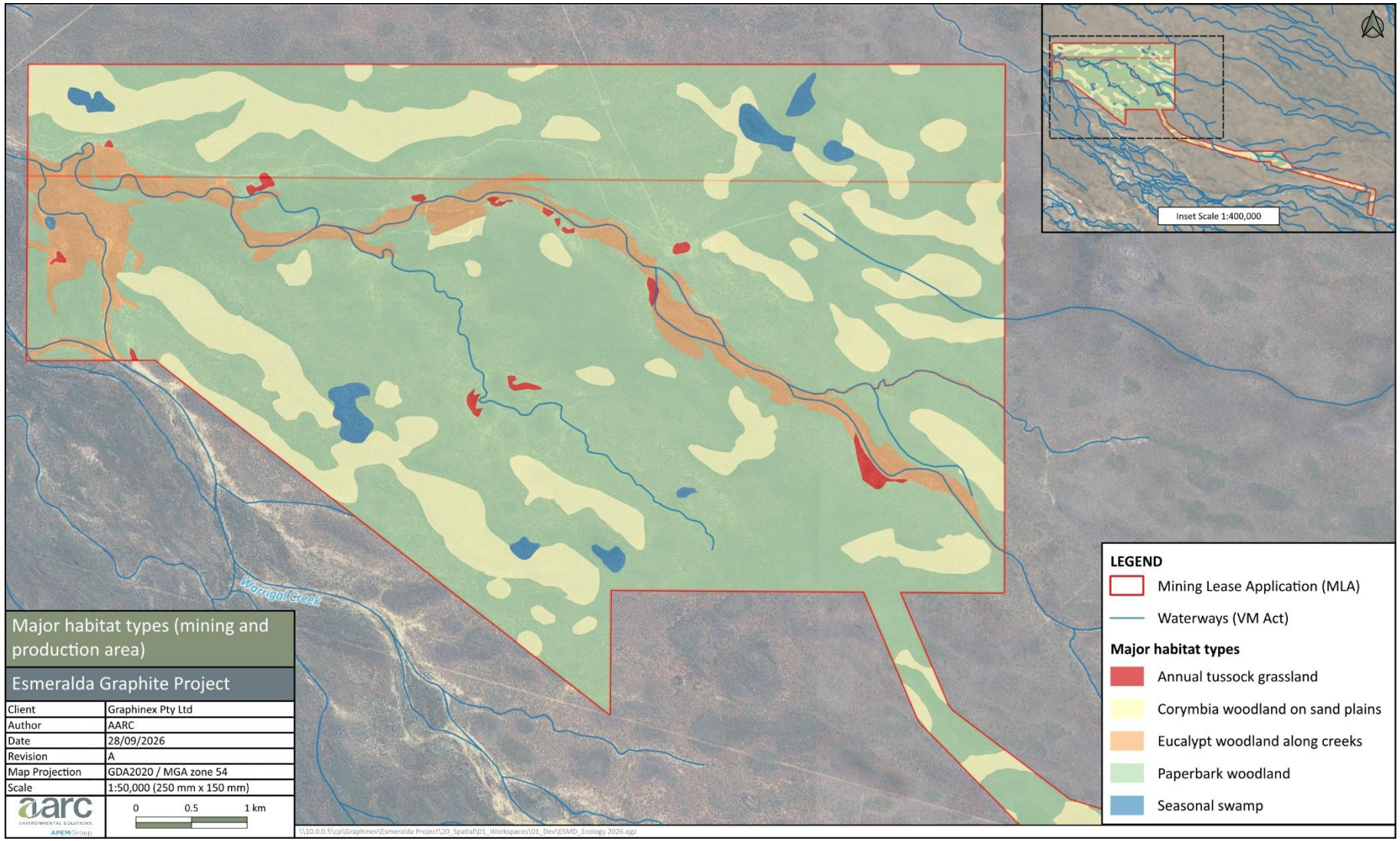


Figure 18-13: Major habitat types (mining and production area)

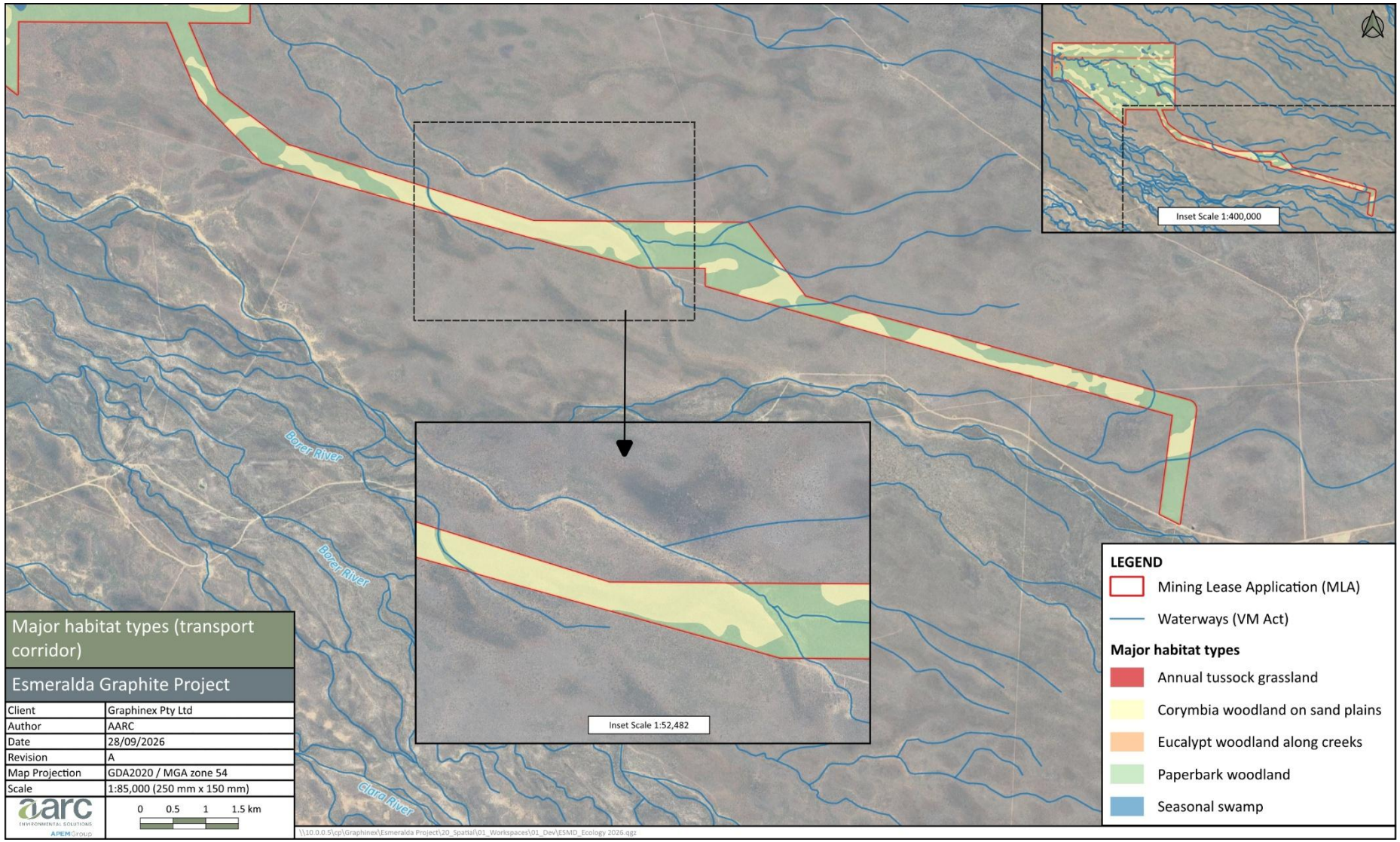


Figure 18-14: Major habitat types (transport corridor)

18.5.1.1 Fauna species of conservation significance

Two bird species of conservation significance, the White-throated Needletail (*Hirundapus caudacutus*), listed as vulnerable and migratory under the EPBC Act, and the Fork-tailed Swift (*Apus pacificus*), listed as migratory under the EPBC Act, were observed during the November 2024 field survey. The Fork-tailed Swift was also recorded during the February 2025 field survey. The location of conservation significant species records within the study area is provided in Figure 18-15.

A summary of the post-survey likelihood assessment is provided in Table 18-6 and a description of each threatened fauna species' distribution, habitat, ecology and an assessment of their likelihood of occurrence is provided in Appendix E, Terrestrial Ecology Assessment. Apart from the two recorded conservation significant species, no other fauna species are considered likely to occur in the Project area.

Table 18-6: Conservation significant fauna species potentially occurring in the study area

Scientific Name	Common Name	NC Act status[1]	EPBC Act status[2]	Likelihood of occurrence within the study area (post-survey)
Birds				
Calidris acuminata	Sharp-tailed Sandpiper	V	V, Mi	Unlikely
Apus pacificus	Fork-tailed Swift	SL	Mi	Known This species was recorded during field surveys.
Actitis hypoleucos	Common Sandpiper	SL	Mi	Unlikely
Chloebia gouldiae	Gouldian Finch	E	E	Unlikely
Gallinago hardwickii	Latham's Snipe	V	V, Mi	Unlikely
Grantiella picta	Painted Honeyeater	V	V	Unlikely
Poephila cincta cincta	Black-throated Finch (White rumped subspecies)	V	E	Unlikely
Calidris ruficollis	Red-necked Stint	SL	Mi	Unlikely
Plegadis falcinellus	Glossy Ibis	SL	Mi	Unlikely
Tringa stagnatilis	Marsh Sandpiper	SL	Mi	Unlikely
Hirundapus caudacutus	White-throated Needletail	V	V, Mi	Known This species was not initially identified in the desktop searches, but was recorded during field surveys.
Rostratula australis	Australian Painted Snipe	E	E	Unlikely
Mammals				
Tachyglossus aculeatus	Short-beaked Echidna	SL	NL	Unlikely

[1] Status may be: CR - Critically Endangered; E - Endangered; V - Vulnerable; NT - Near Threatened; LC - Least Concern; SL – Special Least Concern.[2] Status may be: CE - Critically Endangered; E - Endangered; V - Vulnerable; Mi – Migratory.

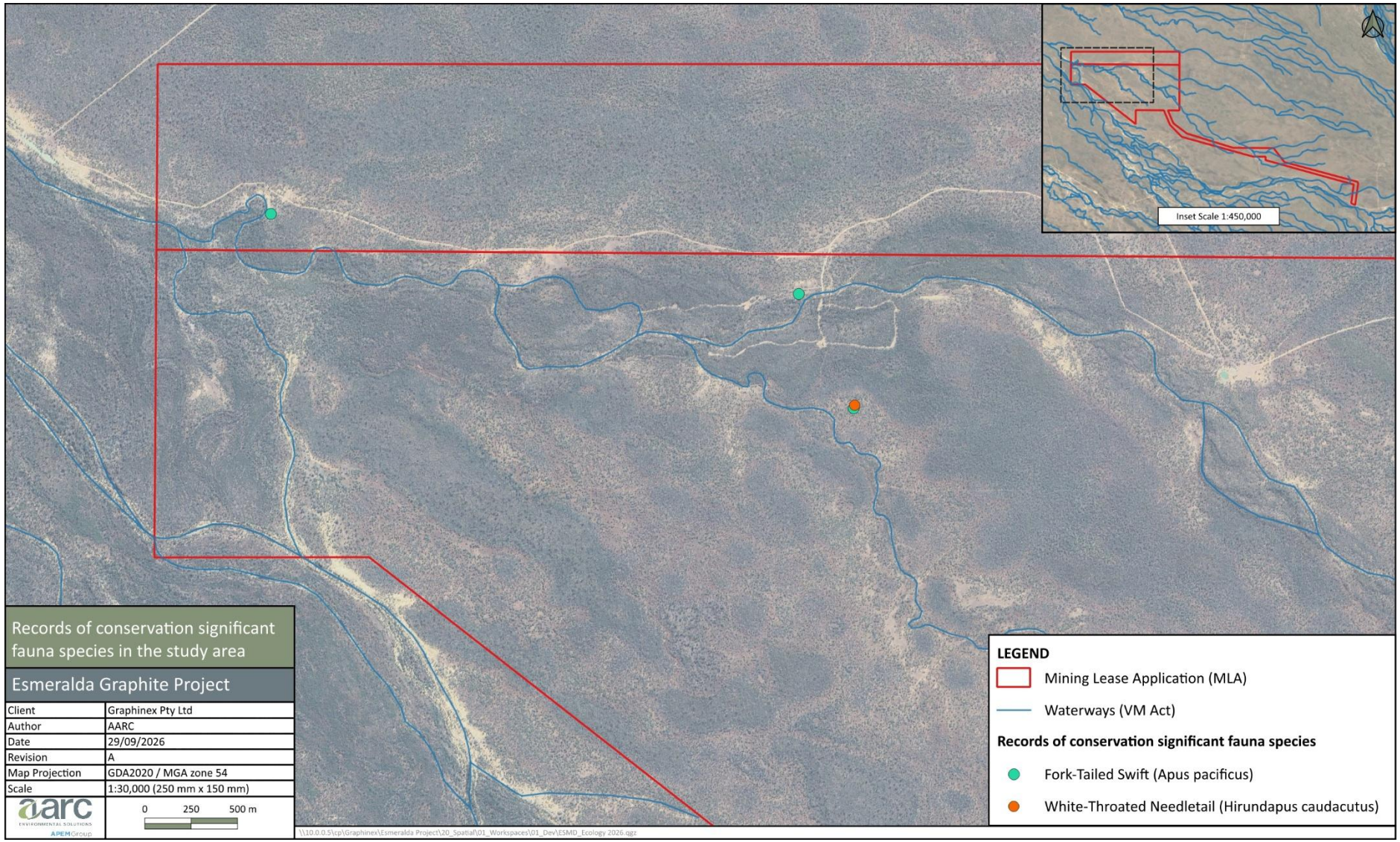


Figure 18-15: Fauna species of conservation significance identified in the study area

White-throated Needletail (Hirundapus caudacutus)

The White-throated Needletail is a large migratory swift, widespread across eastern and south-eastern Australia during its non-breeding season in September/October (DCCEEW 2024-2025b, TSSC 2019). In eastern Australia, it has been recorded in all coastal regions of Queensland, extending inland to the western slopes of the Great Divide and occasionally onto adjacent inland plains (DCCEEW 2024-2025b). The species is considered to be widespread in eastern and south-eastern Australia, from the islands in Torres Strait south to Tasmania. One of two subspecies of White-throated Needletail occurs in Australia although both occur in the northern hemisphere (DCCEEW 2024-2025b).

Primarily an aerial species, this species is known to occur across a variety of habitats including wooded areas, open forests, and rainforests (DCCEEW 2024-2025b). Large tracts of native vegetation, particularly forest, are considered likely to be a key habitat requirement for this species (DoE 2015a). It has been observed flying over farmland, typically over partially cleared pasture or within remnant vegetation at the edge of paddocks where it predominantly forages at cloud level along the edges of low-pressure systems (DCCEEW 2024-2025b). This species also forages in open habitats or recently disturbed areas (TSSC 2019) feeding on a wide variety of insects (DCCEEW 2024-2025b), occasionally near ground level. White-throated Needletails seldom descend to ground to catch insects and have very occasionally been seen foraging by launching into the air from trees in pursuit of flying insects or clinging to flowers on eucalypts, searching for insects (DCCEEW 2024-2025b).

The species prefers to roost in forests and woodlands, both among dense foliage in the canopy or in tree hollows, as well as on bark or rock faces, and occasionally roost aerially (DCCEEW 2024-2025b, DoE 2015a).

Known threats to the White-throated Needletail include (TSSC 2019):

- collision with wind turbines and overhead wires;
- use of insecticides; and
- habitat loss and fragmentation.

The White-throated Needletail does not breed in Australia (Higgins 1996). During the non-breeding season in Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1,000 m above the ground (DCCEEW 2024-2025b). While the species forages above most habitat types, the White-throated Needletail is predominantly recorded above wooded areas. Although it sometimes roosts aerially, it also roosts in forests and woodlands (TSSC 2019).

Potential foraging (and occasional roosting) habitat for the species corresponds with all the major habitat types within the study area (Figure 18-16). The study area does not provide potential breeding habitat for the species, as it is a non-breeding visitor to Australia.

Foraging habitat is not limited to the study area, with extensive, equivalent, habitat identified from the broader surrounding area. The study area is located within a large, contiguous area of suitable habitat associated undisturbed remnant vegetation in the broader region (Figure 18-16).

Fork-tailed Swift (Apus pacificus)

The Fork-tailed Swift is EPBC listed as migratory. Similar to the White-throated Needletail, the Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. It is widespread throughout Queensland, with sightings common from February to March. This species is almost exclusively aerial, known to forage and probably roost aerially, but is occasionally observed to land and recorded to roost in trees (DCCEEW 2024-2025b). Therefore, habitat for the species corresponds with all the major habitat types within the study area (Figure 18-17).

This species does not have specific habitat requirements and is found across a range of habitats, from inland open plains to wooded and coastal areas, where it is exclusively aerial (DCCEEW 2024-2025b). The Fork-tailed Swift forages aerially, up to hundreds of meters above the ground (DCCEEW 2024-2025b). They often occur in areas of updraughts and along the edges of low-pressure systems eating small bees, wasps, termites and

moths (DCCEEW 2024-2025b). It is thought that this species roosts aerially but are occasionally observed to land (DCCEEW 2024-2025b). It is not known to have specific dispersal habitat requirements.

18.5.1.2 Fauna species of cultural significance

The Mertens' Water Monitor (*Varanus mertensi*) is considered a culturally significant species to the Tagalaka People. The likelihood assessment considered the species as unlikely to occur in the study area as potential habitat has not been identified within the study area and there are no confirmed records within the area or surrounds. Wet season surveys, including active searches at all habitat types within the study area, were undertaken during optimal climatic conditions for the Mertens' Water Monitor. Neither the Mertens' Water Monitor nor its potential aquatic habitat have been identified from the study area. Additionally, consultations with representatives of the Tagalaka People and extensive heritage surveys, undertaken separately as part of the cultural heritage assessment for the Project, identified no evidence suggesting the local presence of Mertens' Water Monitor.

One skink species of cultural significance has been identified as potentially relevant to the Project – *Lerista karichigara* sp. *nov*, known as the Tagalaka slider due to part of its distribution overlapping the Tagalaka Native Title area. This species was first described by Zozaya *et al*. (2025) in March 2025. The species' known distribution is 35 km southeast of the southern-most point of the Project, however, the complete distribution of the species is not currently known. While the species was not published at the time of the surveys, Zozaya *et al*. (2025) indicate that the field guides and keys available prior to publication of the paper would have identified the species as *Lerista wilkinsi*.

Although no records of *Lerista wilkinsi* were identified from the study area during the wet and dry season surveys, seven individuals of *Lerista zonulata*, a species in the same genus, were identified during the fauna surveys. *Lerista zonulata* has several distinctive features that make it easily distinguishable from *Lerista wilkinsi* (and, as such, the Tagalaka slider), including its characteristic orange tail, four visible limbs, and bold, dark striations running lengthways down the sides of the skink, all of which are absent in the Tagalaka slider. Given that, following several seasonal surveys, there were no records of *Lerista wilkinsi* or of the genus *Lerista* sp. not identified to species level, it is considered unlikely that the Tagalaka slider is present within the study area. Nonetheless, mitigations for cultural heritage matters have been developed for the Project in consultation with the Tagalaka People, and are addressed in Chapter 11, First Nations Cultural Heritage.

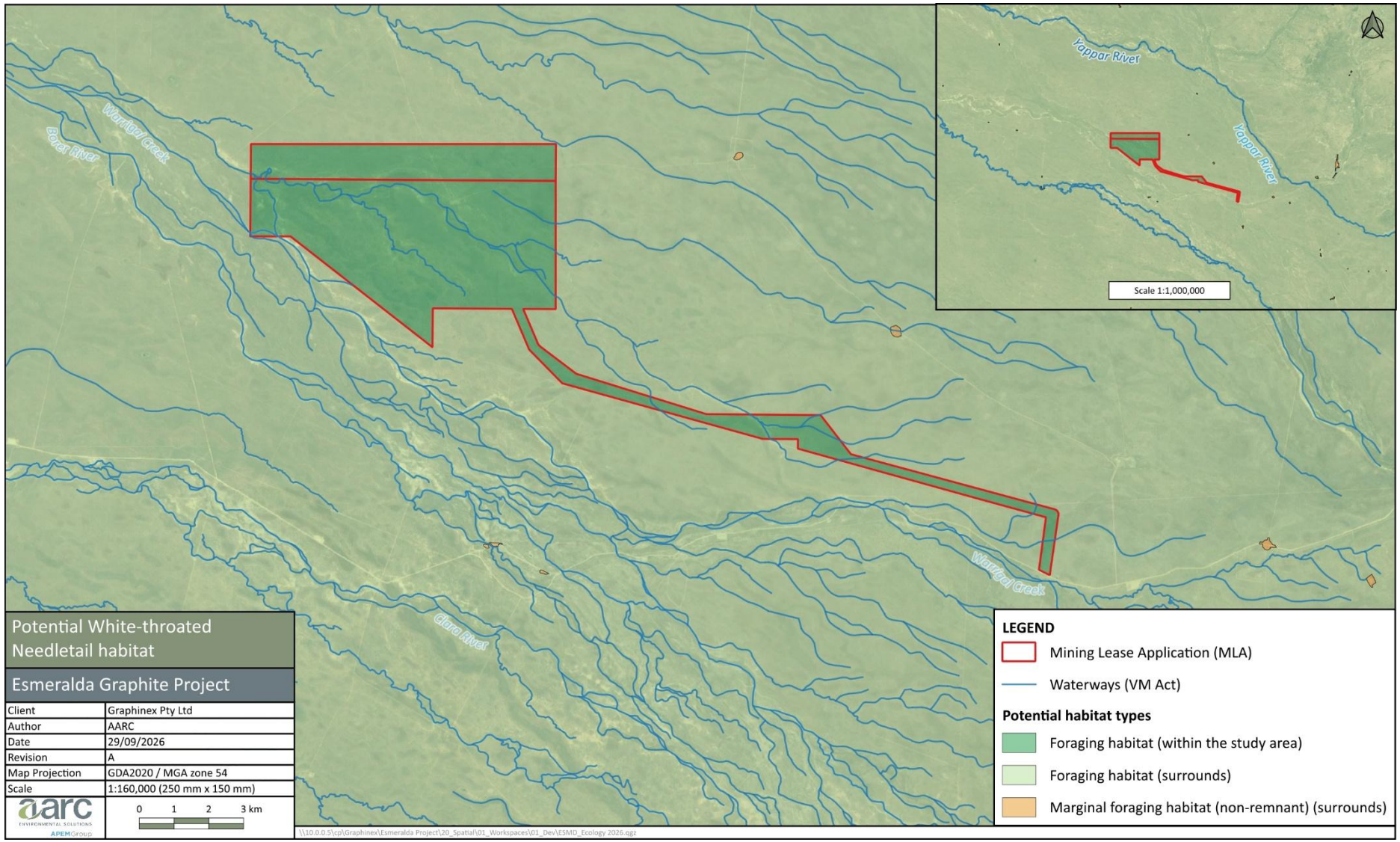


Figure 18-16: Potential White-throated Needletail habitat in the study area and surrounds

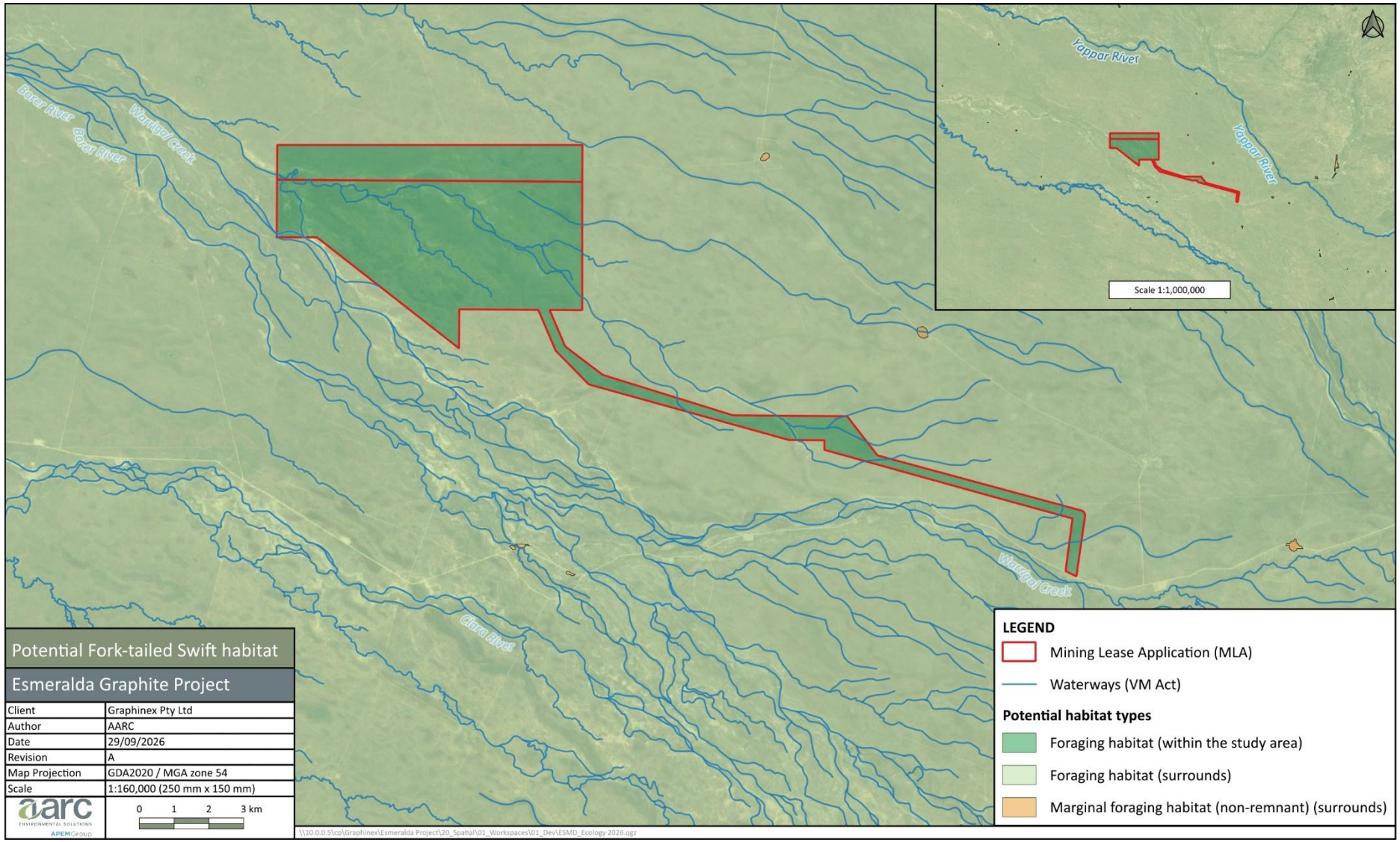


Figure 18-17: Potential Fork-tailed Swift habitat in the study area and surrounds

18.5.2 Aquatic ecology values

The aquatic ecology values identified in Appendix D, Aquatic Ecology Assessment are described in the following sections.

18.5.2.1 Matters of National Environmental Significance

Database searches did not identify any flora species listed as Critically Endangered, Endangered or Vulnerable under the EPBC Act (within a 50 km search area). Refer to Appendix D Aquatic Ecology Assessment.

One shark species, the Largetooth Sawfish (*Pristis pristis*), listed as vulnerable and migratory under the EPBC Act (at the time of the referral decision), has been identified from the desktop searches. The Protected Matters Search Tool (PMST) search identified potential habitat for the species occurring within 50 km of the Project area. The nearest record for the species is approximately 175 km north-west of the Project area. This species can occur in upper reaches of freshwater rivers and isolated water holes across northern Queensland (DCCEEW 2026b). Potential habitat for the species is unlikely to occur within the area due to the ephemeral nature of the waterways and lack of water holes within and surrounding the Project area. As such, the species is considered unlikely to occur in the Project area. The likelihood of occurrence assessment is provided in Appendix D, Aquatic Ecology Baseline report.

18.5.2.2 Matters of State Environmental Significance

Wetland values

The Map of Queensland wetland environmental values is a state-wide statutory map under the 'Environmental Protection (Water and Wetland Biodiversity) Policy 2019'. The map defines:

- High Ecological Significance (HES) wetlands;
- Wetland Protection Areas (WPAs), which comprise;
    - HES wetlands within the Great Barrier Reef Catchments; and
    - trigger areas that represent the area of hydrological influence of HES wetlands.
- General Ecological Significance (GES) wetlands.

Wetlands in WPAs and HES wetlands are identified as MSES under the Environmental Offsets Regulation 2014. There are no WPAs or HES wetlands mapped within or surrounding the Project area. The closest HES wetland is approximately 35 km north-east of the Project area.

Protected wildlife habitat

Protected wildlife habitat is defined as an area of habitat for an Endangered, Vulnerable or Special Least Concern (non-migratory) species under the NC Act. Habitat is defined as the area occupied (including periodically and occasionally) by any species, population or ecological community, or an area used by species during different stages of their life cycles (DEHP 2014).

Protected wildlife habitat is also a prescribed matter in areas that:

- are shown as a high risk area on the flora survey trigger map and that contain plants that are critically endangered wildlife, endangered wildlife or vulnerable wildlife; and
- areas not shown as a high risk area on the flora survey trigger map, to the extent the area contains plants that are critically endangered wildlife, endangered wildlife or vulnerable wildlife.

No wildlife habitat for Endangered or Vulnerable species (NC Act) has been mapped within the Project area, nor has high risk area in the flora survey trigger map.

One shark species, the Largetooth Sawfish (*Pristis pristis*), listed as endangered under the NC Act, has been identified from the desktop searches. This species was listed as vulnerable (when referred) and migratory under the EPBC Act and has been discussed in Section 18.5.2.1. Based on the absence of the potential habitat for the species and lack of species records in the Project area and surrounding area, the species is considered unlikely to occur in the Project area.

Waterways providing fish passage

The Environmental Offsets Regulation 2014 (EO Regulation) states that any part of a waterway providing for passage of fish is a MSES if the construction, installation or modification of waterway barrier works carried out under an authority will limit the passage of fish along the waterway.

A 'waterway' is defined under the Regulation as a river, creek, stream, watercourse or inlet of the sea and 'waterway barrier works' is defined as a dam, weir or other barrier across a waterway.

The 'Queensland waterways for waterway barrier works' spatial data layer indicates the level of 'risk' associated with undertaking waterway barrier works within Queensland waterways. Waterways with higher stream orders, steeper slopes, higher flow rates, greater number of fish present and fish with stronger swimming abilities receive a higher risk level.

As Project activities would be undertaken within the MLA under the conditions of an EA, a waterway barrier works approval under the Fisheries Act is not required. However, waterways providing for fish passage are MSES under the EO Regulation, where the construction, installation or modification of waterway barrier works carried out under an authority will limit the passage of fish along the waterway. As such, the level of risk assigned to the mapped watercourses is a useful tool for considering the potential value of watercourses and, thus, the potential impacts to aquatic ecology values from the Project.

The aquatic ecology assessment undertook observations to allow assessment of fish passage values in the Project area. The assessment results are detailed in Appendix D, Aquatic Ecology Assessment, which included observations of relevant habitat features, flow conditions, watercourse channel definition, and photographs of watercourses.

The updated watercourse mapping relating to the Project area which identifies the watercourses (which are also considered to have fish passage value) is shown in Figure 18-18.

Of the waterways identified as providing fish passage within the Project area (Figure 18-19), ground truthing identified:

- Warrigal Creek and one minor waterway associated with Warrigal Creek (stream order 4) (in the far west of the Project area) – is classified as having a high value to fish movement;
- the unnamed stream order 3 waterway (tributary of Warrigal Creek) is classified as having a moderate value to fish movement; and
- the remaining unnamed stream order 2 waterways (tributaries of Warrigal Creek) are classified as having a low value to fish movement.

The waterway barrier works would be located along a section of the unnamed stream order 3 waterway (tributary of Warrigal Creek), which is categorised as having a moderate value at this location.

The drainage features, including the drainage feature in the transport corridor, were identified through the watercourse determination process by the Department of Primary Industries (Figure 18-18). They are considered to not have attributes consistent with waterways providing for fish passage. These drainage features are considered unlikely to provide value for fish passage.

18.5.2.3 Matters of Local Environmental Significance

No MLES are identified within the State Planning Policy (SPP) biodiversity mapping of the Croydon Shire Planning Scheme (Croydon City Council 2019). The planning scheme refers only to MSES, which would be addressed under the EO Act.

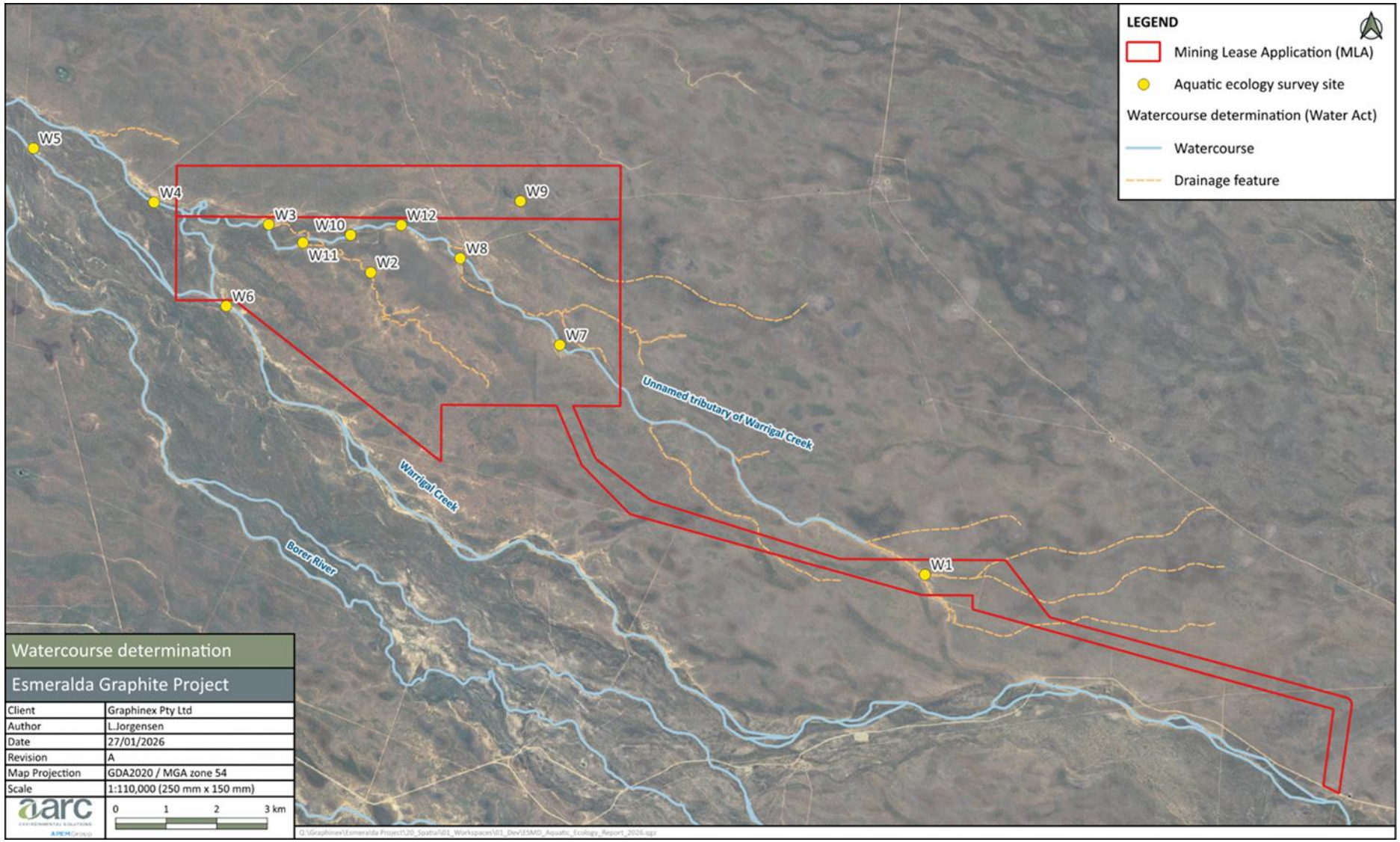


Figure 18-18: Watercourse determination outcome

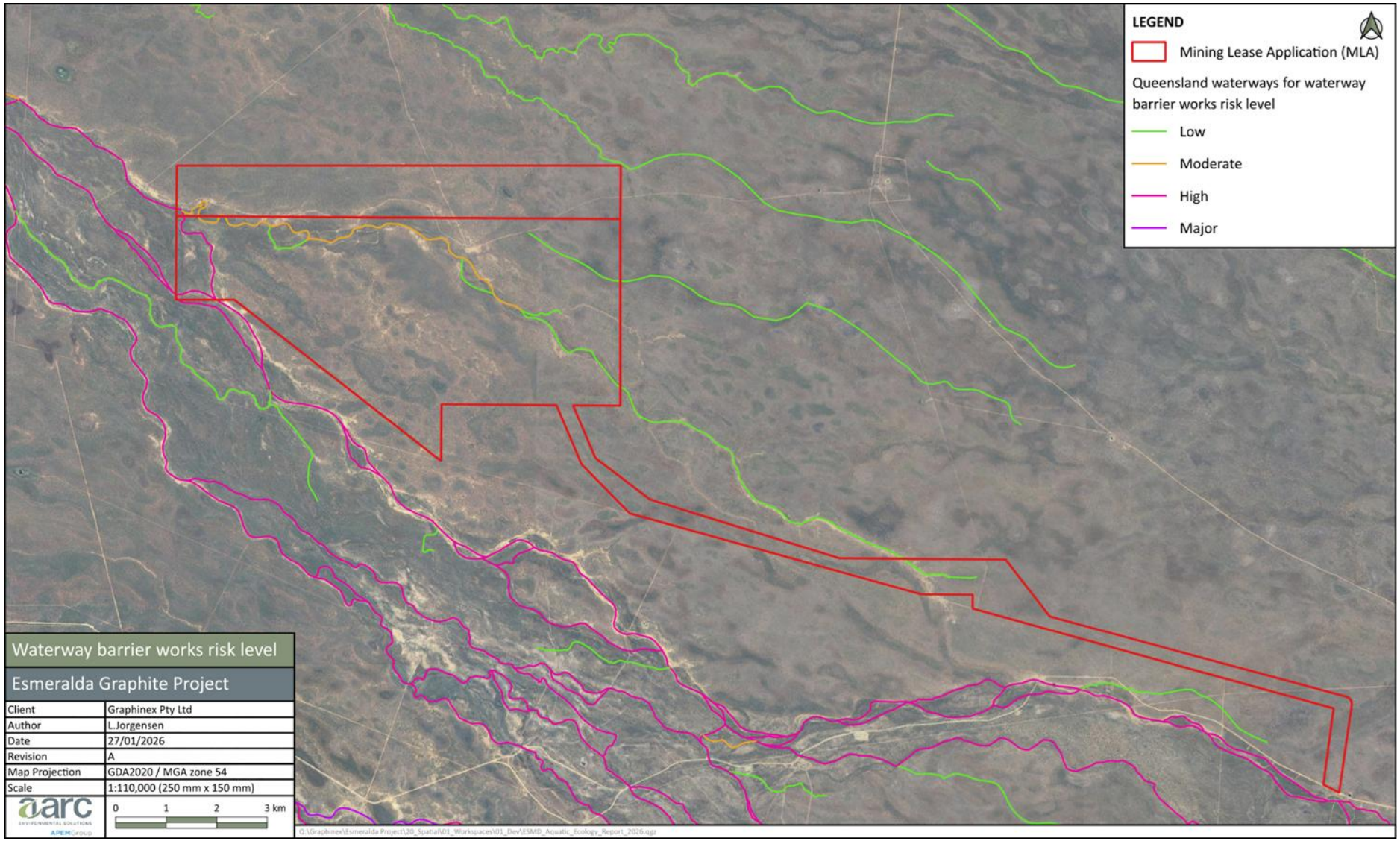


Figure 18-19: Waterway barrier works risk level for the Project area

18.5.2.4 Aquatic habitat values

The aquatic habitat values of the Project area were described through the results of a physical assessment of the watercourses, habitat bioassessment and condition assessment. The physical assessment identified minimal effects of erosion on the waterways with the leading cause of local erosion described as due to stock access. The habitat bioassessment recorded most of the survey sites as representing 'fair' habitat quality, and one site (upstream on the unnamed tributary of Warrigal Creek) representing 'poor' quality. The condition assessment outcome was for all assessed sites to be considered minimally impacted by upstream activities.

The Map of Queensland wetland environmental values identified several GES wetlands intersecting the Project area. These included both palustrine and riverine wetlands (DNRMMRRD 2026). Palustrine wetlands are primarily vegetated (with more than 30% emergent vegetation) non-riverine or non-channel environments of less than eight hectares. This includes billabongs, swamps, bogs, springs, soaks and similar features (DETSI 2013b). In comparison, riverine wetlands include all wetland and deepwater habitat that occurs within a channel. The channels can be naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. This includes rivers, streams, creeks, brooks, rivulets, canals, channels, and watercourses and tributaries (DETSI 2023).

Regional ecosystems associated with wetlands and waterways

In the Project area, Warrigal creek and the unnamed tributary of Warrigal creek are vegetated with River Red Gum (*Eucalyptus camaldulensis*) woodland to low woodland, with *Melaleuca* spp. along them. There are some areas of River Red Gum (*Eucalyptus camaldulensis*) low woodland, with Broad-leaved Paperbark (*Melaleuca viridiflora*), often in the smaller channels.

The wetlands are mapped as seasonal swamps with either Coolibah (*Eucalyptus microtheca*) and Broad-leaved Paperbark (*Melaleuca viridiflora*) woodland in closed depressions on alluvial plains, Broad-leaved Paperbark (*Melaleuca viridiflora*) low woodland in shallow closed depressions on sand sheets, or bare rock and sand with scattered shrubs in watercourse channels (Table 18-7). A heterogeneous polygon was included by the Queensland Herbarium in alignment with best practice regarding alluvial systems (Neldner *et al* 2023).

Table 18-7: Regional Ecosystems analogous to wetlands in the study area

RE	Description	VM Act status	Wetland association
RE 2.3.26a	River Red Gum (*Eucalyptus camaldulensis*) woodland to low woodland, with *Melaleuca* spp., on fringes and in channels of minor watercourses	Least concern	Riverine
RE 2.3.26a / 2.3.50a	River Red Gum (*Eucalyptus camaldulensis*) woodland to low woodland, with *Melaleuca* spp., on fringes and in channels of minor watercourses / Bare sand and rock with scattered shrubs and patches of grasses, forbs and sedges in channels of watercourses	Least concern	Riverine
RE 2.3.26c	River Red Gum (*Eucalyptus camaldulensis*) low woodland, with Broad-leaved Paperbark (*Melaleuca viridiflora*), on fringes of minor watercourses in broad sand sheets	Least concern	Riverine
RE 2.3.55d	Seasonal swamp (wooded). Broad-leaved Paperbark (*Melaleuca viridiflora*) low woodland in shallow closed depressions on sand sheets	Least concern	Palustrine
RE 2.3.61c	Seasonal swamp (wooded). Coolibah (*Eucalyptus microtheca*) and Broad-leaved Paperbark (*Melaleuca viridiflora*) woodland in closed depressions on alluvial plains	Least concern	Palustrine

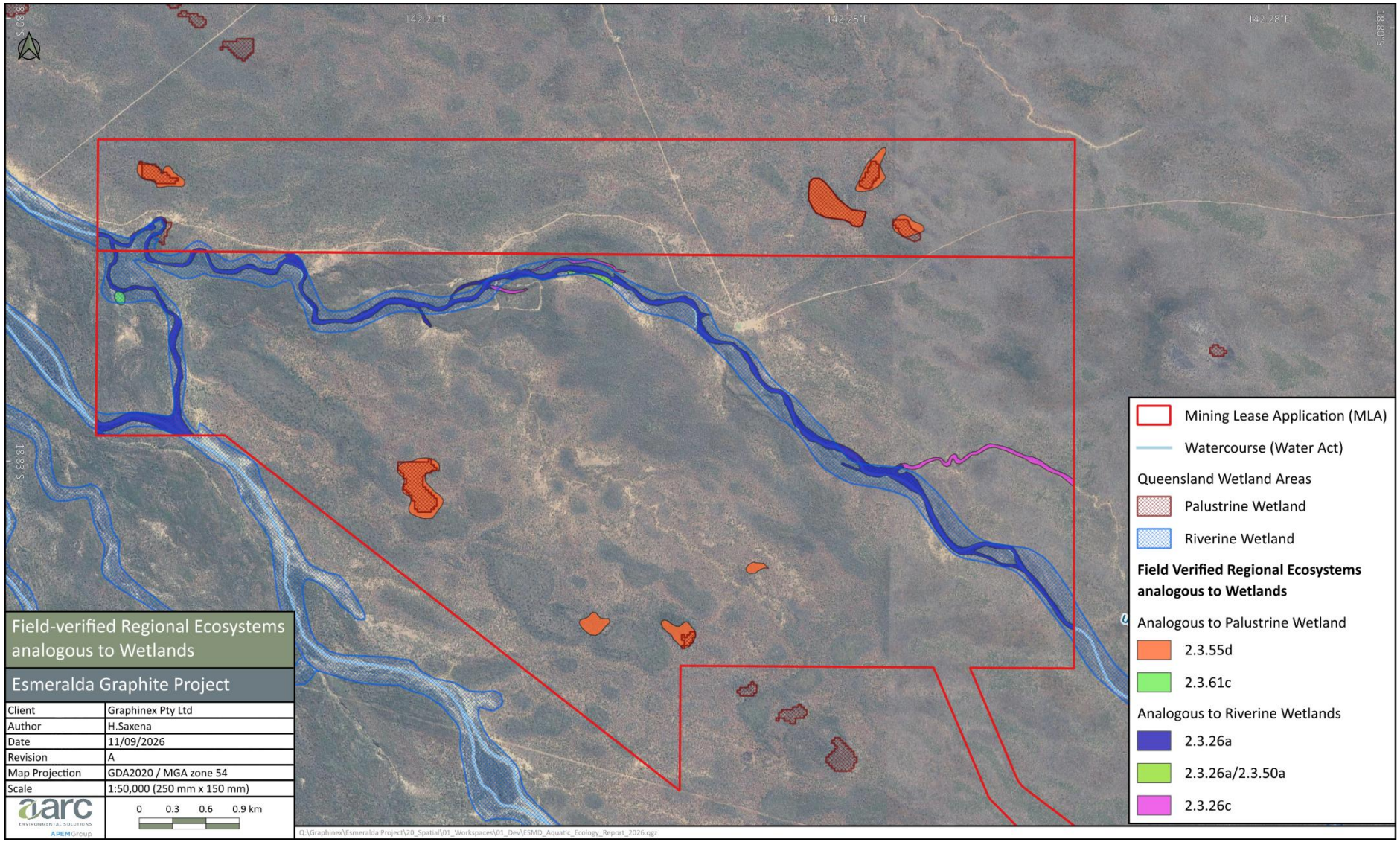


Figure 18-20: Regional ecosystems analogous to wetlands (mining and processing area)

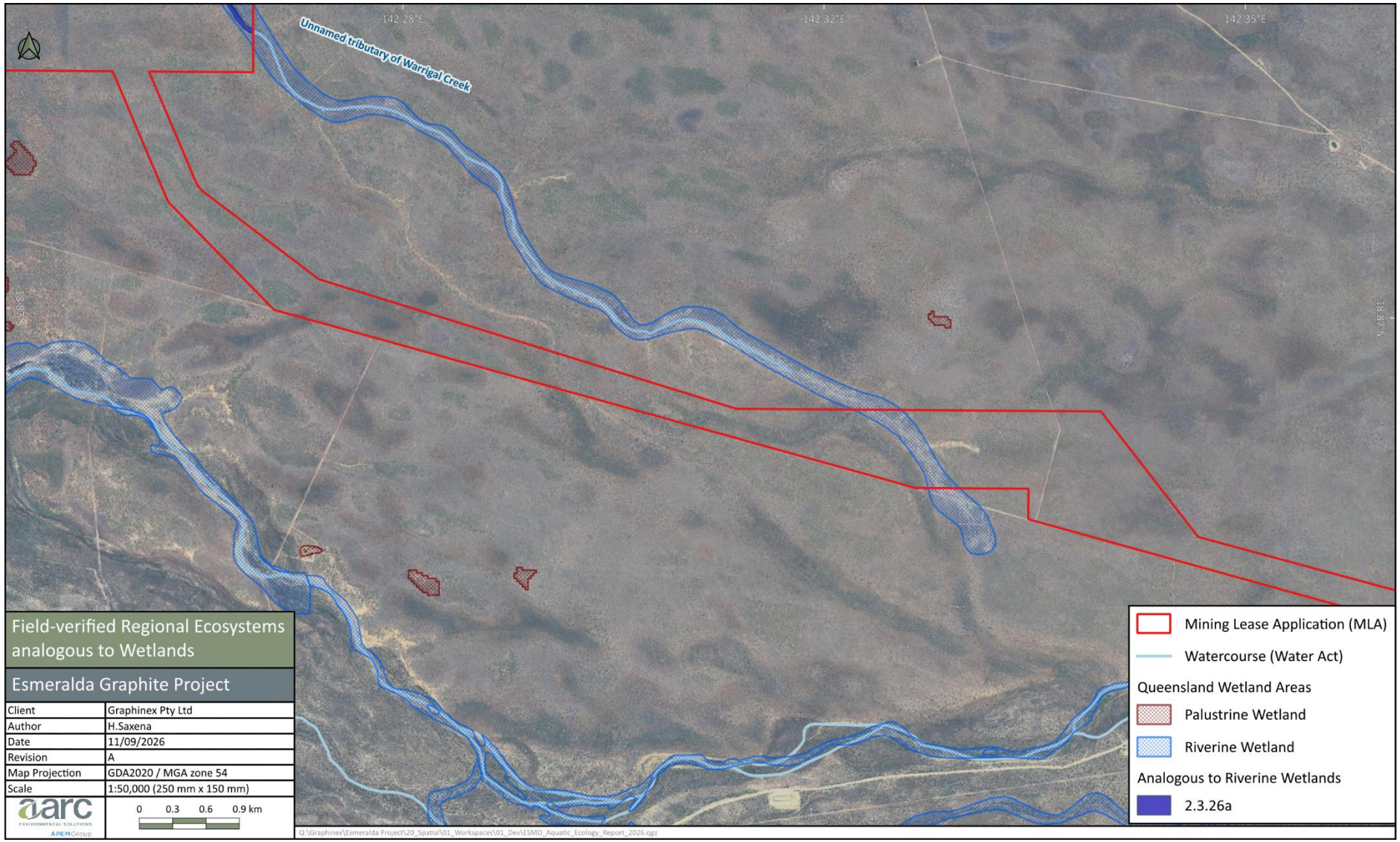


Figure 18-21: Regional ecosystems analogous to wetlands (western transport corridor)

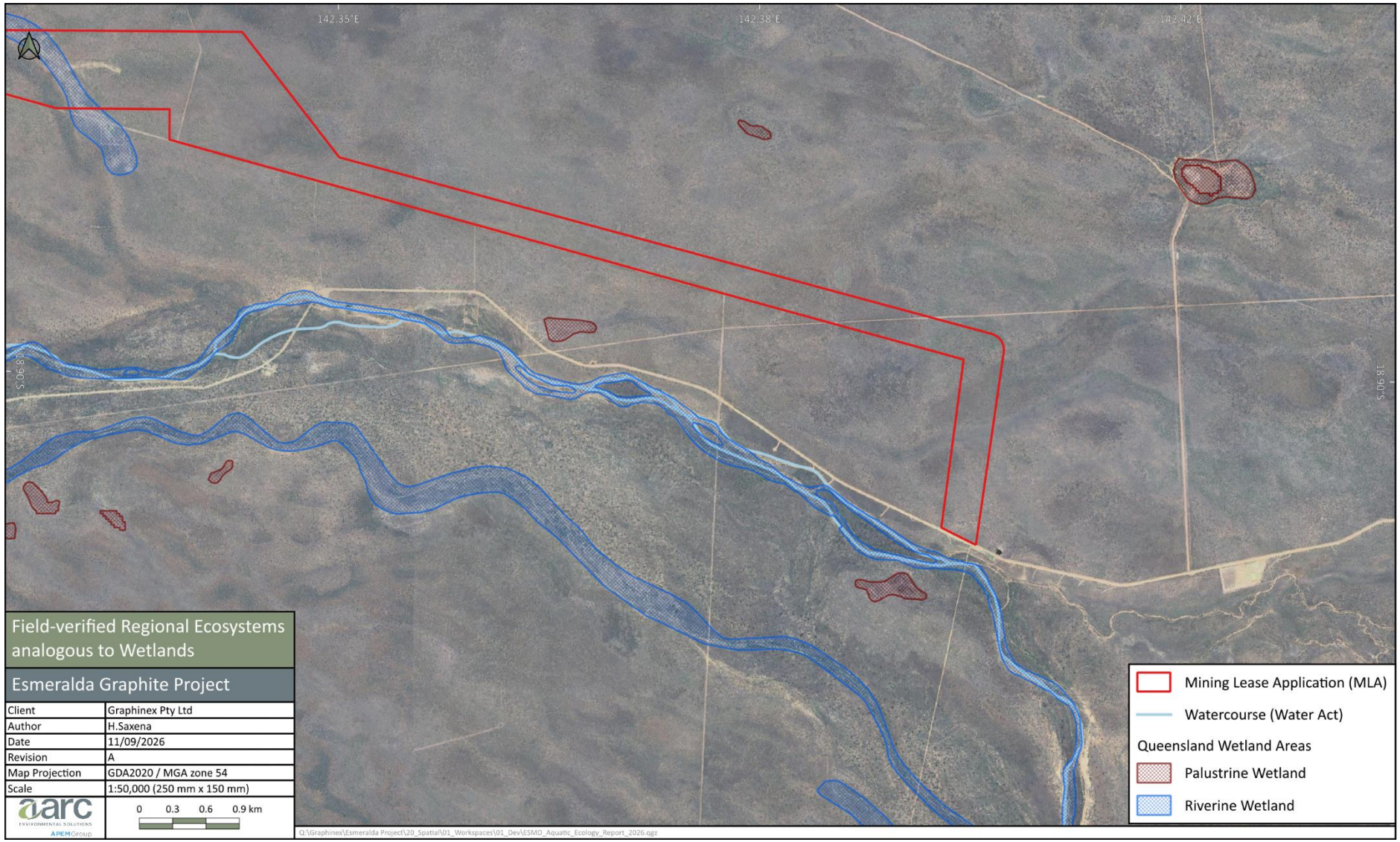


Figure 18-22: Regional ecosystems analogous to wetlands (eastern transport corridor)

Surface water quality

The surface water quality results were compared to interim water quality objectives considered relevant for interpretation of results. In general, the water quality of the Project area watercourses was consistent with the expectations for a slightly disturbed ecosystem in the region with agricultural land use activities. The water was identified to be elevated compared to some water quality objectives including turbidity, nitrogen, phosphorus, dissolved aluminium, dissolved copper and dissolved silver. These issues are considered to be representative of the natural conditions of the catchment and the influence of existing land use practices.

Stream sediment quality

The sediment quality results were compared to interim sediment quality objectives considered relevant for interpretation of the results. All results were within the objectives, indicating no existing impacts to sediment quality for the catchment. Particle size assessment results showed stream sediment was generally composed of sand. Most sites recorded little silt or clay, the maximum proportion of silt and clay at a site was approximately 20% at site W5 on Warrigal Creek.

Aquatic macroinvertebrates

Conditions during the surveys allowed collection of macroinvertebrates at all each targeted site, however, at all but one site, only stream edge habitat was suitable for sample collection. The macroinvertebrate assemblage across the Project area was generally consistent with an ephemeral aquatic ecosystem in the Norman River sub-basin. The analysis of the results included the following:

- Total abundance of macroinvertebrates ranged between 16 and 85 individuals, with Warrigal Creek generally recording fewer individual macroinvertebrates than the unnamed tributary.
- Taxonomic richness ranged between 16 and 5 taxa, with Warrigal Creek generally recording fewer taxa than the unnamed tributary.
- The Plecoptera, Ephemeroptera, and Trichoptera taxonomic richness was very low, with only two individuals of these taxa recorded in the survey. This result could indicate poor water quality however it is noted that no substantial poor water quality results were identified. Therefore, the low richness of these taxa is considered indicative of naturally harsh conditions.
- Weighted SIGNAL2 scores ranged between 2.5 and 5.1, which is considered to be low and indicates that the macroinvertebrate assemblage is not representative of favourable water quality conditions. Given no substantial nature of the catchment.
- The tolerant taxa index result ranged between 50% and 73%, where a high proportion of tolerant taxa indicates unfavourable conditions or water quality. This result is considered to be consistent with the other macroinvertebrate results and indicative of an ephemeral catchment with potentially harsh physical conditions.
- An assessment of the SIGNAL2 score against the taxonomic richness identified that compared to general expectations the macroinvertebrate communities of the survey sites are consistent with a catchment potentially affected by poor water quality. Given no substantial poor water quality results were recorded, the harsh physical environment and ephemeral nature of the catchment is considered to be limiting the SIGNAL2 score and taxonomic richness.

18.5.2.5 Aquatic flora and fauna

No aquatic flora or fauna species listed as threatened under the EPBC Act or NC Act were identified during the aquatic ecology survey.

The aquatic flora species encountered were common emergent macrophyte species, two semi-aquatic sedges, Cyperus sp. and Juncus sp. across the aquatic survey sites. The lack of both diversity and abundance

of aquatic plants at some sites is likely indicative of harsh physical conditions, cattle grazing and trampling, or a combination of these factors.

No fish were recorded through the targeted fish survey methods, noting that conditions were unsuitable for fish trapping at most sites at the time of the survey. Unidentified fish species were opportunistically observed at site W7 during the macroinvertebrate survey.

No aquatic flora and fauna of conservation significance were identified in the Project area, and the flora and fauna present are not considered representative for the general region and not sensitive to change.

18.5.3 Groundwater dependent ecosystem ecology

The Bureau of Meteorology GDE Atlas (BOM, 2025) classifies the riparian corridors of Warrigal Creek, Borer River to the south, and the unnamed tributary (all occupied by RE 2.3.26a) as moderate potential aquatic GDEs. Several circular wetland features scattered throughout the proposed MLA, identified as RE2.3.55d and a patch of RE2.3.61, are also classified as low potential aquatic GDEs (Figure 18-23).

Potential terrestrial GDEs are mapped largely to the south of Warrigal Creek, with scattered occurrences throughout the proposed MLA, represented as a mix of high, moderate, and low potential GDEs (Figure 18-23).

The nearest springs are approximately 28 km north-east; and approximately 32 km north-east of the proposed MLA (DCCEEW, 2023), with a much broader spread of EPBC listed springs occurring more than 50 km from the Project area (Figure 18-24). The risk of impact to these springs is considered minimal due to their distance from the Project disturbance area.

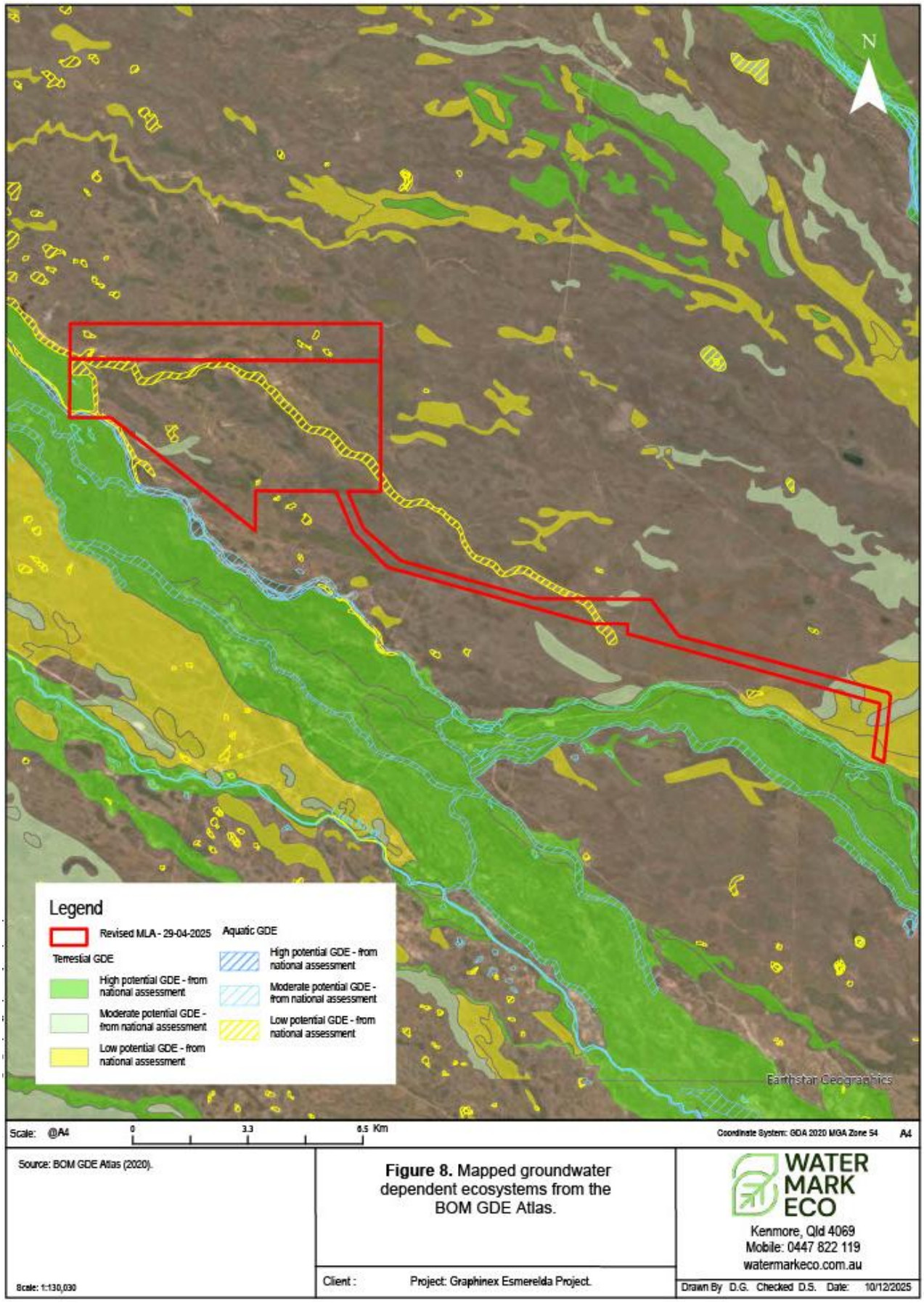


Figure 18-23: Groundwater dependent ecosystem mapping; GDE Atlas (BOM, 2025)

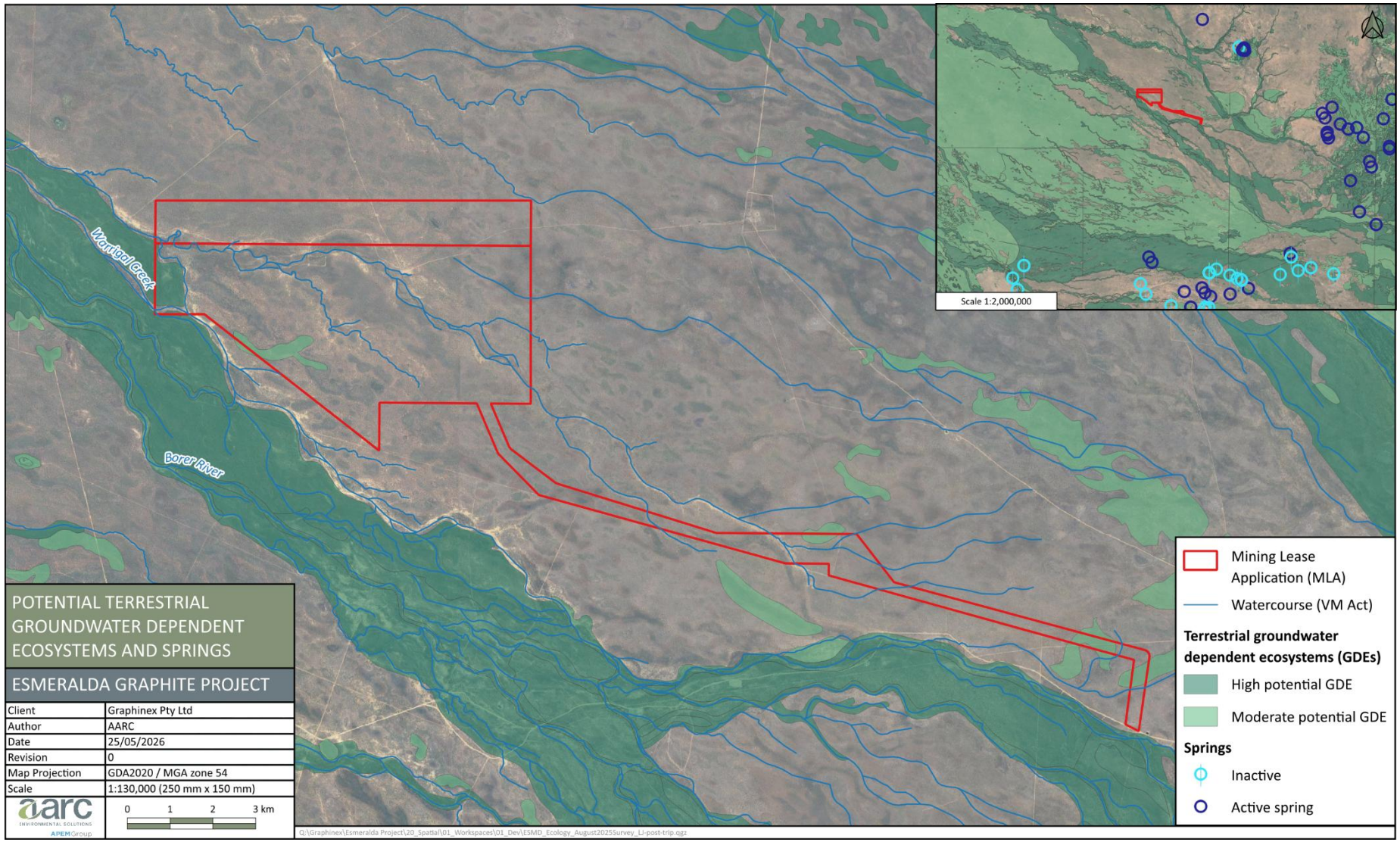


Figure 18-24: Potential terrestrial GDEs and springs

18.5.3.1 Leaf water potential

When measured before dawn, Leaf water potential (LWP) indicates the water availability to trees at each assessment site and whether trees are tapping saturated zones of the soil profile where water is freely accessible or utilising moisture that is more tightly bound to soil particles. It is a function of soil water availability, evaporative demand, and soil conductivity.

The results indicate that only a limited number of survey localities have the potential to be groundwater-supported, which includes RE2.3.26a/2.3.26c at site ES2 and ES9, as well as RE2.3.55d at site ES7. There are, however, several factors suggesting that the vadose zone rather than groundwater supports the moisture requirements of vegetation at these sites, and more broadly across the landscape, including:

- LWP values for many trees sampled from a range of habitats, including both riparian and eucalypt woodlands, are consistently strongly negative, suggesting that woody vegetation is reliant on soil moisture from unsaturated portions of the soil profile.
- There is a consistent overlap between LWP and soil moisture potential (SMP) for all augers sampled, including the deeper auger profile at ES7_AU1. The consistent overlap between LWP and SMP indicates that soil moisture in the unsaturated regions of the soil profile, supported transpiration at the time of sampling.
- Groundwater monitoring bores installed into the Claraville Beds are consistently unsaturated to depths below 10 mbgl. Groundwater was intersected in deeper aquifers of the Gilbert River Formation, rising to ~7 mbgl under sub-artesian pressure. There was, however, no physical or biophysical evidence from LWP and SMP that this sub-artesian groundwater was being expressed at the surface or interacting with the tree root zone to any degree.
- Stable isotope values at all sites and across all landforms suggests that terrestrial vegetation is using soil moisture to support transpiration. There is no isotopic or biophysical evidence that groundwater is supporting vegetation across the site to any degree.

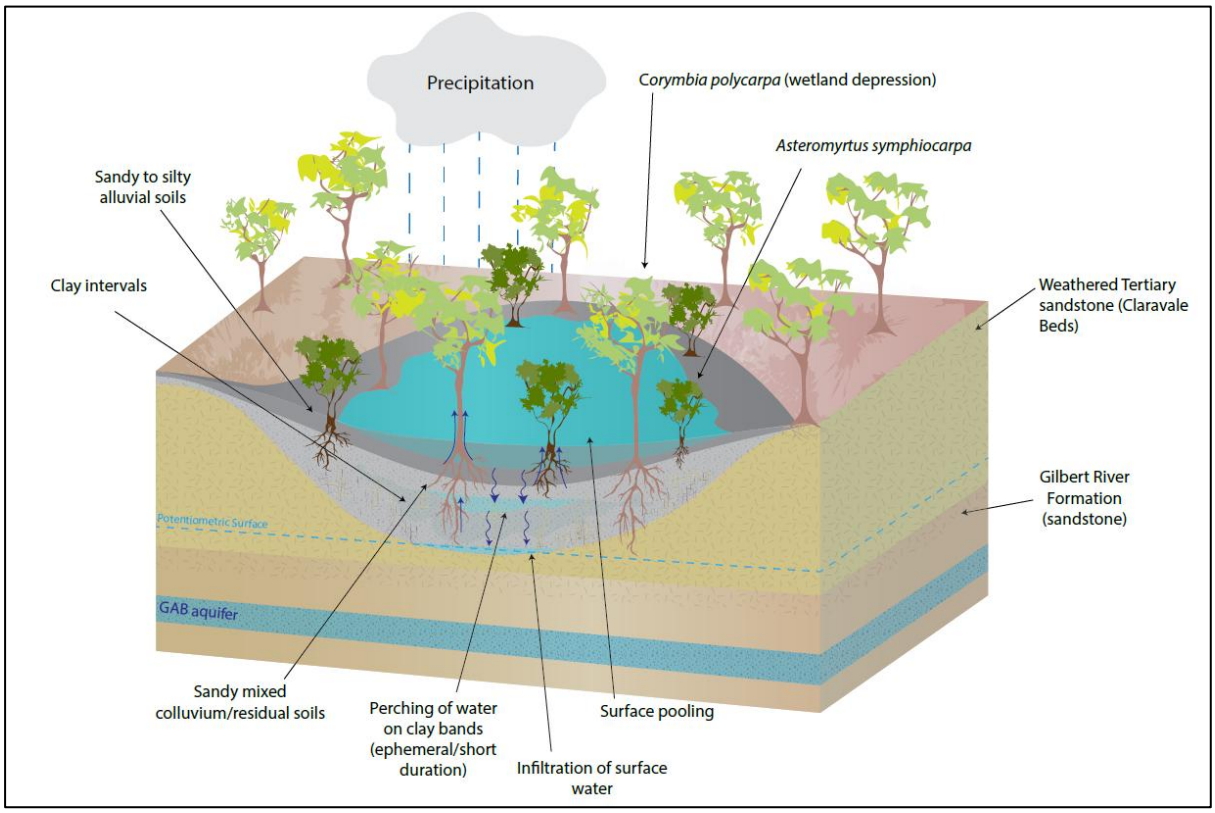
18.5.3.2 Ecohydrological models for Project area wetlands

Ecohydrological models have been developed for riparian ecosystems (RE2.3.26a) and wetland depressions (RE2.3.55d) in the Project area, conceptualising the sources of moisture for woody vegetation on a seasonal basis. Figure 18-25 presents the model for the wetland depression; and Figure 18-26 presents the riparian ecosystem.

Wetland depressions

The soil auger profile (ES7_AU1), constructed in the swamp wetland depression, indicates a deep soil profile down to 6.6m, including intervals of clayey and silt-sand. During the wet season (Figure 18-25) following significant precipitation, surface water fills the wetland depression, infiltrating the wetland surface through mechanisms of both 'preferential' (rapid infiltration along fractures) and 'piston' (slow uniform seepage through soil pores) flow. During this process, the infiltrating surface water may be impeded by clay-rich layers, potentially forming ephemeral zones of saturation wherever these layers occur in the soil profile. Because moisture infiltration is slowed rather than captured, these ephemeral zones of saturation do not represent groundwater, and these wetland features are unlikely to be GDEs. During drier periods, the clay-rich horizons sustain elevated soil moisture content longer than the sandier intervals, extending the availability of soil moisture to support transpiration as the climate dries.

The representation of the Great Artesian Basin (GAB) aquifer hosted in the Gilbert River Formation (quartz sandstone) in Figure 18-25 is conceptual, based on data from recently constructed groundwater monitoring bores. While the inference is that this aquifer is under sub-artesian pressure with a potentiometric surface at ~seven mbgl, there is no evidence from deep auger profiling that groundwater is rising into the root zone of woody vegetation at any of the sample locations, nor is there evidence of groundwater discharge into drainage channels.



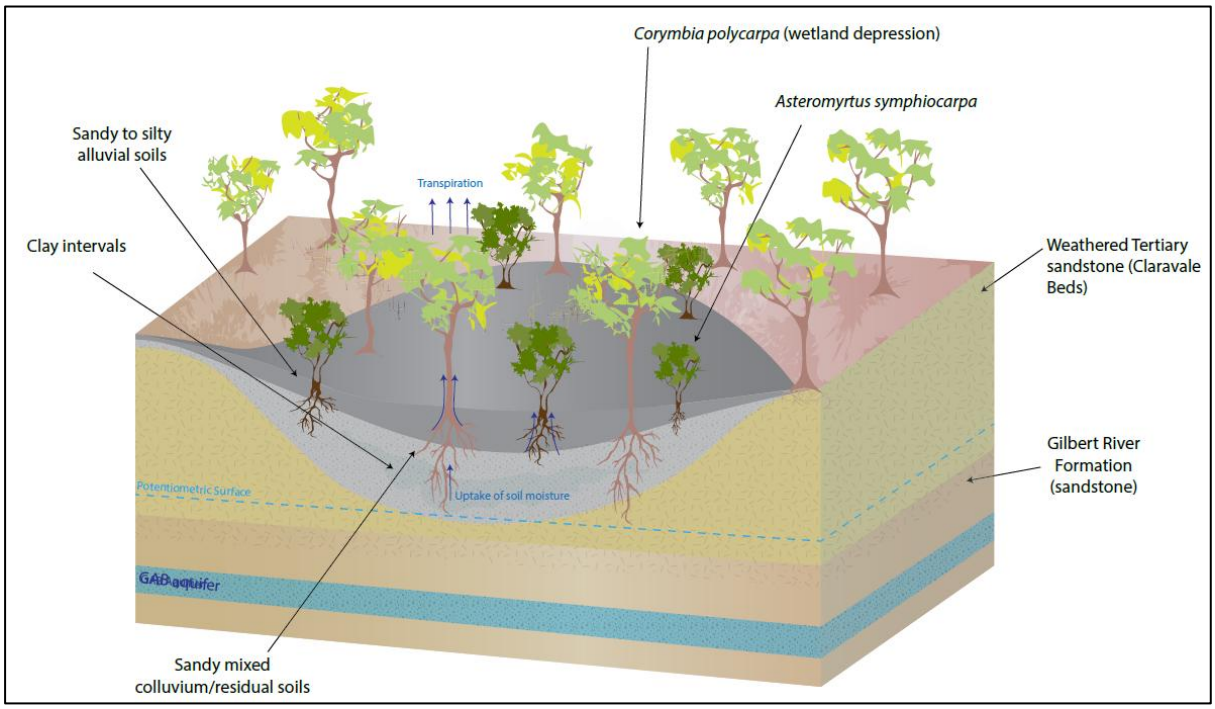


Figure 18-25: Ecohydrological conceptualisation of a swamp wetland depression (RE 2.3.55d) during the wet season (above) and dry season (below)

Riparian ecosystems

Braided channels are often prominent in ephemeral drainage systems, with the channel defined by a shallow mantle of coarse fluvial sand that rests upon weathered sedimentary basement (Claraville beds). A narrow and discontinuous low alluvial terrace fringes the sandy channel, confined by weathered basement on the outer

margins of the terrace. The fluvial sand may have small islands stabilised by *Melaleuca fluviatilis*, a dominant riparian species on the stream banks and channels, interspersed with scattered *Eucalyptus camaldulensis*.

During wet season flows, these fluvial sands are fully saturated, with surface water receding into the sand as surface flows diminish, perched on the weathered basement rock (Figure 18-26). There is likely to be some minor infiltration into basement rock fracture zones and areas of more intense weathering. Because of the conceptualised perched layer, riparian vegetation utilising groundwater in the channel sands would be consistent with the definition of a terrestrial GDE. Groundwater use, however, occurs on a seasonal basis following surface flows and attenuates as the climate dries and shallow groundwater volumes diminish through evapotranspiration (Figure 18-26).

LWP data collected during the assessment indicate that moisture availability is variable along the riparian fringe in drier periods and likely depends on several factors, including:

- The duration and volume of surface flows;
- The depth of the fluvial sand influences the volume of perched groundwater;
- The intensity of weathering and fracturing in the sedimentary basement below the fluvial sand influences the degree to which moisture can infiltrate along fracture zones; and
- Whether a flood event is associated with overbank flow, which influences bank storage within alluvial terraces.

Evidence from the field survey indicates that perching of water in the fluvial sand is ephemeral, lasting only for a few days or weeks following recharge. Hence, any groundwater use is likely to be similarly fleeting, with moisture use rapidly transitioning to utilisation of residual moisture within rock fractures and wet sand grains, which persist as shallow groundwater diminishes. There is no evidence that suggests riparian vegetation interacts with deeper groundwater systems associated with the GAB, which are not connected to the perched groundwater systems associated with ephemeral watercourses.

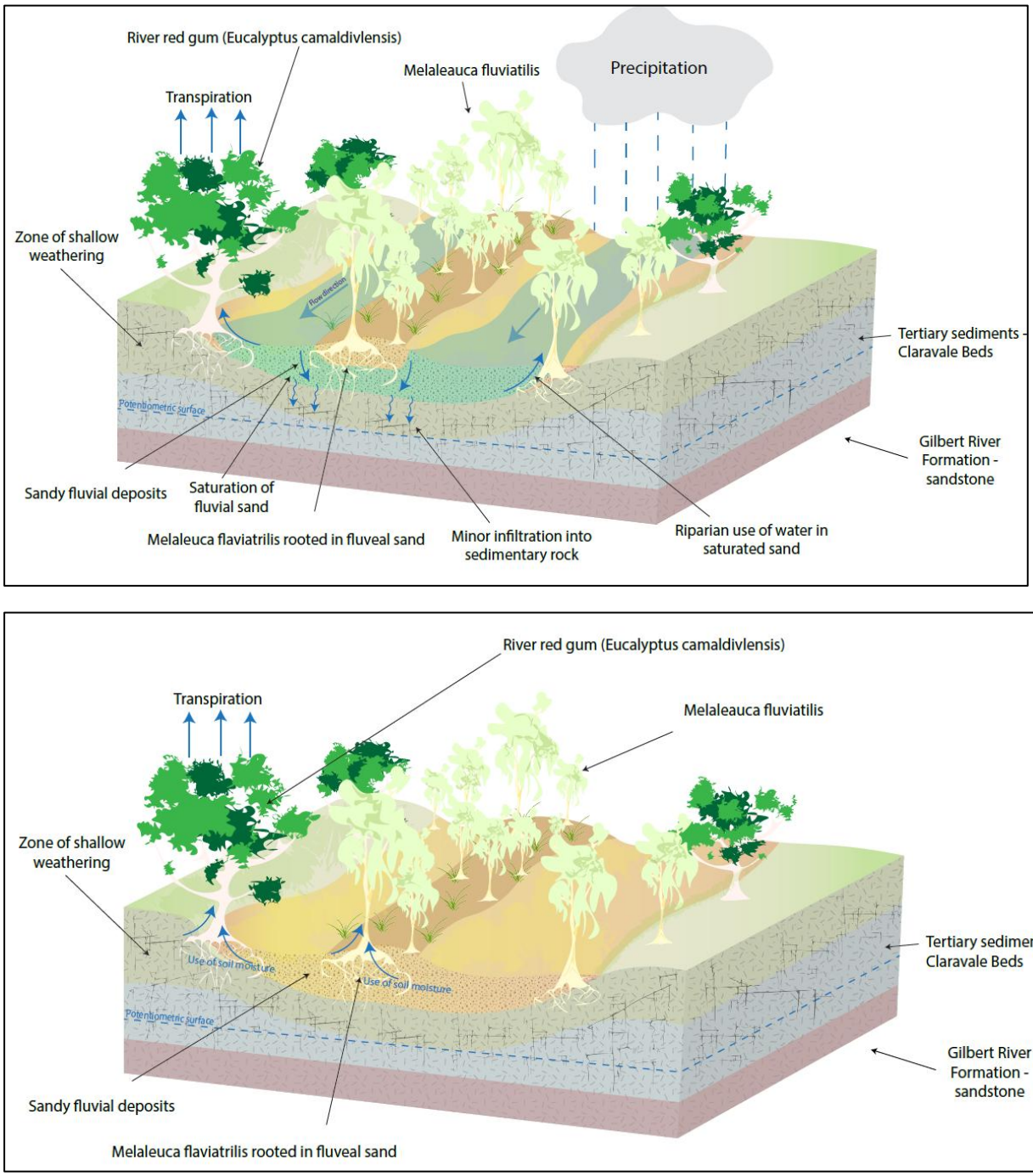


Figure 18-26: Ecohydrological conceptualisation of an ephemeral flood channel system (RE 2.3.26a) during the wet season with saturation of the channel sand (above), and the dry season where moisture usage is restricted to residual moisture in fluvial sand and rock fractures

18.5.3.3 Results summary

During a dry season assessment under optimal seasonal conditions, there is no evidence that woody vegetation is reliant on groundwater to any degree to support transpiration. Additional conclusions include that:

- The dry-season moisture required to support transpiration in woody vegetation is supplied entirely within the vadose zone across all habitats sampled. Some habitats, including swamp wetland depressions (RE2.3.55d) and ephemeral flood channel habitats (RE2.3.26a), retain moisture for longer into the dry season by capturing surface flows and facilitating moisture infiltration. Moisture availability in these habitats declines as soil moisture reserves diminish under drier climate conditions.

- The wet-season ponding of surface water in swamp wetland depressions facilitates deep infiltration into the soil profile. Ephemeral zones of saturation may occur when infiltrating surface water is intercepted by clay soil horizons, though the saturation is fleeting and does not meet the definition of groundwater. The ecohydrological function of these swamp wetlands does not align with the definition of a GDE.
- In ephemeral drainage lines, wet-season recharge of fluvial sands facilitates the perching of shallow groundwater, hosted in channel sand deposits, on impermeable basement rock. Woody vegetation usage of this perched groundwater suggests that these watercourses represent GDEs when perched groundwater is present. Perched groundwater rapidly diminishes as the climate dries, and riparian woodlands become solely reliant on soil moisture held in the vadose zone.
- The recent installation of groundwater monitoring bores indicates a deeper groundwater zone, hosted in the Gilbert River Sandstones, inferred to be a Great Artesian Basin aquifer. This groundwater is under sub-artesian pressure, with a potentiometric surface at ~7 mbgl. There is no indication from biophysical assessment that this deeper groundwater interacts with the rooting zone of woody vegetation.

18.5.4 Stygofauna

18.5.4.1 Stygofauna absence

No stygofauna were recorded from any of the 11 bores assessed for stygofauna in the study area. It is noted that the nearest known stygofauna records are from Chillagoe in limestone strata, 290 km to the north-east of the Project and Lawn Hill, 430 km to the west (*Queenslandnella spinosa*) (Appendix F Stygofauna assessment). Both of those records were in or near limestone strata.

18.5.4.2 Groundwater physico-chemistry

The aquifer appears to go dry for long periods of time, so it is unlikely to be habitat for stygofauna. Most water quality variables were suitable for stygofauna, although temperature and pH were potentially high. Groundwater temperature was between 31.6 and 34.0 °C. pH was between 8 and 9 for all bores except ROWE1, which measured 7.88. Electrical conductivity was low and less than 1.3 mS/cm in most bores. Three of the production bores, ROWE2, ROWE1 and Pelican bore, had EC greater than 2. Dissolved oxygen was lowest in the monitoring bores, being between 7.4 and 27.2% Saturation for 6 of the monitoring bores, and 41.2% Saturation for EMSB01. Dissolved Oxygen Concentration was greater than 30% Saturation for all production bores except NW Bore, which was 19.8% Saturation.

18.5.4.3 Aquifer suitability

The sandstone of the Gilbert River Formation is considered unsuitable for stygofauna, unless it was sufficiently fractured to allow stygofauna movement through the network of cracks and fissures. The extent of fracturing in the Gilbert River Formation at the project location is not known, although it is likely to be greatest near the top of the formation or at fault zones. Without fracturing, the sandstone would lack habitable pore space for stygofauna, and there would be insufficient connectivity with the surface to sustain groundwater food webs.

18.6 Potential impacts

The proposed Project development comprises three Project stages:

- Stage 1– project construction;
- Stage 2– Mining and processing (ramping up to full production by 2030 - 3.5 Mtpa);
- Stage 3– Mid-grade ore stockpile reclaim (plant feed from stockpiles after pit depletion; and
- Final site rehabilitation and monitoring.

The potential Project impacts on terrestrial and aquatic ecological values, GDEs and stygofauna and the proposed measures developed to avoid, mitigate and manage those impacts, are described in Sections 18.6.1 to 18.6.6.

18.6.1 Direct impacts

18.6.1.1 Vegetation clearance and habitat disturbance

The Project Area is entirely covered by remnant vegetation, so clearing remnant vegetation is unavoidable; however, the Project design considered the environmental constraints identified in the area, and the layout has been designed to occupy the minimum feasible area for safe and productive operations. Up to 2,413.7 ha of remnant vegetation would be cleared within the Project disturbance area to facilitate project development.

An alternative Project layout and disturbance extent was presented as part of the Project initial advice statement (IAS) submission to the Office of the Coordinator General on 2 July 2025. This included a larger area of maximum disturbance in the main production area, and a variation in general infrastructure layout. The total Project disturbance area for the IAS disturbance extent was approximately 3,042 ha. The Project disturbance area of the EIS Project is 2,413.7 ha. The layout as presented in the IAS would have had a larger direct impact on Matters of State Environmental Significance, watercourses, and land. In consideration of this, the Project layout was revised to reduce residual impacts. A comparison of the initial and current Project disturbance extents is presented in Figure 18-27. However, complete avoidance was not considered viable given the location of the resource deposit.

Access to the resource would require permanently diverting a section (approximately 1.8 km long) of the unnamed tributary of Warrigal Creek in the north of the Project disturbance area, where the pit is located. The permanent diversion would be designed and managed in accordance with the 'Permanent Watercourse Diversion design criteria' (DNRME 2019).

Minimisation and mitigation measures were considered where avoidance was not feasible. These measures include siting infrastructure away from riparian corridors and providing buffers where possible, as shown in Chapter 4, Chapter 5, and Figure 18-27. The Warrigal Creek, Clara River and the Yappar River are all located outside of the study area and will not be impacted by the Project.

The Project and its associated linear infrastructure were also sited to take maximum advantage of existing transport infrastructure without causing unnecessary additional disturbance. This analysis resulted in connecting the Project to the existing Esmeralda Prospect Road that then connects to the Flinders Highway via Richmond. Riparian corridors were also an environmental constraint informing the design of the linear infrastructure connecting to the existing road network; the Project design ensures the new road connects to the existing road at a point upstream of a fording of Warrigal Creek, minimising local impacts from transport infrastructure-related habitat disturbance.

The decision to create a permanent creek diversion as opposed to a temporary diversion has also provided several benefits that minimise and mitigate the mine's habitat disturbance impacts. Rehabilitation of the diversion area will be conducted to achieve conditions similar to those of the existing stream. As the rehabilitation of the diverted creek will begin immediately following its creation, prior to Stage 1 of Project development reaching completion, the creek diversion will be set to partially ameliorate some of the indirect impacts of the mine's operation during Stage 2 of Project development, such as habitat fragmentation and connectivity. Choosing a permanent creek diversion also benefits the site's ecological amenity and resilience when rehabilitation and monitoring of the final landform take place during the final stage of the Project's development, as the suite of by then mature ecosystem types will support the local hydrology, soil stability, and seedbank.

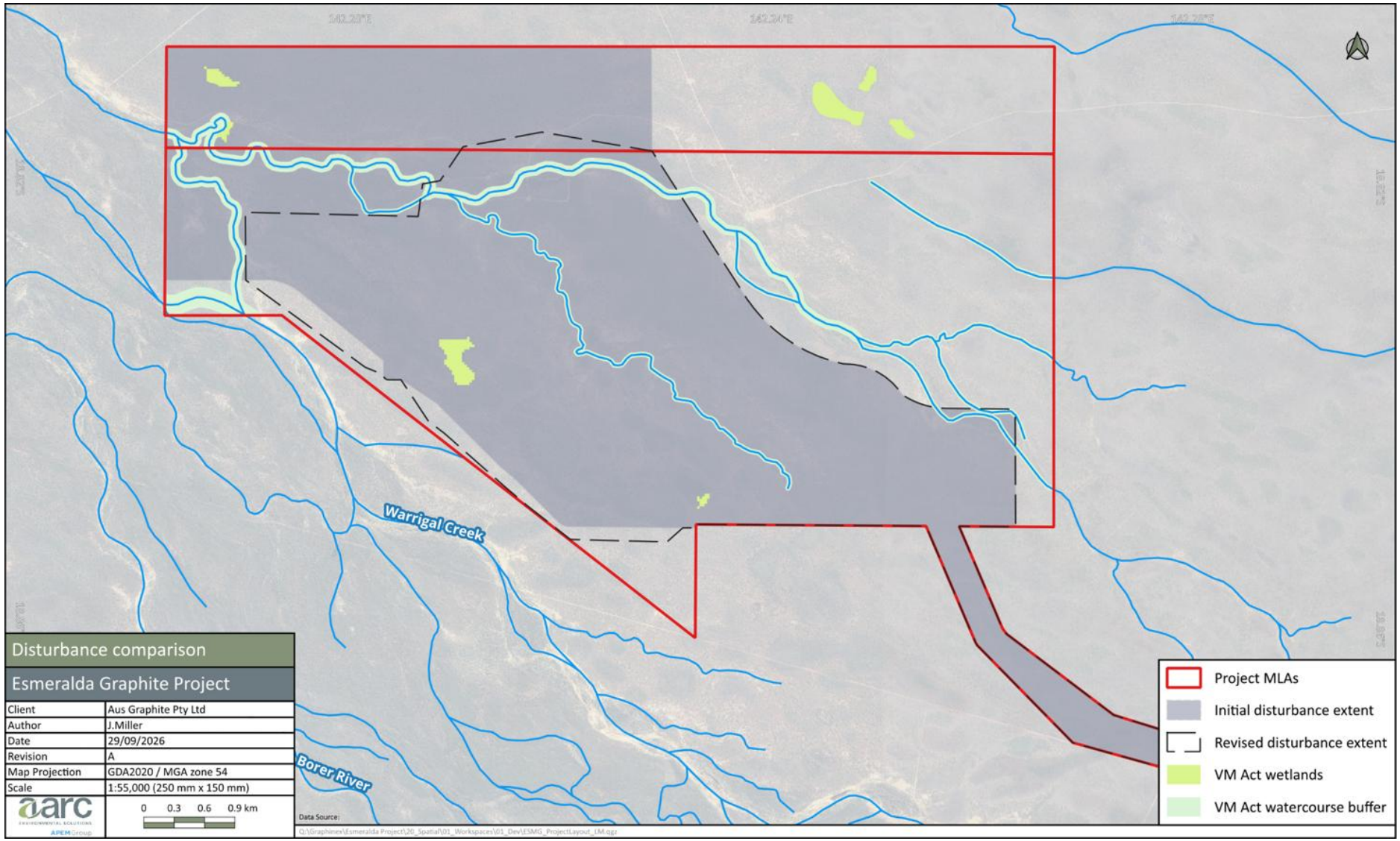


Figure 18-27: Disturbance extent comparison

Creek crossings will be limited to small tributaries traversed by the transport corridor and will be subject to appropriate controls to prevent wider habitat disturbance (DPI 2025). They will be bed-level or low-level crossings, or culvert crossings, to comply with Western drainage basin standards for a green waterway (AARC 2026a). The Project disturbance area in relation to the REs within the study area in Figure 18-28, Figure 18-29, Figure 18-30 and Figure 18-31.

Clearing will occur on an as-needed basis, and only when development will be undertaken soon after. Where practicable, native vegetation within the Project disturbance area may be retained. This will minimise land degradation and serve to maintain ecological processes.

Table 18-8 describes the extent of proposed clearance for each vegetation community in the Project disturbance area.

Table 18-8: Regional ecosystems in the study area and impacted by the Project

RE	Description	Extent within study area (ha)	Area of disturbance (ha)
RE 2.3.22	Long-fruited Bloodwood (*Corymbia polycarpa*) and *Melaleuca* spp. woodland on sandy channels and levees	148.32	37.71
RE 2.3.26a	River Red Gum (*Eucalyptus camaldulensis*) woodland to low woodland, with *Melaleuca* spp., on fringes and in channels of minor watercourses	78.76	21.06
RE 2.3.26a / 2.3.50a	River Red Gum (*Eucalyptus camaldulensis*) low woodland, with *Melaleuca* spp., fringing minor watercourses, with areas of bare sand and rock, and scattered vegetation in channels	1.23	1.23
RE 2.3.26c	River Red Gum (*Eucalyptus camaldulensis*) low woodland, with Broad-leaved Paperbark (*Melaleuca viridiflora*), on fringes of minor watercourses in broad sand sheets	8.67	2.64
RE 2.3.29b	*Melaleuca* spp. low open woodland to low woodland on alluvial plains and drainage depressions	321.28	143.49
RE 2.3.41	Annual tussock grassland on alluvial plains	19.88	11.40
RE 2.3.42b	Coolibah (*Eucalyptus microtheca*) low open woodland to woodland on alluvial plains	45.34	5.31
RE 2.3.55d	Seasonal swamp (wooded). Broad-leaved Paperbark (*Melaleuca viridiflora*) low woodland in shallow closed depressions on sand sheets	48.60	23.13
RE 2.3.61c	Seasonal swamp (wooded). Coolibah (*Eucalyptus microtheca*) and Broad-leaved Paperbark (*Melaleuca viridiflora*) woodland in closed depressions on alluvial plains	0.88	0.00
RE 2.5.14a	Broad-leaved Paperbark (*Melaleuca viridiflora*) low open woodland to low woodland on sand sheets	1,400.12	877.76
RE 2.5.14a / 2.5.17b / 2.3.29b / 2.3.51	Mixed community of *Melaleuca* spp. low open woodland to low woodland on fringes of alluvial plains and sand sheets, with seasonal swamps of River Red Gum (*Eucalyptus camaldulensis*) woodland	12.23	0.00
RE 2.5.17b	Gulbarn (*Melaleuca citrolens*) low open woodland to low woodland on broad sand sheets	1,281.41	675.36
RE 2.5.18a	Rough-leaved Bloodwood (*Corymbia setosa*) low open woodland to woodland on broad sand sheets	104.16	101.80

RE	Description	Extent within study area (ha)	Area of disturbance (ha)
RE 2.5.28a	Long-fruited Bloodwood (*Corymbia polycarpa*) woodland on broad plains of reworked sand deposits	973.57	512.83
Total		4,444	2,413.7

The vegetation within the study area provides terrestrial fauna with opportunities for foraging, breeding, nesting, predator avoidance, and movement between areas. It also facilitates dispersal/migration and promotes genetic diversity by providing connectivity within the broader area. These opportunities could potentially be reduced by clearance activities associated with the Project. Where practicable, the Proponent has efficiently located project infrastructure to avoid and minimise impacts to the woodland communities with connectivity values, such as watercourses.

The Proponent has integrated a buffer zone to its Project disturbance area, ensuring ancillary activities such as vehicle access and mitigation measures such as sediment control or vegetation control for fire risk mitigation can all take place without impacting surrounding riparian and wetland vegetation and their habitat values, connectivity or water quality. This buffer zone also protects vulnerable areas such as the upstream part of the Warrigal Creek tributary that crosses over into the Project disturbance area, further safeguarding vulnerable environmental values.

The proposed maximum disturbance of each major habitat type within the Project disturbance area is in Table 18-9, and illustrated in Figure 18-32 and Figure 18-33.

Table 18-9: Extent of major habitat types in the Project disturbance area and the study area

Major habitat type	Extent within the study area (ha)	Area of disturbance (ha)
Eucalypt woodland along creeks	282.33	67.95
Paperbark woodland	3,015.03	1,696.62
Annual tussock grassland	19.88	11.40
Corymbia woodland on sand plains	1,077.74	614.63
Seasonal swamp	49.48	23.13
Total	**4,444**	**2,413.73**

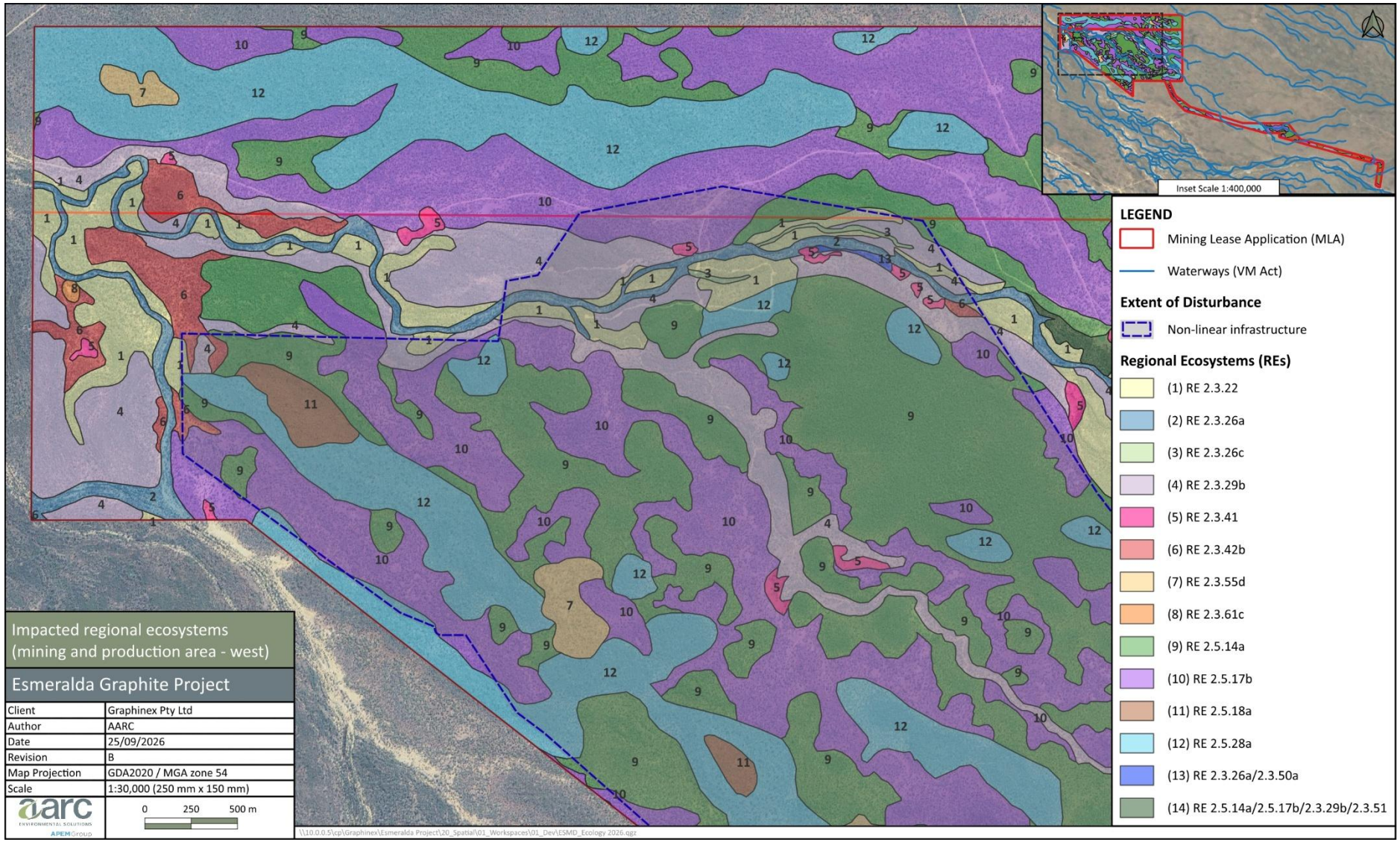


Figure 18-28: Regional ecosystems and extent of disturbance (mining and production area - west)

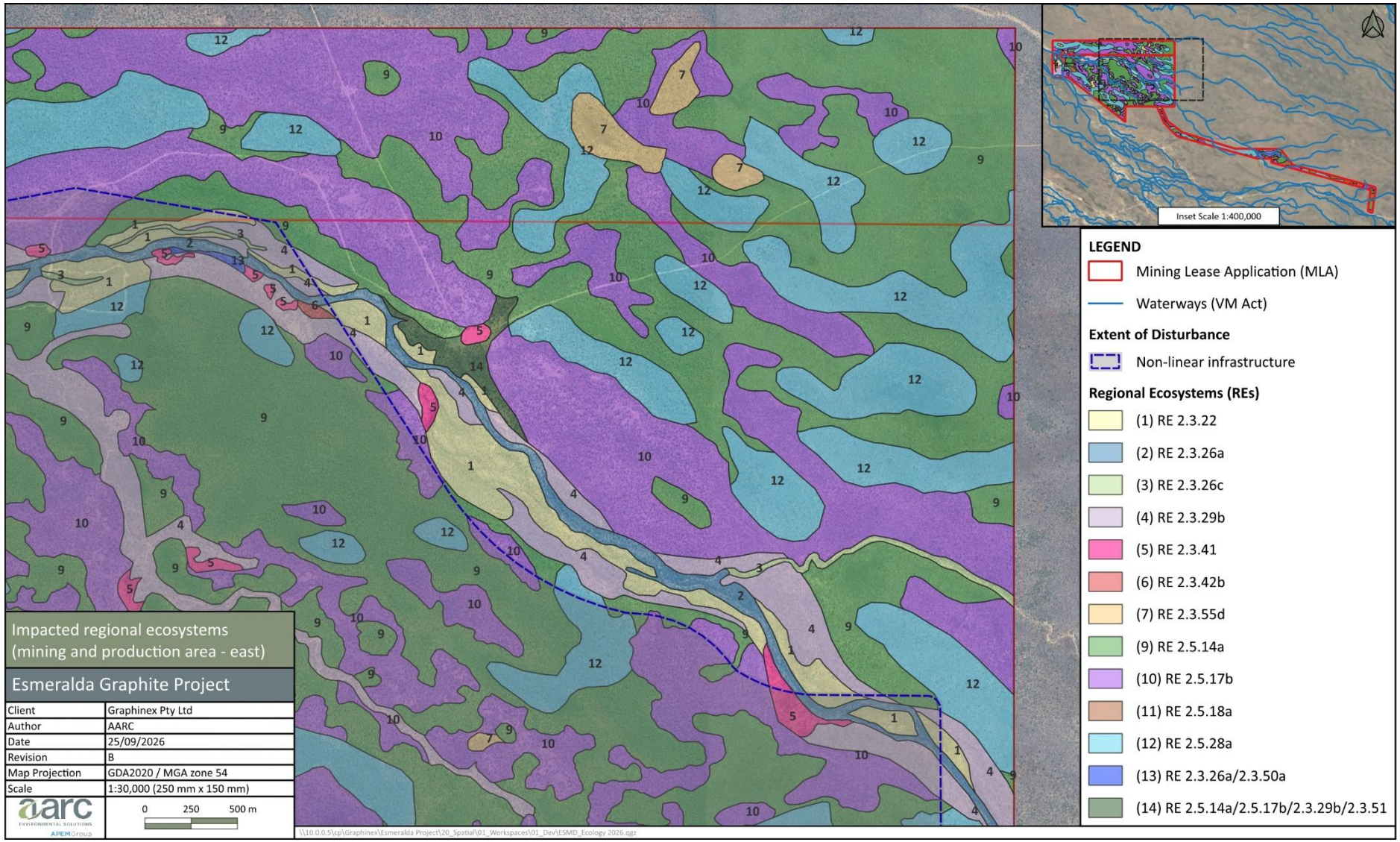


Figure 18-29: Regional ecosystems and extent of disturbance (mining and production area - east)

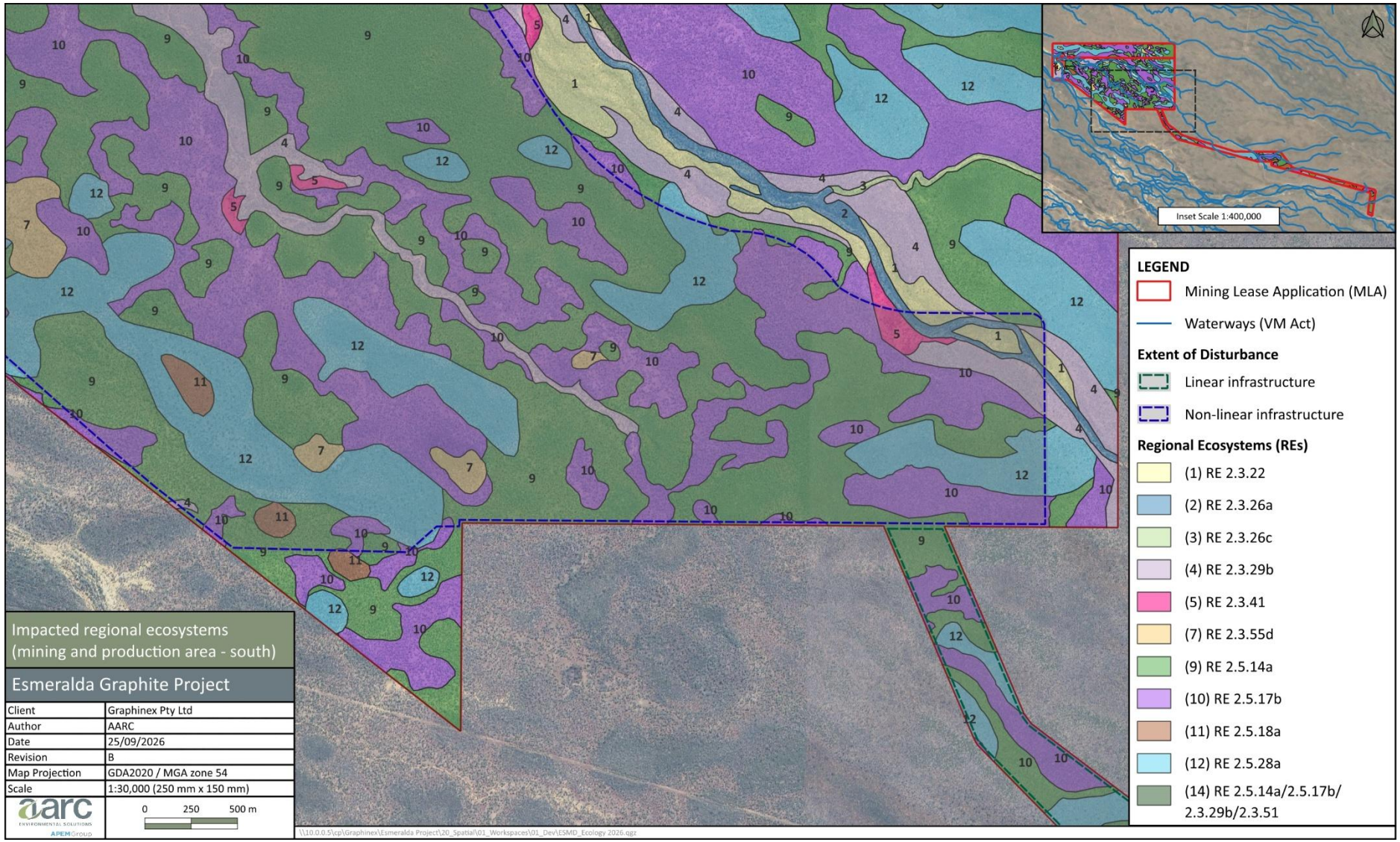


Figure 18-30: Regional ecosystems and extent of disturbance (mining and production area - south)

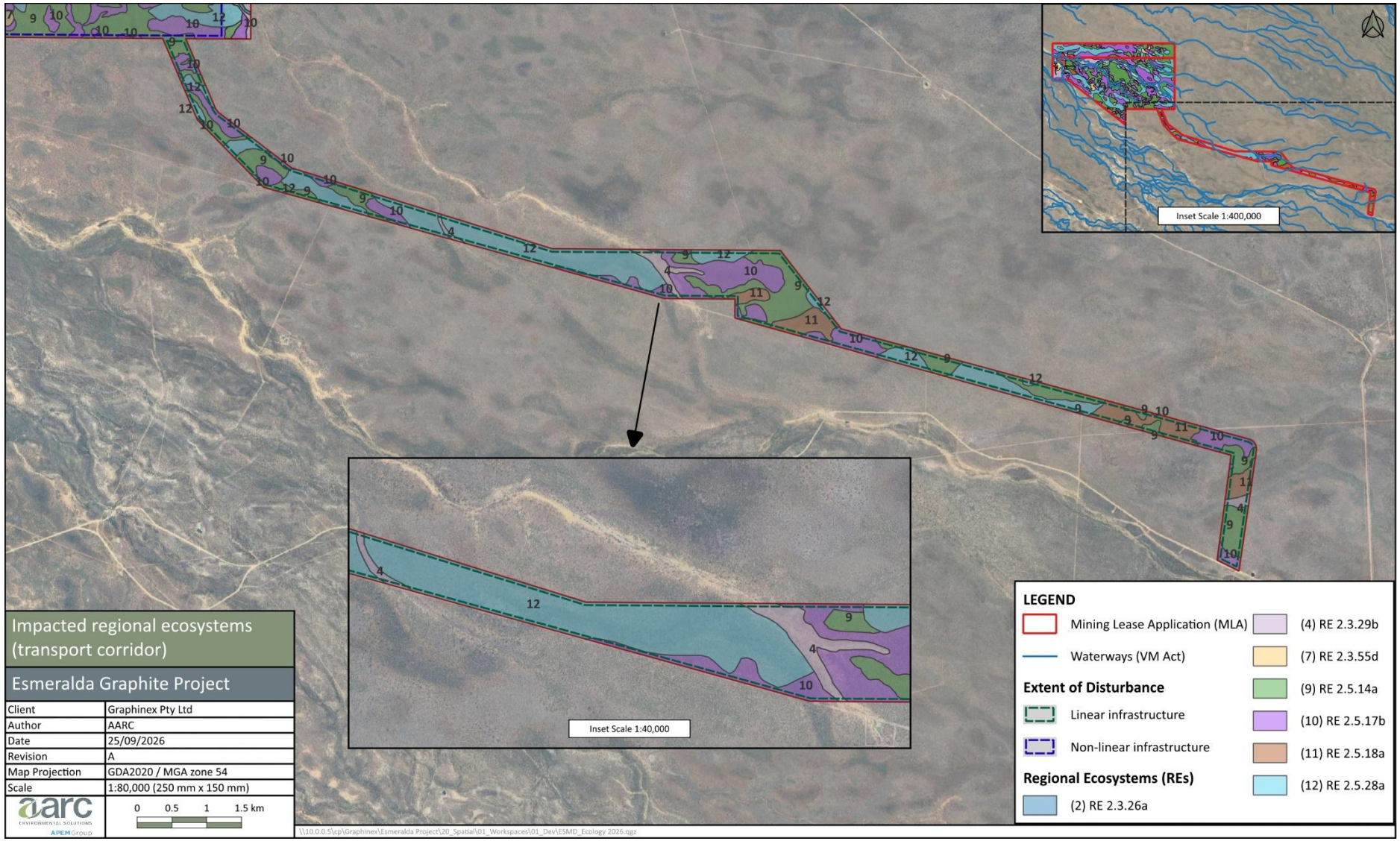


Figure 18-31: Regional ecosystems and extent of disturbance (transport corridor)

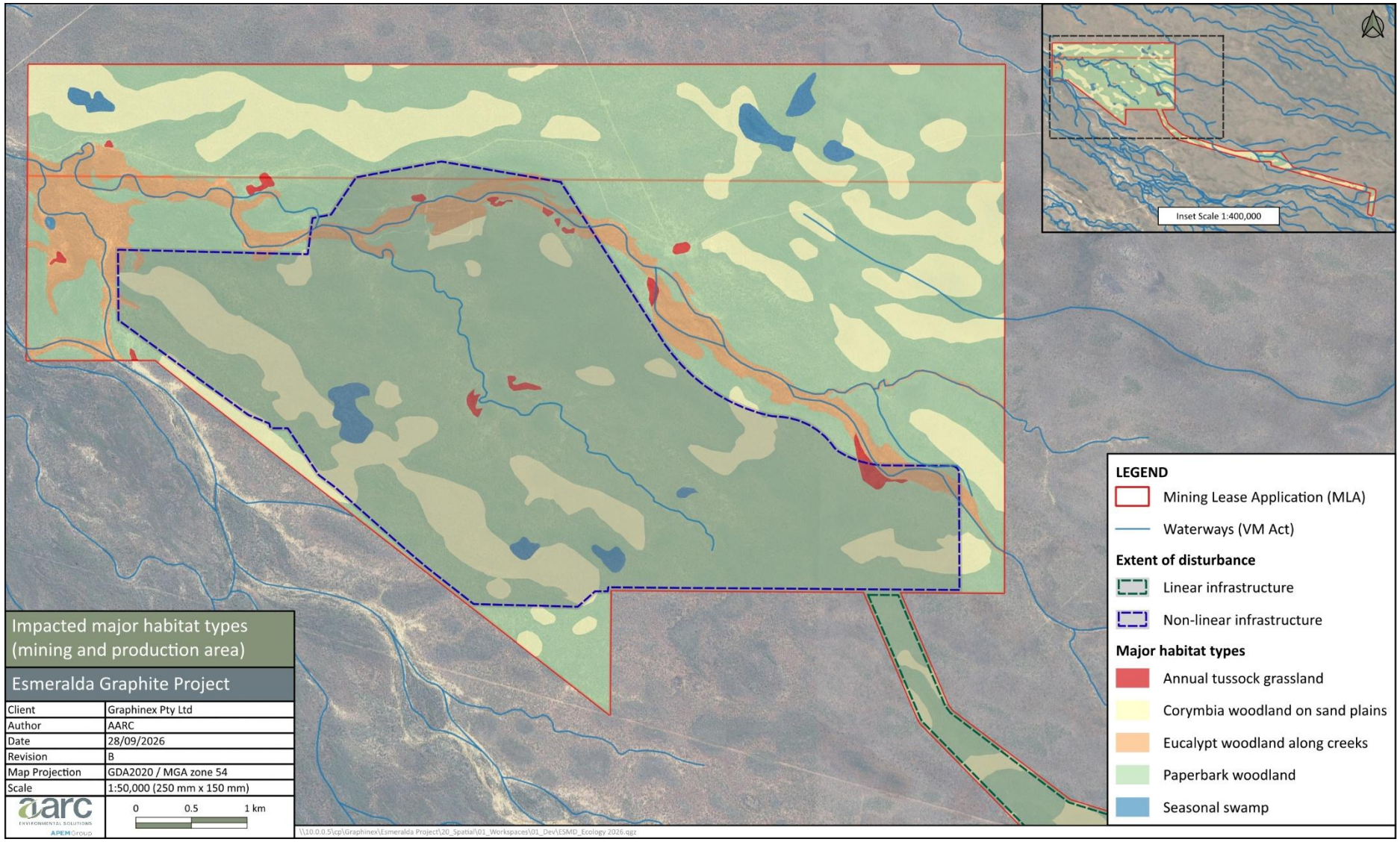


Figure 18-32: Major habitat types and extent of disturbance (mining and production area)

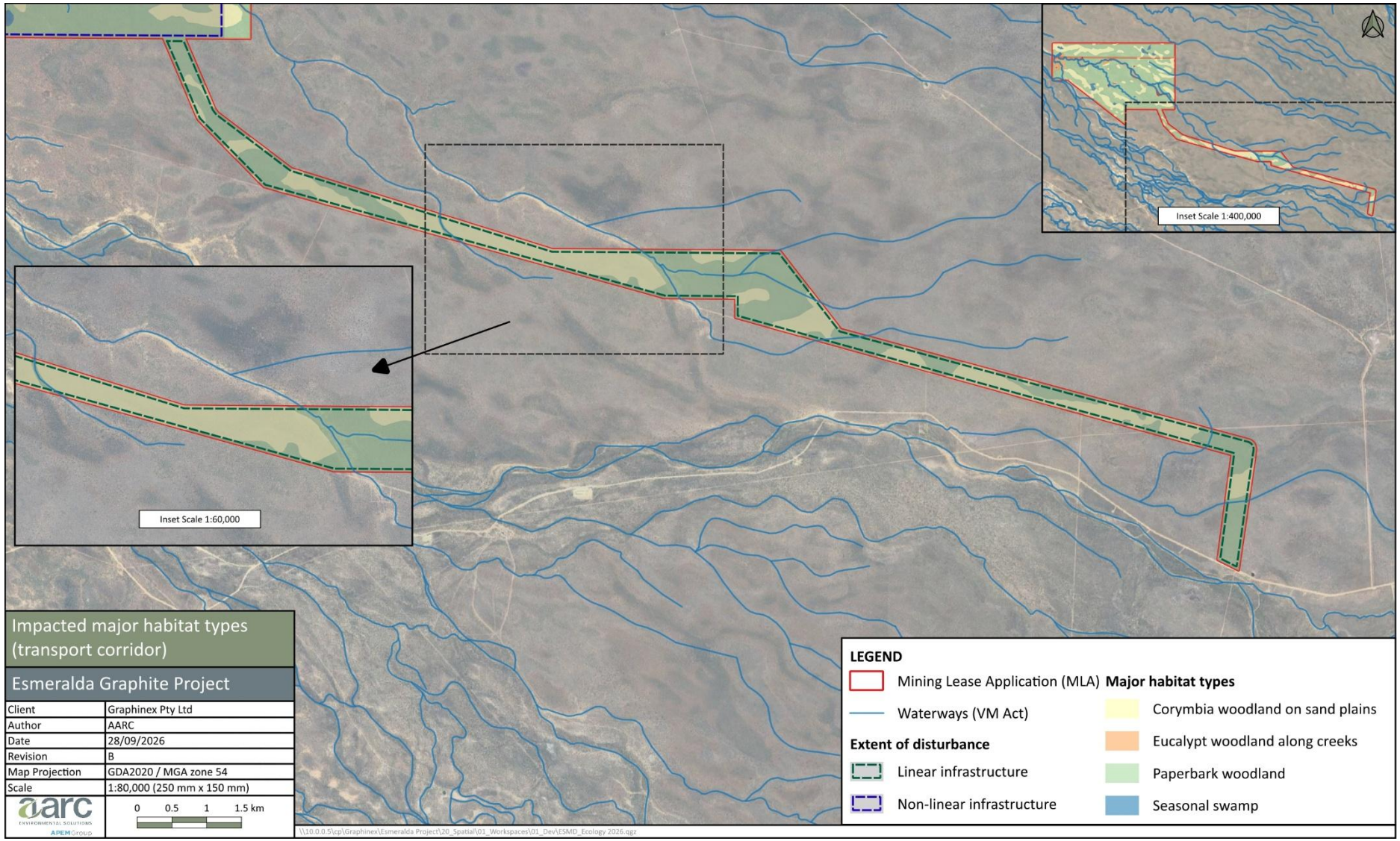


Figure 18-33: Major habitat types and extent of disturbance (transport corridor)

18.6.1.2 Modification of watercourses or wetlands

The Project infrastructure has been sited to consider aquatic values of the environment with the aim of providing safe operations, while minimising impacts to these values. Project infrastructure location has been designed such that direct impacts environmental values has been avoided. However, the target resource is located such that its recovery requires that the open-cut pit to access the resource requires direct impact to a waterway. The location of the pit in relation of the waterway requires the development of associated flood management structures such as levees and the permanent diversion of a section of the unnamed tributary of Warrigal Creek (stream order 3 waterway).

The waterway will be diverted around the northern extent of the planned mining area for a length of 1.8 km, which will include an excavated drainage channel, with a channel base width of approximately 5m, and low flow channel depth of one metre. Levee embankments will be constructed to plug the old waterway and provide flood immunity to the open cut pit. The diversion will connect to the existing waterway, east of the pit and divert it around the pit's northern extent to tie back into the original waterway. The diversion is designed in accordance with the DNRME guidelines for permanent watercourse diversions to maintain or provide equivalent hydrological, hydraulic, geomorphic and ecological function compared to the existing waterway (DNRME, 2019). The diversion will remain at closure.

The Watercourse Diversion Functional Design Report (Appendix X) outlines the design of the diversion, which has utilised channel design parameters representative of the morphology of a creek or waterway present in the catchment. To achieve this, the diversion design has utilised the hydraulic conditions, geology (sediment size and supply), and topography in the existing catchment. The design of the creek diversion adopted a reference reach approach, identifying the typical cross section geometry and longitudinal grade of the existing creek. The hydraulic threshold of the creek diversion was compared against the existing creek to confirm that dynamic equilibrium will be maintained. The proposed geometric design is summarised in Table 18-10, demonstrating that the design matches the average cross section dimensions and stream power of the existing watercourse. By matching the channel dimensions and stream power, the diversion is designed not to impede fish passage by maintaining hydrological, hydraulic connectivity and environmental conditions to support fish habitat.

The proposed diversion geometry and grade are comparable to those in the existing reach of the creek that is to be diverted. The diversion matches the conditions upstream and downstream of the tie in points. Revegetation is proposed to be undertaken using species present in the local ecosystem.

Table 18-10: Detailed channel cross section and longitudinal gradient summary

Channel geometry	Value	Basis
Channel bed width	5 m	Average cross section of existing watercourse
Low flow channel depth	1 m	Average cross section of existing watercourse
Low flow bank grade	1V:8H	Average cross section of existing watercourse
High flow channel depth	1.5 m	Average cross section of existing watercourse
High flow bank grade	4%	Average cross section of existing watercourse
Longitudinal grade	0.11%	Match stream power to existing watercourse

Results from the flooding assessment (refer to Appendix K Surface Water Assessment) for the project determined that there will be minor impacts to Warrigal Creek and Borer River due to the diversion of the unnamed waterway (stream order 3):

- This impact is expected to include isolated increases in peak flood levels at the location of the diversion drain and south of the TSFs, as well as a minor decrease in flood levels in Warrigal Creek downstream of the Project site.

- The changes in flood depth are minor and not expected result in any adverse impacts to the waterway.
- Increases to peak flood velocity are confined to the diversion drains and associated northern breakout flooding. Decreases in peak flood velocity have been modelled at the inlet and outlet of the diversion drain.
- Peak flood velocities in natural environments are expected to increase by a maximum of 0.5 m/s in the breakout flow path north of the watercourse diversion in the 1% AEP flood event however the absolute peak velocity in the operational phase model remains <0.6m/s.

Upgrades to existing crossings of small tributaries within the transport MLA will also likely be required as part of the Project's development and operation.

No WPAs, HES wetlands or high ecological value waters identified under the Environmental Protection (Water) Policy 2009, schedule 2 are present in the Project area. The proposed mining and processing area will have direct impacts to riverine and palustrine wetland ecosystems; however, these are mapped as GES wetlands. An alternate layout which resulted in further impacts to VM Act wetlands was considered, however to reduce impacts on MSES, the Project footprint was constrained to avoid these areas.The Project disturbance area does unavoidably impact some GES wetlands, on the basis of the targeted resource, as the remaining areas between Warrigal Creek and its impacted tributary discussed above was limited. Whilst this meant that some impact was inevitable, the Project design does avoid impacts to other nearby palustrine and riverine wetlands, as demonstrated by the other regional ecosystems analogous to VM Act wetlands within the study area avoided by the Proposed disturbance area (Figure 18-20, Figure 18-21, Figure 18-22). These wetlands are not expected to provide habitat to listed threatened species.

No listed threatened aquatic species have been identified from the waterway during field surveys of the Project area. The potential adverse impacts on all aquatic species and their habitats will be avoided and minimised through proposed management measures specified in sections 18.6.6.10 and 18.6.6.11.

18.6.1.3 Impacts to fish passage values

The levees and the permanent diversion of a tributary of Warrigal Creek and upgrades to existing crossings have the potential to create barriers to fish passage along the waterways. At the location of the proposed diversion, the unnamed stream order 3 waterway is mapped as being of moderate value for fish passage from waterway barrier works. Existing crossings of unnamed stream order 2 waterways (tributaries of Warrigal Creek) are classified as low value for fish passage from waterway barrier works.

The fish passage assessment for the Project validated the presence of waterways providing for fish passage. The unnamed stream order 3 waterway is likely to support fish passage. The diversion will be designed and constructed such that it meets the performance outcomes of the 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022). The diversion will be designed to support fish passage and be representative of the existing waterway conditions.

Upgrades of existing crossings of small tributaries along the transport MLA are unlikely to constitute barriers to fish passage. These areas have been validated as drainage features through the watercourse determination process and are considered unlikely to support fish passage. Nonetheless, these crossings will be designed and constructed in accordance with the 'Accepted development requirements for waterway barrier works' (DPI 2025). They will be bed level or low level crossings, or culvert crossings to comply with western drainage basins on a green waterway.

In the instance that the crossing will be a bed level or low-level crossing the crossing dimensions and design will meet the following requirements from the 'Accepted development requirements for waterway barrier works' (DPI 2025):

- Works within the waterway commence and finish within 360 calendar days;
- The bed level or low level crossing is no greater than 15 metres wide in an upstream/downstream direction that does not include waterway bed scour protection;

- New bed level or low level crossings are aligned perpendicular, within 10°, to the water flow. This does not apply to replacement of existing crossings
- Where the bed level, or low level crossing is constructed using rocks:
    - use clean rocks that are an equivalent or larger size than the natural bed material at the site, and at least 50 mm diameter. Minimal fine material is present. Where rocks larger than 300mm are used, use mixed sizes of rock to lock the structure together, promote surface flows suitable for fish passage, and minimise fish entrapment.
    - the surface is left rough and is not over compacted, such as a track-rolled finish or rougher.

In the instance that the crossing will be a culvert crossing the configuration will meet the following requirements from the 'Accepted development requirements for waterway barrier works' (DPI 2025):

- Has a minimum, combined culvert aperture width of 1.2m;
- All culvert cells are installed at or below bed level;
- The obvert of the culvert cell(s) is a minimum of 300 mm above the level that water commences to flow through the culvert, or bed level, for ephemeral waterways;
- The culvert is installed at no steeper gradient than the waterway bed gradient; and
- New culvert cells are aligned parallel, within 10°, to the direction of water flow to minimise turbulence. This does not apply to replacement of existing culvert crossings.

As the development will be compliant with the accepted development requirements, it is considered unlikely that fish salvage will be required. Additionally, all fish species potentially inhabiting the waterways are assumed to be adapted to conditions of ephemeral waterways, which will not be substantially altered by the Project. No pumping of water from the waterways is proposed, therefore measures to prevent the entrainment of fish into pumping infrastructure is not required. In the event that pumping of surface water is required, screening will be incorporated to prevent the entrainment of fish into water pumping infrastructure.

The proposed disturbance activities to these waterways will be located within the MLA. Development within an ML is exempt from requiring development approval for water barrier works under the Fisheries Act. However, assessment of potential impacts to a waterway providing for fish passage as an MSES is applicable.

18.6.1.4 Impacts to Groundwater Dependent Ecosystems (GDEs)

While modelling predicts project-related groundwater drawdown in the aquifer at the base of the Gilbert River Formation, this groundwater is extremely unlikely to support either terrestrial or aquatic GDEs, no GDEs were identified within the Project area, and therefore project-related GDE impacts are not predicted.

18.6.1.5 Impacts to Stygofauna

Based on the assessment methodology (Section 18.4.4.1), the environmental values and results of the Stygofauna assessment (Section 18.5.4); the impact assessment found little evidence to suggest stygofauna would inhabit the Gilbert River Formation, or the alluvium beneath the Project (Section 7, Appendix F Stygofauna Assessment). Therefore, project related stygofauna impacts are not predicted.

18.6.2 Indirect impacts

18.6.2.1 Habitat fragmentation and connectivity

Vegetation clearing can lead to habitat fragmentation, reducing connectivity and impacting condition of the surrounding habitat (through edge effects).

Edge effects are impacts that occur along the boundary of undisturbed vegetation and cleared or developed land. This boundary is exposed to increased light, wind shear and weed invasions, augmenting the local environment (e.g. altered species and structural composition).

The study area, like the rest of the region, is characterised by large contiguous areas of remnant vegetation. Within the study area, this includes narrow riparian corridors along the unnamed tributaries of the Warrigal Creek, which provide some specific connectivity function. However, no state-significant corridors are mapped in the study area, due to the smaller size and location of waterways within the site, relative to the riparian corridors present in the wider region.

Impacts of the project on habitat fragmentation and connectivity are considered low, based on the extent of undisturbed remnant vegetation remaining within the surrounding landscape, including the presence of larger watercourses identified as state biodiversity corridors outside of the Project impact area. Nevertheless, avoiding additional habitat fragmentation and reduced landscape connectivity was an environmental constraint that informed the Project design; for instance, the linear infrastructure connecting the Project to existing transport infrastructure is built over and parallel to an existing access track. Although the new road will have more increased impacts due to its increased width, it will avoid duplication of habitat fragmentation and barriers to connectivity.

Another measure mitigating edge effects impacting the condition and connectivity of surrounding habitats is the incorporation of a buffer area directly into the Project layout, reducing any disturbance additionality in areas surrounding the Project. This allows for space for ancillary activities such as vehicle access, as well as mitigation measures such as sediment control and vegetation control for fire risk management. This ensures the maintenance of the habitat value, connectivity, and water quality of the surrounding riparian and wetland vegetation.

18.6.2.2 Vehicle strike

Movement of vehicles has the potential to increase the incidence of fauna mortality via vehicular strike. Ground-dwelling fauna are most susceptible to this potential impact. The risk of injury or mortality from vehicle strike will be greatest along the transport corridor.

Contributing risk factors for vehicle strike are the speed of vehicles on roads and tracks, and limiting speed can reduce the threat of vehicle strike to fauna species.

18.6.2.3 Weeds and pests

Some introduced flora species are effective competitors for resources and have the potential to reduce the floristic structure and diversity of native plant communities. One introduced flora species has been recorded within the study area, Rubber Vine, which is listed as restricted matters under the Biosecurity Act (Qld) and as WONS (refer to Chapter 19 Biosecurity).

Activities that could introduce or spread weeds include the disturbance and stockpiling of soil, vehicle movements, and vegetation clearing. The potential introduction or spread of weeds can occur during all phases of the Project, including construction, operation, and rehabilitation.

Five introduced fauna species that present a risk to native fauna and their habitat have been recorded in the study area — Cane Toad (*Rhinella marina*); Dingo (*Canis lupus dingo*); Feral Cat (*Felis catus*); European Cattle (*Bos taurus*) (as a result of the current grazing activities); and Feral Pig (*Sus scrofa*). Three of the introduced fauna species— Feral Cat, Feral Pig and the Dingo are listed as restricted matters; however, there are no prohibited matters under the Biosecurity Act (Qld). For further information, refer to Chapter 19 Biosecurity.

Inadvertently providing scavenging areas (e.g. discarded food scraps and other rubbish) has the potential to increase populations of introduced terrestrial fauna species in and around the Project disturbance area.

The Project is unlikely to introduce or exacerbate impacts of invasive species which would be harmful to aquatic ecology values. No invasive aquatic species were recorded during the aquatic ecology surveys.

18.6.2.4 Noise and vibration

Noise and vibration associated with constructing and operating the Project have the potential to disrupt the routine activities of fauna species in the surrounding habitat areas. Areas close to the source of vibration and noise have the potential to become unused by sensitive fauna species.

Primary sources of noise or vibration in the proposed mining area include the vehicle movements and the operation of equipment (e.g. dump trucks, excavators, loaders, dozers, drill rigs, blasting, compressors and other drilling-related equipment).

The indirect noise impacts on the woodland and other habitats from the mining activities proposed to be undertaken, and from vehicle movements on the haul road, will be localised and are not likely to have a significant long-term impact on wildlife populations given that fauna often readily habituate to continuous noise. While sudden noise (e.g. blasting activities) has the potential to startle native fauna, animals are likely to adapt to the disturbance and/or move to similar habitats in the surrounding landscape (Cumberland Ecology 2015).

18.6.2.5 Dust

The Project has the potential to increase dust emissions in the vicinity of the Project disturbance area, primarily due to dust generation from the operation of mining equipment, blasting, hauling of ore and waste rock, and vehicles travelling on unsealed roads.

Impacts during construction and rehabilitation stages are expected to be lower, as mining equipment and blasting are not expected to be utilised or undertaken, however may occur during operation of vehicles and disturbance of vegetation and soils. Excessive dust generation can impact the health and viability of surrounding vegetation (Reach Environmental 2020, Farmer 1993).

18.6.2.6 Artificial lighting

Artificial lighting will be established in the Project disturbance area. Project lighting has the potential to affect behavioural patterns of some species. Some bird and bat species, for example, are attracted to insects around lights and could become prey for larger predators (e.g. owls). Artificial lighting can also attract predators and invasive pests, both of which may pose a threat to native fauna (DoEE 2020).

18.6.2.7 Hydrological changes

Mine development and associated infrastructure, including the permanent diversion of a tributary of Warrigal Creek, will lead to permanent landform modification and changes in natural runoff patterns. These changes have the potential to impact surrounding vegetation and habitat areas. Impacts may occur through artificial ponding, concentration of flows causing increasing erosion processes, or catchment loss to ecosystems reliant in-flows.

Ephemeral wetlands present within the study area are reliant of overland flows for periodic inundation. These ecosystems may be sensitive to catchment loss.

18.6.2.8 Bushfire

While plants and animals have a range of mechanisms to survive a natural fire regime, the frequency of bushfires may be modified by the mining activity. The operation of mechanical and electrical equipment has potential to cause accidental fires. A change in natural fire patterns can lead to fauna mortality and / or modification of ecosystem condition.

18.6.2.9 Erosion

Vegetation clearing and land disturbance may result in topsoil exposure and erosion. In addition, disturbance in proximity to waterways within the Project disturbance area may also reduce bank stability and increase soil erosion and elevated sediment levels in downstream receiving waters.

The Project has the potential to result in erosion of disturbed areas and sedimentation of waterways from clearing vegetation for the development of open-cut pits and constructing haul roads and other infrastructure.

18.6.2.10 Downstream waterway flows

Aquatic ecosystems are dependent on water flows, and changes to flows can impact the aquatic ecosystem values. The proposed diversion of natural waterways and overland flow around mining activities will be designed to sustain flow.

Nonetheless, the potential for a reduction of catchment area for waterways impacted by the Project is assessed in Appendix K Surface Water Assessment through surface water modelling. The model indicates that impacts to downstream streamflow are expected to be largely confined to smaller local drainage paths immediately downstream of the Project. The affected contributing catchment area represents a relatively small proportion of the broader receiving catchments and, therefore, reductions in flow volumes and duration are not expected to materially alter regional hydrological processes or downstream water availability. Progressive rehabilitation of disturbed areas is also expected to reduce long-term runoff interception by re-establishing stable landforms and promoting infiltration and revegetation over the life of the Project. Given the Project is not expected to materially alter regional hydrological process, impacts to aquatic ecosystem values due to altered flow are not expected.

Mine water storages associated with the Project do not have potential to discharge offsite. All mine water dams overflow to the mining pit. The pit has excess capacity to contain all overflow volumes, ensuring that there would be minimal actual or potential discharge of contaminants to waters that may or have the potential to cause an adverse effect on identified environmental values.

18.6.2.11 Changes to flood regimes

Topography across the Project area and in the surrounding area is very flat, which results in widespread flooding, with interactions between the nearby major waterways during significant flood events. The unnamed stream order 3 waterway (tributary of Warrigal Creek) receives significant breakout flood flows from the northern banks of Warrigal Creek and the Borer River upstream of the Project area (Appendix K Surface Water Assessment).

The proposed flood management structures may alter the flooding regime of the unnamed stream order 3 waterway, and adjacent landscape. A flood levee will be part of the final landform for the Project and minimise surface water incursion into the open-cut pit. The extent of any potential impacts on environmental values has been assessed through detailed modelling as part of the Surface Water Assessment (Appendix K).

Impacts to aquatic ecology values are expected to be negligible as a result of flood regime changes.

18.6.2.12 Groundwater drawdown

Surface construction activities will not intersect the groundwater table. However, construction activities will require a water supply, and a portion of this may be sourced from groundwater. In this instance, supply bore(s) will be installed to provide the necessary construction water supply and advance dewatering prior to mining development.

Potential impacts to groundwater from mining include depressurisation and drawdown of aquifers occurring from excavation of the mining void, reduction of groundwater resource available to existing users, changes to natural groundwater level impacting groundwater dependent ecosystems and potential for contamination from seepage or spills. The exact nature and extent of direct impacts to groundwater have been assessed in

detail as part of the Groundwater Assessment for the Project (Chapter 14 Water Resources, Appendix L Groundwater Impact Assessment, Appendix G, Groundwater Dependent Ecosystem Assessment), with a summary presented below.

The Project will not impact surface waters or sensitive environmental features due to groundwater drawdown. The permanent groundwater table (hosted within the Gilbert River Formation (GRF) does not intersect any creek bed or surface water within the drawdown zone; there is no direct groundwater-surface water interaction. This is reflected by the demonstrably dry and unsaturated Tertiary sediments within the vicinity of the Project, with no evidence to indicate hydraulic connectivity between the GRF aquifer and the rooting depth of vegetation communities or aquatic habitats. Within the extent of the maximum predicted drawdown for the Project, the groundwater table is located between 6-10 metres below the watercourses and drainage features across areas affected by the Project's maximum predicted drawdown and does not provide local baseflow to these surface water features. The drawdown extent is significantly spatially distant from receptors such as GABORA springs and groundwater dependent watercourses. There are no aquatic GDEs present within the drawdown extent of the Project, owing to the depth of the groundwater table and lack of groundwater-surface water interaction. Terrestrial GDEs are unlikely to be supported by the groundwater regime and depth of the groundwater table.

Potentially affected vegetation communities were not considered reliant on direct groundwater uptake, instead predominantly relying on soil moisture stored within the vadose zone from wetland depressions and ephemeral drainage features retaining moisture seasonally through infiltration and temporary perched saturation associated with rainfall and surface water flows. Whilst ephemeral perched groundwater may occur within some drainage line sands following wet season recharge, these conditions are transient, diminishing during dry periods, and importantly not considered to be connected to the GRF aquifer. Thus, even if some reliance on temporary perched saturation could lead some vegetation communities to seem to rely on groundwater, this is groundwater perched above the highly impermeable base layer separating the GRF and will not be affected by the drawdown related to the Project.

Considering the above, drawdown impacts on GDEs are unlikely to be significant. Field investigations and ecohydrological assessments indicate that the mapped terrestrial and aquatic ecosystems within the Project and its potentially impacted surroundings are not reliant on the deeper groundwater system which is predicted to experience drawdown. In line with this, there are no expected impacts on aquatic environmental values either, as the regional groundwater table which seasonally contributes to the broader catchment area is not projected to be impacted by drawdown in the GRF aquifer.

18.6.3 Changes to water quality

Surface water quality in downstream waterways can be impacted by mechanisms, including increased sedimentation and turbidity, increased concentrations of nutrients and contaminants (such as metals and hydrocarbons) and saline and acid drainage. These effects can impact the health, composition and resilience of aquatic fauna and flora and thereby impact aquatic ecology values. The potential drivers and impacts to water quality due to the Project are discussed in the following sections.

Erosion and sedimentation

The Project has the potential to result in erosion of disturbed areas and sedimentation of waterways from clearing vegetation for the development of open-cut pits and constructing haul roads and other infrastructure.

Water releases

Controlled water releases are not proposed for the Project. Effective containment of mine affected water and implementation of an effective water management system will be designed to prevent the release of contaminants. Where possible, mine affected water will be re-used and re-cycled on site as part of Project water supply. A detailed site water balance will be prepared to account for all water inputs and outputs, and the necessary on-site storage and management infrastructure will be developed accordingly.

- Mine water storages associated with the Project do not have potential to discharge offsite. All mine water dams overflow to the mining pit. The pit has excess capacity to contain all overflow volumes, ensuring that there would be minimal actual or potential discharge of contaminants with potential for acute and chronic toxicity to waters that may or have the potential to cause an adverse effect on identified environmental values.
- The sediment dams have been designed to provide sufficient storage for settlement of suspended solids so that water quality during overtopping events has negligible impact on water quality in the receiving waterway. Sediment dams will also include overflow control structures with scour protection (rock chutes, rock aprons or level spreaders) to ensure non-erosive discharges. Monitoring of overtopping events will be undertaken to assess the performance of the sediment dams and ensure downstream environmental values are maintained and validate the design assumptions. Sediment dam overflows and associated water quality are not expected to have adverse impacts on water quality and environmental values in receiving waterways downstream of the Project.
- Any runoff produced by the waste rock dumps will be collected in Sedimentation Dam 1 and 3. Seepage produced by the waste dumps will be collected in the sediment dams and managed by the water management system.
    - Seepage produced during dry to medium rainfall events will be contained and managed by the sediment dams.
    - Any seepage produced during large rainfall events that result in overtopping of the sediment dams would receive significant dilution immediately in the receiving waterway. Because the metal concentrations in the water materials are low compared to the receiving waterway WQOs, the expected dilution with natural flows in the downstream waterway is expected to reduce concentrations below the WQOs. Based on the seepage, a material impact on the environmental value of receiving waters is not expected.

Litter, waste and spills

Waste generated from the Project activities could enter aquatic ecosystems and affect aquatic fauna and flora. Groundwater Dependent Ecosystems (GDEs).

GDEs that rely on groundwater for survival may experience deteriorating ecosystem condition, changes in vegetation composition, or dieback due to mine-induced drawdown.

18.6.4 Facilitated impacts

There are no expected facilitated impacts related to flora and fauna identified as a result of the Project. Third parties are considered highly unlikely to utilise any of the infrastructure required as part of the mine's development in such a way as to cause facilitated impacts. Though third parties may acquire the products generated by the site (graphite ore or graphite concentrate) with a view to further refining, as discussed in Section 4.1.5, there are no third parties currently known to be intent on conducting graphite refinement operations in Queensland that would benefit from market access to the production of graphite concentrate product from the Project.

Whilst the Proponent currently has a refinement demonstration facility in Townsville, it has a very limited capacity. Future potential expansion could not be considered a facilitated impact as it would not be conducted by a third party, and in any case would undergo a separate assessment process and occur within a zoned industrial area where impacts to flora and fauna will be avoided or mitigated.

18.6.5 Cumulative impacts

Cumulative impacts can be defined as the total impact on the environment that results from the incremental impacts of the action (the Project) added to other past, existing, and reasonably foreseeable future actions in the region. Cumulative impacts include direct and indirect impacts on the environment.

To withstand threats, ecosystems require a robust diversity of individuals, species, and populations. The cumulative impact assessment has considered the habitat and species occurring (species diversity, abundance and dynamics), patterns of species distribution (the communities and ecosystem present that encompass all species), broad habitat types (the ecological niches for the range of species present) and ecosystem processes.

The Project is located within the Gulf Plains Bioregion, a national classification system that identifies geographically distinct areas based on common ecological characteristics. This bioregion, which covers 21,910,942 ha, is then classified into more homogeneous and localised subregions, including the Claraville Plains subregion, where the Project is located (Wetlandsinfo and IBRA from DCCEEW). The Claraville Plains subregion has an area of approximately 3,709,694 ha, and has been used to assess cumulative biodiversity impacts that the Project may contribute to; as the subregion supports the most similar vegetation, flora, and habitat types for fauna, on a regional scale, as the Project.

Considering the very sparse surrounding activities and projects, the non-intensive land use of grazing making up over 95.45% of land that is not protected within the bioregion (Section 0), and the lack of other impacts (Sections 18.6.5.2, 18.6.5.3, 18.6.5.4, 18.6.5.5, and 18.6.5.6), no cumulative impacts are considered relevant to the Project.

18.6.5.1 Land use and projects in the Claraville Plain subregion that may contribute cumulative impacts

Within the Claraville Plains subregion, grazing contributes 95.4% to the land use. Other land uses in the subregion are transport and communication, residential and farm infrastructure, mining, intensive animal production and irrigated cropping; however, they contribute less than 0.1% of the total area (wetlands, marsh, lakes and rivers contribute 4.5% of the subregion area).

In the subregion, remnant vegetation communities remain largely in place, relative to more eastern bioregions and subregions that have been subject to road-scale clearing practices. However, despite its largely intact state, the subregion faces several threats, including land degradation from inappropriate grazing pressure and exotic plant invasion, such as Rubber Vine.

In the subregion, there is one town, Croydon, over 70 km north of the Project; and immediately to the north-east of Croydon, there is one mine, Croydon Gold mine - which proposes to recommence mining and processing gold ore. Jubilee Metals is in the construction phase now (accurate at time of reporting, January 2026). There are no other projects identified in the subregion. A recent ecological assessment undertaken for the Croydon Gold Mine (Epic Environmental 2022) identified REs within the site, including those potentially impacted by the recommencement of mining. There are no REs identified by this assessment that are found within the proposed Graphinex Esmeralda Project site, and therefore no cumulative impacts on regional ecosystems in the Claraville Plains subregion will occur. A total of 75.5 ha of remnant vegetation will be impacted by the Croydon Gold mine recommencement.

18.6.5.2 Land clearing

While grazing occurs in the surrounding area and land clearing for tracks and infrastructure has been undertaken, minimal land clearing for grazing has occurred, evidenced by remnant vegetation predominantly occurring throughout the subregion. The Project, however, has the potential to contribute to the cumulative impact of land clearing with other mining activities.

The Project will result in direct disturbance of an estimated 2,413.7 ha of remnant vegetation, adding to the remnant vegetation clearing from other development in Croydon which is considered minor, for a cumulative impact of 2,489.3 ha. The impacted vegetation represents approximately 0.06% of the current extent (Accad *et al.* 2024) of remnant vegetation in the Claraville Plains subregion, and less than 0.01% of the Gulf Plains bioregion.

18.6.5.3 Impacts to fauna

Impacts from noise and vibration, dust and air, and vehicle strike, are not expected to cumulatively impact fauna from other projects.

18.6.5.4 Downstream ecosystems

The Project is unlikely to impact major watercourses, such as the Warrigal Creek or the Clara River. Considering the lack of other development in the local catchment area, key ecosystem cycles are unlikely affected by cumulative impacts.

18.6.5.5 Biodiversity corridors

The Project will not contribute to cumulative impacts on known biodiversity corridors, that provide mobility for fauna, and may also be considered climate refugia for some species (Reside *et al.* 2014).

Impacts within riparian corridors are limited to the upgrade of existing crossings of small tributaries along the transport corridor and the watercourse diversion.

18.6.5.6 Aquatic ecosystems

The Project is unlikely to impact major watercourses, such as the Warrigal Creek, the Borer River or the Clara River. These watercourses are also considered unimpacted by other minerals Projects, though they are considered likely to have been impacted by the agricultural land use activities of the area. Considering the lack of other development in the local catchment area, key ecosystem cycles are unlikely affected by cumulative impacts.

18.6.6 Mitigations, monitoring and management

The following mitigation measures, monitoring, and management are recommended to minimise impacts from the Project for each impact discussed in sections 18.6.1 to 18.6.5.

18.6.6.1 Vegetation clearance, habitat disturbance and habitat fragmentation and connectivity

- Clearing activities will be undertaken progressively in accordance with the mine schedule and Project requirements and not before necessary, to protect the land.
- Vegetation/habitat adjoining proposed clearance areas will be delineated and clearly marked.
- Clearing operations will be managed to maximise the reuse of cleared vegetative material. This will include the potential to salvage and reuse select habitat resources from the cleared vegetation (e.g. logs) for habitat enhancement, either in the rehabilitation program or elsewhere on site, or mulching of removed vegetation for respreading to minimise erosion.
- Clearing activities will be undertaken in accordance with mitigations measures for cultural heritage matters, developed in consultation with the Tagalaka People (detailed in the Cultural Heritage EIS chapter for the Project).
- Land disturbed by mining activities should be rehabilitated progressively as it becomes available. Details of the proposed rehabilitation program are provided in the Progressive Rehabilitation and Closure Plan (PRC Plan) prepared for the Project (Appendix T).
- A Flora and Fauna Management Plan will be developed for the Project, and include procedures for handling injured wildlife, and inspections prior to vegetation clearing to identify fauna at direct risk from clearing activities.

18.6.6.2 Vehicle strike

- Speed limits will be implemented for vehicle strike.
- Safe driving procedures will be incorporated into site inductions to increase awareness of the risk of vehicle strike.

18.6.6.3 Weeds and pests

- A Project Pest and Weed Management Plan will be implemented to incorporate pest and weed management measures for the Project (Refer to Chapter 19, Section 19.4 for further detail). The Pest and Weed Management Plan will include:
    - inspections within the Project disturbance area to identify areas requiring weed management to be implemented;
    - weed management measures (e.g. mechanical removal and application of approved herbicides) in consideration of weed control strategies outlined by the Department of Agriculture and Fisheries and the 'North West Queensland Regional Biosecurity Plan 2022–2027' (North West Queensland Regional Council 2022);
    - procedures for maintaining a clean, rubbish-free environment to discourage scavenging and reduce the potential for colonisation of these areas by introduced fauna; and
    - feral animal control strategies in consideration of pest control strategies outlined by the Department of Agriculture and Fisheries, 'North West Queensland Regional Biosecurity Plan 2022–2027' (North West Queensland Regional Council 2022) and Threat Abatement Plans applicable to the EPBC Act listed key threatening processes.

18.6.6.4 Noise and vibration

- Regular inspections and servicing of vehicles and equipment will be undertaken to ensure they are operating in accordance with specifications.
- Monitoring of noise and vibration impacts will be undertaken at sensitive locations.

18.6.6.5 Dust

- Dust management and mitigation measures will be undertaken, and will include watering or using chemical surface suppressants on unsealed roads, tracks and stockpiles as required.
- Air quality monitoring programs will be implemented to ensure protection of ecology and agriculture in accordance with environmental authority conditions.

18.6.6.6 Artificial lighting

- The exterior lighting design for the Project will consider the Australian Standard AS/NZS 4282:2019, 'Control of the obtrusive effects of outdoor lighting,' which acknowledges the potential impact of artificial light on biota (DoEE 2020).

18.6.6.7 Hydrological changes

- A water management plan will be developed and implemented to ensure effective design and management of surface flows around the mining operation, with consideration of surrounding biota, including wetlands.
- An erosion and sediment control plan will be developed and implemented to mitigate erosion processes and protect downstream ecosystems from increased sediments loads.

- A water quality monitoring program will be developed and implemented to confirm the effectiveness of management practices and the protection of downstream ecosystems.

18.6.6.8 Bushfire

- Bushfire prevention and management measures will be implemented for the Project, and
- Fire awareness will be included in the induction of personnel and contractors to minimise the risk of bushfire.
- The Project infrastructure design will install fire breaks where required, to act as a stop-gap between possible sources of fire, such as sparks and open flames, and vegetation.
- Fuel loads in vegetation surrounding the operation will be monitored and managed.

18.6.6.9 Erosion

- Vegetation clearance protocols will be implemented to minimise potential impacts.
- An erosion and sediment control plan, and a water quality monitoring program will be developed and implemented (refer to section 18.6.2.7).

18.6.6.10 Water course and wetland impact mitigation

The Project is not expected to result in impacts to the aquatic ecology values of watercourses or wetlands. Notwithstanding this, proposed water management measures will be implemented such that potential impacts to aquatic ecology values are minimised. Chapter 14, Water Resources and Chapter 15, Water Quality identify the proposed management measures that will minimise potential impacts to surface water flows and quality.

The disturbance activities are not subject to the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) because they will be located within the Project's ML and, therefore, are exempt from assessment under the Planning Act. Notwithstanding, to minimise impacts to waterways providing fish passage, these activities will be configured and developed according to the accepted development requirements provided in the relevant guidelines.

In particular the diversion will be designed in accordance with the 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) performance outcomes that are relevant to 'All Development' under the code (refer to section 18.6.6.11).

18.6.6.11 Fish passage

The disturbance activities are not subject to the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) because they will be located within the Project's ML and, therefore, are exempt from assessment under the Planning Act. However, in order to minimise potential impacts to aquatic ecology values of the Project area, the proposed diversion will be designed in accordance with the 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) performance outcomes that are relevant to 'All Development' under the code. A summary of performance outcomes from State Code 18 considered relevant to managing potential impacts to fish passage from the diversion includes:

- The development will be designed, constructed and maintained to avoid and minimise impacts on matters of state environmental significance;

- Aspects of development are only permitted within a waterway where there is a functional requirement and the development cannot be feasibly located elsewhere. Ancillary elements will be located outside of the waterway;
- Development will not result in adverse impacts to fisheries resources;
- The design, construction and maintenance of the development will not result in non-essential hardening or unnatural modification of the main channel of the waterway;
- The development will retain natural fish habitat and features such as shade, pools, riffles, rock outcrops and boulders, wherever possible;
- The design, construction and maintenance of the development will not result in straightening of meandering waterways;
- Where channels are to be significantly modified, the design and construction of the development will replicate natural waterways and habitat features;
- The development will be designed, constructed and maintained to provide water exchange sufficient to maintain or improve water quality and flow conditions on which fisheries resources depend; and
- The development will be designed, constructed and maintained to not result in adverse impacts to beds, banks and vegetation adjacent to the permanent development footprint.
- Development activities within the waterways will be avoided during the wet season and will not occur during elevated flow periods. Given that direct disturbance will occur when waterways are not flowing, the likelihood of aquatic fauna becoming stranded or experiencing direct mortality is low.

18.6.6.12 Downstream ecosystems

- A water management plan and a water quality monitoring program will be developed and implemented (refer to Section 18.6.6.7).

18.6.6.13 Changes to flood regimes

- The diversion and flood protection measures will be designed to ensure existing channel features are maintained and flood regimes are not significantly altered.
- A water management plan and a water quality monitoring program will be developed and implemented (refer to Section 18.6.6.7).

18.6.6.14 Changes to water quality

- An erosion and sediment control plan for the Project will be developed and implemented (refer to Section 18.6.6.7).
- A water management plan and a water quality monitoring program will be developed and implemented (refer to Section 18.6.6.7).The water management plan will provide the following:
    - identification of environmental values for receiving waters that could be potentially affected by water releases from the Project;
    - measurable indicators and associated water quality objectives to maintain or enhance the identified environmental values;
    - suitable test sites within the receiving waters that could be potentially impacted by water releases (downstream monitoring locations);
    - suitable upstream control sites to establish background conditions for assessment of potential impacts at the downstream monitoring locations; and

- methods for assessing impacts at the downstream sites against the water quality objectives and upstream monitoring locations (control sites), including for chronic toxicants.

- A detailed site water balance will be prepared to account for all water inputs and outputs, and the necessary on-site storage and management infrastructure will be developed accordingly.
- Waste from the Project will be managed in accordance with the waste and resource management hierarchy from the *Waste Reduction and Recycling Act 2011*, which lists waste and resource management strategies in the order of most to least preferred option:
  1) avoid unnecessary resource consumption;
  2) reduce waste generation and disposal;
  3) re-use waste resources without further manufacturing;
  4) recycle waste resources to make the same or different products;
  5) recover waste resources, including the recovery of energy;
  6) treat waste before disposal, including reducing the hazardous nature of waste; and
  7) dispose of waste only if there is no viable alternative.
- Any hazardous waste would be removed from the site by a licenced contractor and disposed of or recycled at appropriate off-site facilities.

18.7 Potential impacts to prescribed environmental matters

The following sections assess the likelihood of the Project causing a significant impact to matters of national environmental significance (MNES) or matters of state environmental significance (MSES).

18.7.1 Summary of potential impacts to Matters of National Environmental Significance (MNES)

There is unlikely to be a significant impact to any MNES. In summary:

- There are no Threatened Ecological Communities (TEC) in the Project area. 'The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin' TEC, is associated with springs within the Great Artesian Basin discharge area that are the natural surface discharge points of aquifers in the Triassic, Jurassic and Cretaceous sedimentary sequence of the Great Artesian Basin, and the closest springs occur more than 28 km from the Project area (refer to Section 18.5.3). The risk of impact to these springs is considered minimal due to their distance from the Project area.
- There are no conservation significant flora species listed under the EPBC Act considered likely to occur in the study area; and therefore, none are likely to be impacted.
- There are two bird species of conservation significance, the White-throated Needletail (*Hirundapus caudacutus*), listed as vulnerable and migratory under the EPBC Act; and the Fork-tailed Swift (*Apus pacificus*), listed as migratory under the EPBC Act known to occur in the study area. The Project is unlikely to have a significant impact on either species:
  - Refer to section 18.1.1.1 for the significant residual impact assessment for the White-throated Needletail.
  - The Fork-tailed Swift was assessed for the EPBC Referral application (AARC 2025). The assessment found that project vegetation clearing and the limited importance of the habitat present, indicated that the Project is unlikely to have a significant impact on the Fork-tailed Swift.

18.7.2 Potential impacts to Matters of State Environmental Significance (MSES)

18.7.2.1 Regulated vegetation

Prescribed REs that intersect a VM Act wetland

Two VM Act wetlands intersect the Project disturbance area and will be impacted by the Project. Four field-verified REs are associated with these wetlands, namely, RE 2.3.55d, 2.5.14a, 2.5.17b and 2.5.28a. As discussed above in Section 18.6.1, due to the location of the resource these impacts were considered unavoidable. Nevertheless, the Project disturbance area avoids impacting other VM Act wetlands unnecessarily, including multiple situated in MLA 100430 and several situated immediately outside the study area within close proximity of the smaller VM Act wetland impacted in the Project disturbance area Figure 18-27.

Under the EO Act, offsets are required for significant residual impacts to remnant REs that lie within a mapped vegetation management wetland. For an activity to have a significant residual impact on a RE that is within a mapped wetland, the following thresholds must be exceeded (DEHP 2014):

- clearing within 50 m of the defining bank of a VM Act wetland; and
- clearing of greater than:
    - For a linear infrastructure: 25 m wide in grassland (structural category) REs, 20 m wide in sparse (structural category) REs or 10 m wide in dense to mid-dense (structural category) REs.
    - For other than a linear infrastructure: 5 ha in grassland (structural category) REs, 2 ha in sparse (structural category) REs or 0.5 ha in dense to mid-dense (structural category) REs.

REs within a mapped wetland that will be disturbed for the Project are associated with non-linear infrastructure in the mining and processing area. No areas of REs within a mapped wetland will be cleared for linear infrastructure associated with the Project– namely the access road, including the airstrip.

REs located within VM Act wetlands that will be disturbed for the Project are shown in Figure 18-34 and and shown in Figure 18-35. A detailed significant residual impact assessment, in accordance with the Significant Residual Impact guidelines (DEHP 2014), including the structural category of each RE within VM Act wetlands and the proposed extent of disturbance, is provided in Table 18-11.

Table 18-11: Regional ecosystems that intersect a VM Act wetland assessment summary

Regional ecosystem	Structural category	Assessment criteria	Area of disturbance (ha)	Significant impact assessment against criteria
RE 2.3.55d	Sparse	• Clearing within 50 m of the defining bank of a VM Act wetland; and • Clearing an area greater than 2 ha in a sparse RE.	10.45	Yes, the Project disturbance area will result in the removal of 16.51 ha of this community, which is above the 2 ha threshold for a significant residual impact (clearing other than a linear infrastructure).
RE 2.5.14a	Sparse	• Clearing within 50 m of the defining bank of a VM Act wetland; and • Clearing an area greater than 2 ha in a sparse RE.	0.23	No, clearing is below the 2 ha threshold for a significant residual impact (clearing other than a linear infrastructure).
RE 2.5.17b	Sparse	• Clearing within 50 m of the defining bank of a VM Act wetland; and	0.06	No, clearing is below the 2 ha threshold for a significant residual impact (clearing other than a linear infrastructure).

Regional ecosystem	Structural category	Assessment criteria	Area of disturbance (ha)	Significant impact assessment against criteria
		• Clearing an area greater than 2 ha in a sparse RE.		
RE 2.5.28a	Sparse	• Clearing within 50 m of the defining bank of a VM Act wetland; and • Clearing an area greater than 2 ha in a sparse RE.	0.00	No, clearing is below the 2 ha threshold for a significant residual impact (clearing other than a linear infrastructure).

Prescribed REs located within the defined distance of a VM Act watercourse

The Queensland Government vegetation management watercourse map shows watercourses defined under the VM Act that are used to regulate vegetation clearing in proximity of watercourses (DEHP 2014). The ephemeral watercourses intersecting the Project disturbance area are defined watercourses under the VM Act.

Whilst efforts were taken in the Project design to avoid and minimise impacts to prescribed REs within defined distances of VM Act watercourses, as outlined in Sections 18.6.1.1 and 18.6.2.1 and shown in Figure 18-34, some impacts were unavoidable.

Offsets may be required under the EO Act for significant residual impacts on remnant REs located within defining banks of a VM Act watercourse. For an activity to have a significant residual impact, the following thresholds must be exceeded:

- clearing within 5 m of the defining bank of a VM Act watercourse; and
- clearing of greater than:
    - For a linear infrastructure: 25 m wide in grassland (structural category) REs, 20 m wide in sparse (structural category) REs or 10 m wide in dense to mid-dense (structural category) REs.
    - For other than a linear infrastructure: 5 ha in grassland (structural category) REs, 2 ha in sparse (structural category) REs or 0.5 ha in dense to mid-dense (structural category) REs.

Appendix 3 of the 'Queensland Environmental Offsets Policy', lists the defined distance of REs for measuring significance of impacts to watercourse vegetation. In non-coastal regions, for 1st and 2nd order streams, the defined distance is 25 m from the defining banks. For 3rd and 4th order streams, the defined distance is 50 m from the defining banks. For 5th order streams or larger, the defined distance is 100 m from the defining banks.

REs located within the defining banks of a VM Act watercourse that will be disturbed for the Project are associated with non-linear infrastructure in the mining and production area and associated with linear infrastructure in the transport corridor (access road, including airstrip) and shown in Figure 18-35. A detailed significant residual impact assessment, in accordance with the Significant Residual Impact guidelines (DEHP 2014), including the structural category of each RE within the defined distance of VM Act watercourses and the proposed extent of disturbance, is also provided in Table 18-12.

Table 18-12: Regional ecosystems that intersect a VM Act watercourse assessment summary

Regional ecosystem	Structural category	Assessment criteria	Area of disturbance (ha)	Significant impact assessment against criteria
Linear infrastructure				

Regional ecosystem	Structural category	Assessment criteria	Area of disturbance (ha)	Significant impact assessment against criteria
RE 2.3.29b	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing a width greater than 20 m in a sparse RE.	12.01	Yes, the Project disturbance area will involve clearing a width of greater than 20 m in this community, which is above the threshold for a significant residual impact.
RE 2.5.14a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing a width greater than 20 m in a sparse RE.	4.00	Yes, the Project disturbance area will involve clearing a width of greater than 20 m in this community, which is above the threshold for a significant residual impact.
RE 2.5.17b	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing a width greater than 20 m in a sparse RE.	13.24	Yes, the Project disturbance area will involve clearing a width of greater than 20 m in this community, which is above the threshold for a significant residual impact.
RE 2.5.18a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing a width greater than 20 m in a sparse RE.	0.42	Yes, the Project disturbance area will involve clearing a width of greater than 20 m in this community, which is above the threshold for a significant residual impact.
RE 2.5.28a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing a width greater than 20 m in a sparse RE.	1.72	Yes, the Project disturbance area will involve clearing a width of greater than 20 m in this community, which is above the threshold for a significant residual impact.
Non-linear infrastructure				
RE 2.3.22	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	8.99	Yes, the Project disturbance area will result in the removal of 8.99 ha of this community, which is above the 2 ha threshold for a significant residual impact.
RE 2.3.26a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	18.59	Yes, the Project disturbance area will result in the removal of 18.59 ha of this community, which is above the 2 ha threshold for a significant residual impact.
RE 2.3.26c	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	0.15	No, clearing is below the 2 ha threshold for a significant residual impact.
RE 2.3.29b	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	30.01	Yes, the Project disturbance area will result in the removal of 30.01 ha of this community, which is above the 2 ha threshold for a significant residual impact.

Regional ecosystem	Structural category	Assessment criteria	Area of disturbance (ha)	Significant impact assessment against criteria
RE 2.3.41	Grassland	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 5 ha in a grassland RE.	0.99	No, clearing is below the 5 ha threshold for a significant residual impact.
RE 2.3.42b	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	0.33	No, clearing is below the 2 ha threshold for a significant residual impact.
RE 2.3.26a / 2.3.50a (50%/50%)	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	0.48 -RE 2.3.26a 0.48 -RE 2.3.50	Clearing 0.48 ha of RE 2.3.50 is below the 2 ha threshold for a significant residual impact. However, the clearing of RE 2.3.26a within a VM Act watercourse for a non-linear infrastructure already meets the threshold for a significant residual impact; therefore, any additional impact is considered significant.
RE 2.5.14a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	3.29	Yes, the Project disturbance area will result in the removal of 3.29 ha of this community, which is above the 2 ha threshold for a significant residual impact.
RE 2.5.17b	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	2.81	Yes, the Project disturbance area will result in the removal of 2.81 ha of this community, which is above the 2 ha threshold for a significant residual impact.
RE 2.5.28a	Sparse	• Clearing within 5 m of the defining bank of a VM Act watercourse; and • Clearing an area greater than 2 ha in a sparse RE.	0.12	Yes, while clearing 0.12 ha is below the 2 ha threshold for a significant residual impact, the clearing of RE 2.5.28a within a VM Act watercourse for a linear infrastructure already meets the threshold for a significant residual impact; therefore, any additional impact is considered significant.

Connectivity

In accordance with the Significant Residual Impact Guideline (DEHP 2014), the Landscape Fragmentation and Connectivity Tool has been used to assess the significance of impact on connectivity areas. The output of the Landscape Fragmentation and Connectivity Tool is provided in Appendix E Terrestrial Ecology Assessment.

An impact on connectivity areas is determined to be significant if:

- the change in the core remnant ecosystem extent at the local scale (post-impact) is greater than a threshold determined by the level of fragmentation at the regional scale; or
- any core area that is greater than or equal to 1 ha is lost or reduced to patch fragments (core to non-core).

The assessment has determined that the Project change in the core remnant ecosystem extent at the local scale is below the threshold of regional fragmentation. The assessment has also determined that the number of core remnant areas occurring on the site will not be reduced by the Project.

The assessment has concluded no significant impact on connectivity.

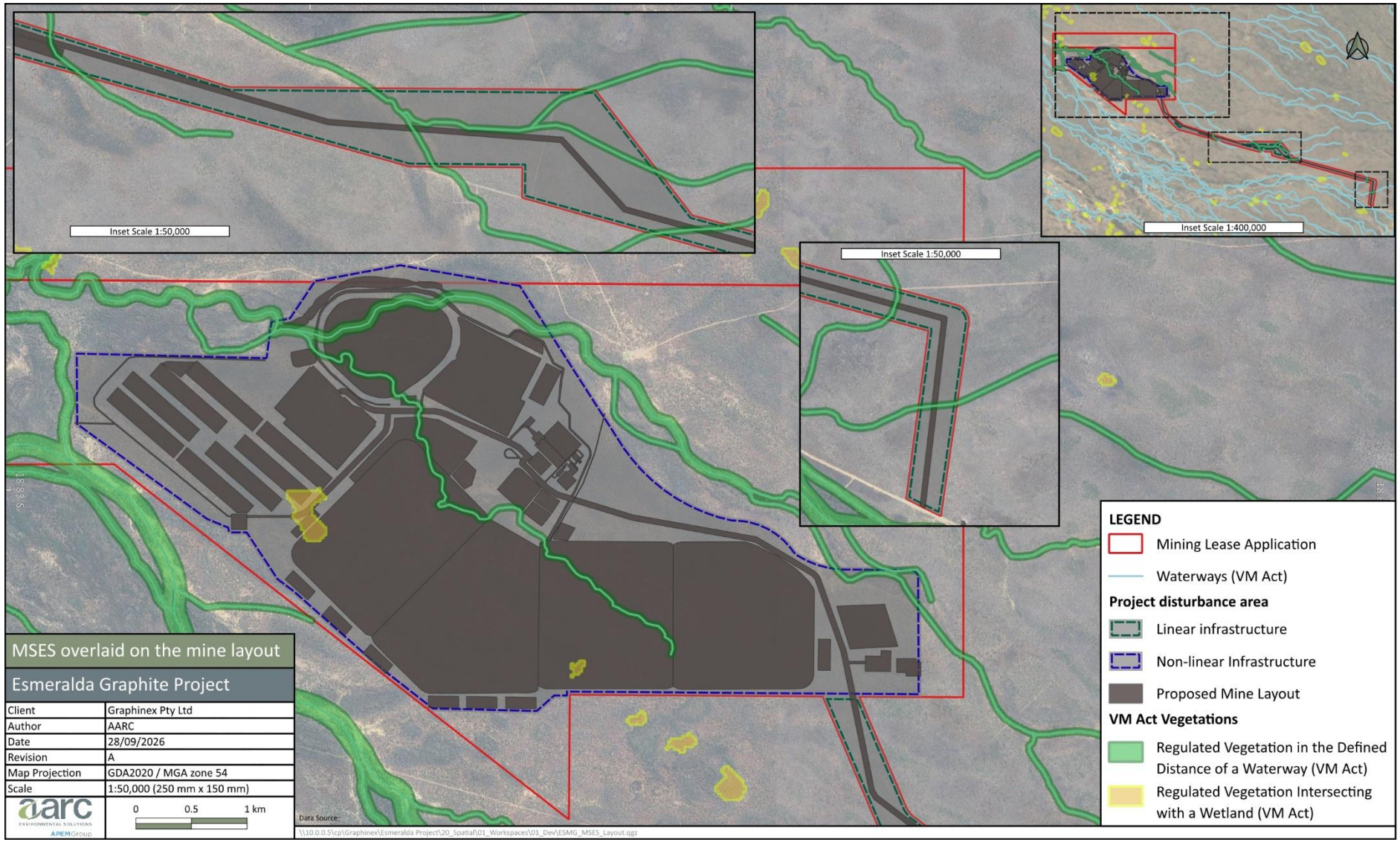


Figure 18-34: Matters of State Environmental Significance in relation to the Project layout

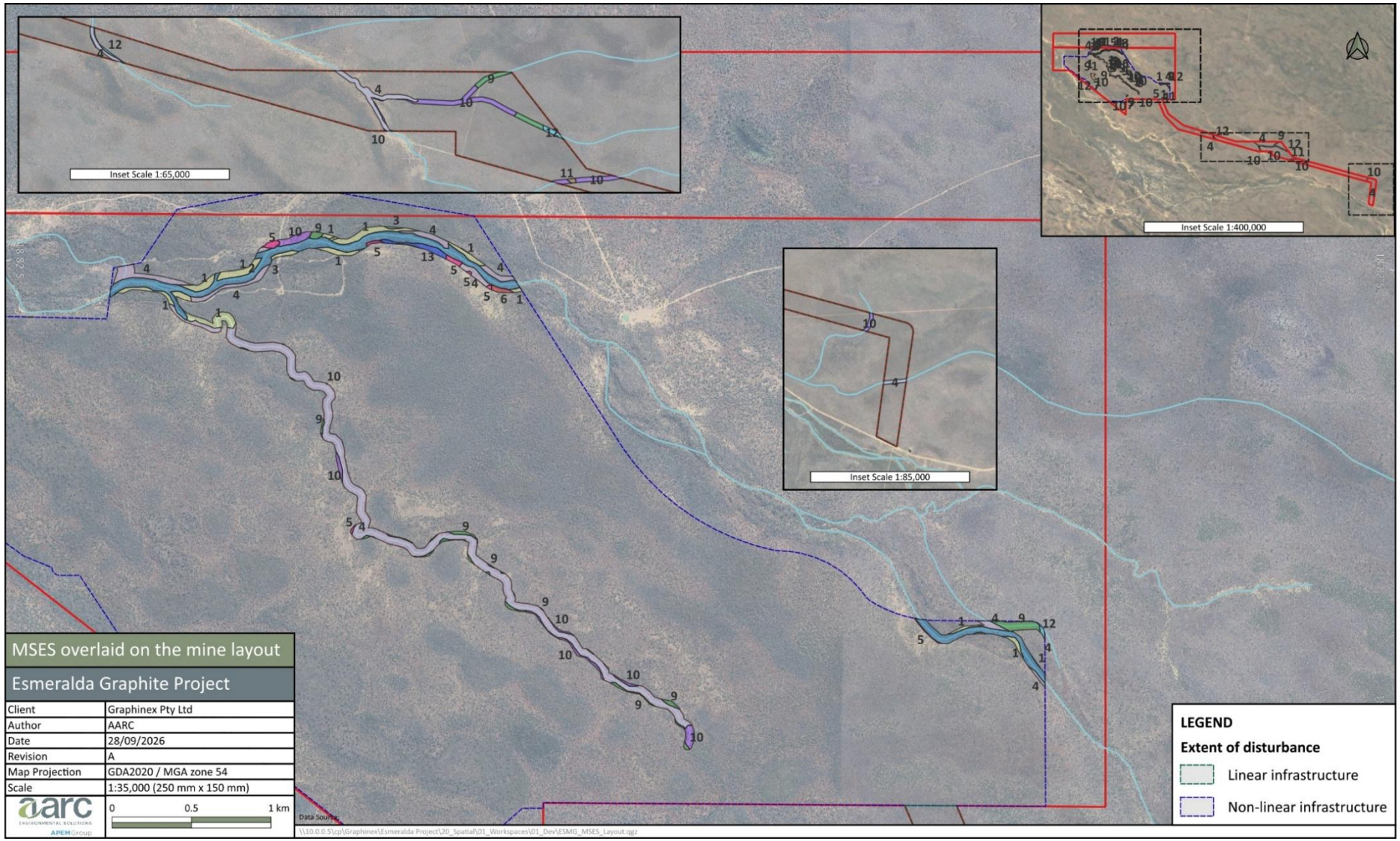


Figure 18-35: MSES within the study area – Regional Ecosystems

18.7.2.2 Protected wildlife habitat

Protected wildlife habitat includes an area of habitat for critically endangered, endangered, vulnerable or non-migratory special least concern animals (Short-beaked Echidna and Platypus) (DEHP 2014).

Protected wildlife habitat for one fauna species, the White-throated Needletail (Vulnerable), is located at the Project site. An assessment of the likelihood of significant impacts on the species is provided in Table 18-13. The Fork-tailed Swift is Special Least Concern – migratory species. Associated habitat does not constitute protected wildlife habitat under the EO Act.

Key terms relevant to the assessment of the likelihood of significant impacts are defined below in accordance with the Significant Residual Impact Guideline (DEHP 2014).

'Habitat' for a species is defined as an area that is —occupied, or periodically or occasionally occupied, by any species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their life cycles.

A 'long-term decrease' refers to any decline in a local population that is greater than which would be apparent without the action being present.

A 'population' for an endangered, vulnerable or special least concern species is defined as an occurrence of the species in a particular area. Occurrences include but are not limited to:

- geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

Up to 2,413.7 ha of White-throated Needletail habitat is proposed to be directly disturbed by the Project activities. An assessment of the likelihood of significant impacts on the White-throated Needletail was undertaken in accordance with the Significant Residual Impact Guideline (DEHP 2014) (Table 18-13). It is considered that the Project will not result in a significant residual impact to the White-throated Needletail.

Table 18-13: White-throated Needletail significant impact assessment

Significance criteria	Assessment of significance
An action is likely to have a significant impact on vulnerable wildlife if the impact on the habitat is likely to:	
Lead to a long-term decrease in the size of a local population	Although two subspecies of the White-throated Needletail breed in separate populations in the Northern Hemisphere, only one migrates to Australia in the non-breeding season (DCCEEW 2024-2025b). Clearing of remnant vegetation for the Project is unlikely to decrease the size of the population given the extent of alternate habitat available to this species in the broader region.
Reduce the extent of occurrence of the species	The extent of vegetation clearing required for the Project is unlikely to reduce the extent of occurrence of this species. The Project is not near the edge of the known distribution of the White-throated Needletail. Expansive areas of woodland vegetation will remain within the study area and widespread throughout the region.
Fragment an existing population	The White-throated Needletail migrates to Australia during the non-breeding season and is widespread across eastern and south-eastern Australia. The species is not dependant on habitat values specific to the Project disturbance area. Equivalent woodland habitat is widespread in the region. The clearing associated with the Project development will not fragment the population into two or more populations.

Significance criteria	Assessment of significance
Result in genetically distinct populations forming as a result of habitat isolation	The White-throated Needletail migrates to Australia during the non-breeding season and is widespread across eastern and south-eastern Australia. The species is not dependant on habitat values specific to the Project disturbance area. Equivalent woodland habitat is widespread in the region. The clearing associated with the Project development will not result in habitat isolation as connectivity across the broader region will be retained. The Project will not result in the formation of genetically distinct populations.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	Invasive species are not a serious threat to the White-throated Needletail. The Project is unlikely to result in invasive species that are harmful to the White-throated Needletail.
Introduce disease that may cause the species to decline	Disease is not a known threat to the White-throated Needletail. The Project activities are not likely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	There is no recovery plan for this species. Priority conservation actions identified for this species include working with governments in East Asia to minimise disturbance to breeding habitats and the identification and protection of important habitats in Australia (TSSC 2019). The Project is unlikely to substantially interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	Primarily an aerial species, the White-throated Needletail predominantly forages aerially, feeding on a wide variety of insects. They roost in forests and woodlands. While the Project will include some vegetation clearance, it will not reduce the quality or availability of habitat to the extent that it will cause disruptions to the species. The species is not dependant on habitat values within the Project disturbance area. Equivalent woodland habitat is widespread in the Project region. The White-throated Needletail does not breed in Australia. The Project will not disrupt breeding locations for the species.
Conclusion	The Project will not result in a significant residual impact to the White-throated Needletail.

18.7.2.3 Waterways providing for fish passage

Under the EO Act, offsets are required for significant residual impacts to any part of a waterway that provides for fish passage, if the Project includes the construction, installation and/or modification of a waterway barrier that will limit fish passage along that waterway.

Within the Project disturbance area, Warrigal Creek and unnamed stream order 4 waterway (tributary of Warrigal Creek) are classified as having a high value for fish passage, the stream order 3 waterway (tributary of Warrigal Creek) is classified as having a moderate value for fish passage, and the stream order 2 waterway (tributary of Warrigal Creek) is classified as having a low value for fish passage.

Potential barriers to fish passage proposed for the Project include the flood levees and diversion of the unnamed stream order 3 waterway (tributary of Warrigal Creek) and upgrades to existing crossings of tributaries (drainage features) in the transport corridor.

The waterway diversion will be constructed around the northern extent of the planned mining area for a length of 1.8km, which will include an excavated drainage channel, with a channel base width of approximately 5m, and low flow channel depth of one metre. Levee embankments will be constructed to plug the old waterway and provide flood immunity to the open cut pit. The diversion will connect to the existing waterway, east of the pit and divert it around the pits northern extent to tie back into the original waterway. The diversion is designed in accordance with the DNRME guidelines for permanent watercourse diversions to maintain the existing hydrology, hydraulic, geomorphic and ecological features of the existing waterway (DNRME 2019). The diversion will remain at closure. The proposed diversion geometry and grade

are comparable to those in the existing reach of the creek that is to be diverted. The diversion matches the conditions upstream and downstream of the tie in points. Revegetation is proposed to be undertaken using species present in the local ecosystem. Results from the flooding assessment (refer to Appendix D Aquatic Ecology Assessment and Appendix K Surface Water Assessment) for the project determined that there will be minor impacts to Warrigal Creek and Borer River due to the diversion of the unnamed waterway. A water management plan will be implemented for the Project.

Upgrades of existing crossings of small tributaries along the transport MLA are unlikely to constitute barriers to fish passage. These areas have been validated as drainage features through the watercourse determination process and are considered unlikely to support fish passage (refer to Section 5.2.6). Nonetheless, these crossings will be designed and constructed in accordance with the 'Accepted development requirements for waterway barrier works' (DPI 2025). They will be bed level or low level crossings, or culvert crossings to comply with western drainage basins on a green waterway.

An assessment of the likelihood of significant impacts on the waterways providing for fish passage in accordance with the Significant Residual Impact Guideline (DEHP 2014) is provided in Table 18-14. It is considered that the Project will not result in a significant residual impact on a waterway providing for fish passage.

Table 18-14: Waterways providing for fish passage significant impact assessment

Significance criteria	Assessment of significance
An action is likely to have a significant impact on a waterway providing for fish passage if there is a real possibility that it will:	
Result in the mortality or injury of fish	The Project is unlikely to result in the mortality or injury of fish. The waterways in the Project area are ephemeral and provide limited fish passage for most of the year. Construction works within the proposed disturbance area will occur during dry period when the ephemeral waterway is not flowing. The proposed diversion, flood levees and upgrades to existing crossings will be constructed in consideration of the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) to minimise or avoid impacts on fish passage. The design of the waterway will be in accordance with the DNRME (2019) guidelines for permanent watercourse diversions to maintain the existing hydrology, hydraulic, geomorphic and ecological features of the existing waterway. No material impacts to water quality are expected. A water management plan will be implemented for the Project to manage sediment, and runoff from mine areas.
Result in conditions that substantially increase risks to the health, wellbeing and productivity of fish seeking passage such as through the depletion of fishes energy reserves, stranding, increased predation risks, entrapment or confined schooling behaviour in fish	The Project is unlikely to create conditions that will substantially increase risks to the health, wellbeing and productivity of fish seeking passage. The waterways in the Project area are ephemeral and provide limited fish passage for most of the year. The proposed diversion will be designed to replicate the geomorphic features of the existing waterways to ensure the waterway conditions are reproduced, where possible. The diversion matches the conditions upstream and downstream of the tie in points. Revegetation is proposed to be undertaken using species present in the local ecosystem. The proposed diversion, flood levees and upgrades to existing crossings will be constructed in consideration of the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) to minimise or avoid impacts on fish passage. The flooding assessment for the project determined that there will be minor changes to Warrigal Creek and Borer River due to the diversion of the unnamed waterway.

Significance criteria	Assessment of significance
Reduce the extent, frequency or duration of fish passage previously found at a site	The proposed diversion is unlikely to reduce the extent, frequency or duration of fish passage conditions. The waterways in the Project area are ephemeral and provide limited fish passage for most of the year. The proposed diversion will be designed to replicate the geomorphic features of the existing waterways to ensure the waterway conditions are reproduced, where possible. The proposed diversion, flood levees and upgrades to existing crossings will be constructed in consideration of the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) to minimise or avoid impacts on fish passage. The flooding assessment for the project determined that there will be minor changes to Warrigal Creek and Borer River due to the diversion of the unnamed waterway.
Substantially modify, destroy or fragment areas of fish habitat (including, but not limited to in-stream vegetation, snags and woody debris, substrate, bank or riffle formations) necessary for the breeding and/or survival of fish	The Project is unlikely to substantially modify, destroy or fragment areas of fish habitat. The waterways in the Project area are ephemeral, and aquatic habitat is largely limited to discrete isolated pools separated by substantial lengths of dry stream bed for most of the year. Fish species in the area are assumed to be adapted to ephemeral systems and poor habitat quality. The proposed diversion will be designed to replicate the geomorphic features of the existing waterways to ensure the waterway conditions are reproduced, where possible. The diversion matches the conditions upstream and downstream of the tie in points. Revegetation is proposed to be undertaken using species present in the local ecosystem. The proposed diversion, flood levees and upgrades to existing crossings will be constructed in consideration of the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) to minimise or avoid impacts on fish passage. The flooding assessment for the project determined that there will be minor changes to Warrigal Creek and Borer River due to the diversion of the unnamed waterway. Erosion resulting from the Project has the potential to reduce in-stream habitat for fish locally, where these features are present. However, development and implementation of an erosion and sediment control plan will mitigate erosion processes and protect these habitats from increased sediments loads.
Result in a substantial and measurable change in the hydrological regime of the waterway, for example, a substantial change to the volume, depth, timing, duration and frequency of flows	The Project is unlikely to create conditions that result in a substantial and measurable change in the hydrological regime of the waterway. The flooding assessment for the project determined that there will be minor changes to Warrigal Creek and Borer River due to the diversion of the unnamed waterway. This impact is expected to include isolated increases in peak flood levels at the location of the diversion drain and south of the TSFs, as well as a minor decrease in flood levels in Warrigal Creek downstream of the Project site. The changes in flood depth are minor and not expected result in any adverse impacts to the waterway. Increases to peak flood velocity will be confined to the diversion drains and associated northern breakout flooding. Decreases in peak flood velocity have been modelled at the inlet and outlet of the diversion drain. Peak flood velocities in natural environments are expected to increase by a maximum of 0.5 m/s in the breakout flow path north of the watercourse diversion in the 1% AEP flood event however the absolute peak velocity in the operational phase model remains <0.6m/s. The proposed diversion will be designed to replicate the geomorphic features of the existing waterways to ensure the waterway conditions are reproduced, where possible. The volume, timing, duration, frequency and depth of flows are expected to be maintained in the diverted channel. The proposed diversion, flood levees and upgrades to existing crossings will be constructed in consideration of the 'Accepted development requirements for waterway barrier works' (DPI 2025) and 'State code 18: Constructing or raising waterway barrier works in fish habitats' (DAF 2022) to minimise or avoid impacts on fish passage.
Lead to significant changes in water quality parameters such as temperature,	The Project is unlikely to lead to a significant change in water quality within the waterways. Development and implementation of an erosion and sediment control plan will mitigate erosion processes and protect waterways from increased sediments loads.

Significance criteria	Assessment of significance
dissolved oxygen, pH and conductivity that provide cues for movement in local fish species	A water quality monitoring program will also be developed and implemented to confirm the effectiveness of management practices and the protection of downstream ecosystems. A water management plan for the Project will be implemented. Where possible, mine affected water will be re-used and re-cycled on site as part of Project water supply. A detailed site water balance will be prepared to account for all water inputs and outputs, and the necessary on-site storage and management infrastructure will be developed accordingly. Mine water storages associated with the Project do not have potential to discharge offsite. All mine water dams overflow to the mining pit. The pit has excess capacity to contain all overflow volumes, ensuring that there would be minimal actual or potential discharge of contaminants to waters that may or have the potential to cause an adverse effect on identified environmental values. The sediment dams have been designed to provide sufficient storage for settlement of suspended solids so that water quality during overtopping events has negligible impact on the water quality in the receiving waterway. Sediment dams will also include overflow control structures with scour protection (rock chutes, rock aprons or level spreaders) to ensure non-erosive discharges. Monitoring of overtopping events will be undertaken to assess the performance of the sediment dams and ensure downstream environmental values are maintained and validate the design assumptions. Sediment dam overflows and associated water quality are not expected to have adverse impacts on water quality and environmental values in receiving waterways downstream of the Project. Any runoff and seepage produced by the waste rock dumps will be collected in Sedimentation Dam 1 and 3. Seepage produced by the waste dumps will be collected in the sediment dams and managed by the water management system. Seepage produced during dry to medium rainfall events will be contained and managed by the sediment dams. Any seepage produced during large rainfall events that result in overtopping of the sediment dams would receive significant dilution immediately in the receiving waterway. Because the metal concentrations in the water materials are low compared to the receiving waterway WQOs, the expected dilution with natural flows in the downstream waterway is expected to reduce concentrations below the WQOs. Based on the seepage, a material impact on the environmental value of receiving waters is not expected.
Conclusion	The Project will not result in a significant residual impact on a waterway providing for fish passage.

18.7.3 Summary of Matters of State Environmental Significance potential impacts

After the mitigation hierarchy has been implemented for the Project, a significant residual impact from the Project will occur for the following matters in Table 18-15. There is no significant residual impact to the White-throated Needletail likely. See Figure 18-34 for a visual overview of the impacted MSES in relation to the Project layout within the Project disturbance area.

Table 18-15: Summary of MSES to have a significant residual impact from the Project

Matter of State Environmental Significance	Regional Ecosystem impacted	Area (hectares)
Regulated vegetation - Prescribed REs that intersect a VM Act wetland	RE 2.3.55d	10.45
Regulated vegetation - Prescribed REs located within the defined distance of a VM Act watercourse	RE 2.3.22	8.99
	RE 2.3.26a	19.07
	RE 2.3.29b	42.02
	RE 2.5.14a	7.38
	RE 2.5.17b	16.13

	RE 2.5.18a	0.42
	RE 2.5.28a	1.90

18.8 Environmental Offset Strategy

Under the EO Act, an environmental offset cannot be considered until it has been demonstrated that all reasonable avoidance and mitigation measures have been, or will be, undertaken. The mitigation hierarchy 'avoid - mitigate - offset' applies to prescribed activities that impact prescribed environmental matters. This means that in designing or planning the prescribed activity, impacts on prescribed environmental matters should, in the first instance, be reasonably avoided wherever possible. For impacts that cannot be avoided, the extent of those impacts should be carefully managed and mitigated to the greatest possible extent. However, if there is still a significant impact to a prescribed environmental matter then an offset may be required.

The layout of Project infrastructure has been located to avoid and minimise impacts to the woodland communities with connectivity values, such as watercourses (refer to Section 18.6.1.1). However, as per Section 18.7.3, a significant residual impact will occur for prescribed environmental matters. In accordance with the EO Act and Queensland Environmental Offsets Policy, offsets will be required for the Project for significant residual impacts on regulated vegetation (REs within mapped vegetation management wetlands; and REs within the defined distance of a vegetation management watercourse) (Table 18-16). Environmental offsets will not be required for White-throated Needletail.

Table 18-16: MSES to be offset via the Environmental Offset Strategy

Matter of State Environmental Significance			**Extent of disturbance (ha)**	**Offset required**
Regulated vegetation	REs within mapped vegetation management wetlands	RE 2.3.55d	10.45	Yes
	REs within the defined distance of a vegetation management watercourse	RE 2.3.22	8.99	Yes
		RE 2.3.26a	19.07	Yes
		RE 2.3.29b	42.02	Yes
		RE 2.5.14a	7.38	Yes
		RE 2.5.17b	16.13	Yes
		RE 2.5.18a	0.42	Yes
		RE 2.5.28a	1.90	Yes

For all prescribed environmental matters, the size and scale of an offset is that which is necessary to achieve a conservation outcome.

Under the Queensland Environmental Offsets Policy, there are three offset delivery options, which include:

1) Proponent-driven offset: A proponent-driven offset may take the form of a traditional land-based offset; be undertaken through actions under a Direct Benefit Management Plan; or a combination of both. For a proponent-driven offset, the offset delivery liability remains with the proponent and the offset must be delivered in accordance with an Offset Delivery Plan approved by the administering agency.

2) Financial settlement offset: For financial settlement offsets, the payment amount must be calculated in accordance with the methodology set out in the QEOP. A web-based 'financial settlement offset

calculator' is available on the Queensland government website that can assist in this process. The State is responsible for delivering a conservation outcome from the financial settlement offset payment.

3) A combination of a proponent-driven offset and financial settlement offset may be utilised. However, the Direct Benefit Management Plan can only contribute up to 10% of the offset delivery.

The Proponent will deliver offsets in accordance with the Queensland Environmental Offsets Policy. The preferred delivery mechanism is financial settlement; however, proponent-driven offsets or a combination may be considered, subject to availability of suitable land and conditions at the time of offset delivery.

The total cost required to secure an offset for the removal of REs that intersect with an area shown on the vegetation management wetlands map and REs within a defined distance of a watercourse has been calculated as part of the Environmental Offset Strategy prepared for the Project (Appendix Z).

18.9 TOR Reconciliation table

Terms of reference -Content requirements of the EIS		EIS Section
Section 18 – Flora and fauna		
18.1	Guidance material relevant for the flora and fauna assessment includes: (a) Queensland Government, *Aquatic ecology - EIS information guidelines*, ESR/2020/5295 (b) Queensland Government, *Terrestrial ecology - EIS information guideline*, ESR/2020/5309. (c) Queensland Government, *Groundwater dependent ecosystems - EIS information guideline*, ESR/2020/5301 (d) Queensland Government, Water - EIS information guideline, ESR/2020/5312 (e) Queensland Government, Business Queensland, Fish salvage (website), available at: **www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/development/waterways/salvage** (f) Queensland Government, Policy for Vegetation Management, VEG/2014/1084 (g) Queensland Government, Waterway Barrier Works (website), available at: **https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/development/waterways/barriers**.	Chapter 18, Section 18.4.1, Section 18.4.2
Flora and fauna – Existing environment		
18.2	Describe the legislative context for flora and fauna in the project footprint and surrounding area, including the protection and conservation status of each identified ecological value under the *Nature Conservation Act 1992* (NC Act), *Vegetation Management Act 1999* (VM Act), *Fisheries Act 1994*, *Marine Parks Act 2004* (MP Act), EP Act, EPBC Act, local government planning scheme and any other relevant statutory instrument	Section 18.2
18.3	Identify and describe matters of national environmental significance (MNES), matters of state environmental significance (MSES), matters of local environmental significance (MLES), fauna and flora of cultural significance to Aboriginal peoples and/or Torres Strait Islander peoples, state and regionally significant biodiversity, and the environmental values of the terrestrial and aquatic ecosystems likely to be impacted by the project. The description should include flora and fauna environmental values in the project area, and surrounding areas, identified in desktop analysis and field surveys, and shown on maps in relation to their habitat and connectivity in the landscape (including upstream and downstream of the project). This includes, but is not limited to the following: (a) regulated vegetation under the VM Act (b) regional ecosystems and biodiversity status (c) connectivity areas (d) wetlands and waterways (e) threatened ecological communities and wildlife habitat	Section 18.2.11, Section 18.3, Section 18.5.1,Section 18.5.2, Section 18.5.3, Section 18.5.4, Section 18.5.1.4, Section 18.5.1.1, Section 18.7, Section 18.7.2

Terms of reference -Content requirements of the EIS		EIS Section
	(f) migratory species (g) protected areas and conservation areas (h) waterways providing for fish passage (i) designated precincts in a strategic environmental area under the Regional Planning Interests Regulation 2014 (j) biodiversity offset areas approved by the State or Australian governments (if any)	
18.4	Describe, with photographs and detailed mapping (at a suitable scale), the context of the project footprint in relation to surrounding MSES/MLES (or any matter identified at TOR item 18.3) including the location of project activities, disturbance footprint, infrastructure and buffers.	Section 18.6.1.1, Section 18.5.1.1, Section 18.6.1
18.5	Provide details of the scope, methodology, timing, effort and results of the field surveys (including spatial data for the survey sites, extent and location of transects, and fauna and flora records on site) undertaken in the EIS. Field surveys should appropriately cover seasonal fluctuations in conditions (i.e. wet and dry seasons). Ecological survey reports (including field proformas and data sheets) should be provided as searchable and hyperlinked appendices.	Section 18.4, Appendix D, Appendix E, Appendix F, Appendix G
18.6	Describe, using relevant literature, habitat mapping, and the results of surveys, the natural and existing upstream and downstream movement and habitat requirements of all aquatic and terrestrial flora and fauna species in the project area and surrounding area. Identify sensitivity to change of aquatic and terrestrial flora and fauna groups, REs, and significant species.	Section 18.5, Appendix D, Appendix E, Appendix F, Appendix G
18.7	Describe the existing quality and suitability of habitat for all flora and fauna species that are known to occur, likely to occur, or have the potential to occur in the project footprint. Provide the area of existing habitat in hectares for each species in the project footprint based on field verification. For habitat area calculations, identify the use (if any) of high value regrowth vegetation and non-remnant areas.	Section 18.5.1, Section 18.5.1.1, 18.5.2.5
18.8	Discuss how the environmental values relating to flora and fauna informed the project design (i.e. constraints, impact mitigation).	Section 18.6, Section 18.6.6, Section 18.6.1.1, Section 18.6.1.2, Section 18.6.1.3
18.9	Address any obligations imposed by State or Commonwealth legislation or policy or international treaty obligations, such as the China–Australia Migratory Bird Agreement, Japan–Australia Migratory Bird Agreement, Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (if relevant) or Republic of Korea–Australia Migratory Bird Agreement.	Section 18.2
Flora and fauna – Impact assessment		
18.10	Describe all relevant impacts (direct, indirect, cumulative and facilitated) on biodiversity and natural environmental values identified at TOR item 18.3 (including the type of habitat impacted, such as breeding, roosting, nesting and foraging habitat) from the project across all stages. The assessment should consider known and potential impacts of the project, and must include:	Section 18.6, Section 18.7.2

Terms of reference -Content requirements of the EIS		EIS Section
	(a) terrestrial and aquatic ecosystems including groundwater-dependent ecosystems (b) biological diversity (c) the integrity of ecological processes, including habitats of listed threatened, near threatened or special least concern species (d) connectivity within and between aquatic and terrestrial habitats and ecosystems (e) identification of analogous (reference) sites and the collection of sufficient baseline information to inform rehabilitation criteria post mining (f) the integrity of landscapes and places, including wilderness and similar natural places (g) chronic, low-level exposure to contaminants or the bioaccumulation of contaminants (h) direct and indirect impacts on terrestrial and aquatic species and ecosystems, whether due to: vegetation clearing; hydrological changes; discharges of contaminants to water, air or land; noise; artificial light; and other relevant matters (i) impacts of waterway barriers on fish passage in all waterways (consider waterways that are mapped on the Queensland Waterways for Waterway Barrier Works spatial data layer and waterways that are present on the ground that are not mapped), including details of any significant diversion or interception of water flows and the effects of subsidence and groundwater drawdown	
18.11	When identifying impacts, ensure figures are appropriately scaled and provided for each activity/component and for each phase of the project.	Section 18
18.12	Describe any actions of the project that require an authority under the NC Act, and/or would be assessable development for the purposes of the VM Act, Regional Planning Interests Act 2014, Fisheries Act 1994, and Planning Act 2016. Features to consider include RE, environmentally sensitive areas, wetlands, nature refuges, protected areas and strategic environmental areas.	Section 18.2, Section 18.5.1, Section 18.5.2, Section 18.3
18.13	Identify where any proposed clearing is accepted or exempt development under relevant planning instruments.	Section 18.2, Section 18.7.2
18.14	Provide an assessment against the relevant prescribed solution(s) for strategic environmental areas impacted by the project, if relevant.	Section 18.3, not relevant
18.15	Provide an assessment against SDAP State code 16: Native vegetation clearing addressing the relevant assessment benchmarks, if relevant	Not relevant
18.16	Provide an assessment against SDAP State code 18: Constructing or raising waterway barrier works in fish habitats for any assessable waterway barrier works required for the project, including construction activities, if relevant	Section 18.5.2.2
Flora and fauna – Mitigation measures		

Terms of reference -Content requirements of the EIS		EIS Section
18.17	Demonstrate how the proposal avoids native vegetation clearing, or where avoidance is not reasonably possible, minimises clearing to conserve vegetation, avoid land degradation and maintain ecological processes.	Section 18.6.1.1
18.18	Describe how the project will be designed, constructed and operated to avoid direct or indirect impacts on ecological environmental values.	Section 18.6.1, Section 18.6.2, Section 18.6.4, Section 18.6.5
18.19	Where impacts to MSES cannot reasonably be avoided, describe measures to minimise and then mitigate the direct or indirect impacts on ecological values.	Section 18.6.6, Section 18.7.2
18.20	Assess how nominated quantifiable indicators and standards may be achieved for nature conservation management. Address measures to protect or preserve any listed threatened, near threatened or special least concern species. Describe the practicality, effectiveness and risks for each avoidance and mitigation measure. Include the timeframes in which results would be achieved, frequency of monitoring, and how corrective actions will be managed for all phases of the project.	Section 18.6.1, Section 18.7.2, Section 18.6.6
18.21	Justify how applying all proposed avoidance and management measures would result in acceptable outcomes for terrestrial and aquatic ecology. Describe how achieving the measures successfully will be monitored, measured and audited. Include provisions to regularly evaluate all the mitigation measures so that improvements may be made as new technologies and best practices evolve.	Section 18.6.1, Section 18.7.2, Section 18.6.6, Appendix K
18.22	Propose measures that would avoid the need for waterway barriers. Where waterway barrier works cannot be reasonably avoided, propose measures to mitigate the impacts of their construction and operation.	Section 18.6.6.11
18.23	Describe, illustrate, and demonstrate how the project provides safe and adequate upstream and downstream aquatic fauna passage, including all monitoring and maintenance measures.	Section Section 18.6.6, Section 18.6.6.11, Appendix K
18.24	Detail measures to ensure waterway diversions are designed and constructed to resemble the natural waterway they replace. Demonstrate waterway diversions tie in with the natural bed and banks of waterways upstream and downstream of the diversion. Demonstrate any proposed diversion will function as a natural waterway and will provide and maintain similar connectivity, hydrological, hydraulic and environmental conditions and include similar profiles, fish habitat and fish passage features.	Section 18.6.1, Section 18.6.6.11
18.25	Describe and illustrate any screening incorporated to prevent the entrainment of fish into water pumping infrastructure.	Section 18.6.1.3
18.26	Assess the need for buffer zones and the retention, rehabilitation or planting of movement corridors. The assessment must take into account the role of buffer zones in maintaining and enhancing riparian vegetation and wetlands to improve water quality, promote habitat connectivity and provide habitat.	Section 18.6.1, Section 18.7.2
18.27	Propose rehabilitation criteria, in relation to natural values, that would be used to measure progressive rehabilitation of disturbed areas. Describe how the achievement of the	Chapter 13 Rehabilitation and closure, Appendix T,

Terms of reference -Content requirements of the EIS		EIS Section
	objectives will be monitored and audited, and how corrective actions will be managed. Proposals for rehabilitation of disturbed areas must, in suitable habitat, describe terrestrial and aquatic fauna habitat features to achieve rehabilitation outcomes.	
18.28	Demonstrate how the project will meet the environmental objectives and performance outcome of the EP Regulation.	Section 18.1
Flora and fauna – Environmental offsets		
18.29	After demonstrating that all reasonable steps have been taken to avoid and then mitigate impacts, identify whether the project will result in a significant residual impact (SRI) to MSES/MLES requiring an environmental offset with reference to the Queensland Environmental Offsets policy, Significant Residual Impact Guideline, and Queensland environmental offset framework. Characterise the scale of SRI in hectares.	Section 18.7.2, Section 18.7.3
18.30	Propose offsets consistent with the relevant State legislation or policies for any SRI. If an SRI will occur on a prescribed environmental matter as outlined in the Environmental Offsets Regulation 2014, offset(s) must be consistent with the requirements of the Environmental Offsets Act 2014 and the latest version of the Queensland Environmental Offsets Policy.	Section 18.8
18.31	In addition to TOR item 18.30, propose environmental offsets, that at a minimum: (a) consider the full extent of potential impacts on prescribed environmental matters for the entire project as part of the SRI assessment (b) identify whether an SRI to MSES will be addressed through a financial or proponent driven offset (land-based offset) (c) evaluate how the proposed offset will achieve a conservation outcome for the impacted matter (d) for land-based offsets: (i) provide results of a habitat quality assessment on both the impact area and the proposed offset area(s) to compensate for impacts (ii) assess the vulnerability and resilience of any proposed offset site(s) under climate change scenarios (e.g. reduced water availability, increased bushfire risk, increased flood risk, sea level rise) (iii) describe any active restoration actions that would be undertaken to improve, enhance and manage native vegetation or threatened species habitat at the proposed offset site (e) for financial offsets, provide a financial offset calculation.	Section 18.8
18.32	Describe how the achievement of the offset will be monitored and audited, and how corrective actions will be managed.	Section 18.8
18.33	Describe any proposed measures that would be used to avoid, minimise, or mitigate any impact on agricultural land of state or regional significance when meeting environmental offset requirements required for the project.	Section 18.3