



Stormwater and Erosion Risk Assessment Report

Dugald River Wind Farm Project

PREPARED FOR



MMG Dugald River Pty Ltd

DATE
7 April 2026

REFERENCE
0755929



DOCUMENT DETAILS

DOCUMENT TITLE	Stormwater and Erosion Risk Assessment Report
DOCUMENT SUBTITLE	Dugald River Wind Farm Project
PROJECT NUMBER	0755929
DATE	7 April 2026
VERSION	Final
AUTHOR	Environmental Resources Management Australia Pty Ltd
CLIENT NAME	MMG Dugald River Pty Ltd

DOCUMENT HISTORY

				ERM APPROVAL TO ISSUE		
VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	COMMENTS
Draft	1	Samuel John	Josh Maunder	Charissa Tomlin	17.04.2025	Draft for Client review
Final	2	Samuel John	Josh Maunder	Charissa Tomlin	2.05.2025	Issued for Use
Draft	3	Clara Donnelly, Samuel Su	Brenton Nicol,	Charissa Tomlin, Chris Gimber (RPEQ)	27.03.2026	Updated in response to SARA Information Request
Final	4	Samuel Su	Brenton Nicol, Josh Maunder	Charissa Tomlin, Chris Gimber (RPEQ)	07.04.2026	Final for Client Use

Stormwater and Erosion Risk Assessment Report

Dugald River Wind Farm Project
0755929



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ACRONYMS AND ABBREVIATIONS

Acronym	Description
AHD	Australian Height Datum
ANZECC	Australian & New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
DRM	Dugald River Mine
EA	Environmental Authority
EIS	Environmental Impact Statement
ERM	Environmental Resources Management Australia Pty Ltd
ESC	Erosion and Sediment Control
EV	Environmental Value
IECA	The International Erosion Control Association (Australasia)
MMG	MMG Dugald River Pty Ltd
NAF	Non-Acid Forming
PO	Performance Outcomes
QFAO	Queensland Floodplain Assessment Overlay
QWQG	Queensland Water Quality Guidelines
REMP	Receiving Environment Monitoring Program
RUSLE	Revised Universal Soil Loss Equation
SDAP	State Development Assessment Provisions
t/ha/yr	tonnes per hectare per year
TSF	Tailings Storage Facility
WQO	Water Quality Objectives
WTG	Wind Turbine Generators

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by MMG Dugald River Pty Ltd (MMG) to prepare a Stormwater and Erosion Risk Assessment for the proposed Dugald River Wind Farm Project (the Project). The Project comprises the construction and operation of up to 24 Wind Turbine Generators (WTGs), a Battery Energy Storage System (BESS) and associated ancillary infrastructure.

The first stage is proposed to comprise the construction and operation of eight WTGs, one permanent Meteorological Mast (Met Mast), the 220/33 kV substation, overhead connection to the Dugald River Mine (DRM) and an initial BESS. Stage 2 of the Project comprises an additional (up to) 16 WTGs, an expanded BESS and an upgrade of the 220/33 kV substation.

1.2 OBJECTIVE AND SCOPE

The objective and scope of this Report is to identify and determine the potential impacts on stormwater and erosion risks as a result of construction and operation of the Project.

The following Scope of Work was undertaken to address the Report's objectives:

- Desktop-based investigations to establish existing stormwater conditions;
- Review of the Project Description;
- Review of the proposed Disturbance Footprint;
- Assessment of impacts on stormwater flows and quality; and
- Provision of recommended management and mitigation measures (if required).

1.3 PROJECT DESCRIPTION

The Project will be located on the Knapdale Range, adjacent to the Dugald River Mine, owned and operated by MMG. The Project is situated on State Land, 63 km north-east of the Township of Cloncurry and immediately west of Dugald River Mine.

The Knapdale Range is situated within the Mount Isa subregion, which is characterised by tilted metamorphic hills and ranges, low open woodlands with *Eucalyptus spp.*, *Corymbia spp.* and Spinifex dominant grasslands with *Acacia spp.* dominant shrub layers throughout. Soil types range from rocky, skeletal soil types to shallow-moderate sandy loam towards the eastern base of the range.

The Project is proposed to be constructed in two stages. The first stage is proposed to comprise the construction and operation of a Met Mast and up to eight WTGs, with an associated substation and BESS. Following the construction and operation of the first stage of the Project, the second stage is proposed to consist of an additional Met Mast, up to 16 WTGS and an expanded BESS.

Once both stages of construction are completed, the Project will consist of the following:

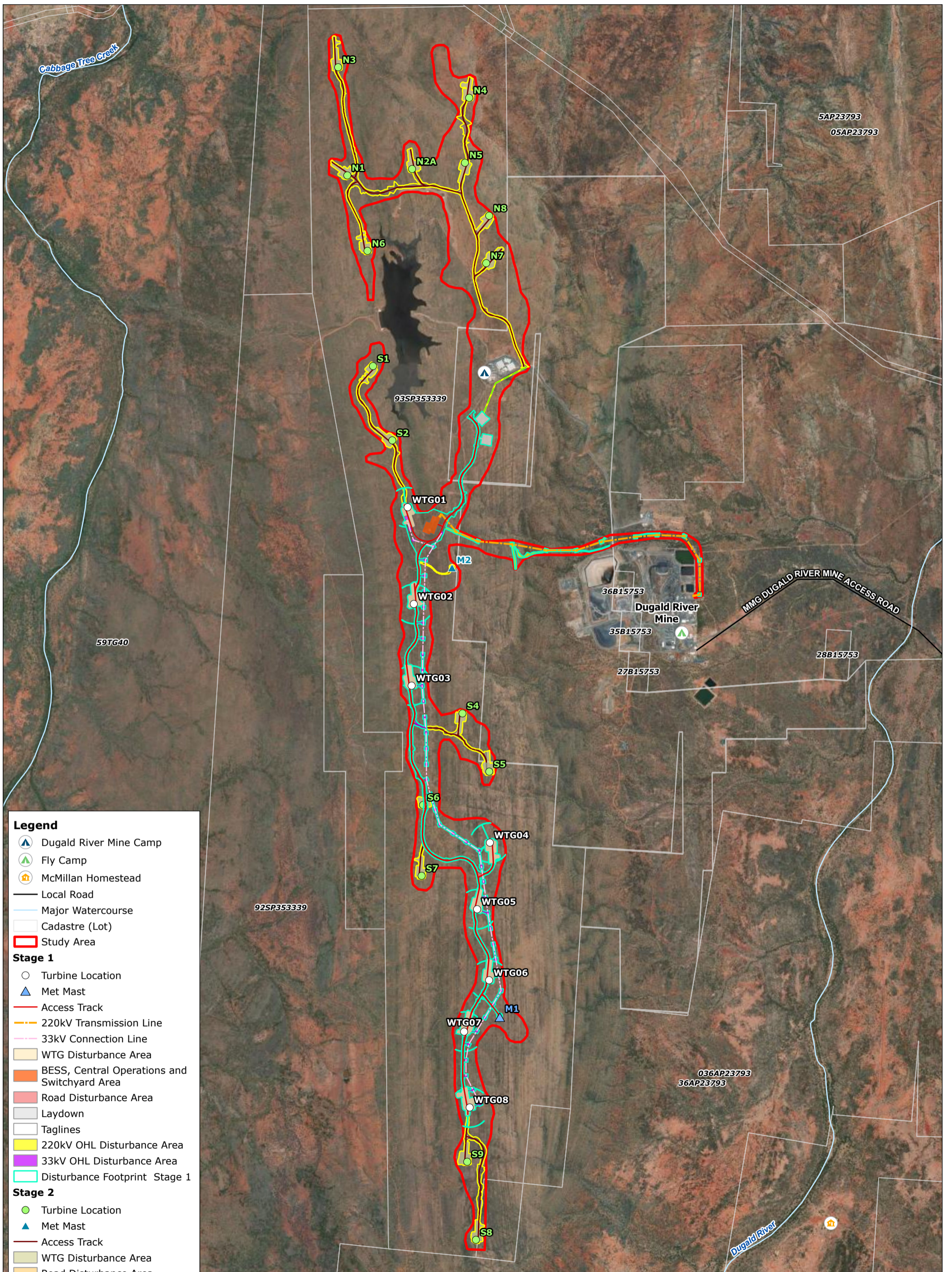
- Up to 24 X 6 MW WTGs;
- A staged BESS facility comprising maximum 66 battery units and 33 Medium Voltage Power Stations;
- Two permanent Met Masts;

- Access tracks, Hardstand and Material laydown areas;
- Supporting infrastructure (including a collection substation, switchyard and underground and overhead powerlines); and
- An Operations And Maintenance Facility.

The Project comprises a total disturbance footprint of 136.74 ha as detailed in Table 1-1 and as shown in Figure 1-1.

TABLE 1-1 PROJECT SPECIFICATIONS

Feature	Details	Area (ha)
Stage One		
WTG Construction Areas	8 X WTGs	21.67
Central Operations and Switchyard Area	<ul style="list-style-type: none"> • 18 X Battery Units • 9 X MVPS • Substation and Switching Infrastructure • Operations Facility 	2.29
Access Tracks	Access Tracks	30.09
Met Mast 1	Stage 1 Met Mast	0.28
33 kV Powerline	Stage 1 Overhead Powerline which links each WTG to the Central Switchyard Area. This area includes the underground power corridors between each WTG and the closest power pole	11.34
220 kV Powerline	Overhead Powerline linking the Central Operations and Switchyard Area to the DRM	4.69
Laydowns	2 X Laydown areas for storage and construction purposes	2.42
Taglines	Temporary Taglines used during construction of each WTG	1.26
Stage One Disturbance Area		74.04
Stage Two		
WTG Construction Areas	Up to 16 X WTGs	31.5
Central Operations and Switchyard Area	<ul style="list-style-type: none"> • 30 X Battery Units • 15 X MVPS 	Nil additional disturbance
Access Tracks	Access Tracks	30.64
Met Mast 2	Stage 2 Met Mast	0.28
Stage 1 and 2 Link	Easement between Stages 1 and 2	0.27
Stage Two Disturbance Area		62.69
Total Disturbance Footprint		136.74



- Legend**
- Dugald River Mine Camp
 - Fly Camp
 - McMillan Homestead
 - Local Road
 - Major Watercourse
 - Cadastre (Lot)
 - Study Area
- Stage 1**
- Turbine Location
 - Met Mast
 - Access Track
 - 220kV Transmission Line
 - 33kV Connection Line
 - WTG Disturbance Area
 - BESS, Central Operations and Switchyard Area
 - Road Disturbance Area
 - Laydown
 - Taglines
 - 220kV OHL Disturbance Area
 - 33kV OHL Disturbance Area
 - Disturbance Footprint Stage 1
- Stage 2**
- Turbine Location
 - Met Mast
 - Access Track
 - WTG Disturbance Area
 - Road Disturbance Area
 - Stage 1 to Stage 2 Connection Easement
 - Disturbance Footprint Stage 2

Source:
 Layout: Client Provided (March 2026)
 Base Data - QSpatial
 Imagery - ESRI World Imagery

Coordinate System:
 GDA2020 MGA Zone 54
 Date: 01/04/2026
 Created By: MB
 Drawing Size: A3
 0 0.5 1km
 1:35,000

F1-1 Project Layout

Dugald River Wind Farm Project
Stormwater and Erosion Assessment
 Client: MMG Dugald River Pty Ltd

2. REGULATORY REQUIREMENTS AND GUIDELINES

This Stormwater and Erosion Risk Assessment and Report has been prepared with reference to the following Legislation and Guidelines for stormwater and erosion risks within Queensland.

Legislation

- *Environmental Protection Act 1994*;
- *Planning Act 2016*;
- *Water Act 2000*;
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019;
- State Code 23 - Wind Farm Development;
- State Code 27: Battery Storage Facility Development; and
- Queensland Planning Regulation 2017.

Guidelines

- Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZECC & ARMCANZ Guidelines, 2018);
- Queensland Urban Drainage Manual: Fourth edition (Institute of Public Works Engineering Australasia, 2021) (QUDM);
- Queensland Water Quality Guidelines (DEHP, 2009); and
- Best Practice Erosion and Sediment Control document (BPESC) (International Erosion Control Association, 2025).

2.1 ENVIRONMENTAL PROTECTION ACT 1994

The *Environmental Protection Act 1994* outlines the obligations and duties to prevent environmental harm. The three primary duties that apply are:

- The General Environmental Duty – not to carry out an activity that may cause harm without taking measures to prevent or minimise the harm;
- The Duty to Notify of Environmental Harm – to inform the relevant authority when environmental harm has (or might) occur; and
- The Duty to Restore the Environment – to take measures to rehabilitate land following a pollution incident.

This Report has been prepared to satisfy the requirements of the *Environmental Protection Act 1994*, and assesses activities associated with the Project that may cause environmental harm.

2.2 WATER ACT 2000

The Queensland *Water Act 2000* works together with the *Environmental Protection Act 1994* and primarily governs the sustainable management and efficient use of water resources. The Queensland *Water Act 2000* sets out requirements for monitoring water quantity and quality, as well as establishing reporting for water use and compliance and reporting related to environmental impact.

2.3 PLANNING ACT 2016

2.3.1.1 STATE CODE 23: WIND FARM DEVELOPMENT

The Queensland Government State Code 23: Wind Farm Development provides a Planning and Impact Assessment Code to protect communities and the environment from adverse impacts resulting from the construction, operation and decommissioning of Wind Farm projects.

This Report has been prepared to assess the Project's compliance with the relevant Performance Outcomes (PO) concerning stormwater, drainage and water quality as outlined in Table 23.1 (Material Change of Use) of State Code 23. The relevant POs from State Code 23 are:

- **Natural drainage patterns**
 - **PO6:** The wind farm, including ancillary infrastructure, is designed and sited to minimise crossings of and interference with natural drainage lines, waterways and wetlands.
- **Protecting water quality and erosion control**
 - **PO7:** Development is designed to avoid areas of high erosion risk, where failure of erosion management devices would result in permanent and/or adverse impacts on receiving waterways or wetlands.
 - **PO8:** Development is constructed to maintain or improve the water quality of receiving waters, waterways and wetlands by:
 - minimising erosion and run off;
 - managing drainage control; and
 - preserving the bank stability of affected waterways and drainage lines.
 - **PO9:** Areas cleared for construction are progressively stabilised during construction to ensure that erosion and run off to the surrounding landscape and waterways is minimised to the greatest extent possible.

2.3.1.2 STATE CODE 27: BATTERY STORAGE FACILITY DEVELOPMENT

The Queensland Government State Code 27: Battery Storage Facility Development provides a Planning and Impact Assessment Code to protect communities and the environment from adverse impacts resulting from the construction, operation and decommissioning of battery storage facility projects.

This Report has been prepared to assess the Project's compliance with the relevant POs concerning stormwater, drainage and water quality outlined in Table 27.1 (Material Change of Use) of State Code 27:

- **Protecting Water Quality and Stormwater Management**
 - **PO16:** Development:
 - minimises the disturbance of high-risk soils; and
 - manages the release of soil-based contaminants.
 - **PO17:** Development maintains the water quality of receiving waters, waterways and wetlands by:
 - avoiding locating in waterways and wetlands;

- minimising crossings of and interference with natural drainage lines, farm drainage and irrigation infrastructure;
 - minimising erosion and sediment run off;
 - managing drainage control; and
 - preserving the bank stability of affected waterways and drainage lines avoiding non-essential hardening or unnatural modification of the waterway.
- o **PO18:** Development prevents the release of contaminants to surface water or groundwater in the event of an incident, including a fire or explosion.
 - o **PO19:** Development minimises interference with overland flow paths.

2.4 ENVIRONMENTAL PROTECTION (WATER AND WETLAND BIODIVERSITY) POLICY

The EPP (Water and Wetland Biodiversity) Policy aims to protect the quality of Queensland waters, while allowing for sustainable development. The EPP Policy sets out the framework for establishing local environmental values, management goals and Water Quality Objectives (WQOs) for waterways in Queensland.

3. ENVIRONMENTAL SETTING

3.1 LOCATION AND LAND USE

The DRM is located to the east of the Project and comprises an underground zinc mine and associated infrastructure. The DRM comprises a mine processing area, Tailings Storage Facility (TSF) (located on the Knapdale Range) and the Dugald River Accommodation Camp and DRM Fly Camp which is a subservient land use to the mining operation. An existing network of access tracks used for exploration and pastoral purposes links the DRM to the Project.

The predominant land use on the Knapdale Range comprises cattle grazing, resource exploration activities and the storage of tailings within the TSF. Under the Australian Land Use and Management Classification mapping system (Department of Agriculture, 2016), grazing native vegetation includes "*land uses based on grazing by domestic stock on native vegetation where there has been limited or no deliberate attempt at pasture modification*".

A review of the historical land uses of the region determined that since European settlement, much of the eastern side of the Knapdale Range has been used for cattle grazing, with disturbance occurring in the flatter grassland areas. The extent of grazing disturbance on the western side of the Knapdale Range is significantly less than the west (DERM, 2011). Grazing implies the ground will have been compacted in areas where stock have been present, with heavy stock traffic having the potential to increase erosion and the loss of sediment.

The Knapdale Range is sparsely vegetated with Spinifex dominant grasslands and *Eucalyptus leucophloia* (Snappy gum) low open woodland. Moderate to sparse Acacia dominant shrub layers are also found throughout the Knapdale Range (WTS, 2026).

3.2 CLIMATE AND RAINFALL

The region is characterised by a grassland climate, with a distinct wet season (December to March) and dry season (April to November). The mean annual rainfall for the region (2001 to 2024) is 640 mm with approximately 80% of rainfall occurring during the wet season.

The driest rainfall month is August (average rainfall of 3 mm), and the wettest month is January (average rainfall of 206 mm). Mean monthly temperature data from the Bureau of Meteorology (BOM) Cloncurry Airport weather station (Station Number 029141) located 100 km south of DRM shows that the lowest temperature experienced is around 26 degrees during the winter months and a maximum of 35 degrees during the summer months. The risk of erosion and sediment transport in rainfall runoff is greatest during the wet season months, particularly January to March.

Mean monthly rainfall from the BOM Gereta Weather Station (Station Number 029131) is presented in Figure 3-1. The Gereta Weather Station is located approximately 40 km northwest of the DRM. The Gereta Weather Station dataset provides monthly rainfall totals collected from September 2001 to March 2026.

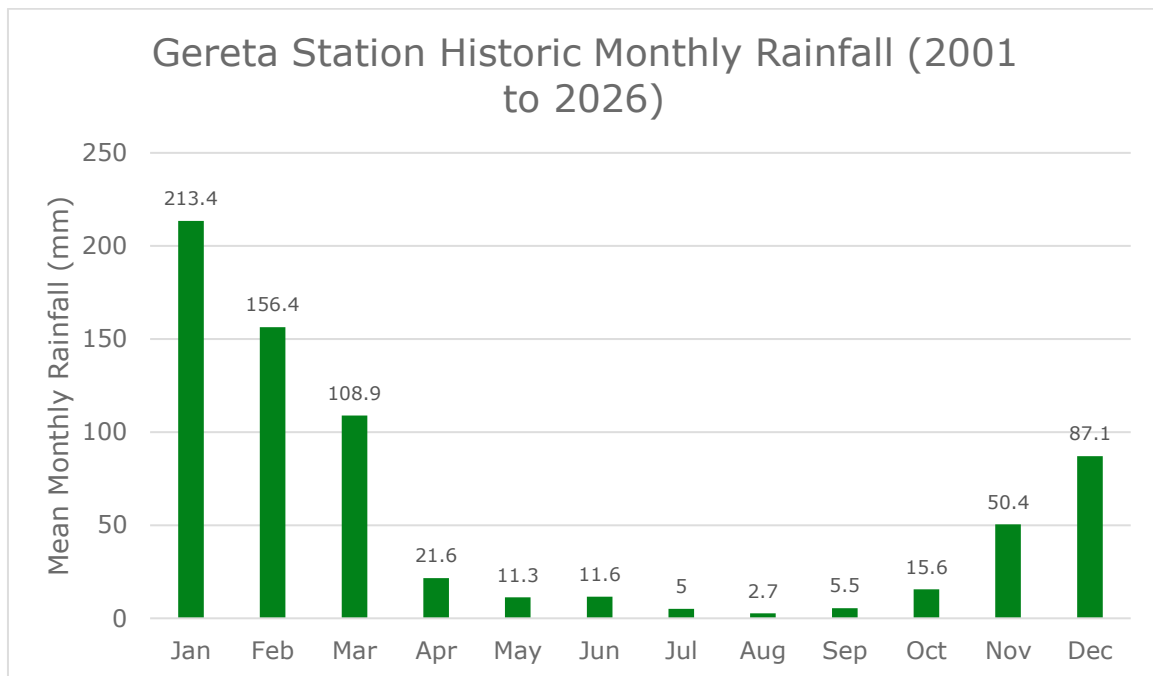


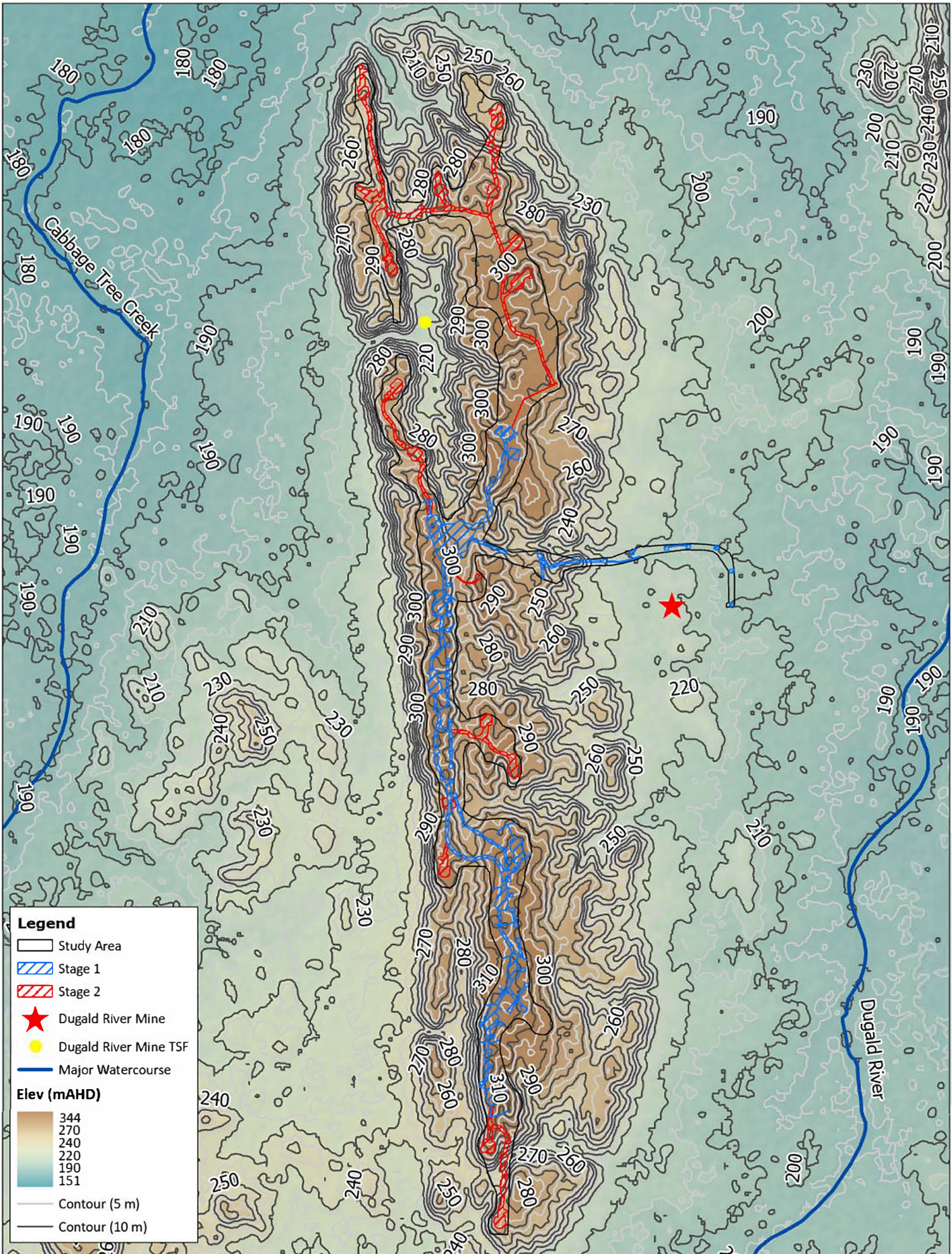
FIGURE 3-1 GERETA STATION (029131) HISTORIC MONTHLY RAINFALL

3.3 TOPOGRAPHY

The Knapdale Range is described as a range of sparsely rocky outcropping hills with rocky scree slopes and sheer rock walls (DERM, 2011). As per Figure 3-2, the elevation across the plateau generally fluctuates between approximately 270 to 310 m Australian Height Datum (AHD). The maximum elevation within the Disturbance Footprint is approximately 310 m AHD. A minimum elevation of approximately 210 m AHD is observed along the existing network of access tracks that links the DRM to the Project.

The Atlas of Australian Soils (accessed via QGlobe (QLD Government, 2024a)) describes the area immediately to the west of the Project Area, as "high sandstone plateaux with prominent cliffs and steep rocky slopes much dissected at the margins" (Bureau of Rural Sciences, 2009). Ten (10) WTGs along with the access roads fall within the western area of the described terrain characteristics. These features rapidly decline away from the peak of the range, with elevation dropping to 220 m AHD over relatively short distances (300 m). The initial decline of many of these escarpments begins within the Disturbance Footprint, before continuing to fall away to the west at a gentler gradient prior to reaching Cabbage Tree Creek.

The eastern area of the Project is characterised by gently undulating land with some areas of stronger relief and occasional low hills (Bureau of Rural Sciences, 2009). Most of the WTGs and associated infrastructure of the Project are located in this type of terrain. The topography of the eastern area of the Project falls eastward away from the Knapdale Range, before descending into a gentle topographic decline toward the floodplain of the Dugald River at approximately 190 m AHD.



Legend

- Study Area
- Stage 1
- Stage 2
- ★ Dugald River Mine
- Dugald River Mine TSF
- Major Watercourse

Elev (mAHd)

- 344
- 270
- 240
- 220
- 190
- 151

- Contour (5 m)
- Contour (10 m)

Coordinate System:
GDA2020

Date: 23/03/2026

Created By: FB

Drawing Size: A4

0 1 2km
1:54,000

F3-2 Site Elevation

Dugald River Wind Farm Project - Stormwater and Erosion Impact Assessment

MMG Dugald River Pty Ltd



3.4 SOILS AND ERODIBILITY

Soil erodibility is multi-faceted and can be determined by the soil particle size, infiltration rate, soil chemical properties, permeability of the soil profile, coherence of the soil particles, vegetative cover, and surface sealing (IECA, 2025). The soil types which are typically at highest risk of erosion are texture contrast soils (duplex soils), with relatively small or light particles that tend to be more sodic.

Previous assessment of the regional soil landscape was undertaken as part of the Environmental Impact Statement (EIS) for the MMG Dugald River Mine (DERM, 2011). The Soil and Land Suitability Assessment (AARC, 2010) undertaken to support the EIS identified six major soil types for the DRM site and the Knapdale Range, detailed below and presented in Figure 3-3:

- **Red Plain Soil (Rudosols):** Red sandy loam to sandy clay loam. This soil is found in the flatter areas of the DRM site (east of the Knapdale Range), occurring up to a depth of 50 cm;
- **Knapdale Soil (Rudosols):** Brown skeletal sandy clay loam. Found on the eastern and western slopes of the Knapdale Range. Low salinity and non-sodic, this soil unit is very skeletal and rocky and was not found at depths greater than 20 cm (AARC, 2010). This is the predominant soil type observed throughout the Knapdale Range;
- **Dale Soil (Rudosols):** Brown sandy loam. Found in depressions such as valley floors and plateaus of the Knapdale Range. Occurs up to a depth of 50 to 70 cm;
- **Miners Soil (Rudosols):** Lode outcrop sandy clay loam. Found on the eastern side of the Knapdale Range. Found at depths <20 cm;
- **Prospectors Soil (Rudosols):** Western Knapdale clay loam. Skeletal soil occurring at depths <20 cm, found in the sloped and rocky areas of the western side of the Knapdale Range; and
- **Pocket Soil (Calcarosols):** Grey clay loam. Skeletal soil occurring at depths <20 cm, located within pockets throughout the eastern and northern side of the Knapdale Range.

As per Figure 3-3, the predominant soil type throughout the plateau region of the is Knapdale Soil, with small areas of Dale Soil also present. The Red Plain, Miners, and Pocket soil management units all occur within the corridor between the DRM and the Project.

Whilst the extent of the soil management units mapping undertaken for the EIS does not capture the full area of the Project, the Soil and Land Suitability Assessment (AARC, 2010) concluded that all soil types identified within the region are non-sodic (exchangeable sodium percentage values below 6%), making them non-dispersive and resistant to erosion (DERM, 2011).

Based on a review of available soil mapping, there are no mapped sodosols within the Disturbance Footprint or surrounding region. The greatest erosion potential on the identified soil unit was determined to be during high intensity rainfall events throughout the summer months (DERM, 2011) (Section 3.2). Assessment of erosion risk is presented in Section 0.



Legend

Study Area

Source:
Base Data - QSpatial
Imagery - ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 54
Date: 02/04/2026
Created By: MB
Drawing Size: A3

0 0.75 1.5Km



1:40,000

F3-3 Soil Management Units

Dugald River Wind Farm Project
Stormwater and Erosion Assessment
Client: MMG Dugald River Pty Ltd



3.5 HYDROLOGY

3.5.1 BASINS

The Project is situated across the boundary of two drainage basins, the Leichhardt Basin to the west and the Flinders Basin to the east (Figure 3-4).

3.5.1.1 LEICHHARDT BASIN

The Leichhardt Basin is approximately 3.3 million ha in size, spanning from the south of Mount Isa to the Gulf of Carpentaria in the north. The Leichhardt Basin is the sole sub-basin of the Leichhardt Basin. The Leichhardt River is the key feature of the basin, flowing in a northerly direction, before reaching the Gulf of Carpentaria approximately 300 km north of the Project.

The most notable watercourse in the vicinity of Project (within the Leichhardt Basin) is Cabbage Tree Creek, a Stream Order 5 waterway based on the Strahler stream order, located approximately 2 km west of the Disturbance Footprint at its nearest point. Cabbage Tree Creek flows 30 km downstream (north) prior to joining the Leichhardt River.

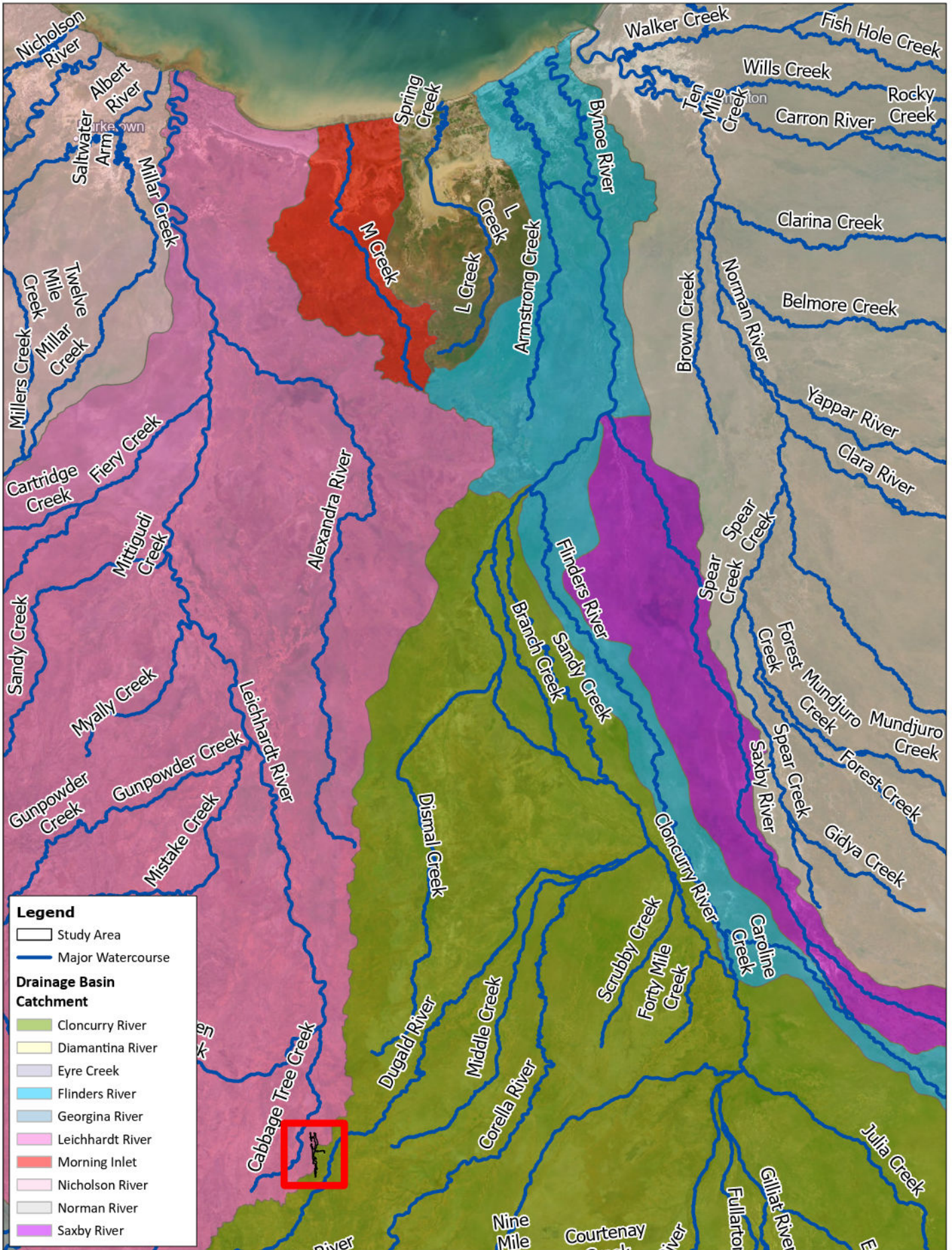
3.5.1.2 FLINDERS BASIN

The Flinders Basin encompasses approximately 11 million ha, spanning from Hughenden in central Queensland, Cloncurry in western Queensland, to the Gulf of Carpentaria in the north. The basin is comprised of three sub-basins, the Saxby River sub-basin in the north, the Flinders River sub-basin in the east, and the Cloncurry River sub-basin in the west.

The eastern portion of the Project is situated within the Cloncurry River sub-basin. The dominant feature of the Flinders Basin is the Flinders River, which flows north and discharges to the Gulf of Carpentaria approximately 290 km north-northeast of the Project.

The most notable watercourse in the vicinity of Project (within the Cloncurry River sub-basin) is the Dugald River, a stream order 5 waterway located approximately 2 km east of the Disturbance Footprint at its nearest point. The Dugald River intersects the Cloncurry River approximately 120 km north-east of the Project. From this point, the Cloncurry River converges with the Flinders Rivers a further 100 km north, which eventually discharges to the Gulf of Carpentaria a further approximately 110 km north of the point of confluence with the Cloncurry River.

Watercourse catchment boundaries are presented in Figure 3-4.



Coordinate System:
GDA2020

Date: 27/03/2026

Created By: FB

Drawing Size: A4

0 10 20 30 40km

1:1,397,000



F3-4 Drainage Basin Catchments

Dugald River Wind Farm Project - Stormwater and Erosion Impact Assessment

MMG Dugald River Pty Ltd



Streamflow data for the Dugald River is presented Figure 3-5 and was sourced from the Queensland Government Water Monitoring Information Portal (WMIP) (Queensland Government, 2024c). Peak flows for Dugald River are historically observed from January through to March. The average streamflow is highest in January where the average daily flow is 619 ML.

Figure 3-5 displays data collected at the Dugald River at Railway Crossing open gauging station (identifier no. 915206A), which is located approximately 10 km downstream of the Project (Figure 3-6). The dataset from the Dugald River at Railway Crossing open gauging station represents streamflow data collected from October 1969 to March 2026.

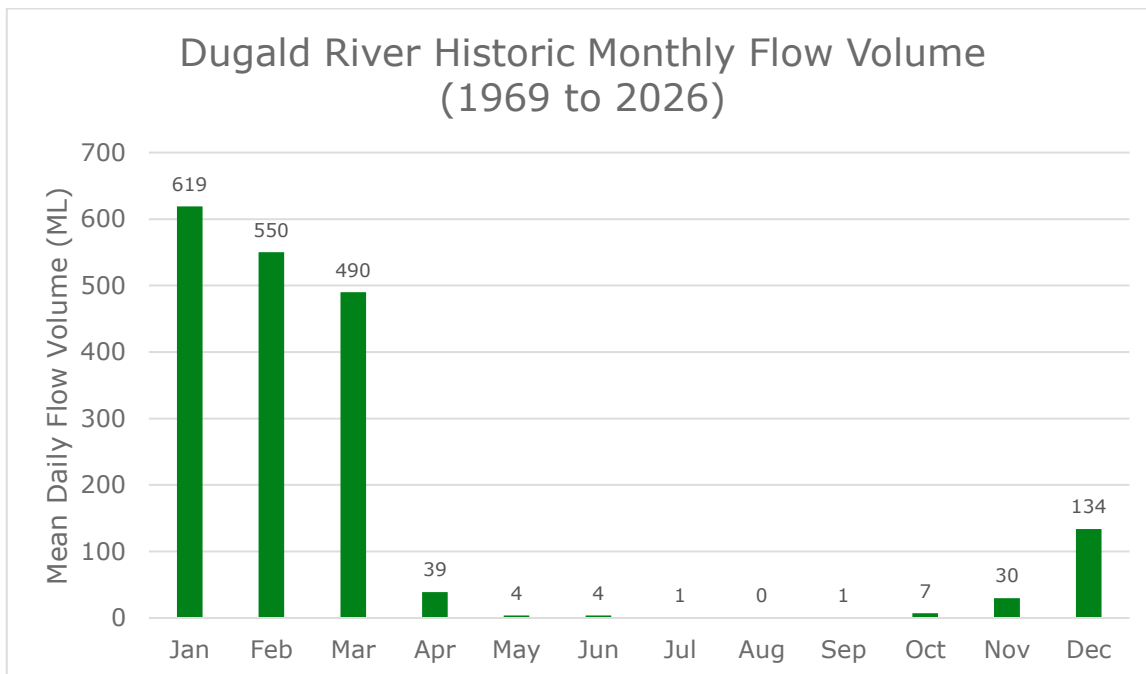


FIGURE 3-5 MEAN DAILY FLOW VOLUME AT STATION 915206A

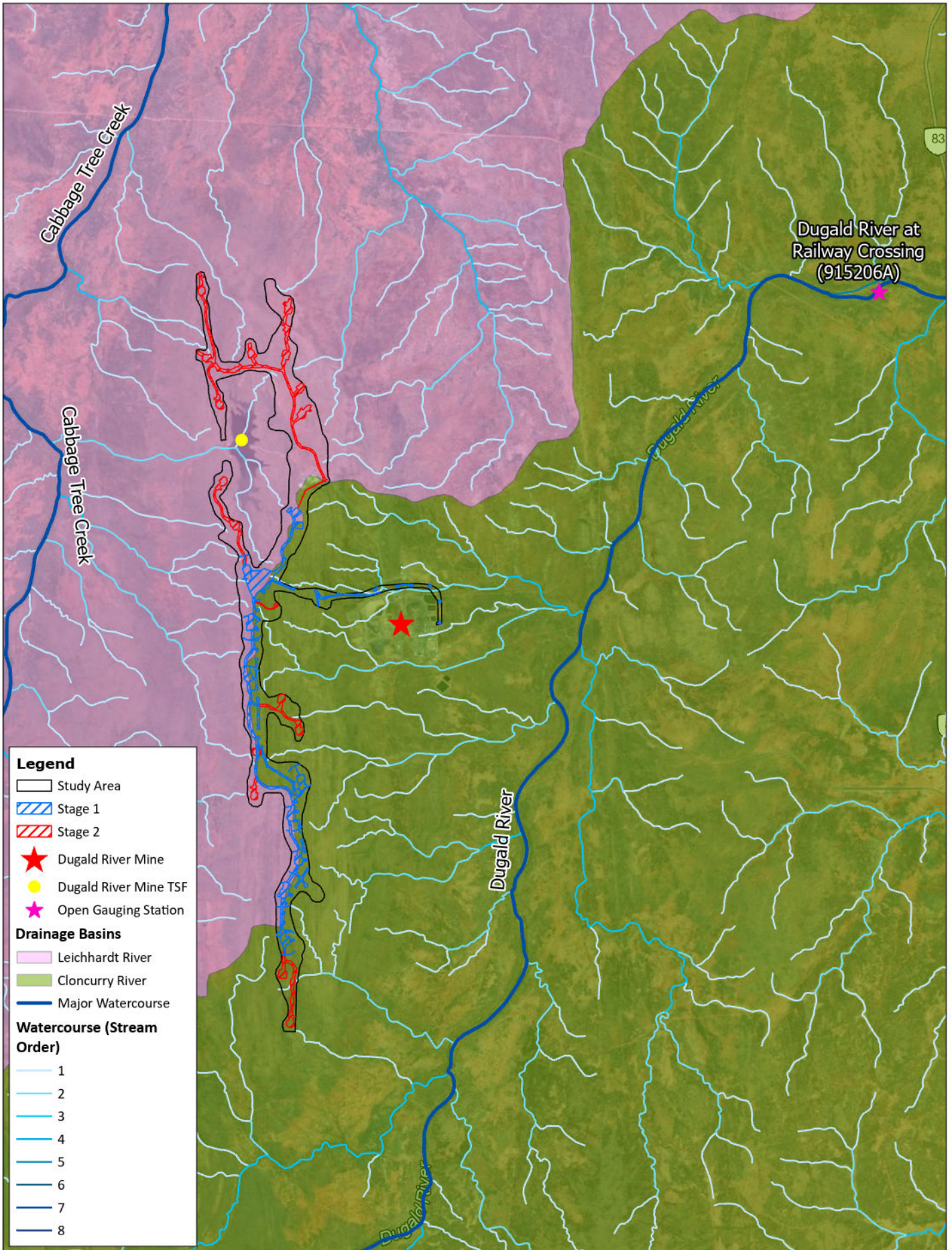
3.5.2 WATERCOURSE AND SURFACE WATER FEATURES

Given the location of the Project along a ridge line at the headwaters of the Leichhardt and Flinders Basins, there are a total of four (4) waterways that either cross or are within the Disturbance Footprint. Two of the waterways are stream order 1 watercourses, tributaries of Dugald River, part of the Flinders Basin. The other two are tributaries of Cabbage Tree Creek, which is part of the Leichhardt Basin. The tributaries of that are defined by intermittent and ephemeral flows (Figure 3-6).

For the Leichhardt Basin waterways, the crossings are located at the northern and central area of the Disturbance Footprint. The Flinders Basin waterways are observed at the southern and central portion of the Disturbance Footprint. Within the Leichhardt Basin, the ephemeral tributaries flow to the west, converging into stream order 2 watercourses before discharging into Cabbage Tree Creek. Ephemeral tributaries of the Flinders Basin flow to the east, converging into stream order 2 watercourses before discharging into the Dugald River. The Disturbance Footprint generally avoids most of the surrounding waterways on the Knapdale Range and therefore the Project is unlikely to impact on the quality of surface water environment.

The TSF for the DRM is located adjacent to the northern portion of the Disturbance Footprint, within the Leichhardt Basin. Several ephemeral tributaries and overland flow paths within the northern part of the Disturbance Footprint are likely to flow into the topographic depression that the TSF is located within. An unnamed tributary flows from the outfall of the TSF to Cabbage Tree Creek.

There are no mapped internationally important wetlands (RAMSAR) or wetlands of national importance (Directory of Important Wetlands in Australia) within the standard buffer distance of 5 km from a central point within the Disturbance Footprint, or any of the tenure areas searched.



Legend

- Study Area
- Stage 1
- Stage 2
- Dugald River Mine
- Dugald River Mine TSF
- Open Gauging Station

Drainage Basins

- Leichhardt River
- Cloncurry River
- Major Watercourse

Watercourse (Stream Order)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Coordinate System:
GDA2020

Date: 23/03/2026

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F3-6 Watercourses

Dugald River Wind Farm Project - Stormwater and Erosion Impact Assessment

MMG Dugald River Pty Ltd



3.6 WATER QUALITY

3.6.1 WATER QUALITY OBJECTIVES

The EPP Water (EPPW) 2019 specifies WQOs for basins to protect aquatic ecosystem environmental values (EVs) and human use EVs within these rivers and their tributaries.

As EVs and WQOs are established for Queensland waters in accordance with the EPPW 2019, after approval they are included in Schedule 1 (DETSI, 2023). For waters not included in Schedule 1, the EVs and WQOs should be derived from the Queensland Water Quality Guidelines (QWQG) and the ANZECC & ARMCANZ 2018 Guidelines. The QWQG do not specify water quality guidelines for Gulf Rivers (such as the Leichhardt River and Dugald Rivers), and as such defer to the default ANZECC & ARMCANZ 2018 Guidelines.

It should be noted that the default ANZECC & ARMCANZ 2018 guidelines values may not be appropriate, particularly for ephemeral and intermittent streams (such as those observed within the Disturbance Footprint). Therefore, Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits) of DRM Environmental authority (EA) EPML00731213 will be used as the guideline value to determine overall water quality.

Besides Schedule C – Table 5 of the DRM EA EPML00731213, the ANZECC & ARMCANZ 2018 guidelines will be used as high-level WQOs for the region, while trigger values will be used as indicators for when further investigation and action is needed for when these are exceeded. For waters in the Gulf Region, the ANZECC & ARMCANZ 2018 guidelines defer to the default guidelines values that are specified in the 2000 version of the ANZECC & ARMCANZ guidelines. WQOs for the Gulf Region are specified within Table 3.3.4 of the ANZECC & ARMCANZ (2000) Guidelines.

3.6.2 BASELINE WATER QUALITY

MMG implements a Receiving Environment Monitoring Program (REMP) for the DRM. The water quality monitoring program for the REMP is undertaken in accordance with *Queensland Monitoring and Sampling Manual* (DES 2018), with sampling undertaken at several locations both upstream and downstream along Dugald River and Cabbage Tree Creek, respectively.

The 2024 REMP Annual Report (FRC Environmental, 2025) found that electrical conductivity, fluoride, and dissolved aluminium exceeded trigger levels specified within Schedule C – Table 5 of the DRM EA EPML00731213 across downstream, upstream, and reference monitoring sites. All other parameters did not exceed the trigger levels.

Chemical analysis of surface water undertaken as part of the DRM EIS identified that background concentrations of dissolved antimony, dissolved arsenic, dissolved lead, dissolved silver, and dissolved zinc within the region were above the trigger values specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ Guidelines, 2000) (DERM, 2011). Testing methods and limits of reporting used for each parameter by the laboratory were based on the 95% ecosystem protection guidelines for contaminant limits and for the trigger level 80th percentile of reference, whichever is higher as highlighted within the most recent REMP Annual Report (FRC Environmental, 2025).

3.7 FLOODING

A review of existing information associated with catchment flooding was undertaken to determine potential flood risk associated with the Project. The Queensland Floodplain Assessment Overlay (QFAO) mapping (available via Queensland Globe and QSpatial) is a publicly available resource that identifies potential floodplains at risk of inundation from riverine flooding. In the absence of specific flood modelling for the basin, the QFAO serves an interim assessment that provides a conservative estimate of flood risk, allowing for the identification of areas with a potential risk of inundation that may require more refined modelling. The outputs of the QFAO for the region are presented in Figure 3-7.

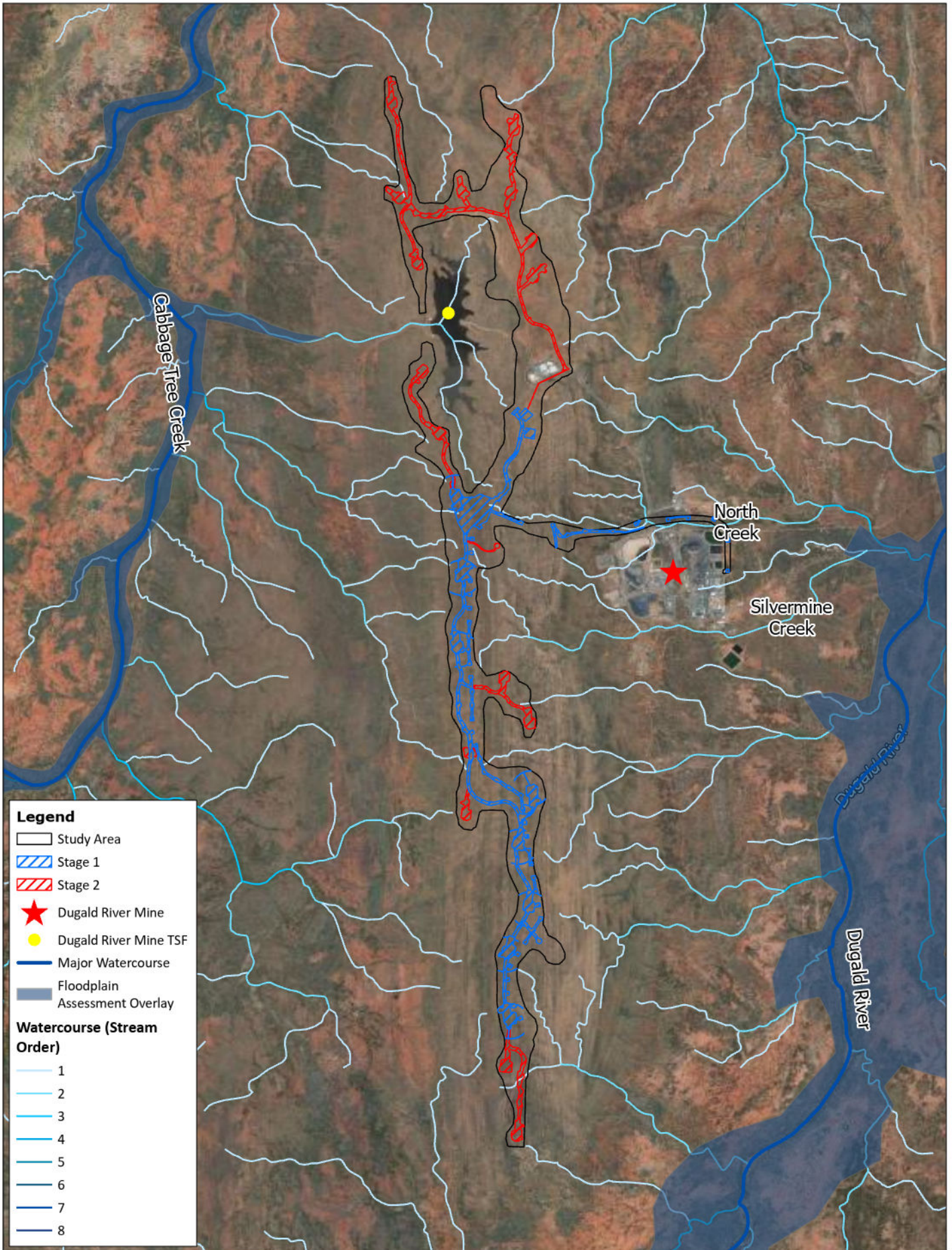
A review of the QFAO indicates that flood risk is highest around Dugald River. The overlay indicates that flood waters are likely to overtop the banks of the Dugald River in the vicinity of the Project, and a number of the unnamed waterways could also be affected by flood waters in a large enough event.

To the west of the site, the QFAO indicates that flood waters are likely to inundate parts of Cabbage Tree Creek and to a lesser degree some of the ephemeral waterways which discharge to Cabbage Tree Creek.

The QFAO does not indicate that any part of the Disturbance Footprint is considered to be at risk from flooding. The nearest areas subject to flood risk include an ephemeral waterway downstream from the TSF release point and a location approximately 2 km east near the existing DRM transformer station.

In supplement to the QFAO, flood modelling conducted to support the previous EIS identified that operations at the DRM (including infrastructure) is located above the 100-year average recurrence interval (ARI) flood levels of the Dugald River and Silvermine Creek (DERM, 2011). Given the location of the main components of the Project are approximately 90 m AHD above the DRM on a ridge, these main components would be immune from flooding from Dugald River and/or Silvermine Creek.

An assessment of flood risk for the Disturbance Footprint is presented in Section 4.2.2.



Legend

- Study Area
- Stage 1
- Stage 2
- Dugald River Mine
- Dugald River Mine TSF
- Major Watercourse
- Floodplain Assessment Overlay

Watercourse (Stream Order)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Coordinate System:
GDA2020


Date: 23/03/2026

Created By: FB

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F3-7 Flood Mapping

Dugald River Wind Farm Project - Stormwater and Erosion Impact Assessment

MMG Dugald River Pty Ltd



3.8 EROSION RISK

Soil erosion is caused by wind, water or physical action displacing soil particles and resulting in movement from their previous location. Erosion is a multifaceted phenomenon combining soil properties, climate, setting, cover and protection. An assessment of potential erosion risk at the site using the Revised Universal Soil Loss Equation (RUSLE) is included in Appendix A.

The RUSLE classifies erosion risk into seven categories based on the mean annual soil loss rate (where mean annual soil loss is calculated as tonnes per hectare per year (t/ha/yr)). The erosion risk classes range from very low to extremely high (IECA, 2025). Figure 3-8 visually displays how the RUSLE classifies the erosion risk level for the Project. It should be noted that RUSLE is a very conservative assessment and considers a blanket impact across the entire footprint of potential sediment loss. The percentage of the Disturbance Footprint area within each erosion risk class was determined and is shown in Table 3-1.

TABLE 3-1 EROSION RISK DISTURBANCE FOOTPRINT PERCENTAGE (IECA, 2025)

Erosion Risk¹	Mean Annual Soil Loss (t/ha/yr)¹	Disturbance Footprint Percentage
Very Low	< 150	57.93
Low	151 - 225	13.59
Low - Moderate	226 - 250	9.51
Moderate	351 - 500	5.60
High	501-750	6.73
Very High	751 - 1500	5.11
Extremely High	>1500	1.53

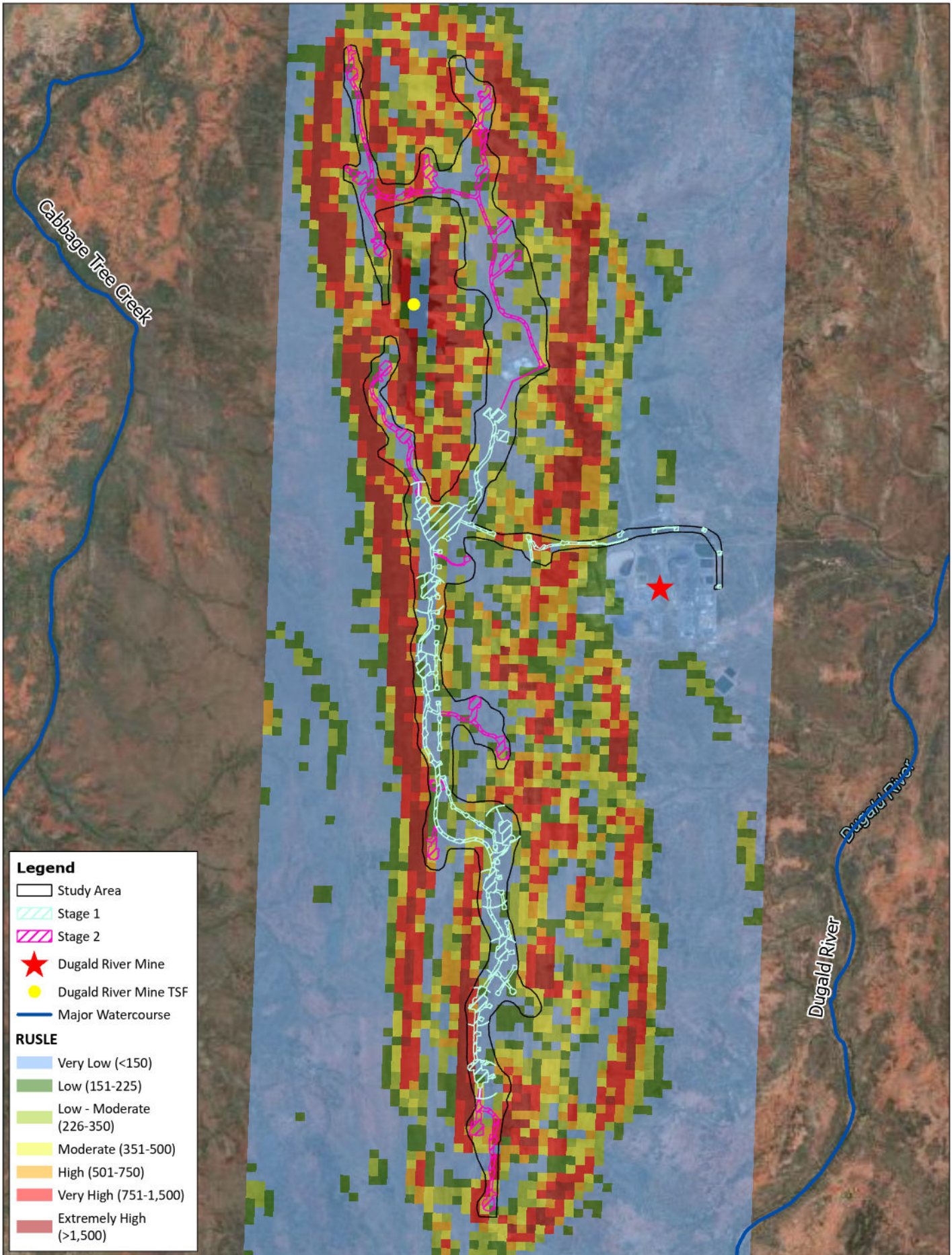
¹ Taken from Table 3-1 – Soil Loss Classes of the IECA 2025 Manual (IECA, 2025)

The findings of the RUSLE assessment determined that a majority of the Disturbance Footprint (cumulatively 72%) is classified as very low to low erosion risk.

The International Erosion Control Association (IECA) 2025 guidance recommends minimisation, if not a total avoidance, of any disturbance within extreme erosion risk areas. From a review of the current proposed Disturbance Footprint, it is evident that the footprint already considers steep slopes and there has been considerable effort to minimise disturbance in these areas.

Extreme erosion risk areas make up less than 2% of the project Disturbance Footprint and are limited to small sections at the northern and southern portions of the Disturbance Footprint, mainly affecting Stage 1 and Stage 2 Access Tracks as shown in Figure 3-9 and Figure 3-10.

The placement of larger infrastructure such as the WTG footings, are located on relatively flat ground where possible. Overall, the erosion risk within the proposed Disturbance Footprint appears to be manageable by implementing best practice land clearing and rehabilitation measures in line with the estimated soil loss rate categories in Table 5-2.



Coordinate System:
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Date: 23/03/2026
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F3-8 Revised Universal Soil Loss Equation (RUSLE)

Dugald River Wind Farm Project - Stormwater and Erosion Impact Assessment
MMG Dugald River Pty Ltd



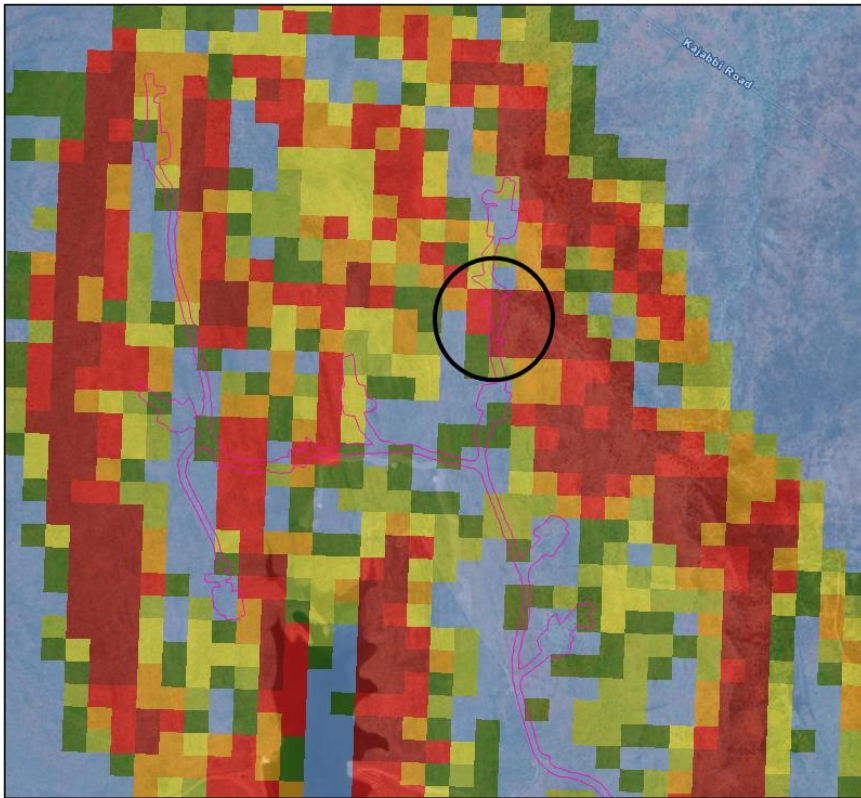


FIGURE 3-9 STAGE 2 NORTHERN EXTREMELY HIGH EROSION RISK (ROAD)

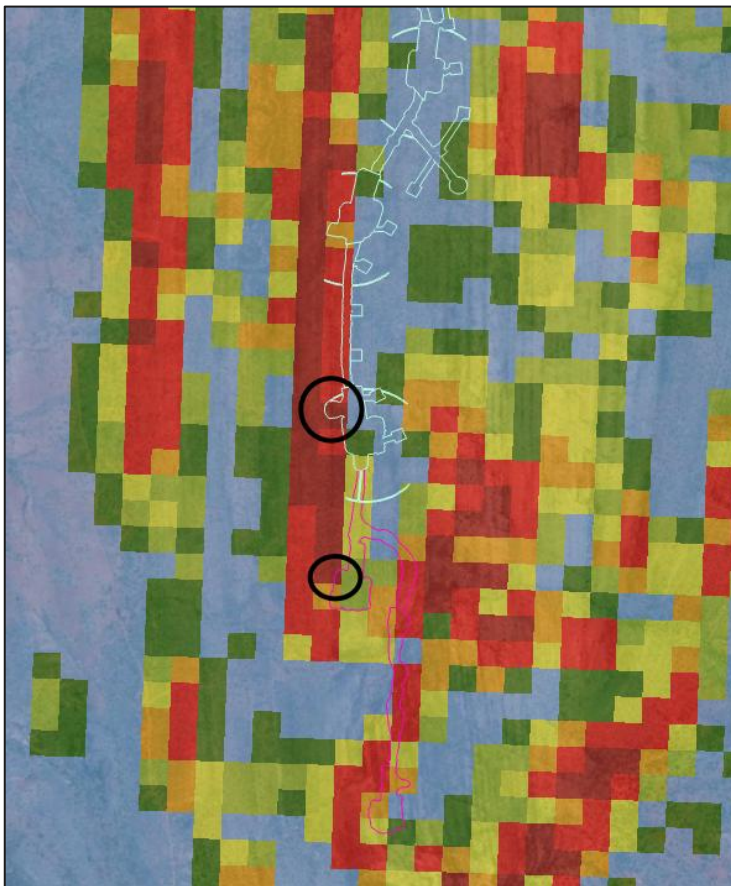


FIGURE 3-10 STAGE 1 & 2 SOUTHERN EXTREMELY HIGH EROSION RISK (ROAD)

4. POTENTIAL IMPACTS

The following sections highlight the potential impacts the Project will have on surface water from the following elements:

- Proposed infrastructure types and their potential impacts;
- Alteration to natural drainage pathways;
 - Flooding;
 - Impervious surfaces and watercourse crossings;
- Water quality and erosion control during construction, operation and decommission phases.

4.1 PROJECT ELEMENTS WITH POTENTIAL TO CAUSE IMPACT

Preliminary design plans for the Project have been provided by MMG which allow for the high-level assessment of potential Project related impacts. Project components shown in Table 4-1 may require further consideration as they involve ground disturbance that can lead to erosion and subsequent impacts on downstream water quality.

TABLE 4-1 GROUND DISTURBANCE ASSOCIATED WITH MAJOR PROJECT COMPONENTS

Infrastructure Type	Summary description of ground disturbance
WTG Construction Areas	<p>Each WTG will be constructed within in a dedicated construction area which provides for Over-sized and Over-Mass (OSOM) vehicle access, temporary WTG laydown and construction, WTG foundations, bushfire management and earthworks.</p> <p>The proposed WTG Construction Areas have been designed in consideration of the underlying topography and in consideration of clearing for bushfire mitigation. Construction requirements including temporary vegetation stockpiles, temporary topsoil stockpiles and stormwater management infrastructure will be located within the defined disturbance area. Given the unique topography of the Knapdale Range, the WTG Construction Areas have been designed to allow for works to be undertaken at each WTG location to limit replicated vehicle movements to and from the Project.</p> <p>Each WTG requires a dedicated foundations and a mass concrete footprint. WTG foundations may vary in size depending on the WTG location, imposed loadings, geotechnical requirements, ground conditions, construction methodology and the drainage design. The top of the foundations will be finished, so that the top of the foundation is close to flush with the surrounding ground level. The detailed design of the foundations will be undertaken prior to construction of the Project by the civil contractor.</p>
Central Operations and Switchyard Area	<p>A Central Operations and Switchyard Area will be constructed to facilitate the distribution of electricity from Stage 1 and Stage 2 of the Project via an overhead powerline which is linked to existing electrical infrastructure at the DRM. The operational infrastructure for the Project will include a central management office, workshop, storage, and warehousing facilities. Clearing and associated earthworks for the ultimate Central Operations and Switchyard will be completed as part of Stage 1.</p> <p>A BESS for the storage of electricity is proposed to be installed at the Central Operations and Switchyard Area and will be connected to the dedicated overhead powerline. The BESS comprises battery containers, MVPS, and electrical equipment including harmonic filters. The proposed battery storage technology with suitable outdoor rated housing will comprise of lithium-ion phosphate cells.</p>

Infrastructure Type	Summary description of ground disturbance
Access Tracks	<p>The Project will be accessed via a network of access tracks located on the Knapdale Range and linked to the existing road network supporting the DRM. The access tracks are designed and located in consideration of topographical limits to allow for the movement of OSOM components to each WTG Pad. To limit disturbance, the Project has been designed with a linear access track configuration with minimal spurs to limit fragmentation.</p> <p>Existing light vehicle tracks will be used where practicable, with the existing tracks being widened and graded to accommodate transport of turbine components. Where track widening and/or new track establishment is required, vegetation and topsoil will be cleared and stockpiled for use in rehabilitation in accordance with the Project's Management Plans.</p> <p>Disturbance associated with the Access Tracks includes the access track itself (nominal width of approximately 7m) as well as the constructability corridor. The constructability corridor is required to accommodate earthworks as well as environmental controls including stormwater management, sediment and erosion control, and the stockpiling of vegetation and topsoil.</p>
Meteorological Masts	<p>Two Permanent Met Masts will be installed to monitor wind conditions for the operation of the Project. The first Met Mast will be located to the south of Stage 1 immediately adjacent to proposed WTG 07, whilst the second Met Mast will be located to the south of the Central Operations and Switchyard Area. For clarity, MMG has secured approval from Cloncurry Shire Council for two Temporary Met Masts, which will be decommissioned and the area rehabilitated once the Permanent Met Masts are constructed.</p>
Electrical Connections and Substations	<p>An internal reticulation network comprising overhead and underground powerlines will connect the Stage 1 WTGs to the Central Operations and Switchyard Area. On terminus at the central switchyard, energy from the Project will be stepped up via a substation and transmitted via a dedicated 220 kV overhead powerline to the existing Dugald River Switchyard. Stage 2 of the Project is currently planned to utilise below ground powerlines and therefore does not require a dedicated 33 kV powerline corridor.</p> <p>The Dugald River Switchyard is connected to the NWPS via the Chumvale Powerline and therefore, no additional clearing or surface disturbance is required for this feature. Additional electrical infrastructure is likely to be installed at the Dugald River Switch Yard to enable connection of the Project to the existing Chumvale Powerline. This infrastructure will be located adjacent to the existing assets in the Switch Yard and will not require any additional clearing to be undertaken to support delivery.</p>
Laydown Areas	<p>The Project includes two dedicated hardstand areas for the temporary storage of WTG components, construction materials and construction management. The hardstand areas are located centrally to the Project to enable WTG components and materials to be dispersed evenly across the Knapdale Range as required for both stages of the Project.</p>
Taglines	<p>A temporary disturbance allowance for Taglines has been included in Stage 1. The proposed Taglines are a constructability requirement from Goldwin as the WTG manufacturer and are necessary to allow for the safe erection of the Stage 1 WTGs. The Taglines will be used by construction equipment to anchor wires to the WTGs through construction to manage wind loading and ensure worker safety.</p> <p>The Tagline disturbance footprints are conservative and reflect uncertainties associated with wind loading and therefore provide optionality for Stage 1. Taglines for Stage 2 are not considered to be required for Stage 2 as sufficient wind-data will be provided for Goldwin to determine anchorage points.</p>

The proposed construction methodology and strategy for general ground disturbance have not been confirmed. The strategy is likely to include vegetation clearing around infrastructure and bulk earthworks to support construction. Limiting the disturbance extent, staging construction, and stabilising disturbed areas as quickly as is practicable will be key to minimising erosion and reducing potential impacts on water quality.

4.2 DRAINAGE RELATED IMPACTS

Changes to the drainage behaviour of the existing catchments have the potential to result in impacts on downstream receptors due to changes in flow regime. Changes in catchment hydrology would typically be associated with a change in the imperviousness characteristics of the catchment, or as a result of substantial diversion of overland flows. Changes may occur throughout all phases of the Project, from construction, during operations and through to the decommissioning phase. Disturbance to watercourses through the construction of watercourse crossings may also present a potential impact on flow behaviour and flooding.

Impacts that have the potential to result in changes to existing drainage behaviour are addressed in Sections 4.2.1 to 4.2.3.

4.2.1 IMPERVIOUS AREAS

Hardstand areas will be required to support each of the proposed WTGs, BESS and collection substation, with these areas expected to represent the largest proportion of impervious surface associated with the Project. Allowing for a nominal 82 m x 50 m area associated with the base of each WTG, that would represent approximately 98,400 m² or 9.84 ha. For the proposed BESS and collection substation, the preliminary design is assumed to be an estimated area of 180 m x 100 m, which represents an approximate area of 18,000 m², or about 1.8 ha. So total impervious area for the whole Disturbance Footprint is estimated to be around 11.64 ha out of 136.4 ha. This accounts around 10% of the Disturbance Footprint.

The impervious areas will be situated away from existing watercourses on a ridgeline, such that interactions with watercourses is negated. Potential changes to localised flow pathways and drainage channels relative to the pre-development landscape as a result of an increase in impervious surface are anticipated to be minor and will be managed by implementing best practice drainage control.

On a sub-catchment scale, the Disturbance Footprint represents a nominal percentage of the encompassing Leichhardt River and Cloncurry River sub-catchments (approximately 3.3 and 4.7 million ha in size respectively). The proportion of the Disturbance Footprint represented by impervious infrastructure will be notably smaller, and as such any impacts would be expected to be both minor and localised.

Whilst it is unlikely for the Project to have a measurable effect on sub-catchment hydrology, localised impacts pertaining to impervious infrastructure have the potential to arise where larger infrastructure that comprise a hardstand surface, such as the BESS facility. These impacts may include the following:

- Localised flooding/ponding of stormwater due to reduced infiltration;
- Increase in peak flows and flow velocity;
- Decline in water quality due to a reduction in sediment trapped by vegetation;
- Increased erosion due to an increase in concentrated flows away from the Project Area.

Overall, the Project is expected to have minimal impact on stormwater flows and natural drainage patterns. Impacts are expected to be manageable through the implementation of best practice drainage controls (Section 5).

4.2.2 FLOODING

As presented in Section 3.7 areas identified as at risk of inundation by the QFAO for the Leichhardt River and Cloncurry River are largely confined to the floodplains surrounding Cabbage Tree Creek and the Dugald River, respectively. Given the location of the Disturbance Footprint atop of the Knapdale Range, it is unlikely that the Project will be impacted by an extreme flood event. The QFAO flood zones are largely confined to the 190 to 200 m AHD contours, considerably below the lowest point (approximately 250 m AHD) within the Disturbance Footprint.

Access tracks may cross streams which are anticipated to experience increased flows and may be subject to flooding during extreme rainfall events, although given the magnitude of these streams (stream order 1), it is anticipated that these flows would be manageable with appropriate stormwater flow and erosion controls. Measures to mitigate flows caused by flooding are outlined in Section 5.3. These drainage features are within small catchments, which in turn will have short duration catchment responses and low peak flows attributed to the catchment area. Despite this, appropriate design criteria in line with relevant drainage standards for access tracks would still need to be considered to manage any potential flood risk.

Where watercourse crossings are required, sizing of infrastructure such as culverts and crossings are to be undertaken during the detailed design phase to ensure structures are appropriately sized or alternative methods of crossing (e.g. bed level crossing) are employed. Best practice guidelines are described in the QUDM.

Minor impacts to the flood regime have the potential to arise where an increase in impervious area may intensify flood events and contribute to localised flooding downstream, however as per Section 4.2.1, any potential impacts as a result of changes to the imperviousness of the catchment are expected to be minor and can be managed with appropriate drainage control measures outlined in Section 5.3.

4.2.3 WATERCOURSE CROSSINGS

A review of potential watercourse crossings sites within the Disturbance Footprint allows for an indicative, conservative determination to be made on the potential impact the Project may have upon local drainage lines.

An evaluation of the local hydrology (Section 3.5) determined that ephemeral and intermittent tributaries are present within the Disturbance Footprint. Given the location of the Project across the boundary of two drainage basins, these ephemeral streams do not typically flow through the whole Disturbance Footprint. Rather, the source point of most of these streams is near the boundary of the Disturbance Footprint, with flows occurring outward from the Project. This gives allowance for the avoidance of watercourses, rather than crossing throughout a significant portion of the Disturbance Footprint.

Based on the review of the local hydrology, the project Disturbance Footprint is noted as crossing one stream order 1 watercourse. The observed watercourse crossing is located at the southern end of the Disturbance Footprint, at a proposed Stage 2 access track of the Disturbance Footprint.

There are also three (3) stream order 1 watercourses observed inside the Disturbance Footprint boundary, two are identified at the central part of the Disturbance Footprint, where it intersects at Stage 1 Laydown area of the Disturbance Footprint. The other is located at the northern portion of the Disturbance Footprint, where it intersects a Stage 2 WTG and road. However, the watercourses do not cross over the Disturbance Footprint, and a crossing is not required. Due to the topography of the Knapdale Range, crossing of the ephemeral stream at the southern area of the Disturbance Footprint is unavoidable (Figure 3-6). The crossing will be constructed to minimise the extent of disturbance and vegetation clearing.

A desktop review determined there are no *Queensland Waterways for Waterway Barrier Works* watercourses within the Disturbance Footprint. As such, it is not anticipated that the Project will have an impact upon fish passage in the region.

Although the extent of disturbance at watercourse crossings is minor, the following potential impacts may arise from disturbance:

- Increased sediment loads due to altered roadside drainage arrangements;
- Disturbance and/or removal of riparian and in-stream vegetation; and
- Alteration of the stream's natural in channel flow patterns.

Given the generally rocky characteristics of the soil landscape throughout the Knapdale Range (Section 3.4), the scale and extent of potential sediment loss and erosion due to the construction and operation of the Project is expected to be minimal.

The Disturbance Footprint will be designed to minimise impacts to mapped watercourses for all non-linear infrastructure. Where linear infrastructure is proposed to impact mapped watercourses, detailed design will further refine the level of disturbance to ensure potential impacts to the natural drainage patterns of watercourses are minimised, with the crossing to be constructed to minimise the extent of disturbance and vegetation clearing. While some localised short-term impacts may be realised, long term impacts downstream are not expected.

4.3 WATER QUALITY AND EROSION CONTROL

Unmitigated discharges of stormwater from disturbed or cleared areas could result in adverse impacts through the transportation of constituents of concern downstream. During all phases of the Project, activities may be undertaken which could result in an impact to water quality. The water quality objectives for the Project are outlined in Section 3.6.1. Activities with the potential to impact surface water quality during each phase of the Project are discussed below.

The likelihood and scale of the erosion related impacts is expected to be amplified when undertaken in regions with a high to extreme erosion risk classification (Figure 3-8). The potential for water quality impacts is greatest during periods of the year characterised by high rainfall (Section 3.2) and high streamflow (Section 3.5). As specified in the DRM EIS, the soil types of the region (Section 3.4) are most susceptible to erosion during high intensity rainfall

events experienced during the wet season. Accordingly, risk will be lower when activities are undertaken in areas where erosion risk is low, and when rainfall and streamflow are minimal.

It is anticipated that potential impacts can be mitigated or controlled with an appropriate construction environmental management plan and an operations phase environmental management plan. Specific measures to be included and considered within the plans are outlined in Section 5.

4.3.1 CONSTRUCTION PHASE

Potential impacts to surface water quality during the construction phase include:

- Increased risk of erosion and subsequent sedimentation from construction activities and land clearing works;
- Site traffic during the construction phase has the potential to compact soil surfaces resulting in increased run off and the mobilisation of sediments downstream;
- Earthworks resulting in exposed soil areas that can lead to increased sedimentation loading in waterways;
- Features such as stockpiles and tracks could be eroded by rainfall or inappropriate site practices, increasing the amount of sediment entering into surface water features;
- The use and storage of fuel for construction vehicles could lead to drainage to local waterways if not appropriately managed;
- If water of poor quality is used in dust suppression activities, this water can cause an impact to downstream surface water quality;
- Leakage or accidental spillage of oil, fuel or other liquids associated with Project infrastructure, with potential to migrate off site if not appropriately managed; and
- Release of concrete based pollutants resulting in an increase in the pH of surface waters. Construction activities that may result in the release of concrete based pollutants include the following:
 - Concrete batching, cutting, and disposal;
 - Spills of wet concrete;
 - Dampening of freshly laid concrete;
 - Cleaning of equipment (e.g. machinery, vehicles, tools) without appropriate controls;
 - Concrete dust released into waterways; and
 - Failure of erosion and sediment control measures (sediment fencing and inspections).

4.3.2 OPERATIONAL PHASE

Potential impacts to surface water quality during the operational phase include:

- Stormwater runoff from impervious surfaces such as hardstand areas and access roads resulting in increased flows and transport of contaminants on hardstand surface;
- Spills or leaks from chemicals stored on site and used for maintenance;
- Newly excavated drains and surface dressings on roads may be prone to erosion as any vegetation would not established or have matured;

- Sedimentation and erosion risks are elevated due to operational activities along linear features on steeper slopes, such as the use of access tracks and equipment maintenance, where drainage channel velocities also tend to be higher; and
- Increase risk of sediment mobilisation downstream if drainage, erosion and sediment control measures are not properly maintained throughout the life of the Project.

4.3.3 DECOMMISSIONING PHASE

Potential impacts to surface water quality during the decommissioning phase include:

- Earthworks associated with decommissioning of Project infrastructure such as:
 - WTG, substation, hardstands, construction compound and laydown area construction; and
 - Drainage works.
- Spills or leaks of fuels, oils and chemicals used in the demolition and decommissioning process; and
- Runoff from disturbed areas that have not been rehabilitated or appropriately stabilised.

5. PROPOSED MITIGATION AND CONTROL MEASURES

The proposed mitigation and control measures outlined in this section are to be used to inform the development of a *site-specific* erosion and sediment control (ESC) plan. The objectives, management measures, monitoring and triggers for corrective actions are to be fully incorporated by the site-specific erosion and sediment control plan and implemented.

5.1 PRINCIPLES OF EROSION AND SEDIMENT CONTROL

As per IECA (2025), the three cornerstones of erosion and sediment control are:

- Drainage control – the prevention or reduction of soil erosion caused by the concentrated flow of water as well as appropriate management of water flows through the Project area;
- Erosion control – prevention or minimisation of soil erosion (from dispersive, nondispersive, or competent material) caused by rain drop impact and exacerbated by overland flow on disturbed surfaces; and
- Sediment control – trapping or retention of sediment either moving along the land surface, contained within runoff (i.e., from up-slope erosion) or from windborne particles.

These controls should be implemented hierarchically, with a primary focus on drainage control before implementing erosion and sediment control measures.

5.2 MANAGEMENT OBJECTIVES

Environmental targets and performance indicators are to be prescribed to meet the management objectives outlined in Table 5-1.

TABLE 5-1 STORMWATER AND SEDIMENT MANAGEMENT OBJECTIVES (IECA, 2025)

Issue	Objective	Target	Measurement
Drainage Control	Minimise occurrence of soil erosion during and following construction works	No excess soil erosion occurring within the project footprint	<ul style="list-style-type: none"> • No visible signs of new gullies forming within or adjacent to the project area
Erosion Control	Prevent the movement of sediment outside of construction areas	No sediment migration outside of construction and project boundaries	<ul style="list-style-type: none"> • No visible sediment migration pathways offsite
Sediment Control	Successful retention of sediments contained within runoff from construction areas	No signs of sediment migration around or through established control measures	<ul style="list-style-type: none"> • No visible sediment passing around or through designated control structures • Sediment containment structures have sufficient capacity to hold anticipated rainfall events

Issue	Objective	Target	Measurement
Protection of Water Quality	Prevent sediment entering local waterways	Maintain pre-construction sediment loads in waterways	<ul style="list-style-type: none"> Total Suspended Solids (TSS) measured upstream and downstream of construction areas
	Prevent contaminants from site activities entering waterways	Maintain pre-construction water quality in local waterways and surface water features	<ul style="list-style-type: none"> Water quality monitoring upstream and downstream of construction areas Monitoring of riparian vegetation health

5.3 PROPOSED MITIGATION MEASURES

The following section outlines proposed management and mitigation measures to be employed at each phase of the Project to reduce or control stormwater and erosion related risk on the receiving environment. It should be noted that mitigation measures identified are subject to review and update following finalisation of the construction environmental management plan (CEMP) once detailed design is completed.

5.3.1.1 GENERAL

- Where areas of high erosion risks are unavoidable (identified in erosion risk mapping presented in Figure 3-8), works should adopt a phased approach, where small areas are cleared and stabilised or rehabilitated as quickly as possible before new areas are cleared or disturbed. The aim is to minimise the duration that soils are exposed and not covered by vegetation or other cover;
- Disturbance to be avoided (where practicable) during high rainfall periods of the year. Rainfall data for the region (refer to Section 3.2) indicates a distinct wet season from December to March, with a dry period from April to November. Where possible, in-stream works should be undertaken during periods when flows are absent or at worst case minimal;
- Construction to be phased and the extent/number of disturbance areas at any given time should be limited as far as practicable. Existing light vehicle tracks will be used and widened where available to reduce the requirement for additional disturbance;
- A stabilised entry/exit point (rumble pad) is to be established and maintained at the entrance to the Disturbance Footprint. An existing wash down bay at the DRM will allow for vehicle cleaning to mitigate the transportation of dust and soil;
- Waterway crossings that are identified as per Section 4.2.3 are to be constructed that minimises the extent of disturbance and vegetation clearing. Where vegetation clearing is required, clearing and stabilisation requirements for the work to be established in line with the best practice identified in IECA 2025 Table I11, as a minimum, for all watercourse crossings identified;
- Access tracks will be constructed in accordance with *Erosion control on property roads and tracks - managing runoff* (Queensland State Government 2013);

- Chemical and fuel storage areas to be appropriately bunded to capture any spills/leaks to enable clean up. The surface drainage system should also be designed to capture any water entering the battery and chemical storage area via rainfall;
- Surface water drainage and containment system to be designed and constructed to collect potential chemical leaks/contaminated stormwater from the battery units;
- Spill kits to be installed in close proximity to the location of the battery units;
- An emergency response plan to be developed to manage potential chemical leaks from lithium-ion batteries; and
- Spill management protocols to be developed and implemented.

5.3.1.2 DRAINAGE CONTROLS

- Specific drainage controls (such as diversion, drains, and chutes) will be confirmed in the finalised CEMP to ensure the separation of clean water runoff from construction area runoff;
- Access tracks will incorporate appropriate drainage measures as a means of managing the risk of erosion presented by surface water runoff along and across the access network;
 - Flow diversion methods (e.g. diversion banks, cross drains) will be installed along access tracks to direct runoff to either into drains (for inflow drainage) or downslope as sheet flow via a level spreader (for outflow drainage). This will also allow for vehicular access without interfering with road runoff flows.
- Scour protection to be installed along drainage features to disperse and dissipate the energy of surface water flows. Protection may include features such as rock, concrete, or geo-fabric linings, or the establishment of vegetation and/or jute-matting; and
- Measures such as level spreaders will be established to ensure concentrated flows leaving infrastructure areas are avoided and that sheet flows are maintained.

5.3.1.3 EROSION CONTROLS

- Construction principles in identified high erosion risk areas to focus on techniques that minimise soil disturbance;
- A Preliminary Vegetation Clearing Management Plan has been developed with vegetation clearance staged to minimise soil exposure extent and duration by implementing the clearing immediately prior to soil disturbance;
- Disturbed areas to be temporarily stabilised during periods of inactivity and permanently stabilised at the conclusion of the disturbance works;
- Any stockpiles generated will be positioned outside of the path of concentrated flow and covered with a suitable material. The management of stockpiles, alongside other best practice land clearing and rehabilitation requirements for high to extreme erosion risk areas are detailed in Table 5-2. Stockpiles will be located at a minimum of 50 m away from the top of watercourse banks and away from drainage lines where practical; and
- For steep embankments, soil ameliorants (subject to the finalised CEMP) will be applied to the face of the slope until such time that revegetation or landscaping can commence. The requirement for, and type of soil ameliorants employed will be subject to factors such as steepness of the slope, and soil composition.

5.3.1.4 SEDIMENT CONTROLS

- Placement of sediment traps (e.g. sediment fence, filter fence, compost berm) along the low-side (downstream) of construction and infrastructure areas where required. The placement of sediment fences will be determined at the completion of detailed design and outlined in the finalised CEMP.
- Sediment traps will be placed at drainage outlets where necessary to capture sediment prior to discharge.
- Transport of loads that are subject to loss through wind or spillage shall be covered or sealed to prevent entry of pollutants to stormwater systems;
- Regular inspection and maintenance of ESC structures: Following rainfall events sufficient to produce runoff, inspection of erosion control measures and removal of collected material will be undertaken. Replacement of any damaged structures should be performed immediately. Inspections and maintenance activities should be documented; and
- Increased inspection and maintenance of ESC structures in high erosion risk areas.

5.4 BEST PRACTICE LAND CLEARING AND REHABILITATION REQUIREMENTS

The stabilisation and rehabilitation (both temporary and permanent) of disturbed areas is a key aspect in managing erosion risk. Chapter 4.4 of the IECA Book 1 provides guidance surrounding the best practice land clearing, erosion control and site rehabilitation measures to be implemented, and how the measures to be implemented are determined by erosion risk. These best practice measures are presented in Table 5-2.

5.5 WATER QUALITY BASELINE MONITORING PROGRAM

The DRM REMP database represents an extensive baseline water quality dataset for the region. Continued implementation of the REMP along the upstream and downstream monitoring points along key waterways such as North Creek, Silvermine Creek, Dugald River, and Cabbage Tree Creek will allow for potential stormwater quality impacts as a result of the Project to be identified. The REMP should aim to ensure water quality objectives are met and that impacts to water quality during construction and operation can be monitored and mitigated as required.

TABLE 5-2 BEST PRACTICE LAND CLEARING AND REHABILITATION REQUIREMENTS BASED ON ESTIMATED SOIL LOSS RATE (IECA, 2025)

Erosion Risk Class (RUSLE)¹	Estimated Soil Loss Rate (t/ha/yr)	Erosion Risk Rating	Maximum weeks for land clearing works	% cover required for rehabilitation of finished areas	No. of days to achieve cover on completed areas	No. of days cover must be applied on exposed areas if no works occurs	No. of days that stockpiles require covering within
Very Low	<150	Very Low	4 – 8 ²	60	10 - 30 ²	10 - 30 ²	15 - 28 ²
Low	151 to 225	Low	4 – 8 ²	70	10 - 30 ²	10 - 30 ²	15 - 28 ²
Low/Moderate	226 to 350	Moderate	4 – 6 ²	70	10 - 20 ²	10 - 20 ²	15 - 28 ²
Moderate	351 to 500						
High	501 to 750	High	4	75	10	10	10
Very High	751 to 1500						
Extremely High	>1500	Extreme	2	80	5	5	5

¹Erosion risk classes derived from the RUSLE assessment conducted for the Project. As such, this table should be read in conjunction with the RUSLE mapping to determine the best practice requirements that a given location is subjected to.

²Depending on the season. Shorter duration during the wet season (December to March), longer duration in the dry season (April to November).

6. CONCLUSION

The Stormwater and Erosion Risk Assessment for the Project considers potential stormwater and erosion related risks during the construction, operation and decommissioning phases of the Project. The assessment is based on the current description of the Project and the indicative layout provided by MMG. Table 6-1 demonstrates how the wind farm development aligns with the performance objectives outlined in State Code 23 and State Code 27.

TABLE 6-1 COMPLIANCE WITH STATE CODE 23 PERFORMANCE OBJECTIVES

Performance Outcomes		Comments
Natural drainage patterns	PO6 The wind farm, including ancillary infrastructure, is designed and sited to minimise crossings of and interference with natural drainage lines, waterways and wetlands	<p>A desktop review of the regional hydrology identified no significant drainage lines, waterways, or wetlands within the Disturbance Footprint. Ephemeral streams and drainage lines are the only surface water features identified within the Disturbance Footprint.</p> <p>The assessment found that the Project will likely result in a small increase in imperviousness based on the overall area for WTG hardstands, the proposed BESS and collection substation impervious foundation outlined in Section 4.2.1. This small increase in imperviousness may have an effect on local catchment characteristics. However, when compared against the broader basin, any affect would be negligible based on the total catchment area of 3.3 and 4.7 million ha for Leichhardt Basin and Cloncurry Sub-Basin respectively.</p> <p>Interactions with waterways are minimised throughout the Project. Water quality will be maintained through the implementation of sediment and erosion control measures.</p> <p>A review of flood risk found that based on the elevation of the Project on the Knapdale Range relative to the surrounding landscape, infrastructure is located significantly above the QFAO flood extent.</p> <p>The Project is compliant with PO6.</p>
Protecting water quality and erosion control	PO7 Development is designed to avoid areas of high erosion risk, where failure of erosion management devices would result in permanent and/or adverse impacts on receiving waterways or wetlands.	<p>A review of RUSLE mapping for the Project identified very low to low erosion risk throughout a majority of the Disturbance Footprint. Extreme erosion risk areas represent a small proportion of the Disturbance Footprint, (less than 2%), which only affects a small area of Stage 2 access roads. Where areas of high to extremely high erosion risk are unavoidable, erosion and sediment control measures are to be implemented in accordance with the ESCP.</p> <p>The Project is compliant with PO7.</p>

Performance Outcomes		Comments
PO8	<p>Development is constructed to maintain or improve the water quality of receiving waters, waterways and wetlands by:</p> <ul style="list-style-type: none"> minimising erosion and run off; managing drainage control; and preserving the bank stability of affected waterways and drainage lines. 	<p>Where land clearing and ground disturbance is required to support the Project, control measures will be required in the form of a site-specific Erosion and Sediment Control Plan which will be developed, informed by the IECA (2025) best practice management measures. This will be developed in conjunction with the construction contractor following the detailed design phase of the project and will be implemented prior to commencement of construction.</p> <p>Sizing of stormwater infrastructure is to be undertaken in accordance with the methodology and principles described in the Queensland Urban Drainage Manual (QUDM, 2021) which applies to projects in both urban and rural settings. This will seek to maintain catchment flows to levels largely similar to the pre-development catchment.</p> <p>The existing REMP program provides an extensive baseline water-quality dataset for upstream and downstream locations relative to the Project. This program will continue through construction and the operational phase where it aligns with the DRM operations. Ongoing monitoring will ensure water-quality objectives are met and that any construction- or operation-related impacts can be detected and mitigated as required.</p> <p>During construction and operation, the monitoring program will assess the effectiveness of Project control measures and identify whether any additional actions are required.</p> <p>The Project is compliant with PO8.</p>
PO9	<p>Areas cleared for construction are progressively stabilised during construction to ensure that erosion and run off to the surrounding landscape and waterways is minimised to the greatest extent possible.</p>	<p>The Project will undertake progressive rehabilitation of disturbed areas with best practice guidance outlined in the IECA Manual. These are replicated in Table 5-2, and include requirements for the progressive management and rehabilitation of disturbed areas and stockpiles. A Preliminary Rehabilitation Plan which also outlines measures to manage erosion and sediment control in accordance with the IECA Manual.</p> <p>Topsoil stripped to support the construction of access tracks will be stockpiled to support future rehabilitation.</p> <p>The Project is compliant with PO9.</p>

TABLE 6-2 COMPLIANCE WITH STATE CODE 27 PERFORMANCE OBJECTIVES

Performance Outcomes			Comments
Natural drainage patterns	PO16	<p>Development:</p> <ul style="list-style-type: none"> • minimises the disturbance of high risk soils; and • manages the release of soil based contaminants. 	<p>A review of RUSLE mapping over the Project Disturbance Footprint identified is generally low to low erosion risk throughout the Disturbance Footprint (cumulative of 72% of the overall Disturbance Footprint). A small area of high-erosion-risk, affecting Stage 1 and Stage 2 roads have been identified, particularly at the northern and southern ends of the Disturbance Footprint, affecting three WTGs and their associated access tracks. Detailed design will ensure that all high to extremely high erosion-risk areas will have BPESC Controls to be implemented as per the ESCP.</p> <p>The Soil and Land Suitability Assessment concluded the soil types within the region and non-sodic making them non-dispersive and resistant to erosion.</p> <p>A ESCP will be developed in consideration of the IECA (2025) best practice management measures. This will be developed in conjunction with the construction contractor following the detailed design phase of the project and will be implemented prior to commencement of construction.</p> <p>Project is compliant with PO16.</p>
Protecting water quality and erosion control	PO17	<p>Development maintains the water quality of receiving waters, waterways and wetlands by:</p> <ul style="list-style-type: none"> • avoiding locating in waterways and wetlands; • minimising crossings of and interference with natural drainage lines, farm drainage and irrigation infrastructure; • minimising erosion and sediment run off; • managing drainage control; and • preserving the bank stability of affected waterways and drainage lines avoiding non-essential hardening or unnatural modification of the waterway. 	<p>There are no significant waterways or wetlands identified throughout the Disturbance Footprint.</p> <p>The small local waterways flow into the TSF to the west, Dugald River to the east and Cabbage Tree Creek to the North.</p> <p>The existing REMP has provided a suitable water quality database to determine the baseline water quality upstream and downstream of the Project. The monitoring program will assist in detecting and assessing overall impacts on water quality during construction and operation. During construction and operation, the monitoring program will help assess the effectiveness of control measures implemented for the project and determine whether additional measures are required.</p> <p>The Project layout has been designed to avoid the crossing of drainage lines. One watercourse crossing has been identified within the Disturbance Footprint. The crossing will be constructed to a standard that minimises the extent of disturbance and vegetation clearing.</p>

Performance Outcomes		Comments
		<p>RUSLE mapping for the Project identified a very low to low erosion risk throughout the majority of the Disturbance Footprint, approximately 72% of the Disturbance Footprint. Where high-erosion-risk areas are identified within the Disturbance Footprint, erosion and sediment control measures commensurate with the erosion risk, as per the BPESC Guidelines, are to be implemented.</p> <p>An ESCP will be developed in line with the IECA (2025) best practice management measures. This will be developed in conjunction with the construction contractor following the detailed design phase of the Project and will be implemented prior to commencement of construction.</p> <p>Project is compliant with PO17.</p>
PO18	Development prevents the release of contaminants to surface water or groundwater in the event of an incident, including a fire or explosion.	<p>Based on the preliminary hydrology and flood assessment, the Project is unlikely to cause any significant risks of contaminant release as there are neither any significant watercourses nor any flood risk within the Disturbance Footprint. Where necessary, areas designated for the storage of chemicals and other identified contaminants will be appropriately bunded to ensure the capture of contaminants in the event of an incident.</p> <p>Project is compliant with PO18.</p>
PO19	Development minimises interference with overland flow paths.	<p>Based on assessment of the preliminary Project design, interference with overland flow paths will be minimised, with pre-development flow pathways retained as far as practicable throughout the construction and operational phase of the Project.</p> <p>Surface water will be directed as overland sheet flow. The legal point of discharge will remain unchanged.</p> <p>Project design and appropriate drainage controls will assist in ensuring that the Project does not result in significant changes to pre-development hydrology.</p> <p>Project is compliant with PO19.</p>

7. RPEQ STATEMENT

This statement pertains to the supporting action guidance provided for BESS facilities as stated in PO17 and PO19 of State Code 27 (Queensland Government, 2025).

The drainage control and bank stability measures, where relevant, identified in this stormwater assessment, align with industry good practice for developments of this nature. These measures, some of which are to be defined during detailed design and in relevant management plans which are to be produced, aim to manage overland flows and prevent concentrated runoff such as pre-development conditions and are not materially altered by the BESS development.

Effective development and implementation of the relevant management plans identified within this report will ensure that during construction and operation phases of the BESS development, waterway banks will not be destabilised, and disturbed areas will be revegetated.

This statement is endorsed by Chris Gimber, RPEQ number 16126.

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APPENDIX A EROSION RISK ASSESSMENT

Erosion and Sediment Risk Assessment

As erosion and sedimentation represents part of the risk associated with stormwater contamination during the development of the Project, the following section outlines potential erosion risk, and mitigation measures to be adopted and outlined in the construction environmental management plan (CEMP).

The Revised Universal Soil Loss Equation (RUSLE) was adopted as a means of quantifying the erosion risk presented by the development of the Project.

Revised Universal Soil Loss Equation

The RUSLE quantifies average annual soil loss (A) using five factors; rainfall erosivity (R), soil erodibility (K), slope length and slope steepness (LS), cover management (C), and support practice (P). The RUSLE can be presented as follows:

$$A = R \times K \times L \times S \times C \times P$$

- **A** is the mean annual soil loss ($t \text{ ha}^{-1}\text{yr}^{-1}$)
- **R** is the rainfall erosivity
 - The **R** factor is an expression of energy and maximum intensity of rainfall averaged over long periods of time (more than 20 years) so as to accommodate discernible recurring rainfall patterns;
- **K** is soil erodibility factor ($t \text{ h MJ}^{-1} \text{ mm}^{-1}$)
 - The **K** factor is defined as the susceptibility of a soil to soil erosion. The K factor accounts for particle size, permeability, organic matter, and structure of the soil as the critical physiochemical properties which affect erodibility;
- **L** is the slope length factor;
 - The landscape's topography has a significant influence on the extent of soil erosion. The **L** factor expresses the effect slope length has on slope erosion;
- **S** is the slope steepness factor;
 - The landscape's topography has a significant influence on the extent of soil erosion. The **S** factor expresses the effect gradient has on slope erosion;
- **C** is the cover management factor
 - The **C** factor considers the effect of vegetation and plant canopy cover
- **P** is the support practice factor
 - The **P** factor measures the impact of control practices which reduce runoff or erosion potential.

The RUSLE assessment for the Project was informed by publicly available information from sources such as Queensland Globe and the Queensland government's QSpatial catalogue. The QSpatial catalogue includes K, R, S and L factors across Queensland based on existing understanding of soil properties, statewide topographic mapping, and climatic data.

Individual maps for the K, R, S and L factors for the Project area are presented in Figures A-1 to A-4 below. The C and P factors were applied based on conservative descriptions of the Project area. A C factor of 1.0 (the most conservative estimation available) assumes no existing cover and that the site is cleared, alongside a P-factor of 1.3 which assumes a compacted and smooth surface (worst case for runoff and erosion) were applied to develop a

conservative “worst-case” estimation of erosion risk. These combined layers form an erosion risk map which presents the results of the RUSLE assessment visually.

Erosion Risk Classification

As a means of classifying erosion risk from the RUSLE assessment, the International Erosion Control Association Best Practice Erosion and Sediment Control (IECA BPESC) (IECA, 2025) Book 1 provides guidance surrounding erosion risk. The IECA recommend an adapted classification developed by Morse and Rosewell (1996) to classify annual soil loss rates (as erosion risk) within ranges from very low, to extremely high. The erosion risk classification, and their corresponding mean annual soil loss rates are presented in Table A-1

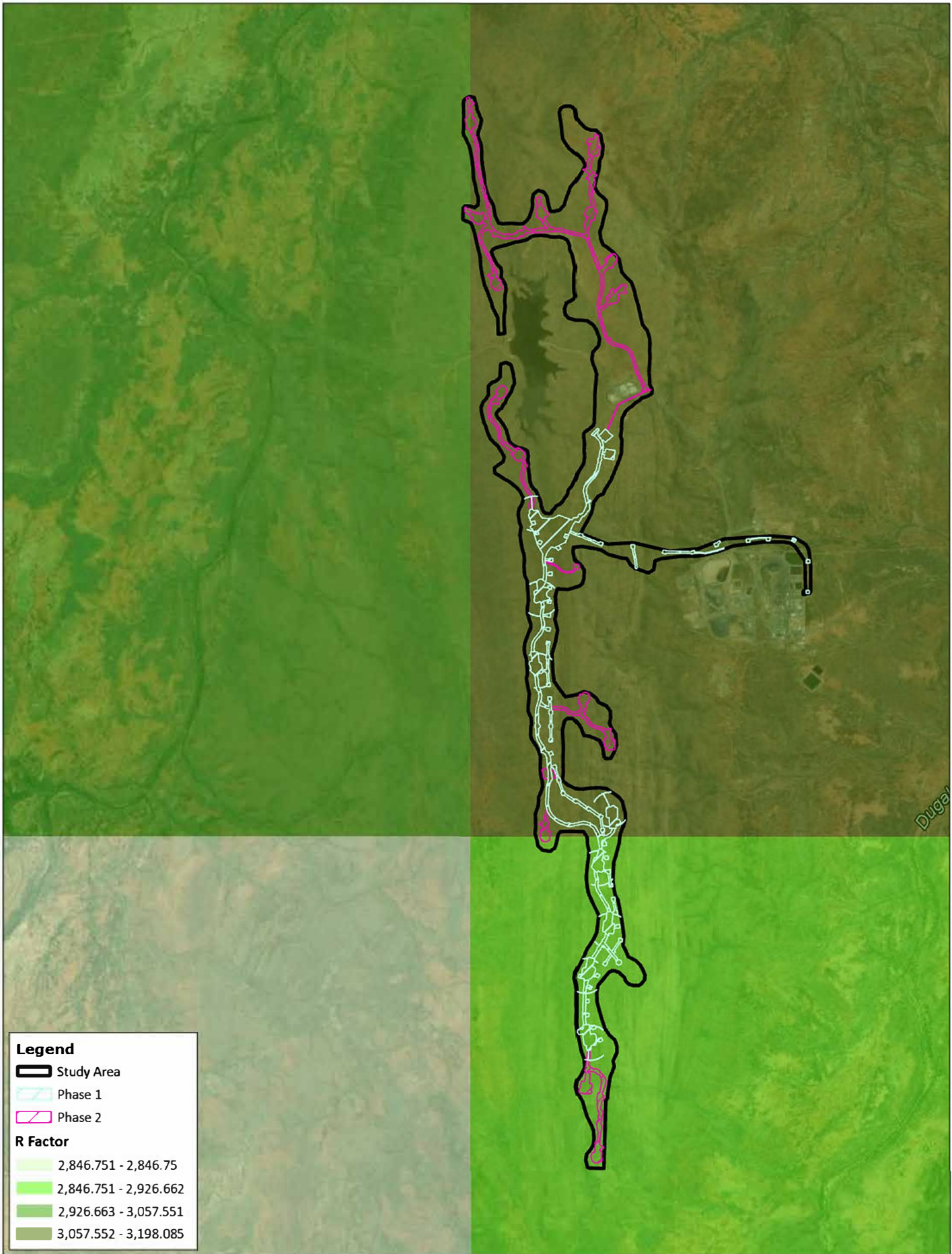
TABLE A-1 EROSION RISK CLASSES

Soil Loss Class	Mean Annual Soil Loss (A) (t/ha/yr)	Erosion Risk
1	<150	Very Low
2	151 to 225	Low
3	226 to 350	Low – Moderate
4	351 to 500	Moderate
5	501 to 750	High
6	751 to 1500	Very High
7	>1500	Extremely High

RUSLE Assessment Results

The results of the RUSLE assessment for the Project are presented in an erosion risk map in **Figure 3-8**.

The RUSLE input factor maps for the Project area are presented in in **Figures A-1 – Figure A-4**. The rainfall and erosivity (R factor) appears to be largely low risk across the majority of the Project area. Soil type (K factor) across the Project area, is mostly soils with low erosivity. Topographical features of slope length (L factor) and slope steepness (S factor) show the hilly and steep areas of the Knapdale Range.



Legend

- Study Area
- Phase 1
- Phase 2

R Factor

- 2,846.751 - 2,846.75
- 2,846.751 - 2,926.662
- 2,926.663 - 3,057.551
- 3,057.552 - 3,198.085

Coordinate System:
GDA2020

Date: 03/03/2026

Created By: FB

Drawing Size: A4

0 1 2km 1:59,000

F A-1 RUSLE - R Factor




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Legend

-  Study Area
-  Phase 1
-  Phase 2

K Factor


-  0.038 - 0.04
-  0.04 - 0.05
-  0.05 - 0.06

Coordinate System:
GDA2020

Date: 03/03/2026

Created By: FB

Drawing Size: A4

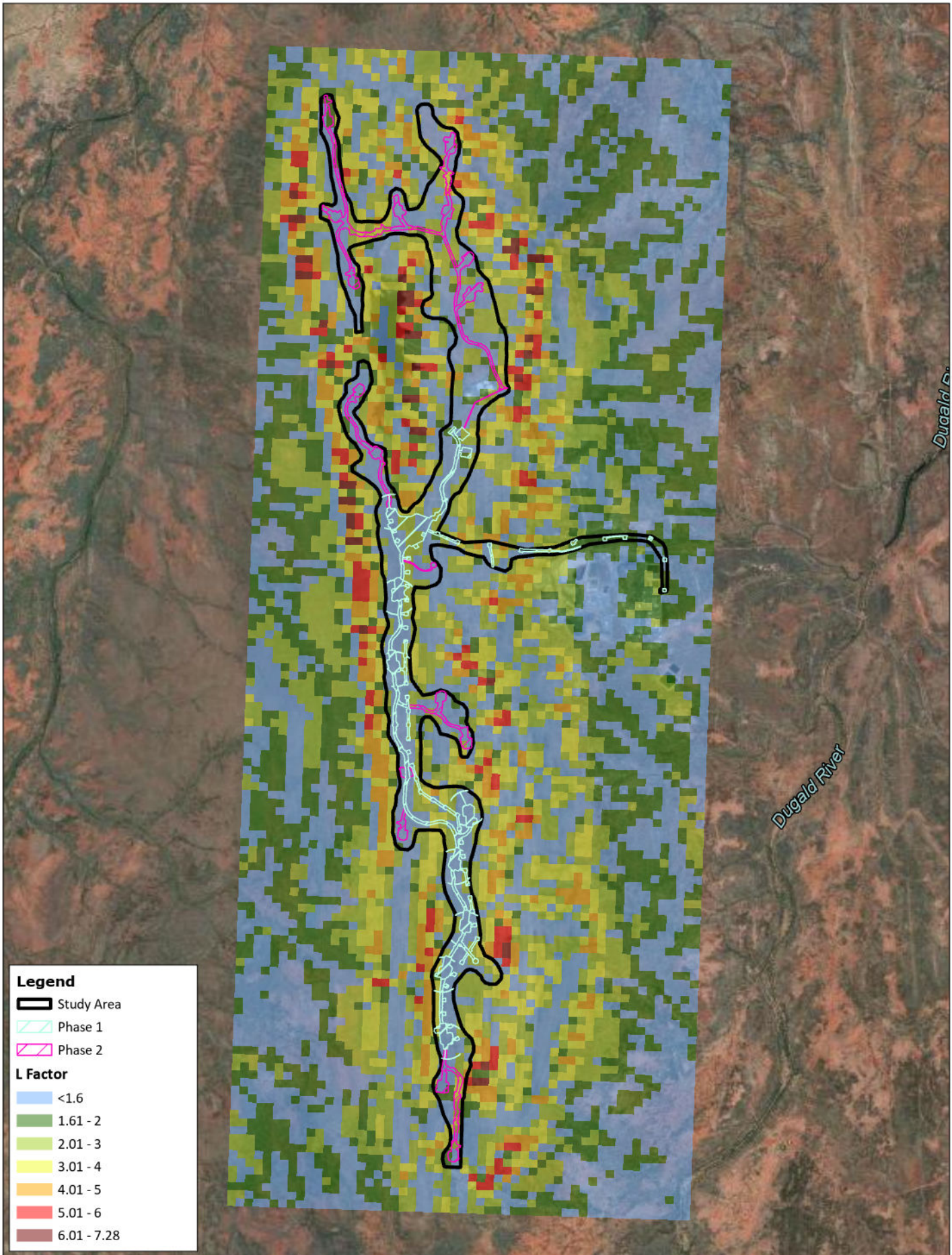
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A-2 RUSLE - K Factor

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Legend

- Study Area
- Phase 1
- Phase 2

L Factor

- <math><1.6</math>
- 1.61 - 2
- 2.01 - 3
- 3.01 - 4
- 4.01 - 5
- 5.01 - 6
- 6.01 - 7.28

Coordinate System:
GDA2020

Date: 03/03/2026

Created By: FB

Drawing Size: A4

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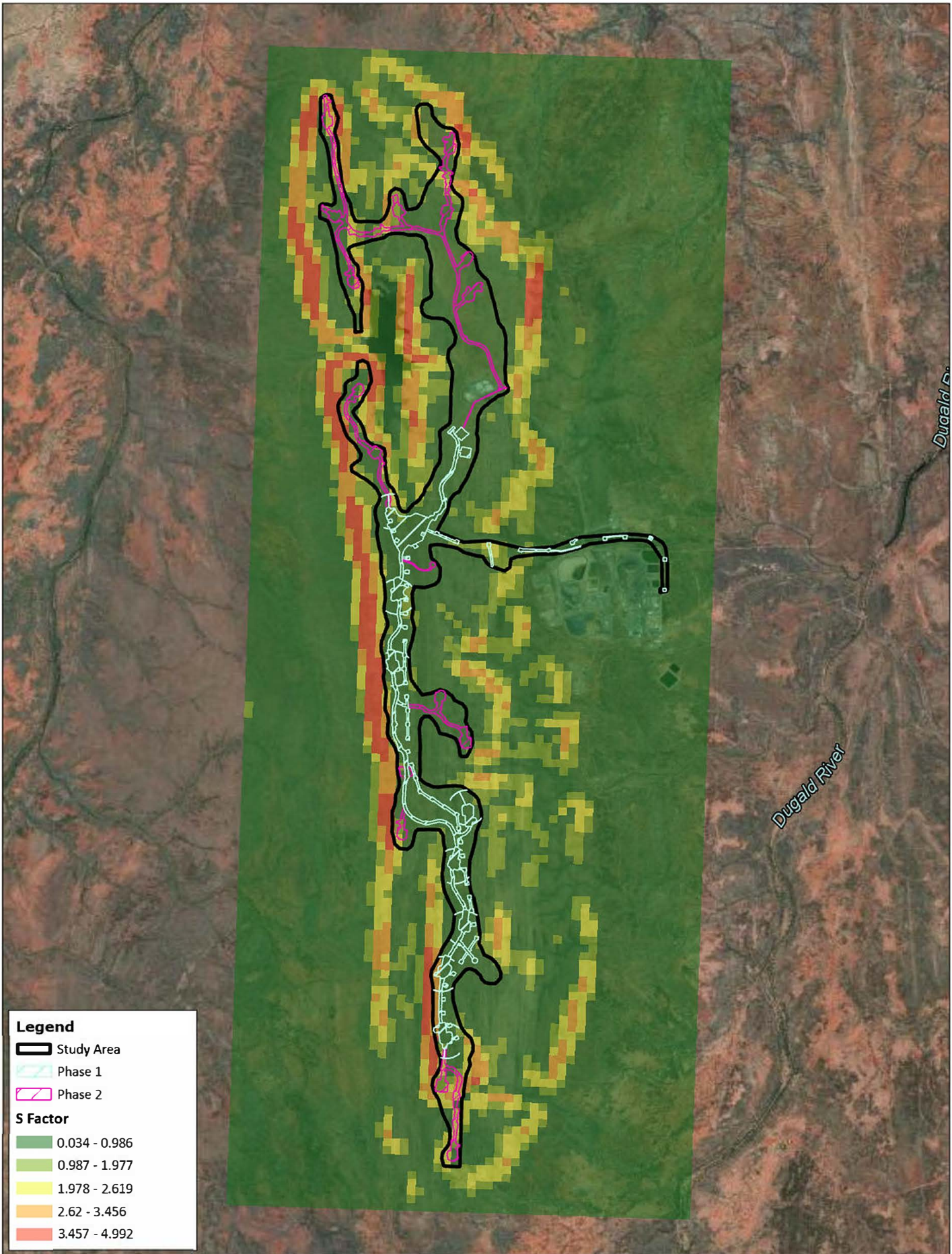
1:59,000

A-3 RUSLE - L Factor

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Legend

- Study Area
- Phase 1
- Phase 2

S Factor

- 0.034 - 0.986
- 0.987 - 1.977
- 1.978 - 2.619
- 2.62 - 3.456
- 3.457 - 4.992

Coordinate System:
GDA2020

Date: 03/03/2026

Created By: FB

Drawing Size: A4

0 1 2km 1:59,000

A-4 RUSLE - S Factor

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