

EA APPLICATION SUPPORTING REPORT

SAVANNAH GOLDFIELDS LTD

Appendix 1 Water Management Plan (ATC Williams, 2025)

REPORT

SAVANNAH GOLDFIELDS LTD
ABN: 79 644 301 655

Agate Creek Gold Mine
Water Management Plan

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1 INTRODUCTION

1.1 Background

The Agate Creek Gold Mine (ACGM, or Project), owned and operated by Savannah Goldfields Limited (SVG) formerly Laneway Resources, is proposing to expand its current mining operation from 45,000 tpa to 250,000 tpa. In 2022, ATC Williams Pty Ltd (ATCW) developed a Water Management Plan (WMP) [1] to support an Environmental Authority (EA) amendment and Progressive Rehabilitation Closure Plan (PRCP) for ACGM. Since then, SVG have revised the mine plan with changes to the proposed open cut pits, Waste Rock Dump (WRD) landforms, and other general site features.

SVG via Ardent Group Pty Ltd (Ardent) have engaged ATCW to review and update existing engineering reports to reflect the new mine plan. This report outlines the amended WMP.

1.1.1 Current Operations

SVG was granted mining lease (ML) 100030 in February 2019 and currently operates within Environmental Authority (EA) EPSL03068015. ACGM activities currently encompass the extraction of gold ore and waste rock from the Sherwood open Cut Pit situated at approximately the midpoint of ML100030. Ore is transported to the ROM pad where it is temporarily stockpiled. Waste rock is transported to the Sherwood Waste Rock Dump WRD on-site. SVG currently extract up to 45,000 tpa.

1.1.2 General Arrangement of the Proposed Expansion

SVG are proposing to expand current operations across the Sherwood and Sherwood West resource areas under ML100030, extracting up to 250,000 tpa across four individual open cut pits. The expansion of operations will include the following mine domains:

- Four open cut pits;
- Five waste rock dumps (WRDs);
- Topsoil stockpile areas;
- Expanded administrative buildings and other mining infrastructure (roads, camp etc.);
- Expanded Run of Mine (ROM) pad;
- Magazine;
- Water storages; and
- Sediment ponds.

Ore is to be transported off site to Georgetown for processing. Access to Agate Creek is to remain as Rungulla Road/Agate Creek Road/Cobb Road and onto Georgetown via Forsayth Road.

1.2 Scope of Works

ATC Williams (ATCW) Pty Ltd have been engaged by SVG to assist with site investigations and the documentation required for the EA amendment and in support of the Progressive Rehabilitation and Closure Plan (PRCP) for the site. This report addresses the requirement for a Water Management Plan. The overall purpose of this WMP is to provide a site surface water assessment, and to outline control measures to be implemented to prevent detrimental impact on receiving waters. This WMP will further inform necessary water management amendments to the EA and will inform part of the PRCP documentation.

The scope of works has been prepared to satisfy the conditions in the Department and Environment and Science (DETSI) guideline *'Preparation of Water Management Plans for Mining Activities'* [17]. The WMP includes the following;



- Contaminant Source Study;
- Site Water Balance and Model;
- Water Management System;
- Saline and Metalliferous, Acid Mine Drainage Prevention and Management Measures;
- Preliminary Consequence Category Assessment
- Emergency and Contingency Planning; and,
- Monitoring and Review.

1.3 Regulatory Requirements and Guidelines

Legislation and regulatory requirements apply to SVG and the ACGM site due to the environmental risks associated with the proposed mining activities. The following principal legal and regulatory documents have been used as a reference when developing this report:

- Environmental Authority (EPSL03068015).
- Department of Environment, Science and Innovation – Guideline: Stormwater and Environmentally Relevant Activities V1.07 (2025).
- Department of Environment, Science and Innovation – Statutory guideline - Progressive Rehabilitation and Closure Plan (2024).
- Department of Environment and Heritage Protection – Eligibility Criteria and Standard Conditions for Mining Lease Activities (ESR/2016/2241)
- Department of Environment, Science and Innovation – Model Mining Conditions (2024)

1.4 Report Summary and Structure

This Water Management Plan (WMP) has been prepared for SVG to outline the proposed measures to meet regulatory and environmental objectives for the ACGM site. This WMP strategy includes several sediment ponds and a large Water Storage Dam, which is intended to contain excess water from the sediment ponds and pits from large/prolonged rainfall events. This will require long lengths of pipeline and significantly sized pumps to meet head requirements given the site topography. The WMP is constrained by the Agate Creek floodplain and the multiple natural gullies that flow through the site. Water management for the mine will therefore be complex due to:

- the steep nature of the site;
- multiple natural gullies that will require culvert crossings, diversion drains, and complex pump line geometry;
- very low on-site water demands, and
- the development areas being spread apart.

This WMP considers an operational scenario where all WRDs and Pits are active and no progressive rehabilitation has progressed over the site. To improve the environmental outcomes for the site and in-line with the intent of the PRCP, it is recommended that mine development staging considers progressive rehabilitation of operational areas as the works progress.

The structure of this report, to address the above purpose and scope, is as follows:

- | | |
|--------------------|--|
| Section 2.0 | - Provides a description of the project in the context of the proposed site water management strategy and site setting covering climatic and hydrological conditions. |
| Section 3.0 | - Presents an overview of the outcomes of the contaminant source study and the receiving environment water quality requirements including saline and acid rock drainage. |
| Section 4.0 | - Outlines the mine stormwater runoff management system and key performance criteria. |



- Section 5.0** - Presents details of the site operational water balance modelling, and reviews the overall hydrological performance based on the adopted water management layout.
- Section 6.0** - Presents a preliminary consequence category assessment for the site water storage dam and other structures.
- Section 7.0** - Details site water monitoring and review requirements.
- Section 8.0** - Provides an overview of the emergency and contingency procedures on-site.
- Section 9.0** - Describes the reporting commitments and complaints response adopted by ACGM.
- Section 10.0** - Conclusions and recommendations.



2 SITE DESCRIPTION

2.1 Site Location

Agate Creek Gold Mine site is located approximately 40 km south-west (Rungulla Road) of Forsayth, Far North Queensland. The mine is part of the larger Agate Creek Gold Project, which also includes a mineral development licence MDL402, and exploration permits for areas north of the mine (EPM17788 and EPM26460). However, this assessment focuses only on the mine area within ML100030, as shown on **Diagram 1**. Typical site conditions are shown in **Photo 1**.

DIAGRAM 1: SITE LOCALITY MAP

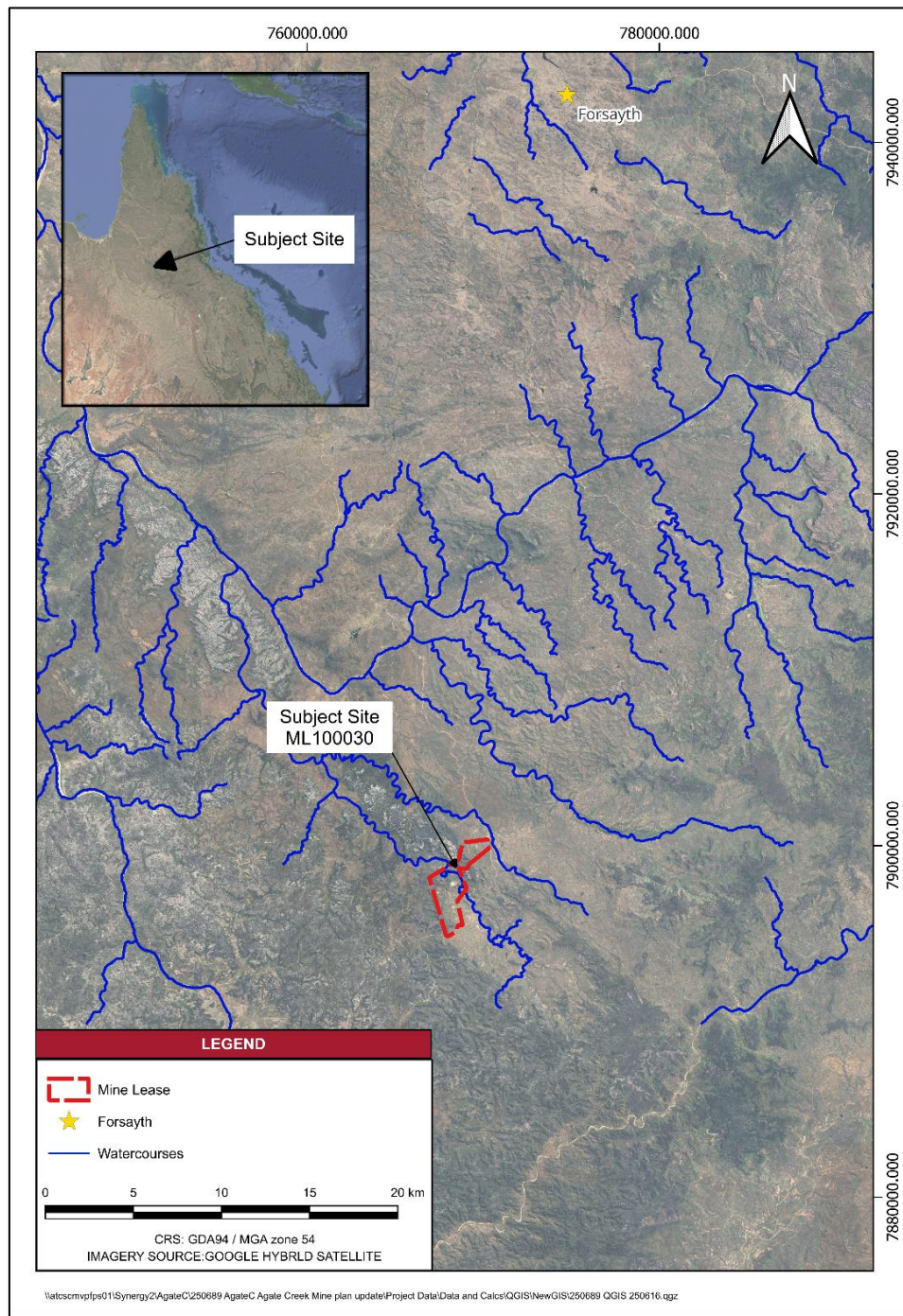


PHOTO 1 – TYPICAL NATURAL SITE CONDITIONS



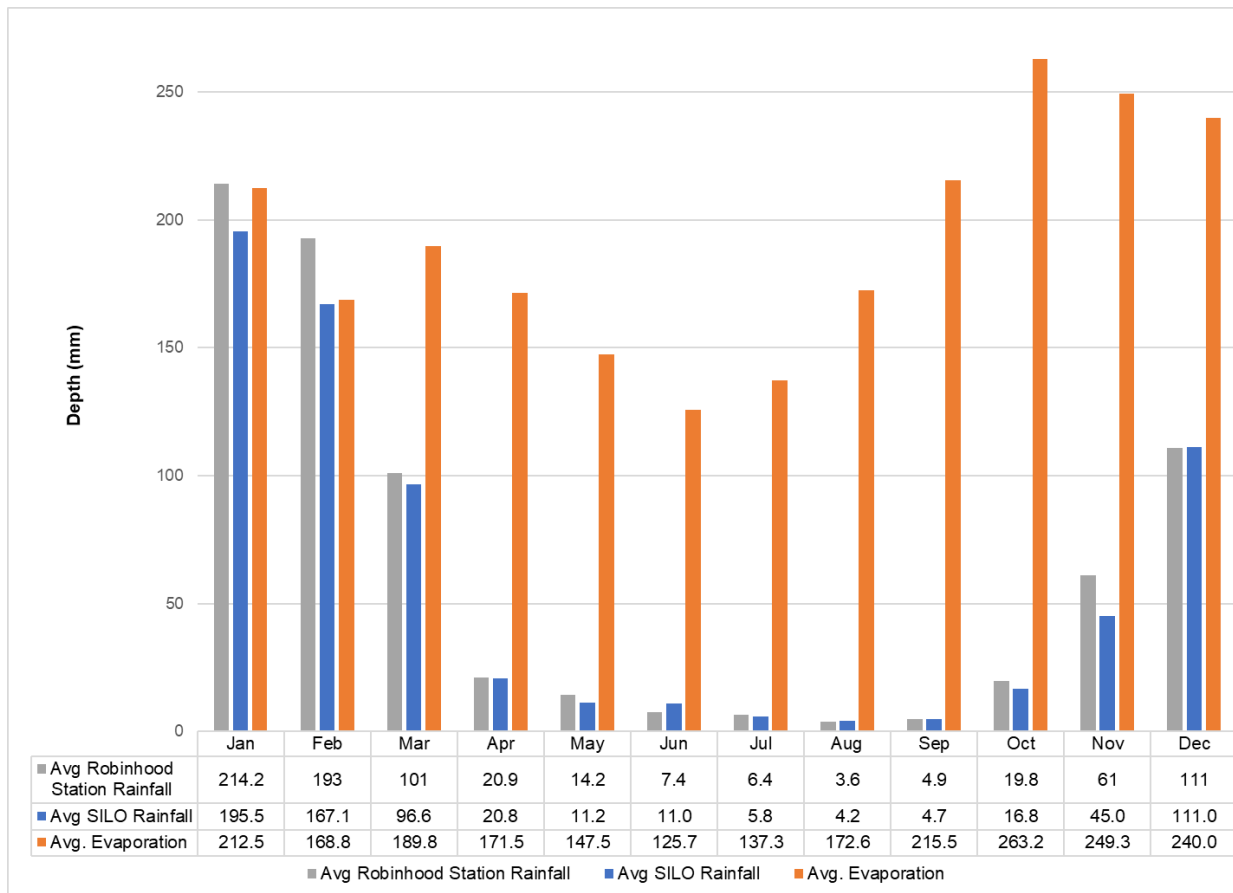
2.2 Climatic Conditions

The ACGM site is located in Far North Queensland region which has a tropical climate characterised by a distinct wet season (December – March) and dry season (April – November) as shown in **Graph 1**. Average annual rainfall is approximately 1085 mm, with most falling during the wet season. The nearest meteorological weather station to the site is the Bureau of Meteorology's (BoM) Robinhood Station (Station 030104, est. Oct 1966) located some 24.4 km to the northeast of the site.

The Robinhood weather station does not have long term evaporation data, which is a key factor in the assessment of surface water management. Therefore, for the purposes of this assessment, all climate data has been sourced from the SILO Data Drill program [30] specific to the site location. Rainfall from the Robinhood weather station has been compared with the SILO data in **Graph 1**, confirming that the SILO data is valid as there are only minor variances between the datasets.



GRAPH 1: RAINFALL AND EVAPORATION MONTHLY AVERAGES



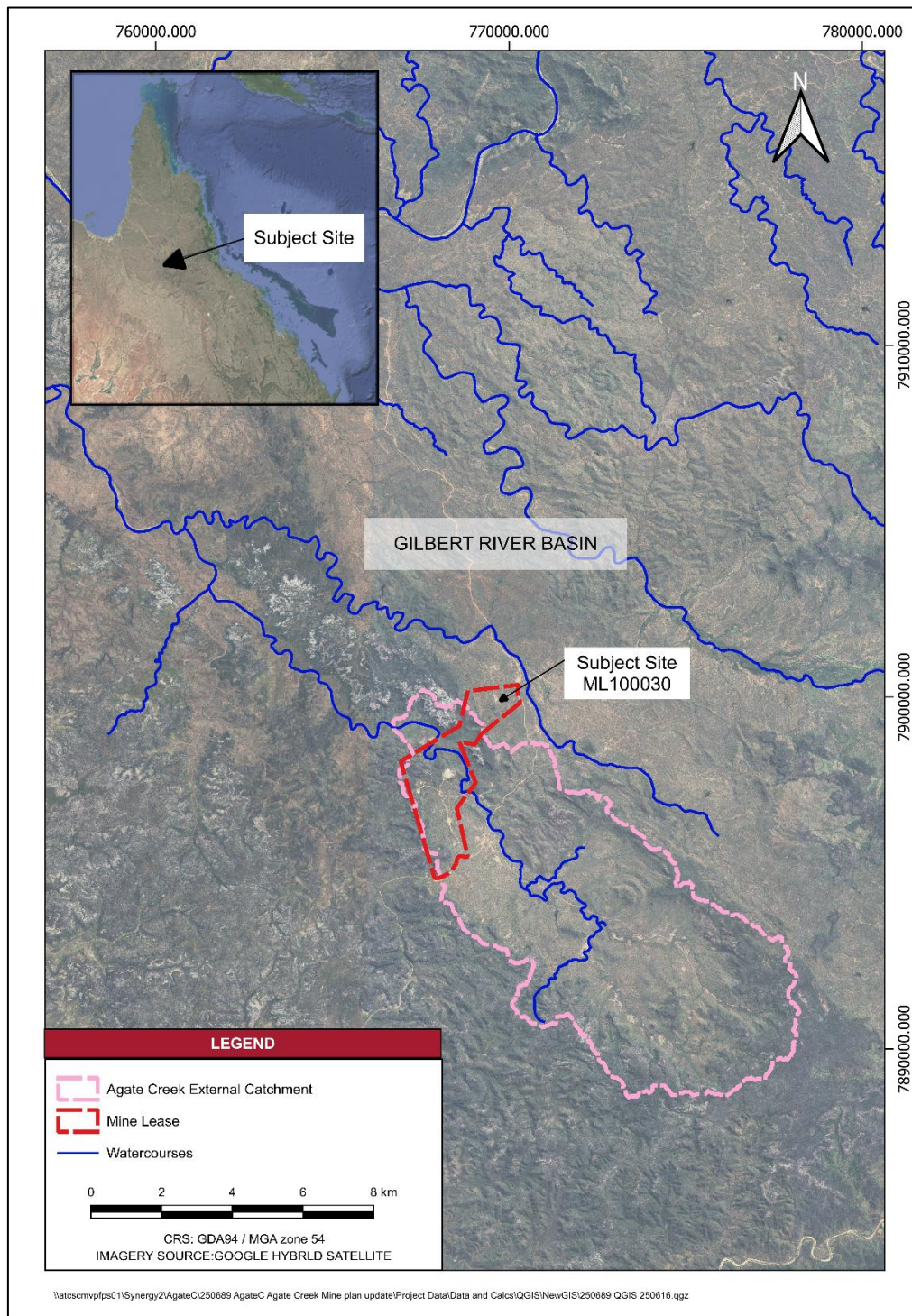
Rainfall data can significantly vary when affected by broader weather patterns, such as 'El Niño Southern Oscillation', and additional tropical cyclones that occur among November and April [30]. For instance, Agate Creek has experienced as much as 202 mm in a single day during the wet season and as much as 1,281 mm in a single month (January) as per SILO data [30].

2.3 Hydrological Characteristics and Topography

2.3.1 Regional Context

The ACGM site forms part of the Gilbert River catchment located within the wider regional Gilbert Basin in Far North Queensland. The site has ephemeral waterways directly discharging to Agate Creek which is the immediate receiving watercourse for the site, located centrally within the mine lease running from east to northwest. Agate Creek subsequently flows northwest until it intersects Robertsons River, approximately 23 km northwest of the site. The Robertsons River then joins the Gilbert River, located approximately 26 km downstream from the point of confluence of Agate Creek and Robertsons River. The Gilbert River travels further downstream by approximately 361 km until it reaches the Gulf of Carpentaria on the northwest, which is the final discharge point for the entire Gilbert Basin. The regional watercourses are depicted on **Diagram 2**, noting that the mine lease has a large upstream catchment of approximately (64.8 km²) that discharges through the site as Agate Creek.

DIAGRAM 2: REGIONAL DRAINAGE

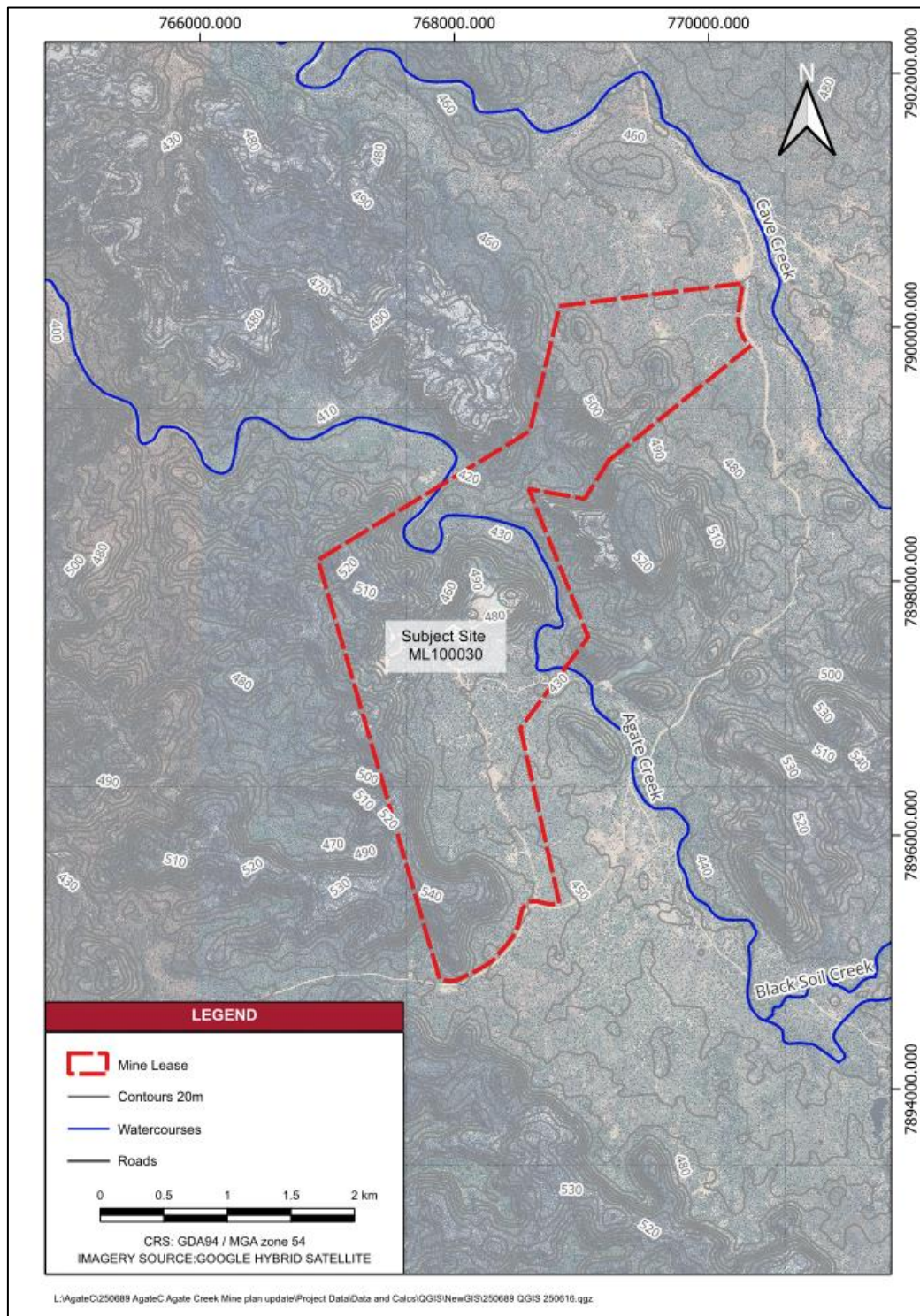


2.3.2 Site Context

The subject site is located on a valley within the Agate Creek catchment. The site is bordered to the east and west by an existing ridge and to the south by the Rungulla Road. The majority of the site drains centrally to Agate Creek, which has a large upstream catchment as described in **Section 3.2.1**. Elevation varies substantially over the entire lease, ranging between approximately RL 422 m and RL 529 m as depicted in **Diagram 3**.



DIAGRAM 3: LOCAL DRAINAGE



2.4 Site Features

Key elements of the proposed project site associated with the water management system are as follows:

- Open Cut Pits;
- Waste Rock Dumps (WRD);



- Haul roads;
- ROM Pad;
- Sediment Ponds;
- Water Storage Dam;

Site features are shown on **Diagram 7** and **Diagram 8**.

2.4.1 Open Cut Pits

There are four (4) proposed open cut pits which are all located on the central zone of the mine lease. Their sizes range from approximately 170,000 m³ to ~1.0 million m³, with an overall total of 1.9 million m³ in terms of loose excavated volume.

2.4.2 Waste Rock Dump

There are five (5) proposed waste rock dumps within the ACGM site, to store waste rock materials during mine operations; Pit 1 WRD, Pit 6 WRD, NW WRD, SW WRD, and the Low-grade WRD. All WRDs except for the Low-Grade WRD will be temporary during operations. The Low-Grade WRD will remain post-closure and therefore needs to be designed to meet PRCP guidelines. The WRDs have capacity to store approximately 2.4 million m³, allowing for more storage than the ~1.9 million m³ of waste that will be generated based on the pit designs. Additional WRD capacity has been designed to allow operational flexibility in terms of where waste material can be placed during operations, which will then be reused to backfill the pits in the closure phase. Larger footprints have therefore been designed, to accommodate key infrastructure under the worst-case WRD size.

The maximum combined footprint area is approximately 17.5 ha during operations. (Refer to ATCW's report 250689_R02 WRDMP [1] for further details). There are also existing WRDs on-site (Pit 1, Pit 4, and Pit 6 WRDs), which are no longer in use and now vegetated. They will be used for pit backfill during the closure phase.

2.4.3 Water Storage Dam

A Water Storage Dam (WSD) is proposed to be located southeast of the proposed Low-grade WRD. The storage is proposed to contain water for site demands, including dust suppression and other ancillary water demands. The storage has been nominally sized (refer **Section 5**) with a storage volume of some 200 ML and an indicative footprint of 4.5 ha. The storage has no external catchments, with pumped transfers to be received from the Pits and the Sediment ponds. In the event of the dam spilling, flows would travel east towards Agate Creek.

2.4.4 Sediment Ponds

Based on the location of the proposed WRDs, six (6) sediment ponds are proposed to contain site water (sediment laden runoff) from the WRDs. Pondered waters within the sediment ponds will be transferred by pumping to the WSD. Further details of conceptual sizing of the sediment ponds are provided in **Section 4.3.1**. All sediment ponds would spill to the unnamed tributaries of Agate Creek, located to the east of the site, before discharging to Agate Creek. Any existing sediment ponds/dams on-site will be become redundant and catchments redirected to the proposed Sediment Ponds described in this report.



3 CONTAMINANT SOURCE STUDY

3.1 Background

Key objectives of this WMP are to maintain the integrity of the surface waters and groundwater at the project site, and to ensure that water quality does not adversely affect any environmental values or the health, welfare and amenity of people, fauna and land users by meeting statutory requirements and acceptable standards. The following sections outline the likely contaminants from disturbed operational areas.

3.2 Receiving Environment

3.2.1 Catchment Conditions

The ACGM site is located within the Gilbert River sub-basin which comprises an area of approximately 22,016 km² and includes nationally important wetlands, national parks, and bioregions. The river captures the northern slopes of Gregory range, western slope of Gilbert range, and southern slope of Newcastle range, travelling approximately 488 km before discharging into the Gulf of Carpentaria to the northwest.

3.2.2 Regulatory Context

As outlined in **Section 1.1**, SVG are currently undertaking investigations and documentation required for an EA amendment and PRCP documentation for the ACGM expansion. Consequently, an Environmental Authority (EA) stipulating surface water monitoring locations and water quality objectives for the proposed mine activities was not available at the time of this report. Notwithstanding, for the purposes of this assessment, existing environmental monitoring locations have been provided by SVG and are set out in **Table 1** and depicted on **Diagram 4**.

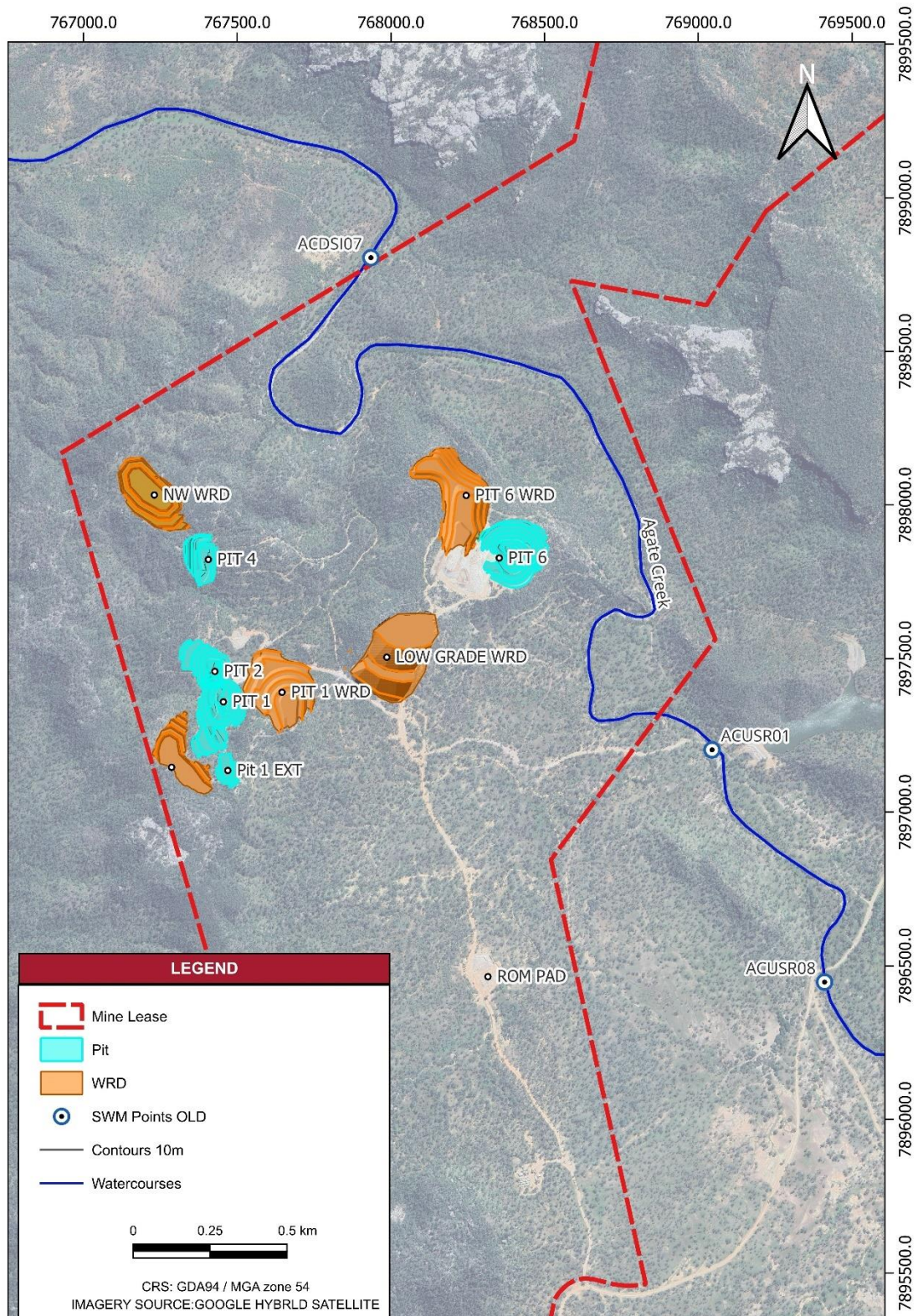
TABLE 1: PROPOSED SURFACE WATER MONITORING POINTS

Monitoring sites	Monitoring site description	Location		Monitoring frequency
		Easting ¹	Northing ¹	
Upstream reference sites				
ACUSR01	Upstream Agate Creek; downstream of landholder dam	769045	7897203	Monthly Within 12 hours of the release from the Water Storage Dam, and weekly thereafter until flow ceases.
ACUSR08	Upstream Agate Creek; adjacent Cobb Road	769411	7896447	
Downstream compliance sites				
ACDSI07	Boundary compliance point in Agate Creek	767935	7898805	Monthly Within 12 hours of the release from the Water Storage Dam, and weekly thereafter until flow ceases.

1. GDA2020 MGA Zone 54



DIAGRAM 4: PROPOSED RECEIVING ENVIRONMENT MONITORING LOCATIONS



\\atcoef2.mpa.wa.gov.local\Projects_L_SC\AgateC\250689 AgateC Agate Creek Mine plan update\Project Data\Data and Calcs\QGIS\NewGIS\250689 QGIS 250616.qgz



In lieu of guidance from EA specified limits, preliminary water quality and contaminant limits for the receiving environment were provided by Ardent via email (August 2025). The values are based off the reference upstream and downstream sites, and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) Design Guideline Values (DGV) for 95% species protection.

TABLE 2: RECEIVING ENVIRONMENT TRIGGER AND CONTAMINANT LIMITS

Quality Characteristic	Unit	Water quality objective ¹	Compliance limit ¹	Comment
pH – lower	pH units	-	6 ^{7, 9}	Compliance limit based off ANZECC (2000).
pH – upper	pH units	-	9.1 ^{6, 7}	Compliance limit based off 95 th percentile.
Electrical conductivity	µS/cm	-	434 ^{6, 7}	Compliance limit based off 95 th percentile.
Turbidity	NTU	298 ^{5, 7}	331 ^{6, 7}	WQO based off 80 th percentile. Compliance limit based off 95 th percentile.
Sulfate	mg/L	2 ⁵	3.2 ⁶	WQO based off 80 th percentile. Compliance limit based off 95 th percentile.
Fluoride	mg/L	1.5 ^{5, 7}	1.8 ^{6, 7}	WQO based off 80 th percentile. Compliance limit based off 95 th percentile.
Aluminum	mg/L	0.28 ⁵	0.31 ⁶	WQO based off 80 th percentile. Compliance limit based off 95 th percentile.
Arsenic	mg/L	0.003 ⁶	0.013 ⁸	WQO based on 95 th percentile with results below LoR removed from dataset. Compliance limit based off ANZECC (2000)
Boron	mg/L	0.05 ⁶	0.37 ⁸	WQO based on LoR for majority of monitoring period. Compliance limit based off ANZECC (2000)
Cadmium	mg/L	0.0001 ⁶	0.0002 ⁸	WQO based on LoR. Compliance limit based off ANZECC (2000)
Cobalt	mg/L	0.001 ⁶	1 ¹⁰	WQO based on LoR. Compliance limit based off ANZECC (2000) for livestock drinking water as no



				aquatic ecosystem protection trigger values exist.
Copper	mg/L	0.0014 ⁸	0.003 ^{6, 7}	WQO based off ANZECC (2000). Interim compliance limit based on 95 th percentile with results below LoR removed from dataset.
Lead	mg/L	0.001 ⁶	0.0034 ⁸	WQO based on LoR. Compliance limit based off ANZECC (2000)
Mercury	mg/L	0.0001 ⁶	0.0006 ⁸	WQO based on LoR. Compliance limit based off ANZECC (2000)
Nickel	mg/L	0.002 ⁶	0.011 ⁸	WQO based on 95 th percentile with results below LoR removed from dataset. Compliance limit based off ANZECC (2000)
Selenium	mg/L	0.01 ⁶	0.011 ⁸	WQO based on LoR. Compliance limit based off ANZECC (2000)
Zinc	mg/L	0.008 ⁸	0.023 ^{6, 7}	WQO based off ANZECC (2000). Interim compliance limit based on 95 th percentile with results below LoR removed from dataset.
Hardness	mg/L	For interpretation purposes only		
Major cations and anions	mg/L	For interpretation purposes only		

¹ Water quality objectives and compliance limits based off laboratory results.

² All samples for metals/metalloids must be analysed for both the total (from analysis of an unfiltered sample) and dissolved (from analysis of a field filtered sample) fractions.

³ 5th percentile surface water data

⁴ 20th percentile surface water data

⁵ 80th percentile surface water data

⁶ 95th percentile surface data.

⁷ Interim limit, to be reviewed once sufficient data has been collected.

⁸ ANZECC (2000) trigger levels for freshwater 95% aquatic ecosystem protection for slightly to moderately disturbed ecosystems

⁹ ANZECC (2000) trigger levels for Tropical Australia upland rivers.

¹⁰ ANZECC (2000) trigger levels for livestock drinking water

3.3 Environmental Values and Beneficial Users

Schedule 1 of the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* [10], which is a subordinate legislation to the *Environmental Protection Act 1994* (EP Act) [11], documents the waters for which the legislation applies that are either enhanced or protected, and specifies relevant environmental values (EV's) and Water Quality Objectives (WQO's). Review of Section 6 indicates that currently the Gilbert Basin have no gazetted and mapped EV's or WQO's. Notwithstanding, generalised assessment under the Environmental Policy can be based on the nature of the receiving environment.

The receiving environment surrounding the project site is 'slightly to moderately disturbed' as a result of the impacts of low intensity cattle grazing, historical mining, and exploration activities in the area. The ANZG guidelines [3] define 'slightly to moderately disturbed' systems as:

"Ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity."

Based upon the hydrological domains downstream of the project site and potential downstream users, classification of Environmental Values (EV's) for the downstream environment may include:

- Aquatic Ecosystems;
- Stock Water;
- Irrigation; and,
- Cultural and Spiritual Values.

3.4 Geochemical Characterisation

The ACGM development involves open cut pit development, disposal of overburden waste rock material into waste rock dumps, handling of extracted ore and its subsequent transportation off site. Accordingly, the principal contaminant sources on site are the extracted waste rock and ore material from the open cut pit.

Potential secondary contaminant sources are associated with secondary activities and infrastructure, such as road infrastructure, fuel storage and local drainage (such as bunds around any buildings and/or workshops). These aspects must be confirmed as the design progresses and this section of the WMP may need to be updated to reflect the proposed operations.

3.4.1 Waste Rock Geochemical Characterisation

Characterisation of the material to be extracted from the open cut pits described in this section has been taken from the following key reference:

Agate Creek Gold Mine – Waste Rock Characterisation (Appendix C), C&R Consulting (CRC) [9].

The report details a geochemistry investigation conducted in 2021, involving 260 samples recovered from 27 exploration drill holes across the six proposed pits. Samples were analysed at a NATA accredited laboratory using industry standard laboratory procedures for the characterisation of mine waste materials. A summary of the acid forming potential of waste rock is as follows:

- Applying the NAG(pH) and total sulphur geochemical classification criteria, it was found that most waste characterisation samples are NAF.
- Approximately 11 out of 260 samples are potentially acid forming (PAF) waste rock. The PAF samples were identified from Pit 2 (3 samples), Pit 5¹ (1 sample) and Pit 6 (7 samples).
- Acid base accounting indicated that the majority of the samples contain more acid-neutralising than acid-generating minerals and are considered to be negligible to low risk.

¹ Note this pit is no longer currently considered for development.

3.4.2 Static Water Quality Analyses

C&R Consulting (CRC) [9] undertook static geochemical tests to provide information on the bulk geochemical characteristics of samples at a single point in time. They do not provide information on rates of chemical processes – or the release rates due to weathering processes.

It is noted that no contaminant release limits were specified in the EA as discussed in **Section 3.2.2**.

The summary for the static water quality analyses is presented in **Table 3**.

**TABLE 3: STATIC WATER QUALITY ANALYSES
(TAKEN FROM C&R CONSULTING (CRC) [9])**

Parameters	Value	Limit*	Key Outcome/Comments
Electrical Conductivity / Salinity	7 – 1,680 $\mu\text{S/cm}$ (<i>Range</i>) 43.5 $\mu\text{S/cm}$ (<i>Median</i>)	5,970 $\mu\text{S/cm}$	EC values represent fresh water and are well below the ANZG limits. Salinity is therefore not considered an issue for the ACGM waste rock.
Fluoride	<1 – 63 mg/kg (<i>Range</i>) 4 mg/kg (<i>Median</i>)	2 mg/L	- Fluoride exceeded the low-risk trigger level and may be of a concern as elevated fluoride is prevalent in most of the waste rock. - However, as a volcanic province, it is expected that surface and groundwater within Agate Creek are enriched with fluoride. - Therefore, there is low risk of increased fluoride loading in the receiving environment.
Sulphate	5 – 1,780 mg/kg (<i>Range</i>) 20 mg/kg (<i>Median</i>)	1,000 mg/L	- Except for one value (a sample in Pit 2), all results were below the ANZG beef cattle livestock drinking water trigger limit. - Sulphate concentration results suggest that sulphate levels within waste rock are not of concern to the environmental values associated with the site.

*ANZECC/ARMCANZ (2000) Livestock Drinking Water Quality Limits

3.4.3 Kinetic Leach Water Quality Analyses

C&R Consulting (CRC) [9] undertook kinetic leach column (KLC) tests to accelerate the weathering of samples and provide information on the magnitude and/or effects of dynamic processes that result from weathering. Unlike static tests, KLC tests measure the varying geochemical characteristics of sample effluent over a prolonged period of time. Four samples were dispatched to a NATA-accredited laboratory for KLC tests: one from Pit 1, one from Pit 4 and two from Pit 6.

It is noted that no contaminant release limits were specified in the EA as discussed in **Section 3.2.2**.

The summary for the static water quality analyses is presented in **Table 4**.

**TABLE 4: KINETIC LEACHATE WATER QUALITY ANALYSES
(TAKEN FROM C&R CONSULTING (CRC) [9])**

Parameters	Key Outcome/Comments
pH	pH remains stable and no significant increase in acidity over the course of the tests was identified.
Electrical Conductivity / Salinity	- All samples were still considered freshwater. Salinity is therefore not considered an issue associated with the Agate Creek waste rock. - While electrical conductivity is not accumulative, the end products, upon evaporation (i.e., salts), are accumulative.
Metals / Metalloids	Levels above compliance values were detected for aluminium, boron, copper, and zinc. These exceedances were relatively low and were probably associated with adsorbed species on colloids being included in the “dissolved” analyses. As such, these exceedances are considered to display a very low to low environmental risk associated with the Agate Creek waste rock piles.
Fluoride	- There is an expected overall accumulation of fluoride with successive leaching in one (out of 4 samples) - In all other samples (and particularly levels of fluoride), particulates are approximately constant with successive leaches.

3.5 Saline, Metalliferous and Acid Rock Drainage

One of the primary mechanisms for the mobilisation of metals occurs due to the production of acid from sulphuric material under oxidised conditions, with the transport of this acid as leachate when in contact with water, either as surface runoff or infiltration, causing acid rock drainage (ARD) [9]. The acid neutralizing capacity (ANC) of materials is also a significant factor in determining the potential for acid generation, with these materials providing a buffer capability [9].

C&R Consulting [9] indicated a low presence of PAF waste rock at the ACGM site, as described in **Section 3.4.1**. As discussed in **Section 3.4** the primary water quality concern would therefore relate to elevated fluoride and metals produced from contact with waste rock. Although salinity is not considered as an issue for the ACGM site, it is noted that salt, being the end product of EC/salinity upon evaporation, is accumulative and may pose risk of impacting the downstream environment from ponded areas (such as the pits) unless suitable mitigation measures are implemented.

To alleviate concerns relating to water quality and minimising the effects of contact with disturbed site surfaces, a high ANC buffer material is recommended to encapsulate any PAF material when it is identified (as per ATCW’s recommendations in the WRD Concept Design report [1]). Stormwater generated from exposed waste rock is captured in the first instance, and subject to ongoing, long term water quality monitoring (refer **Section 6**). The outcome of the monitoring may be that this stormwater is fit for release to the receiving environment if it meets the EA release criteria.

3.6 Receiving Environment Water Quality

Site water quality monitoring provides an overview of the likely contaminants existing within the water stored/collected on-site and the quality of water within the surface runoff and groundwater. Some historical water quality monitoring has been undertaken at ACGM based on the monitoring points identified in **Section 3.2.2**. However, no details of proposed site water quality characteristics are available at the time of developing this report. **Section 6** outlines the water quality monitoring methodology and required parameter suite. This section should be updated once further details relating to water quality are made available.



3.7 Potential Contaminant Sources

Based on a review of available geochemical characterisation results, the potential contaminant sources identified within the site are outlined in **Table 5**.

TABLE 5: POSSIBLE CONTAMINANT SOURCES

Possible Contaminate Source	Likely Contaminant
Water Storages	pH, EC, metals, sulphate
ROM Pad	Suspended solids, metals, sulphate
Waste Rock Dump	Suspended solids, fluoride, metals, sulphate
Open Cut Pit	Fluoride, metals, sulphate, accumulated salt
Administration offices and workshops	Hydrocarbons and chemicals

3.8 Residual Contaminants

It is recommended that ACGM undertake a geochemical assessment of the residual pit waters as part of ongoing operations. This geochemical assessment could be undertaken as part of a revised/annual Receiving Environment Monitoring Program (REMP) and this WMP should be updated following the outcomes of such an investigation.



4 STORMWATER MANAGEMENT SYSTEM

4.1 Stormwater Management Objectives

The key water management objective is to control and minimise the release of potentially mine-impacted water from the site, to ensure that the historical users and environmental values of the receiving environment are not detrimentally impacted. The stormwater systems that are likely to be encountered in relation to the project can be characterised as follows:

Clean Water	-	Stormwater occurring around the project area, but not in contact with active mining/operating areas.
Site Water	-	All water generated from mine affected areas and associated operating surfaces within the project area.

Typical sources and characteristics, and the management of these waters are as follows:

- Clean water will remain unimpacted from site activities (i.e. possess water quality characteristics that are typical of natural conditions) and shall be diverted around mining/operating areas and discharged via effective hydraulic controls. A key objective of stormwater management is to prevent the capture or containment of any clean water.
- Site impacted water is to be captured and managed in relation to its water quality and the source of the water. Site water is to be managed through onsite water management structures to prevent uncontrolled release from the site. The key objective for site water management is to minimise catchment areas from which site water is generated, as well as maximising the containment of site water at its source, to enable direct reuse.

4.2 Water Management Strategy

4.2.1 Clean Water Management

Clean water diversion bunds/drains are proposed around the waste rock dumps and open cut pits to divert any upstream clean water away from the site. Clean water runoff will discharge to tributaries of Agate Creek, located within the project site, before discharging to Agate Creek.

4.2.2 Site Water Management

The water management strategies with respect to the elements described in **Section 2.5**, are identified as follows:

- Open Cut Pit
It is proposed that water contained within the Open Cut Pits is pumped to the Water Storage Dam over the operational period of the project (when required for mining operations) prior to backfilling occurs.
- Water Storage Dam
The Water Storage Dam will contain site impacted runoff from the Open Cut Pits and impacted water from the sediment ponds. The operating objective for this storage is to maintain sufficient capacity to contain site water and limit overflow, as well as to provide make-up water for site water demands, namely dust suppression.
- Sediment ponds
Sediment ponds are proposed, to capture and treat sediment-laden runoff from the WRDs and ROM pad. The objective with respect to water contacting these surfaces is to capture sediment within the sediment ponds, with the potential to release this water directly off-site, subject to water quality testing.

4.3 Site Water Infrastructure Requirements

No processing activities are proposed at ACGM. As a result, the site does not require process water dams or tailings storage facilities. Furthermore, deposition of waste rock will occur in such a way as to limit any potential interaction of any potentially acid-forming (PAF) rock with rainfall runoff. This will be achieved via NAF encapsulation of any PAF rock. Consequently, the water infrastructure proposed for the site is limited to sediment ponds designed to capture runoff from disturbed site areas.

Other minor disturbed areas such as hardstands and camp areas will need localised erosion and sediment control measures.

4.3.1 Indicative Drain Sizing

4.3.1.1 Site Impacted Water Collection Drainage Design Criteria

Site water collection drains/bunds are proposed, to facilitate the collection and conveyance of site water to sediment ponds. These drains are to be constructed around the proposed pits and WRDs to contain and convey any site water, to minimise potential impacts to the downstream environment.

Two general designs for site water drains are shown in **Table 6** below based on conveying the 1% AEP event flow, adopting a longitudinal grade of either <1% or >5%. Two longitudinal grades were adopted for this high-level assessment given the steep natural terrain that will require both flatter sections (along the contour) and steeper sections that tie-in with the natural gullies.

It is assumed that drains on steeper slopes will be cut into the natural underlying rock wherever practical to reduce the risk of erosion. Elsewhere, either a vegetated or placed rock surface protection would be required. A minimum height and depth of 0.5m is implemented for constructability.

TABLE 6: SITE WATER DRAIN DESIGN CRITERIA

Design Criteria	Longitudinal Grade >5%	Longitudinal Grade <1%
Design event	1% AEP	1% AEP
Base Width	2 to 4m	0.5 to 1m
Shape	Trapezoidal	Trapezoidal
Drain Depth	0.5m	0.5m
Side Slope	1:2 rock lined	1:4 if vegetated 1:2 in rock lined

4.3.1.2 Clean Water Diversion Bunds/Drains Design Criteria

Clean water diversion drains are required to divert natural catchment runoff away from site areas. These drains must be designed to accommodate a 1 in 100 annual exceedance probability (1% AEP) peak flow design storm event, similar to the sizing of the site impacted drains noted above. This criterion has been adopted given the significance of clean water diversion drains to protect downstream mine infrastructure from local flood inundation. All natural and/or disturbed areas should be diverted around the proposed pits to reduce the potential for water inflow to the voids.

4.3.2 Sediment Pond Sizing

Sediment ponds are proposed to be constructed to capture runoff from the WRDs and ROM pad catchments. The sediment ponds proposed are Type 'D' style basins in accordance with IECA [23]. The initial sizing for the proposed sediment ponds were determined by using the following criteria:

- 5 year (20%) AEP 24 hour event (129mm as per BOM [6]) runoff capture plus sediment storage as per DETSI Stormwater Guidelines [18]; and
- Spill risk of <20% (to achieve 80% hydraulic efficiency) as per the State Planning Policy (SPP) requirements [25];

The design sediment volumes presented include sediment storage based on an estimated soil loss of approximately 270 t/ha/yr (calculated using the RUSLE method [23]) and assumed clean out frequency of every twelve (12) months, e.g. prior to the wet season.

Table 7 presents the design size capacities and dimensions for the sediment ponds based on the WBM described in **Section 5**.

TABLE 7: SEDIMENT PONDS DETAILS

Pond	Catchment Source	Catchment Area (ha)*	Settling Zone Volume (ML)	Sediment Storage Volume (ML)	Total Storage Volume (ML)
A	Pit 1 WRD	6.0	5.4	1.3	6.7
B	Low-Grade WRD	5.0	4.5	1.1	5.6
C	Pit 6 WRD	4.5	4.0	1.0	5.0
D	ROM Pad	2.0	1.8	0.4	2.2
E	NW WRD	4.0	3.6	0.9	4.5
F	SW WRD	2.5	2.3	0.5	2.8

*Note: catchment areas have been rounded to allow for some conservatism, given this is not based on a detailed design of the WRDs or drains.

4.3.3 Water Storage Dam

The WSD is to be located to the southwest of the southern WRD and receives inputs from the Pits and Sediment ponds via pumped transfer. The geometric parameters of the proposed WSD are detailed in **Table 8**. The WSD incorporates a spillway which directs flows east towards Agate Creek and is proposed to have a spill risk of less than 1%.

TABLE 8: WATER STORAGE DAM DETAILS

Parameter	Value
Indicative Depth (m)	4 m
Total Storage Volume to Emergency Spillway	200 ML (refer to Section 6.4.1.1)
Internal Batter Slopes	1 (V) : 3 (H)
External batter Slopes	1 (V) : 3 (H)

4.3.4 Regional Floodplain

The proposed site features and stormwater infrastructure is located outside of the Agate Creek floodplain as described in ATCW's Flood Impact letter (reference 250689 L01 Rev 1) [2]. This should be considered through the detailed design to confirm structures are not impacted by the floodplain. During operations, SVG must also consider the Agate Creek flooding and develop safety management plans and trigger response plans for haul road traffic that is intended to traverse the creek, or upgrade existing crossings to provide greater immunity.



4.4 Erosion and Sediment Control Measures

As per regulatory requirements, an Erosion and Sediment Control Plan (ESCP) is required for all stages of the mining plan. The Sediment ponds and Water Storage Dam are the primary treatment methods for onsite sediment capture and storage. All mine impacted waters shall report to these structures prior to discharge. Other minor disturbed areas such as hardstands and camp areas will need localised erosion and sediment control measures. A site specific Erosion and Sediment Control plan should be developed as part of the detailed design phase for the project.

5 OPERATIONAL WATER BALANCE ASSESSMENT

5.1 Objectives

A Water Balance Model has been developed to assess the proposed water management strategy, primarily as a means of assessing spill risk. A dynamic probabilistic simulation modelling approach, using GoldSim Pro version 15 [22], was adopted for this purpose, based on a daily climatic record for the site. An integrated catchment yield analysis for the site catchments was also coupled with the water balance model (WBM). The objectives of this modelling are summarised as follows.

- Assess the performance of the proposed site water management systems.
- Quantify the site impacted water generated on site.
- Determine any additional water storage requirements and identify potential options for the short and long-term management of water at the site.

The water balance model is uncalibrated as no measured data or observations related to the proposed water management system were available at the time of model development.

5.2 Simulation Period

The model was run at a daily time step for a 34 month period, from the planned mine start of 1 March 2026 to a completion date of December 2028.

5.3 Model Inputs

A water balance model has been developed to assess the water management strategy during the operational phase primarily as a means of assessing spill risk. For each modelled storage the model simulates:

$$\text{Change in Storage} = \text{Inflow} - \text{Outflow}$$

Where:

- Inflow includes rainfall runoff, groundwater inflow (for the open cut pit), and all pumped inflows from other storages.
- Outflow includes evaporation, spills, and all pumped outflows to other storages.

A schematic diagram of the illustrating the model structure is presented in **Diagram 5**.

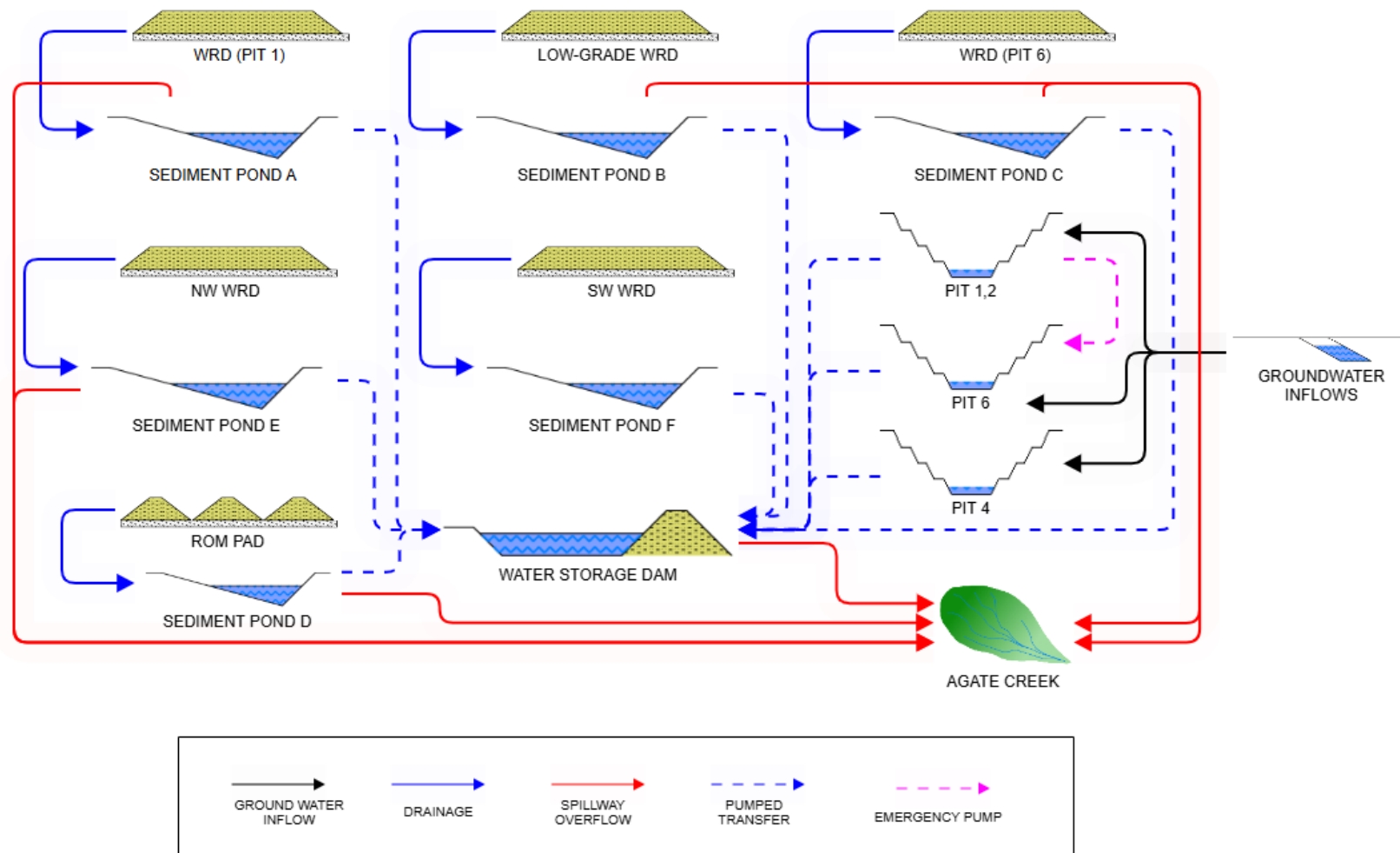
5.3.1 Aerial and Surface Data

The following data was utilised throughout the assessment to characterise catchment areas and storage conditions.

- Site 1m gridded LiDAR (provided by SVG);
- Mine plan and pit geometry (provided by SVG)



DIAGRAM 5: WBM FLOW DIAGRAM





5.3.2 Climate Data

SILO Data Drill specific to the site location was obtained from the Long Paddock Program [30] and applied at a daily timestep. A description of the SILO data utilised in the WBM is provided in **Table 9**.

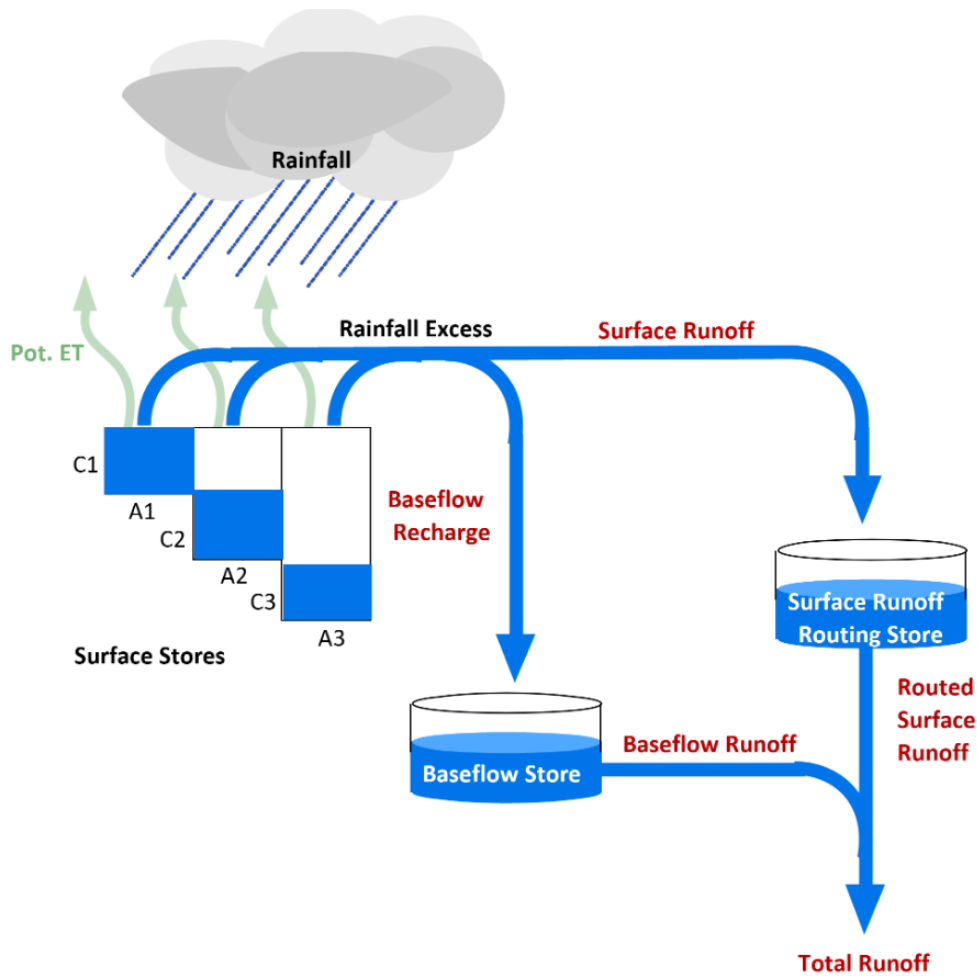
TABLE 9: RAINFALL AND EVAPORATION INPUT DATA

Climate Data	Value	Data Source	Comments
Rainfall	Daily Rainfall Rate (mm/day)	Rainfall data sourced from the SILO Data Drill Program	Applied over surface areas of storages, and as an input parameter for estimation of surface runoff (AWBM)
Evaporation	Daily Evaporation Rate (mm/day)	Evaporation data sourced from the SILO Data Drill Program	Evaporation data is scaled by factors for each site storage to reflect water storage conditions and expected water quality
Evapo-transpiration	Daily Evapo-transpiration Rate (mm/day)	Morton's Evapo-transpiration data sourced from the SILO Data Drill Program	Evapo-transpiration is modelled as a potentially daily loss rate from surface stores within the AWBM model

5.3.3 Catchment Runoff Estimation

The Australian Water Balance Model (AWBM) [5] was utilised to simulate daily runoff from the various sub-catchments and land use types that are present on the Site. The AWBM structure is shown diagrammatically in **Diagram 6**, and is a nationally recognised catchment-scale water balance model that estimates catchment yield (flow) from rainfall and evaporation. Catchment areas reporting to each storage have been assessed based on delineation of catchments undertaken using data provided by SVG.

DIAGRAM 6: AWBM SCHEMATIC



source: (Goldsim, 2025)

Where:

C1 – C3 = Surface Storage Capacities

A1 – A3 = Partial Areas represented by Surface Storages

Pot. ET = Potential Evapotranspiration

The sub-catchment types adopted and AWBM model parameters used to simulate the different catchment types and the average yields from these catchments are summarised in **Table 10**. Runoff yields are calculated dynamically within the site water balance model using the AWBM and the calculated runoff volumes are conveyed to site storage elements (e.g. dams) on a daily timestep basis.

Model parameters have been selected based on experience with similar water balance model studies where no site data was available. For the natural sub-catchment type, recorded streamflow data at the downstream Agate Creek gauge, was used together with SILO Point Data to calibrate a daily streamflow model using the AWBM (refer **Section 5.3.3.1**).

Monthly pan evaporation factors (as a multiplier on pan evaporation data) were applied to water storages to estimate evaporation losses. For water surface areas, rainfall was assumed to add directly to the storage volume with no losses.

**TABLE 10: AWBM MODEL PARAMETERS**

Catchment Type	Split Areas (sum=1.0)			Storage Capacities (mm)			Ks (day-1)	BFI	Kb (day-1)
	A1	A2	A3	C1	C2	C3			
Natural	0.134	0.433	0.433	5	15	250	0.43	0.5	1
Hardstand	0.333	0.334	0.333	6	6	6	0	0	0.96
Waste	0.1	0.3	0.6	15	50	110	0.5	0	0.985
Open Cut	0.2	0.6	0.2	5	70	90	0.4	0	0.94

5.3.3.1 Natural Catchment Runoff Estimation

A rainfall runoff model (AWBM) was developed to simulate the streamflow rate at the Agate Creek gauging station (917005A). Recorded data from the gauging station was available for a period from 1 July 1969 to 29 September 1988 [26]. The catchment area of the gauging station is some 218 km², whilst the operational catchments being modelled in the WBM totals 52 ha (0.52 km²). There is a significant difference in the catchment size; however, given there is no site specific data to use for a calibration and no similar regional estimates available in Peel (2000) [24]; this station was considered suitable to use to calibrate the AWBM parameters. It is recommended that water monitoring is undertaken during operations so that key input parameters can be recalibrated to the site operations.

Model calibration was undertaken in the Rainfall Runoff Library (RRL) by eWater for a selected 10-year period from 1 July 1969 to 30 June 1978, adopting continuous streamflow data and daily SILO rainfall and evapotranspiration data. This 10-year period was selected as there was readily available data and the period experienced similar climate averages when compared to the 136-year SILO dataset; the exception being the tropical cyclone system that resulted in extreme rainfall during January 1974 (1,281 mm).

The resulting AWBM parameters are listed in **Section 5.3.3**. **Graph 2** shows the flow duration curves for station recorded data versus the RRL modelled output. The graph indicates a generally good fit of recorded streamflow.

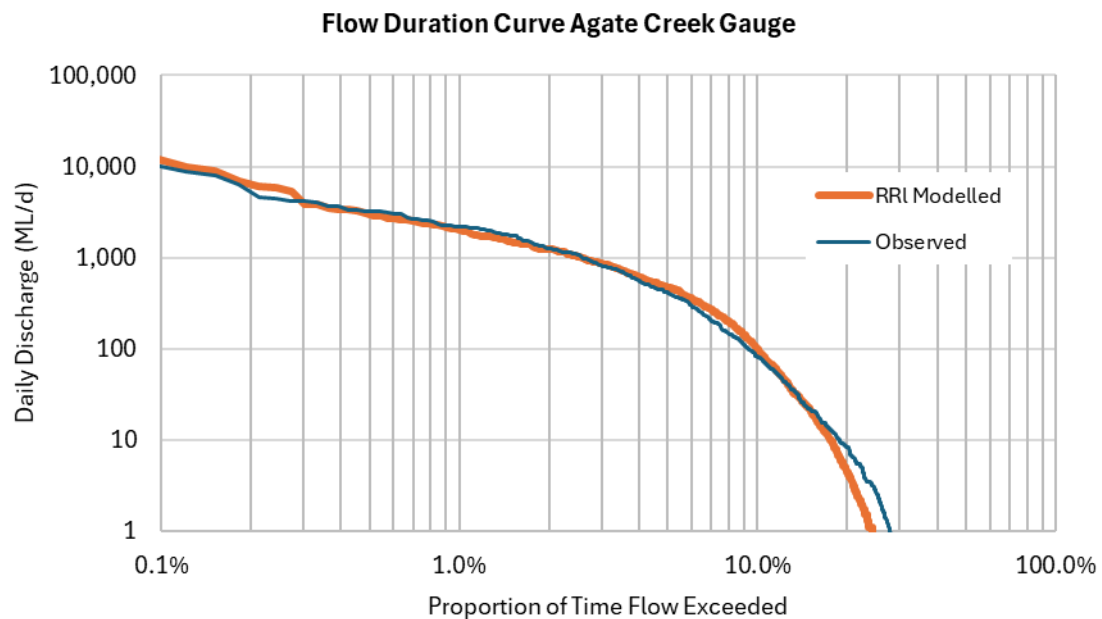
Relevant model goodness-of-fit parameters are as follows:

- Nash-Sutcliffe coefficient of efficiency on monthly flows: 0.92
- Recorded total flow: 319,192 ML
- Modelled total flow: 323,333 ML (~ 1.3% variance from recorded)

The AWBM parameters for natural land-use type used in site water balance modelling are based on the above AWBM calibration. The results for the natural sub-catchment calibration correlates to an equivalent runoff coefficient of 0.18.



GRAPH 2: AGATE CREEK GAUGE – CALIBRATED FLOW DURATION CURVES



5.4 Catchment Areas

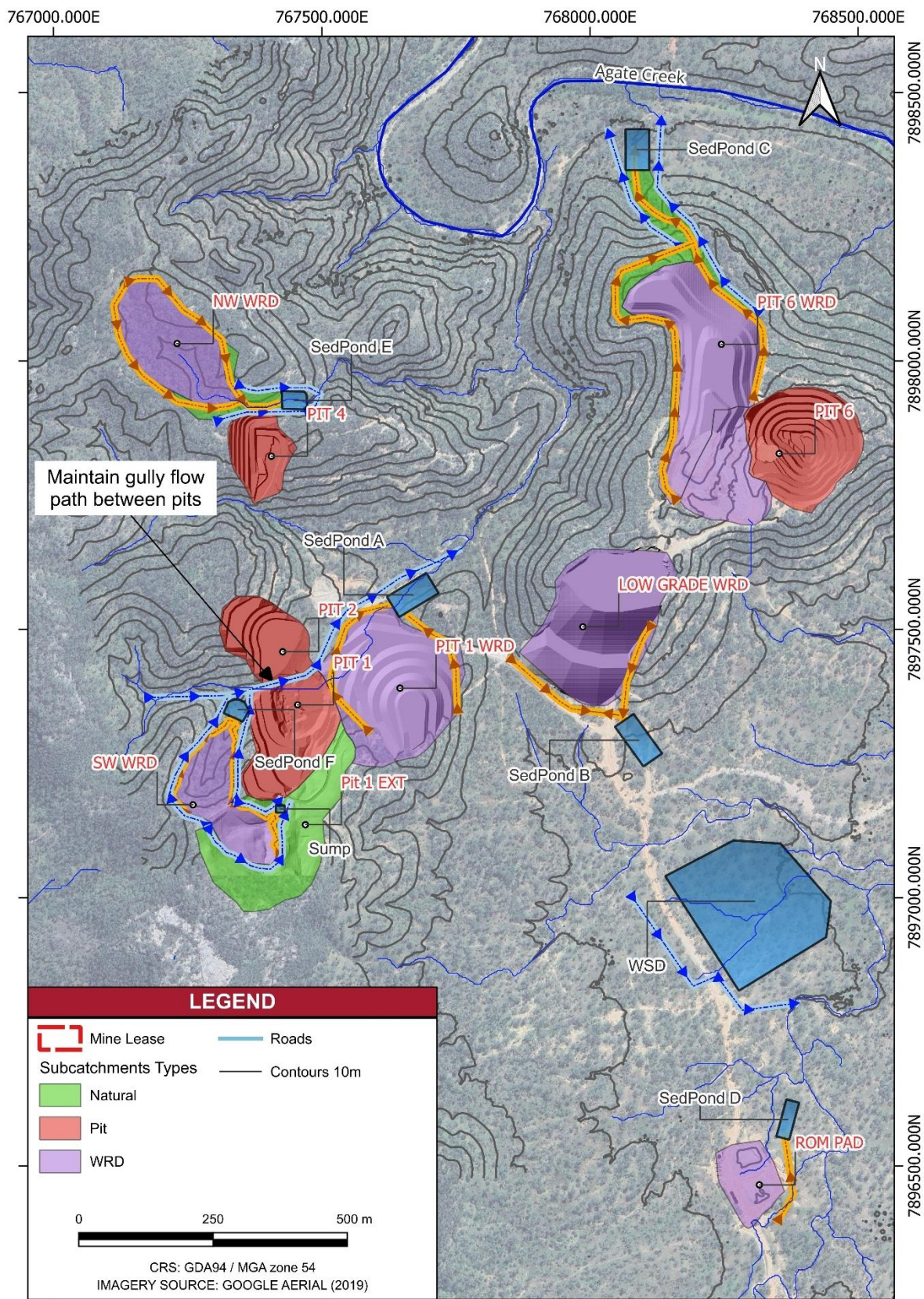
Catchment types and areas were designated using the concept WRD and Pit designs, with areas of catchments outlined in the table below and in **Diagram 7** and **Diagram 8**.

TABLE 11: CATCHMENT AREA TYPE (YEAR 1)

Structure	Catchment Area (ha)				
	Natural	Pit	Hardstand	Waste	TOTAL
Pit 1/2	5.0 (Year 1) 18.2 (Year 2)	3.0 (Year 1) 5.0 (Year 2)	-	-	8.0 (Year 1) 23.2 (Year 2)
Pit 2 (Year 1 only)	-	2	-	-	2.0
Pit 4	-	1.5	-	-	1.5
Pit 6	-	3.8	-	2.3	6.1
Sediment Pond A (Pit 1 WRD)	-	-	-	6.0	6.0
Sediment Pond B (Low-grade WRD)	-	-	-	5.0	5.0
Sediment Pond C (Pit 6 WRD)	-	-	-	6.0	6.0
Sediment Pond D (ROM Pad)	-	-	-	2.0	2.0
Sediment Pond E (NW WRD)	0.7			3.3	4.0
Sediment Pond F (SW WRD)				2.5	2.5



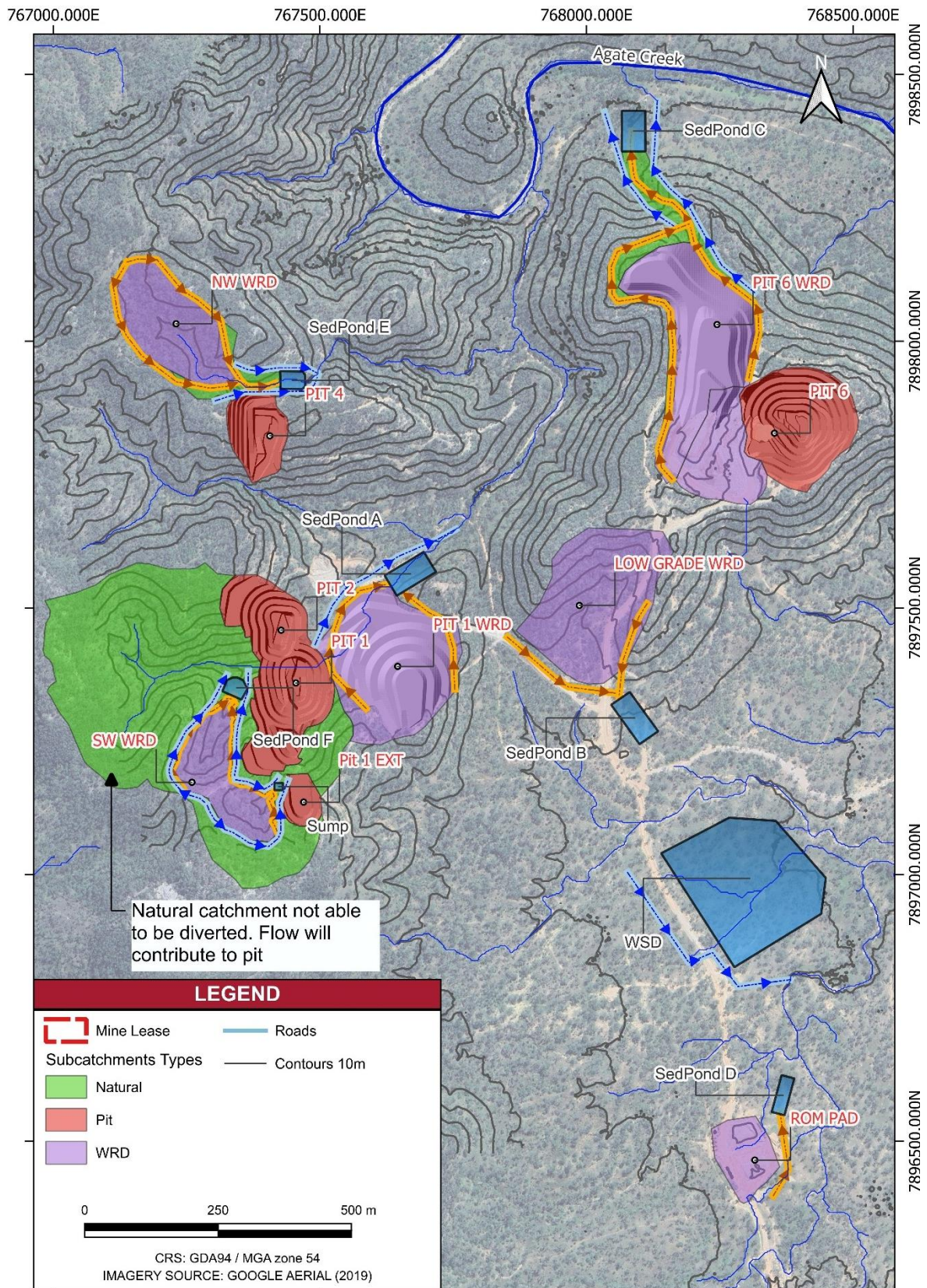
DIAGRAM 7: SITE CATCHMENTS (YEAR 1)



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DIAGRAM 8: SITE CATCHMENTS (YEAR 2-3)



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5.4.1 Storage Conditions

Primary water balance inputs for site storages are outlined in **Table 12**. A description of the storages is provided in **Section 2.4**, with details of the design criteria provided in **Section 4**. The total storage capacities of the water storages have been based on the footprint available within the site infrastructure area. A detailed 3D geometric design of these storages is to be undertaken to confirm the staged storage-volume-area relationship.

TABLE 12: MODELLED SITE STORAGE PROPERTIES

Storage	Storage Capacity (ML)	Initial Storage Volume (ML)
Water Storage Dam	200	Empty
Pit 1 and 2 (year 2 -3)	294.6	Empty
Pit 2 (year 1 only)	15.0*	Empty
Pit 4	15.3*	Empty
Pit 6	775.4	Empty
Sediment Pond A	6.7	Empty
Sediment Pond B	5.6	Empty
Sediment Pond C	5.0	Empty
Sediment Pond D	2.2	Empty
Sediment Pond E	4.5	Empty
Sediment Pond F	2.8	Empty

*note: these pits require bunding/sump to achieve the design volumes stated, as the current mine plan design does not provide sufficient storage to prevent overtopping.

5.4.2 Groundwater Inflows

A hydrogeological study of the ACGM expansion was undertaken by C&R Consulting Pty Ltd (CRC) [8]. The groundwater monitoring network consists of ten (10) monitoring bores within the area of approximately 1.5 km² that incorporates all proposed open cut pits. The adopted groundwater inflow rates for the proposed pits, presented in **Table 13**, were selected based on the anticipated inflow rates provided in the CRC Hydrogeology Assessment [8].

TABLE 13: GROUNDWATER INFLOW RATES (CRC, 2021)

Storage	Estimated Inflow Rates (ML/day)
PIT 1 and 2, PIT 4	0.004
PIT 6	0.010



5.4.3 Pumping Schedule

Site transfers, other than water sourcing for site demands (discussed in **Section 5.4.4**) are outlined in **Table 14**.

TABLE 14: SITE TRANSFERS

Source	Destination	Rate	Activation Condition	Deactivation Condition
Pit 2 (Year 1 only)	WSD	30 L/s	Occurs when water depth within Pit 2 exceeds 1.5 m.	Deactivated when water depth within Pit 2 is below 0.5 m.
Pits 1-2 combined (Year 2-3)	1. WSD 2. Pit 6	1. 30 L/s 2. 50L/s	1. Occurs when water depth within Pit 1/2 exceeds 1.5 m. 2. Occurs when Pit 1/2 is above HOV (265ML)	1. Deactivated when water depth within Pit 1/2 is below 0.5 m. 2. Deactivated when Pit is below HOV (265ML).
Pit 4	WSD	30 L/s	Occurs when water depth within Pit 4 exceeds 1.5 m.	Deactivated when water depth within Pit 4 is below 0.5 m.
Pit 6	WSD	30 L/s	Occurs when water depth within Pit 6 exceeds 1.5 m.	Deactivated when water depth within Pit 6 is below 0.5 m.
Sediment Ponds (all)	WSD	30 L/s	Occurs when water volume within the individual storage exceeds 1.0 ML	Deactivated when water volume within the individual storage is below 0.5 ML

5.4.4 Site Water Demands

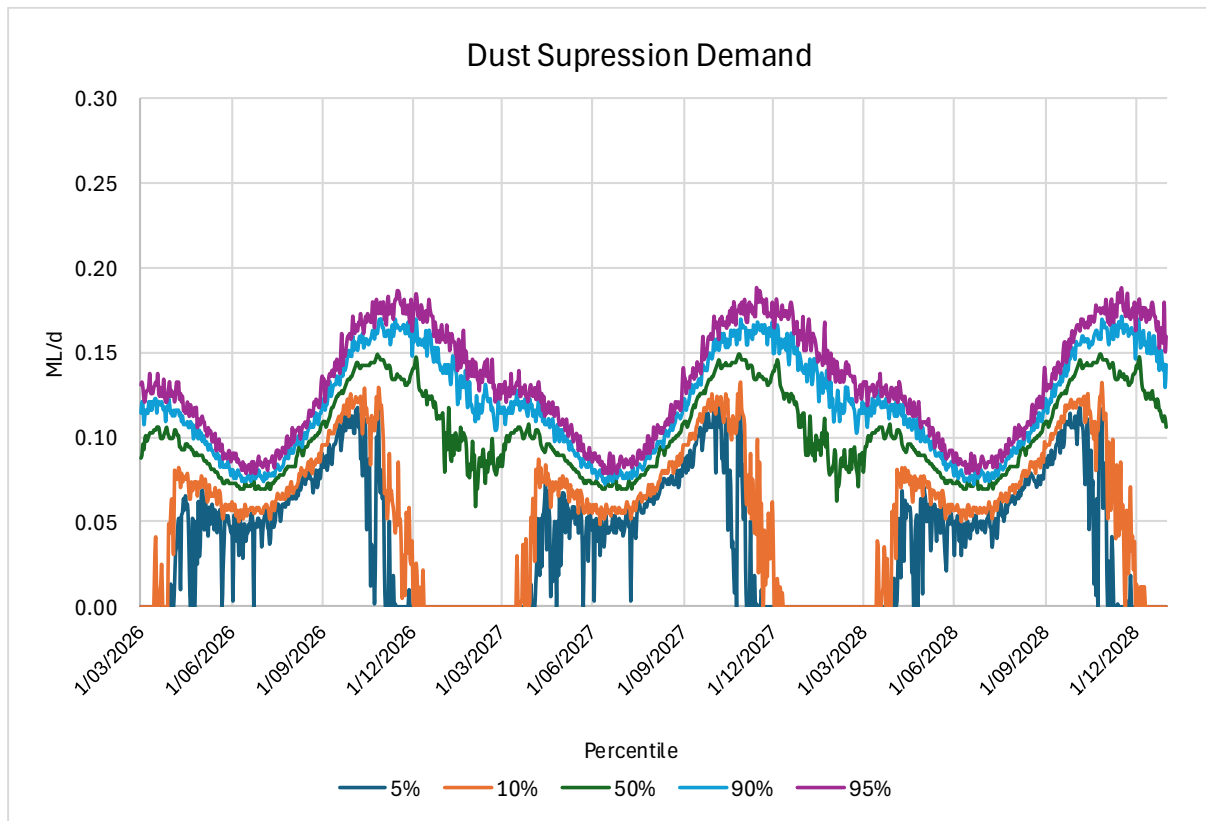
The only site water demand modelled is dust suppression, as all ore processing is undertaken off-site. Simulated dust suppression was calculated based on the following assumptions:

- 1400m length of all haul roads to be watered;
- 15 m average watering width for all haul roads;
- 80% of the total length of the in-pit and waste rock emplacement haul roads would be active and require watering at any one time;
- Evaporation factor of 1.0 (as a multiplier on the excess of pan evaporation over rainfall) to allow for the trafficked haul road surfaces;
- On days where rainfall exceeded evaporation, zero demand was simulated.

As shown in **Graph 3**, simulated haul road dust suppression demand varied between 0.1 ML/d to 0.15 ML/d under the median result. As this is the only water demand for the site from the WSD, further data collection and validation of the assumed parameters should be conducted during operations.



GRAPH 3: SIMULATED DUST SUPPRESSION DEMAND



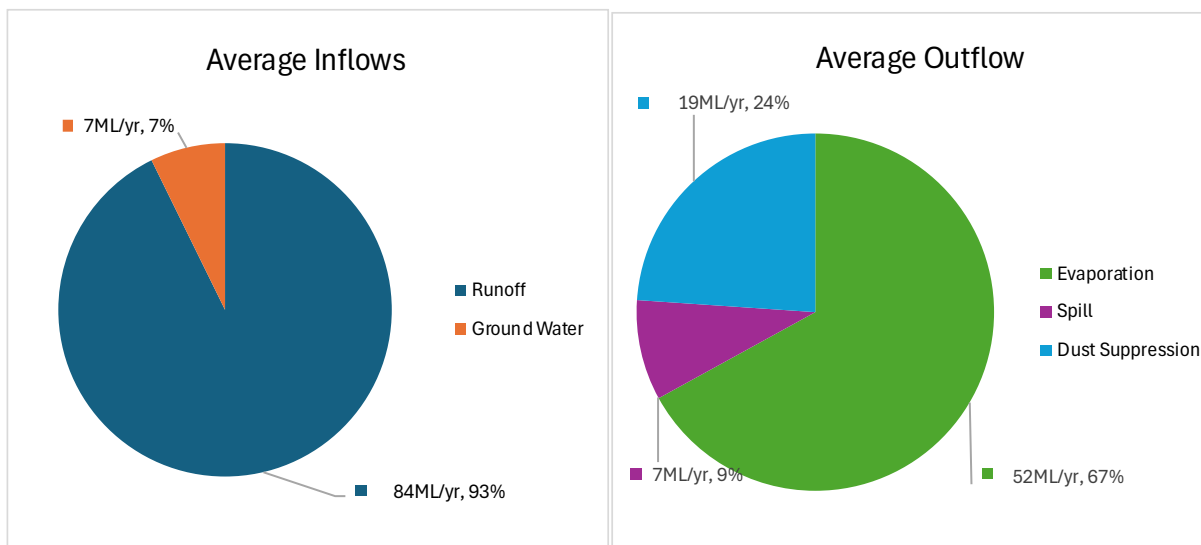
5.5 Model Results

5.5.1 Overall Water Balance

A summary of average yearly modelled inflows and outflows for the simulation is shown in **Graph 4**. This graph shows that, on average, runoff from rainfall is the principal inflow to the WBM, at 92% (84 ML/yr). Groundwater is a minor inflow at only 8% (7 ML/yr) per year on average. Average outflows are predominately to evaporation at 67% (52 ML/yr), followed by dust suppression at 24% (19 ML/yr), and then spill at 9% (7 ML/yr). The minor discrepancy between the average inflows minus average outflows is accumulated in the stored volume of water within the site storages.



GRAPH 4 – AVERAGE WBM INFLOWS AND OUTFLOWS



5.5.2 External Spill Risks

A summary of the modelling results in the form of spill risks is provided in **Table 15**. These values represent the maximum modelled statistical likelihood of a storage experiencing a spill over the modelled period of 34 months. The spill risk of regulated site structures with respect to containment criteria is discussed in **Section 6.3**.

TABLE 15: MAXIMUM SPILL PROBABILITY OVER OPERATIONAL PERIOD

Storage	Target Spill Probability	Simulated Spill Risk
Water Storage Dam	<1.0% ¹	0.5% ¹
Pits 1 and 2 Pit 4 Pit 6	<1.0%	<1.0% ²
Sediment Pond A	<20%	10.5%
Sediment Pond B	<20%	11.8%
Sediment Pond C	<20%	11.8%
Sediment Pond D	<20%	12.5%
Sediment Pond E	<20%	10.8%
Sediment Pond F	<20%	12.0%

- Note: the DSA drives this volume requirement and a conservative approach in sizing the water storage dam has been adopted, given the site water quality from operations is not confirmed at this stage. The minimum containment criteria is <5% for a 'Significant' structure in accordance with the DETSI manual [16]. The required dam volume based on this spill risk and containment criteria could be optimised, following water quality monitoring and testing once operations begin.
- No spills were simulated from the pits; however, there cannot be a 'zero' percent chance of spill given the unknowns regarding climate data and potential variability of other inputs such as groundwater. Hence, less than 1% risk is presented.



5.5.3 Forecast Stored Water Levels

Water balance results from the project site are presented in the form of probability plots for the site storages. These plots depict 5%, median, and 95% percentile outcomes for storage volumes as shown in **Graph 5** to **Graph 9**.

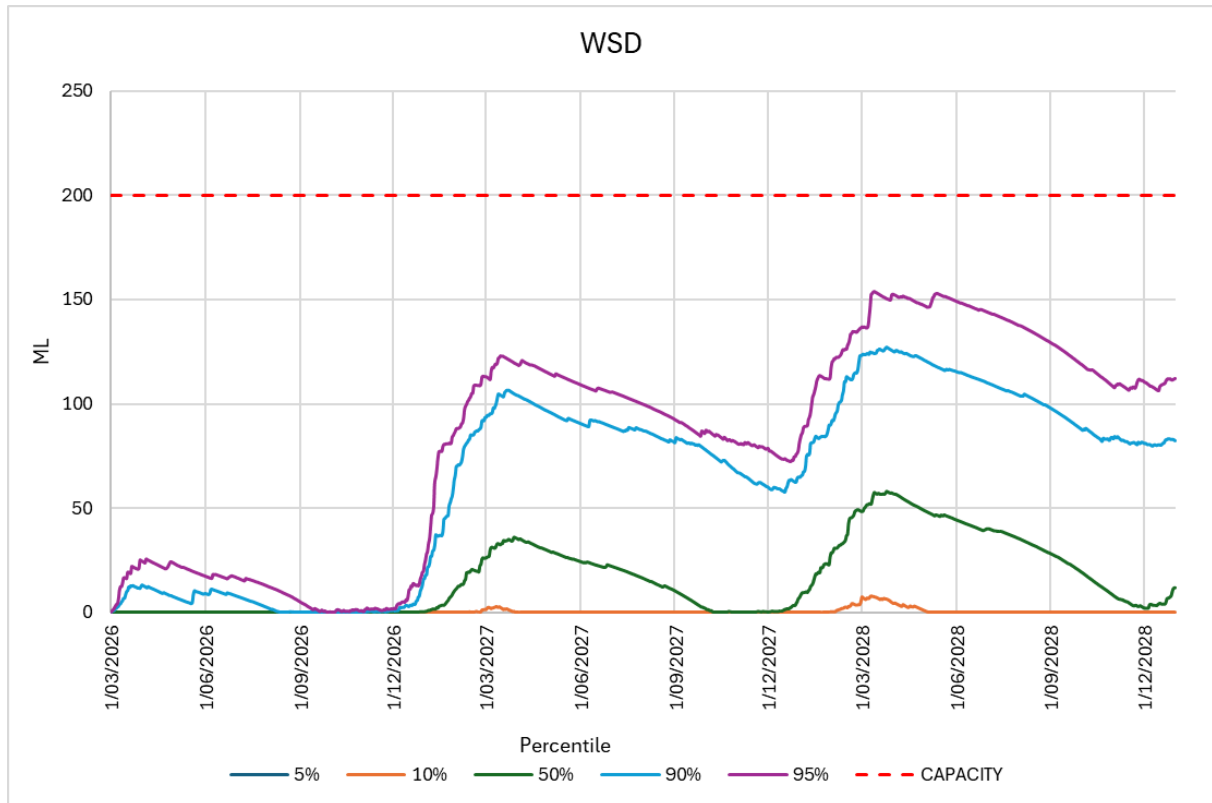
Dewatering of the pits to the WSD occurs within the model; however, the pits still accumulate water in moderate to major wet seasons, illustrating the high rainfall experienced in this region. **Table 16** presents a statistical summary of the highest forecast volume for all storages over the simulation period. It is important to note that none of the statistical outcomes represent a single climatic realisation – the probabilities are compiled from all 136 realisations i.e., the median volume plot does not represent the model forecast volume for median climatic conditions.

TABLE 16: MODELLED STORED WATER VOLUMES

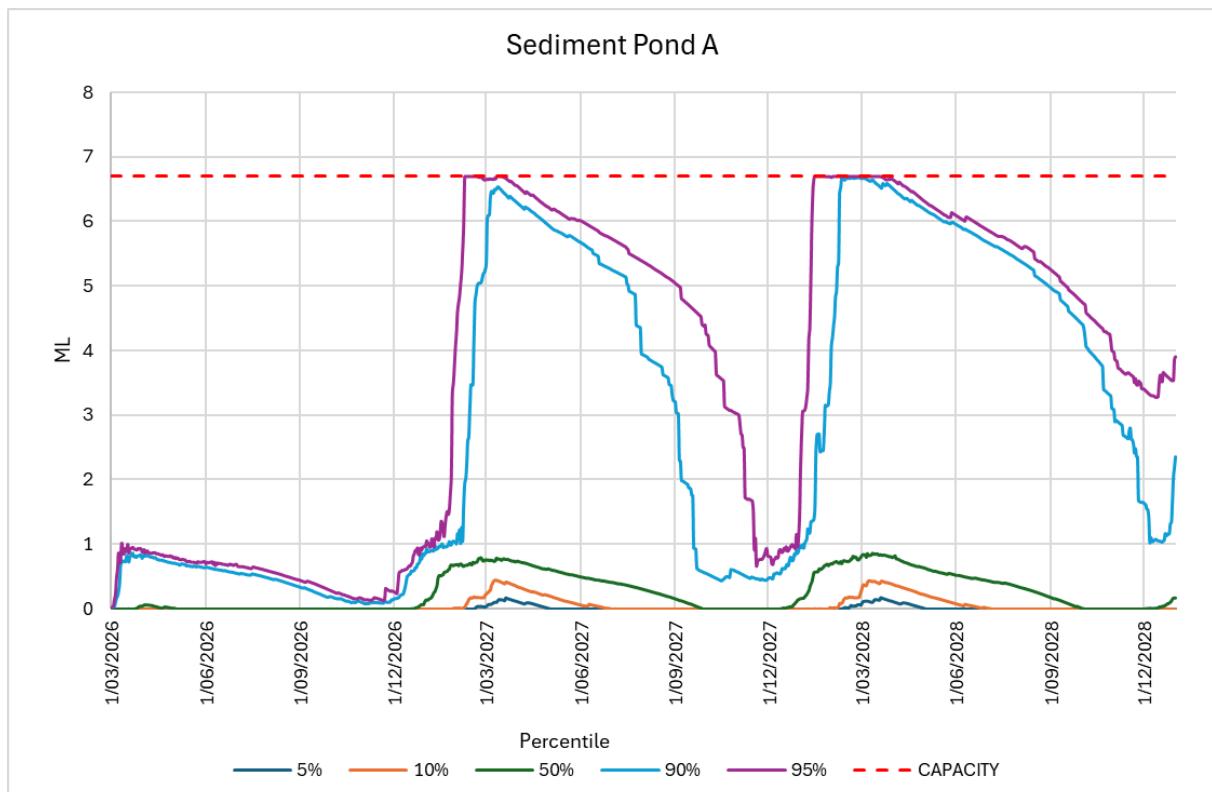
Storage	Storage Capacity (ML)	Highest Modelled Storage Volume (ML)			
		10 th Percentile	Median	90 th Percentile	Maximum
Pit 1 & 2	Start: 39.0 End: 294.6	1.6	1.8	2.8	136.2
Pit 2 (year 1 only)	15.0	0.7	2.6	3.5	12.0
Pit 4	12.5	0.7	2.4	3.5	11.3
Pit 6	775.4	2.0	2.4	3.5	9.81
Sediment Pond A	6.7	0.4	0.8	6.7	6.7
Sediment Pond B	5.6	0.5	1.3	5.6	5.6
Sediment Pond C	5.0	0.6	1.4	5.0	5.0
Sediment Pond D	2.2	0.2	0.3	2.2	2.2
Sediment Pond E	4.5	0.3	0.5	4.5	4.5
Sediment Pond F	2.8	0.2	0.3	2.7	2.8
WSD	200	6.1	46.2	116.3	200



GRAPH 5 – WSD FORECAST VOLUME

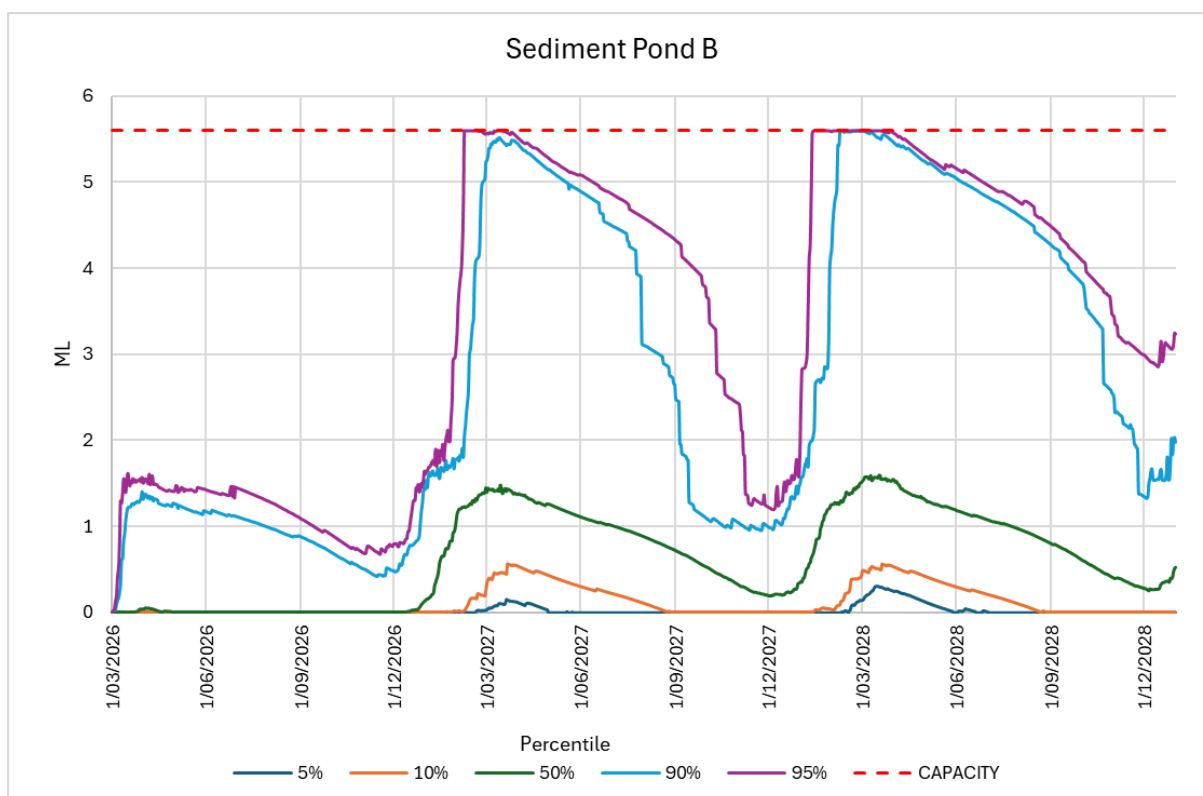


GRAPH 6 – SEDIMENT POND A FORECAST VOLUME

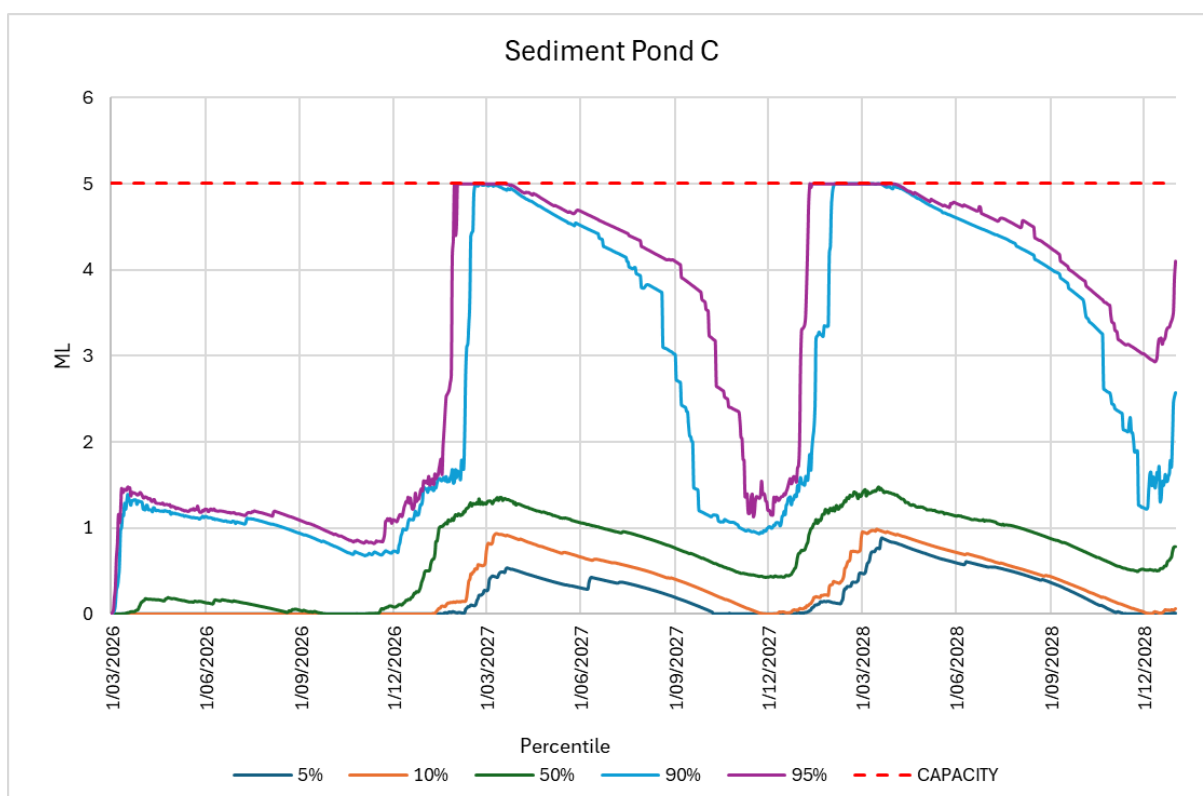




GRAPH 7 – SEDIMENT POND B FORECAST VOLUME

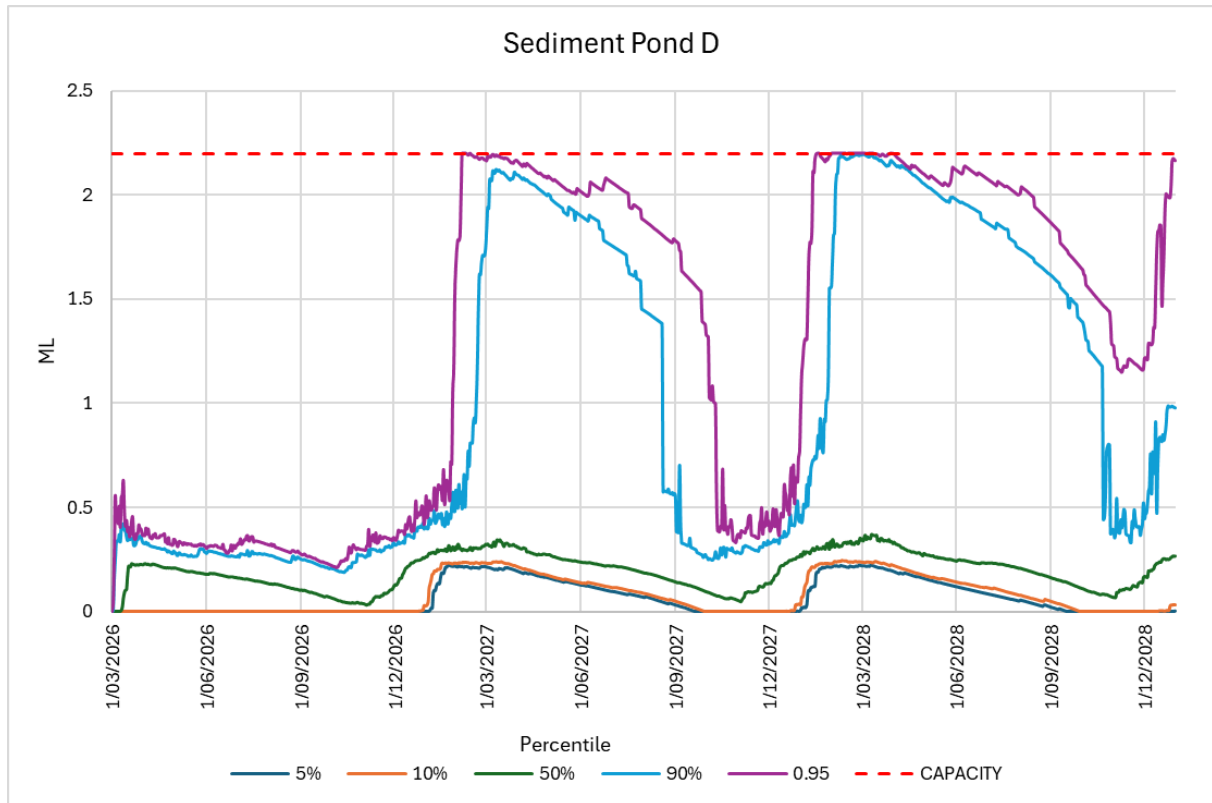


GRAPH 8 – SEDIMENT POND C FORECAST VOLUME

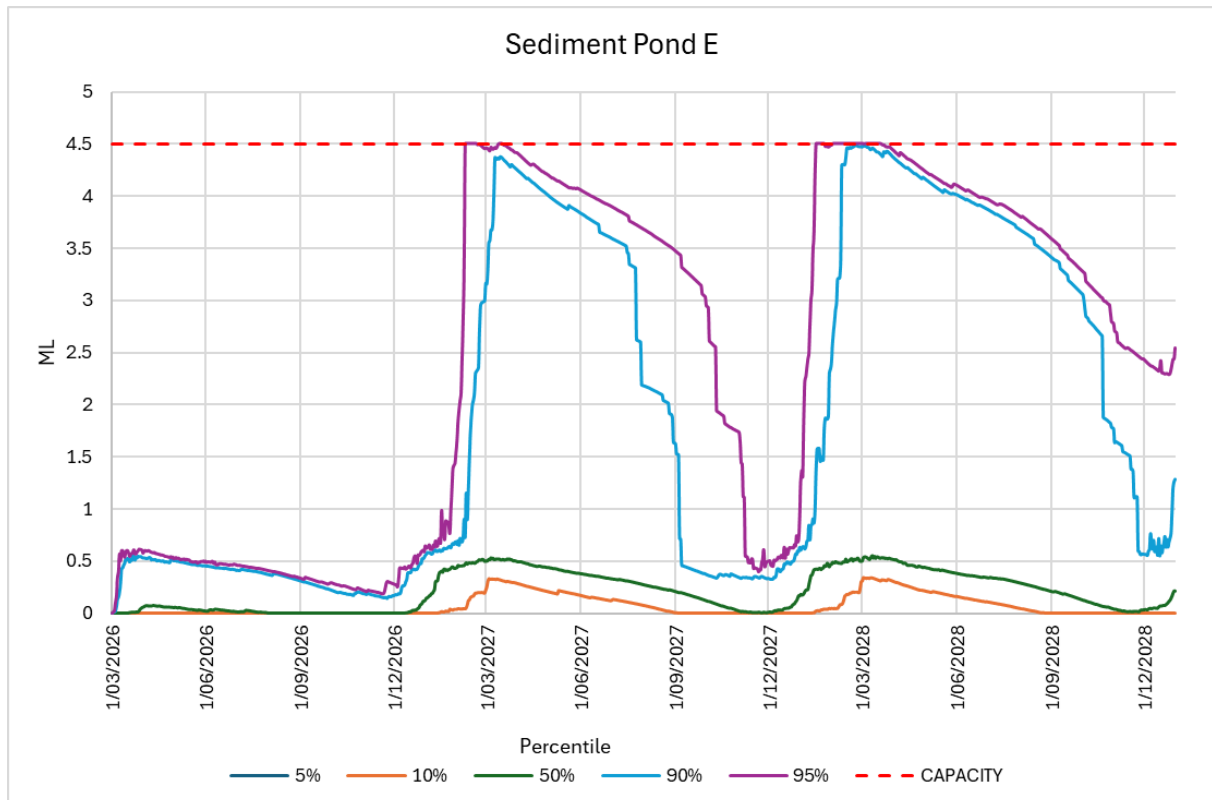




GRAPH 9 – SEDIMENT POND D FORECAST VOLUME

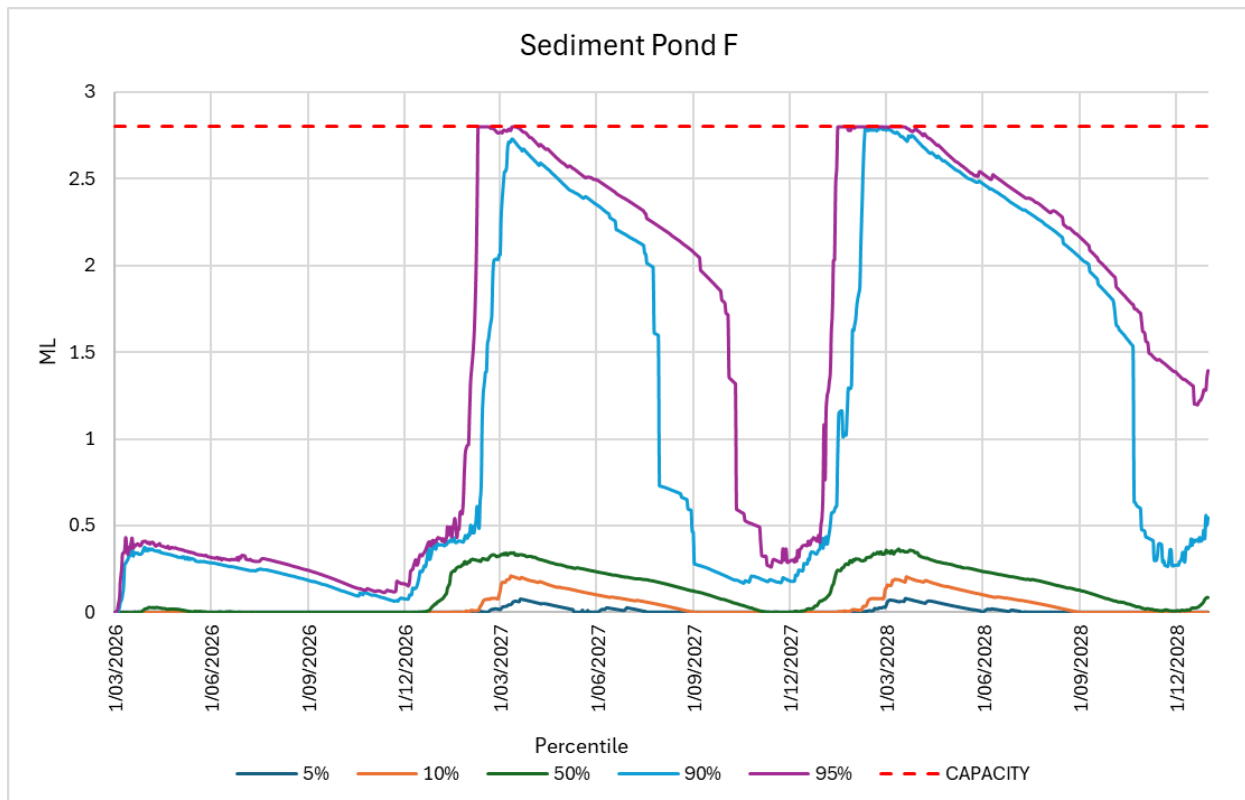


GRAPH 10 – SEDIMENT POND E FORECAST VOLUME





GRAPH 11 – SEDIMENT POND F FORECAST VOLUME



5.6 Rainfall Runoff Sensitivity Analysis

A sensitivity analysis of the model was undertaken, testing the response of the rainfall runoff model (AWBM) input parameters, given that rainfall runoff represents the largest modelled system inflow (refer **Section 5.5.1**). This was undertaken by increasing and decreasing the AWBM surface store capacities by 20%. A reduction of 20% in the AWBM surface store capacities represents a higher runoff scenario, while an increase of 20% gives a lower runoff scenario. A summary of the modelled average water balance inflow and outflow sensitivity results is provided in **Table 17**.

Model results indicate that a 20% change in AWBM surface store capacities results in a similar, although lower, percentage change in average modelled rainfall runoff. For the low runoff scenario, there is an overall reduction in forecast spill volume and evaporation from the storages, while for the high runoff scenario the opposite is forecast. For the high runoff scenario, there is a predicted higher risk of spills offsite.

When operations commence it is recommended that a calibration of the water balance model is undertaken, with a focus on AWBM parameters, in order to validate the assumed parameters.

**TABLE 17: SENSITIVITY ANALYSIS – AVERAGE MINE-LIFE SITE WATER BALANCE**

Item	Low Runoff Scenario	No Change	High Runoff Scenario
Inflows (ML/yr)			
Rainfall Runoff	79	84	90
Groundwater	7	7	7
Total Inflows (ML/yr)	85	91	97
Outflows (ML/yr)			
Evaporation	50	52	55
Dust Suppression	18	19	20
Spill	6	7	8
Total Outflows (ML/yr)	74	78	82
Change in Storage Volume (ML/yr)	12	13	15

5.7 Key Assumptions

Several assumptions had to be made in order to develop the WBM. The key assumptions are listed in **Table 18** and should be investigated further as the mine plan is developed and site data is obtained.

TABLE 18: KEY ASSUMPTIONS

Data	Recommendation
Catchment Area Staging	Conservative approach adopted. Catchments to be confirmed once detailed mine planning developed to understand pit vs. WRD requirements and optimise requirements for the water storages, give the likely surplus of mine affected water that will be experienced during operations.
Groundwater Inflows	To be confirmed via monitoring bores and pit water levels. WBM to be revised once further data is available.
Water Quality	Sediment Pond and Pit water and monitoring locations to be recorded at regular intervals.
AWBM Parameters	On-site water management and runoff to be monitored where possible to allow calibration of site specific AWBM parameters.



6 CONSEQUENCE CATEGORY ASSESSMENT

Dams, water storages and other related land-based containment structures associated with environmentally relevant activities under the *Environmental Protection Act 1994 (EP Act)* [11], are required to have a Consequence Category Assessment (CCA). This should be conducted to assess the potential consequences associated with 'dam break' and 'failure to contain' failure scenarios, and to outline if any specific considerations need to be included in the structure's design and operation. The following sections have been developed in accordance with the DES guidelines (referred to as 'The Manual') [16].

The purpose of The Manual [16] is to:

- guide the assessment of the Consequence Category of all structures constructed as part of activities that require an EA or development approval.
- guide the determination of the structure/s that require formal documentation; and
- provide approved methods for specifying the design performance and monitoring requirements for those structures.

6.1 General Environmental Harm Assessment

6.1.1 Potential Surface Environment Impacts

The receiving environment includes ephemeral waterways, creeks, and rivers. The main receiving environment for the WSD and Sediment ponds within a 10 km flow path to the north includes:

- Agate Creek (and its unnamed tributary on the western side of the creek); and
- Robertson River, which flows into the Gilbert River approximately 26 km downstream from the confluence of Agate Creek and Robertson River.

In accordance with The Manual [16], the Consequence Category Assessment (General Environmental Harm) is concerned with effects to areas with 'Significant Values' and 'Moderate Values'. The values are defined as follows.

- Significant Values
 - Matters of National Environmental Significance (MNES)
 - Matters of State Environmental Significance (MSES)
 - High Ecological Value (HEV) waters as per the Queensland Environmental Protection (Water) Policy 2009 (EPP Water) [15].
- Moderate Values
 - Slightly or moderately disturbed waters as per the EPP Water
 - Wetlands of general ecological significance (GES) as mapped on the Queensland Government referable wetland mapping
 - Riverine areas, springs or lakes and associated flora and fauna.

The characteristics and exposure of these receiving environments is identified in the environmental assessment reports in **Appendix A** and **Appendix B**.

The relevant characteristics of Agate Creek (including its unnamed tributary to the south and north of the site) and the Robertson River in the context of environmental values, are assessed as described in the subsequent sections.

6.1.2 Matters of National Environmental Significance

The Protected Matter Report (PMR) [11] for the project area is included in **Appendix B** and lists the MNES that are may occur 10 km downstream of the WSD and sediment ponds.



The PMR lists several critically endangered, endangered, and vulnerable species as likely to occur, or may occur in the area. The critically endangered and endangered animals listed in the MNES report are summarised in **Table 19**. There are no MNES habitat areas or wetlands listed for the receiving environment in the PMR.

TABLE 19: MNES LISTED CRITICALLY ENDANGERED AND ENDANGERED ANIMALS

Scientific Name	Common Name	Status	Class
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	Bird
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered	Bird
<i>Varanus mertensi</i>	Mertens' Water Monitor, Mertens's Water Monitor	Endangered	Reptile
<i>Erythrotriorchis radiatus</i>	Red Goshawk	Endangered	Bird
<i>Dasyurus hallucatus</i>	Northern Quoll, Digul [Gogo-Yimdir], Wijingadda [Dambimangari], Wiminji [Martu]	Endangered	Mammal
<i>Chloebia gouldiae</i>	Gouldian Finch	Endangered (listed as <i>Erythrura gouldiae</i>)	Bird
<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern)	Vulnerable	Bird
<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Vulnerable	Bird
<i>Tyto novaehollandiae kimberli</i>	Masked Owl (northern)	Vulnerable	Bird
<i>Falco hypoleucos</i>	Grey Falcon	Vulnerable	Bird
<i>Petauroides minor</i>	Greater Glider (northern), Greater Glider (north-eastern Queensland)	Vulnerable	Mammal
<i>Macroderma gigas</i>	Ghost Bat	Vulnerable	Mammal
<i>Dichanthium setosum</i>	bluegrass	Vulnerable	Plant
<i>Saccolaimus saccolaimus nudicluniatus</i>	Bare-rumped Sheath-tailed Bat, Bare-rumped Sheath-tail Bat	Vulnerable	Mammal
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Vulnerable	Bird

6.1.3 Matters of State Environmental Significance

The MSES Environmental Report [13] for ML100030 (plus a 2 km buffer) is included in **Appendix C**. The MSES report lists the MSES that occur within the buffer area, including locations upstream and downstream of the project area. The identified MSES pertain to:

- Protected Areas – estates; and
- Regulated Vegetation – intersecting a watercourse.

These areas are shown in DES [13] and included in **Appendix B**, namely Map 3a and Map 4. The identified MSES are summarised in **Table 20**.

**TABLE 20: MSES LISTED VALUES**

Value	Location	Comments
Protected Areas - estates	External to ML100030 and not part of the Agate Creek catchment.	This area is unlikely to be impacted as it is not part of the Agate Creek catchment.
Regulated vegetation – intersecting a watercourse	Adjacent to Agate Creek and the ML boundary.	All clean or overtopping runoff from the site discharges to Agate Creek, runoff from the site not likely to impact listed value.

6.1.4 High Ecological Value Wetlands and Waterways

Assessment of the available MSES data [13] showed that no High Ecological Value (HEV) wetlands or waterways were identified in the receiving environment within a 2 km radius of the WSD or sediment ponds.

6.1.5 Bores

Table 21 provides a summary of the bores associated with the Mine Lease. The location of the bores relative to the WSD and Sediment Ponds is presented in **Diagram 9**. All these bores are understood to be associated with the mine lease and ACGM activities.

TABLE 21: LOCAL BORE LOCATIONS

Rn	Facility type	Facility status	Drilled date	Easting	Northing
193026	Sub-artesian	Existing	6/06/2020	768402	7896465
193027	Sub-artesian	Existing	10/06/2020	768698	7898078
193028	Sub-artesian	Existing	16/06/2020	767704	7896911
193029	Sub-artesian	Existing	7/06/2020	767764	7897706
193030	Sub-artesian	Existing	8/06/2020	767300	7897863
193031	Sub-artesian	Existing	9/06/2020	767946	7897844
193032	Sub-artesian	Existing	11/06/2020	768760	7897721
193033	Sub-artesian	Existing	13/06/2020	768319	7897583
193034	Sub-artesian	Existing	14/06/2020	768172	7897673
193035	Sub-artesian	Existing	15/06/2020	768166	7897931

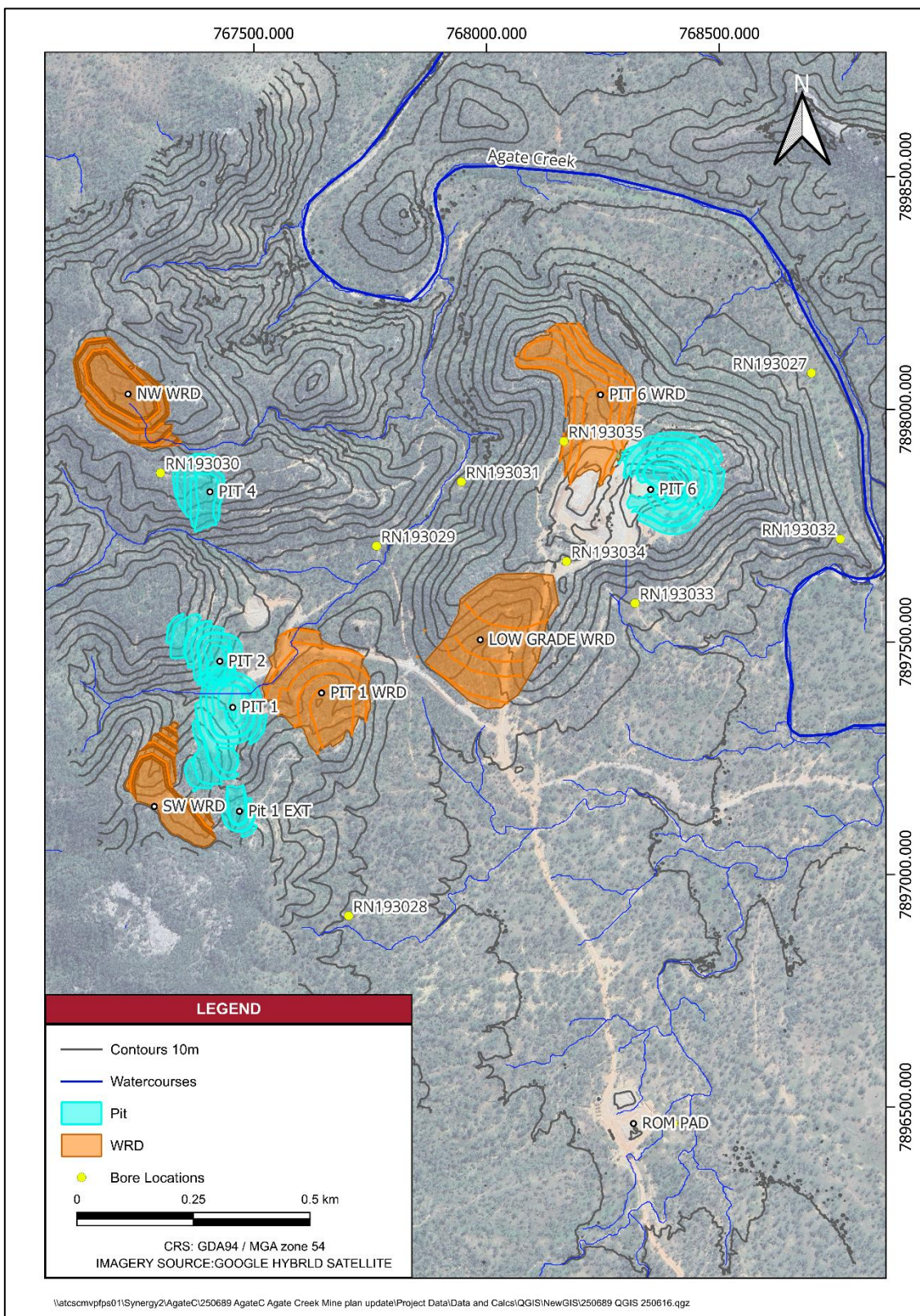
*Details provided by Queensland Globe and Business Queensland [7].

6.1.6 Local Infrastructure

As the site is in a rural region there is limited local infrastructure in proximity to the mine development. Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site.



DIAGRAM 9: ADJACENT BORE LOCATIONS





6.2 Consequence Category Assessment

6.2.1 Basis of Consequence Category Assessment

The benchmark reference relevant to consequence assessment and definition for design criteria in Queensland is the Department of Environment and Science's guidelines: *Manual for assessing consequence categories and hydraulic performance of structures* (referred to as 'The Manual') [16]. Based on this manual, dams or containment structures classified as "Significant" or "High" consequence are referred to as regulated, with design criteria relating to their performance in The Manual. Storages with a "Low" consequence category are not regulated structures and do not have containment design criteria.

The proposed site structures were assessed against the requirements of the Manual [16] for operational site conditions. This involved a desktop review of potential harm associated with failure-to-contain scenarios, and the dam break scenario.

The criteria for Consequence Category assessments are based on the following failure event scenarios.

- Failure to Contain – Seepage
Spills or release to ground/groundwater via seepage from the floor and/or sides of the structure.
- Failure to Contain – Overtopping
Spills or releases from the structure that result from loss of containment due to overtopping of the structure.
- Failure to Contain – Dam Break
Collapse of the structure due to any possible cause.

Under these scenarios, several modes of failure are possible as described below:

- A failure to contain scenario means a release from the structure that results from loss of containment due to excessive seepage, overtopping of the structure and/or other deficiencies in water management aspects of the storage. Although such a failure mechanism is typically non-flood producing, failure to contain events may involve the release of contaminants, which could endanger environmental values or human life/wellbeing.
- A dam break scenario involves the partial or complete collapse of a structure due to any possible cause.

The basis for assessment of Consequence Category from the Manual is reproduced in **Table 22**.

6.2.2 Consequence Category Assessment – Water Storage Dam

Assessments against the failure scenarios in the Manual for the Water Storage Dam under operational site conditions were undertaken. This assessment is contained in **Table 23**. A simplified assessment [20] of a failure scenario was adopted for the WSD given the volume will directly discharge to Agate Creek that has significant capacity.

6.2.3 Consequence Category Assessment – Sediment Ponds

Assessments against the failure scenarios in the Manual for the sediment ponds under operational site conditions were undertaken. This assessment is contained in **Table 24**. A simplified assessment of a failure scenario as per [20] was adopted for the Sediment Ponds given the volumes are minor, and will directly discharge to Agate Creek that has significant capacity.



TABLE 22: CONSEQUENCE CATEGORY ASSESSMENT CRITERIA

Environmental Harm	Consequence Category		
	High	Significant	Low
Harm to Humans	Location such that people are routinely present in the failure path and if present loss of life to greater than 10 people is expected ⁸ . Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.	Location such that people are routinely present in the failure path and if present loss of life to 1 person or greater but less than 10 people is expected ⁷ . Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.	Location such that people are not routinely present in the failure path and loss of life is not expected ⁷ . Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.
	Location such that contamination of waters (surface and/or groundwater ⁹) used for human consumption could result in the health of 20 or more people being affected ¹⁰ .	Location such that contamination of waters (surface and/or groundwater ⁸) used for human consumption could result in the health of 10 or more people but less than 20 people being affected ⁹ .	Location such that contamination of waters (surface and/or groundwater ⁸) used for human consumption could result in the health of less than 10 people being affected ⁹ .
General environmental harm	Location such that: a) Contaminants may be released to areas of MNES, MSES or HEV waters that are not already authorised to be disturbed to at least the same extent under other conditions of this authority subject to any applicable offset commitment (Significant Values); and b) Adverse effects ¹¹ on Significant Values are likely; and c) The adverse effects ¹⁰ are likely to cause at least one of the following: i) loss or damage or remedial costs greater than \$50,000,000; or ii) remediation of damage is likely to take 3 years or more; or iii) permanent alteration to existing ecosystems; or iv) the area of damage (including downstream effects) is likely to be at least 5 km ² .	Location such that contaminants may be released so that adverse effects ¹⁰ (that are not already authorised to be disturbed to at least the same extent under other conditions of the authority subject to any applicable offset commitment) either: a) Would be likely to be caused to Significant Values but those adverse effects ¹⁰ would not be likely to meet the thresholds for the High Consequence Category and instead would be likely to cause at least one of the following: i) loss or damage or remedial costs greater than \$10,000,000 but less than \$50,000,000; or ii) remediation of damage is likely to take more than 6 months but less than 3 years; or iii) significant alteration to existing ecosystems; or iv) the area of damage (including downstream effects) is likely to be at least 1 km ² but less than 5 km ² . or b) Would be likely to be caused to environmental values classed as slightly or moderately disturbed waters ¹² , wetland of general ecological significance ¹³ , riverine areas, springs or lakes and associated flora and fauna (Moderate Values), and the adverse effects ¹⁰ are likely to cause at least one of the following: i) loss or damage or remedial costs greater than \$20,000,000; or ii) remediation of damage is likely to take more than 1 year; or iii) significant alteration to existing ecosystems; or iv) the area of damage (including downstream effects) is likely to be at least 2 km ² .	Location such that either: a) Contaminants are unlikely to be released to areas of Significant Values or Moderate Values; or b) Contaminants are likely to be released to those areas, but would be unlikely to meet any of the minimum thresholds specified for the Significant Consequence Category for adverse effects ¹⁰
General economic loss or property damage	Location such that harm (other than a different category of harm as specified above) to third party assets in the failure path would be expected to require \$10 million or greater in rehabilitation, compensation, repair or rectification costs ¹⁴ .	Location such that harm (other than a different category of harm as specified above) to third party assets in the failure path would be expected to require \$1 million and greater but less than \$10 million in rehabilitation, compensation, repair or rectification costs ¹³ .	Location such that harm (other than a different category of harm as specified above) to third party assets in the failure path would be expected to require less than \$1 million in rehabilitation, compensation, repair or rectification costs ¹³ .

7 To be used for all failure event scenarios

8. 'People routinely present in the failure path' could be considered to be people who occupy buildings or other places of occupation that lie within the failure impact zone. For the purposes of this Manual, this should refer to people other than site personnel engaged by the resource operation and located on the tenements and tenure associated with the resource operation; for other ERAs, it would be the 'premises referred to in the authority'. It should be noted that while this is appropriate for the assessment of consequence categories in accordance with this Manual, adherence to the requirements of this Manual does not limit, amend, or change in any way, any other requirements to be complied with under relevant health and safety acts or legislation that requires the safety of site personnel to be considered.

9 When considering potential impacts on groundwater, it is not envisaged that a full hydrogeological assessment will be required in all cases. Any consideration of potential impacts on groundwater systems should consider the water quality of the potential receiving aquifer as well as the quality of fluid stored in the regulated dam. Existing groundwater drawdown in areas surrounding resource operations (e.g. drawdown as a result of mine pit or underground mine dewatering) can also be considered when assessing the consequence of dam seepage on groundwater systems.

10 'An adverse effect on human health means a physiological effect on human health and does not include an impact on the quality of downstream water that merely negatively affects taste and which is unlikely to cause persons to become physically ill.

11 Adverse effects includes chronic and acute effects where an acute effect is on living organism/s which results in severe symptoms that develop rapidly, and a chronic effect is an adverse effect on a living organism/s which develops slowly. In some instances, it may be necessary to carry out or reference existing ecological/toxicological studies to assess the impacts of contaminants on living organisms.

12 See Water EPP for definitions

13 Wetland of general ecological significance' means a wetland shown on a map of referable wetland as a 'general ecologically significant wetland' or 'wetland of other environmental value'.

14 This does not include the holder's own mine or gas production, on-site industrial or commercial assets, the holder's workers' accommodation, agricultural facilities on the holder's land such as a farm shed or farm dam or infrastructure solely for servicing the holder.



TABLE 23: CONSEQUENCE CATEGORY ASSESSMENT – WATER STORAGE DAM

Environmental Harm	Consequence Category		
	Failure to Contain - Seepage	Failure to Contain - Overtopping	Failure to Contain - Dam Break
Harm to Humans	All bores identified are understood to be associated with the Agate Creek Gold Mine activities. In the event of a seepage failure of the WSD, the impact of humans is expected to impact less than 10 people as there are no bores registered for human consumption located on Agate Creek. The WSD shall be lined, and as such a seepage failure is considered unlikely. Consequence Category is assessed as Low.	Impounded waters and material within the WSD consist of pumped transfers from the Pits and sediment ponds. Waters may contain elevated levels of pH, electrical conductivity (EC) and other chemical properties. Static and kinetic sampling indicates that the site water quality is not likely to meet the threshold for a 'Significant' consequence category. In the event of overtopping of the WSD, it is expected to occur due to a large rainfall event. The spills are therefore expected to flow east towards Agate Creek and be diluted with a regional flood event. Overtopping of the WSD is considered unlikely as it filled via pump transfer or direct rainfall from a small catchment area. Consequence Category is assessed as Low.	In the event of a dam break failure of the WSD, impounded waters will flow east towards, and enter Agate Creek. In a dam break scenario, a maximum of 200 ML may be released with an estimated peak flow of 117m³/s. Approximately 3 km to the south, along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. Due to the upstream location of the Rungulla Road to WSD, dam break flows and inundation to the road is considered unlikely. Non site personnel may be present (but not likely) in the failure path during a dam break failure. Consequence Category is assessed as Low
General environmental harm	In the event of a seepage failure, the 'Regulated vegetation – intersecting a watercourse' to the east within Agate Creek and its unnamed tributaries may be impacted. Water quality sampling indicated that the site water quality is not likely to meet the threshold for a 'Significant' consequence category. The WSD shall be lined, and as such a seepage failure is considered unlikely. Consequence Category is assessed as Low.	Impounded waters and material within the WSD consist of pumped transfers from the Pits and sediment ponds. Waters may contain elevated levels of pH, EC, and other chemical properties. Sampling of waters contained in the WSD should be undertaken upon construction and commissioning. Overtopping would only occur in extreme rainfall events and therefore runoff would be significantly diluted with natural surface flows and the Agate Creek watercourse. In the event of an overtopping failure, the 'Regulated vegetation – intersecting a watercourse' to the east within Agate Creek and its unnamed tributaries may be impacted; however, it is considered a Low consequence as the runoff would be expected to coincide with a flood event for the regional catchment and be diluted. Consequence Category is assessed as Low.	The WSD will receive water from sediment ponds and site pits which may contain constituents of concern. The WSD also consists of a large storage volume. In the event of a dam break failure, Agate Creek and its unnamed tributaries would be impacted by the release of mine affected water. It is assumed that a Dam Break would cause environmental harm as per the Significant category due to the expected water quality of the mine affected water released. Consequence Category is assessed as Significant.
General economic loss or property damage	Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. In the event of a seepage failure, the remediation/repair costs associated with repairing this road are expected to be less than \$1 million. Consequence Category is assessed as Low.	Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. In the event of an overtopping failure, the remediation costs associated with repairing this road are expected to be less than \$1 million as the runoff would be expected to coincide with a flood event for the regional catchment. Consequence Category assessed as Low.	Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. The remediation/repair costs associated with repairing this road are expected to be more than \$1 million but less than \$10 million. Consequence Category is assessed as Low.
Overall Consequence Category	LOW	LOW	SIGNIFICANT



TABLE 24: CONSEQUENCE CATEGORY ASSESSMENT – SEDIMENT PONDS

Environmental Harm	Consequence Category		
	Failure to Contain - Seepage	Failure to Contain - Overtopping	Failure to Contain - Dam Break
Harm to Humans	All bores identified are understood to be associated with mine activities and within the subject mine lease. In the event of a seepage failure of the WSD, the impact of humans is expected to impact less than 10 people as there are no bores registered for human consumption located on Agate Creek. Consequence Category is assessed as Low.	Impounded waters within the sediment ponds consist of runoff from the WRDs. Static and kinetic sampling indicates that the site water quality is not likely to meet the threshold for a 'Significant' consequence category In the event of overtopping of the sediment ponds, spills are expected to flow towards Agate Creek or its unnamed tributaries to the east of the site. Overtopping would only occur in large rainfall events and therefore runoff would be diluted with natural surface flows and the Agate Creek watercourse. Consequence Category is assessed as Low.	In the event of a dam break failure of the sediment ponds, impounded waters will flow east towards, and enter Agate Creek with estimated peak flows of 4-5m³/s for the largest sediment pond. Approximately 3 km to the south, along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. Due to the upstream location of the Rungulla Road to WSD, dam break flows and inundation to the road is considered unlikely. Non site personnel may be present (but not likely) in the failure path during a dam break failure Consequence Category is assessed as Low.
General environmental harm	In the event of a seepage failure, the 'Regulated vegetation – intersecting a watercourse' to the east within Agate Creek and its unnamed tributaries may be impacted. Water quality sampling indicated that the site water quality is not likely to meet the threshold for a 'Significant' consequence category. Consequence Category is assessed as Low.	Impounded waters within the sediment ponds consist of runoff from the WRDs. This water is impacted water that is assumed to be predominately sediment laden. In the event of overtopping of the sediment ponds, spills are expected to flow towards Agate Creek or its unnamed tributaries to the east of the site. Consequence Category is assessed as Low.	In the event of a dam break failure of the sediment ponds, Agate Creek and its unnamed tributaries is likely to be impacted. Water quality in the Sediment Ponds is proposed to be predominantly sediment laden and therefore of Low consequence if released. Consequence Category is assessed as Low.
General economic loss or property damage	Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. In the event of a seepage failure, the remediation/repair costs associated with repairing this road are expected to be less than \$1 million. Consequence Category is assessed as Low.	Approximately 3 km to the south of the subject site and along the southern boundary of the mine lease, Rungulla Road (an unsealed road) provides access to local landowners and to the site. In the event of a seepage failure, the remediation/repair costs associated with repairing this road are expected to be less than \$1 million. Consequence Category is assessed as Low.	Due to the upstream location of the Rungulla Road to the sediment ponds, dam break flows and damage to the road is considered unlikely. Consequence Category is assessed as Low.
Overall Consequence Category	LOW	LOW	LOW



6.3 Consequence Category Outcome

The consequence category assessment outcomes are summarised in **Table 25**. In accordance with The Manual [16], regulated storages (structures defined as “Significant” or “High” consequence category) are required to accommodate a Design Storage Allowance (DSA) and Extreme Storm Surge (ESS).

TABLE 25: CONSEQUENCE CATEGORY ASSESSMENT SUMMARY

Failure Scenario	Water Storage Dam	Sediment Ponds
Failure to Contain – Seepage	Low	Low
Failure to Contain – Overtopping	Low	Low
Failure to Contain - Dam Break	Significant	Low
Overall	Significant	Low
Regulated Structure, as defined in the Manual (Y/N)	Yes	No

As shown in **Table 25**, the Water Storage Dam has a consequence category of ‘Significant’ and the Sediment Pond structures have a consequence category of Low. Details of the hydraulic performance criteria for the Water Storage Dam are detailed in **Section 6.4**.

6.4 Hydraulic Performance Criteria

6.4.1.1 Design Storage Allowance

The Design Storage Allowance (DSA) is the volume required to accommodate inflows during the wet season, thus preventing unauthorised release of water to the environment. The DSA must be available in each regulated structure (or network of linked containment systems with a shared DSA volume) on 1 November of each year. These DSA volumes must be assessed each year and are based on the actual available storage in each of the regulated structures.

The Manual [16] outlines two acceptable methods for calculating the DSA, namely:

1. Method of deciles; or,
2. Method of operational simulation.

The method of deciles utilises historical data to estimate probabilistic wet season rainfall depths and considers other process inputs over the wet season. Operational simulation accounts for the site water management system and is undertaken through site water balance modelling. Given that a water balance model has been developed for the site and there are several transfers proposed, an operational simulation has been used to determine the DSA volume. A minimum 50% Design Simulation Margin (DSM) has also been added as per the DES guidelines [16].

An indicative Water Storage Dam DSA volume for the first two years is presented in **Table 26** based on a 5% AEP wet season rainfall model run. **These values are indicative only and must be confirmed prior the start of each wet season as per the annual regulated dam inspection routine.**

**TABLE 26: DSA BY OPERATIONAL SIMULATION – WATER STORAGE DAM**

Parameter	Water Storage Dam (Year 1)	Water Storage Dam (Year 2)
Consequence Category	Significant	
Critical Wet Period	1 Nov to 31 May	
Design Risk	5% AEP (wet season rainfall)	
Calculated Increase in Stored Water	113 ML	123 ML
Indicative DSA (including 50% DSM)	170 ML	185 ML

6.4.1.2 Mandatory Reporting Level

The Mandatory Reporting Level (MRL) is derived by selecting the highest volume required in a regulated dam to contain:

- The runoff from the contributing catchment of the particular dam for a 72-hour duration storm at a defined annual exceedance probability (AEP); and,
- A wave allowance at that AEP, as estimated using a recognised engineering method.

When the MRL is exceeded for a structure, the holder of the EA is required to inform the administering authority. MRL's for regulated structures at ACGM are listed in **Table 27**.

TABLE 27: CALCULATED MRL – WATER STORAGE DAM

Parameter	Water Storage Dam
Design Risk	1 in 10 AEP, 72hr event
Rainfall Total	218.0 mm
Catchment Area	4.5 ha ¹
Runoff Coefficient	1.0
Extreme Storm Storage (ESS) Volume	9.8 ML
Depth below Spillway Level to achieve ESS Volume	TBC in detailed design
Depth below Spillway Level to achieve Wave Allowance	TBC in detailed design

1. Values such as this must be confirmed following the detailed design of the WSD, as this may impact the required storage.

6.4.1.3 Emergency Spillway Requirements

An emergency spillway is a mandatory requirement for any regulated dam, with design criteria for the spillway design based on The Manual [16] and reproduced in **Table 28**. Details of the emergency spillway will be resolved as part of the detailed design phase for the project.



TABLE 28: SPILLWAY DESIGN CRITERIA

Design Criteria	Flood Passage	Flood Ingress Prevention
Consequence Category for 'dam break'	Spillway capacity	Flood level for embankment crest levels
Significant consequence	1:100 AEP to 1:1,000 AEP	Spillway design flood peak level + wave run-up allowance for 1:10 AEP wind



7 WATER QUALITY MONITORING AND REVIEW

Water quality monitoring is required in accordance with the EA and standard regulatory requirements to identify any potential influence or threat to receiving waters. Proposed monitoring requirements are in relation to:

- weather and rainfall;
- surface water quality;
- groundwater levels and quality;

Standard relating to monitoring are provided below:

- AS/NZS 5667.1:1998 Water Quality – Sampling
- Monitoring and Sampling Manual Environmental Protection Policy (Department of Environment and Science, 2018)

Quality control (QC) and quality assurance (QA) of sampling activities must be undertaken for each sampling event:

- duplicate samples are collected at a nominal rate of 1 duplicate per 20 samples;
- field blank samples are collected at a nominal rate of once per day of water sampling; and
- samples are analysed at a NATA accredited laboratory.

7.1 Baseline Monitoring Data

Detailed baseline monitoring data shall be undertaken as discussed in **Section 3.2**.

7.2 Weather and Rainfall Monitoring

7.2.1 Objectives

The objectives of the weather and rainfall monitoring are to:

- provide input to the site water balance and numerical groundwater model calibration and forecasting;
- inform site water management decisions; and
- inform the interpretation and analysis of surface water and groundwater monitoring data.

7.2.2 Monitoring Program

Climatic conditions to be monitored via weather stations and pluviometers. Data collection is automated and imported to an environmental database system via telemetry. The pluviometers are recommended to record rainfall depth at 10-minute intervals. Weather stations to record rainfall, barometric pressure, temperature, wind speed, wind direction and relative humidity at 10-minute intervals. Care is to be taken to locate the weather station clear of vegetation or other structures that may impede the monitoring data.

7.3 Surface Water Quality Monitoring

7.3.1 Objectives

The objectives of the surface water quality monitoring program are to:

- characterise water quality within operational areas and adjacent watercourses;
- assess the site performance in relation to prevention of pollution;



- identify and quantify any potential impacts associated with mining activities; and
- monitor the effectiveness of remediation and rehabilitation measures.

7.3.2 Monitoring Parameters

Surface water quality monitoring is to occur for all key water quality constituents set by the EA. Preliminary surface water limits have been advised by Ardent as described in **Section 3.2.2**.

7.3.3 Monitoring Analyses and Frequency

Surface water quality results will be assessed against exceedance and trigger value limits identified in the Environmental Authority once it is approved, as well as the Water Quality Objectives.

Monitoring is proposed to be undertaken on a monthly basis at a minimum, and daily during release events. Surface water sampled in watercourses should be collected during flow events.

7.4 Groundwater Quality Monitoring Approach

The objectives of the groundwater monitoring program are to:

- characterise local and regional groundwater quality and groundwater level trends;
- identify potential effects of mining activities on the local hydrogeological regime and groundwater quality;
- quantify groundwater depressurization associated with underground mining operations;
- identify potential groundwater quality impacts associated with seepage;
- monitor the effectiveness of remediation and rehabilitation measures; and
- support the development, calibration and verification of the numerical groundwater model predictions.

7.4.1 Monitoring Locations

Groundwater monitoring locations shall be constructed to identify any groundwater impacts occurring as a result of mining activities.

7.4.2 Groundwater Level Monitoring

Groundwater level monitoring should be undertaken prior to sampling for groundwater quality data. The purpose of groundwater level monitoring would be to confirm the groundwater flow direction.

7.4.3 Monitoring Parameters

Groundwater quality monitoring is to occur for all key water quality constituents set by the EA. Groundwater quality parameters should be based off the preliminary surface water limits that have been advised by Ardent as described in **Section 3.2.2**.

7.4.4 Monitoring Analyses and Frequency

Water quality results are to be assessed against exceedance and trigger value limits identified in the Environmental Authority, as well as the Water Quality Objectives.

Groundwater quality monitoring within and around the project site must be undertaken to examine groundwater levels and water quality at the site. Groundwater monitoring should be undertaken on a quarterly (3-monthly) basis during mine operations and annually post-closure.



8 EMERGENCY AND CONTINGENCY PLAN

8.1 Assessment Criteria

Site specific assessment criteria are to be developed for the ACGM based on baseline data and DES requirements and will be set out in the amended EA for the site. This criteria in combination with Trigger Action Response Plans (TARPs) as per **Section 8.1.1** must be developed as part of operational management, enable potential surface water and groundwater impacts to be detected and managed at an early stage.

In addition to monitoring and reporting in accordance with the EA, monitoring data for all sites shall be assessed and reported on a quarterly, biannual and/or annual basis by independent specialists.

8.1.1 Trigger Action Response Plans

Trigger action response plans (TARPs) must be implemented for surface water and groundwater. The primary aim of TARP is to:

- define appropriate trigger levels for surface water and groundwater resources;
- implement specific actions in response to a potential impact to surface water and groundwater resources; and
- implement appropriate and effective management and mitigation measures.

8.2 Management of Major Storages

Water storages and transfer dams must be actively managed to reduce the risks associated with below average rainfall conditions (water deficit) or above average rainfall conditions (flood risk). Any regulated structure requires an Operational Plan which includes an Emergency Action Plan to be in place prior to the operation of the new regulated structure.

8.3 Incident Management and Emergency Response

A site-specific *Incident Response Management Plan* must be developed to define the preparation for and response to a potential or actual pollution incident associated with operations.

8.4 Adaptive Management

Continuous improvement activities and adaptive management shall be incorporated within the operational management to ensure that potential impacts to surface water and groundwater resources are actively identified, assessed, and managed. Should it be identified that a performance measure has not been met, at the earliest opportunity the operations shall:

- take all reasonable and feasible measures to cease the activities causing the exceedance;
- investigate and implement a root cause analysis and implement actions to ensure it does not recur;
- consider all reasonable and feasible options for remediation (where relevant);
- notify the regulator and submit an investigation report where appropriate; and
- implement remediation measures as directed and to the satisfaction of the regulator.

All incidents will be reviewed annually. Trends and commonalities will be investigated and continuous improvement measures identified and implemented. These improvements will be documented in revisions to this Plan.



9 REPORTING AND COMPLAINTS RESPONSE

9.1 Reporting Commitments

9.1.1 Water Quality Monitoring

Regular reporting regarding water quality is to be undertaken by ACGM. An annual report regarding water quality monitoring would typically include:

- a comprehensive review of the monitoring results including a comparison of these results against:
- relevant statutory requirements, limits of performance measures/criteria;
- requirements of any plan or program required under the approval;
- monitoring results of previous years; and
- any non-compliance or incident which occurred in the previous year and the measures adopted to rectify the non-compliance and avoid reoccurrence;
- evaluation and reporting on compliance with the performance measures, criteria and operating conditions of the approval;
- any trends in monitoring data over the life of the Project;
- any discrepancies between the predicted and actual impacts of the Project and the potential cause of any discrepancies;
- conducted water infrastructure maintenance measures;
- recalibration and verification of groundwater and surface water models; and
- measures to be implemented to improve the environmental performance of the Project.

9.1.2 Water Management Plan Review and Auditing

In conjunction with annual dam safety inspections, the hydraulic performance requirements for each structure are to be reviewed and updated to identify possible shortcomings. This inspection is to be completed by 1 November each year.

There is no formal frequency for review of the entire site Water Management Plan. However, it is recommended a review is undertaken at least every three years or as deemed necessary, to ensure measures, practices and procedures are carried out effectively to minimise the risk of environmental harm. This may occur in the case of changes to the mining schedule, operations or other relevant aspects that could potentially impact the effectiveness of the Water Management Plan.

9.2 Complaints Response

Complaints related to groundwater to be recorded and investigated by a Senior Environment Officer. Follow up correspondence with the complainant will be made explaining the outcome of complaint investigations and where appropriate DES are to be notified of the complaint and findings.

9.3 Incident and Non-Compliance Reporting

Incident and non-compliance reporting is to be undertaken as required by DES and the EA.



10 CONCLUSIONS AND RECOMMENDATIONS

This Water Management Plan was developed to meet DETSI Progressive Rehabilitation Closure Plan guidelines and to assist in the application for an Environmental Authority amendment to allow operations at the site to commence.

It is expected that the site will generate a surplus of site impacted water from disturbed areas during wet climate cycles. This is due to the multiple catchments from the WRDs and Pits, combined with low (dust suppression only) site water demands. The proposed water management strategy for site impacted water is to transfer water from four Sediment Ponds to a large, centralised Water Storage Dam. Water Balance Modelling indicated that the Water Storage Dam has an annual spill risk of <1% and the Sediment Ponds are designed to have an annual spill risk of less than 20%. The proposed Water Storage Dam has a consequence category of 'Significant', and as such, must ensure it has sufficient Design Storage Allowance before 1 November every year, and a Mandatory Reporting Level applies. The Sediment Ponds are not considered to be regulated structures.

A conservative approach has been adopted in sizing the structures within the Water Balance Model as there is limited information regarding the expected water quality in the pits and from the WRDs. Ongoing monitoring of site water quality will be required during operations to confirm and manage the design risks.

This WMP considers limited catchment staging where all WRDs and Pits are all operational and no progressive rehabilitation has progressed over the site. To improve the environmental outcomes for the site and in-line with the intent of the PRCP, it is recommended that mine development staging considers progressive rehabilitation of operational areas as the works progress.



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APPENDICES



APPENDIX A – MSES MAPPING



Queensland Government

Department of the Environment, Tourism, Science and Innovation

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest

Custom input

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 2020). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and a field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@detsi.qld.gov.au

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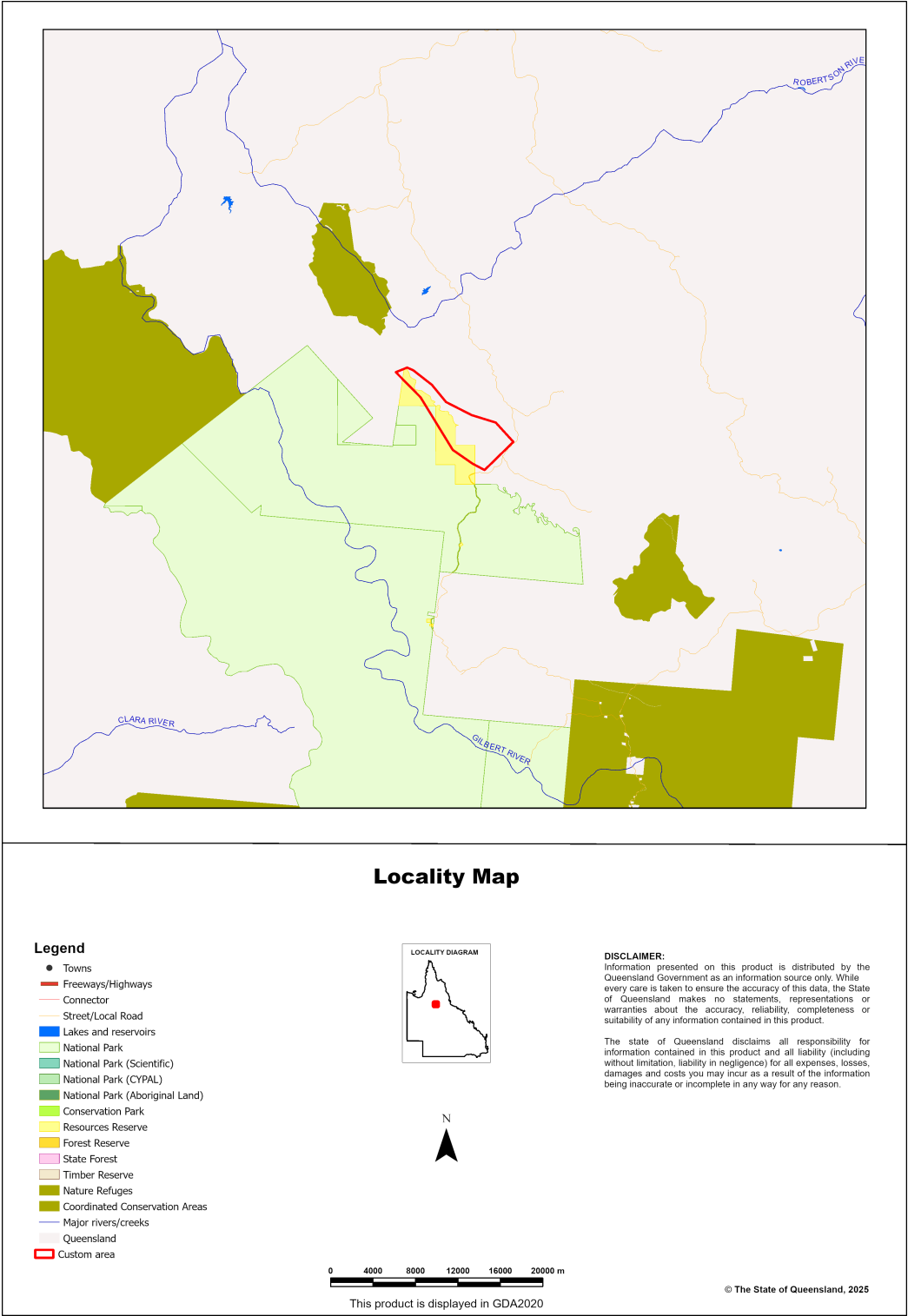
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI: Custom input, with area 3116.39 ha

Local Government(s)	Catchment(s)	Bioregion(s)	Subregion(s)
Etheridge Shire	Gilbert	Einasleigh Uplands	Kidston
		Gulf Plains	Gilberton Plateau



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992*;
- *Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the Marine Parks Act 2004 ;*
- *Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;*
- *Threatened wildlife under the Nature Conservation Act 1992 and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;*
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014 ;*
- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;
- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	955.84 ha	30.7%
1b Protected Areas- nature refuges	0 ha	0.0%
1c Protected Areas- special wildlife reserves	0 ha	0.0%
2 State Marine Parks- highly protected zones	0 ha	0.0%
3 Fish habitat areas (A and B areas)	0 ha	0.0%
4 Strategic Environmental Areas (SEA)	0 ha	0.0%
5 High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values	0 ha	0.0%
6a High Ecological Value (HEV) wetlands	0 ha	
6b High Ecological Value (HEV) waterways	0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	0 ha	0.0%
7b Special least concern animals	0 ha	0.0%
7c i Koala habitat area - core (SEQ)	0 ha	0.0%
7c ii Koala habitat area - locally refined (SEQ)	0 ha	0.0%
7d Sea turtle nesting areas	0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	257.55 ha	8.3%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0 ha	0.0%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0 ha	0.0%
8d Regulated Vegetation - Essential habitat	0 ha	0.0%
8e Regulated Vegetation - intersecting a watercourse	54.8 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0 ha	0.0%
9a Legally secured offset areas- offset register areas	0 ha	0.0%
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0 ha	0.0%

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

Estate name
Rungulla National Park
Rungulla Resources Reserve

1b. Protected Areas - nature refuges

(No results)

1c. Protected Areas - special wildlife reserves

(No results)

2. State Marine Parks - highly protected zones

(No results)

3. Fish habitat areas (A and B areas)

(No results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(No results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Not applicable

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

7d. Wildlife habitat (sea turtle nesting areas)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>	Keys boronia	V	None
<i>Calyptrorhynchus lathamii</i>	Glossy black cockatoo	V	None
<i>Casuarius casuarius johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	None
<i>Euastacus bindal</i>	Mount Elliot crayfish	CR	None
<i>Euastacus binzayedii</i>		CR	None
<i>Euastacus eungella</i>		E	None
<i>Euastacus hystricosus</i>		E	None
<i>Euastacus jagara</i>	Jagara hairy crayfish	CR	None
<i>Euastacus maidae</i>		CR	None
<i>Euastacus monteithorum</i>		E	None
<i>Euastacus robertsi</i>		E	None
<i>Taudactylus pleione</i>	Kroombit tinkerfrog	E	None
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Macadamia integrifolia</i>		V	None
<i>Melaleuca irbyana</i>	swamp tea-tree	E	None
<i>Macadamia ternifolia</i>		V	None
<i>Macadamia tetraphylla</i>	bopple nut	V	None
<i>Petrogale penicillata</i>	brush-tailed rock-wallaby	V	None
<i>Petrogale coenensis</i>	Cape York rock-wallaby	E	None
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V	None
<i>Petrogale sharmani</i>	Sharmans rock-wallaby	V	None
<i>Petrogale xanthopus celeris</i>	yellow-footed rock-wallaby (Qld subspecies)	V	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	E	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

(No results)

Special least concern animal species records

(No results)

Shorebird habitat (critically endangered/endangered/vulnerable)

Not applicable

Shorebird habitat (special least concern)

Not applicable

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** and **Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

<https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/>

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
2.10.9	O-dom	rem_oc

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Not applicable

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets**9a. Legally secured offset areas - offset register areas**

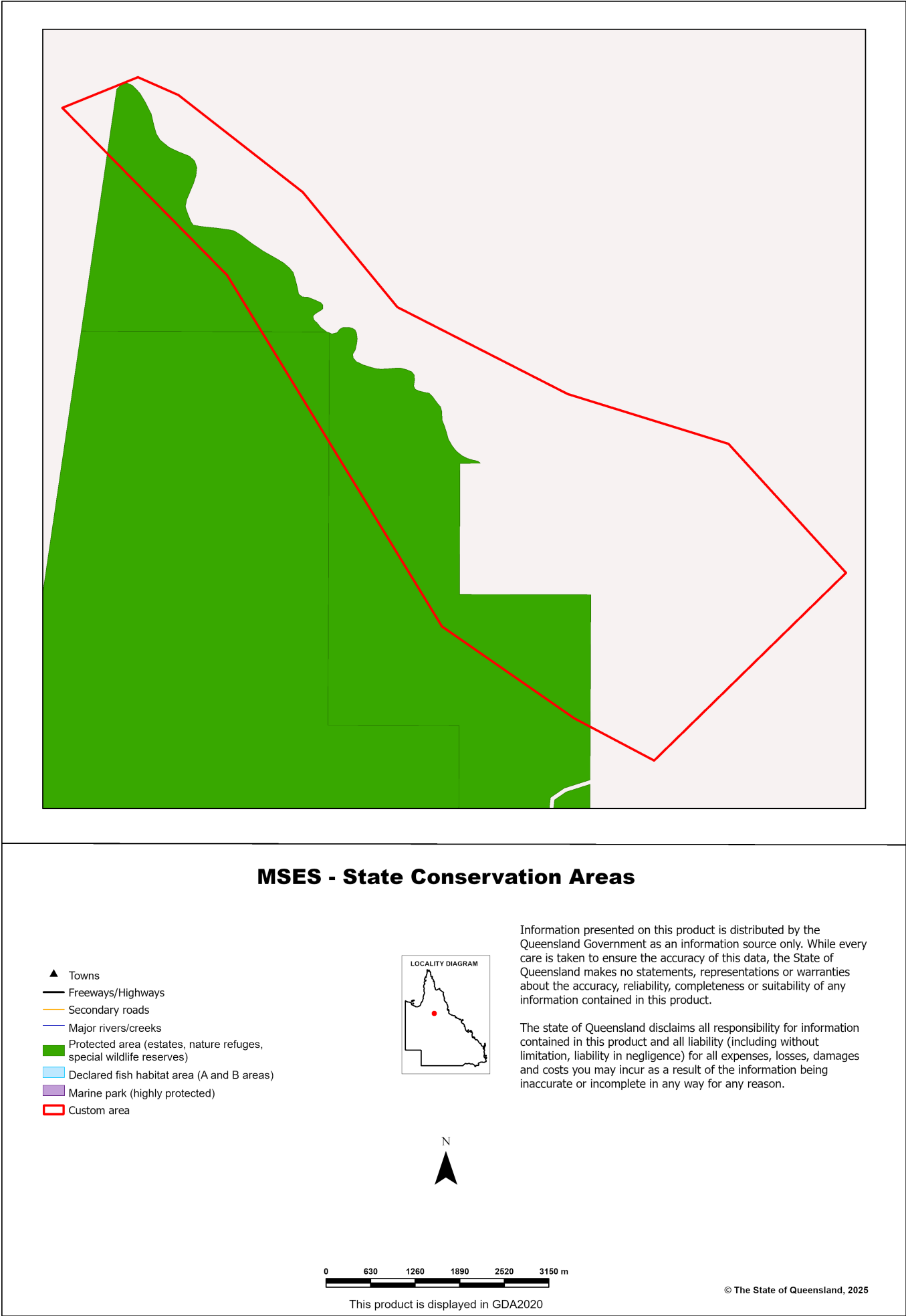
(No results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

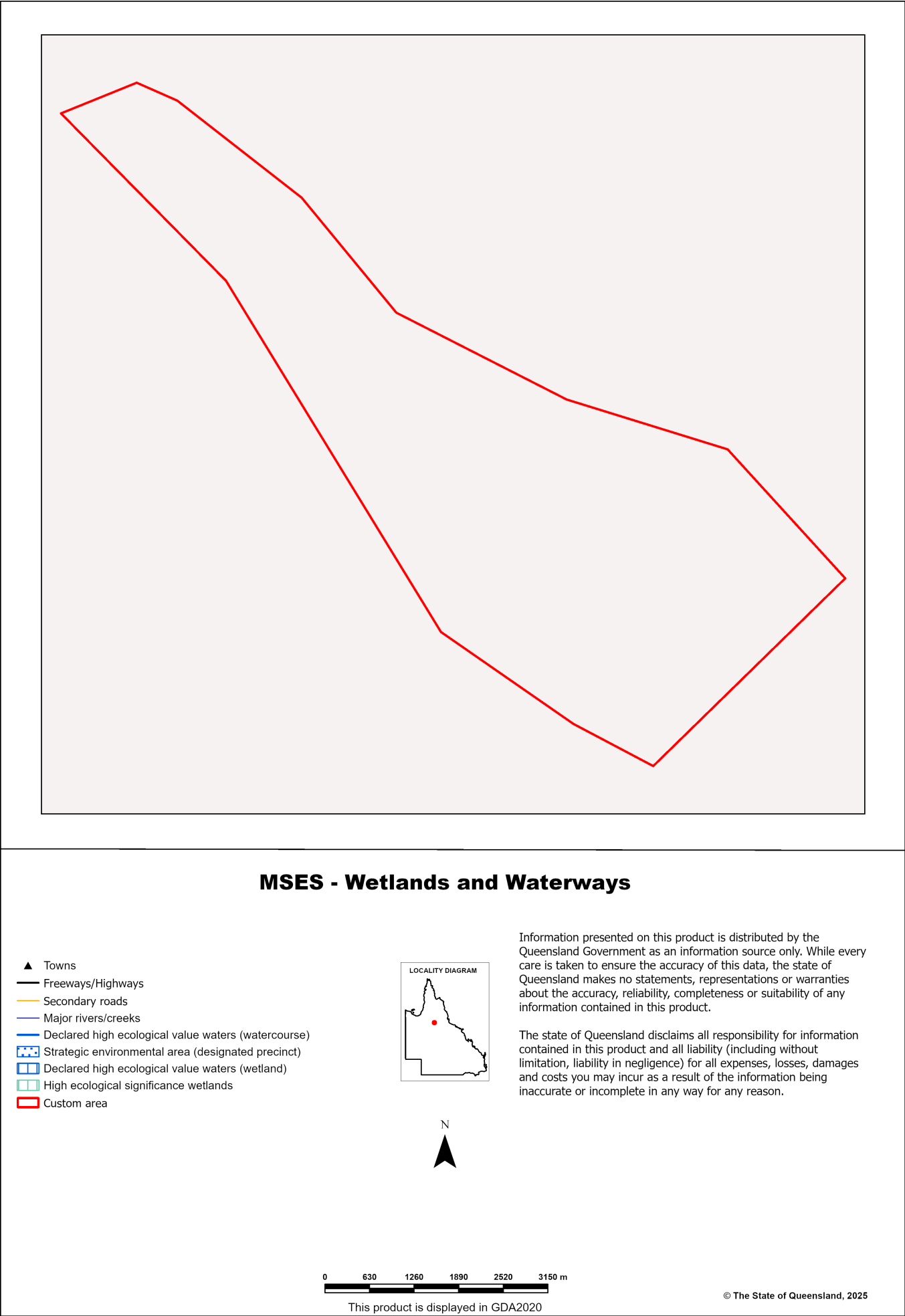
(No results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

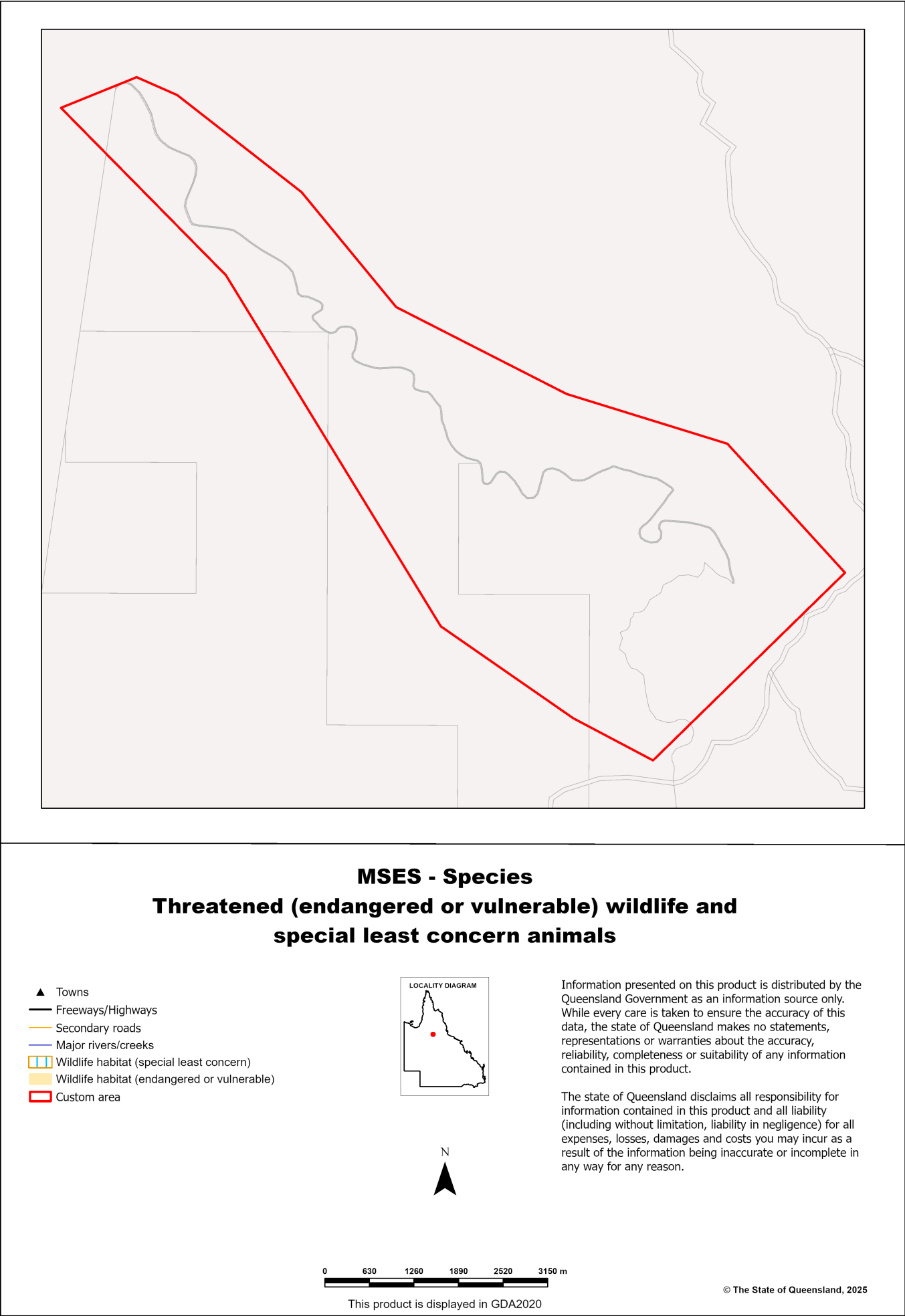
Map 1 - MSES - State Conservation Areas



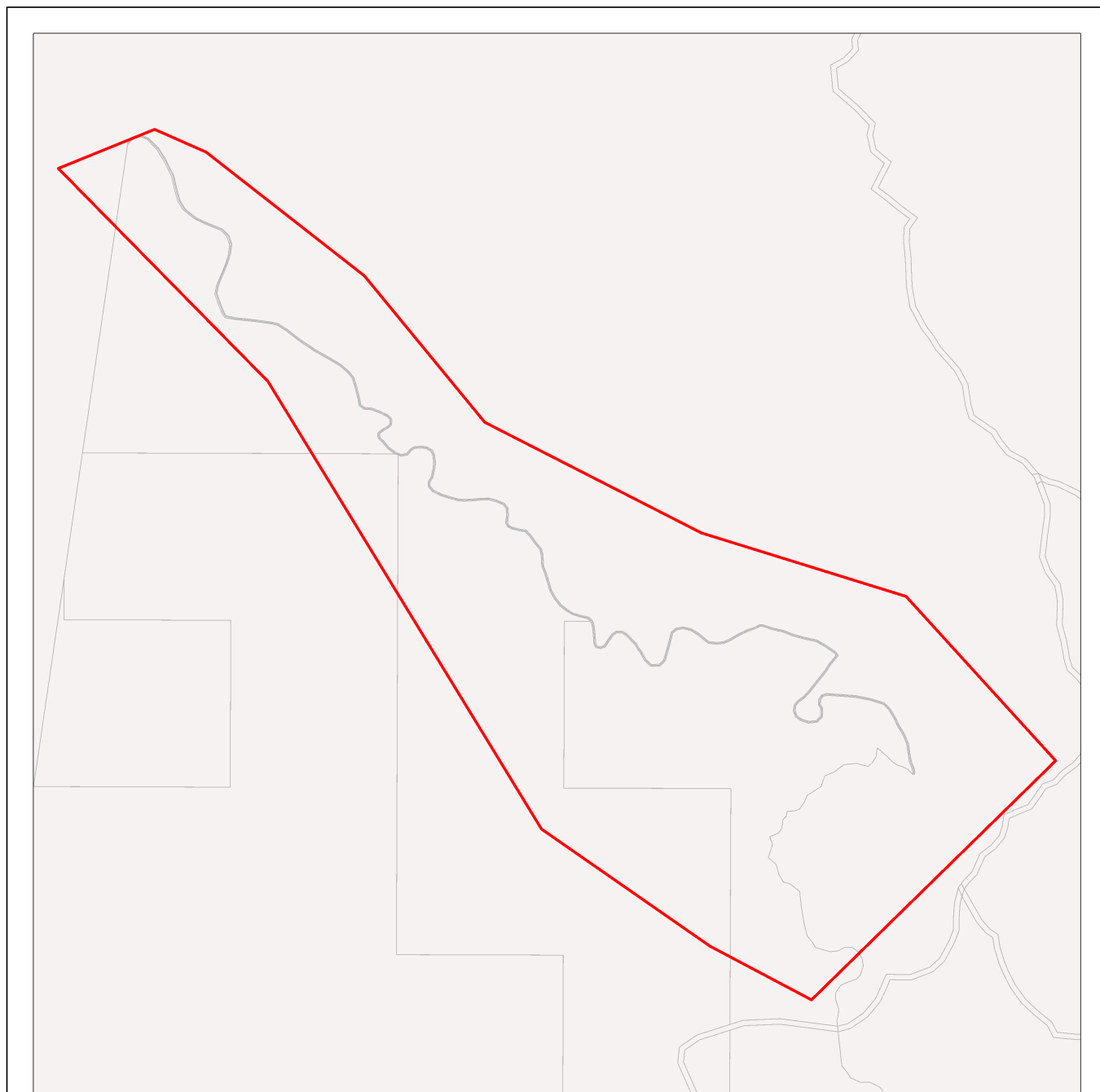
Map 2 - MSES - Wetlands and Waterways



Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

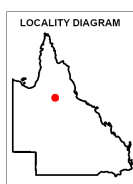


Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

- ▲ Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)
- Custom area



The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

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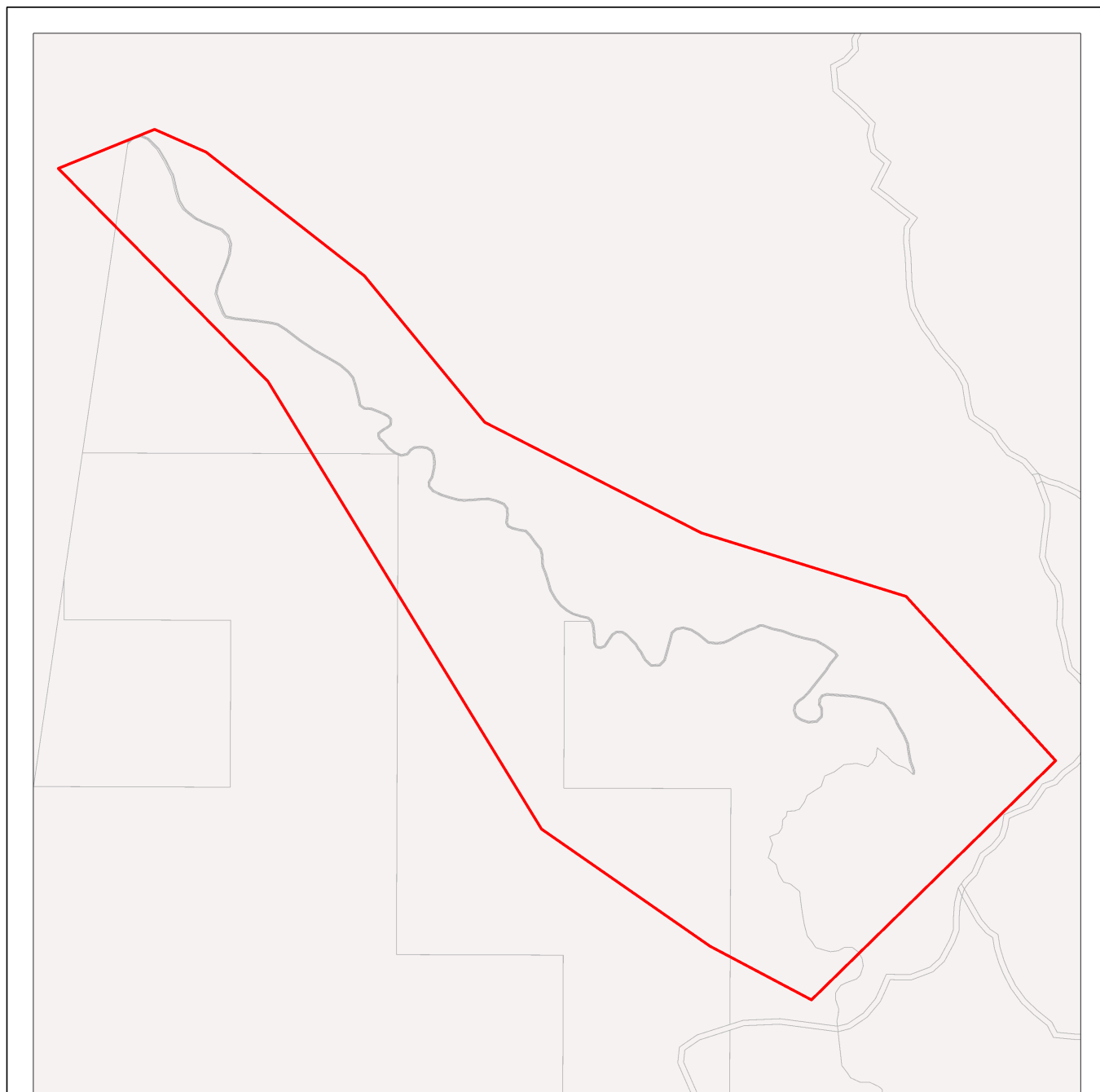
0 600 1,200 1,800 2,400 3,000 m

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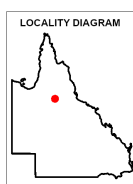
The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area-locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See <https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping>

Map 3c - MSES - Species - Wildlife habitat (sea turtle nesting areas)



MSES - Wildlife habitat (sea turtle nesting areas)

- ▲ Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)
- Custom area

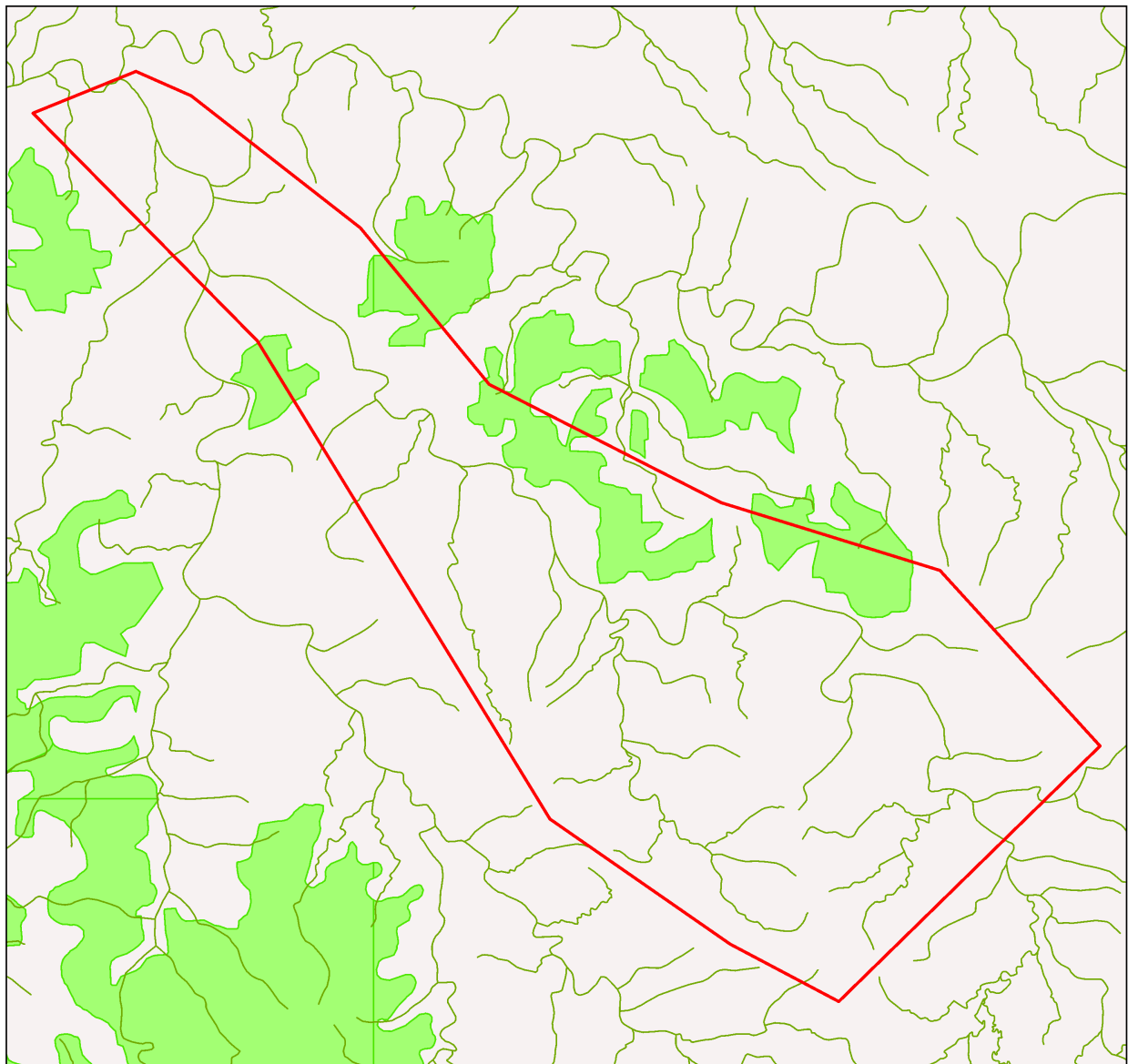


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MSES mapping of sea turtle nesting areas identifies beaches where the recorded number of turtle nests are over 1% of the turtle species or genetic stock. The linework is also deliberately extended along nearby rocky coastlines and headlands to recognise that significant numbers of nesting adults and hatchlings can become disoriented by light pollution from development on rocky coastlines and headlands while navigating offshore from nesting beaches.

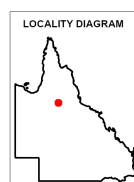


Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

- ▲ Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)
- Custom area

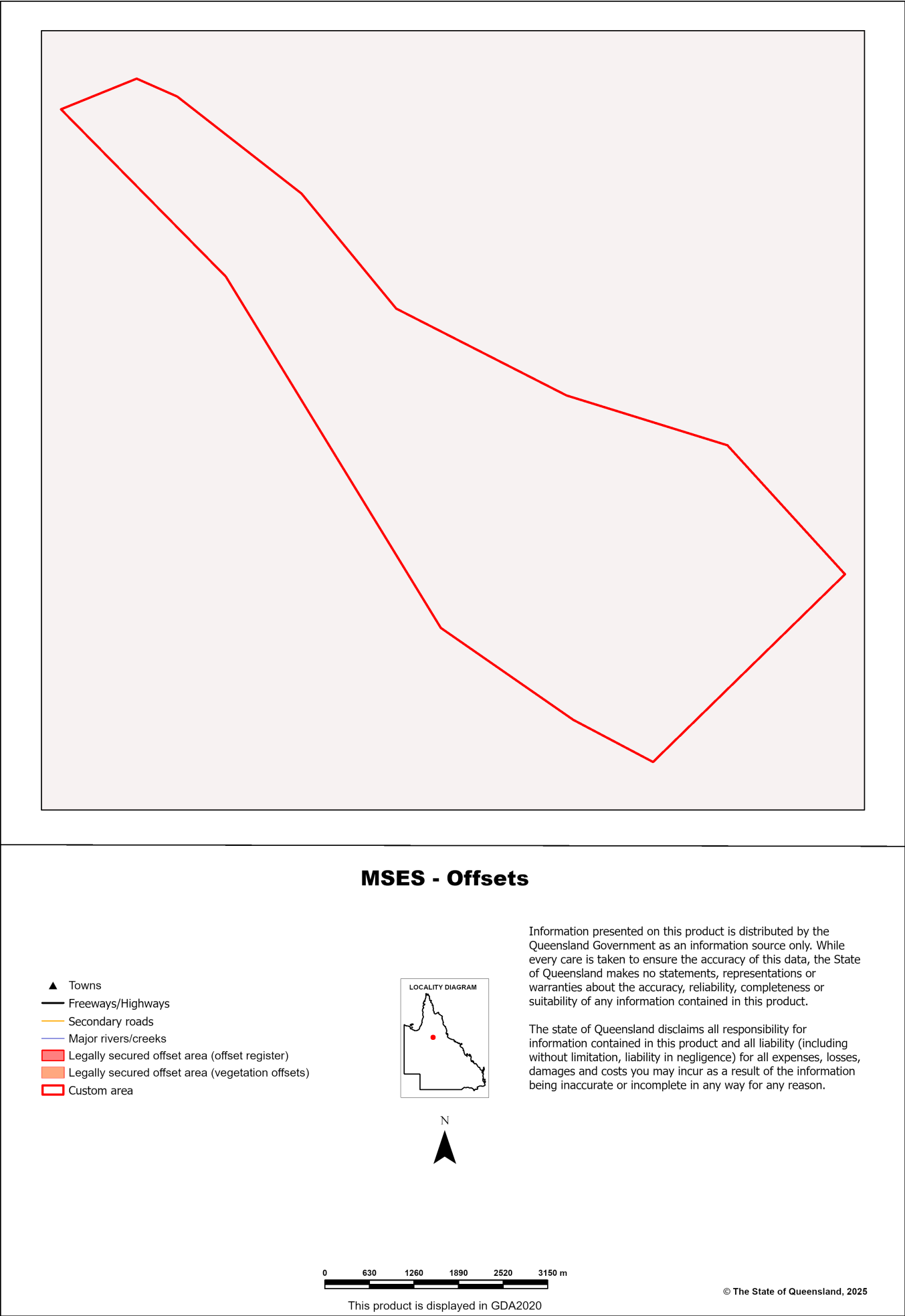


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Map 5 - MSES - Offset Areas



Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). Its primary purpose is to support implementation of the SPP biodiversity policy.

MSES mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations.

MSES mapping does not determine whether state or local development assessment is required. For state assessment triggers refer to the Development Assessment Mapping System (DAMS). For local assessment triggers, refer to the relevant local planning scheme.

The Queensland Government's "Method for mapping - matters of state environmental significance can be downloaded from:

<http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html> .

Appendix 2 - Source Data

The datasets listed below are available on request from:

<http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	current QSpatial data (http://qspatial.information.qld.gov.au)
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DETSI
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DETSI	- Department of the Environment, Tourism, Science and Innovation
EP Act	- Environmental Protection Act 1994
EPP	- Environmental Protection Policy
GDA2020	- Geocentric Datum of Australia 2020
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- Nature Conservation Act 1992
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- Vegetation Management Act 1999



APPENDIX B – MNES PROTECTED MATTERS



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 12-Aug-2025

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species

[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Chloebia gouldiae listed as Erythrura gouldiae Gouldian Finch [90091]	Endangered	Species or species habitat likely to occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area	In feature area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides minor Greater Glider (northern), Greater Glider (north-eastern Queensland) [92008]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area	In feature area
PLANT			
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Varanus mertensi Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat may occur within area	In feature area
Listed Migratory Species [Resource Information]			
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area

Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Reptile
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]
Species or species habitat may occur within area
In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Rungulla	Resources Reserve	QLD	In feature area
Rungulla	National Park	QLD	In feature area

EPBC Act Referrals				[Resource Information]	
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	
Not controlled action					

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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