

**ENVIRONMENTAL AUTHORITY
AMENDMENT - SUPPORTING
INFORMATION REPORT**

DUGALD RIVER MINE

EPML00731213

MINERALS AND METALS GROUP PTY LTD

JULY 2023



**WULGURU TECHNICAL
SERVICES**

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1. Introduction

Wulguru Technical Services Pty Ltd (WTS) was engaged by MMG Dugald River Pty Ltd (MMG) to prepare supporting information for an amendment to Environmental Authority (EA) EPML00731213, dated 19 December 2022. The proposed amendment will address matters relating to administrative and non-administrative amendments.

This report is submitted to the Department of Environment and Science (DES) in support of MMG's application to amend the EA and provides a detailed response to the following guidelines:

- *Approval processes for Environmental Authorities* (DES 2019b);
- *Application requirements for activities with impacts to air* (DES 2017a);
- *Application requirements for activities with impacts to land* (DES 2017b);
- *Application requirements for activities with impacts to water* (DES 2017c);
- *Application requirements for activities with noise impacts* (DES 2017d); and
- *Application requirements for activities with waste impacts* (DES 2019a).

1.1. Purpose

The purpose of this document is to describe the existing environmental values and assess the potential environmental impacts that may arise from the proposed amendment. A risk assessment has been completed for the identified potential impacts and reasonable and appropriate mitigation measures are proposed.

1.2. Project Location

Dugald River Mine (DRM) is located approximately 63 km northwest of Cloncurry in north-western Queensland (Figure 1). The site encompasses 40 Mining Leases (MLs) and one Mineral Development Lease (MDL) as detailed in Table 1.

Table 1. Granted and Underlying Tenure for DRM and Associated Linear Infrastructure

Permit	Permit Name	Area (ha)	Land Tenure
MDL 79	NA	227.59	59TG40; 36AP23793; 92SP303378
ML 2467	DUGALD 1	16.21	27B15753; 36AP23793
ML 2468	DUGALD 2	16.21	27B15753; 35B15753; 36AP23793
ML 2469	DUGALD 3	16.2	35B15753; 36AP23793; 36B15753
ML 2470	DUGALD 4	16.19	36AP23793; 36B15753
ML 2471	DUGALD 5	16.19	36AP23793
ML 2477	DUGALD 6	32.51	36AP23793
ML 2478	DUGALD 7	129.49	36AP23793; 92SP303378
ML 2479	DUGALD 8	32.37	36AP23793; 92SP303378
ML 2480	DUGALD 9	32.37	36AP23793; 92SP303378
ML 2481	DUGALD 10	129.49	36AP23793; 92SP303378
ML 2482	DUGALD 11	32.37	36AP23793
ML 2496	DUGALD RIVER NO 6	129.49	36AP23793
ML 2497	DUGALD RIVER NO 7	8.09	36AP23793
ML 2498	DUGALD RIVER 8	29.06	36AP23793; 36B15753
ML 2499	DUGALD RIVER 9	28.08	36AP23793
ML 2500	DUGALD RIVER 10	28.35	36AP23793
ML 2501	DUGALD RIVER 11	30.4	36AP23793
ML 2502	DUGALD RIVER 12	31.63	36AP23793
ML 2556	CLANDESTINE 7	127.72	36AP23793; 92SP303378
ML 2557	CLANDESTINE 8	129.14	36AP23793
ML 2558	CLANDESTINE 13	128.5	36AP23793; 92SP303378
ML 2559	CLANDESTINE 14	98.7	36AP23793; 92SP303378
ML 2596	DUGALD RIVER 51	19	36AP23793
ML 2599	DUGALD RIVER 57	44.77	36AP23793; 92SP303378
ML 2601	DUGALD RIVER 61	28.5	36AP23793
ML 2638	KNAPDALE	122.51	36AP23793; 92SP303378
ML 2684	DUGALD NO 12	1.05	36AP23793
ML 2685	DUGALD NO 13	2.45	36AP23793
ML 7496	DUGULD	24.76	27B15753; 35B15753; 36AP23793
ML 90047	KNAPDALE NO 2	8.36	36AP23793
ML 90049	DUGALD SOUTH NO 7	0.31	36AP23793
ML 90050	DUGALD SOUTH NO 8	0.22	36AP23793
ML 90051	SCANLAN NO 6	9.59	36AP23793
ML 90211	DUGALD TSF	642.67	36AP23793; 92SP303378
ML 90212	DUGALD TXS1	100.48	36AP23793; 92SP303378
ML 90213	DUGALD TXS2	31.7	36AP23793; 92SP303378
ML 90218	DUGALD WPIPE	43.49	5AP23793; 36AP23793

Permit	Permit Name	Area (ha)	Land Tenure
ML 90220	DUGALD PLINE	507.93	2BD56; 3635SP274652; 36AP23793; 3AP23793; 4144SP256851; 521CP905413; 7CP905412; 91SP303378; 92SP303378
ML 90230	DACCESS	120.32	2577PH139; 36AP23793; 92SP303378; 211SP136468
ML 90237	DUGALD TXS3	20.5	36AP23793; 92SP303378



Client: Dugald River Mine Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG:7844
 Date: 21 March 2023

Print as A3



Figure 1. Project Location

- Legend**
- Key Features
 - State Roads
 - Mine Lease
- ESRI Satellite

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1.3. Legislative Context

1.3.1. *Environmental Protection Act 1994 (Qld)*

The *Environmental Protection Act 1994* (EP Act) is Queensland's primary piece of environmental legislation. The objective of the EP Act is to 'protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'.

'Environment' is defined under the Act as (section 8):

- Ecosystems and their constituent parts, including people and communities;
- All natural and physical resources;
- The qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community; and
- The social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs (a) to (c).

To ensure the protection of environmental values, MMG are required to meet the requirements of the EP Act and its subordinate legislations.

1.3.2. *Mineral Resources Act 1989 (Qld)*

The *Mineral Resources Act 1989 (Qld)* (MR Act) provides for the assessment, development and utilisation of mineral resources. The MR Act establishes a framework to facilitate mining-related activities through the leasing of prospecting, exploration, mineral development, and mining tenure.

Approval is required to mine minerals specified in the lease and for all purposes necessary to effectually carry on the mining as well as purposes other mining specified in the ML and associated with, arising from, or promoting the activity of mining. Mining and production and associated activities including processing and rehabilitation must be conducted within a ML.

1.4. Overview of Proposed EA Amendment

Applications to amend an EA must be made in accordance with s.224 and s.225 of the EP Act and meet the application requirements detailed in s.226. An application must also comply with s.226AA, s.226A, s.226B, s.227 and s.227AA to be considered 'properly made'.

1.4.1. Administrative Amendments

Table 2 details the proposed administrative amendments to existing conditions. The proposed amendments do not propose any change to activity, nor do they increase the risk of environmental harm. As such, they have been assessed as having low risk to environmental values and have not been discussed further.

Where a non-administrative change has been proposed, the potential environmental impacts have been investigated, with the results presented in Section 4.

For completeness, a revised EA is provided in Appendix A for consideration. Revised figures for Schedule K – Maps/Plans have been provided in Appendix B for inclusion in the amended EA.

Table 2. Proposed Administrative Amendments

Condition		Proposed Amendment	Justification
<p>Schedule A – Table 1 (Authorised Mining Activities)</p>		<p>Remove the reference to the Plan of Operations.</p> <p>Proposed condition: Exploration activities must be consistent with conditions A33 and A34 of this environmental authority.</p>	<p>The Plan of Operations framework is no longer implemented. Disturbance areas and rehabilitation objectives are described in the approved Progressive Rehabilitation and Closure Plan.</p>
<p>A15</p>	<p>The emergency response/contingency plan required under condition A17 must address the following matters as a minimum:</p> <p>(a) response procedures to be implemented to prevent or minimise the risk of environmental harm arising from any emergency event or incident;</p> <p>(b) response procedures to minimise the extent and duration of environmental harm caused by any emergency event or incident;</p> <p>(c) the practices and procedures to be employed to restore the environment or mitigate any environmental harm caused by any emergency event or incident;</p> <p>(d) the resources to be used in response to any emergency event or incident;</p> <p>(e) procedures to investigate the cause of any emergency event or incident and where necessary, implement remedial actions to reduce the likelihood of recurrence of similar emergency event or incident;</p>	<p>Amend the reference from condition A17 to condition A14.</p> <p>Proposed condition: The emergency response/contingency plan required under condition A14 must address the following matters as a minimum:</p> <p>(a) response procedures to be implemented to prevent or minimise the risk of environmental harm arising from any emergency event or incident;</p> <p>(b) response procedures to minimise the extent and duration of environmental harm caused by any emergency event or incident;</p> <p>(c) the practices and procedures to be employed to restore the environment or mitigate any environmental harm caused by any emergency event or incident;</p> <p>(d) the resources to be used in response to any emergency event or incident;</p>	<p>The incorrect condition is referenced.</p>

Condition	Proposed Amendment	Justification
<p>(f) the provision and availability of documented procedures to staff attending any emergency event or incident to enable them to effectively respond;</p> <p>(g) training of staff that will be called upon to respond to any emergency event or incident to enable them to effectively respond;</p> <p>(h) timely and accurate reporting of the circumstance and nature of any emergency event or incident to the administering authority in accordance with conditions of this environmental authority;</p> <p>(i) procedures for accessing monitoring points during any emergency event or incident; and</p> <p>(j) procedures to notify any potentially impacted stakeholder who may be affected by the emergency event or incident.</p>	<p>(e) procedures to investigate the cause of any emergency event or incident and where necessary, implement remedial actions to reduce the likelihood of recurrence of similar emergency event or incident;</p> <p>(f) the provision and availability of documented procedures to staff attending any emergency event or incident to enable them to effectively respond;</p> <p>(g) training of staff that will be called upon to respond to any emergency event or incident to enable them to effectively respond;</p> <p>(h) timely and accurate reporting of the circumstance and nature of any emergency event or incident to the administering authority in accordance with conditions of this environmental authority;</p> <p>(i) procedures for accessing monitoring points during any emergency event or incident; and</p> <p>(j) procedures to notify any potentially impacted stakeholder who may be affected by the emergency event or incident.</p>	
<p>A25</p> <p>All exploration activities carried out at the licensed place must comply with each of the Standard Environmental Conditions contained in the most recent version of the <i>Code of Environmental Compliance for exploration and mineral development projects</i>.</p>	<p>All exploration activities carried out at the licensed place must comply with each of the Standard Environmental Conditions contained in the most recent version of the <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i>.</p>	<p>The <i>Code of Environmental Compliance for exploration and mineral development projects</i> has been superseded by the <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i>.</p>

Condition		Proposed Amendment	Justification
A26	Disturbance due to exploration activities in areas not scheduled to be mined within twelve (12) months must be rehabilitated in accordance with the provisions detailed in the administering authority's <i>Code of Environmental Compliance for Exploration and Mineral Development Projects</i> .	Disturbance due to exploration activities in areas not scheduled to be mined within twelve (12) months must be rehabilitated in accordance with the provisions detailed in the administering authority's <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i> .	The <i>Code of Environmental Compliance for exploration and mineral development projects</i> has been superseded by the <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i> .
A27	Where a condition of this environmental authority refers to a matter addressed in the <i>Code of Environmental Compliance for Exploration and Mineral Development Projects</i> , the condition of this environmental authority prevails.	Where a condition of this environmental authority refers to a matter addressed in the <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i> , the condition of this environmental authority prevails.	The <i>Code of Environmental Compliance for exploration and mineral development projects</i> has been superseded by the <i>Eligibility criteria and standard conditions for exploration and mineral development projects</i> .
B16	A wash bay for mobile equipment must be installed as part of the mineral concentrate storage facility, for cleaning machinery before exit from the area and to prevent the movement of mineral concentrate outside the building.	Remove condition	This condition is not relevant to DRM as there is no movement of vehicles in or out of the concentrate shed. The concentrate shed is considered to be a concentrate transfer point; it is not used for storage of concentrate. Concentrate is deposited into the concentrate transfer shed from the processing plant where it is collected by a front-end loader and transferred into two half height shipping containers while the shed is under negative pressure. The containers are then washed. At this point, the doors are opened, and the

Condition		Proposed Amendment	Justification
			<p>containers are removed via a telehandler. The front end loader does not leave the concentrate shed. Likewise, the reach stacker does not enter the concentrate shed.</p> <p>The concentrate transfer shed does contain a sump to capture contaminated water from the washing of the containers and the front end loader. This sump reports to either the lead or zinc thickener within the processing circuit, depending on what type of concentrate is being loaded.</p>
Schedule C – Table 1 (Release Points)		<p>Remove the reference to “controlled release pipes” in the description of Sediment Dam C and Sediment Dam D.</p> <p>Proposed condition: Stormwater runoff from the existing construction camp, the change house and car park, the administration building and data centre, the sewerage treatment plant, water treatment plant and the vehicle wash bay – from the Sediment Dam C spillway.</p>	<p>Water is released via the spillway only. Controlled release pipes are not and have never been used at DRM.</p>
Schedule C – Table 1 (Release Points)		<p>Amend the reference to the PAF waste rock dumps in relation to the source of water reporting to Sediment Dam G.</p>	<p>Sediment Dam G does not and has never received runoff from the PAF waste rock dumps.</p>

Condition		Proposed Amendment	Justification
		Proposed Condition: Stormwater runoff from the clean water catchments adjacent to the PAF waste rock dumps – from the Sediment Dam G spillway.	
	Schedule C – Table 2 (Contaminant Release Limits)	Remove cyanide as a monitoring parameter.	Cyanide is not stored or used in processing activities at DRM and is not considered a risk to environmental values.
	Schedule C – Table 3 (Contaminant Release during Flow Events)	Addition of release point – Sediment Dam D to report to Silvermine Creek.	Improve clarity on release points.
	Schedule C – Table 3 (Contaminant Release during Flow Events)	Addition of release point – Sediment Dam G to report to North Creek.	Improve clarity on release points.
C28	The holder of this environmental authority must undertake a review of the water management plan before 1 November each year to ensure that proper and effective measures, practices or procedures are in place so that the mine is operated in accordance with the conditions of this environmental authority and that environmental harm is prevented or minimised.	Remove condition.	This is a duplication of condition A7 that requires any management plan be reviewed every three years. Due to the nature of activities (underground extraction) and limited surface disturbance, a review every three years is sufficient to capture any changes on site that may influence water management controls.
	Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits)	Remove cyanide as a monitoring parameter.	Cyanide is not stored or used in processing activities at DRM and is not considered a risk to environmental values. It is noted that footnote 5 specifies that monitoring for cyanide is deferred until such time that cyanide is introduced into the mining

Condition		Proposed Amendment	Justification
			process. DRM have no intention of using cyanide in processing, therefore the condition is redundant.
Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency)		Remove Saturday Bore from Schedule C - Table 7 (Groundwater Monitoring Locations and Frequency)	<p>Saturday Bore has collapsed and is no longer serviceable for obtaining groundwater levels or samples for analysis. Removing the bore from Table 7 provides clarity on monitoring commitments.</p> <p>It has been assessed that the removal of the Saturday Bore from the network does not diminish the effectiveness of groundwater monitoring at DRM. Further information is provided in Appendix D.</p>
C18	The release of contaminants must not result in an exceedance of contaminant limits stated in Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits) at the downstream monitoring points specified in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points).	<p>Revise condition to be consistent with the requirements of Condition C17.</p> <p>Proposed condition: The release of contaminants must not result in an exceedance of contaminant limits stated in Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits) at the downstream monitoring points specified in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points). Where the downstream result is the same or a lower value than</p>	The results of monitoring conducted at downstream locations is compared to reference sites, as described in C17. The addition of this statement provides clarity to the existing approach.

Condition		Proposed Amendment	Justification
		the reference site value for the quality characteristic during the monitoring event then no action is to be taken.	
I14	Rehabilitation must commence progressively as soon as areas become available and in accordance with the plan of operations.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I15	Within six (6) months of the commencement of tailings disposal in the tailings storage facility, the holder of this environmental authority must commence trials to establish suitable capping systems for infrastructure on the licensed place including but not limited to the tailings storage facility and all waste rock dumps.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I16	By 1 October 2017 and once every two (2) years thereafter the holder of this environmental authority must submit a report to the administering authority detailing the success and findings from the capping system trials.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I17	By 2 October 2019 the holder of this environmental authority must submit to the administering authority a report nominating the most appropriate capping system for the tailings storage facility based on the results from trials required by condition I18.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I18	A Post Mine Land Use Plan must be developed and implemented by the authority holder and submitted to the administering authority upon request. The PMLUP must be	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).

Condition	Proposed Amendment	Justification
<p>developed by an appropriately qualified person and include:</p> <ul style="list-style-type: none"> (a) schematic representation of final land form inclusive of drainage features; (b) slope designs; (c) cover design (not limited to store and release covers); (d) drainage design; (e) erosion controls; (f) description of experimental design for monitoring of analogue and rehabilitated areas inclusive of statistical design; (g) proposed revegetation methods inclusive of plant species selection, re-profiling, respreading soil, soil ameliorants/amendments, surface preparation and method of propagation; (h) materials balance including available top soil, and low permeability capping material; (i) geotechnical, geochemical and hydrological studies; 		

Condition	Proposed Amendment	Justification	
(j) chemical, physical and biological properties of soil and water; and a rehabilitation monitoring program as required by condition I20			
I19	A rehabilitation monitoring program must be developed and be implemented on commencement of rehabilitation identified in Schedule I – Table 1 (Dugald River Project Rehabilitation Requirements) by an appropriately qualified person.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I20	The holder of this environmental authority must conduct rehabilitation monitoring in accordance with the program developed in condition (I21) at least once a year including sufficient spatial and temporal replication to enable scientifically justifiable conclusions to be made, as established in the rehabilitation monitoring program.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I21	Verification of rehabilitation success is to be carried for each domain. Monitoring must be carried out for each domain at a minimum sampling intensity of 1:15,000 and must include sufficient replication to enable statistical analysis of results at an acceptable power.	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).
I22	A Post Closure Management Plan must be developed and implemented by the authority holder and submitted to the administering authority upon request. The Plan must be implemented for a period of:	Delete condition.	Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).

Condition	Proposed Amendment	Justification	
	<p>(a) at least thirty (30) years following cessation of the mining activity (excluding rehabilitation) on the licensed place; or</p> <p>(b) a shorter period if:</p> <p>(i) the licensed place is proven to be geo-technically and geo-chemically stable; and</p> <p>(ii) it can be demonstrated to the satisfaction of the administering authority that no release of contaminants from the licensed place will result in environmental harm.</p>		
I23	<p>The Post Closure Management Plan must include the following elements:</p> <p>(a) operation and maintenance of:</p> <p>(i) contaminated water collection and reticulation systems;</p> <p>(ii) contaminated water treatment systems;</p> <p>(iii) the groundwater monitoring network;</p> <p>(iv) final cover systems; and</p> <p>(v) vegetative cover.</p> <p>(b) monitoring of:</p> <p>(i) surface water;</p> <p>(ii) groundwater;</p> <p>(iii) seepage rates;</p>	<p>Delete condition.</p>	<p>Superseded by conditions imposed by the Progressive Rehabilitation and Closure Plan (PRCP).</p>

Condition		Proposed Amendment	Justification
	<ul style="list-style-type: none"> (iv) erosion rates; (v) the integrity and effectiveness of final cover systems; and (vi) the health and resilience of vegetative cover. 		
Schedule K – Maps/Plans		Update mapping format to be consistent with other Schedule K maps and include additional disturbance proposed.	Provide consistency in Schedule K maps.

1.4.2. Non-Administrative Amendments

Additional amendments are proposed relating to a change in activity at DRM. The proposed amendments are summarised in Table 3. The potential environmental impacts of the proposed actions are discussed in Section 4.

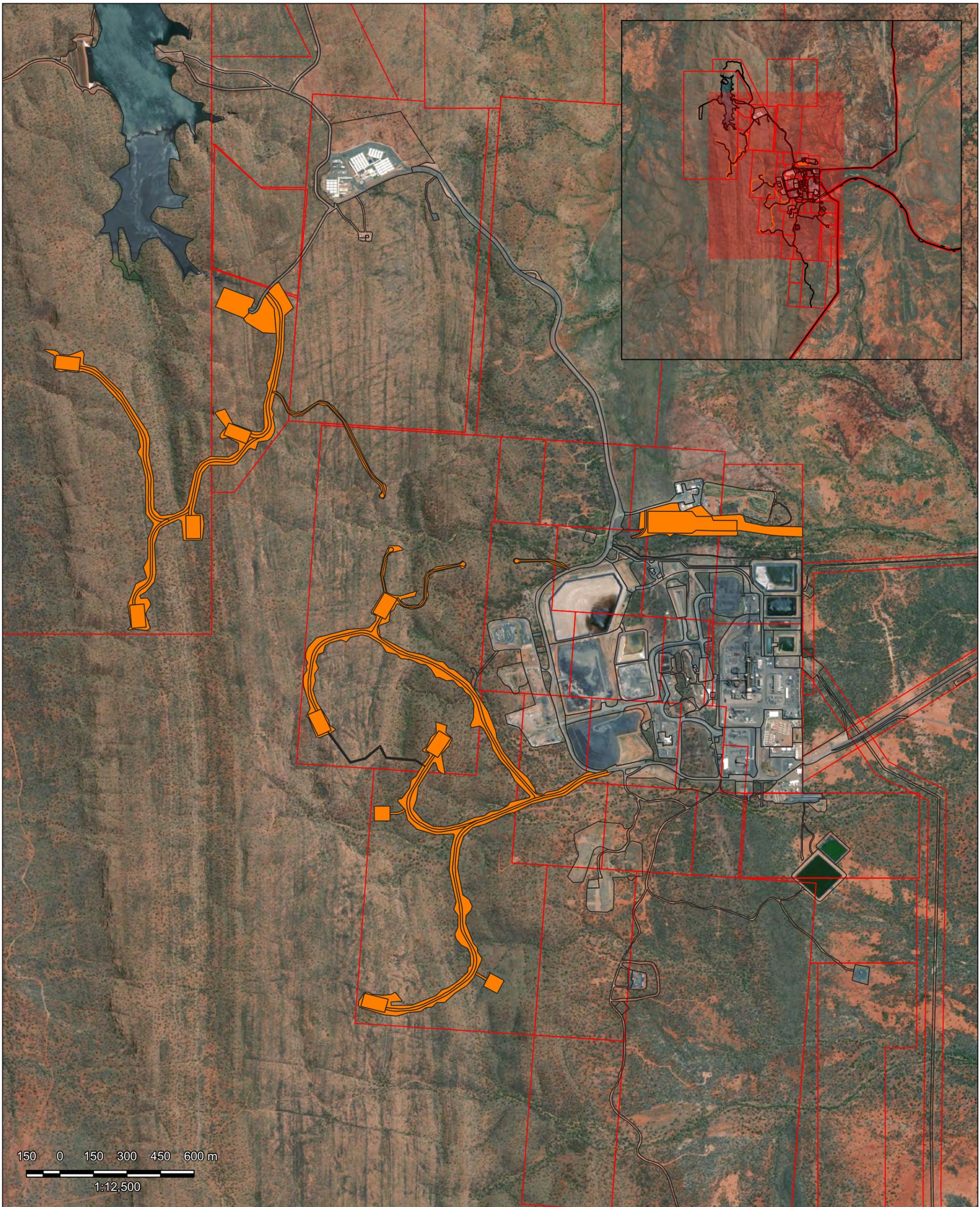
Table 3. Proposed Amendments to Site Specific Conditions

Condition	Proposed Amendment	Justification
<p>Schedule A – Table 1 (Authorised Mining Activities)</p>	<p>Addition of 38 ha disturbance area for wind farm access tracks and pads.</p>	<p>The wind farm at DRM will have the potential to offset approximately 40% of DRMs power usage (currently sourced from the gas fired Diamantina power station) via renewable energy sources and contribute to MMGs commitment of net zero Scope 1 and Scope 2 emissions by 2050. The locations for the windfarm have been defined through detailed studies based on the geotechnical requirements of the turbines. Additionally, the wind turbines must be located above 270 mAHD. As such, the proposed locations for the drill pads and associated roads and tracks are the most suitable at the proposed location, taking into consideration the operations of the Tailings Storage Facility. The width of the proposed tracks is required to enable safe transport of infrastructure to the final locations. Existing tracks have been utilised, where possible, to minimise disturbance.</p> <p>Potential impacts to land and control measures are described in Section 4.1.</p>
<p>Schedule A – Table 1 (Authorised Mining Activities)</p>	<p>Revise the location of the Sewage Treatment Plant to 412059.8, 7760070.</p>	<p>The facility is proposed to be relocated. There are no proposed changes to the Maximum Disturbance Area.</p> <p>Potential impacts to land and control measures are described in Section 4.1.</p>
<p>New condition within Schedule A – General, Exploration</p>	<p>New Condition</p> <p>Proposed condition: The holder of the environmental authority must not carry out activities in a category A or B</p>	<p>The latest version of the Code of Environmental Compliance for exploration and mineral development projects (Eligibility criteria and standard conditions for exploration and mineral development projects) specifies that activities involving machinery must not be carried out within 1 km of a category A environmentally sensitive area or within 500 m of a</p>

Condition		Proposed Amendment	Justification
		environmentally sensitive area. Activities involving machinery must not be carried out within 1km of a category an environmentally sensitive area or within 50 m of a category B environmentally sensitive area.	category B environmentally sensitive area. The proposed amendment is to reduce this buffer to allow machinery to work up to 50 m from a category B environmentally sensitive area. This will allow MMGs exploration program to continue, with appropriate controls to mitigate impact to category B environmentally sensitive areas. Potential impacts to land and control measures are described in Section 4.1.
	Schedule A – Table 1 (Authorised Mining Activities)	Addition Ventilation Shaft 9 at 411466.4, 7761320 (0.5 ha).	An additional shaft is proposed to be located on an existing track. This will result in no net increase in surface disturbance. No impacts to land are anticipated.
	Schedule A – Table 1 (Authorised Mining Activities)	Addition of Switchyard 2 at 411878, 7760073 (1 ha).	An additional switchyard is required to support renewable energy projects. The switchyard is to be located on an existing track, resulting in no net increase in surface disturbance. No impacts to land are anticipated.
	Schedule A – Table 1 (Authorised Mining Activities)	Addition of 7 ha to Office and Administration Buildings for a battery farm.	A battery farm is required to support renewable energy projects. Potential impacts to land and control measures are described in Section 4.1.
	Schedule A – Table 1 (Authorised Mining Activities)	Additional of 0.75 ha of disturbance for power infrastructure to support the battery farm	A battery farm is needed to support renewable energy projects. Potential impacts to land and control measures are described in Section 4.1.
B14	The buildings and structures in place at the licensed place for the storage, stockpiling and loading of	Remove condition	The likelihood of a Category 2 cyclone crossing the Cloncurry region is low.

Condition		Proposed Amendment	Justification
	mineral concentrate must be constructed and maintained to withstand a Category 2 cyclone.		<p>Additionally, the concentrate shed is considered to be a concentrate transfer point; it is not used for storage of concentrate. Concentrate is deposited into the concentrate transfer shed from the processing plant where it is collected by a front-end loader and transferred into two half height shipping containers while the shed is under negative pressure.</p> <p>In the unlikely event that a cyclone did occur in the region, there would be no concentrate stored within the shed, and therefore the risk of loss of concentrate is negligible.</p> <p>Potential impacts to land and control measures are described in Section 4.1</p>
B15	The construction and state of the buildings and structures in place at the licensed place for the storage, stockpiling and loading of mineral concentrate must be checked for compliance with condition B14 by an appropriately qualified person at least once every three (3) years.	Remove condition.	As above.
Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits)		Remove the contaminant limit for total Aluminium, replace the trigger level and contaminant limit for filterable Aluminium with site specific values. A historical dataset is provided in Appendix F.	<p>The existing Contaminant Limit for total aluminium (T-Al) of 0.2 mg/L is derived from ANZECC 2000 guidelines for recreational purposes (body immersion). As the surrounding land uses at DRM are pastoral, it is unlikely that the receiving waters would be used for recreational purposes.</p> <p>This is discussed further in Section 4.2.</p>

Condition	Proposed Amendment	Justification
<p>Schedule D – Table 2 (Hydraulic performance criteria for Regulated Dams)</p>	<p>Remove the hydraulic performance criteria for the Stage 2 PAF Run Off Dam.</p> <p>Revise the associated footnotes to reference the most recent consequence category assessment.</p>	<p>The Consequence Category of a dam is used to determine the level of safety that is applied to the design, construction, and operation of the structure.</p> <p>Hydraulic performance criteria are required for regulated dams that are assessed as a ‘significant’ or ‘high’ consequence for the overtopping scenario.</p> <p>The consequence category for the PAF 2 Run Off Dam was re-assessed in May 2023 with a resultant rating of ‘low’ for overtopping. Hydraulic performance criteria are therefore not required. More detail is provided in Appendix C.</p> <p>Potential impacts to water and control measures are described in Section 4.2.</p>



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 CRS: GDA2020 EPSG:7844
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Figure 2. Proposed Disturbance Areas

- Legend**
- Disturbance Footprint
 - Existing
 - Additional
 - Mine Lease
 - ESRI Satellite

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1.4.3.Environmentally Relevant Activities

The operations Environmentally Relevant Activities (ERAs) defined under the Environmental Protection Act 1994 (EP Act) and approved in the EA are listed below (Table 4).

No changes are proposed to the existing ERAs.

Table 4. Approved Environmentally Relevant Activities for DRM as listed in EPML00731213

ERA Number	Description
8-(1)	Chemical storage >50t class 1 or 2
8-(3)	Chemical storage >500m ³ class C1 or C2
8-(4)	Chemical storage >200t solids or gases
15	Fuel burning >500kg per hr
16-(2c)	Extractive >1,000,000t per yr
16-(3c)	Screening >1,000,000t per yr
31-(2b)	Mineral processing >100,000t per yr
33	Crushing, milling, grinding or screening >5,000t per yr
63-(1b)(i)	Sewage treatment >100 to 1500EP – IT or IR
63-(1b)(ii)	Sewage treatment >100 to 1500EP – no IT or IR
Mining – site specific	ML gold ore - 16
Mining – site specific	ML copper ore - 17
Mining – site specific	ML lead, silver or zinc - 18

1.4.4.Notifiable Activities

The following notifiable activities are currently associated with the DRM operation:

- **Notifiable Activity 7: Chemical storage** (other than petroleum products or oil under item 29)—storing more than 10 t of chemicals (other than compressed or liquefied gases) that are dangerous goods under the dangerous goods code.
- **Notifiable Activity 15: Explosives production or storage**—operating an explosives factory under the *Explosives Act 1999*.
- **Notifiable Activity 24: Mine wastes**—storing hazardous mine or exploration wastes, including, for example, tailings dams, overburden or waste rock dumps containing hazardous contaminants; or
exploring for, or mining or processing, minerals in a way that exposes faces, or releases groundwater, containing hazardous contaminants.
- **Notifiable Activity 25: Mineral processing**—chemically or physically extracting or processing metalliferous ores.
- **Notifiable Activity 37: Waste storage, treatment or disposal**—storing, treating, reprocessing or disposing of waste prescribed under a regulation to be regulated waste, for this

item (other than at the place it is generated), including operating a nightsoil disposal site or sewage treatment plant where the site or plant has a design capacity that is more than the equivalent of 50 000 persons having sludge drying beds or on-site disposal facilities.

No changes are proposed to the existing notifiable activities.

1.4.5. Assessment Level Consideration

Under s.228 of the EP Act, the administering authority must decide whether the proposed amendment is a minor or a major amendment. WTS considers the proposed amendment to be a major amendment, supported by the thresholds detailed in Table 5.

Table 5. Thresholds to be considered a major amendment (threshold) assessment level decision

Consideration	Response
(a) is not a change to a standard condition identified in the EA as a standard condition, other than a condition conversion or replacing a standard condition with a standard condition for the ERA; and	The proposed amendment includes a change to condition A13 in the <i>“Eligibility criteria and standard conditions for exploration and mineral development projects”</i> . WTS considers the proposed amendment to be a major amendment for this reason.
(b) does not significantly increase the level of environmental harm caused by the relevant activity; and	The proposed changes do not significantly increase the level of environmental harm.
(c) does not change any rehabilitation objectives in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the EA; and	Additional surface disturbance is proposed in the form of access tracks and pads for the development of a wind farm and a battery farm to support renewables projects. Rehabilitation objectives will remain as described in the Progressive Rehabilitation and Closure Plan. A revised PRCP is submitted as part of this amendment application to include the additional proposed disturbance.
(d) does not significantly increase the scale or intensity of the relevant activity; and	The proposed changes do not significantly increase the scale or intensity of the activity.
(e) does not relate to a new relevant resource tenure for the EA that is— (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act 2010; or	The proposed amendments do not relate to a new resource tenure.

Consideration	Response
(iv) a new greenhouse gas injection and storage lease under the Greenhouse Gas Storage Act 2009; and	
(f) increases the existing surface area for the relevant activity by 10% or less; and	The proposed amendment will result in approximately 46 ha of additional surface disturbance. The area is less than 10% of the current approved disturbance for DRM.
(g) for an EA for a petroleum activity: <ul style="list-style-type: none"> <li>i. involves constructing a new pipeline that does not exceed 150km in length; and <li>ii. involves extending an existing pipeline by no more than 10% of the existing length of the pipeline; 	This is not a petroleum activity.

2. Project Description

2.1. Project Background

The DRM ore body was discovered in the late 1900s following early small-scale mining and prospecting. The explorers identified gossanous zinc/ lead/ silver outcropping between two main drainage features on the plains below the Knapdale Range. Evidence of the outcropping is still visible within a demarcated area of the mines surface features. The surrounding area is littered with surficial copper oxides deposits as well as historic small scale mining features including waste dumps, collapsed shafts and rusted infrastructure (WTS 2021).

Systematic exploration of the deposit began in the 1950s. Zinifex Australia Limited started the most recent phase of exploration in 2004 who subsequently began the process of gaining State and Federal approvals. During this period, the Project was purchased by Minerals and Metals Group (MMG) with approval being granted in 2012 and the first phase of construction (earth works, waste rock pads and dams and underground development) following in 2013. After a brief pause mid-construction to more thoroughly investigate the mining methodology, the Project was completed early 2017. MMG shipped the first parcel of zinc concentrate later that year (WTS 2021).

2.2. Overview of Proposed Activities

Additional surface disturbance is proposed related to the following:

- Approximately 38 ha for construction of wind turbine pads and access tracks to enable safe transport of infrastructure required for the wind farm;
- Approximately 7 ha for construction of a battery farm to support the renewables project;
- Approximately 0.75 ha for power infrastructure to connect to the battery farm;
- Approximately 0.2 ha for relocation of the exploration camp STP; and
- Approximately 0.05 ha for additional groundwater infrastructure.

The areas designated for Switchyard 2 and Ventilation Shaft 9 have been previously used for access roads, therefore no additional clearing or surface disturbance is required for these features.

The proposed disturbance areas are shown on Figure 2.

3. Existing Environment

3.1. Climate

DRM is situated within the northwest highlands biogeographic region. The bioregion is characterised by distinctive wet and dry seasons with hot conditions and periods of rainfall between November to April, and relatively dry and mild conditions between May to October.

Statistics from the nearest Bureau of Meteorology weather station at the Cloncurry Airport (BOM 2023 - Station ID 29141 1978-current) generalise a 12°C spread of the mean monthly minimum and maximum daily temperatures during summer while increasing to 14°C in winter (Figure 3). The highest mean monthly temperatures are recorded in December and the lowest in July (Table 6).

Most rainfall measured at the Cloncurry Airport is received between January and February (Figure 4) with an annual average rainfall of 501.1mm. With only 35 days where rainfall is ≥ 1mm, short and intense storm events are common (Table 7).

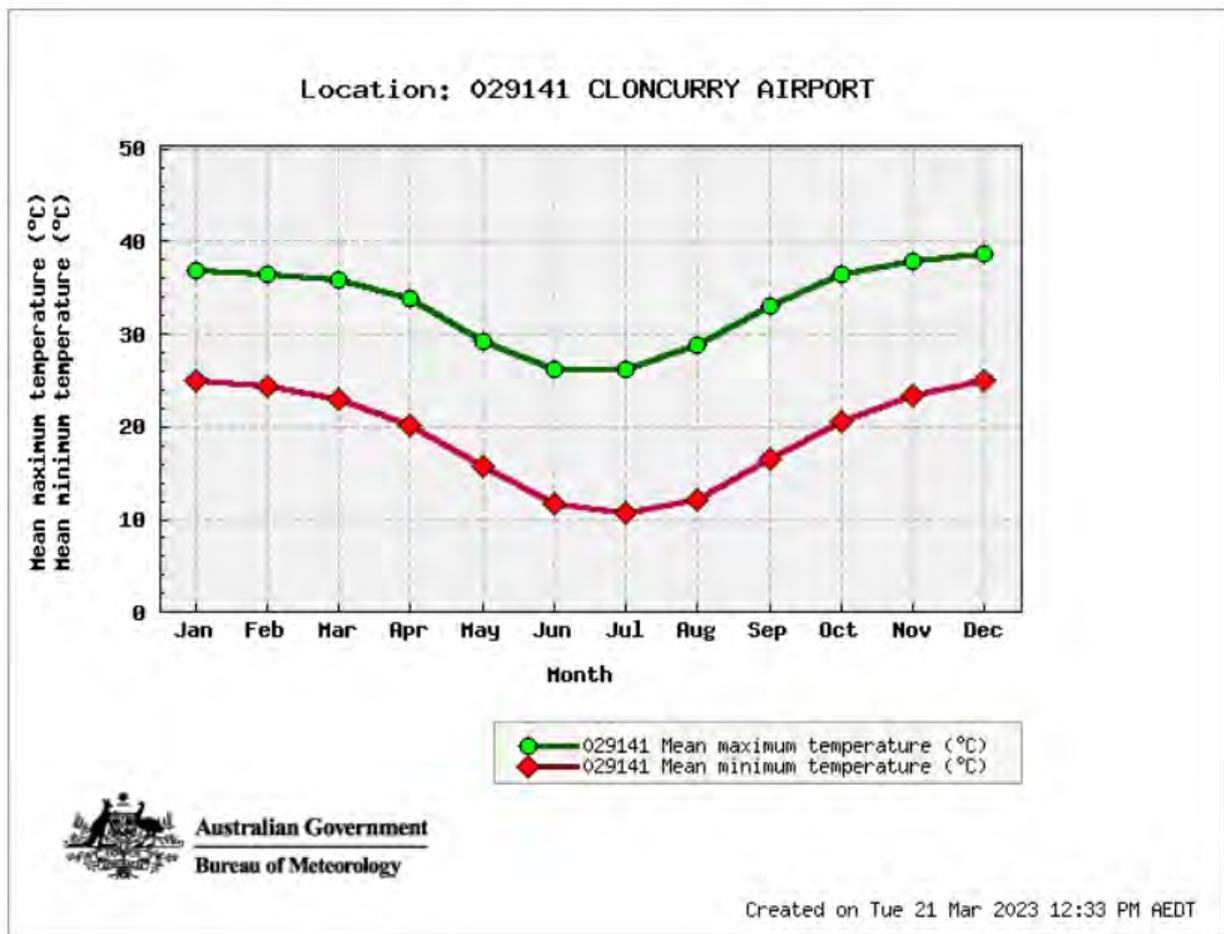


Figure 3. Minimum and Maximum Monthly Mean Temperatures from the Cloncurry Airport (BOM 2023)

Table 6. Temperature Statistics Recorded from the Cloncurry Airport (BOM 2023)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Temp max (°C)	36.9	36.4	35.9	33.8	29.3	26.2	26.3	28.8	33.1	36.5	37.9	38.7	33.3
Mean Temp min (°C)	25.1	24.3	23.0	20.2	15.7	11.8	10.8	12.2	16.6	20.6	23.3	25.0	19.0

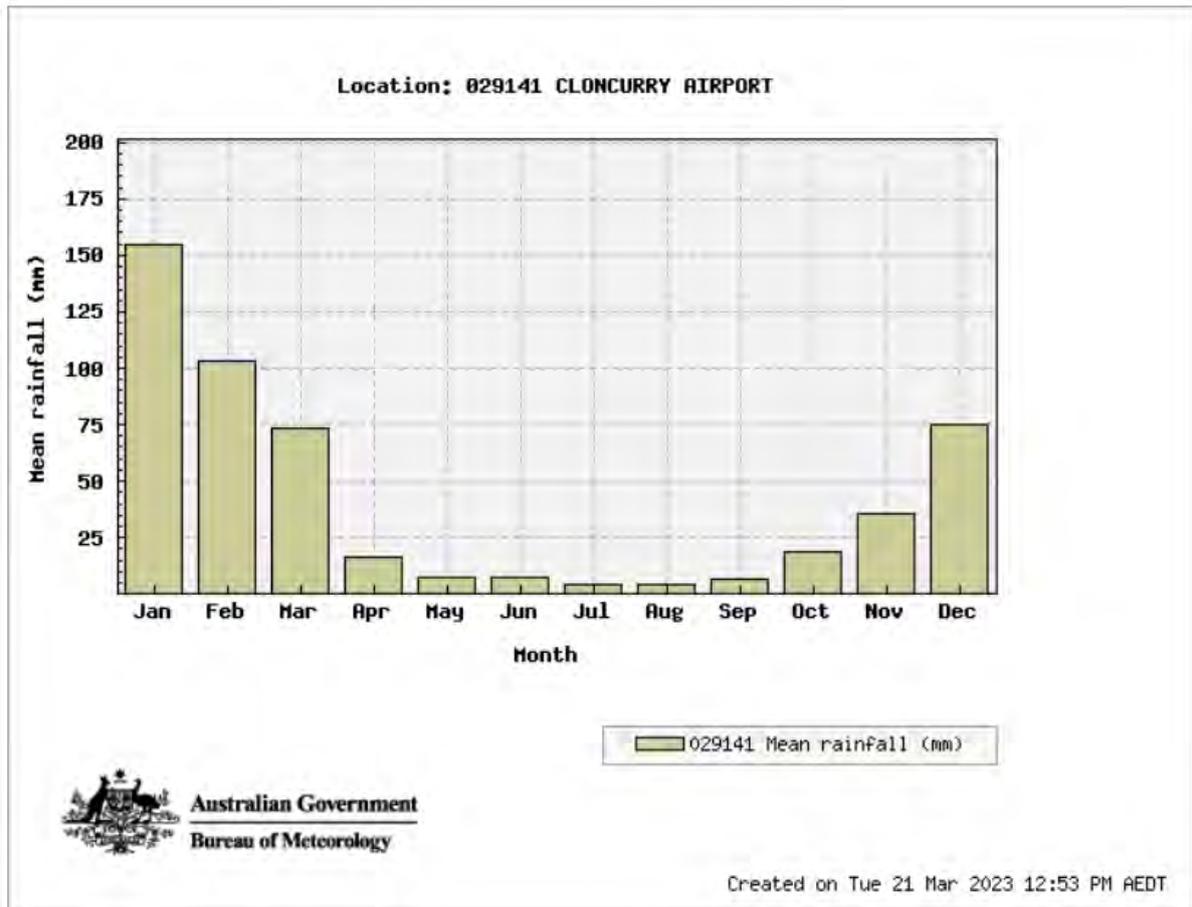


Figure 4. Mean Monthly Rainfall Recorded from the Cloncurry Airport (BOM 2023)

Table 7. Rainfall Statistics Recorded from the Cloncurry Airport (BOM 2023)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm)	154.8	103.4	73.7	16.0	7.6	7.8	4.3	4.1	6.9	18.8	35.8	75.1	501.1
Days ≥ 1mm	8.3	6.2	4.2	1.4	0.8	0.7	0.5	0.4	1.2	2.0	3.8	5.4	34.9

3.2. Topography and Hydrology

3.2.1. Topography

The topography of DRM is dominated by the Knapdale Range (Knapdales) as the topographical high (~310m AHD). The Knapdales is a north-south orientated formation ~14km long and ~2.5km wide sharply transitioning to undulating country east to the Dugald River and west to Cabbage Tree Creek at ~200m AHD (Figure 5).

The mining and processing infrastructure is located on the eastern slope of the Knapdale Range with the Tailings Storage Facility sited within the centre valley of the range, formerly draining to the west.

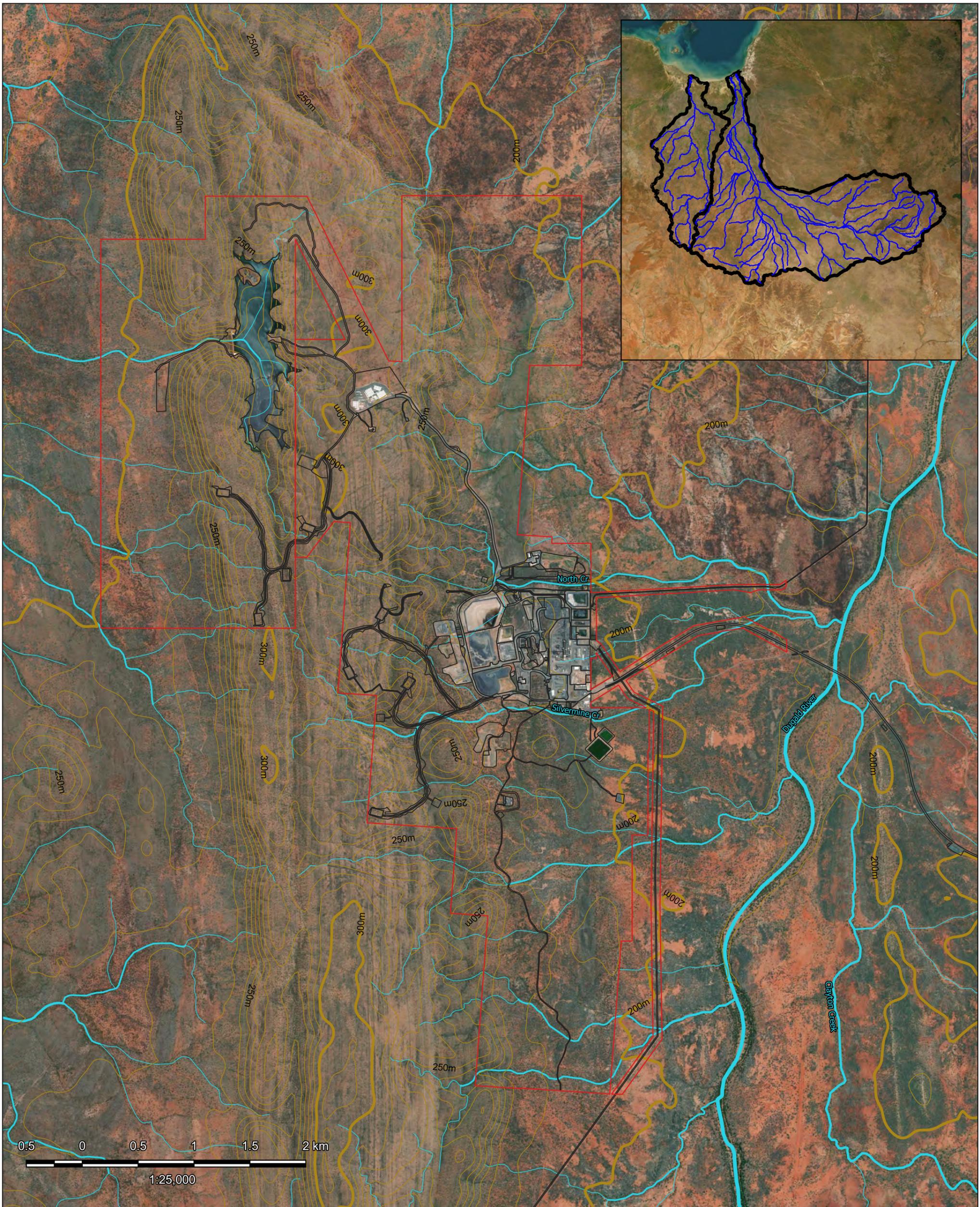
3.2.2. Hydrology

Regionally DRM is situated in the Leichardt and Flinders drainage basins with the Knapdale Range providing the drainage divide between the two catchments (WRM Water & Environment Pty Ltd, 2010). Both the Leichardt and Flinders Rivers drain north into the Gulf of Carpentaria approximately 300 km north of DRM (Figure 6).

Locally, the DRM area is dominated by 1st and 2nd order ephemeral drainage features that flow intermittently during wet season rains. The north-west portions of the MLs drain to the north through 1st and 2nd order streams to the Vieux Rose Creek and Cabbage Tree Creek which flow into Pinnacle Creek, a tributary of the Leichardt River. Drainage to the east and south of the Knapdales enters the Flinders River via Dugald River, a tributary of the Cloncurry River (WTS 2021). The catchments associated with the predominant mine features are listed in Table 8.

Table 8. Local Catchments and Mine Features

Local catchment	Mine features
Silvermine Creek	Mining, processing, mineral waste storage, administration, mine access, village, and logistics
Vieux Rose Creek	Village
Cabbage Tree Creek	Tailings storage facility



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Figure 5. Topography and Hyrdology

Legend

- Mining Lease
- Disturbance Footprint
- 10m Contour
- ESRI Satellite

Watercourse - Stream Order

- 1
- 2
- 3
- 5

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3.3. Waters

3.3.1. Surface Water

3.3.1.1. Environmental Values

The Environmental Protection Policy (Water and Wetland Biodiversity) (EPP Water) details the scheduled water quality basins and their specific management intent. DRM is situated between the Leichardt and Flinders drainage basins with the Knapdale Range providing the drainage divide between the two catchments. No Environmental Values are listed for either the Leichardt or Flinders drainage basins. In the absence of EVs for either catchment, the following EVs have been adopted from the EPP Water Part 3:

- For high ecological value waters—the biological integrity of an aquatic ecosystem that is effectively unmodified or highly valued; or
- For slightly disturbed waters—the biological integrity of an aquatic ecosystem that has effectively unmodified biological indicators, but slightly modified physical, chemical or other indicators; or
- For moderately disturbed waters—the biological integrity of an aquatic ecosystem that is adversely affected by human activity to a relatively small but measurable degree; or
- For highly disturbed waters—the biological integrity of an aquatic ecosystem that is measurably degraded and of lower ecological value than waters mentioned in paragraphs (a) to (c); or
- For waters from which aquatic foods intended for human consumption are taken—the suitability of the water for producing the foods for human consumption; or
- For waters that may be used for aquaculture—the suitability of the water for aquacultural use; or
- For waters that may be used for agricultural purposes—the suitability of the water for agricultural purposes; or
- For waters that may be used for recreation or aesthetic purposes—the suitability of the water for—
 - Primary recreational use; or
 - Secondary recreational use; or
 - Visual recreational use; or
- For waters that may be used for drinking water—the suitability of the water for supply as drinking water having regard to the level of treatment of the water; or
- For waters that may be used for industrial purposes—the suitability of the water for industrial use; or

- The cultural and spiritual values of the water (Environmental Protection Act 1994 (Qld) (b)).

3.3.1.2. Water Quality Trigger Limits

The EA provides receiving water reference sites and downstream monitoring locations (Schedule C – Table 4 of the EA). Each site is monitored and sampled in accordance with Schedule C Table 5 of the EA, presented in Table 9.

Table 9. Receiving Waters Trigger Levels and Contaminant Limits (Schedule C - Table 5 of the EA)

Quality Characteristic	Unit	Trigger Level	Contaminant Limit	Monitoring Frequency
Hardness (CaCO ₃)	mg/L	For interpretation purposes		<p><u>Sites on tributaries of Dugald River:</u></p> <p>Sample daily for the first two days when releases or stream flows commence at interpretative sites. If releases or flows at interpretative sites persist, sample weekly until flow ceases.</p> <p><u>Dugald River Sites:</u></p> <p>Sample Dugald River sites daily while there is flows at DR-14, and daily for one week after cessation of flows at SC-38 and SN-23.</p> <p>Sample monthly if flows are present in Dugald River during the wet season.</p> <p><u>Cabbage Tree Creek sites:</u></p> <p>Sample CT3-08, CC-05 and CC-15 daily when flows are present at CT3-08 and sample CC-05 and CC-15 daily for</p>
pH	pH Units	6.0 (minimum) 8.6 (maximum)	5.5 (minimum) 9.0 (maximum)	
Electrical Conductivity	µS/cm	435 or 80 th percentile of reference whichever is higher	1000	
Total Suspended Solids	mg/L	For interpretation purposes		
Sulfate	mg/L	77 [Dugald River] or 80 th percentile of reference whichever is higher	400	
Fluoride	mg/L	80 th percentile of reference	2 or 95 th percentile of reference whichever is lower	
Aluminium (dissolved)	mg/L	0.055 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Aluminium (total)	mg/L	-	0.2	
Arsenic (dissolved)	mg/L	0.013 or	95 th percentile of reference	

Quality Characteristic	Unit	Trigger Level	Contaminant Limit	Monitoring Frequency
		80 th percentile of reference whichever is higher		two days after flows at CT3-08 cease. Sample CC-05 and CC-15 weekly if flows are present.
Arsenic (total)	mg/L	-	0.5	
Cadmium (dissolved)	mg/L	0.0002 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Cadmium (total)	mg/L	-	0.005	
Copper (dissolved)	mg/L	0.0014 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Copper (total)	mg/L	-	1	
Cyanide Free	mg/L	0.007 or 80 th percentile of reference whichever is higher	0.022	
Cyanide WAD	mg/L	-	0.1	
Lead (dissolved)	mg/L	0.0034 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Lead (total)	mg/L	-	0.05	
Manganese (dissolved)	mg/L	1.9 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Manganese (total)	mg/L	For interpretation purposes		
Nickel (dissolved)	mg/L	0.011 or	95 th percentile of reference	

Quality Characteristic	Unit	Trigger Level	Contaminant Limit	Monitoring Frequency
		80 th percentile of reference whichever is higher		
Nickel (total)	mg/L	-	1	
Zinc (dissolved)	mg/L	0.008 or 80 th percentile of reference whichever is higher	95 th percentile of reference	
Zinc (total)	mg/L	-	20	

3.3.2. Groundwater

3.3.2.1. Environmental Values

The most relevant EVs were derived from the EPP (Water and Wetland Biodiversity) 2019 which include:

- For waters that may be used for agricultural purposes – the suitability of the water for agricultural purposes;
- For waters that may be used for recreation or aesthetic purposes – the suitability of water for:
 - Primary recreational use; or
 - Secondary recreational use; or
 - Visual recreational use
- For water that may be used for drinking water – the suitability of the water for supply as drinking water having regard to the level of treatment of the water;
- For waters that may be used for industrial purposes – the suitability of the water for industrial use; or
- The cultural and spiritual values of the waters.

3.3.2.2. Groundwater Monitoring Network

The DRM groundwater network is described in Table 10 and Figure 6. Note that the Saturday Bore has collapsed and is no longer serviceable for obtaining groundwater levels or samples for analysis.

The groundwater monitoring program focusses on risk associated with the mine infrastructure area. Several bores are located to the west of the Knapdale Range (MB5, MB6, MB9S and MB9D) to monitor for impacts from the TSF.

Table 10. Groundwater Bore Details

Bore	Formation	EA classification	Permeability
MB1	Mount Roseby Schist	Background	7.53×10^{-6}
MB3	Mount Roseby Schist	Background	2.60×10^{-1}
Saturday Bore	Mount Roseby Schist	Background	No data
MB5	Mount Roseby Schist	Compliance	9.21×10^{-2}
MB6	Mount Roseby Schist	Compliance	2.23×10^{-3}
MB9S	Knapdale Quartzite	Compliance	No data
MB9D	Knapdale Quartzite	Compliance	No data
MB2	Mount Roseby Schist	Compliance	4.08×10^{-1}
MB4	Mount Roseby Schist	Compliance	7.52×10^{-2}
GWBFAB	Dugald River Slate	Interpretation	No data
MB1AB	Mount Roseby Schist	Interpretation	No data
MB2AB	Mount Roseby Schist	Interpretation	No data
MB3AB	Mount Roseby Schist	Interpretation	No data
MB4AB	Mount Roseby Schist	Interpretation	No data
SHALL6AB	Mount Roseby Schist	Interpretation	No data

CDM Smith (2021) completed the most recent biennial review of the groundwater monitoring program. The review refers to the ionic composition as being bicarbonate dominant across the bores except for MB3 which is sulfate dominant, and the water quality is described as suitable for stock watering and marginally potable at some locations. CDM Smith (2021) summarised the compliance assessment for DRM as:

- Most analytes were below trigger levels, Hardness Modified Trigger Levels (HMTVs) or below background levels. Copper at MB2 should be assessed using control charting if exceedances of the HMTV are noted in future; and
- Most analytes were below contaminant limits with the exception of fluoride at MB2 (within natural variation) and aluminium at MB9D (potentially due to high suspended sediment in the bore).

3.3.2.3. Groundwater Trigger Limits

EA Schedule C – Table 8 specifies the groundwater quality trigger limits for DRM. Trigger limits are detailed in Table 11.

Table 11. Groundwater Trigger Levels and Contaminant Limits (Schedule C – Table 8)

Quality Characteristic ¹	Unit	Trigger Level ^[1]	Contaminant limit ^[2]
pH	pH unit	6.0 (minimum) 8.0 (maximum)	6.0 (minimum) 9.0 (maximum)
Electrical Conductivity	µS/cm	1500 ^[6]	2000 ^[6]
Hardness (as CaCO ₃)	mg/L	For interpretation purposes	
Total Dissolved Solids (TDS)	mg/L	For interpretation purposes	
Major ions	mg/L	For interpretation purposes	
Sulphate (mg/L)	mg/L	150 ^[6]	1000 ^[5]
Fluoride (mg/L)	mg/L	-	2 ^[4]
Aluminium	mg/L	0.055 ^[3]	5 ^[4]
Arsenic ^[7]	mg/L	0.013 ^[3]	0.5 ^[4]
Cadmium (mg/L)	mg/L	0.0002 ^[3]	0.01 ^[4]
Copper (mg/L)	mg/L	0.0014 ^[3]	1 ^[4]
Cyanide ^[8]	mg/L	0.007 ^[9]	0.022 ^[10]
Lead (mg/L)	mg/L	0.0034 ^[3]	0.1 ^[4]
Manganese (mg/L)	mg/L	1.9 ^[3]	-
Nickel (mg/L)	mg/L	0.011 ^[3]	1 ^[4]
Zinc (mg/L)	mg/L	0.008 ^[3]	20 ^[4]

[1] All metals and metalloids must be measured as filtered with the exception of fluoride.

[2] All metals and metalloids must be measured as total (unfiltered).

[3] Based on ANZECC/ARMCANZ (2000) Table 3.4.1 (high reliability trigger values) and Section 8.3 moderate or low reliability trigger values if no value available in Table 3.4.1.

[4] Based on ANZECC/ARMCANZ (2000) Table 4.3.2 for livestock drinking water.

[5] Based on ANZECC/ARMCANZ (2000) Section 4.3.3.4;

[6] MMG Dugald River - site specific value

[7] Speciated arsenic concentrations for As (III) and As (V) only required if 13 mg/L is exceeded - note that the sample bottle requirements for As (total species) and As (speciated) may differ.

[8] The requirement to monitor for cyanide is deferred until the time cyanide is introduced into the mining process.

[9] Cyanide as un-ionised HCN, measured as [CN] - based on ANZECC/ARMCANZ (2000) Table 3.4.1, refer also Section 8.3.7.2.

[10] Free Cyanide - based on International Cyanide Management Institute (2009) Implementation Guidance - Standard of Practice 4.5 - receiving surface waterbody guideline value



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Figure 6. Groundwater Monitoring and Surface Geology

Legend

- | | | | |
|------------------------|---|---|--|
| Surface Geology | <ul style="list-style-type: none"> Boomarra Metamorphics/s Coocerina Formation Corella Formation-c do-MI Dugald River Shale Member Dugald River Shale Member/l Knapdale Quartzite | <ul style="list-style-type: none"> Knapdale Quartzite/c Knapdale Quartzite/q Knapdale Quartzite/t Lady Clayre Formation/d Mount Roseby Schist Qa-QLD q-MI TQa-QLD | <ul style="list-style-type: none"> TQf-QLD Wondoola beds Mining Lease Disturbance Footprint Groundwater Monitoring |
|------------------------|---|---|--|

ESRI Satellite

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3.3.3. Hydrogeology

A conceptual hydrogeological model for DRM has been refined by CDM Smith Australia Pty Ltd. CDM Smith (2019) describe the hydrogeology as being recharged predominately via diffuse infiltration from rainfall on the Knapdale Range. Information to date indicates that groundwater flows from west to east beneath the mining and processing areas.

Groundwater movement is generally within the unweathered fracture zones of the Mount Roseby Schist with North and Silvermine Creeks acting as potential preferential flow paths however basal flow contribution is unlikely given the depth to groundwater being > 4 m. Groundwater discharge is seasonal within likely basal flow contribution to the Dugald River.

The permeability of the surrounding sedimentary rock is generally low which is thought to mitigate the potential for a cone of depression from dewatering activities.

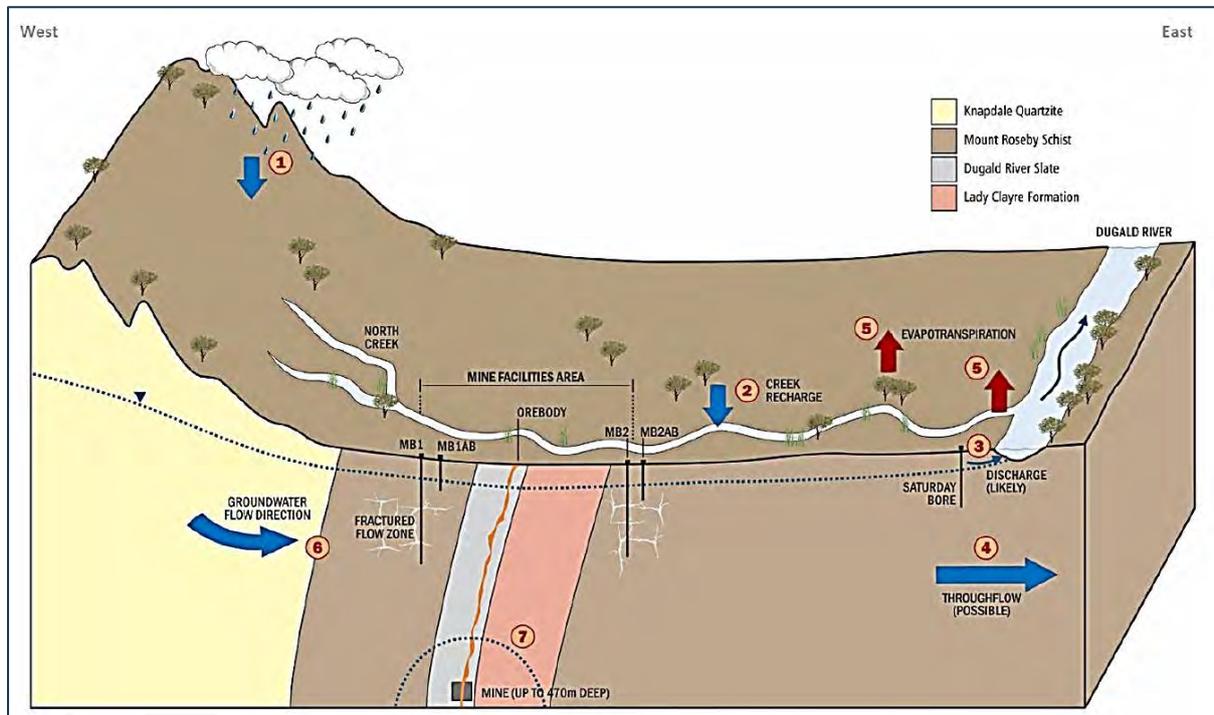


Figure 7. Conceptual Hydrogeological Model for DRM (CDM Smith 2019).

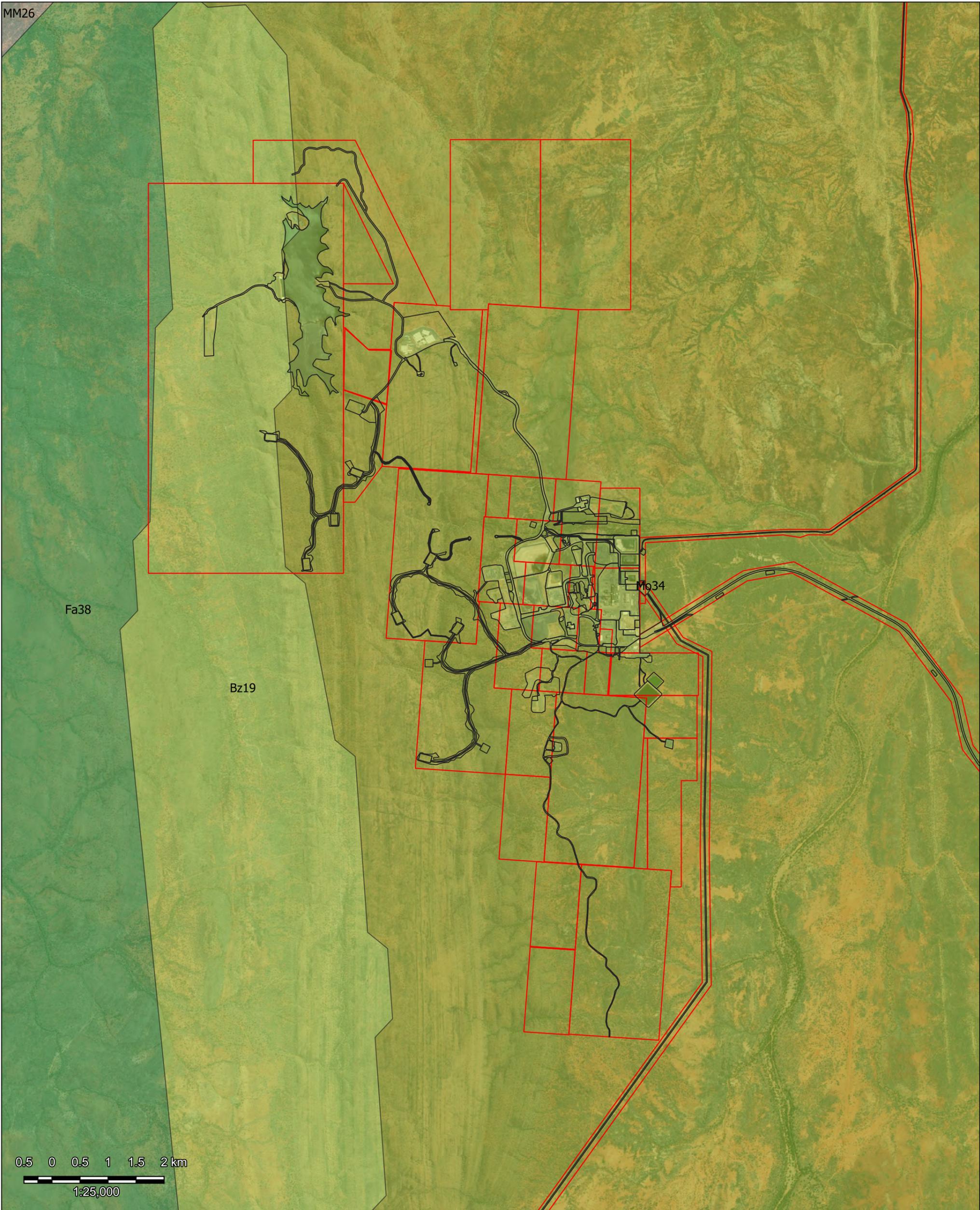
3.4. Soils

The soils of DRM area are dominated by Rudosols with minor areas of Calcarosols (AARC 2010a). Australian Soil Classification (Isbell 2016) define Rudosols as being soils with negligible pedology, minimal development of an A1 horizon or the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

Six soil types were described by AARC (2010a) (Table 12). All soil management units are dominated by features that severely limit their productive use in grazing or cropping due to very low plant-available water, erosion potential and limited nutrient availability. Subsequent to the AARC (2010a) soil surveys, several pockets of dispersive red clays were identified during construction activities.

Table 12. DRM Soil Types (AARC 2010a)

Soil Type	Description
Red Plains	The Red Plains Soil Mapping Unit (SMU) consists of red sandy loams to sandy clay loams with a neutral to slightly acidic pH. These soils are Rudosols with weak pedality and a maximum depth of 0.5 m.
Knapdale	The Knapdale SMU consists of brown skeletal sandy clay loams with a neutral to slightly acidic pH. These soils are Rudosols and very shallow (less than 0.2 m thick). They are mostly found on the eastern and western slopes of the Knapdale Range.
Dale	The Dale SMU consists of brown to reddish sandy loams with a slightly acidic pH increasing down the profile. Pedality ranges from weak to moderate with a depth of between 0.5-0.7 m. These soils are Rudosols and are generally found in depressions such as valley floors or plateaus in the Knapdale Range.
Miners	The Miners SMU consists of dark yellowish-brown sandy clay loams to silty loams with a slightly alkaline pH. Pedality is weak with a maximum depth of 0.2 m. These soils are Rudosols and are found on and immediately supporting the outcropping of the Dugald River deposit lode on the eastern side of the Knapdale Range.
Prospectors	The Prospectors SMU consists of dark yellowish-brown clay loams with a slightly acidic pH. Pedality is weak with a maximum depth of 0.2 m. These soils are Rudosols and are found on the toe slope of the western side of the Knapdale Range.
Pocket	The Pocket SMU consists of brown-grey sandy clay loams with an alkaline pH due to elevated levels of calcium carbonate. Pedality is weak. These soils are Calcarosols and are found in small pockets on the eastern and northern side of the Knapdale Range.



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Figure 8. Soil Management Units

Legend

- Disturbance Footprint Soil Mapping Unit
- Mine Lease
- ESRI Satellite
- Dermosol
- Rudosol
- Tenosol
- Vertosol

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3.5. Geology

DRM is located within a north to south trending feature named the Mt Roseby Corridor, within the Eastern Fold Belt of the Mount Isa Inlier (Figure 6). The Mount Roseby Corridor is bordered to the west by the Knapdale Quartzite and to the east by the Mt Roseby Fault. The Knapdale Quartzite forms the Knapdale Range, a local topographic high. The Mount Roseby corridor is comprised of the Mount Roseby Schist Formation which includes the Dugald River Slate Sequence of hanging wall calc-silicates, Dugald River slate (host of the ore body) and the footwall limestone (SGM 2021).

The geology of the rock units mined at DRM were described in EGi (2011). The units are calc-silicate, white mica schist, mafic feldspar porphyry, hanging wall slate, mineralized lode waste, footwall slate, and footwall limestone. Waste mined was found to be predominately non-acid forming (NAF) but areas of potentially acid forming (PAF) rock may be encountered proximal to the ore body and minor volumes within the hanging and foot wall slate. Table 13 describes the four dominant geological units at DRM.

Table 13. Mapped Geology for Dugald River Mine

Geological Unit	Description	Age
Lady Clayre Dolomite	Dolomitic, locally pyrrhotitic siltstone, silty to sandy dolostone and fine-grained, variably dolomitic sandstone	Paleoproterozoic
Knapdale Quartzite	Pink, fine-grained, feldspathic to quartzose, locally micaceous sandstone	Paleoproterozoic
Dugald River Slate Sequence	Dark grey, carbonaceous shale and siltstone and grey mica schist; Ore body; and Dark grey silty, dolomitic limestone and siltstone	Paleoproterozoic
Mount Roseby Schist	Grey muscovite-biotite-quartz schist (psammopelite) and minor quartzite, calc-silicate granofels and limestone; commonly thin-bedded with abundant poikiloblastic scapolite porphyroblasts, particularly in the north	Paleoproterozoic

3.6. Flora and Fauna

3.6.1. Regional Ecosystems

Mapped regional ecosystems (RE) were reviewed using DRMs recent Property Map of Assessable Vegetation (PMAV) which has been submitted for assessment (December 2021), as well as the Queensland Globe interactive mapping tool (Queensland Government 2023).

Based on the revised PMAV (EcoSmart Ecology 2021a), five regional ecosystems are mapped as occurring within the proposed additional disturbance areas (Figure 10). Much of this footprint sits over two heterogenous REs, 1.11.2a/1.11.2x1 and 1.11.2a/1.11.2e (1.11.2x1 is now mapped as 1.7.7a and 1.11.2e is now mapped as 1.11.3a). Small ephemeral creek lines with vegetation conforming to RE 1.3.7b flow through the disturbance areas, and small sections of RE 1.11.2e/1.5.4x3 and RE 1.11.2a are also present (1.5.4x3 is now mapped as 1.5.15).

State mapping also includes another RE, 1.3.6x1a (now mapped as 1.3.13a). RE 1.3.7b has a biodiversity status of endangered, though it is considered least concern under the Vegetation Management Act (VM Act). All other REs have a biodiversity status of 'no concern at present' and a VM Act status of 'least concern' (Table 14) (Figure 9).

Table 14. Regional Ecosystems Present Within the Proposed Disturbance Area

RE	Short description	VM Act Status	Biodiversity Status
1.11.2a	<i>Eucalyptus leucophloia</i> low open woodland.	Least Concern	No Concern
1.11.3a	<i>Corymbia terminalis</i> and / or <i>Eucalyptus leucophylla</i> low open woodland on metamorphics.	Least Concern	No Concern
1.3.13a	<i>Eucalyptus leucophylla</i> woodland on levees and minor drainage lines.	Least Concern	No Concern
1.3.7b	<i>Eucalyptus camaldulensis</i> woodland on channels and levees.	Least Concern	Endangered
1.5.15	<i>Aristida contorta</i> annual grasslands on hard setting red soils.	Least Concern	No Concern
1.7.7a	<i>Corymbia capricornia</i> and / or <i>Eucalyptus leucophloia</i> or <i>Eucalyptus miniata</i> low open woodland on silcrete.	Least Concern	No Concern

The following long descriptions are available for the vegetation communities in each regional ecosystem:

1.11.2a: “*Eucalyptus leucophloia* low open woodland often with *Corymbia terminalis*, *Corymbia capricornia*, *Terminalia aridicola* and *Eucalyptus leucophylla* with shrub layer of *Acacia* spp. and ground layer of *Triodia* spp.. Occurs on steep hills and strike ridges.”

1.11.3a: “Woodland of *Eucalyptus leucophylla*, commonly with *Corymbia terminalis*, *Acacia cambagei*, *Atalaya hemiglauca* and *C. aparrerinja*.. Occasional canopy species include *Corymbia confertiflora*, *Lysiphyllum cunninghamii* and *Eucalyptus pruinosa*. The ground layer is a mix of tussock grasses and *Triodia* spp.. Occurs on recent levees of larger watercourses and in-channel deposits of ephemeral streams.”

1.3.13a: “Woodland of *Eucalyptus leucophylla*, commonly with *Corymbia terminalis*, *Acacia cambagei*, *Atalaya hemiglauca* and *C. aparrerinja*. Occasional canopy species include *Corymbia confertiflora*, *Lysiphyllum cunninghamii* and *Eucalyptus pruinosa*. The ground layer is a mix of tussock grasses and *Triodia* spp.. Occurs on recent levees of larger watercourses and in-channel deposits of ephemeral streams.”

1.3.7b: “*Eucalyptus camaldulensis* fringing woodland, usually with *Lophostemon grandiflorus* and *Melaleuca bracteata* and/or *M. dissitiflora*. Occurs on recent levees and channel deposits of medium and smaller tributaries which are dry for most of the year; alluvial soils. Riverine.”

1.5.15: “*Aristida contorta* annual grasslands, usually with *Aristida inaequiglumis*, that are bare for most of the year and can be dominated by forbs. Occurs on older alluvium and residual soils.”

1.7.7a: “Low open woodland of *Corymbia capricornia*, often with *Eucalyptus leucophloia*. Mixed shrub layer usually including *Grevillea wickhamii*. Ground layer of *Triodia pungens* and/or *Triodia bitextura*. Occurs on silcrete.”



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Figure 9. Mapped Regional Ecosystems

Legend

- | | |
|-----------------------|---------------------------------|
| Disturbance Footprint | Regional Ecosystem - BDS |
| Mine Lease | Endangered Subdominant |
| ESRI Satellite | Of Concern |
| | Least Concern |

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Figure 10. Draft PMAV

Legend

- Mine Lease
- Draft PMAV**
- Endangered
- No Concern at Present
- Non-rem
- ESRI Satellite

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3.6.2. Matters of National Environmental Significance (MNES)

The Protected Matters Search Tool (PMST) was used to conduct a desktop analysis to determine the presence of any MNES under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) (DAWE 2023).

3.6.2.1. Threatened Flora Species

No EPBC listed flora species were identified within 50 km of DRM.

3.6.2.2. Threatened Ecological Communities

No listed Threatened Ecological Communities were identified within 50 km of DRM (DAWE 2023).

3.6.2.3. Threatened Fauna and Migratory Species

30 EPBC listed fauna species were identified to potentially occur within 50 km of DRM. This included 14 species listed as Endangered, Vulnerable or Near Threatened (EVNT), 14 migratory, and 19 marine species. A further 10 marine species were recorded during the original Environmental Impact Statement fauna surveys at DRM (DAWE 2023). As detailed in Table 15, the likelihood of occurrence within the DRM area was determined by the presence of local records and suitability of habitat.

Table 15. EPBC and NCA listed species identified within 50km of DRM

Taxa	Common Name (<i>Scientific name</i>)	EPBC Status	NCA Status	Likelihood of Occurrence
<i>Mammals</i>	Ghost bat (<i>Macroderma gigas</i>)	V	E	Unlikely
	Greater bilby (<i>Macrotis lagotis</i>)	V	E	Unlikely
	Julia Creek dunnart (<i>Sminthopsis douglasi</i>)	V	E	Unlikely
	Purple-necked rock-wallaby (<i>Petrogale purpureicollis</i>)	-	V	Known (surveys)
	Short-beaked echidna (<i>Tachyglossus aculeatus</i>)	-	SL	Possible
<i>Birds</i>	Australian painted-snipe (<i>Rostratula australis</i>)	E, M	E	Possible
	Australian pelican (<i>Pelecanus conspicillatus</i>)	Ma	LC	Known (surveys)
	Barn swallow (<i>Hirundo rustica</i>)	M, Ma	SL	Unlikely
	Black-eared cuckoo (<i>Chalcites osculans</i>)	Ma	LC	Known (surveys)
	Black-faced cuckoo-shrike (<i>Coracina novaehollandiae</i>)	Ma	LC	Known (surveys)
	Carpentarian grasswren (<i>Amytornis dorotheae</i>)	E	E	Possible

Taxa	Common Name (<i>Scientific name</i>)	EPBC Status	NCA Status	Likelihood of Occurrence
	Caspian tern (<i>Hydroprogne caspia</i>)	M, Ma	SL	Possible
	Cattle egret (<i>Bubulcus ibis</i>)	Ma	LC	Possible
	Common greenshank (<i>Tringa nebularia</i>)	M, Ma	SL	Possible
	Common sandpiper (<i>Actitis hypoleucos</i>)	M, Ma	SL	Unlikely
	Curlew sandpiper (<i>Calidris ferruginea</i>)	CE, M, Ma	CE	Unlikely
	Eastern curlew (<i>Numenius madagascariensis</i>)	CE, M, Ma	E	Unlikely
	Fork-tailed swift (<i>Apus pacificus</i>)	M, Ma	SL	Possible
	Glossy ibis (<i>Plegadis falcinellus</i>)	M, Ma	SL	Possible
	Gouldian finch (<i>Erythrura gouldiae</i>)	E	E	Unlikely
	Grey falcon (<i>Falco hypoleucos</i>)	V	V	Possible
	Grey wagtail (<i>Motacilla cinerea</i>)	M, Ma	SL	Unlikely
	Horsfield's bronze cuckoo (<i>Chalcites basalus</i>)	Ma	LC	Known (surveys)
	Latham's snipe (<i>Gallinago hardwickii</i>)	M, Ma	SL	Possible
	Magpie-lark (<i>Grallina cyanoleuca</i>)	Ma	LC	Known (surveys)
	Night parrot (<i>Pezoporus occidentalis</i>)	E	E	Unlikely
	Oriental plover (<i>Charadrius veredus</i>)	M, Ma	SL	Unlikely
	Oriental pratincole (<i>Glareola maldivarum</i>)	M, Ma	SL	Unlikely
	Painted honeyeater (<i>Grantiella picta</i>)	V	V	Possible
	Pectoral sandpiper (<i>Calidris melanotos</i>)	M, Ma	SL	Unlikely
	Purple-crowned fairy-wren (<i>Malurus coronatus</i>)	-	V	Possible
	Rainbow bee-eater (<i>Merops ornatus</i>)	Ma	LC	Known (surveys)
	Red goshawk (<i>Erythrotriorchis radiatus</i>)	V	E	Unlikely
	Sacred kingfisher (<i>Todiramphus sanctus</i>)	Ma	LC	Known (surveys)

Taxa	Common Name (<i>Scientific name</i>)	EPBC Status	NCA Status	Likelihood of Occurrence
	Sharp-tailed sandpiper (<i>Calidris acuminata</i>)	M, Ma	SL	Possible
	Spotted nightjar (<i>Eurostopodus argus</i>)	Ma	LC	Known (surveys)
	Stubble quail (<i>Coturnix pectoralis</i>)	Ma	LC	Known (surveys)
	Whistling kite (<i>Haliastur sphenurus</i>)	Ma	LC	Known (surveys)
	White-bellied sea-eagle (<i>Haliaeetus leucogaster</i>)	Ma	LC	Possible
	Yellow wagtail (<i>Motacilla flava</i>)	M, Ma	SL	Unlikely
<i>Reptiles</i>	Freshwater crocodile (<i>Crocodylus johnstoni</i>)	Ma	LC	Unlikely
	Mertens' water monitor (<i>Varanus mertensi</i>)	-	E	Possible
	Plains death adder (<i>Acanthophis hawkei</i>)	V	V	Unlikely
<i>Fish</i>	Freshwater sawfish (<i>Pristis pristis</i>)	V, M, Ma	-	Unlikely

Key: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory, Ma = Marine, SL = Special Least Concern, LC = Least Concern

3.6.3. Matters of State Environmental Significance (MSES)

14 EVNT species were identified as potentially occurring within a 50 km radius of DRM. Table 15 details the likelihood of occurrence within DRM by the presence of local records and suitability of habitat.

One mammal species of conservation significance was identified during the 2011 surveys, the Purple-necked rock-wallaby (PNRW). This species is listed as vulnerable under the *Nature Conservation Act 1992* (NCA) and is associated with the rocky scarps of the Knapdale Range and significant rocky outcrops of the plains (Figure 11).

3.6.3.1. Watercourses and Wetlands

Lake Julius, located approximately 40 km west of DRM, is an important dry season refuge for waterbirds as it is a large permanent waterbody found in a semi-arid area. Lake Julius is located upstream of current and proposed activities.

3.6.3.2. Protected Wildlife Habitat and Essential Habitat

The following special values are listed for certain REs:

- 1.11.2 – Potential habitat for NCA listed species: *Eucalyptus nudicaulis*, *Ipomoea antonschmidii*, *Solanum carduiforme*, *Trachymene glandulosa*;

- **1.11.3** – Potential habitat for NCA listed species: *Eucalyptus nudicaulis*;
- **1.3.13** – Potential habitat for NCA listed species: *Ipomoea antonschmidii*, *Ptilotus maconochiei*;
- **1.3.7** – Important seasonal water bird habitat; regional corridor for fauna; and
- **1.7.7** – Potential habitat for NCA listed species: *Ipomoea antonschmidii*.

Regional ecosystems conforming to RE 1.11.2a and 1.7.7a (previously 1.11.2x1) are likely to represent the most significant habitat within the proposed disturbance areas for the potentially occurring *Carpentarian grasswren*, which favours rocky hills with spinifex ground layers.

Essential habitat for the purple-necked rock-wallaby is present throughout DRM. Most of the proposed disturbance footprint of the wind farm tracks and pads overlaps with or is directly adjacent to essential habitat for the PNRW (Figure 11).

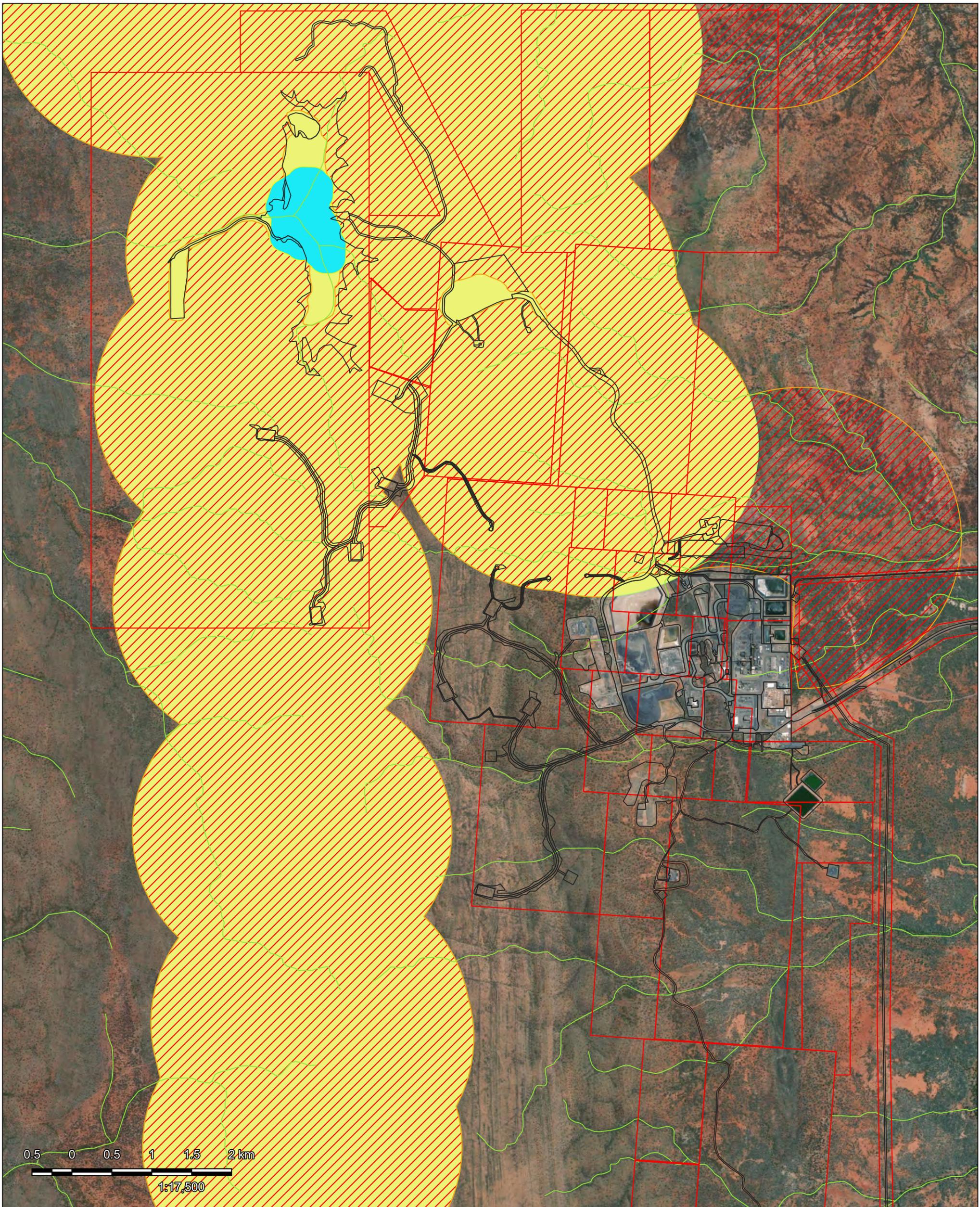
3.6.3.3. Protected Areas

There are no protected areas within 50 km of DRM.

3.6.3.4. Regulated Vegetation

Regulated vegetation is managed through *Vegetation Management Act 1999* (VM Act). Vegetation classifications described by the VM Act as being Category A, Category B, Category C, Category R or Category X are required to meet certain criteria prior to impact.

With the exception of a small (0.05 ha) portion of category X vegetation, the entire DRM ML is mapped as Category B (Figure 12).



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Figure 11. Mapped Matters of Environmental Significance

- Legend**
- MSES**
- RV - Defined Watercourse
 - RV - 100m from Wetland
 - Mine Lease
 - RV - Essential Habitat
 - WH - END or VUL
- ESRI Satellite

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0.25 0 0.25 0.5 0.75 1 km
 1:25,000

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Figure 12. Regulated Vegetation

- Legend**
-  Disturbance Footprint
 -  Mine Lease
 - Regulated Vegetation**
 -  Cat B - Remnant
 - ESRI Satellite

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3.6.4.Environmentally Sensitive Areas

3.6.4.1. Category A

A category A environmentally sensitive area (ESA) is defined as any of the following:

- a. any of the following under the Nature Conservation Act 1992:
 - (i) a national park (scientific);
 - (ii) a national park;
 - (iii) a national park (Aboriginal land);
 - (iv) a national park (Torres Strait Islander land);
 - (v) a national park (Cape York Peninsula Aboriginal land);
 - (vi) a conservation park;
 - (vii) a special wildlife reserve;
 - (viii) a forest reserve;
- b. the wet tropics area under the Wet Tropics World Heritage Protection and Management Act 1993;
- c. the Great Barrier Reef Region under the Great Barrier Reef Marine Park Act 1975 (Cwlth);
- d. a marine park under the Marine Parks Act 2004, other than a part of the park that is a general use zone under that Act.

No category A ESAs are mapped to occur within DRM.

3.6.4.2. Category B

A Category B environmentally sensitive area (ESA) is defined under the Environmental Protection Regulation 2019 as any of the following—

- a) any of the following areas under the Nature Conservation Act 1992—
 - (i) a coordinated conservation area;
 - (ii) an area of critical habitat or major interest identified under a conservation plan;
 - (iii) an area subject to an interim conservation order;
- b) an area subject to the following conventions to which Australia is a signatory—
 - (i) the 'Convention on the Conservation of Migratory Species of Wild Animals' (Bonn, 23 June 1979);
 - (ii) the 'Convention on Wetlands of International Importance, especially as Waterfowl Habitat' (Ramsar, Iran, 2 February 1971);
 - (iii) the 'Convention Concerning the Protection of the World Cultural and Natural Heritage' (Paris, 23 November 1972);
- c) a zone of a marine park under the Marine Parks Act 2004 that is within a general use zone of the marine park under that Act;
- d) an area to the seaward side of the highest astronomical tide;
- e) the following under the Queensland Heritage Act 1992—

- (i) a place of cultural heritage significance;
- (ii) a Queensland heritage place, unless there is an exemption certificate issued under that Act;
- f) an area recorded in the Aboriginal Cultural Heritage Register established under the Aboriginal Cultural Heritage Act 2003, section 46, other than the area known as the 'Stanbroke Pastoral Development Schedule 19 Environmental Protection Regulation 2019 Current as at 5 April 2023 Page 287 Authorised by the Parliamentary Counsel Holding', leased under the Land Act 1994 by lease number PH 13/5398;
- g) a feature protection area, State forest park or scientific area under the Forestry Act 1959;
- h) a declared fish habitat area under the Fisheries Act 1994;
- i) a place in which a marine plant under the Fisheries Act 1994 is situated;
- j) an endangered regional ecosystem identified in the database known as the 'Regional ecosystem description database' published on the department's website.

The following Category B ESA is mapped to occur at DRM (Figure 13):

- Endangered Regional Ecosystem RE 1.3.7b (*Eucalyptus camaldulensis*) woodland on channels and levees.

3.6.5. Non-Native Flora and Fauna

Four introduced species, listed as pest species under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), were detected at DRM during the wet and dry season surveys (AARC 2011). Species observed included:

- House Mouse (*Mus musculus*) listed as a Class 1 pest under the LP Act;
- Dingo (*Canis lupus familiaris*) listed as a Class 2 pest under the LP Act;
- Feral Cat (*Felis catus*) listed as a Class 2 pest under the LP Act; and
- Feral Pig (*Sus scrofa*) listed as a Class 2 pest under the LP Act.



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Figure 13. Mapped Environmentally Sensitive Area

Legend

- Disturbance Footprint
- Mine Lease
- Regional Ecosystem**
- Endangered
- Endangered Subdominant
- ESRI Satellite

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4. Potential Environmental Impacts and Management

4.1. Land Impacts

In preparing this application, consideration has been given to guideline *ESR/2015/1839 – Application requirements for activities with impacts to land* (DES, 2017b). DES is required to assess the application against the requirements stated in the *Environmental Protection Act 1994* and the EP Regulation to meet the environmental objective and performance outcomes described below:

Environmental Objective

'The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.'

Performance Outcome

There is no actual or potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity, or

All of the following:

- a) activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land, and
- b) areas disturbed will be rehabilitated or restored to achieve sites that are:
 - i. safe to humans and wildlife;
 - ii. non-polluting;
 - iii. stable; and
 - iv. able to sustain an appropriate land use after rehabilitation or restoration.
- c) the activity will be managed to prevent or minimise adverse effects on the environmental values of and due to unplanned releases or discharges, including spills and leaks of contaminants.
- d) the application of water or waste to land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.

RISK OF ENVIRONMENTAL IMPACT: MODERATE

4.1.1. Overview of Land Impacts

4.1.1.1. Concentrate Shed Cyclone Rating

The EA currently prescribes that the concentrate shed be constructed and maintained to withstand a Category 2 cyclone. The intent of this condition is to prevent the release of concentrate during a cyclone, particularly in high-risk areas, e.g. port facilities. This condition is not relevant to the activities at DRM

due to the location of the site, the low risk of cyclones, and the manner in which the concentrate shed is used.

The concentrate shed is considered to be a concentrate transfer point; it is not used for storage of concentrate. Concentrate is deposited into the concentrate transfer shed from the processing plant where it is collected by a front-end loader and transferred into two half height shipping containers. This process is completed while the shed is enclosed and under negative pressure. The shipping containers are then removed from the shed.

In the unlikely event that a cyclone did occur in the region, there would be no concentrate stored within the shed, and therefore the risk of loss of concentrate is negligible. DRM will continue to implement this process to ensure that concentrate is contained, during all weather scenarios.

4.1.1.2. Proposed Disturbance

The following new disturbance areas are proposed to be cleared, grubbed and stripped:

- Approximately 38 ha for the wind farm access tracks and pads;
- Approximately 7 ha for a battery farm to support renewables projects at DRM;
- Approximately 0.75 ha for power infrastructure to connect to the battery farm;
- Approximately 0.2 ha for relocation of the exploration camp STP; and
- Approximately 0.05 ha vegetation clearing for additional groundwater infrastructure.

The areas designated for the Switchyard 2 and Ventilation Shaft 9 have been previously disturbed for use as access roads, therefore no additional clearing or surface disturbance is required for these features.

4.1.1.3. Proposed Buffer for Category B ESA

The “Code of Environmental Compliance for exploration and mineral development projects” was superseded by the “Eligibility criteria and standard conditions for exploration and mineral development projects” in 2016. The latest version of the code specifies that activities involving machinery must not be carried out within 1 km of a category A environmentally sensitive area or within 500 m of a category B environmentally sensitive area. Maintaining a buffer from ESAs reduces the risk of impact to areas that may be mapped incorrectly.

The proposed amendment is to reduce this buffer to allow machinery to work up to 50 m from a category B environmentally sensitive area. This will allow MMGs exploration program to continue, with appropriate ground truthing to confirm the presence and extent of the ESA. Additional controls have been proposed to further minimise risk to ESAs.

4.1.2.Environmental Protection Act 1994 Environmentally Sensitive Areas

4.1.2.1. Category A

There are no Category A ESAs mapped to occur within DRM. The proposed amendment will not impact upon any category A Environmentally Sensitive Areas. No changes are proposed to working buffers for category A Environmentally Sensitive Areas.

4.1.2.2. Category B

As discussed in section 3.6.3, desktop searches identified the following category B Environmentally Sensitive Area within the Project:

- Endangered Regional Ecosystem RE 1.3.7b (*Eucalyptus camaldulensis*) woodland on channels and levees.

Ground truthing surveys have been completed across the Project to refine the extent of the RE. A draft PMAV has been prepared and is currently under assessment. The ground truthing has sufficiently refined the location and extent of RE 1.3.7b across the proposed disturbance areas. Utilising this PMAV, the risk of unintended impact to RE 1.3.7b is low. DRM will continue to implement appropriate controls, as described below, to further mitigate any potential impacts (Section 4.1.10.) from the proposed amendment.

Avoidance is the first order of preference to managing environmental impacts in or adjacent to an endangered RE (Queensland Government, 2022). No exploration disturbance is proposed within areas confirmed to be a category B ESA. A 50 m buffer will be maintained around areas confirmed to be RE 1.3.7b.

4.1.3.Flora

As discussed in section 3.6.2. no EPBC listed flora species are mapped to occur within 50 km of DRM.

RE 1.3.7b has a biodiversity status of endangered, though it is considered least concern under the Vegetation Management Act. As described in the latest PMAV, currently under assessment, RE 1.3.7b is restricted to small ephemeral creek lines. Disturbance to RE 1.3.7b is restricted to proposed access tracks crossing the creek on five occasions, with a total disturbance of 1.13 ha. Figure 9 and Figure 10 show the proposed disturbance in relation to the RE's currently mapped and the PMAV, currently being assessed.

4.1.4. Matters of State Environmental Significance

Approximately 25.46 ha of disturbance is proposed within areas mapped as of state environmental significance - wildlife habitat (endangered or vulnerable/ special least concern) and regulated vegetation (essential habitat). As previously discussed, wildlife habitat and essential habitat within the disturbance areas are associated with the presence of the PNRW.

4.1.5.Fauna

As discussed in Section 3.6.2.3, 30 EPBC listed fauna species, including 14 migratory and 19 marine species, were identified through the PMST to potentially occur within 50 km of DRM. Of the listed EVNT species, three have been identified to have a “possible” likelihood of occurrence:

- Carpentarian Grasswren (*Amytornis dorotheae*) (EPBC – Endangered);
- Grey Falcon (*Falco hypoleucos*) (EPBC – Vulnerable); and
- Painted Honeyeater (*Grantiella picta*) (EPBC – Vulnerable).

A significant impact assessment has been completed for these species and is detailed in section 4.1.3.2.

The proposed area of clearing for the wind farm tracks and pads is within areas mapped as essential habitat of the PNRW. Suitable habitat for the PNRW has previously been described in the Purple-necked Rock-wallaby, Northern Tailings Re-alignment Assessment (Ecosmart Ecology 2021b) as:

- Steep relief,
- Cliff faces (sheer or near sheer drops of > 2m),
- Large boulders (rocks >1m in diameter),
- Crevices and tunnels of varying sizes suitable for rock-wallaby use, and
- Dense vegetation (especially *Ficus* sp.) which can sometimes be used by the PNRW in place of rock shelters.

A significant impact assessment has been completed for the PNRW and is detailed in Section 4.1.5.2. Additional monitoring for the PNRW is proposed within the proposed disturbance areas as discussed in Section 4.1.10.3.

4.1.5.1. Field Assessment

AustralAsian Resource Consultants Pty Ltd (AARC 2011) undertook field assessments of terrestrial flora and fauna for the initial Environmental Impact Assessment across the mining lease. The survey identified 222 flora species and 113 vertebrate fauna, none of which were of conservation significance. The surveys did not identify any of the twenty-eight fauna species mapped to occur in the area.

One of the mapped EPBC listed species, Carpentarian grasswren, generally favours stony outcrops with spinifex grasses, consistent with habitat within the proposed disturbance area for the wind farm. Records of this species exist within 50 km of the proposed additional disturbance areas and due to the presence of potential habitat, this species is considered a possible inhabitant of the area. Limited surveys completed in likely areas for the Carpentarian grasswren suggests prior studies are not sufficient.

4.1.5.2. Impact Assessments

The Significant Impact Guidelines (DCCEEW 2013) outline the criteria for determining whether an action is considered likely to have a significant impact on a species. An action is likely to have a significant impact on a critically endangered, endangered or vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

Individual significant impact assessments were completed for the three EVNT species with a likelihood status of "possible". The assessments concluded that there is no significant residual impact to these species, therefore the proposed additional disturbance areas are unlikely to result in any direct and/or indirect impacts on these protected matters. Details of the assessments are outlined in Table 16 – Table 18.

Table 16. Significant impact criteria for the endangered Carpentarian grasswren (*Amytornis dorotheae*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of a population.	There are no known populations within the proposed additional disturbance areas.
Reduce the area of occupancy of the species.	The proposed additional disturbance areas are outside the current area of occupancy of this species.
Fragment an existing population into two or more populations.	No populations of this species are known to occur within the proposed additional disturbance areas. Habitat fragmentation within the proposed additional disturbance areas is minimal.
Adversely affect habitat critical to the survival of a species.	Critical habitat is not known to be present within the proposed additional disturbance areas.
Disrupt the breeding cycle of a population	Breeding is not known to occur within the proposed additional disturbance areas.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Proposed habitat degradation within the proposed additional disturbance areas is minimal.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Significant invasive species including cats are already well established throughout the species' range. No novel invasive species are likely to be introduced.
Introduce disease that may cause the species to decline.	No known diseases are likely to be introduced. Activities within the proposed additional disturbance areas will adhere to biosecurity guidelines.
Interfere with the recovery of the species.	No recovery plan currently applicable for this species.
An action is likely to have a significant impact on a critically endangered or vulnerable species if there is a real chance or possibility that any of the above-mentioned criteria are true - No significant residual impact.	

Table 17. Significant impact criteria for the vulnerable grey falcon (*Falco hypoleucos*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of an important population of a species.	The grey falcon is considered very sparse across its range and is very unlikely to suffer population level declines as a result of the proposed additional disturbance.
Reduce the area of occupancy of an important population.	Species has a very large area of occupancy that is unlikely to be affected.
Fragment an existing important population into two or more populations.	Species is continuously distributed across a large range and is non susceptible to fragmentation.
Adversely affect habitat critical to the survival of a species.	Critical habitat is not known to be present within the proposed additional disturbance areas.
Disrupt the breeding cycle of an important population.	Breeding is not known to occur within the proposed additional disturbance areas. Unlikely to be affected.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Proposed habitat degradation within the proposed additional disturbance areas is minimal and the species is unlikely to suffer any negative effects.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Significant invasive species including cats are already well established throughout the species' range. No novel invasive species are likely to be introduced.
Introduce disease that may cause the species to decline.	No known diseases are likely to be introduced. Activities within the proposed additional disturbance areas will adhere to biosecurity guidelines.
Interfere substantially with the recovery of the species.	No recovery plan currently applicable for this species.
An action is likely to have a significant impact on a critically endangered or vulnerable species if there is a real chance or possibility that any of the above-mentioned criteria are true - No significant residual impact.	

Table 18. Significant impact criteria for the vulnerable painted honeyeater (*Grantiella picta*)

Is there a chance or possibility that an action will?	Response
Lead to a long-term decrease in the size of an important population of a species.	No noteworthy populations are known to occur in the proposed additional disturbance areas. Habitat within the proposed additional disturbance areas is unlikely to support a significant population.
Reduce the area of occupancy of an important population.	The painted honeyeater has a large area of occupancy that is unlikely to be reduced.
Fragment an existing important population into two or more populations.	Species is continuously distributed and dispersive across its range. Unlikely to become fragmented.
Adversely affect habitat critical to the survival of a species.	Critical habitat not known or likely to be present within the proposed additional disturbance areas.
Disrupt the breeding cycle of an important population.	Breeding does not occur in this part of the painted honeyeater's range.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Proposed habitat degradation within the proposed additional disturbance areas is minimal and the species is unlikely to suffer any negative effects.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Significant invasive species including cats are already well established throughout the species' range. No novel invasive species are likely to be introduced.
Introduce disease that may cause the species to decline.	No known diseases are likely to be introduced. Activities within the proposed additional disturbance areas will adhere to biosecurity guidelines.
Interfere substantially with the recovery of the species.	No recovery plan currently applicable for this species.
An action is likely to have a significant impact on a critically endangered or vulnerable species if there is a real chance or possibility that any of the above-mentioned criteria are true - No significant residual impact.	

4.1.6. Acid Sulphate Soils

Acid Sulfate Soils (ASS) form in coastal areas lower than 5 mAHD. DRM is located above 5 mAHD and the risk of encountering ASS is considered very low. No impacts relating to ASS are expected.

4.1.7. Waste Storage

The proposed amendment does not include any changes to waste rock management and therefore has not been considered further. Non mineral waste will continue be removed from site by an authorised third-party contractor in accordance with established DRM waste management procedures.

4.1.8. Areas of Regional Interest

Areas of regional interest are managed under the *Regional Planning Interests Act 2014*. No areas of regional interests are identified over DRM, and none are proposed to be impacted.

4.1.9. Soil Erosion Potential

WTS (2022) estimated the erosion potential for DRM based on average rainfall. DRM has very low erosion risk for the majority of the year. The highest erosion risk is experienced in January (156.6 mm) which coincides with the north Queensland wet season.

4.1.10. Management of Land Impacts

4.1.10.1. Flora

Prior to any exploration work commencing within 50 m - 500 m of a Category B ESA, a site inspection will be undertaken by a suitable qualified ecologist. The ecologist will conduct a ground truthing assessment to determine the actual extent, status, and condition of the ESA. The final location and dimensions of disturbance areas will be determined based on results of the ecological survey. No exploration work will be permitted within 50 m of a confirmed category B ESA.

For all disturbance works, the clearance area will be clearly pegged by the site surveyors, placing pegs at a minimum spacing of 100 m.

A land disturbance permit will be issued in accordance with the MMG Land Clearance and Disturbance Permitting Procedure. The permit will be signed by the MMG project supervisor, equipment operators, equipment spotter, and fauna spotter catcher, to ensure that all conditions of the permit are understood.

The final clearance areas will be recorded in the MMG Land Clearance Spatial Dataset.

4.1.10.2. Fauna

It is recommended that thorough pre-clearance surveys of proposed disturbance areas be conducted with specific reference to the Carpentarian grasswren. These surveys should involve:

- Pre-clearance searches for breeding places; and

- Fauna spotter catcher present prior to and during clearing.

Additional habitat assessment, targeted searches and monitoring will also be required for the PNRW. These on-ground surveys should include:

i. Field assessment of habitat suitability.

Field surveys of the proposed wind farm footprint should be undertaken to identify potential habitat for the PNRW. This would typically involve ecologists walking through the area and recording habitat features of known significance to the PNRW. Areas adjacent to proposed disturbance considered likely to support populations of the PNRW should also be investigated. EcoSmart Ecology (2021) identified the following habitat features as indicators of PNRW habitat:

- Steep relief;
- Cliff faces;
- Large boulders;
- Crevices and tunnels in rocks; and
- Dense vegetation (usually *Ficus* sp.) sometimes used by the PNRW in place of rock shelters.

Scats, tracks and other signs of PNRW should also be recorded during this stage of the field assessments.

ii. Targeted surveys of suitable habitat to identify locations and sizes of PNRW colonies.

Once potential habitat for the PNRW is identified, targeted surveys to assess the presence and abundance of this species should be conducted in these areas. Figure 14 shows areas where previous surveys have detected PNRW colonies and where probable locations of colonies are based on suitable habitat. Previous and ongoing survey methodology, which includes camera trapping and faecal pellet counts should be utilised in this case.

In addition to this, another potentially useful tool for PNRW detection and monitoring is aerial thermal imagery detection via drones. This type of thermal imagery is particularly useful in larger and difficult to access areas. When conducted in periods of higher thermal contrast (cool mornings) this is an especially effective method of detecting individual PNRWs and their thermal signatures in rocky areas.

iii. Long-term biannual monitoring of populations.

Additional monitoring for the PNRW should be implemented within the proposed wind farm expansion area, with particular focus on large colonies in high quality habitat. This can be incorporated into the current biannual monitoring program and largely follow the established methods.

This additional monitoring should prioritise:

- Identification of habitat features relevant to the PNRW within the proposed wind farm footprint;

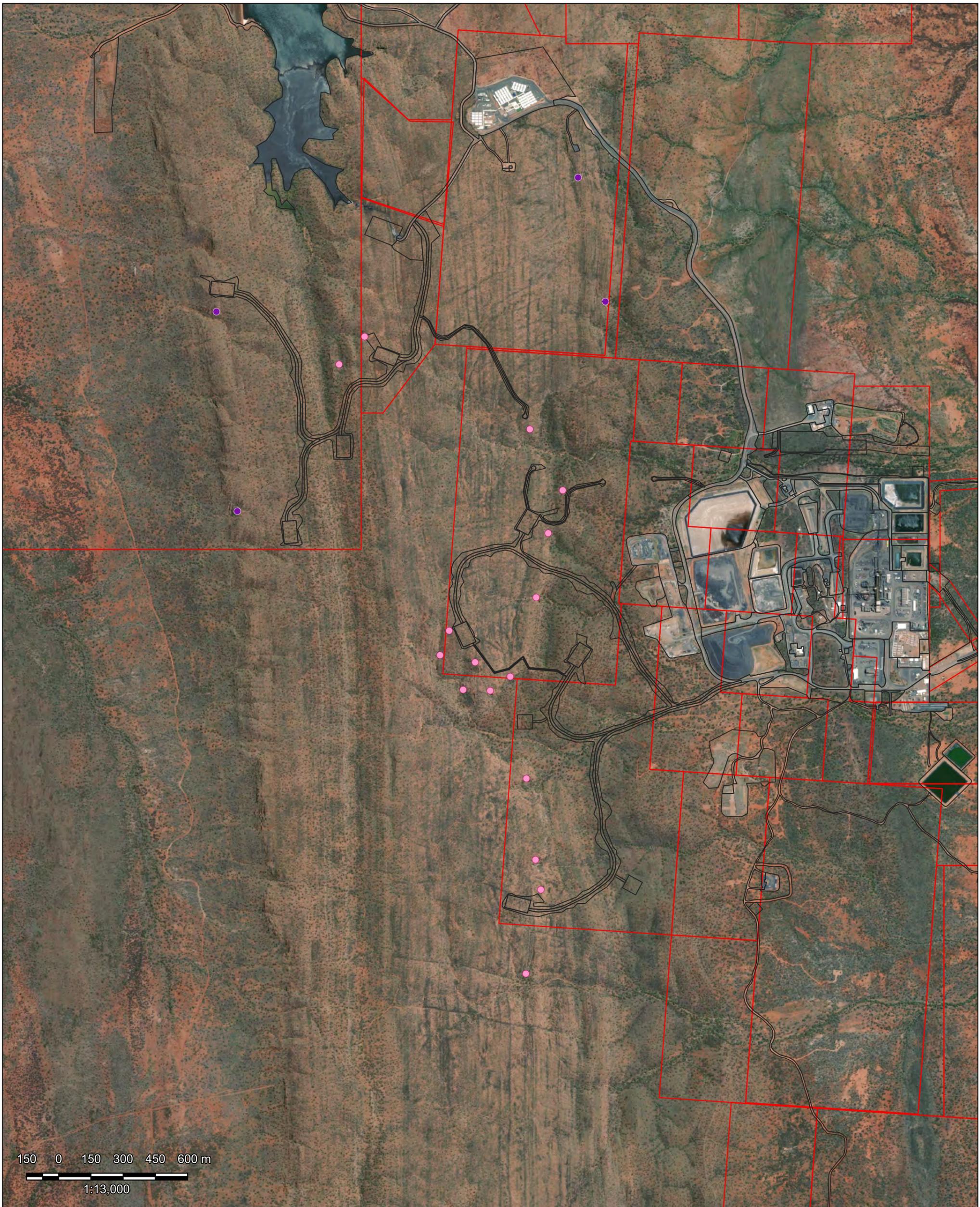
- Identification of locations and sizes of PNRW colonies within the proposed wind farm footprint;
- Establishing long-term monitoring sites for the PNRW within the wind farm footprint;
- During preparation for clearing and development, avoid areas of PNRW activity, especially those of significance to larger colonies;
- All habitat disturbance should be preceded by thorough pre-clearance surveys;
- During clearing, qualified personnel (spotter catchers) should be present to ensure minimal impact and injury occurs to all fauna species; and
- Continue monitoring populations of the PNRW, biannually.

Habitat that is likely to host all other “possible” EPBC and NCA listed species has been sufficiently surveyed during previous field assessments. It is likely that habitat within the proposed disturbance areas is of minimal significance to the identified species and additional surveys are not considered necessary.

4.1.10.3. PNRW Monitoring Program

Ongoing monitoring of the purple-necked rock-wallaby occurs biannually at DRM and is currently serviced by EcoSmart Ecology. The current methods implemented for monitoring PNRW populations within the greater DRM project area are considered broadly sufficient. However, as the footprint for the proposed wind farm includes areas not previously surveyed, additional habitat assessment, targeted searches and monitoring will be required in these areas.

The purple-necked rock-wallaby is patchily distributed throughout the Knapdale Range, with colonies of varying sizes occurring in discrete locations. As such, it is important to identify specific locations and size of populations within the proposed disturbance footprint. Prior studies by EcoSmart Ecology (2020 and 2021) have outlined the significance of large, secure populations of the PNRW for broader scale population security. These larger populations are correlated with increased habitat quality, including complex rocky slopes with abundant sheltering sites. These populations are less susceptible to significant fluctuation in population size and are therefore the most appropriate targets for long-term monitoring.



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Figure 14. Known and Probable PNRW Populations

- Legend**
- Disturbance Footprint
 - Mine Lease
- PNRW Population**
- Known
 - Probable
- ESRI Satellite

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4.1.10.4. Topsoil Stripping

With vegetation cleared and grubbed, topsoil and subsoil will be stripped from the proposed disturbance areas. Topsoil stripping will be conducted via dozers or similar and material will be placed in windrows at the edge of the disturbance area to a maximum height of 2 metres. Topsoil will then be transported to existing Stockpiles listed in Schedule A – Table 1 (Authorised Mining Activities).

4.1.10.5. Timing of Works

All clearing work will be undertaken during the dry season (April – November). Work will not be conducted during significant rain, or when significant rainfall is forecast.

4.1.10.6. Waste Rock Management

The proposed amendment does not include any changes to waste rock management and therefore has not been considered further.

4.1.10.7. Tailings Management

The proposed amendment does not impact upon tailings disposal and therefore has not been considered further.

4.1.10.8. Waste Management

Other than organic waste (i.e., cleared vegetation) and soil to be re-used for remediation, there are no plans for waste storage within the proposed wind farm disturbance area. Waste storage and disposal will comply with established DRM waste management procedures.

4.1.10.9. Erosion and Sediment Control

The risk of erosion as a result of the proposed additional disturbance is considered low. However, MMG will implement erosion and sediment controls (ESC) during construction in line with MMG's Erosion and Sediment Control Plan (Appendix E). Generally, ESC may consist of (but is not limited to):

- Conducting construction works during the dry season where possible (April – November);
- Minimising all disturbed areas and stabilisation as much as possible by conducting progressive rehabilitation/stabilisation as soon as practical;
- Maintaining vegetative buffer zones where possible;
- Delineating areas required to be disturbed and ensuring that disturbance is limited to those areas;
- Construction of diversion bunds upslope of disturbance to direct clean water runoff away from disturbed areas;

- Construction of drains to capture runoff from disturbed areas and direct runoff into sediment basins or dams;
- Construction of sediment basins or dams to capture sediment and contaminants for treatment or retention;
- Construction of graded banks over final reshaped landforms to minimise erosion and re-direct runoff to catch drains;
- Topsoil stockpiles located away from operational areas; and
- Revegetation of final landforms as soon as possible.

4.1.10.10. Contamination Management

The following measures have been implemented to manage any contamination identified from general activities at DRM:

- Surface waters will be monitored biannually during the REMP events;
- Groundwater is monitored quarterly in line with the EA conditions; and
- Where new contamination is identified at DRM, MMG will conduct an investigation to the contamination, and engage a contaminated land specialist to investigate and provide mitigation recommendations.

4.1.10.11. Unplanned and Uncontrolled Releases

The proposed additional disturbance does not propose changes to implemented water management strategies. There is unlikely to be any unplanned and uncontrolled releases; surface water flow in the proposed disturbance areas is in response to natural rainfall events only. If an unplanned release does occur, actions will be taken in accordance with the EA.

4.1.10.12. Handling and Storage of Chemicals and Fuels

All chemicals and fuels will be stored in accordance with *Australia Standard (AS) 1940 The storage and handling of flammable and combustible liquids*. Chemicals and fuels proposed to be handled and stored onsite will be fuels, oils and greases required for the usual operation of vehicles and plant. Chemicals and fuels are proposed to be stored in appropriate containers (e.g., fuel drums) on bunded pallets or in bunded areas. Minimal volumes will be stored or transported for the wind farm project, with any larger quantities stored at the existing mine infrastructure areas (e.g., workshop).

4.1.10.13. Spill Management

Vehicle spills (e.g., oil spills) will be managed using readily accessible onsite spill kits. All employees will be appropriately trained in the use of spill kits including containment, absorption, and recovery. Any spill greater than 20L will be recorded as an incident and appropriately investigated and documented.

4.1.10.14. *Progressive Rehabilitation*

Disturbance areas have been proposed to allow safe transport of the wind turbines to their final locations. Once the turbines are in place, access tracks will only be required to service light vehicles for inspection and maintenance purposes. The additional width of the tracks will be rehabilitated as it becomes available.

MMG have a detailed Progressive Rehabilitation and Closure Plan (PRCP) to ensure the environment is returned to an agreed or pre-mine condition. Progressive rehabilitation will be completed as per the defined progressive rehabilitation schedule.

4.2. Water Impacts

In preparing this application, consideration has been given to guideline *ESR/2015/1837 – Application requirements for activities with impacts to water* (DES, 2021c). DES is required to assess the application against the requirements stated in the *Environmental Protection Act 1994*, EP Regulation and the EPP Water to meet the environmental objective and performance outcomes described below:

Environmental Objective

‘The activity will be operated in a way that protects environmental values of waters.’

Performance Outcome

There is no actual or potential discharge to waters of contaminants that may cause an adverse effect on an environmental value from the operation of the activity.

All of the following:

- The storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks.
- Contingency measures will prevent or minimise adverse effects on the environment due to the unplanned releases or discharges of contaminants to water.
- The activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the Project without prior treatment.
- The disturbance of any Acid Sulfate Soils, or potential Acid Sulfate Soils, will be managed to prevent or minimise adverse effects on environmental values.
- Acid producing rock will be managed to ensure that the production and release of acidic waste is prevented or minimised, including impacts during operation and after the environmental authority has been surrendered.
- Any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a water course or wetland.
- For a petroleum activity, the activity will be managed in a way that is consistent with the coal seam gas water management policy, including the prioritisation hierarchy for managing and using coal seam gas water and the prioritisation hierarchy for managing saline waste.
- The activity will be managed so that adverse effects on environmental values are prevented or minimised.

Environmental Objective

The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.

Performance Outcome

Both of the following apply:

- There will be no direct or indirect release of contaminants to groundwater from the operation of the activity.
- There will be no actual or potential adverse effect on groundwater from the operation of the activity.

Or, the activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.

Some activities involving direct releases to groundwater are prohibited by the EP Regulation.

RISK OF ENVIRONMENTAL IMPACT: LOW

4.2.1. Overview of Water Impacts

The following proposed EA amendments have potential impacts to water:

- Remove the Contaminant Limit for total aluminium in receiving waters samples;
- Revise the Trigger Level and Contaminant Limit for filterable aluminium, in receiving waters samples to site specific values; and
- Remove the hydraulic performance criteria for the Stage 2 PAF Runoff Dam.

4.2.2. Aluminium in Receiving Waters

The proposed EA amendments are to remove the Contaminant Limit (Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits)) for total Aluminium and replace the Contaminant Limit for and Trigger Limit for filterable aluminium to site specific values.

The existing Contaminant Limit for total aluminium (T-Al) of 0.2 mg/L is derived from the ANZECC 2000 guidelines for recreational purposes (body immersion). As the surrounding land uses at DRM are pastoral, it is unlikely that the receiving waters would be used for recreational purposes. The ANZECC 2000 livestock drinking water guideline for aluminium is 5 mg/L, which is significantly higher than the current limit.

DRM propose to continue monitoring for total aluminium, however using it as an interpretative parameter only, similar to how total suspended solids are measured.

Currently the Trigger Limit for dissolved aluminium (D-Al) is 0.055mg/l or the 80th percentile of reference values. A review of historical data demonstrates that dissolved aluminium frequently exceeds that trigger limit of 0.055mg/l at all three reference monitoring locations. Further, there are no statistically significant difference between the results for reference and impact locations. Given this, Ref-80 is not considered to be a useful marker for detecting impact from mining activities.

Currently the Contaminant Limit for dissolved aluminium (D-Al) is the 95th percentile of the reference value. As discussed above, there has been no statistically significant difference between the results for reference and test sites. For the same reasons, Ref-95 is not a useful tool for detecting anomalous results potentially indicative of impacts.

Fixed Trigger Level and Contaminant Limits are proposed to be implemented to monitor dissolved aluminium. A historical dataset is provided in Appendix F for consideration of these fixed values.

4.2.3. Stage 2 PAF Runoff Dam

4.2.3.1. Consequence Category Assessment

A revised Consequence Category Assessment (CCA) was completed for the Stage 2 PAF Dam in 2023, in accordance with the Manual for assessing hazard consequence and hydraulic performance of structures (The Manual) (Environmental Protection Act 1994 (Qld) (a)). The results of the assessment are summarised below. A full copy of the report is provided in Appendix C.

4.2.3.2. Failure to contain – seepage

Under Section 2.1.2.1.a of the Manual, the assessment against the ‘Failure to contain – seepage’ scenario is applicable to new structures and does not apply to structures approved prior to development of Version 5.02 of the Manual (ATC Williams, 2023). The consequence category was therefore assessed as N/A.

The proposed amendment does not result in any changes to the assigned risk rating for “failure to contain – seepage”.

4.2.3.3. Failure to contain – overtopping

In the event of an overtopping failure from the PAF Stage 2 Run Off Dam, flows would pass south entering Dugald River via the unnamed Dugald River tributaries. There are no on-site personnel routinely present in the failure path, nor are there bores for human consumption or third-party infrastructure.

The unnamed tributaries of Dugald River and the Dugald River contain the following:

- Wildlife habitat (endangered or vulnerable);
- Regulated vegetation (essential habitat); and
- Regulated vegetation (intersection a watercourse).

Impacts to these areas would be likely; however, would not be expected to reach the thresholds for a ‘Significant’ or ‘High’ consequence impact (ATC Williams, 2023). In the event of an overtopping failure, water quality parameters are expected to be diluted due to significant, prolonged rainfall in the upstream catchment.

Overall, the consequence category has been assessed as ‘low’ for the overtopping scenario.

4.2.3.4. Failure to contain – dam break

In the event of a dam break failure of the PAF Stage 2 Runoff , flows would pass north east entering Dugald River via the unnamed Dugald River tributaries. The population at risk has been defined as 0, resulting in a ‘low’ risk rating.

There are no third party assets in the failure path therefore the economic loss has been defined as 'low' risk.

In a dam break scenario, water quality is expected to impact upon:

- Wildlife habitat (endangered or vulnerable);
- Regulated vegetation (essential habitat); and
- Regulated vegetation (intersection a watercourse).

The impacts to the areas of MSES are likely to result in the following:

- remediation of damage is likely to take more than 6 months but less than 3 years; or
- significant alteration to existing ecosystems.

The consequence category for general environmental harm has been assessed as being a 'significant' risk.

Overall, the consequence category has been assessed as 'significant' for the dam break scenario.

4.2.3.5. Hydraulic Performance Criteria

Dams assessed as having a "Significant" or "High" consequence for the 'failure to contain – overtopping' must have hydraulic performance objectives which include a design storage allowance (DSA), an extreme storage allowance (ESS) and a mandatory reporting level (MRL).

The PAF Stage 2 Runoff Dam has been risk assessed as 'Low Risk' for 'failure to contain – overtopping', therefore hydraulic performance criteria are not required.

4.2.4. Proposed Additional Disturbance

4.2.4.1. Surface Water

The proposed wind farm tracks cross small ephemeral creek lines on five occasions, as displayed on Figure 5. Existing tracks will be used where possible, and disturbance will be minimised as much as practical. The impacts of the proposed tracks are considered to be minimal and will be mitigated using erosion and sediment controls outlined in Section 4.2.5.2. DRM will continue to implement existing surface water management controls including ongoing monitoring.

One wetland, Lake Julius is located within the vicinity of DRM. As it is upstream and located approximately 40 km from DRM, no impacts are anticipated as a result of the proposed additional disturbance areas.

4.2.4.2. Groundwater

Impacts to ground waters are not anticipated as a result of the proposed amendments. DRM will continue to implement existing water management controls including ongoing monitoring.

4.2.5. Management of Water Impacts

4.2.5.1. Timing of Works

All clearing work will be undertaken during the dry season (April – November). Work will not be conducted during significant rain, or when significant rainfall is forecast.

4.2.5.2. Erosion and Sediment Control

The risk of erosion as a result of the proposed additional disturbance is considered low. However, MMG will implement erosion and sediment controls (ESC) during construction in line with MMG's Erosion and Sediment Control Plan. Generally, ESC may consist of (but not limited to):

- Conducting construction works during the dry season where possible (April – November);
- Minimising all disturbed areas and stabilisation as much as possible by conducting progressive rehabilitation/stabilisation as soon as practical;
- Maintaining vegetative buffer zones where possible;
- Delineating areas required to be disturbed and ensuring that disturbance is limited to those areas;
- Construction of diversion bunds upslope of disturbance to direct clean water runoff away from disturbed areas;
- Construction of drains to capture runoff from disturbed areas and direct runoff into sediment basins or dams;
- Construction of sediment basins or dams to capture sediment and contaminants for treatment or retention;
- Construction of graded banks over final reshaped landforms to minimise erosion and re-direct runoff to catch drains;
- Topsoil stockpiles located away from operational areas; and
- Revegetation of final landforms as soon as possible.

4.2.5.3. Discharges and Releases

The release of contaminants to waters at DRM is only authorised at the points specified in Schedule C – Table 1 (Release Points) of the EA. No discharges and/or releases are anticipated as a result of the proposed activities.

4.2.5.4. Unplanned and Uncontrolled Releases

No additional discharges or releases are associated with the proposed amendments. All existing water management controls will continue to be implemented.

4.2.5.5. Handling and Storage of Chemicals

All chemicals and fuels will be stored in accordance with *Australia Standard (AS) 1940 The storage and handling of flammable and combustible liquids*. Chemicals and fuels proposed to be handled and stored onsite will be fuels, oils and greases required for the usual operation of vehicles and plant. Chemicals and fuels are proposed to be stored in appropriate containers (e.g., fuel drums) on bunded pallets or in bunded areas. Minimal volumes will be stored or transported for the wind farm project, with any larger quantities stored at the existing mine infrastructure areas (e.g., workshop).

4.2.5.6. Spill Management

Vehicle spills (e.g., oil spills) will be managed using readily accessible onsite spill kits. All employees will be appropriately trained in the use of spill kits including containment, absorption, and recovery. Any spill greater than 20L will be recorded as an incident and appropriately investigated and documented.

4.2.6. Monitoring of Water Impacts

4.2.6.1. Receiving Environment Monitoring Program

A Receiving Environment Monitoring Program (REMP) has been implemented at DRM that encompasses event-based surface water sampling, stream sediment sampling and macroinvertebrate and fish sampling. The REMP will continue to be carried out to capture any potential impacts from the proposed additional disturbance and a report will be prepared annually in line with the EA.

4.2.6.2. Groundwater Monitoring

The EA requires groundwater quality and levels to be monitored at the locations and frequencies outlined in Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency). Groundwater monitoring will continue as described in the EA.

4.3. Waste Impacts

In preparing this report, consideration has been given to guideline *ESR/2015/1836 - Application requirements for activities with waste impacts* (DES, 2019a). DES is required to assess the application against the requirements stated in the *Environmental Protection Act 1994*, the Environmental Protection Regulation 2019 (EP Regulation) and the *Waste Reduction and Recycling Act 2011* to meet the environmental objective and performance outcomes described below:

Environmental Objective

'Any waste generated, transported, or received as part of carrying out the activities is managed in a way that protects all environmental values'

Performance Outcome

- Waste generated, transported, or received, is managed in accordance with the waste and resource management hierarchy in the *Waste Reduction and Recycling Act 2011*; and
- If waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.

RISK OF ENVIRONMENTAL IMPACT: LOW

4.3.1. Overview of Waste

In preparing supporting information relating to waste impacts, due consideration has been given to the waste and resource management hierarchy (Figure 15). Measures proposed for the minimisation and management of waste have been considered in line with this hierarchy with disposal considered to be the final option.

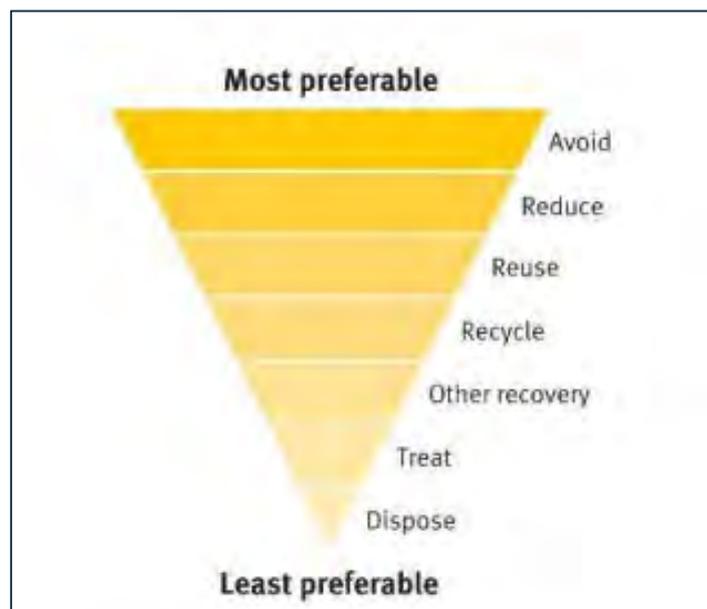


Figure 15. Waste and resource management hierarchy

4.3.2.Types of Waste at DRM

Waste generated at DRM is typical of remote mining operations. Table 19 summarises the varied waste streams and their management groups. The proposed amendment will not result in any change to the waste types and volumes will remain within the current ERA thresholds.

Table 19. Waste Types at DRM

Waste Type	Management Group	Management Strategy
Mineral Waste - PAF	Mineral Waste	Temporary storage onsite for use in underground fill
Mineral Waste - NAF	Mineral Waste	Temporary storage onsite for use in site maintenance and closure rehabilitation
Tailings	Mineral Waste	Use in paste fill and surplus storage in the TSF
Putrescible domestic	Non-Mineral Waste	Disposed of via a third-party contractor
Non-putrescible domestic	Non-Mineral Waste	Disposed of via a third-party contractor
Recyclables	Non-Mineral Waste	Recycled via a third-party contractor
Scrap steel	Non-Mineral Waste	Recycled via a third-party contractor
Sewage	Non-Mineral Waste	Evaporation ponds
Septic and grease waste	Non-Mineral Waste	Disposed of offsite via a third-party regulated waste transporter
Chemicals	Non-Mineral Waste	Disposed of offsite via a third-party regulated waste transporter
Hydrocarbons	Non-Mineral Waste	Recycled offsite via a third-party regulated waste transporter
Other regulated wastes (batteries etc)	Non-Mineral Waste	Disposed of offsite via a third-party regulated waste transporter
Tyres	Non-Mineral Waste	Recycled offsite via third-party contractor
Inert construction	Non-Mineral Waste	Disposed of or recycled offsite via third-party contractor

4.3.3.Management of Waste Impacts

4.3.3.1. Waste Storage

Waste will continue to be stored in accordance with established DRM waste management procedures. Other than organic waste (i.e., cleared vegetation) and soil to be re-used for remediation, the proposed amendment will not result in any changes to waste volumes. Any stripped topsoil will then be transported to existing Stockpiles listed in Schedule A – Table 1 (Authorised Mining Activities).

4.3.3.2. Waste Tracking and Documentation

Waste tracking and documentation for regulated waste generated by day-to-day activities (i.e., waste oil and grease) will be managed by the service contractor(s), in compliance with QLD regulated waste tracking requirements, under the EP Regulation.

4.3.3.3. Waste disposal

Waste will continue to be disposed in accordance with established DRM waste management procedures. All general and regulated waste (other than mineral waste) will be removed from DRM and disposed at a licenced facility.

4.4. Air Impacts

In preparing this application, consideration has been given to guideline *ESR/2015/1840 – Application requirements for activities with impacts to air* (DES, 2017a). DES is required to assess the application against the requirements stated in the *Environmental Protection Act 1994*, EP Regulation and Environmental Protection (Air) Policy 2019 (EPP Air) to meet the environmental objective and performance outcomes described below:

Environmental Objective

'The activity will be operated in a way that protects environmental values of air.'

Performance Outcome

There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity, or

All of the following:

- Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised.
- Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air.
- Releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.

RISK OF ENVIRONMENTAL IMPACT: LOW

4.4.1. Surrounding Land and Sensitive Receptors

DRM is situated in an unpopulated region with the nearest sensitive receptor being The Roseby Homestead, approximately 6 km south of DRM. The remaining area is made up of grazing land with some homesteads approximately 30 km from DRM. The nearest major centre is Cloncurry, approximately 65 km south. The predominant wind direction is from the south southeast, away from the nearest sensitive receptor.

Depositional and ambient dust is monitored at the locations and frequencies outlined in Table 20. The key aim of the monitoring program is to monitor for dust impacts at the sensitive receptor, Roseby Homestead. Dust is monitored using depositional dust gauges and high-volume air samplers (total suspended particulates) and low-volume air samplers (suspended particulate matter <10µm).

Table 20. Schedule B - Table 2 (Air Quality Monitoring Program)

Monitoring Location Description	Location (GDA94 MGA z54)		Monitoring Site ID	Monitoring Frequency
	Easting	Northing		
Compliance				
Roseby Homestead	413970	7754962	EA_DG_005	For TSP, PM10, arsenic, cadmium and lead: As required by condition B8.
			EA_AQ_005	For dust deposition measured as insoluble matter: Monthly For arsenic, cadmium and lead in deposited dust: Monthly
Reference				
North of Roseby Homestead and the licensed place	408471	7766889	EA_DG_007	For TSP, PM10, arsenic, cadmium and lead: As required by condition B8.
			EA_AQ_007	
	411918	7764933	EA_DG_008	For dust deposition measured as insoluble matter: Monthly
			EA_AQ_008	
410576	7762936	EA_DG_009		
South of Roseby Homestead and the licenced place	413110	7752939	EA_DG_006	For arsenic, cadmium and lead in deposited dust: Monthly
			EA_AQ_006	
Between Roseby Homestead and the licenced place	413589	7760259	EA_DG_001	
	412867	7758953	EA_DG_010	

4.4.2. Fugitive emissions

The proposed amendment will not result in any changes to the storage, handling or processing of material, other than during vegetation clearing. Appropriate dust mitigation techniques will be implemented, as described below.

4.4.3. Management of Air Impacts

The most recent external review of air quality (ERM 2019) at DRM identified no residual impacts to the receiving environment from existing activities. No complaints have been received to date.

Further air impacts are not envisaged from the proposed amendment and management will continue in accordance with DRMs Air Quality, Noise and Vibration Management Plan. Management controls are summarised as following:

- Conduct air quality monitoring to include meteorological monitoring, dust depositional sampling and volumetric monitoring;
- Maintain sealed roadways;

- Plan dust minimisation activities on disturbed surfaces where practicable, for example: timely rehabilitation; seeding of soil stockpiles; and soil binders;
- Cover and containment of potential odour sources; and
- Record community air emission complaints/grievances.

4.4.4. Contingency measures

If monitoring or visual assessment detects significant emissions to air, works will cease until appropriate controls are implemented and emissions are reduced.

4.5. Noise Impacts

In preparing this application, consideration has been given to guideline *ESR/2015/1838 – Application requirements for activities with noise impacts* (DES, 2017d). DES is required to assess the application against the requirements stated in the *Environmental Protection Act 1994*, EP Regulation and the Environmental Protection (Noise) Policy 2019 (EPP Noise) to meet the environmental objective and performance outcomes described below:

Environmental Objective

'The activity will be operated in a way that protects the environmental values of the acoustic environment.'

Performance Outcome

- Sound from the activity is not audible at a sensitive receptor, or
- The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

RISK OF ENVIRONMENTAL IMPACT: LOW

4.5.1. Overview of Noise Impacts

Studies completed for the DRM Environmental Impact Statement by AustralAsian Resource Consultants Pty Ltd (AARC) describe background levels for the area prior to the DRM development as being typical of quiet rural areas with the median background noise levels measured at during the day - 23 dB(A), evening - 21 dB(A) and night-time -16 dB(A) (AARC 2010b).

Predicted noise level impacts modelled for the Roseby Homestead were found to be predominately below the limits of the EA. Table 21 compares the predicted with measured values from a 2016 noise review conducted by Wood & Grieve Engineers. To date, MMG has received no noise complaints.

Table 21. Predicted (AARC 2010b) and Actual (WGE 2016) Noise Levels for DRM (AARC 2010b).

Noise level dB(A) as $L_{Aeq,adj,T}$	Day	Evening	Night
EA guideline	40	35	30
Background (2010)	23	21	26
Predicted max impact (2010)	31	31	31

4.5.2. Noise Management

The proposed amendment does not include any changes to noise impacts and management will continue in accordance with DRMs Air Quality, Noise and Vibration Management Plan. The management actions are summarised as follows:

- Conduct routine maintenance on mobile and stationary assets to ensure optimal efficiency;
- Conduct noise monitoring at the sensitive receptors as specified in the EA Schedule F;
- Calibrate, maintain and service noise monitoring equipment and record all calibration reports;
and
- Record community noise complaints/grievances.

5. Environmental Risk Assessment

5.1. Overview

An environmental risk assessment has been prepared in relation to the proposed amendment. The risk methodology utilised has been developed based on the Australia and New Zealand Standard AS/NZS for Risk Management – Principles and Guidelines (ISO 31000:2018).

The risk management process involves the systematic application of policies, procedures, and practices to the activities of communicating and consulting, establishing the context and assessing, treating, monitoring, reviewing, recording, and reporting risk (Figure 16).

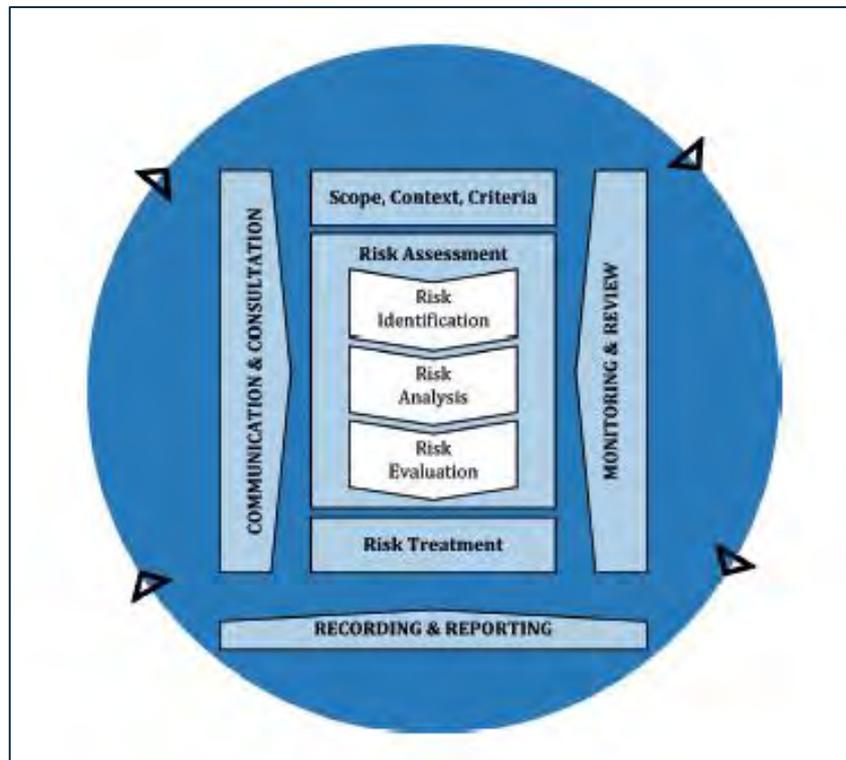


Figure 16. ISO 31000: 2018 Risk management process

5.1.1. Risk Identification

The purpose of risk identification is to find, recognise and describe risks that might help or prevent an organisation achieving its objectives. Relevant, appropriate and up-to-date information is important in identifying risks (Standards Australia 2018).

The following factors and the relationships among these factors have been considered by this risk assessment:

- Tangible and intangible sources of risk;
- Causes and events;

- Threats and opportunities;
- Vulnerabilities and capabilities;
- Changes in the external and internal context;
- Indicators or emerging risks;
- The nature and value of assets and resources;
- Consequences and their impacts on objectives;
- Limitations of knowledge and reliability of information;
- Time-related factors; and
- Biases, assumptions, and beliefs of those involved.

5.1.2.Risk Analysis and Evaluation

The purpose of risk analysis is to comprehend the nature of risk and its characteristics, including, where appropriate, the level of risk. Risk analysis can be undertaken with varying degrees of detail and complexity, depending on the purpose of the analysis, the availability and reliability of information and the resources available. Risk analysis techniques can be qualitative, quantitative or a combination of these and should include:

- The likelihood of events and consequences;
- The nature and magnitude of consequences;
- Complexity and connectivity;
- Time-related factors and volatility;
- The effectiveness of existing controls; and
- Sensitivity and confidence levels.

A likelihood of occurrence and severity of consequence rating has been assigned to each identified risk in accordance with the risk matrix detailed in Table 22. Control measures have been developed following the identification of risks to achieve a level of risk that is considered to be an acceptable level, as described in Table 23.

Table 22. Risk matrix

Likelihood of Occurrence	Severity of Consequence				
	Catastrophic	Major	Moderate	Minor	Insignificant
	(5)	(4)	(3)	(2)	(1)
Almost certain (5)	10	9	8	7	6
Likely (4)	9	8	7	6	5
Possible (3)	8	7	6	5	4
Unlikely (2)	7	6	5	4	3
Rare (1)	6	5	4	3	2

Table 23. Risk scores

Risk Score	Risk Rating	Actions Required
9 – 10	Extreme	Requires immediate action to reduce risk score.
7 – 8	High	Requires an action plan approved by senior management.
5 – 6	Moderate	Specific monitoring and procedures required.
2 - 4	Low	Management through routine procedures and protocols.

5.1.3. Risk Assessment Results

Risks identified were assessed using the methodology described above. Five risks were identified with three rated as ‘Low’, and two rated as ‘Moderate’. All risks considered the existing and proposed controls to reduce the level of risk to as low as reasonably practicable. Control strategies are reflected in Table 24.

Table 24. Risk assessment

Aspect	Potential Impact	Risk Rating			Risk Controls	Residual Risk Rating			Treatment	Comments
		L	C	R		L	C	R		
Land	Excessive clearing of remnant REs. Disturbance to PNRW habitat. Disturbance to Carpentarian grasswren habitat. Increased erosion.	3	4	7	Pre-clearance searches for breeding places of Carpentarian grasswren. Pre-clearance searches for breeding places of PNRW. Fauna spotter catcher present prior to and during clearing. Provide crew with accurate mapping of activities, access routes and designed disturbance area. Survey and peg disturbance areas prior to works commencing. Regular visual inspection of disturbance area to ensure clearing has been minimised. Conduct construction works during the dry season where possible. Minimise open disturbed areas to the smallest practical areas when conducting clearance works.	2	4	6	Conduct activities in accordance with DRM Land Clearance and Disturbance Permitting Procedure	

Aspect	Potential Impact	Risk Rating			Risk Controls	Residual Risk Rating			Treatment	Comments
		L	C	R		L	C	R		
					Conduct ground truthing surveys ESA before commencing work within 50 – 500 m of a mapped ESA.					
Water	Increased erosion. Surface water runoff from disturbance areas discharging into the receiving environment resulting in release of contaminants.	3	3	6	Conduct construction works during the dry season where possible. Ensure topsoil resources stockpiled are placed away from drainage areas. Trap sediment laden water and treat prior to discharging into the receiving environment.	2	3	5	Conduct activities in accordance DRM Erosion and Sediment Control Plan.	
Waste	Incorrect storage or disposal of waste leading to contamination.	2	2	4	Waste storage, transport and disposal as per existing waste management procedures.	1	2	3		
Air	Emissions to air resulting in nuisance at a sensitive receptor.	3	2	5	Maintain clearance areas to as small as practicable. Conduct routine air quality monitoring. Maintain unsealed roads using relevant dust suppression methods. Timely rehabilitation of disturbed surfaces.	2	2	4	Conduct activities in accordance DRM Air Quality, Noise and Vibration Management Plan.	

Aspect	Potential Impact	Risk Rating			Risk Controls	Residual Risk Rating			Treatment	Comments
		L	C	R		L	C	R		
Noise	Increase in noise at sensitive receptor.	2	2	4	<p>Conduct routine maintenance on mobile and stationary assets to ensure optimal efficiency.</p> <p>Record and investigate community noise complaints/grievance.</p> <p>Conduct noise monitoring as required.</p>	1	3	3	Conduct activities in accordance DRM Air Quality, Noise and Vibration Management Plan.	

6. Conclusions and Recommendations

This report is submitted to the DES in support of MMG Dugald River Pty Ltd.'s application for a major EA amendment to EA EPML00731213 for the Dugald River Mine and provides a detailed response to the following guidelines:

- *Approval processes for Environmental Authorities* (DES 2019b).
- *Application requirements for activities with impacts to air* (DES 2017a).
- *Application requirements for activities with impacts to land* (DES 2017b).
- *Application requirements for activities with impacts to water* (DES 2017c).
- *Application requirements for activities with noise impacts* (DES 2017d).
- *Application requirements for activities with waste impacts* (DES 2019a).

Risks were assessed in accordance with ISO 31000:2018 and identified five risks. Five risks were identified with three rated as 'Low', and two rated as 'Moderate'. All risks considered the existing and proposed controls to reduce the level of risk to as low as reasonably practicable. Control strategies are reflected in supporting information contained within this document.

It is recommended that this application for the major amendment for EA EPML00731213 be accepted with appropriate and reasonable conditions.

7. References

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**APPENDIX A: Proposed Environmental Authority
EPML00731213**

Permit

Environmental Protection Act 1994

Environmental authority EPML00731213

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: EPML00731213

Environmental authority takes effect on 19 December 2022.

Environmental authority holder(s)

Name(s)	Registered address
MMG Dugald River Pty Ltd	Level 23, 28 Freshwater Place SOUTHBANK VIC 3006.

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
8-(1) Chemical storage >50t class 1 or 2	MDL79 ML2502 ML90213
8-(3) Chemical storage >500m ³ class C1 or C2	ML2467 ML2556 ML90218
8-(4) Chemical storage >200t solids or gases	ML2468 ML2557 ML90220
15-Fuel burning >500kg per hr	ML2469 ML2558 ML90230
16-(2c) Extractive >1,000,000t per yr	ML2470 ML2559 ML90237
16-(3c) Screening >1,000,000t per yr	ML2471 ML2596
31-(2b) Mineral processing >100,000t per yr	ML2477 ML2599
33-Crushing, milling, grinding or screening >5,000t per yr	ML2478 ML2601
63-(1b)(i) Sewage treatment >100 to 1500EP - IT or IR	ML2479 ML2638
63-(1b)(ii) Sewage treatment >100 to 1500EP - no IT or IR	ML2480 ML2684
Mining - ML gold ore - 16, Site Specific	ML2481 ML2685
Mining - ML copper ore - 17, Site Specific	ML2482 ML7496
Mining - ML lead, silver or zinc - 18, Site Specific	ML2496 ML90047
	ML2497 ML90049
	ML2498 ML90050
	ML2499 ML90051
	ML2500 ML90211
	ML2501 ML90212



Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days)

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

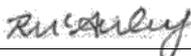
- a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or
- b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or
- c) otherwise- one the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

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Signature

19/12/2022

Date

Rebecca McAuley
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Mineral Business Centre
PO Box 7230, Cairns QLD 4870
Phone: (07) 4222 5352
Email: ESCairns@des.qld.gov.au

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where serious or material environmental harm may be caused (section 443)
- offence to place contaminant where environmental nuisance may be caused (section 443A)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Natural Resources and Mines (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

Obligations under the *Mining and Quarrying Safety and Health Act 1999*

If you are operating a quarry, other than a sand and gravel quarry where there is no crushing capability, you will be required to comply with the *Mining and Quarrying Safety and Health Act 1999*. For more information on your obligations under this legislation contact Mine Safety and Health at www.dnrm.qld.gov.au, or phone 13 QGOV (13 74 68) or your local Mines Inspectorate Office.

Conditions of environmental authority

This **environmental authority** incorporates the following schedules:

- Schedule A - General
- Schedule B - Air
- Schedule C - Water
- Schedule D - Regulated Structures
- Schedule E - Sewage Treatment
- Schedule F - Noise and Vibration
- Schedule G - Non-Mineral Waste
- Schedule H - Mineral Waste
- Schedule I - Land and Rehabilitation
- Schedule J - Definitions
- Schedule K - Figures

Schedule A – General

Activity

- A1 This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.
- A2 In carrying out the mining activity the holder of this environmental authority must comply with Schedule A – Table 1 (Authorised Mining Activities) and Schedule K – Figure 1a (Project Infrastructure Layout – Mine Infrastructure Area), Schedule K – Figure 1b (Project Infrastructure Layout – TSF and Accommodation Village) and Schedule K - Figure 1c (Project Infrastructure Layout – Support Infrastructure).

Schedule A – Table 1 (Authorised Mining Activities)

Mine Domain	Mine Feature Name	Location (GDA94 MGA z54)		Maximum Disturbance Area (hectares)	Constraints
		Easting	Northing		
Ancillary Infrastructure and Services	Accommodation Village and sewage treatment plant	410282	7762986	24.3	
	Pipeline and Accommodation Village Road	-	-	6	
	Communications tower	410265	7762672	0.06	
	Powerline	-	-	65.75	
	Raw water pipeline	-	-	12.7	
	Roads and Tracks	-	-	66.49 6	
	Cleared Pads	-	-	0.28 0	Related to windfarm geotechnical investigation works
	Groundwater infrastructure	-	-	0.5	
Borrow Pits & Stockpiles	Borrow Pit/Topsoil Stockpile, Borrow Pit A, and Topsoil Stockpile A	411283	7759760	16.98	
	Borrow Pit B	411092	7760669	2.5	
	Borrow Pit C1	411171	7761447	1.1	
	Borrow Pit C2	411154	7761268	1.8	
	Access Road Borrow Pit(s)	-	-	5	
	TSF Borrow Pit A	408393	7762874	8.3	
	TSF Borrow Pit B	408405	7763128		
	TSF Stockpile	408448	7762900		
	Topsoil Stockpile B	412073	7761399	9.7	
	Spoil Stockpile 1	411945	7760871	0.65	
Spoil Stockpile 2	411873	7761152	1.5		
Dams and Diversion Structures	Diversion Drains	-	-	2	
	Stage 1 PAF PAD Run Off Dam	411483	7760727	2.25	Dam constructed in accordance with conditions specified in Schedule D of this environmental authority.
	Stage 2 PAF PAD Run Off Dam	411271	7760924	11.7	
	Underground Mine Water Collection Dam	411632	7760659	0.65	

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Mine Domain	Mine Feature Name	Location (GDA94 MGA z54)		Maximum Disturbance Area (hectares)	Constraints
		Easting	Northing		
	STP Dam Stage 1	412389	7759783	0.9	
	STP Dam Stage 2	412328	7759645	4	
	ROM Area Run Off Dam	412175	7761066	3.7	
	Raw Water Dam	412153	7760929	1.8	
	Sediment Dam A	412172	7760845	1.1	
	Process Plant Run Off Dam	412176	7760751	1.5	
	Containment Dam	412091	7760745	0.6	
	Mine Workshop Run Off Dam	411989	7760058	0.6	
	Sediment Dam C	412224	7750313	4.5	
	Sediment Dam D	412336	7759989	3.5	
	Sediment Dam F	411592	7760144	1.4	
	Sediment Dam G	411459	7761074	1.4	
Exploration	Drill Pads	-	-	10	Exploration activities must be consistent with conditions A33 and A34 of this environmental authority and the current Plan of Operations.
Mineralised Waste	NAF waste rock dump	411393	7760288	8	Maximum disturbance area relates to the disturbance authorised during the operation of the mine. Only non-acid forming waste rock is authorised to be placed in NAF waste rock dump. Where possible non-acid forming waste rock will be used in rehabilitation and only in accordance with the conditions of this environmental authority. Maximum disturbance area relates to the disturbance authorised during the operation of the mine. All potentially acid forming rock must be returned to the void at the end of mine life.
	NAF waste rock dump bund	-	-		
	PAF waste rock dump (Stage 1)	411492	7760604	1.6	
	PAF waste rock dump (Stage 1 Extension)	411270	7760598	1.1	
	PAF waste rock dump (Stage 2)	411512	7760518	9.5	
Mining and Processing Area	West Laydown Area	411157	7760276	10.3	
	Waste Transfer Station	411476	7759611	0.25	
	Explosives magazine	411554	7759189	0.6	
	Fuel Storage	411958	7760396	0.2	
	Temporary Waste Laydown	412193	7759618	1	
	Construction Laydown, Warehouse, Mobile Equipment Laydown and Core Shed	-	-	6.8	
	North decline	411699	7760952	1	
	South decline	411813	7760628	1	
	Ventilation shaft 1	411582	7761135	0.05	
Ventilation shaft 2	411532	7761107	0.05		

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Mine Domain	Mine Feature Name	Location (GDA94 MGA z54)		Maximum Disturbance Area (hectares)	Constraints
		Easting	Northing		
	Ventilation shaft 3	411590	7761068	0.05	
	Ventilation shaft 4	411775	7760549	0.05	
	Ventilation shaft 5	411801	7760484	0.05	
	Ventilation shaft 6	411866	7760294	0.05	
	Ventilation shaft 7	411834	7760290	0.05	
	Ventilation shaft 8	411878	7760205	0.05	
	Ventilation shaft 9	411466	7761320	0.05	
	Run of Mine (ROM) Pad	411882	7760964	3.8	
	ROM Haul Roads	-	-	3.6	
	Processing Plant and Conveyor Area	411986	7760590	14.3	
	Switchyard 1	412170	7760656	1.04	
	Switchyard 2	411878	7760073	1.0	
	Exploration camp, Sewage Treatment Plant and Camp Expansion Works	412173	7760344	32.8	
	Sewage Treatment Plant	412060	7760070	0.2	
Workshop, Vehicle Washdown and Maintenance Area	411963	7760191	3.8		
Office & Administration Buildings	412232	7760234	3.610 6		
Tailings Storage Facility (TSF)	TSF and Seepage Collection Pond	409197	7763517	207	Dam constructed in accordance with conditions specified in Schedule D of this environmental authority
	TSF Pipelines and Roads	-	-	5.7	

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- A3 Notwithstanding condition A2, infrastructure that has the potential to contaminate groundwater must not be constructed within fifty (50) metres of Silvermine Creek or North Creek.
- A4 Access to the licensed place via land authorised for that purpose by the *Mineral Resources Act 1989* is subject to the conditions of this environmental authority.

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Maintenance of Measures, Plant and Equipment

- A5 The holder of this environmental authority must:
- (a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority;
 - (b) maintain such measures, plant and equipment in a proper condition; and
 - (c) operate such measures, plant and equipment in a proper manner.
- A6 No change, replacement or alteration of any plant or equipment is permitted if the change, replacement or alteration increases, or is likely to increase, the risk of environmental harm.

Monitoring and Reporting

- A7 Any management or monitoring plans, systems, programs or reports required to be developed and implemented by a condition of this environmental authority must be reviewed for effectiveness in minimising the likelihood of environmental harm every 3 years and amended immediately if required. The review must be documented and completed by an appropriately qualified person.
- A8 Monitoring records or reports required under this environmental authority must be maintained and be readily accessible at the licensed place or at another location agreed to in writing by the administering authority for a period of not less than seven (7) years.
- A9 The holder of this environmental authority must upon request from the administering authority, supply monitoring records, plans and reports in the form and by the means requested by the administering authority within five (5) business days.
- A10 All monitoring referred to in this environmental authority must be undertaken by an appropriately qualified person using monitoring equipment that is accurately calibrated and maintained in accordance with the manufacturer's specifications.
- A11 All analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.
- A12 The holder of this environmental authority must make reasonable efforts to provide safe and all-weather access to all monitoring locations required under this environmental authority where practicable and safe to do so. This includes:
- (a) providing appropriate site infrastructure to gain safe all-weather access to monitoring locations during reasonably foreseeable events, where practicable and safe to do so; and
 - (b) developing and implementing contingency plans to facilitate sampling during extreme events where provision of site infrastructure is not safe or practical.

Risk Management

- A13 The holder of this environmental authority must develop and implement a risk management system for mining activities which conforms to the latest edition of the Australian Standard for Risk Management.

Emergency Response / Contingency

- A14 The holder of this environmental authority must implement and maintain an emergency response/contingency plan to respond to any emergency event or incident.
- A15 The emergency response/contingency plan required under condition [A17-A14](#) must address the following matters as a minimum:
- (a) response procedures to be implemented to prevent or minimise the risk of environmental harm arising from any emergency event or incident;
 - (b) response procedures to minimise the extent and duration of environmental harm caused by any emergency event or incident;
 - (c) the practices and procedures to be employed to restore the environment or mitigate any environmental harm caused by any emergency event or incident;
 - (d) the resources to be used in response to any emergency event or incident;
 - (e) procedures to investigate the cause of any emergency event or incident and where necessary, implement remedial actions to reduce the likelihood of recurrence of similar emergency event or incident;
 - (f) the provision and availability of documented procedures to staff attending any emergency event or incident to enable them to effectively respond;
 - (g) training of staff that will be called upon to respond to any emergency event or incident to enable them to effectively respond;
 - (h) timely and accurate reporting of the circumstance and nature of any emergency event or incident to the administering authority in accordance with conditions of this environmental authority;
 - (i) procedures for accessing monitoring points during any emergency event or incident; and
 - (j) procedures to notify any potentially impacted stakeholder who may be affected by the emergency event or incident.

Notification of Incidents, Exceedances and Releases

- A16 The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.
- A17 The notification in condition A16 must include, but not be limited to, the following:
- (a) the environmental authority number and name of the holder of this environmental authority;
 - (b) the name and telephone number of the designated contact person;
 - (c) the location of the incident, exceedance or release;
 - (d) the date and time of the incident, exceedance or release;
 - (e) the time the holder of this environmental authority became aware of the incident, release or exceedance;
 - (f) where known:
 - (a) the estimated quantity and type of substances involved in the incident, exceedance or release;
 - (b) the actual or potential cause of the incident, release or exceedance; and
 - (c) a description of the nature and effects of the incident, exceedance or release including environmental risks and any risks to public health or livestock.
 - (g) any sampling conducted or proposed, relevant to the incident, exceedance or release;
 - (h) immediate actions taken to prevent or mitigate any further environmental harm caused by the incident, exceedance or release; and
 - (i) what notification of stakeholders who may be affected by the incident, exceedance or release has occurred/is being undertaken.

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- A18 The holder of this environmental authority must notify the occupiers or registered owners of affected land and any other potentially impacted stakeholder as soon as reasonably practicable after becoming aware of any incident, exceedance or release that has the potential to impact on environmental values or breaches any condition of this environmental authority concerning releases of contaminants to the environment.
- A19 The notification in condition A18 must include the following:
- (a) the location of the incident, exceedance or release;
 - (b) the date and time of the incident, exceedance or release;
 - (c) the estimated quantity and type of any substances involved in the incident, exceedance or release;
 - (d) the potential impacts to environmental values caused by the incident, exceedance or release; and
 - (e) where there is potential impact on livestock or human health, precautionary measures that will be taken.
- A20 Within ten (10) business days following the initial notification of an incident, exceedance or release, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following:
- (a) results and interpretation by an appropriately qualified person of any samples taken and analysed;
 - (b) outcomes of actions taken at the time of the incident, release or exceedance to prevent or minimise unlawful environmental harm; and
 - (c) outcomes of actions to prevent a recurrence of the incident, exceedance or release.

Complaints

- A21 The holder of this environmental authority must record all environmental complaints received about the mining activity including the following details:
- (a) name, address and contact number for complainant;
 - (b) time and date of complaint;
 - (c) reasons for the complaint;
 - (d) investigations undertaken;
 - (e) conclusions formed;
 - (f) actions taken to resolve complaint;
 - (g) any abatement measures implemented; and
 - (h) person responsible for resolving the complaint.
- A22 The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented must be provided to the administering authority within 10 business days of completion of the investigation, or no later than 10 business days after the end of the timeframe nominated by the administering authority to undertake the investigation.

Community

- A23 The holder of this environmental authority must establish, promote and maintain easily accessible lines of communication between residents, stakeholders and land owners, reasonably expected to be affected by the mining activity to ensure that environmental impacts are identified and managed. This must include but not be limited to the following:
- (a) regular meetings with all residents, stakeholders and land owners, at intervals of not more than six (6) months; and
 - (b) the establishment of a consultative committee with representation open for all residents, stakeholders and land owners, that meets at regular intervals as determined by the committee.

Third Party Auditing

- A24 The holder of this environmental authority must:
- (a) By 1 June 2023, obtain from an appropriately qualified person a report on compliance with the conditions of this environmental authority
 - (b) obtain further such reports at regular intervals, not exceeding three yearly, from the completion of the report referred to above
 - (c) provide each report to the administering authority within 90 days of its completion.

Exploration

- A25 All exploration activities carried out at the licensed place must comply with each of the Standard Environmental Conditions contained in the most recent version of the [Eligibility criteria and standard conditions for exploration and mineral development projects, Code of Environmental Compliance for exploration and mineral development projects.](#)
- A26 Disturbance due to exploration activities in areas not scheduled to be mined within twelve (12) months must be rehabilitated in accordance with the provisions detailed in the administering authority's [Eligibility criteria and standard conditions for exploration and mineral development projects, Code of Environmental Compliance for Exploration and Mineral Development Projects.](#)
- A27 Where a condition of this environmental authority refers to a matter addressed in the [Eligibility criteria and standard conditions for exploration and mineral development projects, Code of Environmental Compliance for Exploration and Mineral Development Projects.](#), the condition of this environmental authority prevails.
- [NEW, The holder of the environmental authority must not carry out activities in a category A or B environmentally sensitive area. Activities involving machinery must not be carried out within 1km of a category an environmentally sensitive area or within 50 m of a category B environmentally sensitive area.](#)

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Transition to New Standards

- A28 Where a condition of this environmental authority requires compliance with a standard, guideline or relevant legislation published externally to this environmental authority and the standard, guideline or relevant legislation is amended or changed subsequent to the issues of this environmental authority the holder of this environmental authority, unless otherwise agreed to by the administering authority, must:
- (a) comply with the amended or changed standard, guideline or relevant legislation within twelve (12) months of the amendment or change being made, unless a different period is specified in the amended standard, guideline or relevant legislation; and
 - (b) continue to remain in compliance with the previous standard, guideline or relevant legislation until compliance with the amended or changed standard or guideline is achieved.

Regard for Comment

- A29 Where comments are provided by the administering authority with respect to any plans, systems or programs required to be developed by a condition of this environmental authority then the holder of this environmental authority must have due regard to these comments.

END OF CONDITIONS FOR SCHEDULE A

Schedule B – Air

General

B1 Unless authorised by this environmental authority, the release of noxious or offensive odour, dust or any other airborne contaminant resulting from the mining activity must not cause environmental harm.

Bulk Material Handling Management

B2 The holder of this environmental authority must ensure that vehicles used for transporting bulk materials on or from the licensed place, have appropriate load preparation to prevent the spillage and/or loss of particulate matter and/or windblown dust during transport.

Air Quality – Particulate Matter

- B3 The mining activity must not cause particulate matter to exceed the following levels when measured at any sensitive place or commercial place:
- (a) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM₁₀) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time monitored in accordance with:
 - (i) the most recent version of Australian Standard AS3580.9.6 *Determination of suspended particulate matter – PM(sub) 10(/sub) high volume sampler with size-selective inlet – Gravimetric method*; or
 - (ii) an alternate method of monitoring PM₁₀ which complies with the performance specifications detailed in another Australian Standard for PM₁₀ and agreed to in writing by the administering authority.
 - (b) a concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a one (1) year averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.3:2003 *Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method*;
 - (c) a concentration of arsenic with an aerodynamic diameter of less than 10 micrometres (PM₁₀) suspended in the atmosphere of 0.006 micrograms per cubic metre over a one (1) year averaging time monitored in accordance with:
 - (i) the most recent version of Australian Standard AS3580.9.6 *Determination of suspended particulate matter – PM(sub) 10(/sub) high volume sampler with size-selective inlet – Gravimetric method*; or
 - (ii) an alternate method of monitoring PM₁₀ which complies with the performance specifications detailed in another Australian Standard for PM₁₀ and agreed to in writing by the administering authority.
 - (d) a concentration of cadmium with an aerodynamic diameter of less than 10 micrometres (PM₁₀) suspended in the atmosphere of 0.005 micrograms per cubic metre over a one (1) year averaging time monitored in accordance with:
 - (i) the most recent version of Australian Standard AS3580.9.6 *Determination of suspended particulate matter – PM(sub) 10(/sub) high volume sampler with size-selective inlet – Gravimetric method*; or
 - (ii) an alternate method of monitoring PM₁₀ which complies with the performance specifications detailed in another Australian Standard for PM₁₀ and agreed to in writing by the administering authority.
 - (e) a concentration of lead suspended in the atmosphere of 0.5 micrograms per cubic metre over a one (1) year averaging time monitored in accordance with:
 - (i) the most recent version of Australian Standard AS/NZS3580.9.3:2003 *Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method*; or
 - (ii) an alternate method of monitoring TSP which complies with the performance specifications detailed in another Australian Standard for TSP and agreed to in writing by the administering authority.

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Note: The holder of this environmental authority may elect to monitor the concentration of arsenic and cadmium as the total metal content in total suspended particulates (TSP) when measured in accordance with the most recent version of AS/NZS3580.9.3:2003 Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method and meet the same limit as specified in condition B3.

Air Quality – Dust Deposition

B4 The holder of this environmental authority must conduct the mining activity in such a manner so as not to cause any exceedance of limits identified in Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits) at any sensitive place or commercial place.

Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits)

Air Quality Indicator	Measurement Period	Trigger Level (µg/m ² /day)	Limit (µg/m ² /day unless specified otherwise)
Arsenic and its compounds as arsenic ⁴	Annual average	4 ¹	-
Cadmium and its compounds as cadmium ⁴	Annual average	2 ¹	-
Lead and its compounds as lead ⁴	Annual average	100 ¹	250 ²
Total insoluble matter (insoluble analysis and particulate matter deposition rate) ³	Monthly average	-	4g/m ² /month ^{5,6}

1. Trigger levels based on First General Administrative Regulation Pertaining to the *Federal Emission Control Act* (Technical Instructions on Air Quality Control – TA Luft) (Table 6 page 29).
2. Air quality limit derived from World Health Organisation – Air Quality Guidelines for Europe Second Edition, 2000 (Chapter 6 page 152).
3. Monitored in accordance with the most recent version of Australian Standard AS3580.10.1 *Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method*.
4. Metals analysis is to be carried out in accordance with a methodology, sufficient to produce representative results capable of comparison against the respective limits and trigger levels.
5. Based on the New Zealand Ministry for Environment Good Practice Guide for Assessing and Managing for Environmental Effects of Dust Emissions (Table 7.1).
6. The dust deposition limit is calculated over a nominal month as per AS/NZS3580.10.1 of 2003 (or more recent editions).

B5 If monitoring indicates the maximum concentrations in condition B3 or the limits in Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits) have been exceeded at a sensitive place or commercial place as a result of the mining activity, then the holder of this environmental authority must immediately implement dust abatement measures to ensure that dust emissions generated by the mining activity no longer exceed the levels specified in condition B3 and Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits).

Note: If the holder of the environmental authority can demonstrate to the administering authority that it is not the cause of the exceedance of concentrations in condition B3 or the limits in Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits) then this condition does not apply.

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- B6 In the event of monitoring results showing an exceedance of any of the trigger levels or limits specified in Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits) at a sensitive place or commercial place, the holder of this environmental authority must:
- (a) complete an investigation to identify the cause of the exceedance;
 - (b) if the investigation shows that the exceedance is not attributable to the mining activity, then no further action is required and this must be advised to the administering authority; or
 - (c) if the investigation shows that the exceedance is attributable to the mining activity provide a written report to the administering authority within one (1) month of the date of the monitoring results showing an exceedance, outlining:
 - (i) details of the investigations carried out;
 - (ii) details of the environmental impacts observed; and
 - (iii) actions taken to prevent environmental harm.

Air Quality Monitoring Program

- B7 The holder of this environmental authority must implement and maintain an air quality monitoring program for the air quality indicators specified in condition B3 and Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits) at the monitoring locations and specified in Schedule B – Table 2 (Air Quality Monitoring Program) and Schedule K – Figure 2 (Air Quality Monitoring Program Monitoring Locations).

Schedule B – Table 2 (Air Quality Monitoring Program)

Monitoring Location Description	Location (GDA94 MGA z54)		Monitoring Site ID	Monitoring Frequency
	Easting	Northing		
Compliance				
Roseby Homestead	413970	7754962	EA_DG_005	For TSP, PM ₁₀ , arsenic, cadmium and lead: As required by condition B8. For dust deposition measured as insoluble matter: Monthly
			EA_AQ_005	For arsenic, cadmium and lead in deposited dust: Monthly
Reference				
North of Roseby Homestead and the licenced place ¹	408471	7766889	EA_DG_007	For TSP, PM ₁₀ , arsenic, cadmium and lead: As required by condition B8. For dust deposition measured as insoluble matter: Monthly For arsenic, cadmium and lead in deposited dust: Monthly
			EA_AQ_007	
	411918	7764933	EA_DG_008	
EA_AQ_008				
410576	7762936	EA_DG_009		
South of Roseby Homestead and the licenced place ¹	413110	7752939	EA_DG_006	
			EA_AQ_006	
Between Roseby Homestead and the licenced place	413589	7760259	EA_DG_001	
	412867	7758953	EA_DG_010	

1. Upwind sites must be located upwind of Roseby Homestead and the licenced place at the time of monitoring.
Note: Monitoring sites must comply with Australian Standard 3580.1.1:2007 Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment.

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- B8 Air quality monitoring for TSP, PM₁₀, arsenic, cadmium and lead must be carried out on a campaign basis for at least seven (7) consecutive days on four (4) separate occasions in May, July, September and November each year.
- B9 Notwithstanding condition B7, the holder of this environmental authority must implement and maintain a dust deposition monitoring program to monitor the deposition and airborne concentrations of contaminants in dust generated by the mining activity in the receiving environment and the actual and potential environmental impacts as a result. At a minimum, the program must include:
- (a) a description of the sources, locations and predicted quantity of contaminants in air emissions generated by each mining activity carried out at the licensed place;
 - (b) suitable monitoring locations, nominated by an appropriately qualified person, for monitoring of dust deposition and heavy metals in dust, associated with dust generating mining activities as specified in Schedule B – Table 3 (Air Quality Monitoring Program – Dust Deposition);
 - (c) collection of contaminants in dust deposition samples at the monitoring locations and at the frequency specified in Schedule B – Table 3 (Air Quality Monitoring Program – Dust Deposition);
 - (d) annual assessment of the environmental harm caused by dust deposition on the receiving environment and performance against air quality trigger levels and limits specified in Schedule B – Table 1 (Dust Deposition Trigger Levels and Limits); and
 - (e) a sufficient number of impact monitoring and reference locations, constructed in accordance with Australian Standard 3580.1.1:2007 *Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment*, to enable scientifically justifiable conclusions on the level of impact from mining activity.

Schedule B – Table 3 (Air Quality Monitoring Program – Dust Deposition)

Monitoring Location Description	Monitoring Site ID	Location (GDA94 MGA z54)		Monitoring Frequency
		Easting	Northing	
1km east of the site, along the main access road	EA_DG_001	413589	7760259	Monthly
Approximately 700m NE of the Roseby Homestead	EA_DG_005	413970	7754962	Monthly
Approximately 1.5km SE of the Roseby Homestead	EA_DG_006	413110	7752939	Monthly
Far northern end of the lease, at the northern end of the Knapdale Range	EA_DG_007	408471	7766889	Monthly
North-eastern corner of the mining lease area	EA_DG_008	411918	7764933	Monthly
Between the mine site and the permanent accommodation village	EA_DG_009	410576	7762936	Monthly
Approximately 2km SE of the mine site.	EA_DG_010	412867	7758953	Monthly

1. The holder of this environmental authority must provide monitoring location description and location information to the administering authority as part of the dust monitoring program required by condition B9.
2. Monitoring sites must comply with Australian Standard 3580.1.1:2007 *Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment*

Air Quality Monitoring Requirements

- B10 Samples taken for air quality monitoring specified in this environmental authority must be collected and analysed in accordance with the requirements of the administering authority's latest edition of the *Air Quality Sampling Manual*, or more recent editions or supplements to that document as are published by the administering authority, unless otherwise agreed by the administering authority in writing.

Concentrate Management

- B11 All mineral concentrate must be stored, stockpiled and loaded in fully enclosed buildings.
- B12 Buildings or structures used for the storage, stockpiling and loading of mineral concentrate must incorporate the following dust control measures as a minimum:
- (a) all necessary openings and vents in the buildings or structures (other than doorways and access ways) must be covered with filter media or other equivalent dust control measures;
 - (b) cladding of the buildings or structures must be securely affixed and free of any unnecessary holes;
 - (c) all doorways and access ways in the buildings or structures must be fitted with doors;
 - (d) all doors in the buildings or structures must remain closed except when being used for access or egress;
 - (e) all doors, doorways and access ways in the buildings or structures must be maintained in such a condition that doors, when closed, provide a seal against the release of mineral concentrate to the receiving environment;
 - (f) transfer of mineral concentrate to vehicles and containers must be carried out in a manner that minimises the likelihood of any release of mineral concentrate to the atmosphere and waters; and
 - (g) transfer of mineral concentrate along conveyor belts must be designed and operated in a manner that minimises, using best practice technology and design, the release of mineral concentrate to the atmosphere and waters.
- B13 The interior of all mineral concentrate storage, stockpiling and loading buildings must be maintained under negative air pressure sufficient to minimise, using best practice technology and design, the release of concentrate from the buildings or structures.
- B14 ~~The buildings and structures in place at the licensed place for the storage, stockpiling and loading of mineral concentrate must be constructed and maintained to withstand a Category 2 cyclone.~~
- B15 ~~The construction and state of the buildings and structures in place at the licensed place for the storage, stockpiling and loading of mineral concentrate must be checked for compliance with condition B14 by an appropriately qualified person at least once every three (3) years.~~
- B16 ~~A wash bay for mobile equipment must be installed as part of the mineral concentrate storage facility, for cleaning machinery before exit from the area and to prevent the movement of mineral concentrate outside the building.~~

House-keeping Procedure

- B17 A whole of site housekeeping procedure must be developed and implemented which must include, but not be limited to:
- (a) the completion of periodic inspections of the licensed place including all structures, plant, equipment and trafficked surfaces to identify and remove exposed mineral concentrate that may be mobilised by wind, water or equipment movement; and
 - (b) an ongoing cleaning and maintenance schedule to minimise any potential release of mineral concentrate and to ensure there is no build-up of mineral concentrates over time in areas where it may be mobilised.

Weather Station

- B18 The holder of this environmental authority must establish and maintain a permanent meteorological station to continuously measure and record wind speed, wind direction, temperature and daily rainfall volume.
- B19 The permanent meteorological station must be installed in accordance with the latest edition of the Bureau of Meteorology guideline *Observation Specifications No.2013.1 – Guidelines for the positioning and exposure of meteorological instruments and observing facilities*.
- B20 The holder of this environmental authority must record, compile, evaluate and keep all monitoring records obtained from the permanent automatic meteorological station.

END OF CONDITIONS FOR SCHEDULE B

Schedule C – Water

General

- C1 Contaminants that will, or have the potential to cause environmental harm, must not be released directly or indirectly to any waters except as permitted under the conditions of this environmental authority.
- C2 The maintenance and cleaning of vehicles and any other equipment or plant must not be carried out in areas from which contaminants can be released into any waters, roadside gutter or stormwater drainage system.
- C3 Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.
- C4 All determinations of water quality/sample analysis required under a condition of this environmental authority must be:
- (a) made in accordance with methods prescribed in the latest edition of the latest edition of the administering authority's *Water Quality Sampling Manual*;
 - (b) collected from the monitoring locations identified within this environmental authority, within two (2) hours of each other where possible; and
 - (c) carried out on representative samples.
- C5 The release of contaminants directly or indirectly to waters must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, or litter.
- C6 The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format when requested:
- (a) the date and time when the sample was taken;
 - (b) the monitoring point where the sample was taken;
 - (c) the measured or estimated daily quantity of the contaminants released from all release points;
 - (d) the release flow rate at the time of sampling for each release point; and
 - (e) the results of all monitoring and details of any exceedances of the conditions of this environmental authority.

Contaminant Release to Waters

- C7 The release of contaminants to waters must only occur from the release points specified in Schedule C – Table 1 (Release Points) and depicted in Schedule K – Figure 3 (Release Points and Water Storage Monitoring Locations).

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Schedule C – Table 1 (Release Points)

Release Point	Location (GDA94 MGA z54)		Contaminant Source, Location and Description of Release Point	Receiving Waters Description
	Easting	Northing		
Sediment Dam C	412210	7760305	Stormwater runoff from the existing construction camp, the change house and car park, the administration building and data centre, the sewerage treatment plan, water treatment plant and the vehicle wash bay – from the Sediment Dam C spillway and controlled-release pipe.	Unnamed tributary of Silvermine Creek
Sediment Dam D	412346	7759965	Stormwater runoff from the site services lay-down and storage area, Gatehouse and security, emergency services, temporary generators, core yard and core shed, and laydown area – from the Sediment Dam D spillway and controlled-release pipe.	Silvermine Creek
Sediment Dam F	411642	7760116	Stormwater runoff from the NAF Waste Rock Dump and stormwater runoff from the clean water catchment between mine workshop area and the NAF waste rock dump – from the Sediment Dam F spillway	Silvermine Creek
Sediment Dam G	411491	7761147	Stormwater runoff from the PAF waste rock dumps, Stages 1 and 2, and the clean water catchments adjacent to the PAF waste rock dumps – from the Sediment Dam G spillway	North Creek
Stage 2 PAF Pad Run Off Dam	411198	7761055	Stormwater runoff from the PAF waste rock dump – from the PAF Pad Run Off Dam spillway	North Creek
STP Dam Stage 1	412426	7759746	Treated effluent from the project STPs – from the STP Dam spillway	Silvermine Creek
STP Dam Stage 2	412403	7759586	Treated effluent from the project STPs – from the STP Dam Stage 2 spillway	Silvermine Creek
ROM Area Run Off Dam	412223	7761099	Stormwater runoff from ROM Pad, crusher and conveyor – from the ROM Area Run Off Dam spillway	North Creek
Process Plant Run Off Dam	412201	7760797	Stormwater from processing plant and reagent shed (roofed and bunded), as well as the warehouse and reagent storage – from the Process Plant Run Off Dam spillway	North Creek
Mine Workshop Run Off Dam	411980	7760028	Stormwater from workshop, fuel depot, go-line and light vehicle parking area – from the Mine Workshop Run Off Dam spillway	Silvermine Creek
Raw Water Dam	412220	7760903	Raw water from Lake Julius – from the Raw Water Dam spillway	North Creek
Sediment Dam A	412191	7760848	Stormwater runoff from the clean water catchment between the process plant area and the PAF waste rock dump	North Creek
Tailings Storage Facility (TSF)	408976	7763597	Water release from the TSF	Cabbage Tree Creek
Seepage Collection Pond	408920	7763507	Release from the TSF	Cabbage Tree Creek

C8 The release of contaminants to waters from the authorised release points must be monitored at the locations specified in Schedule C – Table 1 (Release Points) for each quality characteristic and at the frequency specified in Schedule C – Table 2 (Contaminant Release Limits).

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C9 The release of contaminants to waters must not exceed the contaminant limits stated in Schedule C – Table 2 (Contaminant Release Limits).

Schedule C – Table 2 (Contaminant Release Limits)

Quality Characteristic ^[1]	Unit	Contaminant Limit	Monitoring Frequency
Hardness	mg/L	For interpretation purposes only	Event based sampling of release events: <ul style="list-style-type: none"> One sample must be taken within twelve (12) hours of a release event commencing. A second sample must be taken between twelve (12) and twenty four (24) hours after the release event commences. Where a release event has a duration of twenty four (24) hours or greater, samples must be taken daily for one (1) week, and once a week thereafter until release event ceases.
pH	pH unit	5.5 ^[2] (minimum) 9.0 ^[3] (maximum)	
EC	µS/cm	1000	
Total Suspended Solids	mg/L	Reference ^[3] value plus 10% ^[4]	
Aluminium	mg/L	5 ^[5]	
Arsenic ^[6]	mg/L	0.5 ^[5]	
Cyanide ^[8]	mg/L	0.5 ^[7]	
Sulphate	mg/L	1000 ^[5]	
Fluoride	mg/L	2 ^[5]	
Cadmium	mg/L	0.01 ^[5]	
Copper	mg/L	1 ^[5]	
Lead	mg/L	0.1 ^[5]	
Manganese	mg/L	Reference ^[3] value plus 10% ^[4]	
Nickel	mg/L	1 ^[5]	
Zinc	mg/L	20 ^[5]	

[1] All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered) concentrations.
 [2] Based on Environmental Management Plan for the Dugald River Project dated February 2012.
 [3] Reference sites defined in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points).
 [4] Contaminant limit based on quality of upstream reference site sampled at the time of release plus 10%.
 [5] Contaminant limit based on ANZECC (2000) stock water quality guidelines.
 [6] Speciated arsenic concentrations for As (III) and As (V) only required if 13 µg/L is exceeded - note that the sample bottle requirements for As (total species) and As (speciated) may differ.
 [7] International Cyanide Management Code discharge limit, International Cyanide Management Institute, June 2011.
 [8] Cyanide as un-ionised hydrogen cyanide from ANZECC (2000)
 [9] Based on TropWATER Technical Memo – Recommended amendments to Dugald River Mine Environmental Authority EPML00731213 dated January 2020.

NOTES:
 (a) Where release(s) or flow event(s) occur simultaneously only one (1) set of samples are required to be taken.
 (b) All dissolved (filtered) samples must be obtained from field filtered grab samples.
 (c) Grab sampling is the preferred method for sample collection.

Stream Flow Monitoring

C10 The holder of this environmental authority must install, operate and maintain a stream flow gauging station to determine and record stream flows at the locations upstream of each release point, as specified in Schedule C – Table 3 (Contaminant Release during Flow Events) and Schedule K – Figure 4 (Stream Flow Gauge, Receiving Waters and Stream Sediment Monitoring Locations) for any receiving water into which a release occurs.

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C11 Notwithstanding any other condition of this environmental authority, the release of contaminants to waters must only take place during periods of natural flow specified as minimum flow in Schedule C – Table 3 (Contaminant Release during Flow Events) and at the contaminant release point(s) specified in Schedule C – Table 1 (Release Points) and shown in Schedule K – Figure 4 (Stream Flow Gauge, Receiving Waters and Stream Sediment Monitoring Locations).

Schedule C – Table 3 (Contaminant Release during Flow Events)

Receiving Water Description	Release point	Gauging station description ^[1]	Location (GDA94 MGA zone 54)		Minimum Flow in Receiving Water Required for a Release Event	Flow Recording Frequency
			Easting	Northing		
Silvermine Creek	Sediment Dam F	SC-29 (MS5)	411465	7760021	As specified in condition C12	Continuous (minimum daily)
	Mine Workshop Run Off Dam					
	Sediment Dam D					
North Creek	Stage 2 PAF Pad Run Off Dam	SN-15 (MS8)	411282	7761188	As specified in condition C12	
	Sediment Dam A					
	ROM Area Run Off Dam					
	Sediment Dam G					

[1] Codes in parentheses are provided for consistency with the Receiving Environment Monitoring Program and the Dugald River Project Baseline Limnological Data Report (2012-2014).

Note: The volume of flow can be determined by height of water or flow. The actual flow must be a quantifiable measure, e.g.: $\geq 5m^3/sec$

C12 At the time of release from the authorised release points specified in Schedule C – Table 3 (Contaminant Release during Flow Events) there must be natural flow in the respective receiving water at a sufficient volume to allow for dilution of the release to comply with the contaminant limits associated with the respective receiving waters.

C13 The daily quantity of water and contaminant load released from each release point specified in Schedule C – Table 1 (Release Points) must be measured and recorded.

Onsite Water Storages

C14 Onsite water storages must be monitored in accordance with the Receiving Environment Monitoring Program required by condition C23.

C15 The holder of this environmental authority must implement measures to prevent access to the following dams by livestock and minimise access by native fauna: Sediment Dam A, Sediment Dam F, Sediment Dam G, Stage 1 PAF PAD Run Off Dam, Stage 2 PAF PAD Run Off Dam, Underground Mine Water Collection Dam, ROM Area Run Off Dam, Raw Water Dam, Process Plant Run Off Dam, Containment Dam, Mine Workshop Run Off Dam and STP Dam Stages 1 and 2.

Receiving Waters Monitoring

C16 Waters at the monitoring points specified in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points) and Schedule K – Figure 4 (Stream Flow Gauge, Receiving Waters and Stream Sediment Monitoring Locations) must be monitored for each quality characteristic and at the frequency stated in Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits).

Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points)

Monitoring Point ^[1]	Description	Location (GDA94 MGA Zone 54)	
		Easting	Northing
Interpretative Sites			
SC-08 (MS5 Ref)	Silvermine Creek – upstream of processing plant area	410892	7759982
SN-05 (MS8 Ref)	North Creek – upstream of processing plant area	410893	7761256
CT3-08 (MS2)	Un-named tributary of Cabbage Tree Creek – West of Knapdale Ranges on the northwest boundary, downstream of the tailings storage facility (TSF)	408063	7763376
MS5 (SC-29)	Un-named tributary of Silvermine Creek – South of processing plant area, east of the Knapdale Ranges, downstream of the processing plant area	412689	7760035
UT1-06 (MS6 Ref)	Un-named tributary of Dugald River - East of the Knapdale Ranges on the south eastern boundary	412495	7758628
SN-15 (MS8)	North Creek – Downstream of processing plant on the boundary of the mining lease	412043	7761203
SN-23 (MS9)	North Creek – Downstream of processing plant, and upstream of confluence with Silvermine Creek	413842	7761258
SC-38 (MS10)	Un-named tributary of Silvermine Creek – East of processing plant area, downstream of the Process Plant Run off Dam overflows and within access road easement	413453	7760754
Reference Sites^[2, 3]			
DR-10	Dugald River upstream of unnamed tributary (REMP waterway designation UT1)	414144	7759328
DR-14	Dugald River mine site access bridge, downstream of UT1 and upstream of Silvermine Creek confluence	414431	7760405
CC-05	Cabbage Tree Creek, upstream of the tributary which drains the TSF (REMP waterway designation CT3)	406375	7763485
Downstream Monitoring Points			
DR-18 (Downstream compliance site for DR-10 and DR14)	Dugald River downstream of Silvermine Creek (the upstream end of Longamundi Waterhole, possibly within the mixing zone associated with Silvermine Creek)	414660	7761171
DR-22 (Downstream compliance site for DR-10 and DR14)	Dugald River downstream of Silvermine Creek (the downstream end of Longamundi waterhole, and likely downstream of the Silvermine Creek mixing zone)	415275	7762341
CC-15 (Downstream compliance site for CC-05)	Cabbage Tree Creek downstream of the TSF (the closest waterhole to the TSF that retains water long enough to sustain seasonal aquatic communities, and the only accessible point on the creek during wet weather).	407593	7768969

[1] Codes in parentheses are provided for consistency with historical site names.

[2] Reference sites must:

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- (a) be from the same bio-geographic and climatic region;
 (b) have similar geology, soil types and topography;
 (c) contain a range of habitats similar to those at the test sites;
 (d) have a similar flow regime;
 (e) not be so close to the test sites that any disturbance at the test site also results in a change at the reference site; and
 (f) the data from upstream reference monitoring points must not be used where they are affected by releases from other mines.
- [3] Reference sites must comply with the criteria specified in ANZECC 2000.

Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits)

Quality Characteristic ¹	Unit	Trigger Level ^[1,10]	Contaminant Limit ^[1,10,12]	Monitoring Frequency
Hardness (CaCO ₃)	mg/L	For interpretation purposes		<p><u>Sites on tributaries of Dugald River:</u> Sample daily for the first two days when releases or stream flows commence at interpretative sites. If releases or flows at interpretative sites persist, sample weekly until flow ceases.</p> <p><u>Dugald River Sites:</u> Sample Dugald River sites daily while there is flows at DR-14, and daily for one week after cessation of flows at SC-38 and SN-23.</p> <p>Sample monthly if flows are present in Dugald River during the wet season.</p> <p><u>Cabbage Tree Creek sites:</u> Sample CT3-08, CC-05 and CC-15 daily when flows are present at CT3-08 and sample CC-05 and CC-15 daily for two days after flows at CT3-08 cease.</p> <p>Sample CC-05 and CC-15 weekly if flows are present.</p>
pH	pH units	6.0 (minimum) 8.6 ^[13] (maximum)	5.5 (minimum) 9.0 ^[13] (maximum)	
Electrical conductivity	µS/cm	435 or 80th percentile of reference whichever is higher	1000	
Total Suspended Solids	mg/L	For interpretation purposes		
Sulfate	mg/L	77 (MMG Dugald River) or 80th percentile of reference whichever is higher	400 ^[4]	
Fluoride	mg/L	80th percentile of reference	2 ^[3] or 95th percentile of reference ^[10] whichever is lower	
Aluminium (dissolved)	mg/L	0.065 ^[2] TBC or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Aluminium (total)	mg/L	-	TBC ⁰⁻² ^[4]	
Arsenic ^[8] (dissolved)	mg/L	0.013 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Arsenic (total)	mg/L	-	0.5 ^[3]	
Cadmium (dissolved)	mg/L	0.0002 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Cadmium (total)	mg/L	-	0.005 ^[4]	
Copper (dissolved)	mg/L	0.0014 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Copper (total)	mg/L	-	1 ^[4]	
Cyanide ^[5] Free	mg/L	0.007 ^[6] or 80th percentile of reference whichever is higher	0.022 ^[6]	
Cyanide WAD	mg/L	-	0.1 ^[4]	

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Quality Characteristic ¹	Unit	Trigger Level ^[1,10]	Contaminant Limit ^[1,10,12]	Monitoring Frequency
Lead (dissolved)	mg/L	0.0034 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Lead (total)	mg/L	-	0.05 ^[4]	
Manganese (dissolved)	mg/L	1.9 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Manganese (total)	mg/L	For interpretation purposes.		
Nickel (dissolved)	mg/L	0.011 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Nickel (total)	mg/L	-	1 ^[5]	
Zinc (dissolved)	mg/L	0.008 ^[2] or 80th percentile of reference whichever is higher	95th percentile of reference ^[10]	
Zinc (total)	mg/L	-	20 ^[3]	

[1] All metals and metalloids must be measured as both 'total' (from analysis of an unfiltered sample) and 'dissolved' (from analysis of a field filtered sample). All trigger levels are based on dissolved metal concentrations.

- Metals concentrations may be adjusted to the site-specific hardness in accordance with ANZECC 2000 (Section 3.4.3 and Table 3.4.3) as appropriate.
- If a filterable result exceeds the applicable trigger value, further analysis may be performed to quantify the dissolved component of the filtrate.

[2] Based on ANZG (2018).

[3] Based on ANZECC/ARMCANZ (2000) Table 4.3.2 for livestock drinking water.

[4] Based on ANZECC/ARMCANZ (2000) Table 5.2.3 for recreational purposes.

[5] The requirement to monitor for cyanide is deferred until the time cyanide is introduced into the mining process.

[6] Cyanide as un-ionised HCN, measured as [CN] - based on ANZECC/ARMCANZ (2000) Table 3.4.1, refer also Section 8.3.7.2.

[7] Free Cyanide - based on International Cyanide Management Institute (2009) Implementation Guidance - Standard of Practice 4.5 - receiving surface waterbody guideline value

[8] Speciated arsenic concentrations for As (III) and As (V) only required if 13 mg/L is exceeded - note that the sample bottle requirements for As (total species) and As (speciated) may differ.

[9] Site-specific trigger levels and contaminant limits for water quality (80th and 95th percentile of reference site concentration) must be calculated in accordance with QWQG (2009) and ANZECC (2000) methodology if sufficient monitoring data is available. The environmental authority holder must maintain a database documenting all relevant water quality monitoring data and calculation of 80th/95th percentiles adopted as water quality trigger levels and contaminant limits.

[10] The contaminant limit '95th percentile of reference' is not applicable where the 95th percentile of reference site concentration is below the specified trigger level for the respective Quality Characteristic.

[11] Reference site concentration determined from reference sites specified in Schedule C – Table 6 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points).

[12] Compliance at DR-18 and DR-22 is assessed when surface flows are present at either interpretive site SC-38 or SN-23

[13] Based on TropWATER Technical Memo – Recommended amendments to Dugald River Mine Environmental Authority EPML00731213 dated January 2020.

Note: The method of sampling of waters must comply with the latest edition of the administering authority's Water Quality Sampling Manual.

- C17 If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits) the holder of this environmental authority must compare the downstream results to the reference site results in the receiving waters and:
- (a) where the downstream result is the same or a lower value than the reference site value for the quality characteristic during the monitoring event then no action is to be taken; or
 - (b) where the downstream results exceed the reference site complete an investigation in accordance with the ANZECC and ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report to the administering authority within three (3) months, outlining:
 - (i) details of the investigations carried out;
 - (ii) details of the environmental impacts observed; and
 - (iii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with clause (b) of this condition, then no further reporting is required for subsequent trigger events for that quality characteristic within the three (3) month investigation period.

- C18 The release of contaminants must not result in an exceedance of contaminant limits stated in Schedule C – Table 5 (Receiving waters trigger levels and contaminant limits) at the downstream monitoring points specified in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Downstream Monitoring Points). Where the downstream result is the same or a lower value than the reference site value for the quality characteristic during the monitoring event then no action is to be taken.

Stream Sediment

- C19 Sediment quality of receiving waters and reference waters must be monitored twice a year (once at the end of the wet season and once at the end of the dry season) at the monitoring locations defined in Schedule C – Table 4 (Receiving Water Reference Sites and Downstream Monitoring Points) and identified on Schedule K – Figure 4 (Stream Flow Gauge, Receiving Waters and Stream Sediment Monitoring Locations) and for the parameters defined in Schedule C – Table 6 (Stream Sediment Trigger Levels and Contaminant Limits).

Schedule C – Table 6 (Stream Sediment Trigger Levels and Contaminant Limits)

Parameter ¹	Trigger Level	Contaminant Limit
Arsenic (mg/kg)	20 ^[3] or reference ^[2] , whichever is higher	70 ^[4] or 3 times the reference ^[2] , whichever is higher
Cadmium (mg/kg)	1.5 ^[3] or reference ^[2] , whichever is higher	10 ^[4] or 3 times the reference ^[2] , whichever is higher
Copper (mg/kg)	65 ^[3] or reference ^[2] , whichever is higher	270 ^[4] or 3 times the reference ^[2] , whichever is higher
Lead (mg/kg)	50 ^[3] or reference ^[2] , whichever is higher	220 ^[4] or 3 times the reference ^[2] , whichever is higher
Manganese (mg/kg)	For interpretation purposes	
Nickel (mg/kg)	21 ^[3] or reference ^[2] , whichever is higher	52 ^[4] or 3 times the reference ^[2] , whichever is higher
Zinc (mg/kg)	200 ^[3] or reference ^[2] , whichever is higher	410 ^[4] or 3 times the reference ^[2] whichever is higher
Particle size distribution	For interpretation purposes	

[1] All samples must be sieved to the sand fraction (63 – 2000µm) prior to analysis.

[2] Reference sites as specified in Schedule C – Table 4 (Receiving Water and Stream Sediment Reference Sites and Down Stream Monitoring Points).

[3] ANZECC (2000) Interim Sediment Quality Guidelines – low values based on total sediments.

[4] ANZECC (2000) Interim Sediment Quality Guidelines – high values based on total sediments.

[5] Analysis for metals/metalloids concentrations in sediment must be conducted on the <2mm fraction of the sample and measured as a dilute acid extractable concentration in a manner consistent with the Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines, CSIRO (May 2013). Metals and metalloids concentrations in the <63µm fraction must be performed for interpretative purposes.

Note: Where compliance monitoring results are compared with reference site monitoring results, data must be normalised to account for any difference in particle size distribution.

- C20 Releases of contaminants from the mine must not result in an exceedance of sediment contaminant limits stated in Schedule C – Table 6 (Stream Sediment Trigger Levels and Contaminant Limits).
- C21 If quality characteristics of the sediments exceed any of the trigger levels specified in Schedule C – Table 6 (Stream Sediment Trigger Levels and Contaminant Limits), the holder of this environmental authority must compare the results of the downstream site to the data from reference monitoring sites and:
- (a) if the level of contaminants at the downstream site does not exceed the reference monitoring site data, then no action is to be taken; or
 - (b) if the level of contaminants at the downstream site is greater than the reference monitoring site data, complete an investigation in accordance with the ANZECC and ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report to the administering authority within three (3) months, outlining:
 - (i) details of the investigations carried out;
 - (ii) details of the environmental impacts observed; and
 - (iii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with clause (b) of this condition, then no further reporting is required for subsequent trigger events for that quality characteristic within the three (3) month investigation period.

- C22 All stream sediment sampling and analysis must be undertaken using the methods documented in the MMG Dugald River Project Baseline Limnological Data Report (2012-2014).

Receiving Environment Monitoring Program

C23 The environmental authority holder must develop and implement a Receiving Environment Monitoring Program to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site. For the purposes of the Receiving Environment Monitoring Program, the receiving environment is the waters of Cabbage Tree Creek, Silvermine Creek, Silvermine Creek Tributary B, North Creek, Dugald River and connected waterways potentially influenced by the tailings storage facility. The Receiving Environment Monitoring Program should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.

C24 A Receiving Environment Monitoring Program Design Document that addresses the requirements of the Receiving Environment Monitoring Program must be prepared and made available to the administering authority upon request.

NOTE: the Receiving Environment Monitoring Program Design Document sets out, for the next monitoring period, the location, frequency and parameters to be monitored under the Receiving Environment Monitoring Program.

C25 A report outlining the findings of the Receiving Environment Monitoring Program (REMP), including all monitoring results and interpretations must be prepared annually and made available on request to the Administering Authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.

Water Management Plan

C26 A water management plan that provides for the proper and effective management of the actual and potential environmental impacts resulting from the mining activity and to ensure compliance with the conditions of this environmental authority must be implemented and maintained.

C27 The water management plan must be developed by an appropriately qualified person and must include at least the following components:

- (a) contaminant source study;
- (b) site water balance and model;
- (c) water management system;
- (d) saline drainage prevention and management measures;
- (e) acid rock drainage prevention and management measures;
- (f) emergency and contingency planning; and
- (g) monitoring and review.

~~C28 The holder of this environmental authority must undertake a review of the water management plan before 1 November each year to ensure that proper and effective measures, practices or procedures are in place so that the mine is operated in accordance with the conditions of this environmental authority and that environmental harm is prevented or minimised.~~

Site Water Balance

C29 The holder of this environmental authority must develop a site specific operational site water balance model.

C30 The water balance model must be run for a simulation period for the following:

- (a) weekly during the period November to March;
- (b) monthly during other periods;
- (c) promptly after each rainfall event greater than fifty (50) millimetres within a twenty four (24) hour period within the relevant surface water containment area;

- (d) with documentation of inputs and outputs from each run being stored and retrievable for a minimum period of one (1) year.
- (e) performance in response to rainfall must be undertaken by an appropriately qualified person and
- (f) assessments using the operational simulation water balance model must use a minimum of 100 years of historical rainfall data.

Saline, Acid and Metalliferous Drainage

- C31 The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline, acid and/or metalliferous mine drainage as a result of the mining activity.

Erosion and Sediment Control

- C32 An Erosion and Sediment Control Plan must be maintained by an appropriately qualified person and implemented for all stages of the mining activity on the licensed place to prevent or minimise erosion and the release of sediment to receiving waters and contamination of storm water.
- C33 The erosion and sediment control plan must provide for at least the following functions:
- (a) prevent or minimise the contamination of receiving waters and stormwater;
 - (b) diverting uncontaminated stormwater run-off around areas disturbed by the mining activity or where contaminants or wastes are stored or handled;
 - (c) contaminated stormwater runoff, incident rainfall and leachate is collected; and treated, reused, or released in accordance with the conditions of this environmental authority;
 - (d) roofing or minimising the size of areas where contaminants or wastes are stored or handled;
 - (e) erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent the contamination of any waters;
 - (f) procedures to ensure that erosion and sediment control structures are maintained and adequate storage is available in sediment dams in accordance with design criteria; and
 - (g) training of staff that will be responsible for maintenance and operations of sediment and erosion control structures.
- C34 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.

Groundwater

- C35 Groundwater quality and level must be monitored at the locations and frequencies defined in Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency) and Schedule K – Figure 5 (Groundwater Bore Monitoring Locations) for quality characteristics identified in Schedule C – Table 8 (Groundwater Trigger Levels and Contaminant Limits)

Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency)

Monitoring Point	Location (GDA94 MGA zone 54)		Monitoring frequency
	Easting	Northing	
Interpretation Bores – Depth ^[1]			
GWBFAB	411395	7761383	Quarterly
MB1AB	411199	7761205	
MB2AB	412187	7761185	
MB3AB	411421	7760107	
MB4AB	412744	7760042	
SHALL6AB	410983	7760929	
Compliance Bores – Depth ^[1] and quality			
MB2	412191	7761189	Quarterly
MB4	412749	7760041	
MB5	408537	7763364	
MB6	408287	7763224	
MB9D	408723	7763433	
MB9S	408724	7763433	
Background Bores ^[2] – Depth ^[1] and quality			
MB1	411301	7761214	Quarterly
MB3	411931	7760127	

[1] RL must be measured to the nearest 5cm from the top of the bore casing.

[2] Reference sites must:

- (a) have similar flow regime;
- (b) be from the same bio-geographic and climatic region;
- (c) have similar geology, soil types and topography; and
- (d) not be so close to the test sites that any disturbance at the test site also results in a change at the reference site.

[3] ~~To be monitored when landholder access allows.~~

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Schedule C – Table 8 (Groundwater Trigger Levels and Contaminant Limits)

Quality Characteristic ¹	Unit	Trigger Level ¹¹	Contaminant limit ²
pH	pH unit	6.0 (minimum) 8.0 (maximum)	6.0 (minimum) 9.0 (maximum)
Electrical Conductivity	µS/cm	1500 ⁶	2000 ⁶
Hardness (as CaCO ₃)	mg/L	For interpretation purposes	
Total Dissolved Solids (TDS)	mg/L	For interpretation purposes	
Major ions (Na, Ca, K, Mg, Cl, bicarbonate, total alkalinity)	mg/L	For interpretation purposes	
Sulphate (mg/L)	mg/L	150 ⁶	1000 ⁶
Fluoride (mg/L)	mg/L	-	2 ⁴
Aluminium	mg/L	0.055 ^{3,11}	5 ⁴
Arsenic ⁷	mg/L	0.013 ^{3,11}	0.5 ⁴
Cadmium (mg/L)	mg/L	0.0002 ^{3,11}	0.01 ⁴
Copper (mg/L)	mg/L	0.0014 ³	1 ⁴
Cyanide ⁸	mg/L	0.007 ⁹	0.022 ¹⁰
Lead (mg/L)	mg/L	0.0034 ^{3,11}	0.1 ⁴
Manganese (mg/L)	mg/L	1.9 ^{3,11}	-
Nickel (mg/L)	mg/L	0.011 ^{3,11}	1 ⁴
Zinc (mg/L)	mg/L	0.008 ^{3,11}	20 ⁴

[1] All metals and metalloids must be measured as filtered with the exception of fluoride.

[2] All metals and metalloids must be measured as total (unfiltered).

[3] Based on ANZG (2018).

[4] Based on ANZECC/ARMCANZ (2000) Table 4.3.2 for livestock drinking water.

[5] Based on ANZECC/ARMCANZ (2000) Section 4.3.3.4;

[6] MMG Dugald River - site specific value

[7] Speciated arsenic concentrations for As (III) and As (V) only required if 13 mg/L is exceeded - note that the sample bottle requirements for As (total species) and As (speciated) may differ.

[8] The requirement to monitor for cyanide is deferred until the time cyanide is introduced into the mining process.

[9] Cyanide as un-ionised HCN, measured as [CN] - based on ANZECC/ARMCANZ (2000) Table 3.4.1, refer also Section 8.3.7.2.

[10] Free Cyanide - based on International Cyanide Management Institute (2009) Implementation Guidance - Standard of Practice 4.5 - receiving surface waterbody guideline value)

[11] Where appropriate, the default trigger values may be hardness adjusted in accordance with ANZG (2018).

- C36 If quality characteristics of groundwater from compliance bores identified in Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency) exceed any of the trigger levels stated in Schedule C – Table 8 (Groundwater Trigger Levels and Contaminant Limits), the holder of this environmental authority must compare the compliance monitoring bore results to the reference bore results and:
- (a) if the level of contaminants at the compliance monitoring bore does not exceed the reference bore results, then no action is to be taken; and
 - (b) if the level of contaminants at the compliance monitoring bore is greater than the reference bore results, complete an investigation in accordance with the ANZECC and ARMCANZ 2000, into the potential for environmental harm and provide a written report to the administering authority within three (3) months, outlining:
 - (i) details of the investigations carried out;
 - (ii) details of environmental impacts observed; and
 - (iii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with clause (b) of this condition, then no further reporting is required for subsequent trigger events for that quality characteristic within the three month investigation period.

- C37 Results of monitoring of groundwater from compliance bores identified in Schedule C – Table 7 (Groundwater Monitoring Locations and Frequency), must not exceed any of the contaminant limits defined in Schedule C – Table 8 (Groundwater Trigger Levels and Contaminant Limits).

Monitoring Bore Construction, Maintenance and Decommissioning

- C38 The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.

Reporting

- C39 A report on groundwater monitoring, including monitoring results and interpretations, must be prepared by a relevantly qualified and suitable person on a biennial (two yearly) basis and be made available to the administering authority on request. The report must include:
- (a) An assessment of groundwater monitoring results against the objectives of the MMG Dugald River Mine Groundwater Monitoring Program.
 - (b) A review of groundwater compliance against requirements specified in the environmental authority.
 - (c) Any proposed refinement or update to the groundwater monitoring program or environmental authority, with respect to monitoring locations, frequency, parameters, specified trigger values and/or specified contaminant limits, that may be applicable on review of the collected data or other relevant information.

END OF CONDITIONS FOR SCHEDULE C

Schedule D – Regulated Structures

Assessment of Consequence Category

- D1 The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)* at the following times:
- (a) prior to the design and construction of the structure, if it is not an existing structure; or
 - (b) prior to any change in its purpose or the nature of its stored contents.
- D2 A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
- D3 Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.

Notification of affected persons

- D4 All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure
- (a) for existing structures that are regulated structures, within 10 business days of this condition taking effect;
 - (b) prior to the operation of the new regulated structure; and
 - (c) if the emergency action plan is amended, within 5 business days of it being amended.

Operation of a Regulated Structure

- D5 Operation of a regulated structure, except for an existing structure, is prohibited unless the holder has submitted to the administering authority, all of the following:
- (a) one paper copy and one electronic copy of the design plan and certification of the 'design plan' in accordance with condition D6;
 - (b) a set of 'as constructed' drawings and specifications;
 - (c) certification of those 'as constructed drawings and specifications' in accordance with condition D9;
 - (d) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan;
 - (e) the requirements of this authority relating to the construction of the regulated structure have been met;
 - (f) the holder has entered the details required under this authority, into a Register of Regulated Structures; and,
 - (g) there is a current operational plan for the regulated structure.
- D6 For existing structures that are regulated structures:
- (a) where the existing structure that is a regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, the holder must submit to the administering authority within 12 months of the commencement of this condition a copy of the certified system design plan including that structure; and
 - (b) there must be a current operational plan for the existing structures.
- D7 Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.

Mandatory Reporting Level

- D8 Conditions D15 to D16 inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain – overtopping'.

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- D9 The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.
- D10 The holder must, as soon as practicable but within forty-eight (48) hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
- D11 The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
- D12 The holder must record any changes to the MRL in the Register of Regulated Structures.

Design Storage Allowance

- D13 The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.
- D14 By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).
- D15 The holder of this environmental authority must, as soon as possible and within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.

- D16 The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

Annual Inspection Report

- D17 Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
- D18 At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.
- D19 The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.
- D20 The holder of this environmental authority must:
- (a) within twenty (20) business days of receipt of the annual inspection report, provide to the administering authority:
 - (i) the recommendation section of the annual inspection report; and,
 - (ii) if applicable, any actions being taken in response to those recommendations; and
 - (b) if, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.

Transfer Arrangements

- D21 The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.

Decommissioning and Rehabilitation

- D22 Regulated structures must not be abandoned but be either:
- (a) decommissioned and rehabilitated to achieve compliance with condition D23; or
 - (b) be left in-situ for a use by the landholder provided that:
 - (i) it no longer contains contaminants that will migrate into the environment; and
 - (ii) it contains water of a quality that is demonstrated to be suitable for its intended use(s); and
 - (c) the holder of the environmental authority and the landholder agree in writing that the:
 - (i) dam will be used by the landholder following the cessation of the environmentally relevant activity(ies); and
 - (ii) landholder is responsible for the dam, on and from an agreed date.
- D23 Before surrendering this environmental authority the site must be rehabilitated to achieve a safe, stable, non-polluting landform.

Register of Regulated Dams

- D24 A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.
- D25 The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated dam is submitted to the administering authority.
- D26 The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with condition D11 and D12 has been achieved.
- D27 The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.

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- D28 All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.
- D29 The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.

Transitional arrangements

- D30 All existing regulated structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in Schedule D - Table 1 (Transitional hydraulic performance requirements for existing structures), depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.
- D31 Schedule D - Table 1 (Transitional hydraulic performance requirements for existing structures) ceases to apply for a structure once any of the following events has occurred:
- (a) it has been brought into compliance with the hydraulic performance criteria applicable to the structure under the Manual; or
 - (b) it has been decommissioned; or
 - (c) it has been certified as no longer being assessed as a regulated structure.
- D32 Certification of the transitional assessment required by D30 (as applicable) must be provided to the administering authority within 6 months of amendment of the authority adopting this schedule.

Schedule D – Table 1 (Transitional hydraulic performance requirements for existing structures)

Transition period required for existing structures to achieve the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Dams</i>			
Compliance with criteria	High	Significant	Low
>90% and a history of good compliance performance in last 5 years	No transition required	No transition required	No transitional conditions apply. Review consequence assessment every 7 years.
>70%–≤90%	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 10 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	No transitional conditions apply. Review consequence assessment every 7 years.
>50–≤70%	Within 5 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 7 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Review consequence assessment every 7 years.
≤50%	Within 5 years or as per compliance requirements (e.g. TEP timing)	Within 5 years or as per compliance requirements (e.g. TEP timing)	Review consequence assessment every 5 years.
Regulated levee designed to prevent the ingress of clean flood water <100% compliant ⁷	Within 5 years unless otherwise agreed with the administering authority.		

Hydraulic performance of regulated dams

D33 Regulated dams must meet the hydraulic performance criteria specified in Schedule D - Table 2 (Hydraulic performance criteria for Regulated Dams).

Schedule D - Table 2 (Hydraulic performance criteria for Regulated Dams)

Name of dam	Consequence category	Hydraulic performance criteria	
		Design Storage Allowance (DSA)	Mandatory Reporting Level (MRL)
Stage 2 PAF Pad Run Off Dam	Significant ^[1]	RL 207.65m ^[2]	RL 208.60m ^[2]
Tailings Storage Facility	High ^[3]	RL 236.2m ^[4]	RL 239.6m ^[4]

[1] Consequence category assessed in ATC Williams (1 May 2015) report titled "MMG Dugald River - Consequence Category Assessment - 2015 Review: Stage 1 & 2 PAF Pad Runoff Dams, STP Evaporation Dam, NAF Pad Runoff Dam, Underground Mine Water Collection Dam and ROM Area Runoff Dam: May 2015: Doc. No. 108003.19-R01", which includes certification by Mark Dillon (RPEQ 8690).

[2] DSA and MRL details as recorded in ATC Williams (22 December 2014) report titled "MMG Dugald River - Dugald River Mine Regulated Dams Operation Plan: December 2014, ATCW Doc No: 108003.12-R04, Version No: 2".

[3] Consequence category assessed in ATC Williams (24 May 2016) report titled "MMG Dugald River Tailings Storage Facility: May 2016, ATCW Doc No: 108003.18-R03", which includes certification by Mark Dillon (RPEQ 8690).

[4] DSA and MRL details as recorded in ATC Williams (October 2019) report titled "MMG Dugald River - Dugald River Mine - Regulated Structures - Annual Inspection Report - 2019. ATCW Doc No: 1080033.37-R01, Revision No: 0".

Tailings Disposal

D34 Upon disposal of tailings into the tailings storage facility, the holder of this environmental authority must inspect the tailings storage facility weekly to identify and register any fauna mortalities. This information will be made available to the administering authority upon request within and forty eight (48) hours of the discovery of any fauna mortalities. Details of mortalities will include but not be limited to:

- (a) animal species of the discovery of any fauna mortality;
- (b) number of animals;
- (c) location; and
- (d) likely cause of death.

D35 If in the opinion of the administering authority, the mortality rate referred to in condition D34 is unacceptable, the holder of this environmental authority will be required to develop and implement an action plan to reduce the mortality rate and provide the action plan to the administering authority within one (1) month of the plan being required.

END OF CONDITIONS FOR SCHEDULE D

Schedule E – Sewage

Sewage Treatment Management Plan

- E1 A Sewage Treatment Management Plan that provides for the proper and effective management of actual and potential environmental impacts resulting from the operation of sewage treatment plants and to ensure compliance with the conditions of the environmental authority must be implemented and maintained.
- E2 The Sewage Treatment Management Plan must include but no be limited to:
- (a) topographical map of suitable scale clearly showing the licensed place and surrounding land likely to be affected by the sewage treatment plants along with the location of any sensitive receptors;
 - (b) a site plan including the Q100 flood level in conjunction with licensed place boundaries and infrastructure and buffer zones;
 - (c) detail any potential impact on groundwater and surface water from the discharge of effluent; and
 - (d) strategies for managing and minimising the impact on surface water and groundwater; and

Alarms

- E3 Sewage treatment infrastructure must be fitted with stand-by pumps and pump-failure alarms as well as high level alarms to warn of imminent overflow. All alarms must be able to operate via telemetry and without mains power.

Sewage Treatment – Effluent Release to Waters

- E4 Treated sewage effluent may be released to waters from the STP Dam in accordance with the conditions of this environmental authority.
- E5 Notwithstanding the monitoring requirements specified Schedule C of this environmental authority, the release of contaminants to waters from the STP Dam release point must also be monitored at the release point STP Dam and for each quality characteristic and at the frequency specified in Schedule E - Table 1 (Sewage Effluent Contaminant Release Limits).

Schedule E - Table 1 (Sewage Effluent Contaminant Release Limits)

Quality Characteristic	Release Limit	Monitoring Frequency
Total Nitrogen (mg/L)	20	Daily during release (the first sample must be taken within 2 hours of commencement of release)
Total Phosphorous (mg/L)	5	
5 Day Biochemical Oxygen Demand (mg/L)	20	
Faecal Coliforms (cfu/100mL)	1000	
Free Residual Chlorine (mg/L)	1	

- E6 The release of contaminants to waters must not exceed the release limits stated in Schedule E - Table 1 (Sewage Effluent Contaminant Release Limits) for each quality characteristic.

END OF CONDITIONS FOR SCHEDULE E

Schedule F – Noise and Vibration

Noise Monitoring

- F1 The holder of this environmental authority must ensure that noise generated by the mining activity does not cause a nuisance at a sensitive place or commercial place.
- F2 In the event of a complaint made to the administering authority, considered in the opinion of an authorised officer to be neither frivolous or vexatious, about noise generated in carrying out the mining activity and the noise is considered by the administering authority to be an unreasonable noise, the holder of this environmental authority must take action to ensure that it is no longer an unreasonable noise. Noise monitoring and recording must include the following descriptor characteristics and matters:
- (a) L_{Aeq}
 - (b) $L_{AN,T}$ (where N equals the statistical levels of 1, 10 and 90 and T = 15 minutes);
 - (c) background noise L_{A90} ;
 - (d) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels;
 - (e) atmospheric conditions including temperature, relative humidity and wind speed and directions;
 - (f) effects due to any extraneous factors such as traffic noise;
 - (g) location, date and time of monitoring;
 - (h) if the complaint concerns low frequency noise, Max $L_{pLIN,T}$; and
 - (i) if the complaint concerns low frequency noise, one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range.
- F3 In the event of a complaint about noise from the mining activities, noise from the mining activities must not exceed the criteria in Schedule F – Table 1 (Noise Limits).

Schedule F – Table 1 (Noise Limits)

Noise Level dB(A) Measured As:	7 Days per Week		
	7am to 6pm	6pm to 10pm	10pm to 7am
$L_{Aeq, adj, T}$	40	35	30

Note: T = 15 minutes

Air Blast and Ground Vibration

- F4 The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in Schedule F – Table 2 (Blasting Noise Limits) to be exceeded at any sensitive place or commercial place.

Schedule F – Table 2 (Blasting Noise Limits)

Blasting Noise Limits	Sensitive or Commercial Place Limits	
	7am to 6pm	6pm to 7am
Airblast overpressure	115 dB (Linear) peak for four (4) out of five (5) consecutive blasts initiated and not greater than 120 dB (Linear) peak at any time	95 dB (Linear) peak
Ground vibration peak particle velocity	5mm/second peak particle velocity for four (4) out of five (5) consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	1mm/second peak particle velocity

- F5 The holder of this environmental authority must implement measures to reduce airblast overpressure and ground vibration impacts upon receipt of a complaint such that blasting activities no longer cause environmental harm.
- F6 Where blast monitoring detects non-compliance with Schedule F – Table 2 (Blasting Noise Limits) the holder of this environmental authority must:
- (a) take steps to ensure compliance is achieved by subsequent blasts; and
 - (b) continue to monitor all consecutive blasts until at least three (3) successive blasts comply with Schedule F – Table 2 (Blasting Noise Limits).
- F7 The method of measurement and reporting of airblast overpressure levels must comply with the most recent Australian standard *Explosives – Storage and use* guidelines.
- F8 The method of measurement and reporting of vibration levels must comply with the most recent edition of the administering authority's guideline *Noise and vibration from blasting*.

END OF CONDITIONS FOR SCHEDULE F

Schedule G – Non Mineral Waste

Waste Management Program

- G1 A Waste Management Program must be developed and implemented by the environmental authority holder and submitted to the administering authority upon request.

Waste Disposal

- G2 All general and regulated waste (other than waste authorised in condition G3) must be removed from the licensed place to a facility that is lawfully able to accept the waste.
- G3 The only waste that can be disposed of on the licensed place is waste generated on the licensed place and is limited to:
- (a) waste rock;
 - (b) tailings;
 - (c) tyres;
 - (d) plastic; and
 - (e) SIPEX and Sodium Metabisulphite containers.
- G4 Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.

Regulated Waste

- G5 Regulated waste, other than that authorised to be disposed of at the licensed place under this environmental authority, must only be removed and transported from the licensed place by a person who holds a current authority to transport such wastes to a facility that is lawfully able to accept the waste.
- G6 Regulated waste generated by the mining activity can be temporarily stored at the licensed place prior to removal provided it is for a period no longer than six (6) months and it is stored in a manner to minimise risk of fire or contamination of land or waters.
- G7 Each container of regulated waste stored awaiting movement from the licensed place must be clearly marked to identify the contents.

Tyre Storage and Disposal

- G8 Tyres stored awaiting disposal or transport for take-back and recycling or waste-to-energy options – must be stockpiled in volumes less than three (3) metres in height and 200m² in area and at least ten (10) metres from any other tyre storage area.
- G9 Fire prevention measures must be implemented including the removal of all combustible materials, including grass and vegetation, within a ten (10) metre radius of any tyre storage area.
- G10 Subject to demonstrating to the administering authority that no other use higher in the waste hierarchy can be practicably implemented, waste tyres generated from the mining activity may be disposed of at the licensed place in the underground mine workings.

END OF CONDITIONS FOR SCHEDULE G

Schedule H – Mineral Waste

Tailings Disposal

- H1 Tailings must be managed in accordance with procedures contained within the Mineral Waste Tailing Disposal Plan. The Mineral Waste Tailing Disposal Plan must be regularly reviewed and updated every three years. These procedures must include provisions for:
- (a) containment of tailings in accordance with the approved design plan(s);
 - (b) the management of seepage and leachates both during operation and post closure;
 - (c) the control of fugitive emissions to air;
 - (d) a program of progressive sampling and characterisation to identify acid producing potential and metal concentrations of tailings that must include:
 - (i) progressive characterisation of all tailings material during disposal for net acid producing potential (NAPP) and the following contaminants: arsenic, cadmium, copper, cyanide, iron, lead, manganese, nickel, silver, zinc, fluoride and sulfate;
 - (ii) geochemical kinetic testing where the acid producing potential of tailings material has not been conclusively determined to indicate oxidation rates, potential reaction products and effectiveness of control strategies.
 - (e) management of tailings in order to minimise the potential for environmental harm.

Waste Rock

- H2 No waste rock dumps are to remain upon surrender of environmental authority.
- H3 All potentially acid forming (PAF) waste material is to be returned to the North or South Decline at end of mine life and must not cause environmental harm.
- H4 Non-acid forming waste rock (NAF) may be used in rehabilitation or the construction of temporary or permanent structures within the operational areas if it is characterised as un-reactive (including material that does not cause acid, neutral or saline mine drainage).
- H5 A Waste Rock Management Plan must be developed and implemented by the environmental authority holder and submitted to the administering authority upon request.
- H6 Waste rock disposal must not occur on the licensed place unless the holder of this environmental authority has submitted to the administering authority a waste rock management plan. The waste rock management plan must be certified by an appropriately qualified person, to ensure the plan has addressed the requirements of this environmental authority in accordance with best practice environmental management.
- H7 The waste rock management plan must include:
- (a) a detailed design of the waste rock dumps;
 - (b) characterisation of the waste rock to predict the quality of runoff and seepage generated, including salinity, acidity, alkalinity, dissolved metals, metalloids and non-metallic inorganic substances;
 - (c) a program of progressive sampling program to validate pre-mine waste rock characterisation. The waste rock sampling program must include validation of salinity, acid and alkali producing potential and metal concentrations including arsenic, cadmium, copper, lead, manganese, nickel, silver, zinc, fluoride and sulfate;
 - (d) where the acid rock drainage potential / neutral mine drainage potential of waste rock material has not been conclusively determined, geochemical kinetic testing must be conducted to indicate oxidation rates, potential reaction products and effectiveness of control strategies;
 - (e) records must be maintained of all waste rock characterisation and disposal including contingency planning for the management of acid rock / neutral mine drainage;
 - (f) a materials balance and disposal plan demonstrating how potentially acid forming and acid forming waste rock will be selectively placed and/or encapsulated to minimise the generation of acid mine drainage;

- (g) a materials balance and disposal plan demonstrating how waste rock that has a potential to generate neutral and/or saline mine drainage will be selectively placed and managed to minimise the generation of neutral and/or saline mine drainage;
- (h) a sampling program to verify encapsulation and/or placement of potentially acid forming / acid forming waste rock / waste rock that has a potential to generate neutral mine drainage;
- (i) how often the performance of the plan will be assessed;
- (j) a rehabilitation strategy which meets the rehabilitation objectives specified in Schedule I of this environmental authority; and
- (k) monitoring or rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.

H8 The waste rock dumps must be designed, constructed and operated to minimise the infiltration of incidental rainfall into the waste rock dump.

H9 Any seepage from the waste rock dump must be captured and directed to an appropriately engineered and maintained storage authorised to receive seepage in accordance with Schedule D – Regulated Structures of this environmental authority.

Acid Rock Drainage Management

H10 Subject to the release limits defined in Schedule – C of this environmental authority, all reasonable and practicable measures must be implemented to prevent contaminated water being directly or indirectly released or likely to be released as a result of the mining activity to any waters.

END OF CONDITIONS FOR SCHEDULE H

Schedule I – Land and Rehabilitation

General

- I1 Unless authorised by this environmental authority contaminants that will or may cause environmental harm must not be directly or indirectly released to land.
- I2 Any spillage of wastes, contaminants or other materials must be cleaned up promptly. Such spillages must be cleaned up using dry methods that minimise the impact of the release of wastes, contaminants or materials to land.

Topsoil

- I3 Topsoil and subsoils must be stripped and stockpiled ahead of the areas proposed to be disturbed for the mining activity to a depth determined from soil surveys to ensure that useable soil resources are preserved for rehabilitation.
- I4 Topsoil and subsoil stockpiles must be managed to ensure stability and minimise the release of contaminants. Measures must include:
- (a) Vegetating stockpiles;
 - (b) Minimising the height of stockpiles; and
 - (c) Re-using stockpiles as soon as possible.
- I5 A topsoil and subsoil inventory which identifies the soil requirements for the mining activity and availability of suitable soil on the licensed place must be submitted to the administering authority upon request.

Disturbance to Land

- I6 When carrying out the mining activity the holder of this environmental authority must:
- (a) avoid, minimise or mitigate (in order of preference) any impacts on areas of sensitive vegetation or other areas of ecological value;
 - (b) minimise the risk of injury, harm, or entrapment to wildlife and stock;
 - (c) minimise disturbance to land that may otherwise result in land degradation;
 - (d) prior to carrying out any disturbance activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any Category A, B or C Environmentally Sensitive Area (ESA) and the relevant requirements of this environmental authority;
 - (e) if significant disturbance to land is unavoidable, the holder of this environmental authority must clear vegetation in a way which minimises fragmentation; and
 - (f) manage cleared vegetation so that it is stockpiled in a manner that facilitates salvage and respreading and does not impede vehicle, stock or wildlife movements.
- I7 A registered spotter/catcher is to be engaged to work ahead of site clearing works at the commencement of vegetation clearing to ensure the protection of species that may be of conservation significance.

Note: This environmental authority does not authorise the taking of protected animals or the tampering with an animal breeding place that is being used by a protected animal to incubate or rear the animal's offspring.

- I8 In the event of identification of threatened species on the licensed place, a diagrammatic representation of the species occurrence relative to the mining activity together with a management and monitoring strategy for species conservation must be prepared to the satisfaction of the administering authority and submitted with the plan of operations.

Purple-necked Rock-wallaby Monitoring Program (*Petrogale purpureicollis*)

- I9 The holder of this environmental authority must take all reasonable and practicable measures to avoid, minimise and mitigate impacts on the Purple-necked Rock-wallaby (*Petrogale purpureicollis*).
- I10 A purple-necked rock-wallaby monitoring program must be implemented by an appropriately qualified person to monitor and record the effects of the mining activity on the purple-necked rock wallaby population. The purple-necked rock-wallaby monitoring program must be implemented and maintained for the life of the environmental authority.
- I11 The purple-necked rock-wallaby monitoring program required by condition I10 must be conducted annually in each wet and dry season and must include the following at a minimum:
- an estimation of the number of purple-necked rock-wallabies inhabiting the licensed place;
 - continuation of data collection on suitable purple-necked rock-wallaby shelter sites and foraging areas;
 - details of the person that undertook the monitoring program and the methods used;
 - details of when (both date and time of day) and the climatic conditions at the time that the monitoring program was undertaken;
 - an estimation of the number and type of pest species occurring along the Knapdale Range within the licensed place that may impact on the population of the purple-necked rock-wallaby;
 - consideration and comparison to previous similar monitoring programs;
 - support for findings as follows including photos/records of the purple-necked rock-wallaby, scats or other trace material; and
 - procedures for notification to the administering authority and contingency plans in the event that any significant decline in the purple-necked rock-wallaby population is detected.
- I12 A report detailing the results of the purple-necked rock-wallaby monitoring program carried out in accordance with conditions I10 and I11 must be provided to the administering authority, before 1 February each year.

Rehabilitation Objectives

- I13 Land disturbed by mining must be rehabilitated in accordance with Schedule 1 – Table 1 (Dugald River Project Rehabilitation Requirements) and the objectives of the Post Mine Land Use Plan required under condition I18.
- ~~I14 — Rehabilitation must commence progressively as soon as areas become available and in accordance with the plan of operations.~~
- ~~I15 — Within six (6) months of the commencement of tailings disposal in the tailings storage facility, the holder of this environmental authority must commence trials to establish suitable capping systems for infrastructure on the licensed place including but not limited to the tailings storage facility and all waste rock dumps.~~
- ~~I16 — By 1 October 2017 and once every two (2) years thereafter the holder of this environmental authority must submit a report to the administering authority detailing the success and findings from the capping system trials.~~
- ~~I17 — By 2 October 2019 the holder of this environmental authority must submit to the administering authority a report nominating the most appropriate capping system for the tailings storage facility based on the results from trials required by condition I18.~~

Post Mine Land Use Plan

- ~~I18 — A Post Mine Land Use Plan must be developed and implemented by the authority holder and submitted to the administering authority upon request. The PMLUP must be developed by an appropriately qualified person and include:~~
- ~~(a) — schematic representation of final land form inclusive of drainage features;~~
 - ~~(b) — slope designs;~~
 - ~~(c) — cover design (not limited to store and release covers);~~
 - ~~(d) — drainage design;~~
 - ~~(e) — erosion controls;~~
 - ~~(f) — description of experimental design for monitoring of analogue and rehabilitated areas inclusive of statistical design;~~
 - ~~(g) — proposed revegetation methods inclusive of plant species selection, re-profiling, respreding soil, soil ameliorants/amendments, surface preparation and method of propagation;~~
 - ~~(h) — materials balance including available top soil, and low permeability capping material;~~
 - ~~(i) — geotechnical, geochemical and hydrological studies;~~
 - ~~(j) — chemical, physical and biological properties of soil and water; and~~
 - ~~(k) — a rehabilitation monitoring program as required by condition I20.~~

Rehabilitation Monitoring Program

- ~~I19 — A rehabilitation monitoring program must be developed and be implemented on commencement of rehabilitation identified in Schedule 1 — Table 1 (Dugald River Project Rehabilitation Requirements) by an appropriately qualified person.~~
- ~~I20 — The holder of this environmental authority must conduct rehabilitation monitoring in accordance with the program developed in condition (I21) at least once a year including sufficient spatial and temporal replication to enable scientifically justifiable conclusions to be made, as established in the rehabilitation monitoring program.~~
- ~~I21 — Verification of rehabilitation success is to be carried for each domain. Monitoring must be carried out for each domain at a minimum sampling intensity of 1:15,000 and must include sufficient replication to enable statistical analysis of results at an acceptable power.~~

Schedule I – Table 1 (Dugald River Project Rehabilitation Requirements)

Mine Domain	Mine Feature	Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
Ancillary Infrastructure and Services	Accommodation Village	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects).	Class 5 Native Habitat.	Compliance with condition I19 and the Post Mine Land Use Plan.	TBA ¹
	Pipeline and Accommodation Village Road				
Borrow Pits & Stockpiles	Topsoil Stockpiles – Mine Infrastructure Area	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects)	Class 4 – 5 Low-Intensity Grazing / Native Habitat.	Compliance with condition I19 and the Post Mine Land Use Plan.	TBA ¹
	Borrow Pits and Stockpiles				
Dams and Diversion Structures	Sediment Dams A, C, D, F and G	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects).	Class 4 – 5 Low-Intensity Grazing / Native Habitat.	Compliance with condition I19 and the Post Mine Land Use Plan.	TBA ¹
	Containment Dam				
	Stage 1 PAF Pad Run-Off Dam				
	Stage 2 PAF Pad Run-Off Dam				
	Underground Mine Water Collection Dam				
	STP Dam Stage 1				
	STP Dam Stage 2				
	ROM Area Run-Off Dam				
	Process Plant Run-Off Dam				
	Mine Workshop Run-Off Dam				
	Raw Water Dam				
	Diversion Drains				

Permit
Environmental authority EPML00731213

Mine Domain	Mine Feature	Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
Mineralised Waste	PAF waste rock dump (Stage 1)	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects).	Class 4 Low-Intensity Grazing.	Compliance with condition I19 and the Post-Mine Land Use Plan.	TBA ¹
	PAF waste rock dump (Stage 2)				
	NAF Waste Rock Dump	All potentially acid-forming waste rock must be returned to the void at the end of mine life.			
	Temporary Ore Stockpile	Only non-acid-forming waste rock is authorised to be placed in the NAF waste rock dump. Where possible non-acid-forming waste rock will be used in rehabilitation and only in accordance with the conditions of the environmental authority.			
Mining and Processing Area	ROM Pad	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects)	Class 4 Low-Intensity Grazing.	Compliance with condition I19 and the Post-Mine Land Use Plan.	TBA ¹
	ROM Haul Roads				
	Processing Plant and Conveyor Area				
	Underground Portals and Support Infrastructure	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authority's Guideline Rehabilitation requirements for Mining Projects)	Class 4 – 5 Low-Intensity Grazing / Native Habitat.	Compliance with condition I19 and the Post-Mine Land Use Plan.	TBA ¹
	Switchyard				
	Existing Camp and Expansion Works				
	Sewage Treatment Plant				

Mine Domain	Mine Feature	Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
	Workshop, Vehicle Washdown and Maintenance Area				
	Shared Construction Laydown and Warehouse Laydown Area				
	Water Services				
	Shared Mobile Equipment and Construction Laydown Area				
	Mine Infrastructure Area Roads and Parking				
Tailings Storage Facility (TSF)	TSF and Seepage Collection Pond	Safe, non-polluting, stable and self-sustaining. (All land subject to the mining activity must be rehabilitated to meet the requirements of the administering authorities Guideline Rehabilitation requirements for Mining Projects).	Class 5 Native Habitat.	Compliance with condition H9 and the Post Mine Land Use Plan.	TBA ¹
	Topsoil Stockpiles — TSF				
	TSF Pipelines and Roads				

1. — Post mine land use, rehabilitation indicators and completion criteria are to be nominated in accordance with condition H8.

2. — Table 2 of the Land Suitability Techniques — Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995).

Post Closure Management Plan

- I22 ~~A Post Closure Management Plan must be developed and implemented by the authority holder and submitted to the administering authority upon request. The Plan must be implemented for a period of:~~
- ~~(a) at least thirty (30) years following cessation of the mining activity (excluding rehabilitation) on the licensed place; or~~
 - ~~(b) a shorter period if:
 - ~~(i) the licensed place is proven to be geo-technically and geo-chemically stable; and~~
 - ~~(ii) it can be demonstrated to the satisfaction of the administering authority that no release of contaminants from the licensed place will result in environmental harm.~~~~
- I23 ~~The Post Closure Management Plan must include the following elements:~~
- ~~(c) operation and maintenance of:
 - ~~(i) contaminated water collection and reticulation systems;~~
 - ~~(ii) contaminated water treatment systems;~~
 - ~~(iii) the groundwater monitoring network;~~
 - ~~(iv) final cover systems; and~~
 - ~~(v) vegetative cover.~~~~
 - ~~(d) monitoring of:
 - ~~(i) surface water;~~
 - ~~(ii) groundwater;~~
 - ~~(iii) seepage rates;~~
 - ~~(iv) erosion rates;~~
 - ~~(v) the integrity and effectiveness of final cover systems; and~~
 - ~~(vi) the health and resilience of vegetative cover.~~~~

Infrastructure

- I24 All buildings, structures, mining equipment and plant erected and/or used for the mining activity must be removed from the licensed place prior to surrender, except where agreed to in writing by the administering authority and the landowner.

Chemicals and Flammable or Combustible Liquids

- I25 All explosives, hazardous chemicals, corrosive substances, toxic substances, gases, *flammable or combustible* liquids and dangerous goods must be stored and handled in accordance with the current, relevant Australian Standard where such is applicable.
- I26 Notwithstanding the requirements of any applicable Australian Standard, any liquids stored on licensed place that have the potential to cause environmental harm must be stored and serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land.
- I27 Where no relevant Australian Standard is available, the following must be applied:
- (a) storage tanks must be bunded such that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and
 - (b) drum storages must be bunded such that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.
- I28 All containment systems must be designed to minimise rainfall collection within the system.

Contaminated Land

- I29 Prior to making an application for surrender or approval for progressive rehabilitation the holder of this environmental authority must undertake a contaminated land assessment / investigation of the relevant areas of the licensed place in accordance with, but not limited to, the following guidance: National Environment Protection (Assessment of Site Contamination) Amendment Measure, 2013. Other appropriate guidance may also be utilised where appropriate, however, application of any additional guidance must not contradict the requirements of Qld legislation and guidance.

Biodiversity Offsets

- I30 The holder of this environmental authority must implement and maintain the *Biodiversity Offset Strategy* and the *Dugald River Project: Offset Area Management Plan*, developed in accordance with the *Queensland Biodiversity Offset Policy*.

END OF CONDITIONS FOR SCHEDULE I

Schedule J – Definitions

Key terms and/or phrases used in this document are defined in this section. Applicants should note that where a term is not defined, the definition in the *Environmental Protection Act 1994*, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.

“**acceptance criteria**” means the measures by which the actions implemented to rehabilitate the land are deemed to be complete. The acceptance criteria indicate the success of the rehabilitation outcome or remediation of areas which have been significantly been disturbed by the mining activity. Acceptance criteria may include information regarding:

- a) vegetation establishment, survival and succession;
- b) vegetation productivity, sustained growth and structure development;
- c) fauna colonisation and habitat development;
- d) ecosystem processes such as soil development and nutrient cycling, and the recolonisation of specific fauna groups such as collembola, mites and termites which are involved in these processes;
- e) microbiological studies including recolonisation by mycorrhizal fungi, microbial biomass and respiration;
- f) effects of various establishment treatments such as deep ripping, topsoil handling, seeding and fertiliser application on vegetation growth and development;
- g) resilience of vegetation to disease, insect attack, drought and fire; and
- h) vegetation water use and effects on ground water levels and catchment yields.

“**acid mine drainage (AMD)**” means any contaminated release emanating from a mining operation formed through a series of chemical and biological reaction, when geological strata is disturbed and exposed to oxygen and moisture as a result of the mining activity.

“**acid rock drainage (ARD)**” means any contaminated release emanating from a mining activity formed through a series of chemical and biological reactions, when geological strata is disturbed and exposed to oxygen and moisture as a result of the mining activity.

“**administering authority**” means the chief executive of the agency administering the *Environmental Protection Act 1994*.

“**affected land**” means land on which an event has caused or threatens serious or material environmental harm.

“**affected person**” is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life or property can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

“**airblast overpressure**” means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

“**Annual Exceedance Probability**” or “**AEP**” the probability that at least one event in excess of a particular magnitude will occur in any given year.

“**annual inspection report**” means an assessment prepared by a suitably qualified and experienced person containing details of the assessment against the most recent consequence assessment report and design plan (or system design plan);

- a) against recommendations contained in previous annual inspections reports;
- b) against recognised dam safety deficiency indicators;
- c) for changes in circumstances potentially leading to a change in consequence category;
- d) for conformance with the conditions of this authority;
- e) for conformance with the ‘as constructed’ drawings;
- f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
- g) for evidence of conformance with the current operational plan.

“**ANZECC 2000**” means Australian and New Zealand Environment Conservation Council Marine and Freshwater Quality Guidelines.

“**appropriately qualified person**” means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods or literature.

“**assessed**” or “**assessment**” by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

- a) exactly what has been assessed and the precise nature of that determination;
- b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;
- c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

“**associated works**” in relation to a dam, means:

- a) operations of any kind and all things constructed, erected or installed for that dam; and
- b) any land used for those operations.

“**authority**” means an environmental authority or a development approval.

“**environmental authority**” means environmental authority under the *Environmental Protection Act 1994*.

“**background**” means the average of samples taken prior to the commencement of mining from the same waterway that the current sample has been taken.

“**blasting**” means the use of explosive materials to fracture:

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

“**bunded**” means within bunding consistent with Australian Standard 1940.

“**certification**”, “**certifying**”, “**certify**” or “**certified**” in relation to any assessment or documentation required by the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*, including design plans, ‘as constructed’ drawings and specifications, construction, operation or an annual report regarding regulated structures, means assessment and approval must be undertaken by a suitably qualified and experienced person in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A)).

“**CFU**” means colony forming units.

“**chemical**” means:

- a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994* (Commonwealth); or
- b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council; or
- c) a lead hazardous substance within the meaning of the *Workplace Health and Safety Regulation 1997*;
- d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers’ Advisory Council and published by the Commonwealth; or
- e) any substance used as, or intended for use as:
 - (i) a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product; or
 - (ii) a surface active agent, including, for example, soap or related detergent; or
 - (iii) a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
 - (iv) a fertiliser for agricultural, horticultural or garden use; or
 - (v) a substance used for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
 - (vi) manufacture of plastic or synthetic rubber.

“**climatic season**” means summer (1 December to 29 February), autumn (1 March to 31 May), winter (1 June to 31 August) and spring (1 September to 30 November).

“**commercial place**” means a workplace used as an office or for business or commercial purposes, which is not part of the mining activity and does not include employees accommodation or public roads.

“**consequence**” in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

“**consequence category**” means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.

“**construction**” or “**constructed**” in relation to a dam/structure includes building a new dam/structure and modifying or lifting an existing dam/structure, but does not include investigations and testing necessary for the purpose of preparing a design plan.

“**contaminant**” A contaminant can be a gas, liquid or solid; or an odour; or an organism (whether alive or dead), including a virus; or energy, including noise, heat, radioactivity and electromagnetic radiation; or a combination of contaminants

“**contaminated**” means the substance has come into contact with a contaminant.

“**control measure**” means any action or activity that can be used to prevent or eliminate a hazard or reduce it to an acceptable level.

“**dam**” means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

“**dam crest volume**” means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneous maximum volume within the walls, without regard to flows entering or leaving (for example, via spillway).

“**design plan**” is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.

“**design storage allowance**” or “**DSA**” means an available volume, estimated in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)* published by the administering authority, must be provided in a dam as at 1 November each year in order to prevent a discharge from that dam to an annual exceedance probability (AEP) specified in that Manual.

“**development approval**” means a development approval under the *Integrated Planning Act 1997* or the *Sustainable Planning Act 2009* in relation to a matter that involves an environmentally relevant activity under the *Environmental Protection Act 1994*.

“**EC**” means electrical conductivity.

“**effluent**” treated waste water released from sewage treatment plants.

“**emergency action plan**” means documentation forming part of the operational plan held by the holder of this environmental authority or a nominated responsible officer, that identifies emergency conditions that sets out procedures and actions that will be followed and taken by the dam/structure owner and operating personnel in the event of an emergency. The actions are to minimise the risk and consequences of failure, and ensure timely warning to downstream communities and the implementation of protection measures. The plan must require dam/structure owners to annually update contact details that are part of the plan, and to comprehensively review the plan at least every five years.

“**environmentally relevant activity (ERA)**” means an environmentally relevant activity as defined under Section 18 of the *Environmental Protection Act 1994* and listed under Schedule 2 of the *Environmental Protection Regulation 2008*.

“**existing structure**” means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

“**flare pit**” means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted. The flare pit is only used during the drilling and work over process on a petroleum well.

“**flowable substance**” means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

“**flow event**” means a surface water flow in a drainage feature or watercourse that occurs as a result of rainfall.

“**hazard**” in relation to a dam/structure as defined, means the potential for environmental harm resulting from the collapse or failure of the dam/structure to perform its primary purpose of containing, diverting or controlling flowable substances.

“**hazard category**” means a category, either low, significant or high, into which a dam/structure is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*.

“**hazardous waste**” means a substance, whether liquid, solid or gaseous that, if improperly treated, stored, disposed of or otherwise managed, is likely to cause environmental harm.

“**holder of this environmental authority**” means any person who is the holder of, or is acting under, that environmental authority.

“**hydraulic performance**” means the capacity of a regulated dam to contain or safely pass flowable substances based on the design criteria specified for the relevant consequence category in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933).

“**implement**” means to put (a plan, proposal, etc.) into effect.

“**infrastructure**” means water storage dam/structures, roads and tracks, buildings and other structures built for the purpose of the mining activity but does not include facilities required for the long term management of mining impacts or the protection of potential resources. Such facilities include dam/structures containing hazardous waste, waste rock dumps, voids, or ore stockpiles and buildings or other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background land owner.

“**levee**” means an embankment that only provides for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releases from other works, during the progress of those stormwater or flood flows or those releases; and does not store any significant volume of water or flowable substances at any other times.

“**land**” in the “land schedule” of this document means land excluding waters and the atmosphere.

“**land suitability**” as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland.

“**land use**” term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

“**leachate**” means a liquid that has passed through or emerged from, or is likely to have passed through or emerged from, a material stored, processed or disposed of at the operational land which contains soluble, suspended or miscible contaminants likely to have been derived from the said material.

“**licensed place**” means the mining activities carried out at the mining tenements detailed in Table 3 (page 3) of this environmental authority.

“**low consequence dam**” means any dam that is not a high or significant consequence category as assessed using the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933).

“**m**” means metres.

“**maintain**” to keep in due condition, operation, or force.

“**mandatory reporting level**” or “**MRL**” means a warning and reporting level determined in accordance with the criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933) published by the administering authority.

“**Manual**” means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933) published by the administering authority.

“**measures**” includes any measures to prevent or minimise environmental impacts of the mining activity such as bunds, silt fences, diversion drains, capping, and containment systems.

“**metalliferous mine drainage**” means any waters, contaminated with metals / metalloids or other contaminants as a result of the mining activity.

“**mg/L**” means milligrams per litre.

“**mineral**” means a substance which normally occurs naturally as part of the earth’s crust or is dissolved or suspended in water within or upon the earth’s crust and includes a substance which may be extracted from such a substance, and includes—

- a) clay if mined for use for its ceramic properties, kaolin and bentonite;

- b) foundry sand;
- c) hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil there from;
- d) limestone if mined for use for its chemical properties;
- e) marble;
- f) mineral oil or gas extracted or produced from shale or coal by in situ processes;
- g) peat;
- h) salt including brine;
- i) shale from which mineral oil may be extracted or produced;
- j) silica, including silica sand, if mined for use for its chemical properties;
- k) rock mined in block or slab form for building or monumental purposes;

but does not include—

- l) living matter;
- m) petroleum within the meaning of the *Petroleum Act 1923*;
- n) soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form;
- o) water.

“**ML**” means megalitres.

“**mL**” means millilitres.

“**modification**” or “**modifying**” (see definition of “construction”)

“**NAF waste rock**” means non-acid forming waste rock.

“**NATA**” means National Association of Testing Authorities, Australia.

“**natural flow**” means the flow of water through waters caused by nature.

“**non polluting**” means having no adverse impacts upon the receiving environment.

“**noxious**” means harmful or injurious to health or physical well being.

“**offensive**” means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

“**operational plan**” includes:

- a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA allowance);
- b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

“**PAF waste rock**” means potentially acid forming waste rock with either a Net Acid Producing Potential of greater than 5 kg of H₂SO₄/tonne or a Net Acid Generation oxidation pH of less than 4.5 (pH unit).

“**peak particle velocity (ppv)**” means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mm/s).

“**performance**” as it relates to site water balance, means the effectiveness of the water balance model to react to certain rainfall conditions.

“**process water**” means water used or produced during the mineral development activities.

“**progressive rehabilitation**” means rehabilitation (defined below) undertaken progressively or a staged approach to rehabilitation as mining operations are ongoing.

“**protected area**” means – a protected area under the *Nature Conservation Act 1992*; or

- a) a marine park under the *Marine Parks Act 1992*; or
- b) a World Heritage Area.

“**receiving environment**” means all groundwater, surface water, land, and sediments that are not disturbed areas authorised by this environmental authority.

“**receiving waters**” means all groundwater and surface water that are not disturbed areas authorised by this environmental authority.

“**reference site**” (or analogue site) may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

“**Register of Regulated Structures**” includes:

- a) Date of entry in the register;
- b) Name of the structure, its purpose and intended/actual contents;
- c) The consequence category of the dam as assessed using the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933);
- d) Dates, names, and reference for the design plan plus dates, names, and reference numbers of all document(s) lodged as part of a design plan for the dam;
- e) Name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings;
- f) For the regulated dam, other than in relation to any levees –
 - (i) The dimensions (metres) and surface area (hectares) of the dam measured at the footprint of the dam;
 - (ii) Coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of the dam including its storage area
 - (iii) Dam crest volume (megalitres);
 - (iv) Spillway crest level (metres AHD).
 - (v) Maximum operating level (metres AHD);
 - (vi) Storage rating table of stored volume versus level (metres AHD);
 - (vii) Design storage allowance (megalitres) and associated level of the dam (metres AHD);
 - (viii) Mandatory reporting level (metres AHD);
- g) The design plan title and reference relevant to the dam;
- h) The date construction was certified as compliant with the design plan;
- i) The name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan;
- j) Details of the composition and construction of any liner;
- k) The system for the detection of any leakage through the floor and sides of the dam;
- l) Dates when the regulated dam underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November of any year;
- m) Dates when recommendations and actions arising from the annual inspection were provided to the administering authority;
- n) Dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.

“**regulated structure**” means any structure in the significant or high consequence category as assessed using the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority. A regulated structure does not include:

- a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container;
- a sump or earthen pit used to store residual drilling material and drilling fluid only for the duration of drilling and well completion activities;
- a flare pit.

“**regulated waste**” means non-domestic waste mentioned in schedule 7 of the *Environmental Protection Regulation 1998* (whether or not it has been treated or immobilised), and includes:

- a) for an element – any chemical compound containing the element; and
- b) anything that has contained the waste.

“**rehabilitation**” the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

“**release event**” means a surface water discharge from water storages or contaminated areas on the licensed place.

“**representative**” means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activity.

“residual drilling material” means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.

“RL” means reduced level, relative to mean sea level as distinct from depths to water.

“saline mine drainage” The movement of waters, contaminated with salt(s), as a result of the mining activity.

“self sustaining” means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

“sensitive place” means;

- a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- b) a motel, hotel or hostel; or
- c) an educational institution; or
- d) a medical centre or hospital; or
- e) a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
- f) a public park or gardens.

“significant disturbance” – includes land;

- a) if it is contaminated land; or
- b) it has been disturbed and human intervention is needed to rehabilitate it;
 - (i) to a state required under the relevant environmental authority; or
 - (ii) if the environmental authority does not require the land to be rehabilitated to a particular state – to its state immediately before the disturbance.

Some examples of disturbed land include:

- a) areas where soil has been compacted, removed, covered, exposed or stockpiled;
- b) areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation and topsoil)
- c) areas where land use suitability or capability has been diminished;
- d) areas within a watercourse, waterway, wetland or lake where the mining activity occur;
- e) areas submerged by tailings or hazardous contaminant storage and dam/structure walls in all cases;
- f) areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after the mining activity have ceased; or
- g) areas where land has been contaminated and a suitability statement has not been issued.

However, the following areas are not included:

- a) areas off lease (e.g. roads or tracks which provide access to the mining lease);
- b) areas previously significantly disturbed which have achieved the rehabilitation outcomes;
- c) by agreement with the administering authority, areas previously significantly disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions);
- d) areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be left by agreement with the landowner. The agreement to leave permanent infrastructure must be recorded in the Landowner Agreement and lodged with the administering authority;
- e) disturbances that pre-existed the grant of the tenure unless those areas are disturbed during the term of the tenure.

“subsoil”, or substrata, is the layer of under the topsoil on the surface of the ground. The subsoil may include substances such as sand, silt and/or clay that has only been partially broken down by air, sunlight, water and wind, to produce true soil.

“spillway” means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the dam, normally under flood conditions or in anticipation of flood conditions.

“spotter/catcher” means a registered spotter catcher operating under a current Rehabilitation Permit as prescribed by the Qld. Nature Conservation Act 1992.

“structure” means dam or levee.

“suitably qualified and experienced person” in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:

- a) for regulated dam/structures, an RPEQ who is a civil engineer with the required
 - (i) qualifications in dam safety and dam design.
- b) for regulated levees, an RPEQ who is a civil engineer with the required
 - (i) qualifications in the design of flood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.

“system design plan” means a plan that manages an integrated containment system that shares the required DSA volume across the integrated containment system.

“TBA” means to be advised.

“trivial harm” means environmental harm which is not material or serious environmental harm and will not cause actual or potential loss or damage to property of an amount of, or amounts totalling more than \$5,000.

“µS/cm” means micro siemens per centimetre.

“void” means any constructed, open excavation in the ground.

“waste water” means used water from the mining activity, process water or contaminated storm water.

“watercourse” has the meaning in Schedule 4 of the Environmental Protection Act 1994 and means:

- 1) a river, creek or stream in which water flows permanently or intermittently—
 - (a) in a natural channel, whether artificially improved or not; or
 - (b) in an artificial channel that has changed the course of the watercourse.
- 2) Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

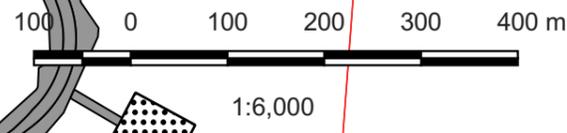
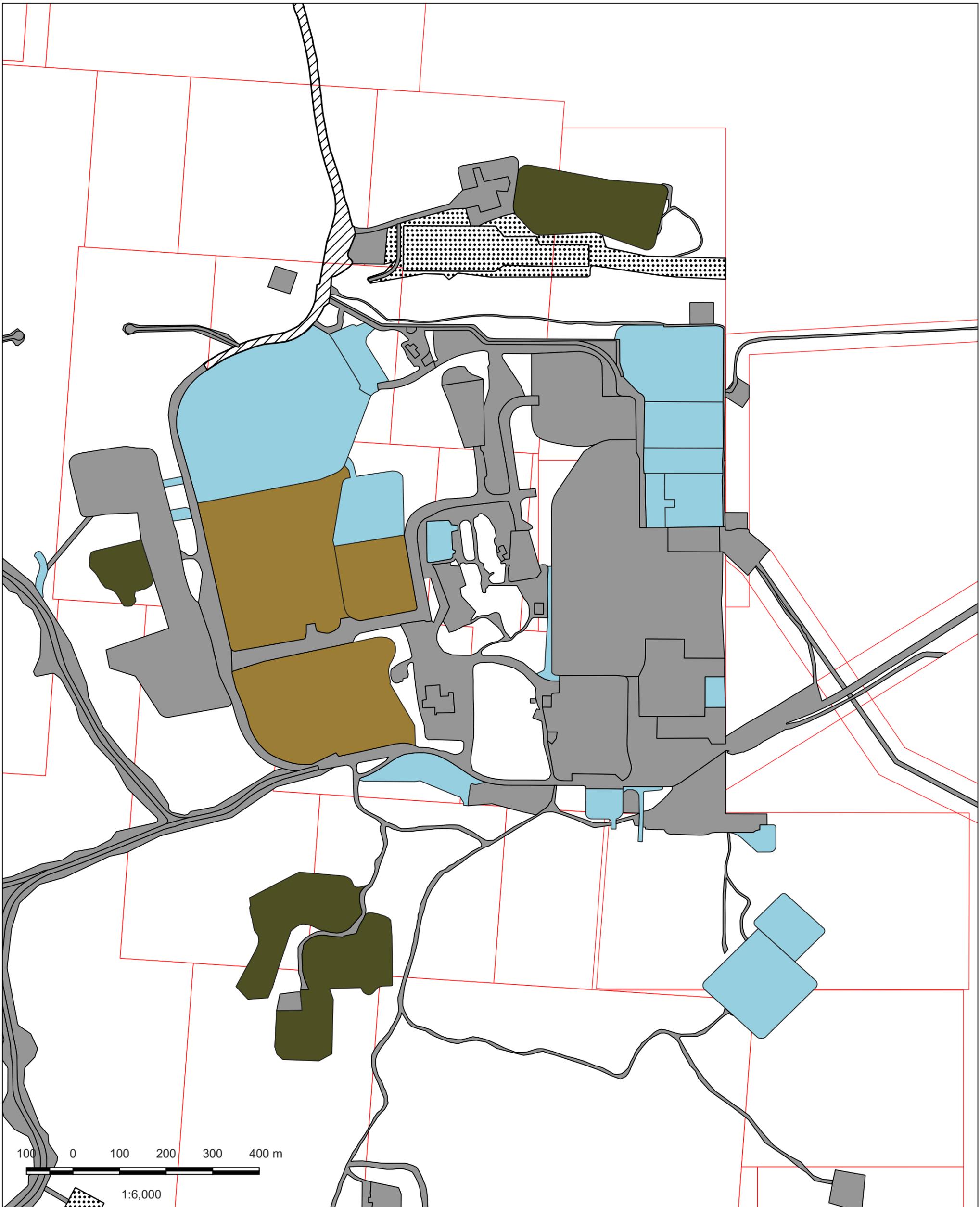
“water quality” means the chemical, physical and biological condition of water.

“waters” includes all or any part of a river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water in natural or artificial watercourses, bed and banks of a watercourse, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater.

“wet season” means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

END OF DEFINITIONS FOR SCHEDULE J

APPENDIX B: Revised Figures for Schedule K – Maps/Plans



Client: Dugald River Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

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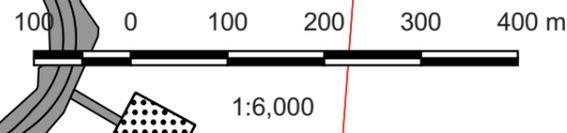
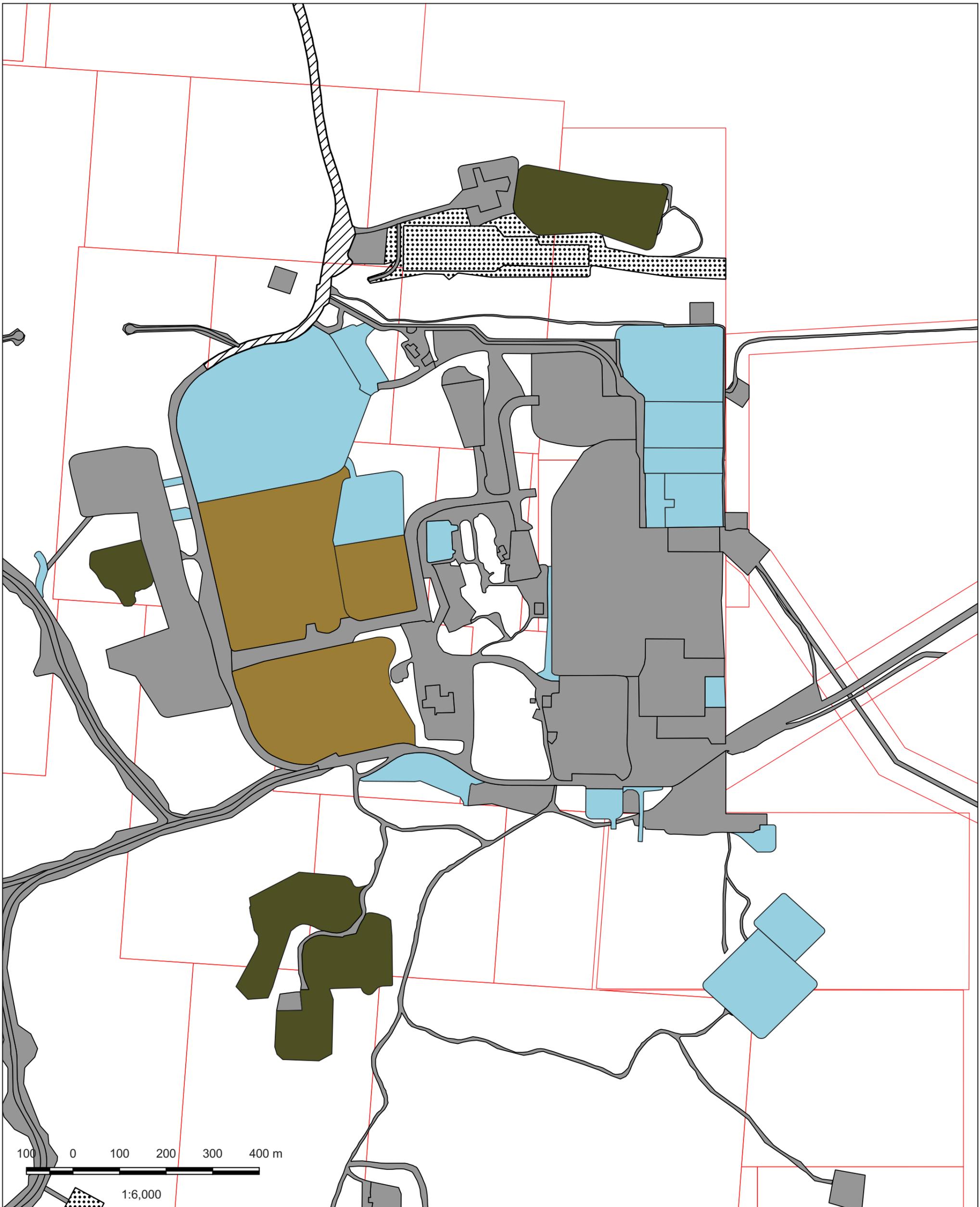
Schedule K - Figure 1a (Project Infrastructure Layout – Mine Infrastructure Area)

Legend

- Mine Lease
- Disturbance Domain
- Accommodation Village
- Borrow Pit/Stockpile
- Water Storage
- Waste
- Mine Infrastructure Area
- Renewable Energy Infrastructure

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Client: Dugald River Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

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Schedule K - Figure 1a (Project Infrastructure Layout – Mine Infrastructure Area)

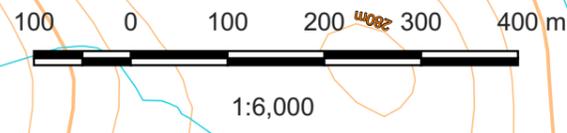
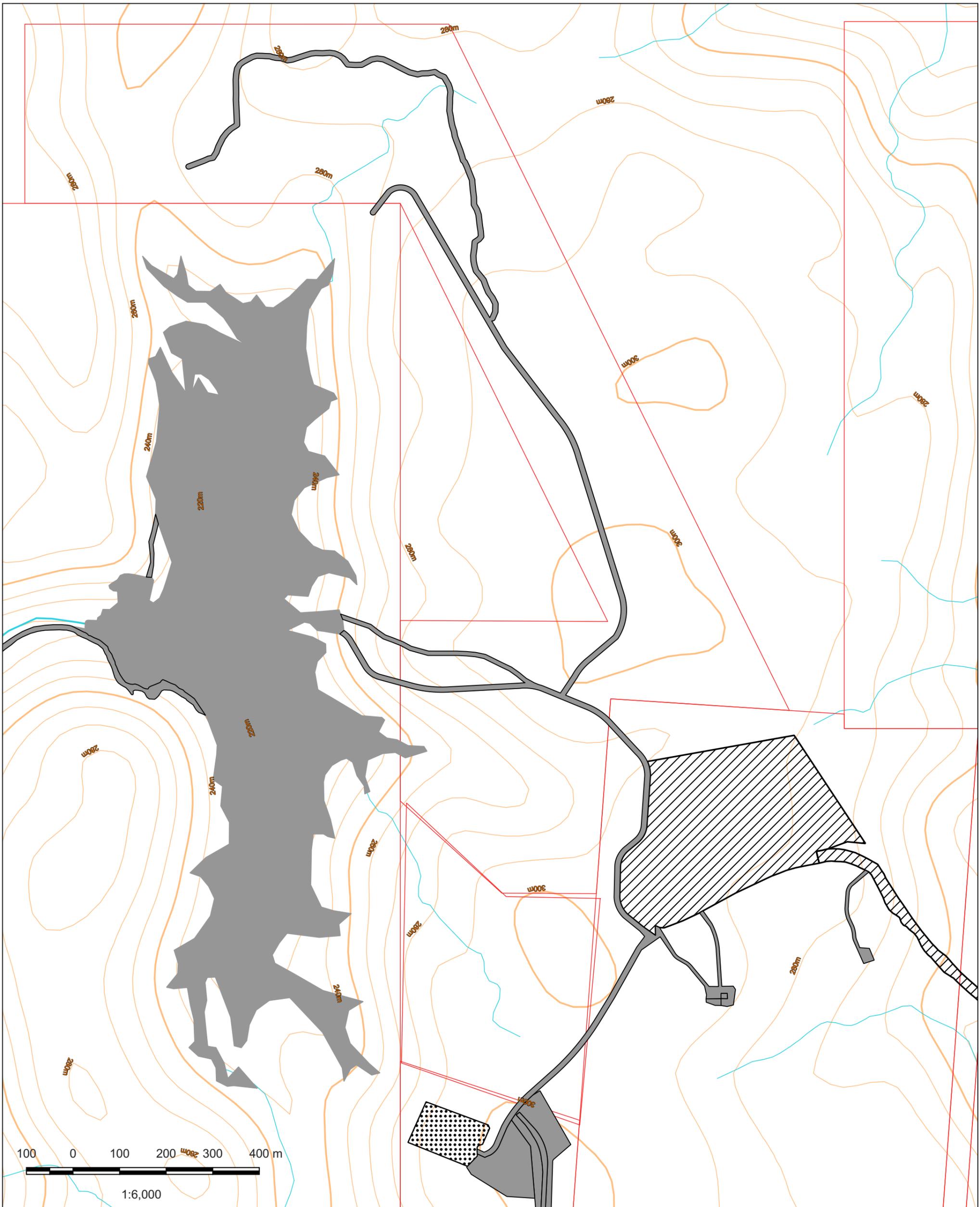
Legend

- Mine Lease
- Disturbance Domain
- Accommodation Village
- Borrow Pit/Stockpile
- Water Storage
- Waste
- Mine Infrastructure Area
- Renewable Energy Infrastructure



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 Project number: 2023.07002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

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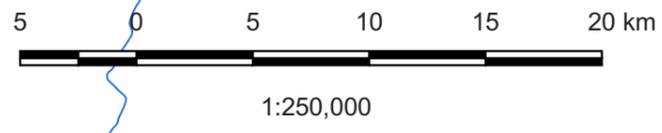
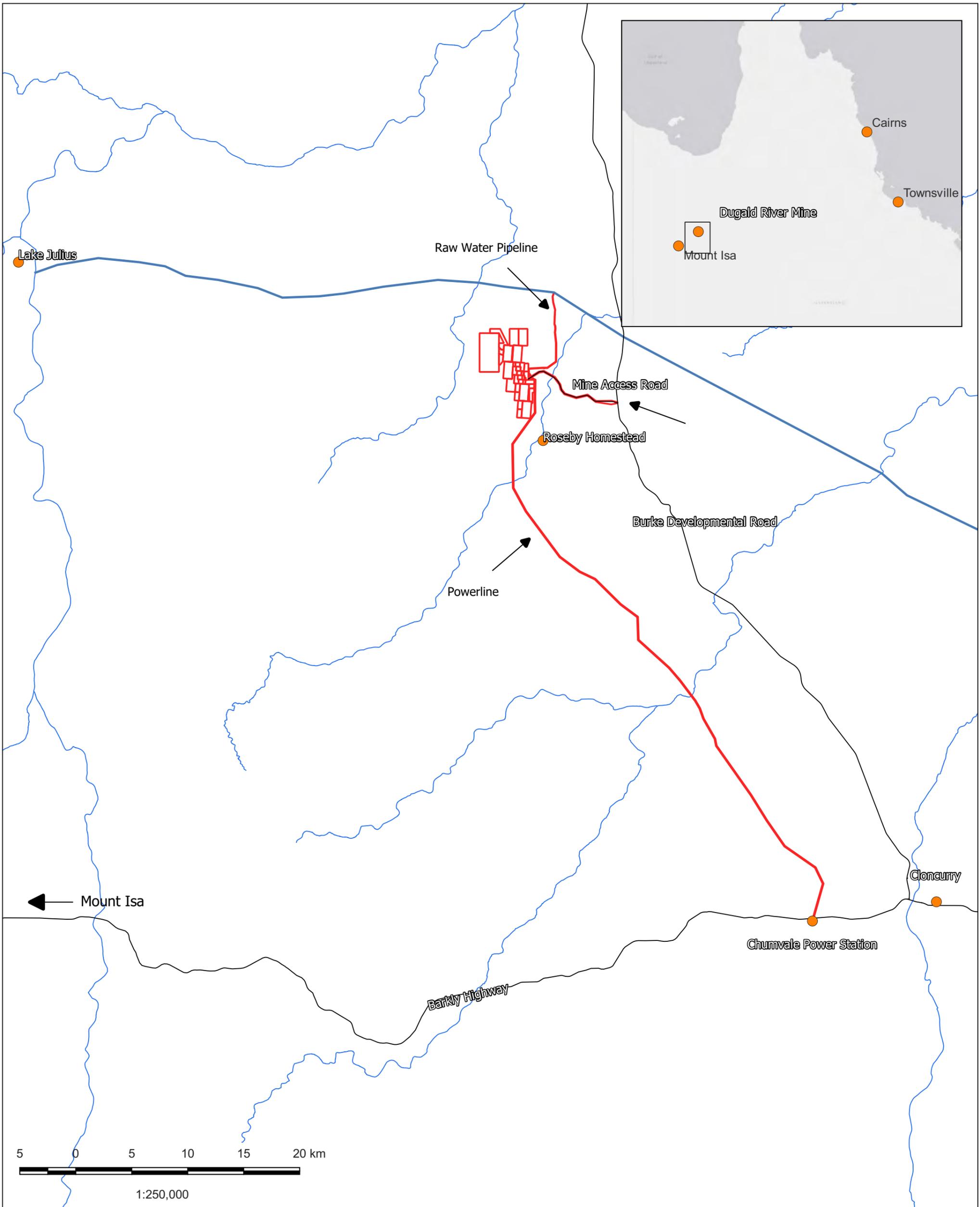
Schedule K - Figure 1b (Project Infrastructure Layout – TSF and Accommodation Village)

Legend

- Mine Lease
- Disturbance Domain
- Accommodation Village
- Mine Infrastructure Area
- Renewable Energy Infrastructure
- TSF Footprint
- Watercourse - Stream Order**
- 1
- 2
- 10m Contour

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Client: Dugald River Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

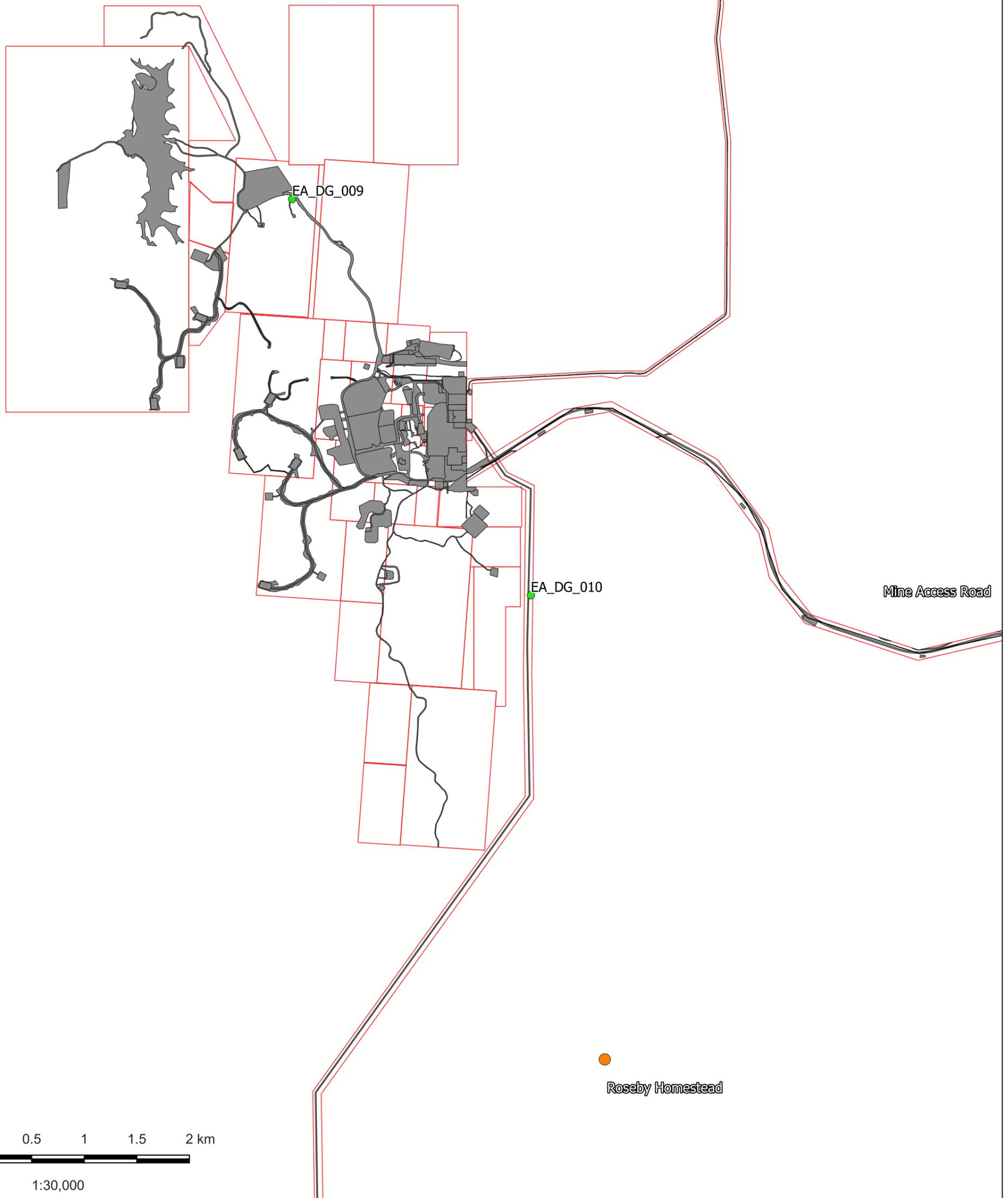
Schedule K – Figure 1c (Project Infrastructure Layout – Support Infrastructure)

- Legend**
- ▭ Mine Tenement
 - State Roads
 - Major River
 - Lake Julius Pipeline
 - Key Features

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Client: Dugald River Pty Ltd
 Project number: 2022.01016
 CRS: GDA2020 EPSG: 7844
 Date: 187 September 2022

Schedule K – Figure 2 (Air Quality Monitoring Program Monitoring Locations)

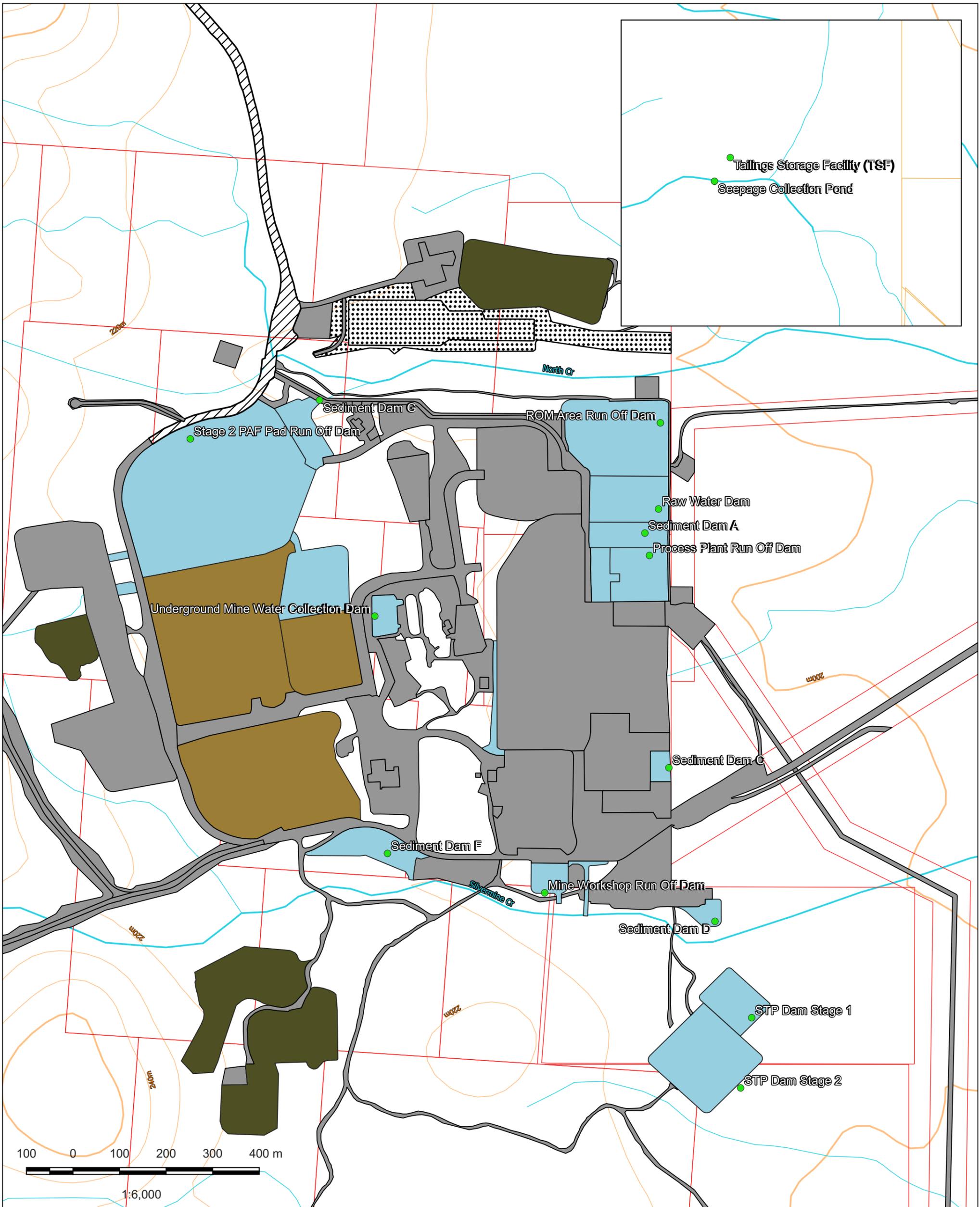
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Legend

- Mine Lease
- Sensitive Receptor
- State Roads
- Dust Monitoring





Client: Dugald River Pty Ltd
 Project number: 2022.01016
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

Schedule K – Figure 3 (Release Points and Water Storage Monitoring Locations)

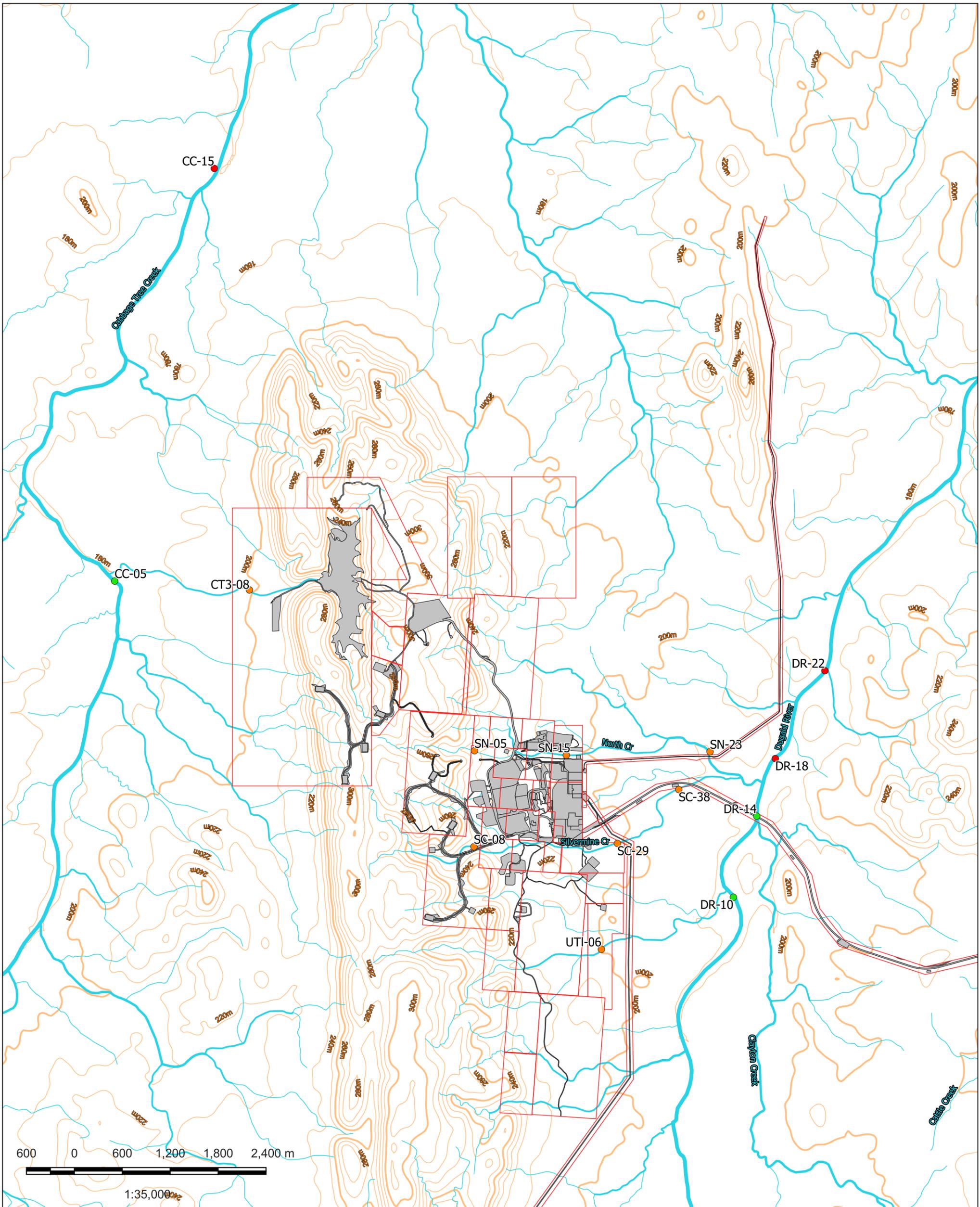
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Legend

- | | | |
|-----------------------|---------------------------------|---------------------|
| Mine Lease | Borrow Pit/Stockpile | Watercourse |
| 10m Contour | Water Storage | Stream Order |
| Release Points | Waste | 1 |
| Disturbance Domain | Mine Infrastructure Area | 2 |
| Accommodation Village | Renewable Energy Infrastructure | |





Client: Dugald River Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

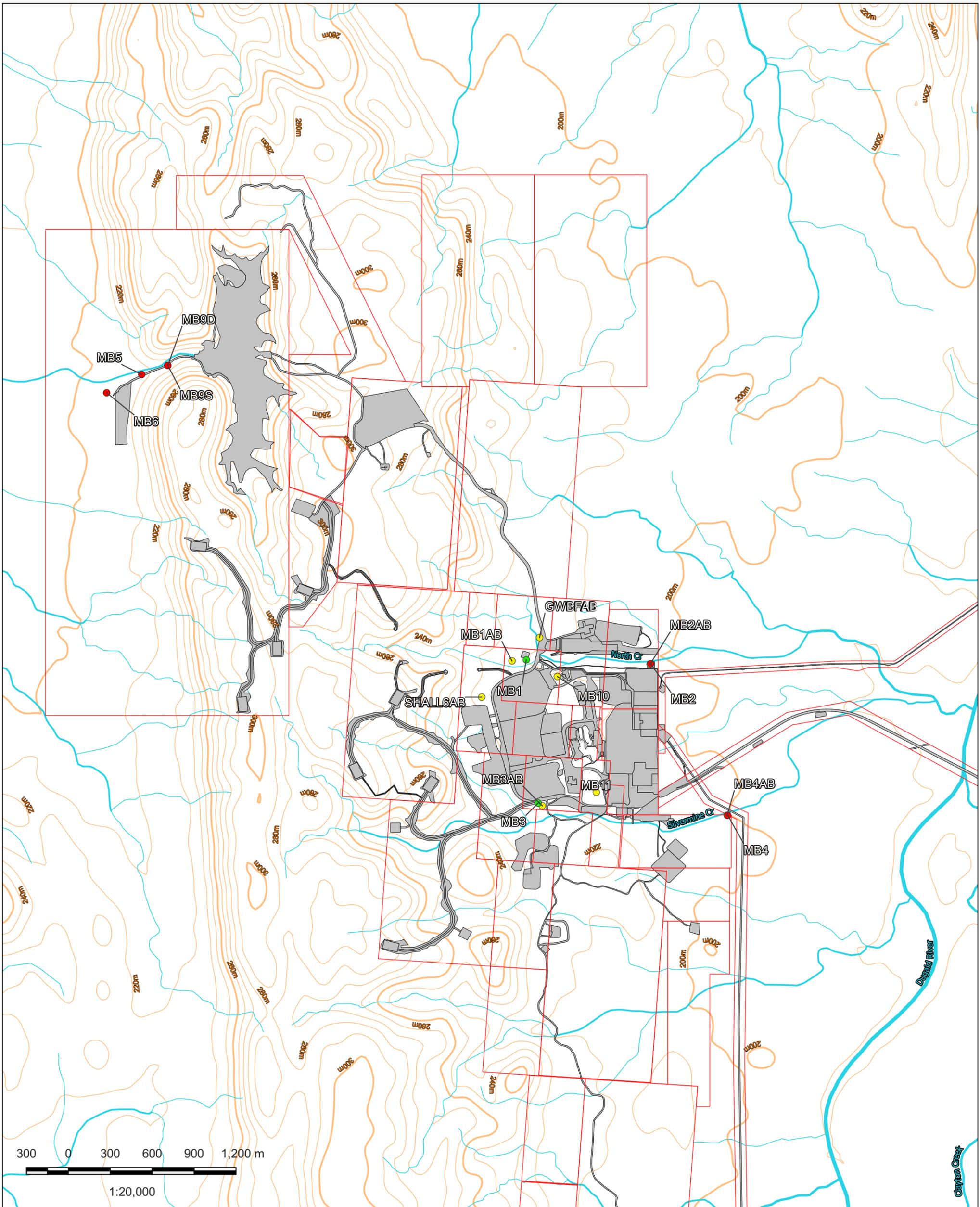
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Schedule K – Figure 4 (Stream Flow Gauge, Receiving Waters and Stream Sediment Monitoring Locations)

Mine Lease	Watercourse	5
10m Contour	Stream Order	Surface Water Monitoring
Disturbance Footprint	1	Downstream
	2	Interpretive
	3	Reference

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Client: Dugald River Pty Ltd
 Project number: 2023.03002
 CRS: GDA2020 EPSG: 7844
 Date: 28 July 2023

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Schedule K – Figure 5 (Groundwater Bore Monitoring Locations)

- | | | |
|-----------------------|-------------------------------|--------------|
| Mine Lease | 2 | Compliance |
| 10m Contour | 3 | Interpretive |
| Disturbance Footprint | 5 | depth |
| Watercourse | Groundwater Monitoring | |
| Stream Order 1 | Background | |

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APPENDIX C: PAF 2 Run Off Dam Consequence Category Assessment (ATC Williams, 2023)

REPORT

MMG DUGALD RIVER
ABN: 19 083 405 556

Dugald River Mine
PAF Stage 2 Dam
Consequence Category Assessment

108003.63.R01_Rev0
JULY 2023





Document Control

Project Name: Dugald River Mine
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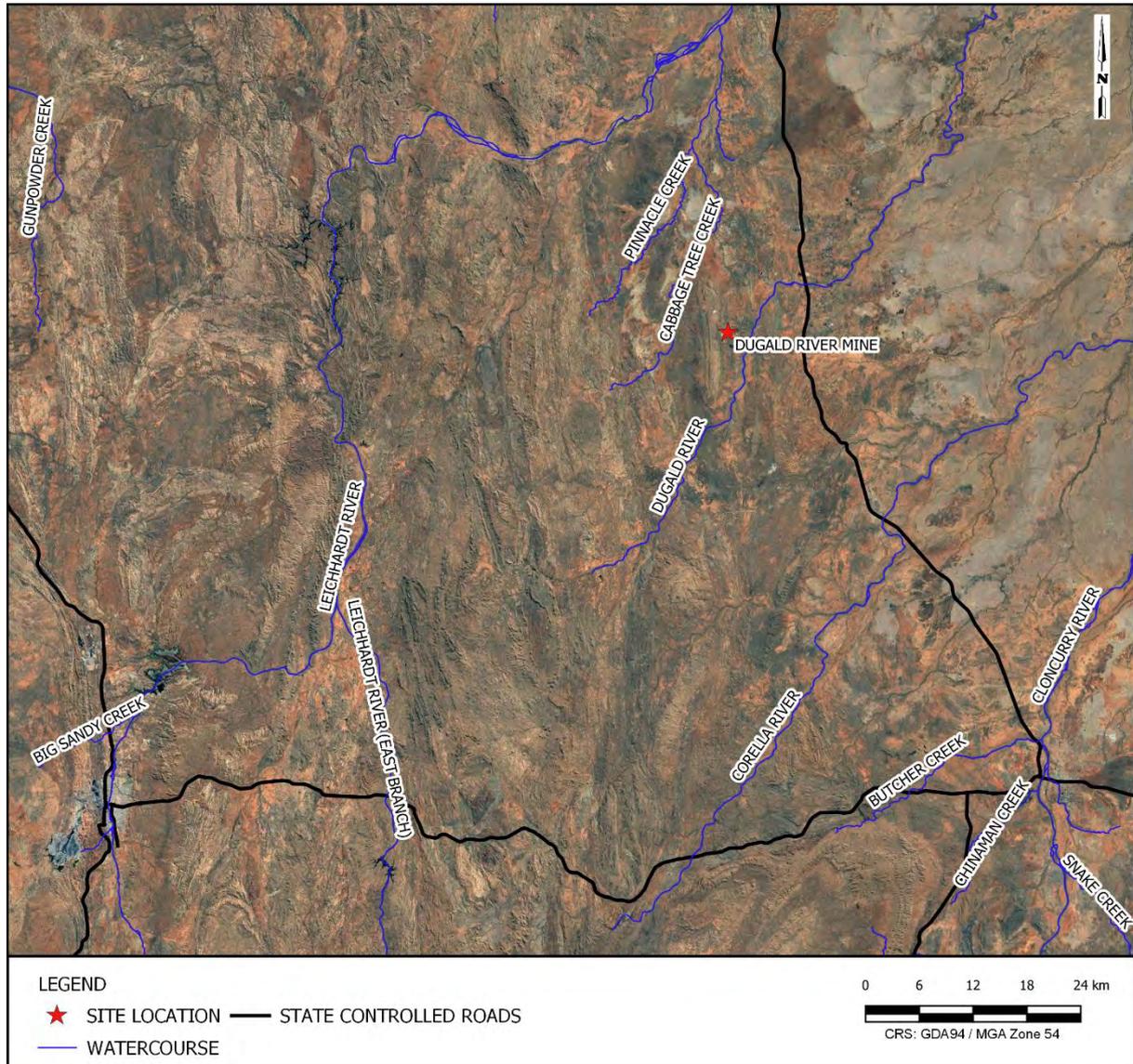


1 INTRODUCTION

1.1 Location

MMG Australia Pty Ltd (MMG) owns and operates the Dugald River Mine (DRM) in northwest Queensland. The DRM is located approximately 65 km northwest of Cloncurry and is accessed from the Burke Developmental Road. The location of DRM is shown on **DIAGRAM 1**.

DIAGRAM 1: SITE LOCATION



1.2 Setting and Stage 2 PAF Dam Background

The mine water storage infrastructure at the Dugald River Mine processing area comprises the following:

- PAF Stage 2 Dam
- PAF Stage 1 Dam
- Sediment Dam G (SDG)



- ROM Area Runoff Dam (RARD)
- Raw Water Dam (RWD)
- Processing Plant Containment Dam (PPCD)
- Processing Plant Runoff Dam (PPRD)
- Sediment Dams A, C, D and F (SDA, SDC, SDD, SDF)
- Mine Workshop Runoff Dam (MWRD)
- STP Dam 1 and 2 (STPD1 & 2)
- Underground Mine Water Collection Dam (UGMWCD)

The processing area layout including the above infrastructure and mining leases are shown on **DIAGRAM 2**. The PAF Stage 2 Dam is located on ML2499, ML2469 and ML2470.

DIAGRAM 2: SITE LAYOUT



Waste rock materials from the underground mining operations are stockpiled on dedicated, non-acid forming (NAF) and potentially acid-forming (PAF) pads.

Runoff from the PAF stockpile pads is directed to and contained within HDPE lined dams (the PAF Stage 1 and Stage 2 Dams). As of mid-2014, the Stage 1 PAF Pad Runoff Dam is no longer a Regulated



Structure but has been constructed to the same standard as if it were a Regulated Structure. The Stage 2 PAF Pad Runoff Dam (PAF2 Dam) is the larger of the two and remains a Regulated Structure, as defined in the Dugald River Mine Environmental Authority (EA) EPML00731213 (updated 21 April 2023) [1].

1.3 Scope of Work

The Dugald River Mine process area water dams are regulated under Conditions D1 to D3 of the EA [1], reproduced as follows:

- D1 'The consequence category of any structure must be assessed by a suitably qualified and experience person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structure (ESR/2016/1993)* at the following times:
- (a) prior to the design and construction of the structure, if it is not an existing structure; or
 - (b) prior to any change in its purpose or the nature of its stored contents.
- D2 A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than once structure.
- D3 Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.

The most recent Consequence Category Assessment (CCA) was undertaken by ATC Williams (ATCW) in October 2019 [2]. This CCA [2] assessed the PAF Stage 2 Dam as '**Significant**' consequence on the basis of failure to contain (Dam Break) scenario. This was a result of the water quality of the PAF runoff and seepage collecting in the Runoff Pond being assessed as hazardous.

The purpose of this CCA is to re-assess the consequence category of the PAF Stage 2 Dam and determine if there is a change to the consequence category and any applicable hydraulic performance criteria in accordance with the Manual [3].

1.4 Available Site Data

This CCA was undertaken using the guidelines in the Manual [3]. The following data were available and considered in completing the CCA:

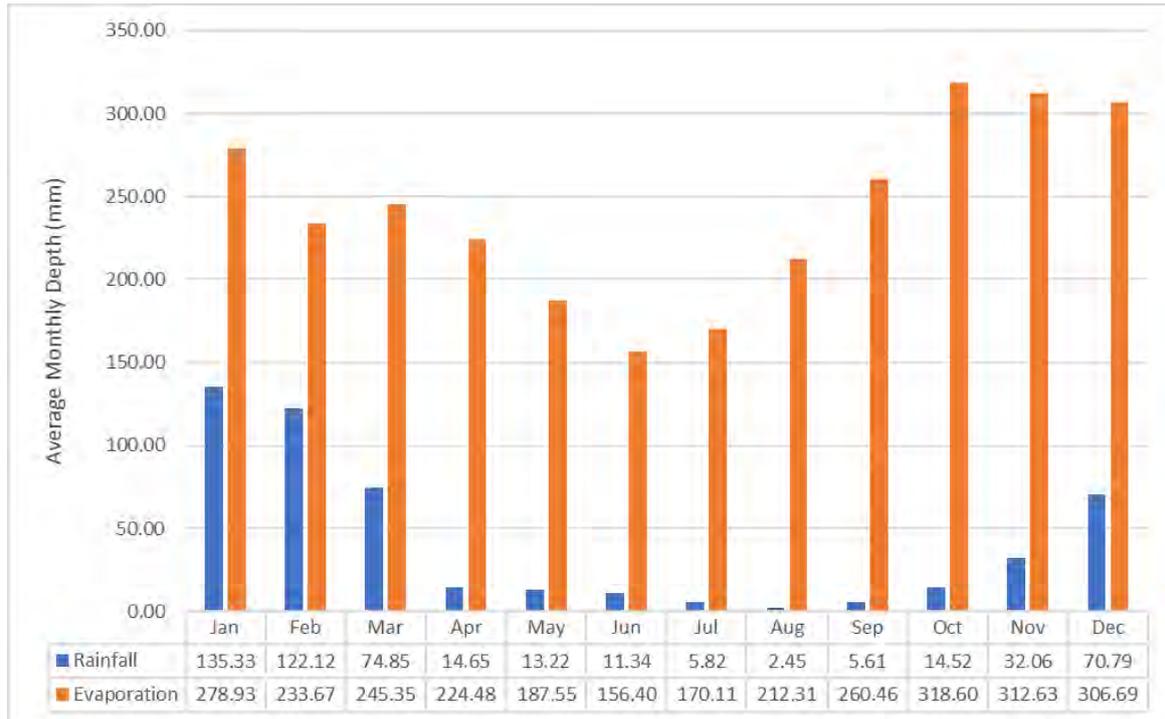
- 'Stage 2 PAF Pad Runoff Dam – Operational Plan', Ref: 108003.40.R01, dated 02 October 2019 ATC Williams [2].
- Queensland Globe Map Resourced, retrieved 15 May 2023 [4].
- SILO Data Drill for Cell -20.23 (latitude), 140.15 (longitude) of evaporation data and patched rainfall for the period of 01/01/1889 to 13/05/2023 [5].
- 'EPBC Act Protected Matters Report', 15 May 2023, Department of Agriculture, Water and the Environment and Energy [6].
- 'Environmental Reports – Matters of State Environmental Significance', 15 May 2023, Department of Environment and Science [7].
- 'Environmental Reports – Biodiversity and Conservation Values – Biodiversity Planning Assessments and Aquatic Conservation Assessments', 15 May 2023, Department of Environment and Science [8].
- 'Environmental Reports – Regional Ecosystems – Biodiversity Status', 15 May 2023, Department of Environment and Science [9].
- 'WetlandMaps', 15 May 2023, Department of Environment and Science [10].
- 'Bore Reports', Business Queensland, accessed 15 May 2023, [11].
- Dugald River Mine Water Quality Sampling, 'Chemistry Table', 13 March 2023 [12].



1.5 Climatic Conditions

The Köppen Climate classification of the region is a hot semi-arid climate (BSh) [14]. Highly variable rainfall occurs in the summer/ wet season, which is typically hot and humid. The data obtained from the SILO Data Drill (The Long Paddock, 2023) [5] indicates that the mean annual rainfall for the region is 508 mm. The highest monthly rainfall occurs mostly in December through to March, as illustrated in **DIAGRAM 3**. The lowest monthly rainfall occurs in the dry winter months of April to October. **DIAGRAM 3** indicates that monthly evaporation rates exceed rainfall year-round at the Dugald River Mine site.

DIAGRAM 3: AVERAGE ANNUAL RAINFALL AND EVAPORATION FOR DUGALD RIVER MINE



1.6 Subsurface Conditions

Investigation of available surface geology data from 'Queensland Globe' determined that the Dugald River mine site is located in an area of 'The Mount Albert Group' (PLa) formation. The formation is composed of sandstone, mudstone, and conglomerate, and it was deposited during the Late Triassic and Early Jurassic periods. The sandstone formations are relatively porous and weak, while the shale formations are relatively impermeable and strong. The limestone formations are considered porous and strong.

1.7 Surface Water Quality and Sampling

Water quality sampling data was provided by MMG for the PAF Stage 2 Dam for the period February 2014 to January 2022. The water quality results are summarised in **Table 1**. Where sampled analytes exceed the EA release limits, these values are highlighted in red.



TABLE 1: PAF STAGE 2 DAM WATER QUALITY SAMPLING

Quality Parameter (Total)	Release Limit	Sampling Date										
		06/02/14	15/08/14	31/08/14	09/11/14	17/01/15	02/01/16	10/04/16	18/07/16	29/03/18	15/04/18	30/01/22
pH (pH units)	5.5 – 9.0	10.24	8.27	9.98	8.02	8.18	6.24	6.65	7.31	7.33	7.69	7.09
EC (µS/cm)	1000	507	2,625	2,656	8,595	723	4,280	6,256	6,993	6,705	7,200	14,512
Sulphate (mg/L)	1000	12	-	910	3,660	347	1,780	3,140	3,690	2,260	2,770	-
Dissolved Metals												
Aluminium (mg/L)	5	1.97	0.15	0.2	0.47	0.12	0.45	<0.01	0.05	0.1	0.04	-
Arsenic (mg/L)	0.5	0.004	0.003	0.003	0.006	<0.01	0.001	<0.001	0.001	0.001	<0.001	-
Cadmium (mg/L)	0.01	<0.0001	<0.0001	0.0007	0.0002	<0.005	0.162	0.175	0.191	0.0231	0.0212	-
Copper (mg/L)	1	0.006	0.006	0.006	0.002	<0.01	<0.001	<0.001	<0.001	0.002	0.001	-
Lead (mg/L)	0.1	0.014	0.003	0.002	0.004	<0.01	0.041	0.007	-	0.029	0.01	-
Manganese (mg/L)	Containment limit based on upstream quality plus 10%	0.145	0.02	0.014	-	0.27	6.98	0.632	0.833	1.99	1.28	-
Nickel (mg/L)	1	0.003	0.002	<0.001	0.008	<0.01	0.068	0.06	0.074	0.013	0.011	-
Zinc (mg/L)	20	0.029	0.01	0.011	0.008	1.23	97.1	65.2	79.3	14.3	10.6	-

* As provided by MMG



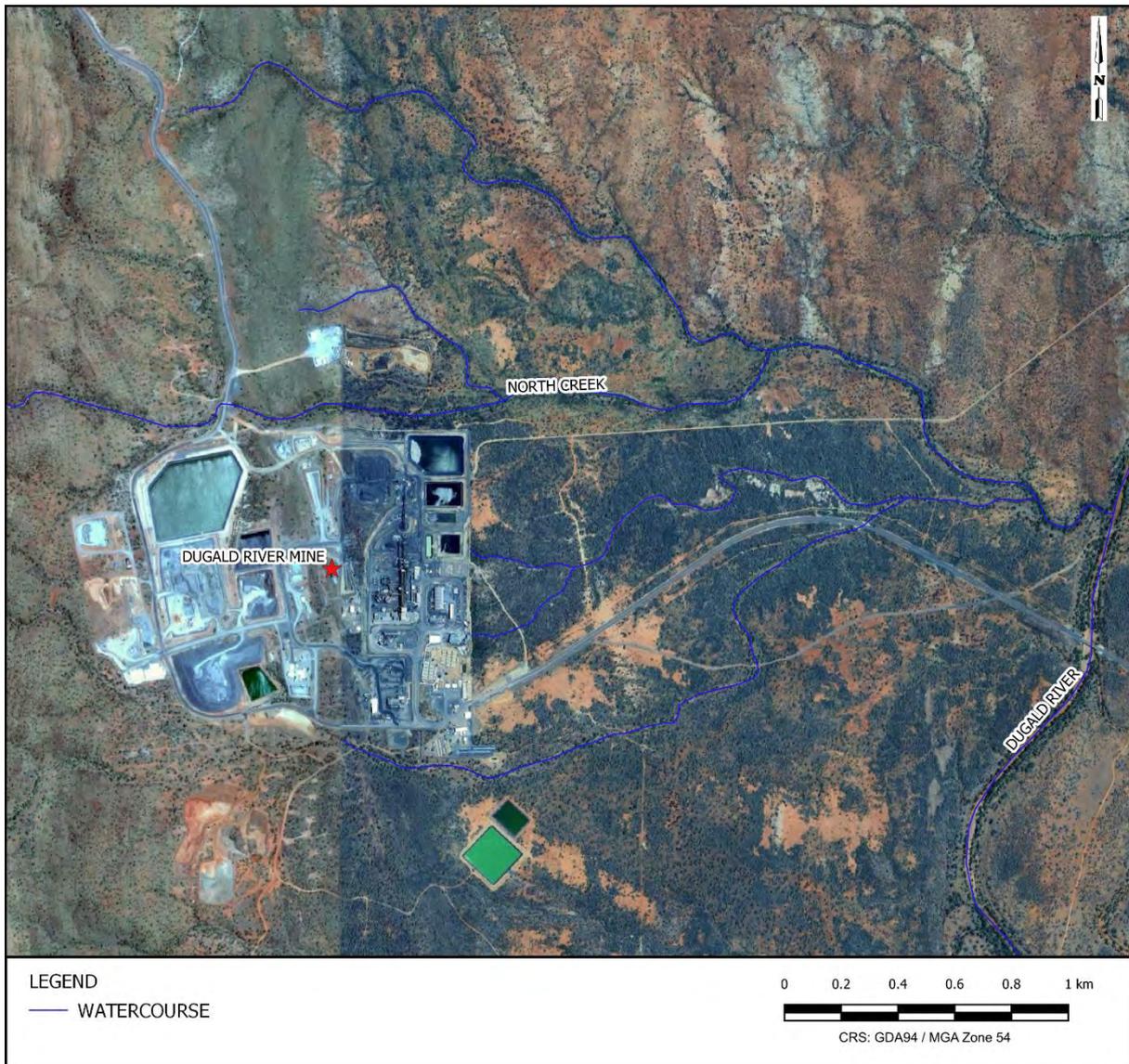
2 SITE DESCRIPTION

2.1 Site Topography and Hydrology

The DRM site is situated on gently sloping plains in central western Queensland, approximately 3 km west of the Dugald River. The Dugald River flows in a northerly direction past the site.

On the north side of the PAF Stage 2 Dam, North Creek conveys flows in an easterly direction to the Dugald River. The location of North Creek and the Dugald River relative to the site are shown on **Diagram 4**.

DIAGRAM 4: LOCAL WATERCOURSES





2.2 Configuration and Details of PAF Stage 2 Dam

2.2.1 PAF Stage 2 Dam

The PAF Stage 2 Dam is deemed to consist of the following components and related infrastructure items:

- PAF Waste Rock Pad constructed integrally with the Runoff Dam;
- Drains and bunds around the perimeter of the PAF Pad, which discharge 'Dirty' water into the Runoff Dam via a concrete inlet spillway;
- Runoff Dam comprising zoned, granular fill perimeter embankments;
- HDPE liner on the internal embankment slope and floor of the Runoff Dam;
- HDPE double-lined basin areas in the low-point of the Runoff Dam;
- Runoff Dam internal toe seepage collection system, comprising drainage pipework, outlet pipe and collection well;
- Runoff Dam emergency spillway; and
- 'Clean' stormwater runoff diversion drains and bunds (surrounding the PAF Stage 2 facility).

The dam itself is a fully HDPE-lined, hexagonal storage formed partially in cut, with perimeter embankments and localised impoundment flood infilling restricted to the eastern sides. The six perimeter walls are each between 100 m and 300 m in length.

The PAF Stage 2 Dam configuration details are summarised in Table 2.

TABLE 2: PAF STAGE 2 CONFIGURATION

Description	Specifications
Type	HDPE lined
Construction Material	Formed in excavation, with rockfill embankments
Dam Crest Level	210.5 m AHD
Spillway Crest (full supply) level	209.25 m AHD
Spillway Base Width	38 m
Minimum spillway Side Slope	3(H) to 1(V)
Storage Capacity to Spillway	205 ML
Storage Area	8.0 Ha



3 GENERAL ENVIRONMENTAL HARM ASSESSMENT

In assessing the consequence category for the failure of a structure in accordance with the Manual [3], the assessment is undertaken against the following 'environmental harms':

- harm to humans;
- general environment harm; and
- general economic loss or property damage.

When considering general environmental harm, the receiving environment for the failure of a structure includes, but is not limited to, ephemeral waterways and rivers. The main receiving environment for a failure of a regulated structure within a 10 km flow path downstream to the south and east includes:

- North Creek, and
- Dugald River.

The Dugald River receives flows from the Corella River approximately 111 km to the northeast of the site.

In accordance with the Manual [3], the Consequence Category Assessment (General Environmental Harm) is concerned with effects to areas with 'Significant Values' and 'Moderate Values' within the receiving environment. 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 [15];
 - Wetland 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**, **Appendix B**, **Appendix C** and **Appendix D**.

3.1 Potential Surface Environment Impacts

The relevant characteristics of North Creek and the Dugald River and the Corella River in the context of environmental values, were assessed from the following sources:

- Matters of National Environmental Significance;
- Matters of State Environmental Significance;
- High Ecological Value Wetlands and Waterways;
- Aquatic Conservation Significance; and
- Registered Private Bores.

The relevant information from each of these data sources are discussed in the following sub-sections.



3.1.1 Matters of National Environmental Significance (MNES)

The Protected Matter Report (PMR) [6] for the project area is provided in **Appendix A**. The report lists the MNES that may occur within ML2499, ML2470 and ML2469, and within a 5 km buffer. It includes locations upstream and downstream of the project area, as well as locations in adjacent catchments.

There are no Commonwealth Lands, Commonwealth Heritage Places, World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, Commonwealth Marine Area or Listed Threatened Ecological Communities listed for the receiving environment in the PMR [6].

The PMR [6] contains 14 Listed Threatened Species and 13 Migratory Species listed for the receiving environment. The critically endangered and endangered animals listed in the PMR [6] report is summarised in **Table 3**.

TABLE 3: MNES LISTED CRITICALLY ENDANGERED AND ENDANGERED ANIMALS

Name	Scientific Name	Status	Presence	Location
Curlew Sandpiper	Calidris Ferruginea	Critically Endangered	Species or species habitat may occur within area (Bird)	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Carpentarian Grasswren	Amytornis dorotheae	Endangered	Species or species habitat know to occur within area	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Red Goshawk	Erythrotriorchis radiatus	Endangered	Species or species habitat know to occur within area	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Gouldian Finch	Erythrura gouldiae	Endangered	Species or species habitat may occur within area (Bird)	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Eastern Curlew, Far Eastern Curlew	Numenius madagascariensis	Critically Endangered	Species or species habitat may occur within area (Bird)	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Night Parrot	Pezoporus occidentalis	Endangered	Species or species habitat likely to occur within area (Bird)	Within ML2499, ML2470, ML2469 and with a 5 km buffer
Australian Painted Snipe	Rostratula australis	Endangered	Species or species habitat may occur within area (Bird)	Within ML2499, ML2470, ML2469 and with a 5 km buffer

3.1.2 Matters of State Environmental Significance (MSES)

There are several areas of MSES [7] within ML2499, ML2470, ML2498 and ML2601:

- Wildlife Habitat (endangered or vulnerable);
- Regulated vegetation (essential habitat) downstream of the PAF Stage 2 Dam; and
- Regulated vegetation (intersecting a watercourse) along North Creek.

This area is shown in the MSES documentation in **Appendix B – Maps 3a and Map 4**.



3.1.3 High Ecological Value Wetlands and Waterways

Assessment of the available data MSES data [7] (**Appendix B**) showed that no High Ecological Value (HEV) wetlands or waterways were identified in the receiving environment within ML2499, ML2470, ML2498 and ML2601.

3.1.4 Aquatic Conservation Significance

North Creek and Dugald River are located in the Northwest Highlands bioregion, the Mount Isa Inlier biogeographic subregion, which falls within the Flinders catchment. North Creek and the Dugald River were assessed against the characteristics for riverine areas, lakes and springs, as per the Queensland Government Maps [10].

Review of the available wetland mapping, MNES [6], MSES [7], Biodiversity and Conservation Values [8] and Regional Ecosystems [9] did not identify any riverine waterbodies in the unnamed tributary of Dugald River or Dugald River.

North Creek or Dugald River were identified as areas of 'High' riverine sub catchment significance as depicted in **Appendix C – Map 5**. 'Medium' riverine values refer to riverine wetlands in deep water habitat in a natural or artificial channel.

3.1.5 Groundwater Supply

The location of the boreholes relative to the site and downstream of PAF Stage 2 Dam are shown on **Diagram 5**.



DIAGRAM 5: BORES ADJACENT TO SITE LOCATION

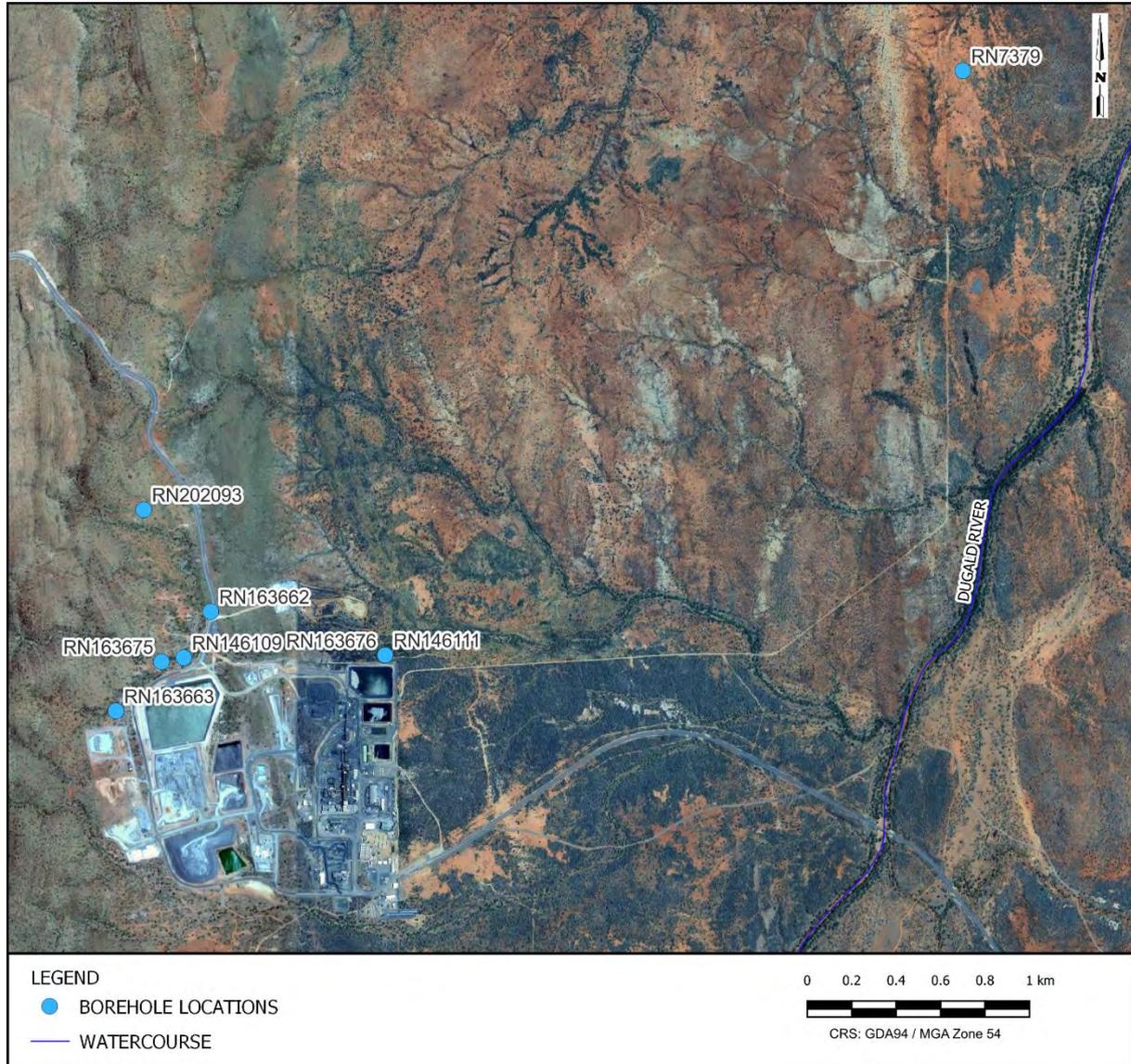


Table 4 provides a summary of the local registered private boreholes adjacent to ML2499, ML2470, ML2498 and ML2601 located downstream of PAF Stage 2 Dam, all of the listed boreholes are no longer in use.

TABLE 4: REGISTERED LOCAL BOREHOLES LOCATED DOWNSTREAM

Local Bore Locations and Details				
Bore*	Coordinates (GDA94, Zone 54)	Location on Site	Date Drilled	Type/Role
RN146109	411301 E 7761214 N	Approx. 140 m downstream of PAF Stage 2 Dam	21/11/2008	Sub Artesian Facility – Water Supply
RN163675	411199 E 7761205 N	Approx 170 m downstream of PAF Stage 2 Dam	01/11/2012	Sub Artesian Facility – Water Supply
RN163662	411395 E 7761383 N	Approx. 320 m downstream of PAF Stage 2 Dam	01/11/2012	Sub Artesian Facility – Water Supply
RN202093	411126 E 7761865 N	Approx. 830 m downstream of PAF Stage 2 Dam	11/12/22	Sub Artesian Facility – Water Supply



Local Bore Locations and Details				
Bore*	Coordinates (GDA94, Zone 54)	Location on Site	Date Drilled	Type/Role
RN163663	410983 E 7760929 N	Located 125 m west of PAF Stage 2 Dam	01/11/2012	Sub Artesian Facility – Water Supply
RN163676	412187 E 7761185 N	Approx. 800 m east of PAF Stage 2 Dam	01/11/2012	Sub Artesian Facility – Water Supply
RN146111	412191 E 7761189 N	Approx. 800 m east of PAF Stage 2 Dam	20/11/2008	Sub Artesian Facility – Water Supply
RN7379	414777 E 7763841 N	Approx 4.5 kms north-east of PAF Stage 2 Dam	1/01/1900	Sub Artesian Facility – Water Supply

*Details provided by Queensland Globe [4] and Business Queensland [11]. Accessed 18 May 2023.

3.2 Simplified Runout Estimate

3.2.1 Release Estimate

The PAF Stage 2 Dam contains mine-impacted waters. Within the ‘Guideline for failure impact assessment of water dams’ [17], **Section 2.2.3** provides for a preliminary assessment of an indicative runout distance of up to 5 km for a storage containing 200 ML. As a conservative measure the PAF Stage 2 Dam will be considered at a full supply level capacity of 205 ML. However, under normal operating conditions, the storage is not operated at full supply. As such, a credible failure scenario has assumed a maximum stored volume of 200 ML. Therefore, a failure of the PAF Stage 2 Dam would have a maximum runout distance of 5 km.

3.2.2 Failure Conditions and Impact Area

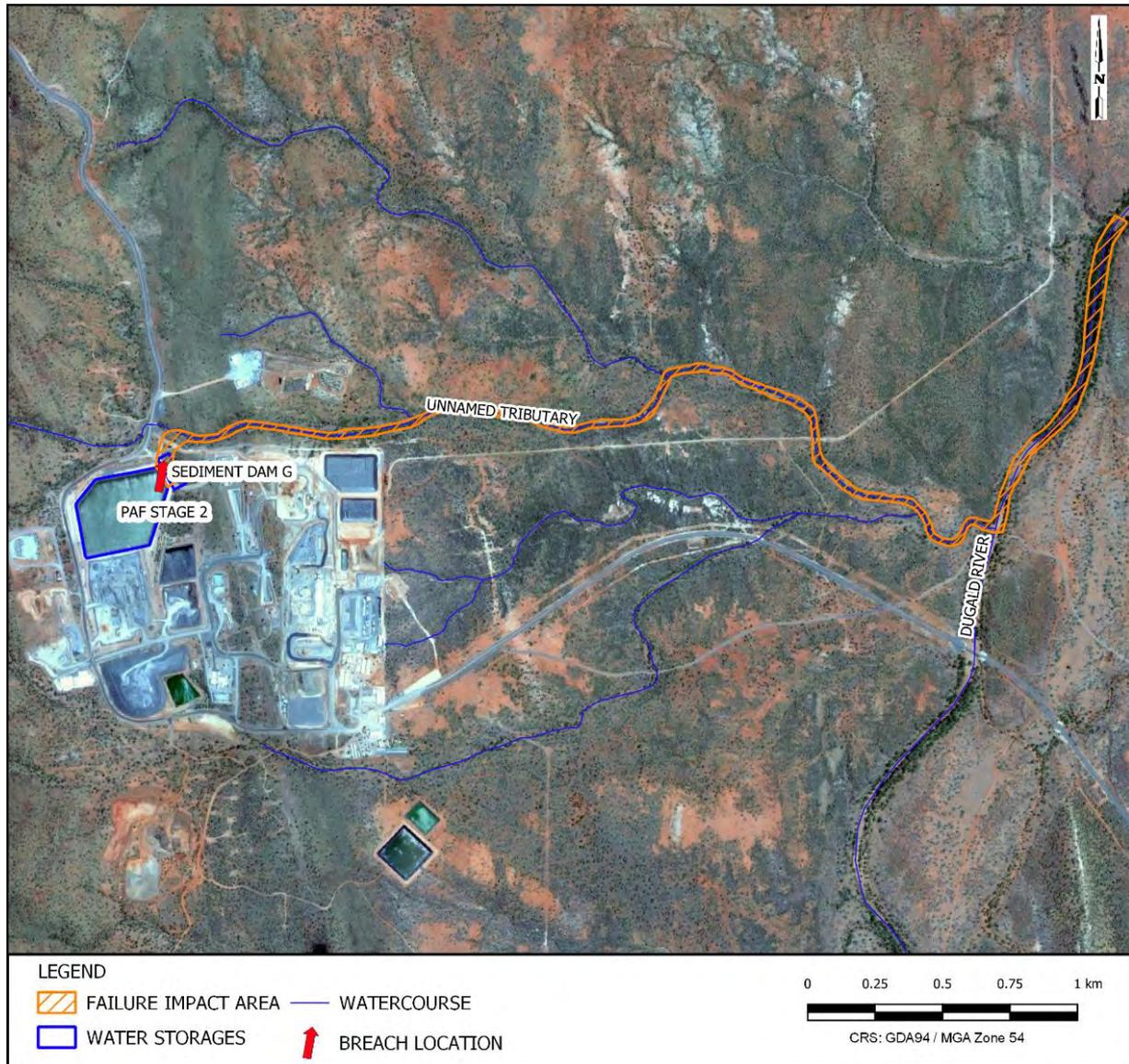
Due to the simplified nature of this runout assessment, the failure assessment assumes ‘Sunny Day Failure’ (SDF) conditions, namely, occurring without coincident rainfall over the site or failure impact area. A ‘Flood Day Failure’ (FDF) occurs in conjunction with coincident rainfall over the site and impact area. As such only the SDF failure has been included as part of this assessment.

Located immediately downstream of PAF Stage 2 Dam is Sediment Dam G. This dam would be impacted from the dam break of PAF Stage 2 Dam. A dam break failure of the PAF Stage 2 Dam into the sediment dam would cause either an overtopping or partial/full collapse of the sediment dam embankment. However, as the assumed breach occurs as part of a SDF, the downstream sediment dam would not contain any impounded water. As such, no additional mine-impacted waters would be released into North Creek; however, sediment release would be expected to occur.

The Dugald River Mine Access Road provides access to the site and is located approximately 400 m upstream of the confluence of North Creek with the Dugald River, as shown on **Diagram 6**.



DIAGRAM 6 – ASSUMED BREACH LOCATION AND FAILURE PATH



The width of the North Creek was measured from detailed site survey for several locations downstream of the PAF Stage 2 Dam. Detailed survey of the Dugald River was not available, and as such, the low flow channel of the Dugald River was estimated based on aerial imagery. An average maximum flow width of 0.1 km was measured for North Creek and 0.13 km for Dugald River.

Based on a maximum runout distance of 5 km across North Creek and the Dugald River the average flow width of 0.08 km and 0.10 km, the downstream impacted area was calculated to be 0.55 km². This was calculated using **Equation 1**.

EQUATION 1: IMPACT AREA ASSESSMENT

$$\text{Unnamed Tributary (3.5 km) x Width (0.1 km) + Dugald River (1.5 km) x Width (0.13 km) = 0.55 km}^2$$

3.2.3 Population at Risk

Population at Risk (PAR) is a key indicator in characterising off property impacts. PAR is defined as people other than site personnel or people engaged in on-site work. The PAR comprises the general public in the failure impact zone. The most likely locations of impact to non-site personnel are the general public travelling on the Burke Developmental Road.



The Burke Developmental Rd is located approximately 9.5 km downstream of the site. In the event of a dam break of the PAF Stage 2 Dam, with a maximum runout distance of 5 km, the Burke Development Road would not be impacted.

The Mine Access Road is located approximately 400 meters upstream of the confluence of North Creek with the Dugald River. As this road only provides access to the site, it has been assumed that the general public would not be routinely present on this road.

Therefore, the PAR has been assessed to be 0.



4 CONSEQUENCE CATEGORY ASSESSMENT

4.1 Basis of the Consequence Category Assessment

The PAF Stage 2 Dam was assessed against the requirements of the Manual [3] for operational site conditions. This involved a desktop review of potential harm associated with failure-to-contain scenarios, and the dam break scenario.

4.2 Consequence Category Assessment Regulatory Requirements

The Manual sets out the requirements of the administering authority for a consequence category assessment and certification of the design of regulated structures, constructed as part of environmentally relevant activities under the Environmental Protection Act (1994) [15].

The purpose of the Manual 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.

Assessment criteria for CCA is 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. This is only relevant to a new structure so has not been included in this CCA review.
- Failure to Contain – Overtopping
Spills or releases from the structure that result from loss of containment due to overtopping.
- 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 that results from loss of containment due to excessive seepage, overtopping and/or other deficiencies in water management aspects of the storage. Although typically non-flood producing, failure to contain events may involve contaminant release, 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. For the purposes of the CCA, a simplified empirical dam break assessment was undertaken for the PAF Stage 2 Dam to the north towards North Creek and the Dugald River, assuming the following:
 - Sunny Day Failure conditions with the PAF Stage 2 Dam full to the spillway level; and
 - Full failure of above ground embankments to natural ground level.

The basis for assessment of Consequence Category from the Manual is reproduced in **Table 5**.



TABLE 5: 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 .	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 .	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.	Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.	Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.
General environmental harm	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 .
	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 include 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.

4.3 Consequence Category Assessment

Assessments against the failure scenarios in the Manual for the PAF Stage 2 Dam for operational site conditions were undertaken. These assessments are contained in **Table 6** respectively.



TABLE 6: CONSEQUENCE CATEGORY ASSESSMENT – PAF STAGE 2 DAM

Environmental Harm	Consequence Category	
	Failure to Contain - Overtopping	Failure to Contain - Dam Break
Harm to Humans	<p>In the event of an overtopping failure, flows would pass south through the unnamed tributary of Dugald River and enter Dugald River.</p> <p>There are no non-site personnel that are routinely present in the failure path. There are no identified bores used for human consumption in the failure impact area.</p> <p>It is considered that in the event of an overtopping failure, flows would be contained to the existing site drainage infrastructure and/or the unnamed tributary of the Dugald River.</p> <p>Overtopping would occur in conjunction with period of prolonged, significant rainfall.</p> <p>Consequence Category is assessed as Low.</p>	<p>In the event of a dam break failure of the PAF Stage 2 Dam, flows would pass north-east through the unnamed tributary of Dugald River and enter Dugald River.</p> <p>The estimated impact area is 0.55 km² with no PAR due to the natural topography making it unlikely the dam break will impact the Burke Developmental Rd. The Mine Access Road crosses the Dugald River, but is located upstream of the confluence North Creek and the Dugald River. As the Mine Access Road is used for site access only, the general public are not expected to be present on it.</p> <p>As such, the PAR was assessed to be 0.</p> <p>Consequence Category is assessed as Low.</p>
General environmental harm	<p>In the event of an overtopping failure, flows would pass east through the unnamed tributary of Dugald River and enter Dugald River.</p> <p>The unnamed tributary of Dugald River and Dugald River contain the following:</p> <ul style="list-style-type: none"> • Wildlife Habitat (endangered or vulnerable) • Regulated vegetation (essential habitat) downstream of the PAF Stage 2 Dam; and • Regulated vegetation (intersecting a watercourse) along the unnamed tributary of Dugald River. <p>In the event of an overtopping failure, water quality parameters are expected to be diluted due to significant, prolonged rainfall in the upstream catchment.</p> <p>Impacts to these areas would be likely; however, would not be expected to reach the thresholds for a 'Significant' or 'High' consequence impact.</p> <p>Consequence Category is assessed as Low</p>	<p>In the event of a dam break failure of the PAF Stage 2 Dam, flows would pass north-east through North Creek and enter Dugald River. There are several areas of MSES which would be impacted by released mine impacted water. The released waters exceed EA criteria for released water for multiple analytes and chemical parameters.</p> <p>In the event of a release, these chemical parameters are expected to impact the following areas of MSES:</p> <ul style="list-style-type: none"> • Wildlife Habitat (endangered or vulnerable) • Regulated vegetation (essential habitat) downstream of the PAF Stage 2 Dam; and • Regulated vegetation (intersecting a watercourse) along North Creek. <p>The impacts to these areas of MSES are not likely to meet the threshold for a 'High' consequence category.</p> <p>The impacts to the areas of MSES are likely to result in the following:</p> <ul style="list-style-type: none"> • remediation of damage is likely to take more than 6 months but less than 3 years; or • significant alteration to existing ecosystems. <p>Consequence Category is assessed as Significant.</p>
General economic loss or property damage	<p>In the event of an overtopping failure of the PAF Stage 2 Dam, there is no third party assets in the failure path that would require rehabilitation, compensation, repair or rectification.</p> <p>An overtopping failure to the north or east would impact site infrastructure only.</p> <p>Consequence Category assessed as Low.</p>	<p>In the event of a dam break failure of the PAF Stage 2 Dam. There are no third party assets in the failure path that would require rehabilitation, compensation, repair or rectification.</p> <p>A dam break failure would only impact site infrastructure.</p> <p>Consequence Category is assessed as Low.</p>
Overall Consequence Category	LOW	SIGNIFICANT



5 CONSEQUENCE CATEGORY ASSESSMENT SUMMARY

Table 7 summarises the CCA outcome for PAF Stage 2 Dam. This assessment is consistent with the outcome of the previous CCA, due to the quality of the water contained in the dam and the risk of impact to the downstream receiving environment.

TABLE 7: CONSEQUENCE CATEGORY ASSESSMENT SUMMARY

Failure Scenario	PAF Stage 2 Dam
Failure to Contain – Seepage	N/A
Failure to Contain – Overtopping	Low
Failure to Contain - Dam Break	Significant
Overall	Significant
Regulated Structure, as defined in the Manual (Y/N)	Y

As the risk for the 'Failure to Contain – Overtopping' scenario is low there is no requirement for the dam to accommodate the Design Storage Allowance (DSA) at the start of the wet season (1 November). Nor does the dam require a Mandatory Reporting Level (MRL).



REFERENCES

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- [5] The Long Paddock (2021), SILO Data Drill for Cell -18.75, 138.60, accessed 18 May 2023 <https://www.longpaddock.qld.gov.au/silo/gridded-data/>, Queensland Government
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- [7] Department of Environment and Science (2021a), 'Environmental Reports - Matters of State Environmental Significance', accessed 18 May 2023, <https://apps.des.qld.gov.au/report-request/environment/>, Queensland Government.
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- [14] Department of Natural Resources, Mines and Energy (DNRME), 'Queensland Globe', accessed 18 May 2023, <https://qldglobe.information.qld.gov.au/help-info/>, Queensland Government.
- [15] Queensland Parliament (2018), Environmental Protection Act 1994, 1 January 2018 Reprint, Queensland Government.
- [16] Queensland Government (2019), 'Traffic census of the Queensland state-declared road network – 2019', Accessed 18 May 2023
- [17] Department of Natural Resources, Mines and Energy (2018), 'Guideline for failure impact assessment of water dams', November 2018, Queensland Government.



CONDITIONS OF REPORT

1. This report must be read in its entirety.
2. This report has been prepared by ATCW for the purposes stated herein and ATCW's experience, having regard to assumptions that can reasonably be expected to make in accordance with sound professional principles. ATCW does not accept responsibility for the consequences of extrapolation, extension or transference of the findings and recommendations of this report to different sites, cases, or conditions.
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APPENDICES



APPENDIX A – EPBC ACT PROTECTED MATTER REPORT



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: 18-May-2023

[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:	14
Listed Migratory Species:	13

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:	18
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:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	3
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			
Amytornis dorotheae Carpentarian Grasswren [558]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	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
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area	In feature area
Sminthopsis douglasi Julia Creek Dunnart [305]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area	In feature area
SHARK			
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	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 Marine Species			
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
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]		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
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In buffer area only
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	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			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within 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]		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 known to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In buffer area only
Glareola maldivarum Oriental Pratincole [840]		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 likely to occur within area	In feature area
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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	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

EPBC Act Referrals				[Resource Information]	
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	
Controlled action					
CopperString Project	2010/5581	Controlled Action	Completed	In feature area	
Not controlled action					
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In buffer area only	
Not controlled action (particular manner)					
Dugald River Zinc and Lead Mine extension, Qld	2015/7573	Not Controlled Action (Particular Manner)	Post-Approval	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 are 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

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

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

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
- 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

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-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.

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**APPENDIX B – ENVIRONMENTAL REPORTS – MATTERS OF STATE
ENVIRONMENTAL SIGNIFICANCE**



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 2601

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 1994). 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 field survey may be required to validate values on the ground.

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

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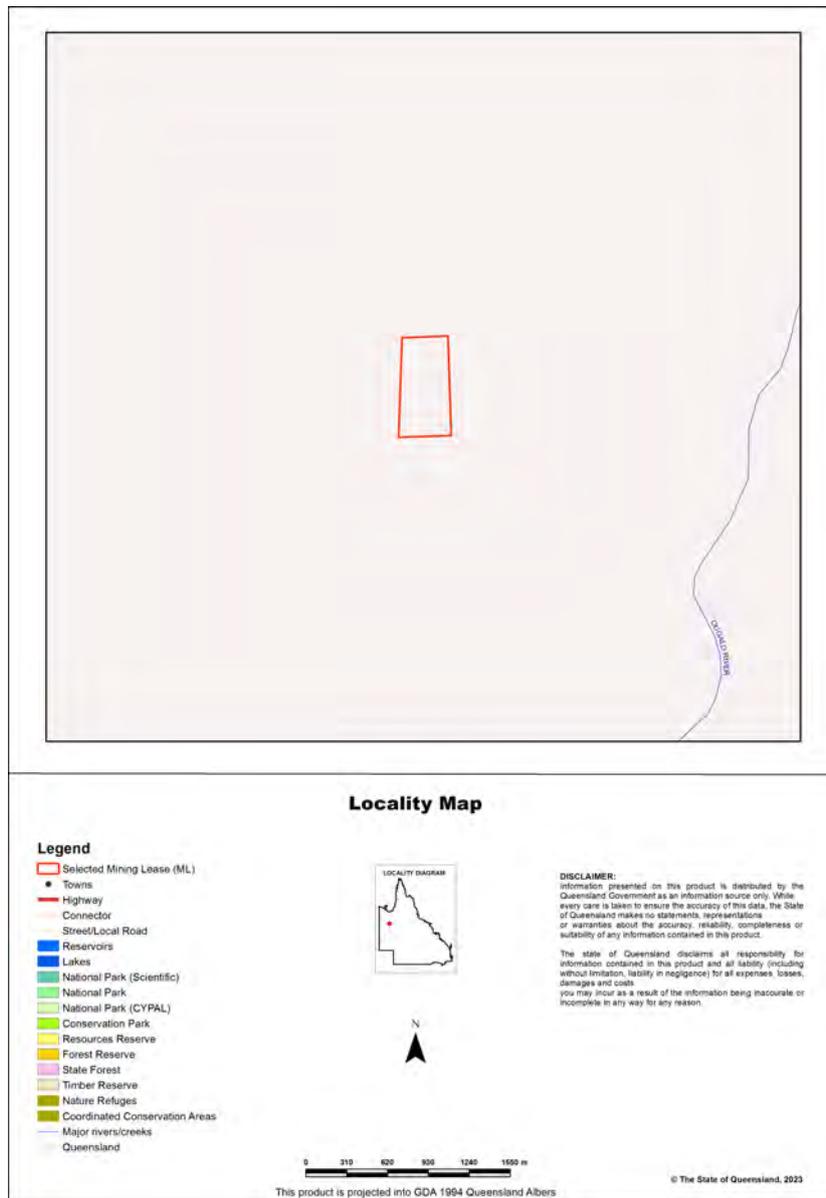
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Assessment Area Details

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 ml: 2601

Size (ha)	28.5
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders



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 planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts 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	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	16.1 ha	56.5%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
7d Sea turtle nesting areas	0.0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	0.43 ha	1.5%
8e Regulated Vegetation - intersecting a watercourse	0.7 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

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

Values are present

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>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarium casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	None
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Macadamia integrifolia</i>		V	None
<i>Macadamia ternifolia</i>		V	None
<i>Macadamia tetraphylla</i>		V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	E	None
<i>Taudactylus pleione</i>	Kroombit tinkerfrog	E	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

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		

Special least concern animal species records

(no results)

Shorebird habitat (critically endangered/angered/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**, **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)

Not applicable

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

Values are present

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

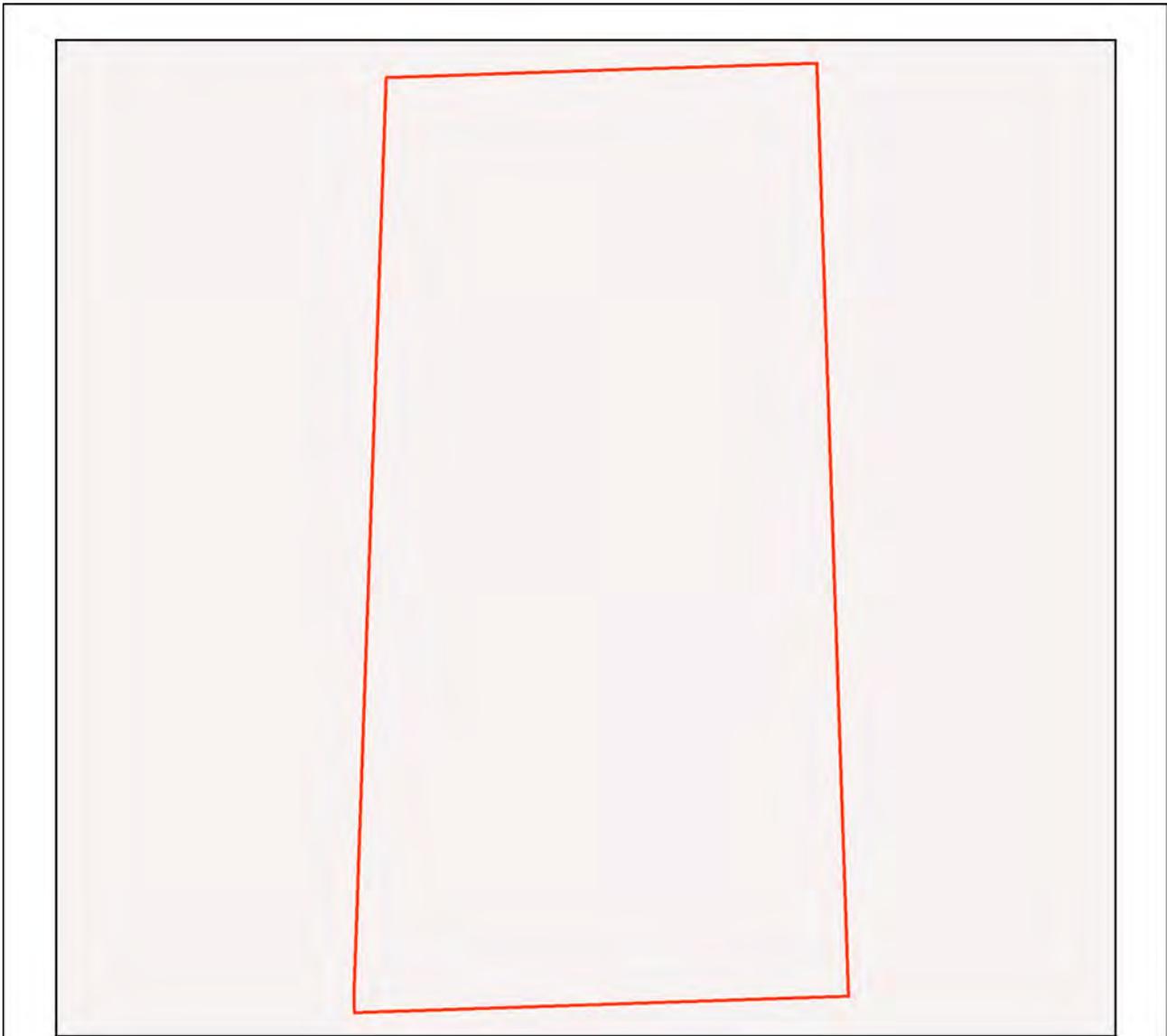
(no results)

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.

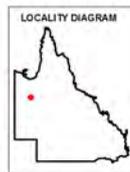
Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

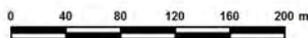
Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Protected area (estates, nature refuges, special wildlife reserves)
-  Declared fish habitat area (A and B areas)
-  Marine park (highly protected)



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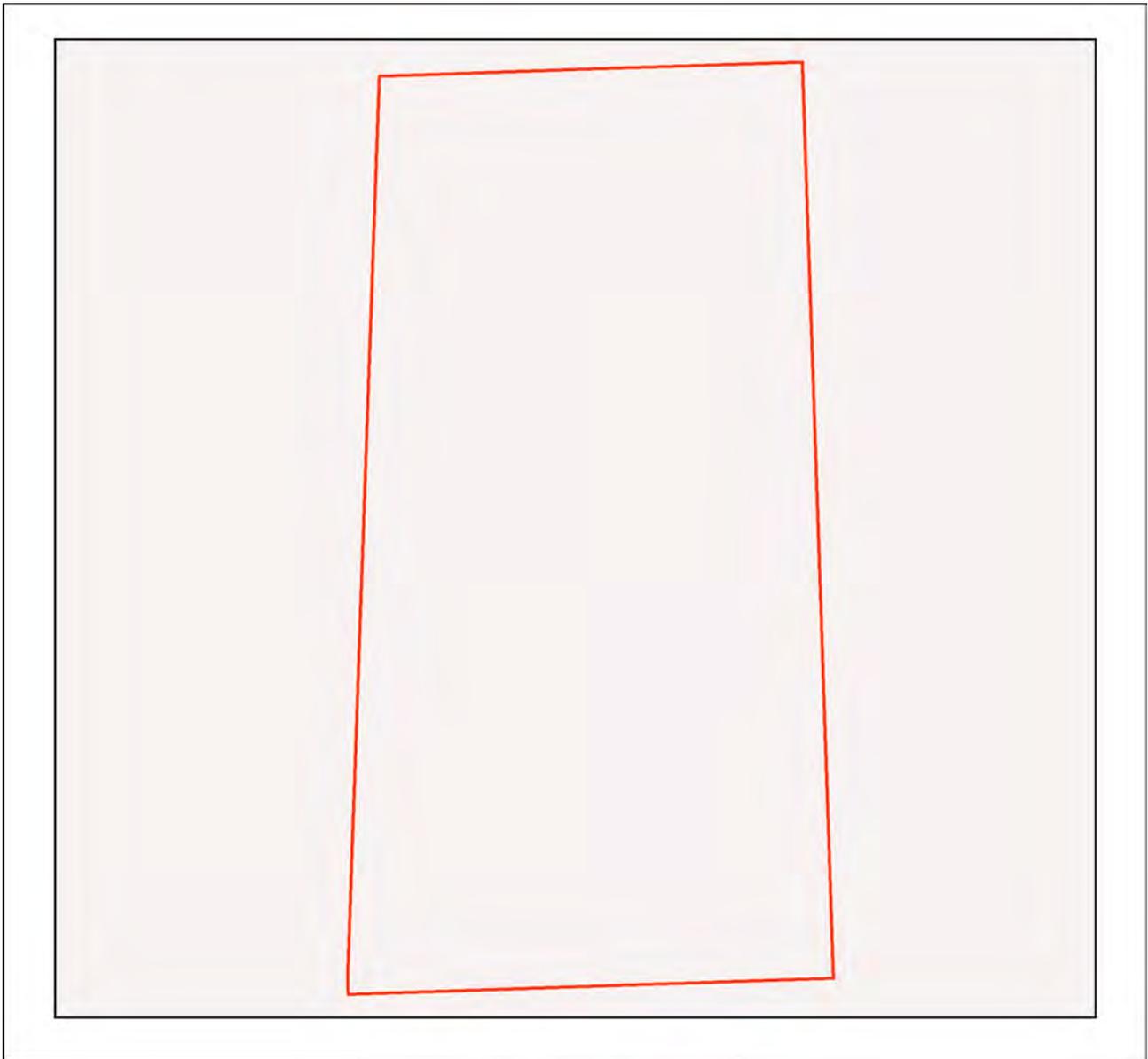
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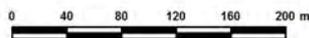
Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Declared high ecological value waters (watercourse)
-  Strategic environmental area (designated precinct)
-  Declared high ecological value waters (wetland)
-  High ecological significance wetlands



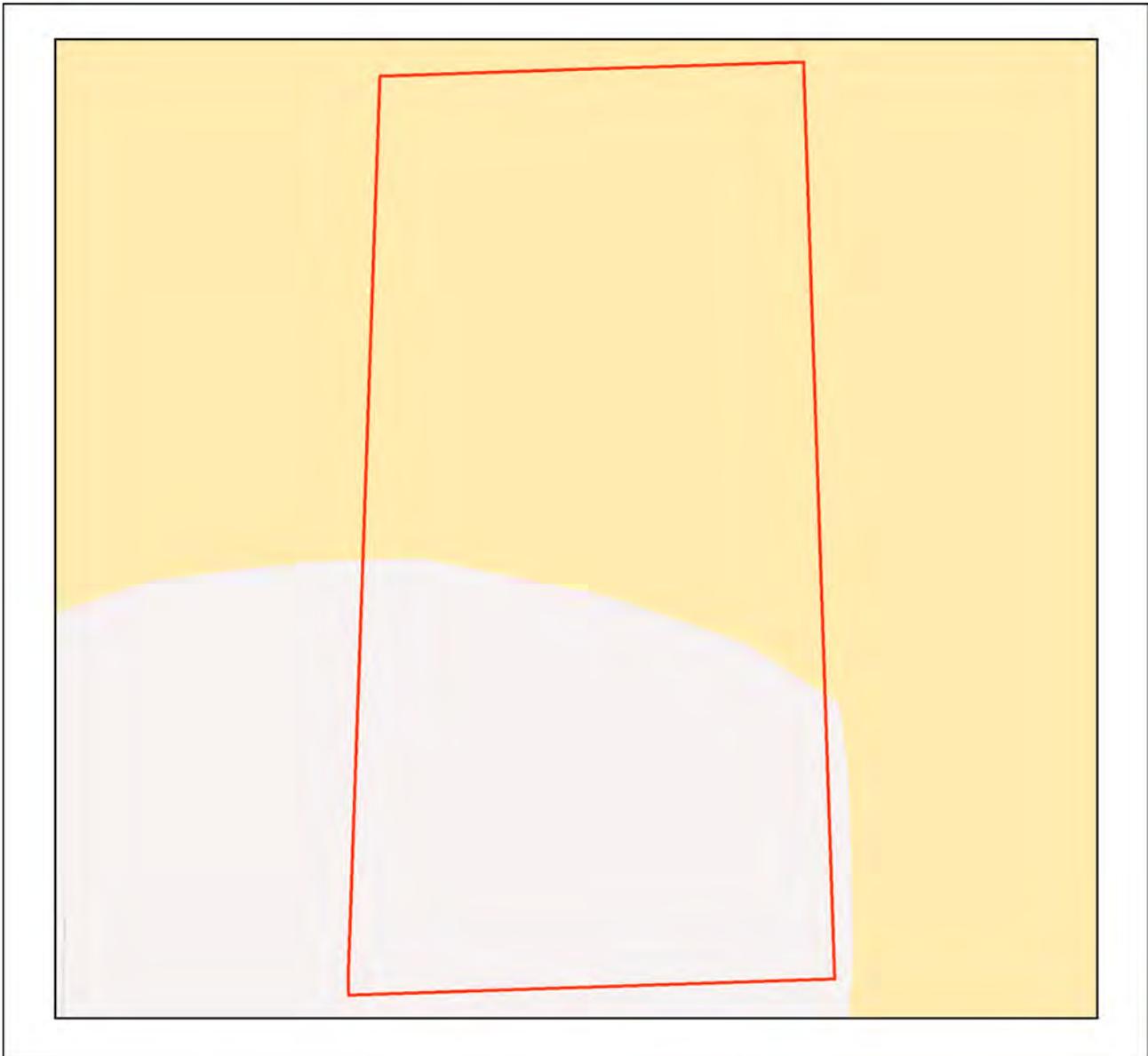
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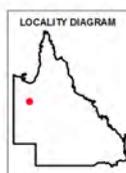
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



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

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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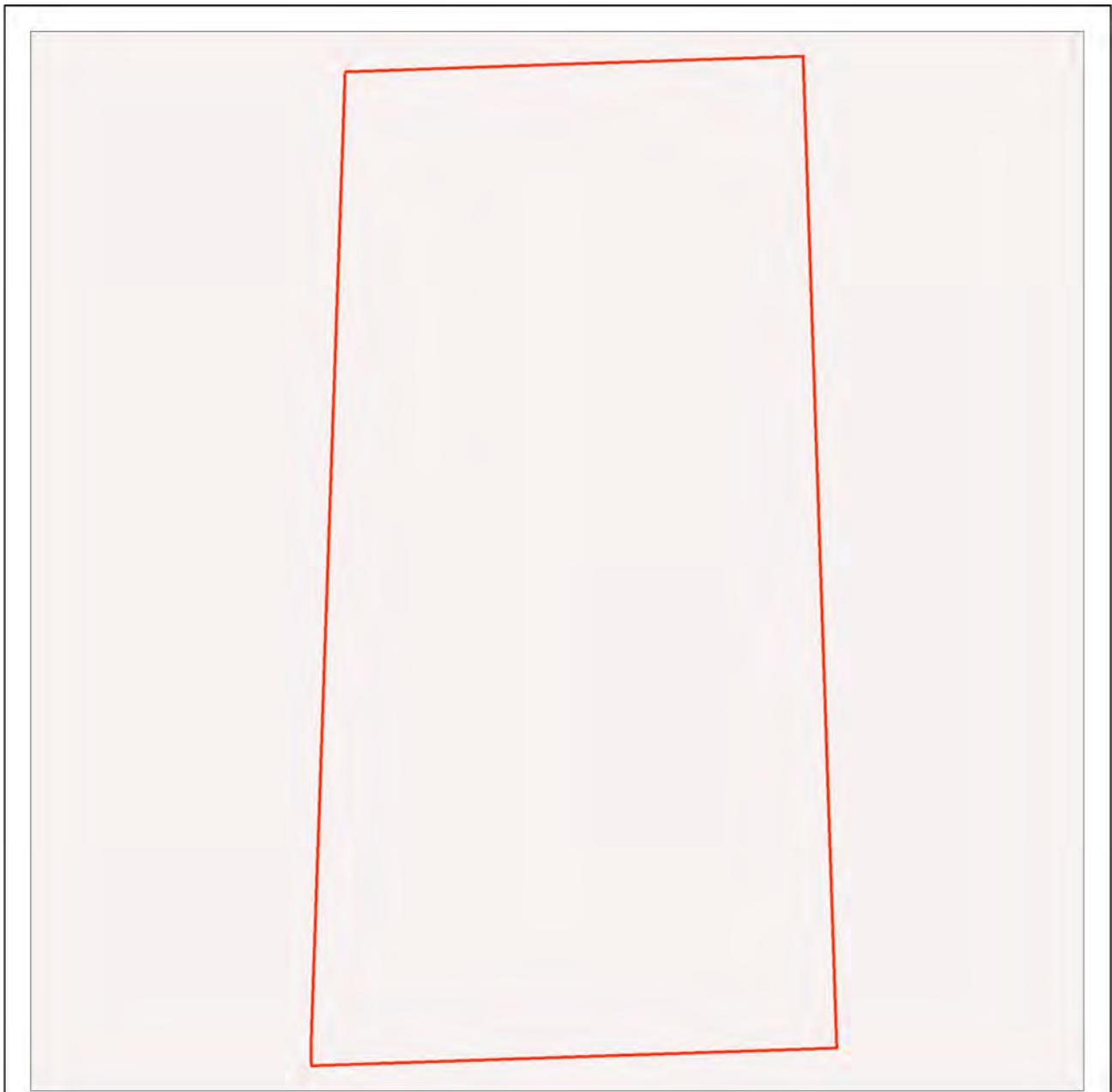
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Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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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>

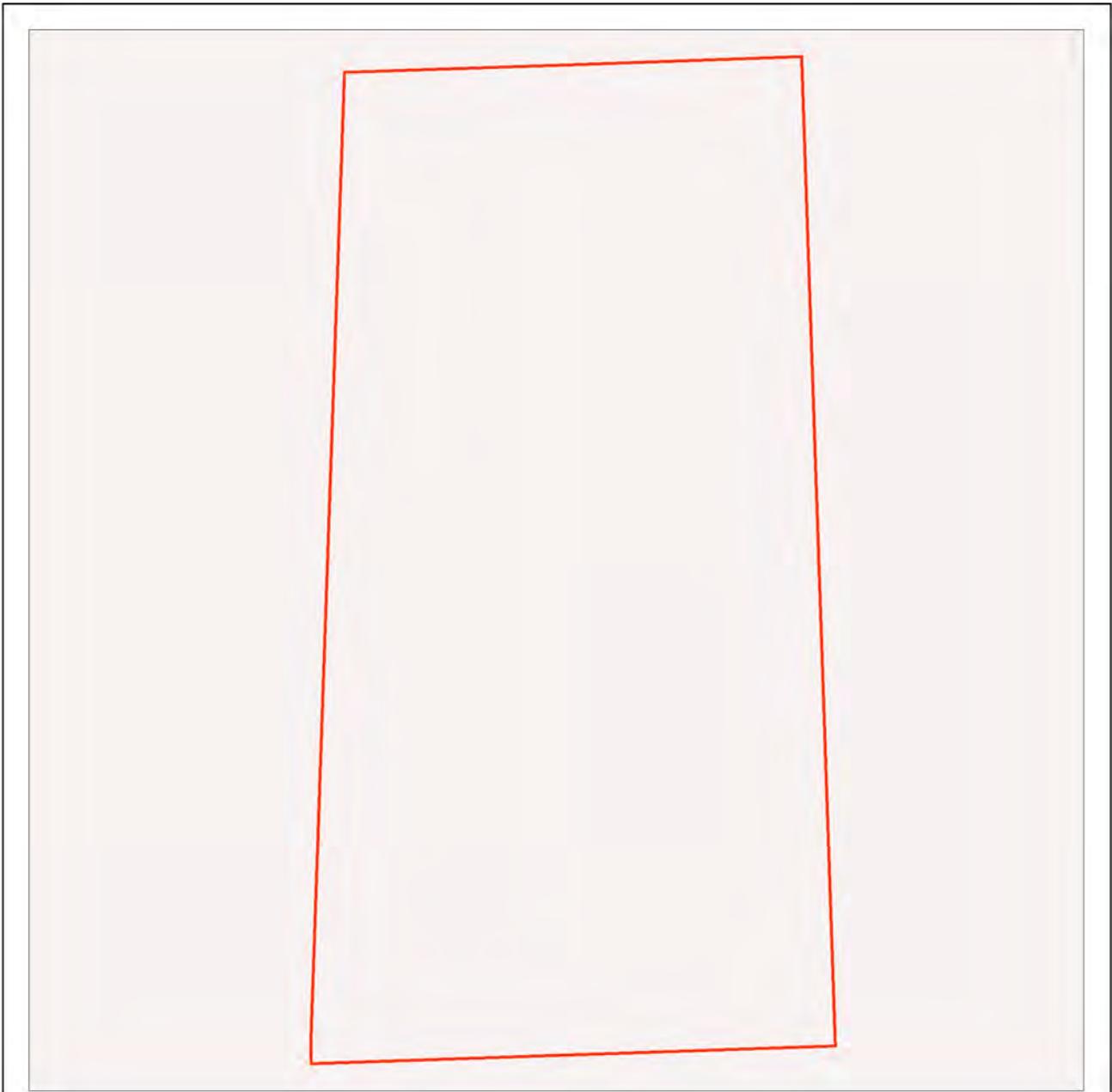
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



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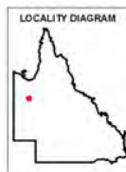
Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)



MSES - Wildlife habitat (sea turtle nesting areas)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)



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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.



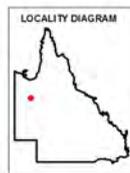
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

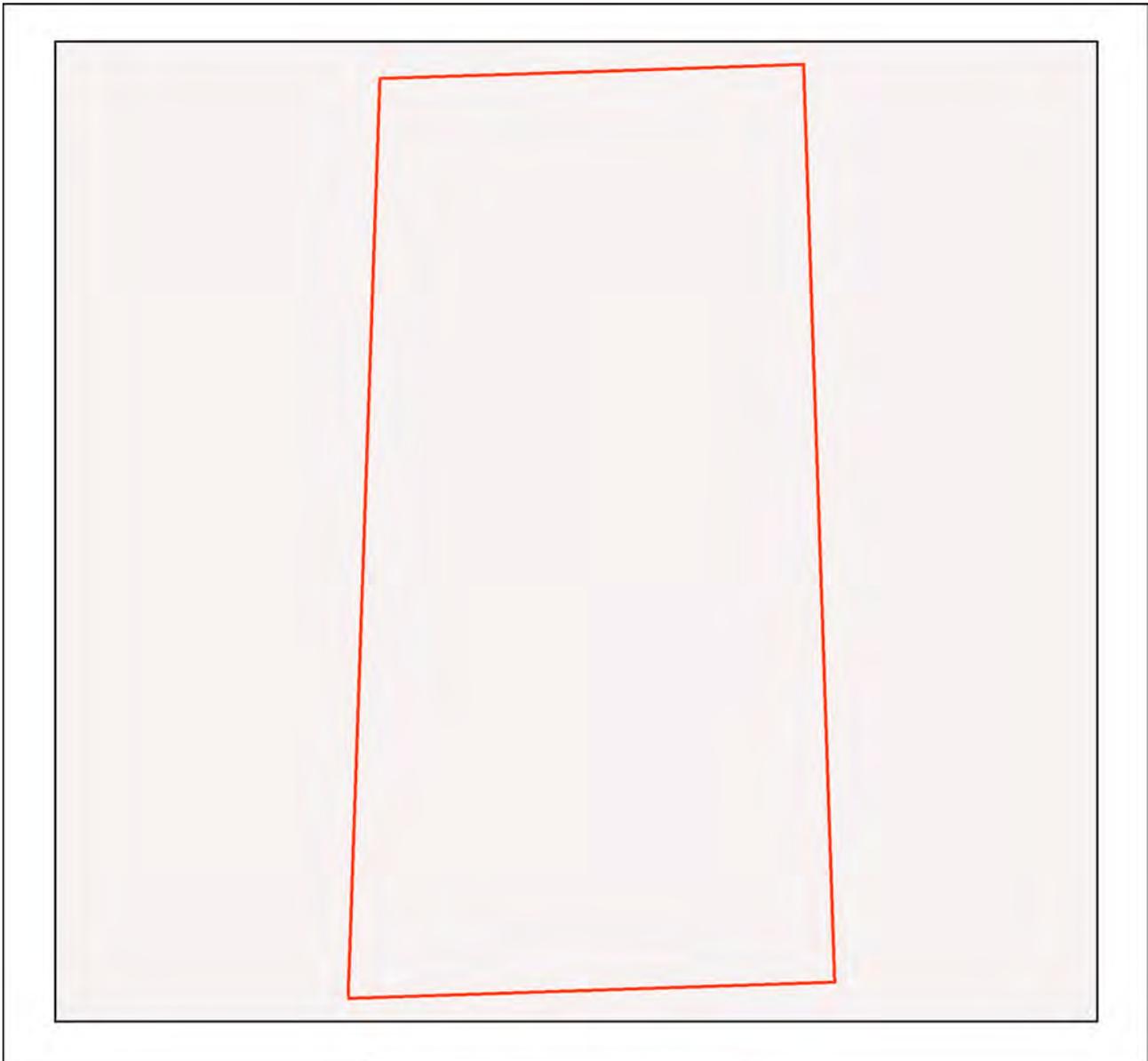
- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered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



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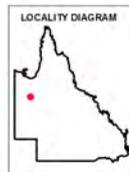
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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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). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" 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 - Sea Turtle Nesting Areas records
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 DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 2498

Environmental Reports - General Information

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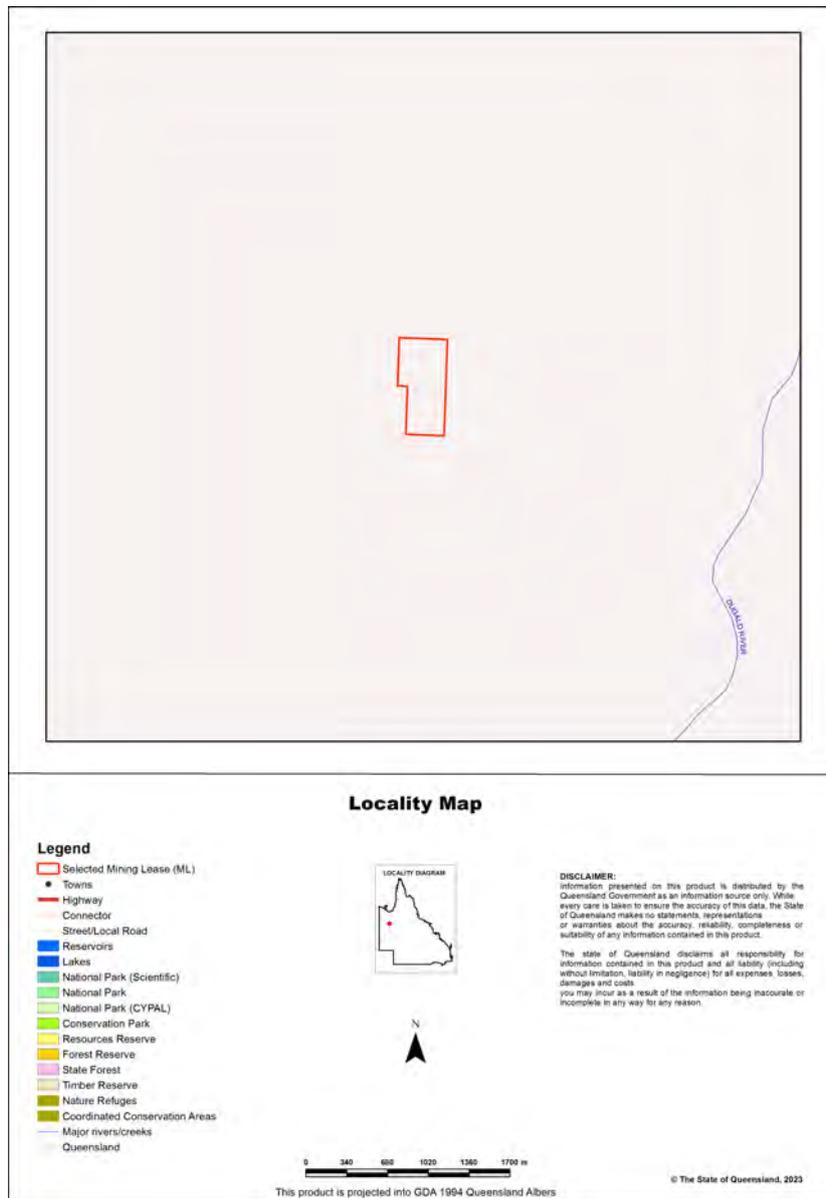
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Assessment Area Details

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 ml: 2498

Size (ha)	29.06
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders



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 planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts 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	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	18.93 ha	65.1%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
7d Sea turtle nesting areas	0.0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	16.1 ha	55.4%
8e Regulated Vegetation - intersecting a watercourse	0.6 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

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

Values are present

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>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarium casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	None
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Macadamia integrifolia</i>		V	None
<i>Macadamia ternifolia</i>		V	None
<i>Macadamia tetraphylla</i>		V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	E	None
<i>Taudactylus pleione</i>	Kroombit tinkerfrog	E	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

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		

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**, **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)

Not applicable

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

Values are present

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

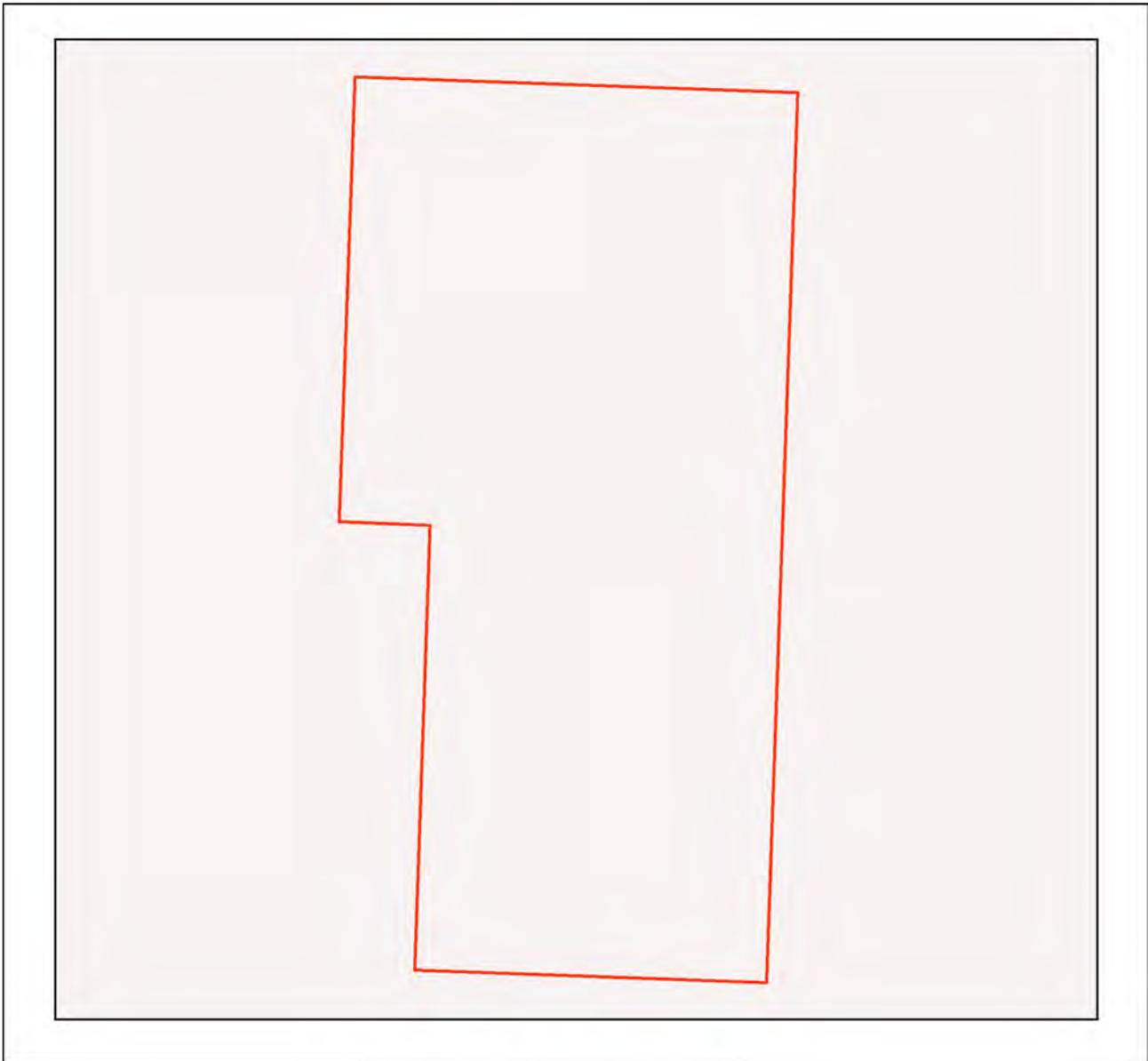
(no results)

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.

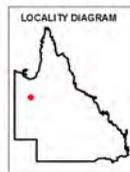
Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

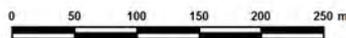
Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Protected area (estates, nature refuges, special wildlife reserves)
-  Declared fish habitat area (A and B areas)
-  Marine park (highly protected)



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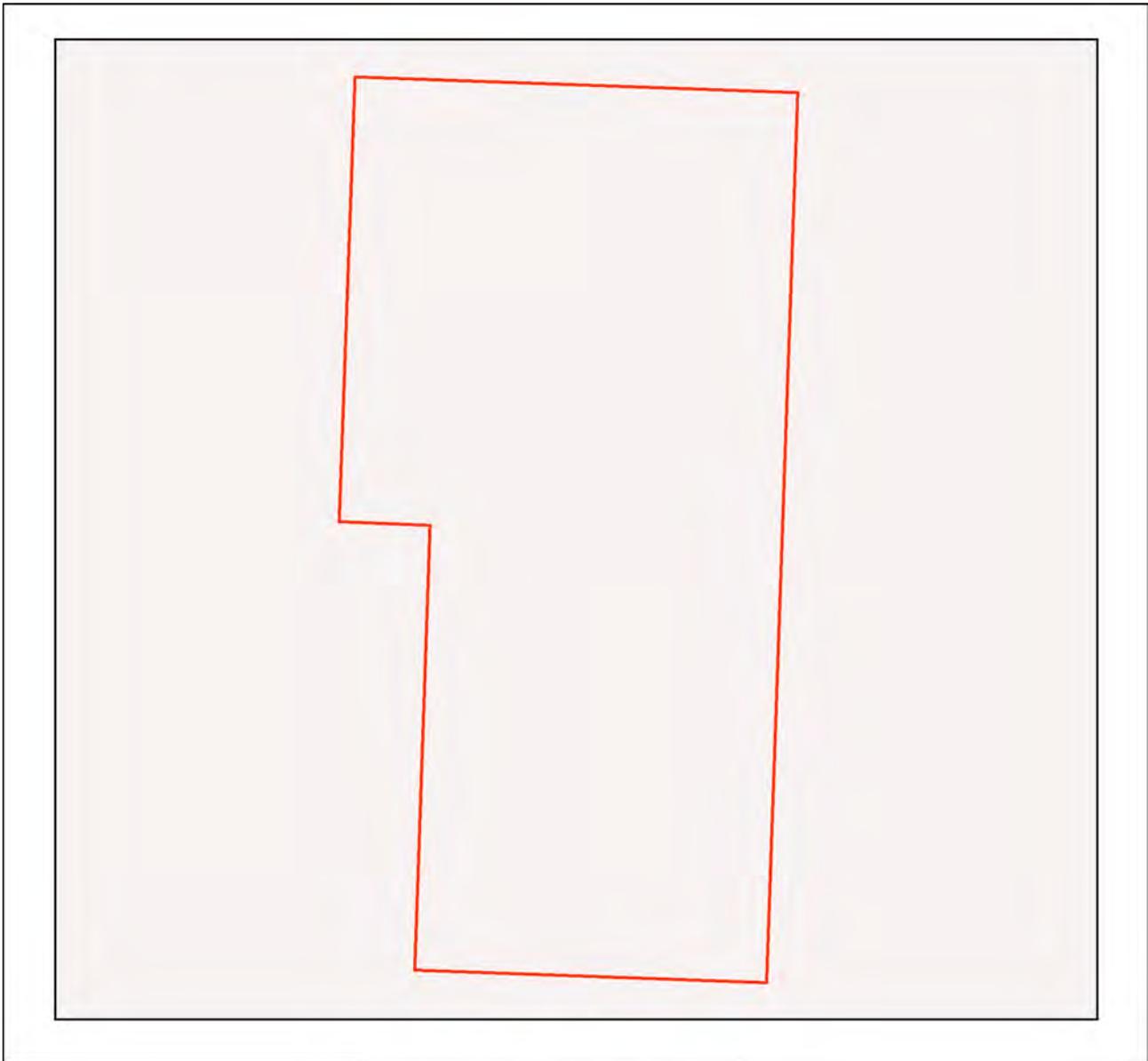
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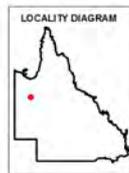
Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands



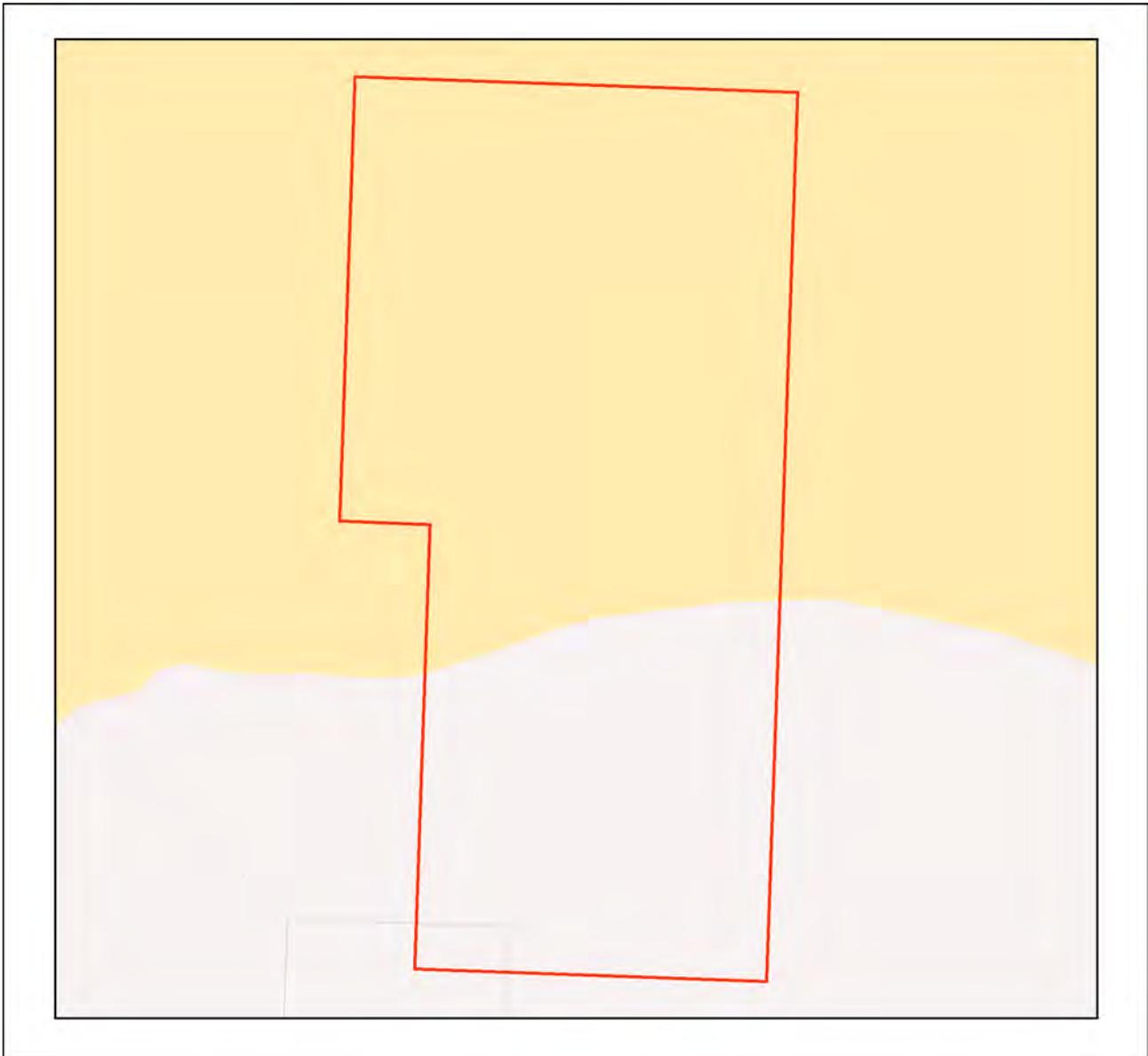
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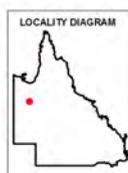
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



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

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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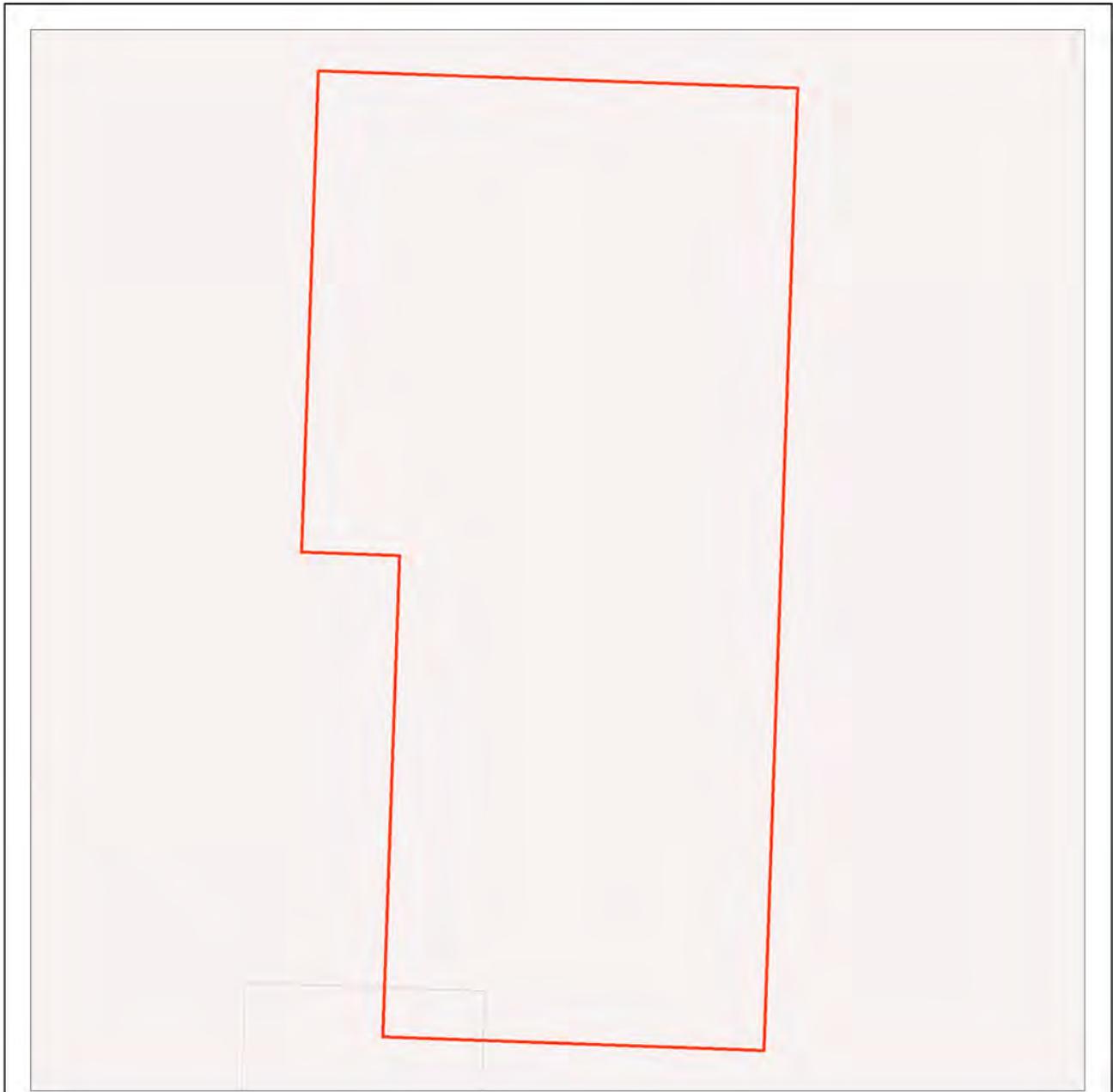
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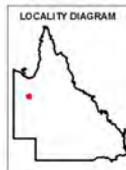
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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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>

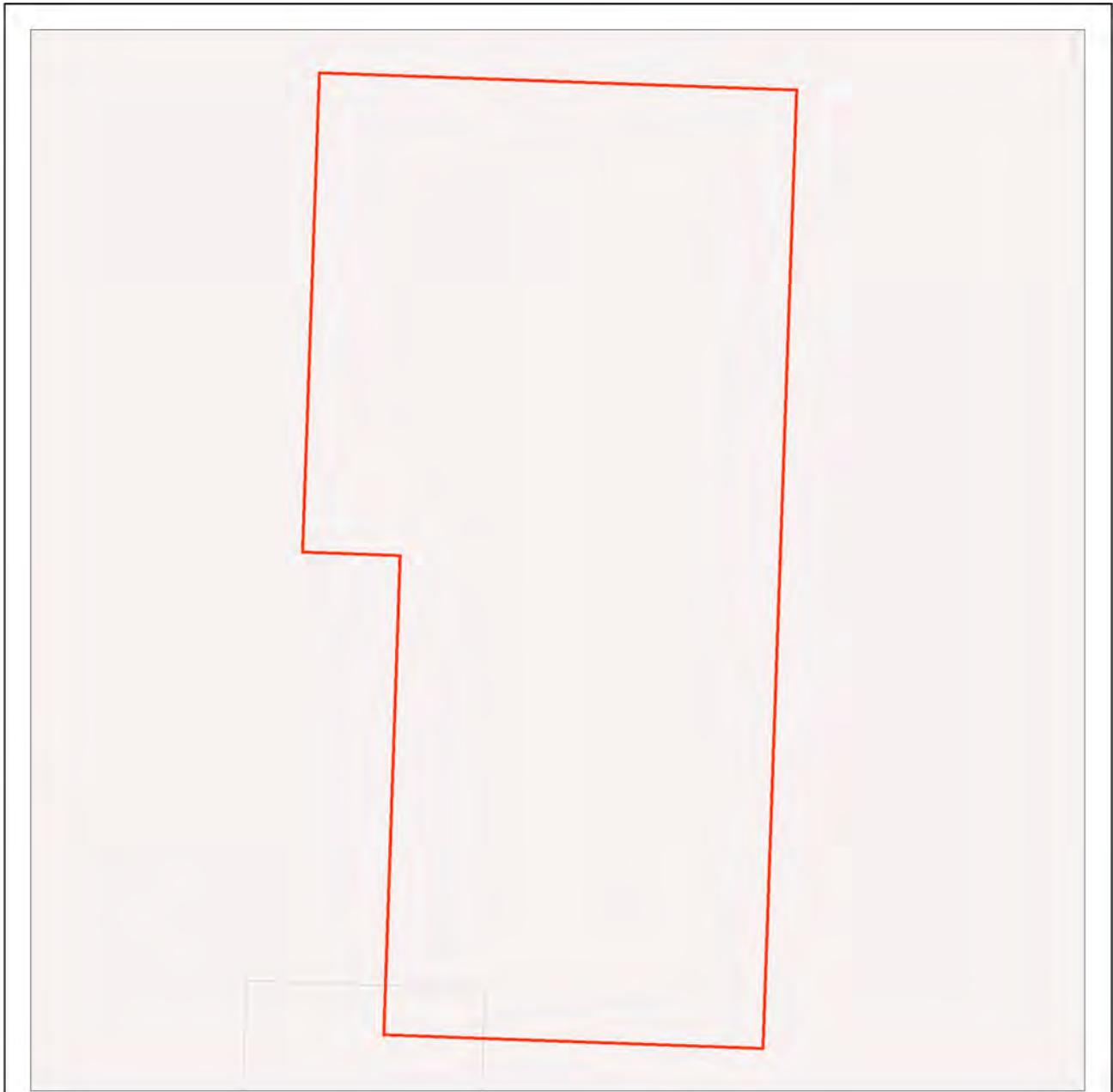
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



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



MSES - Wildlife habitat (sea turtle nesting areas)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)

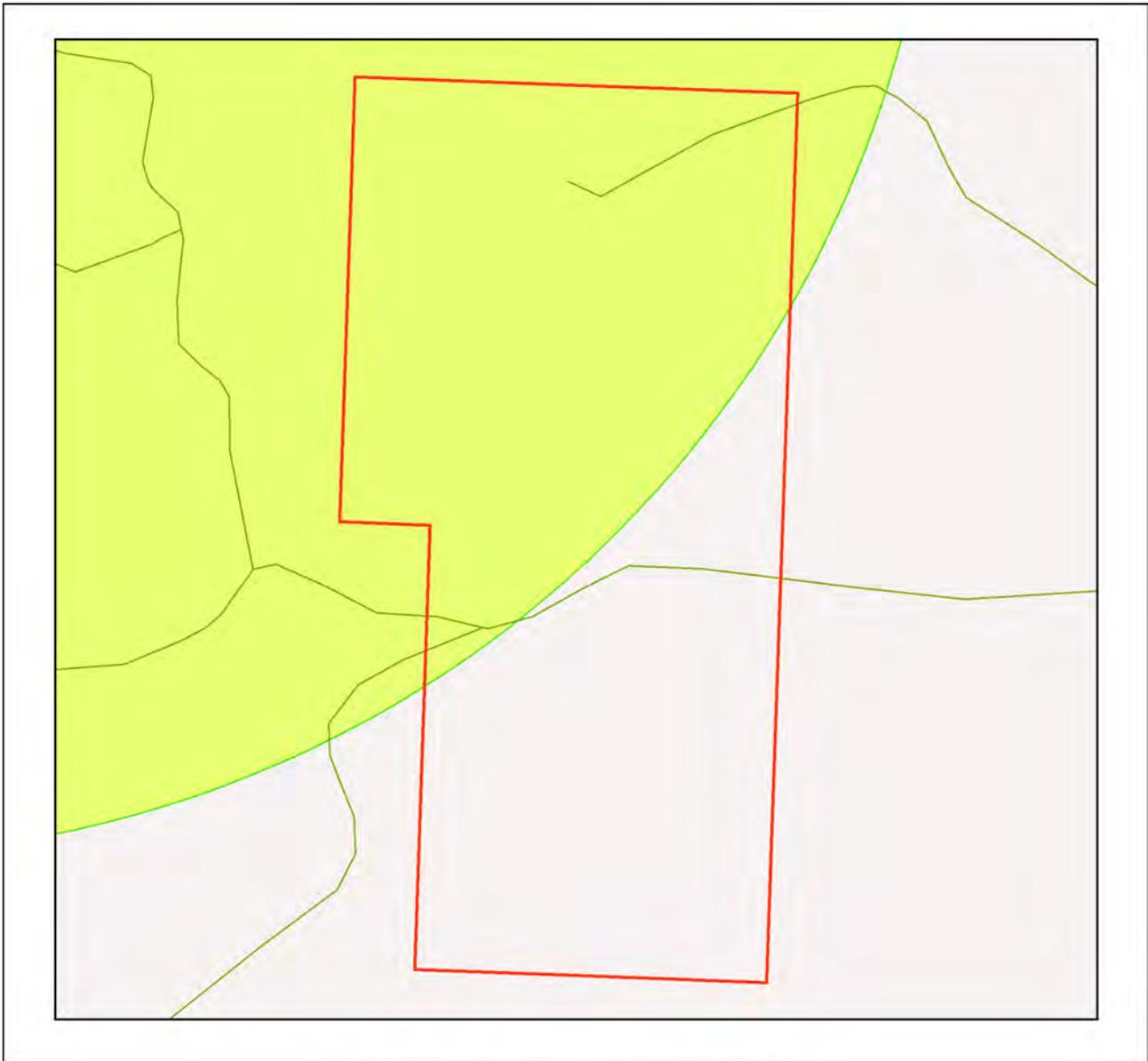


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MSES mapping of sea turtle nesting areas identifies beaches where the recorded number of turtle nests are over 1% of the turtle species or genetic stock. The linework is also deliberately extended along nearby rocky coastlines and headlands to recognise 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.



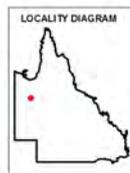
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- Selected Mining Lease (ML)
- 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)



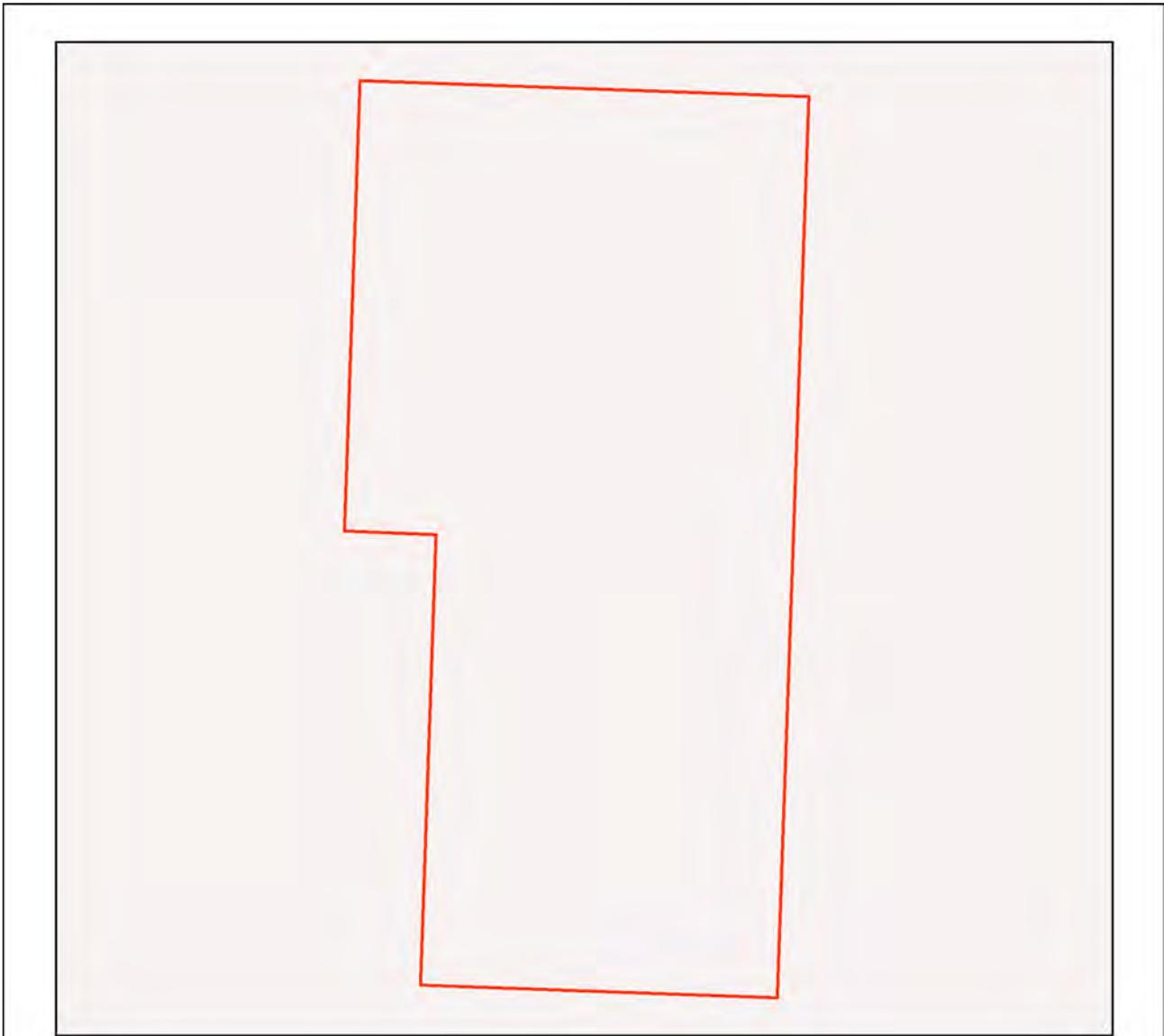
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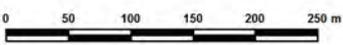
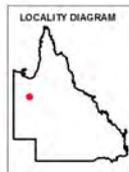
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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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). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" 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 - Sea Turtle Nesting Areas records
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 DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 2470

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 1994). 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 field survey may be required to validate values on the ground.

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

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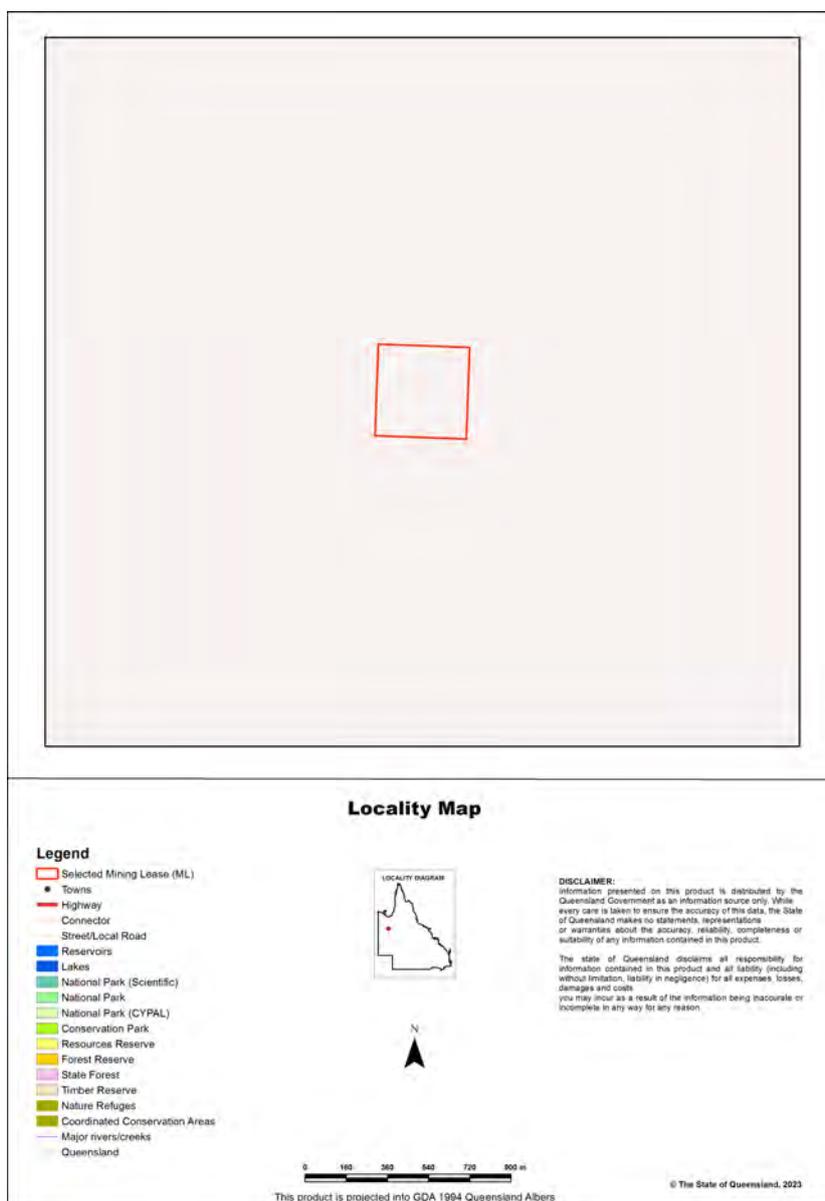
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Assessment Area Details

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 ml: 2470

Size (ha)	16.19
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders



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 planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts 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	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	6.41 ha	39.6%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
7d Sea turtle nesting areas	0.0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	9.77 ha	60.3%
8e Regulated Vegetation - intersecting a watercourse	0.9 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

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

Values are present

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>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarium casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	None
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Macadamia integrifolia</i>		V	None
<i>Macadamia ternifolia</i>		V	None
<i>Macadamia tetraphylla</i>		V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	E	None
<i>Taudactylus pleione</i>	Kroombit tinkerfrog	E	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

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		

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**, **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)

Not applicable

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

Values are present

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

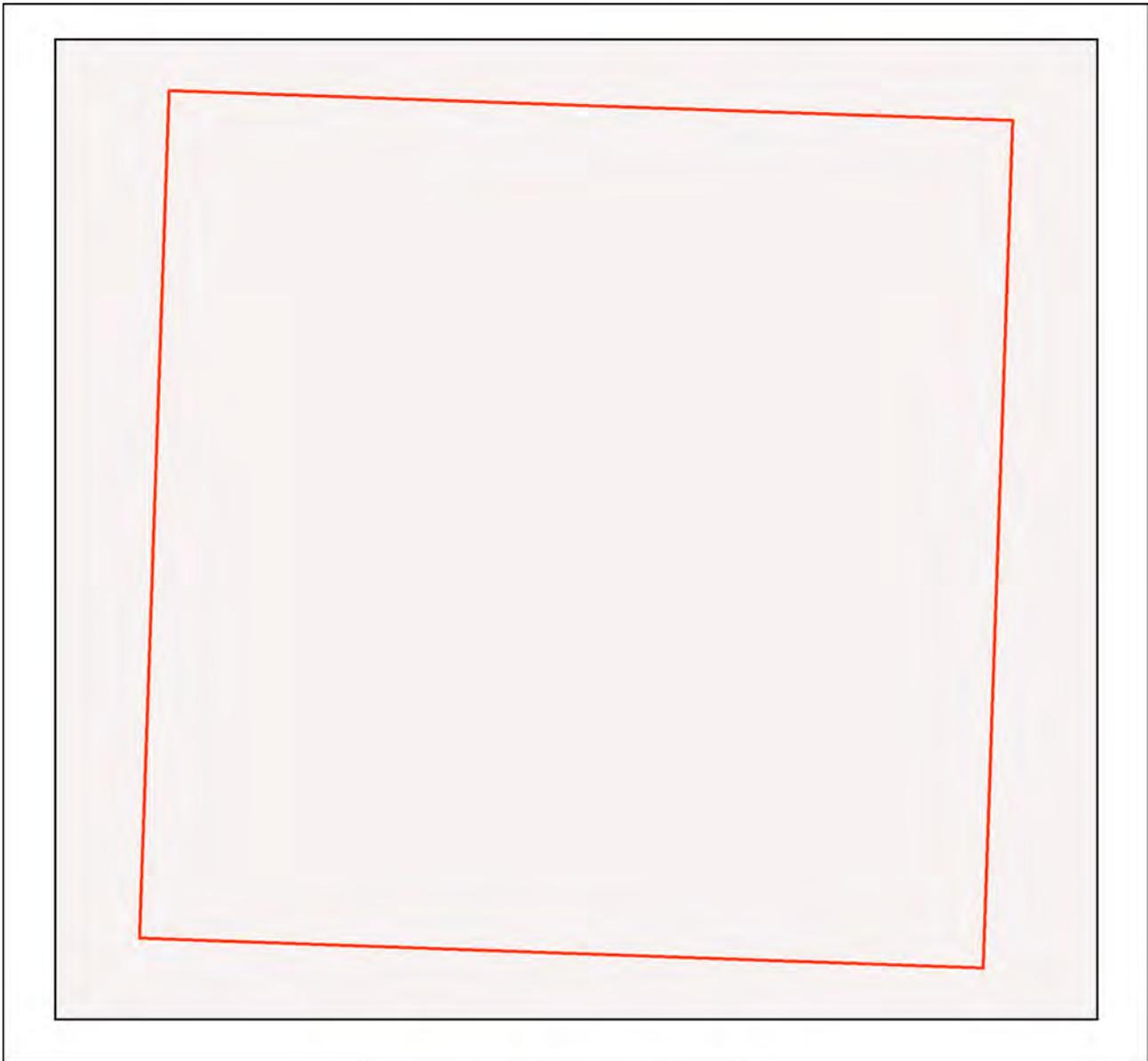
(no results)

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



MSES - State Conservation Areas

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates, nature refuges, special wildlife reserves)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



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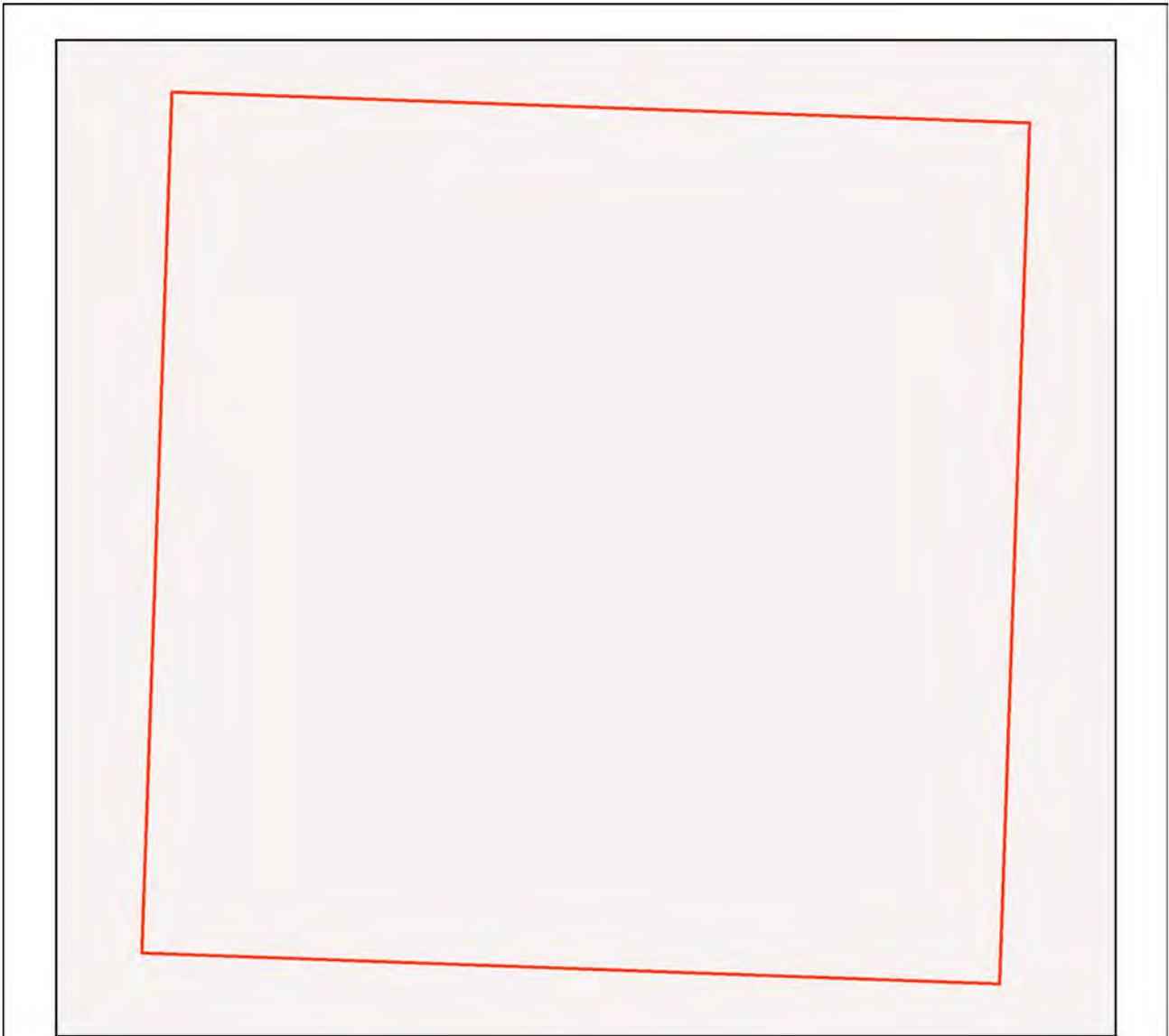
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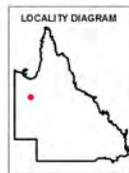
Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Declared high ecological value waters (watercourse)
-  Strategic environmental area (designated precinct)
-  Declared high ecological value waters (wetland)
-  High ecological significance wetlands



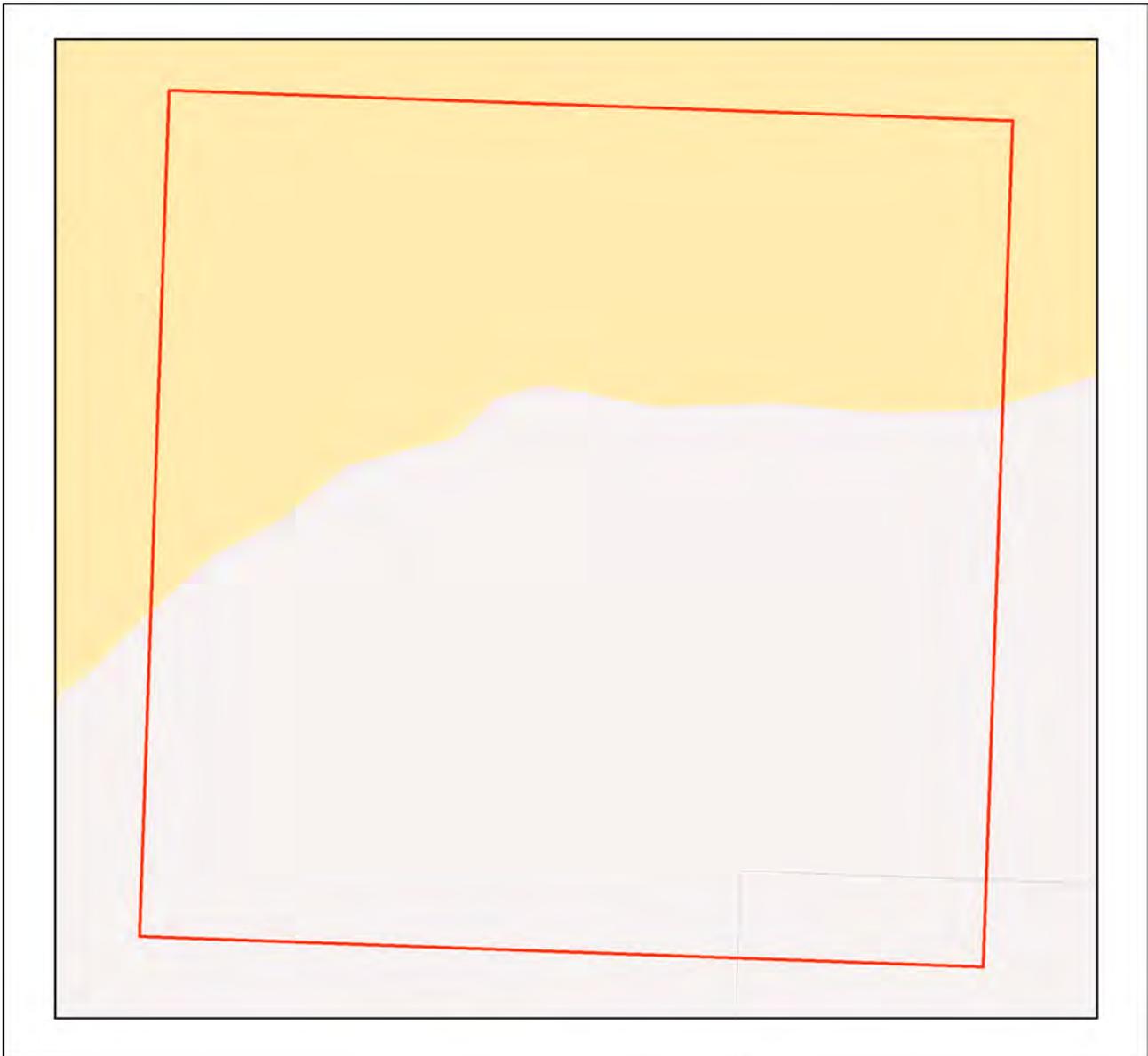
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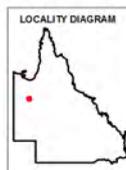
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



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

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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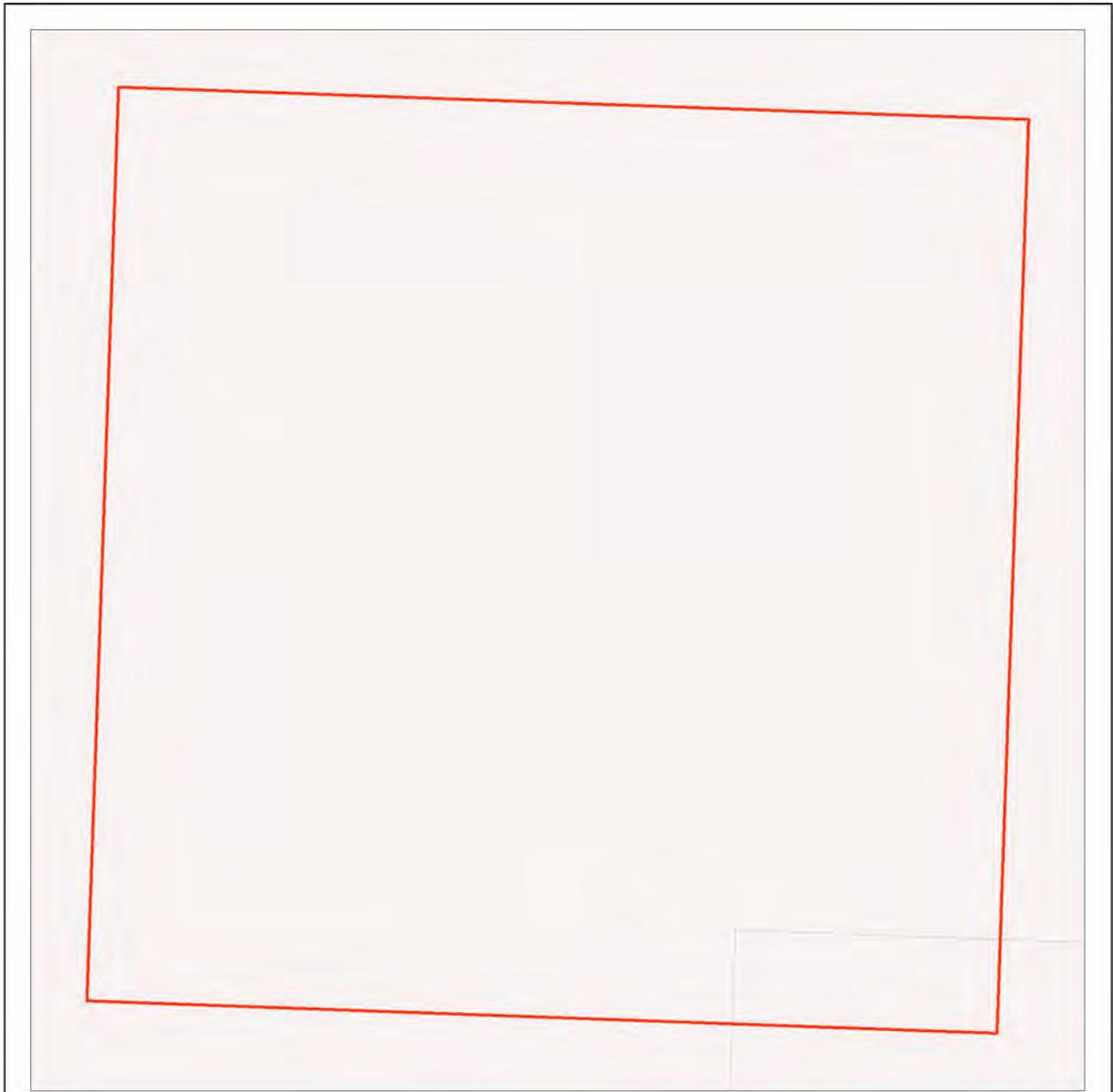
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Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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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>

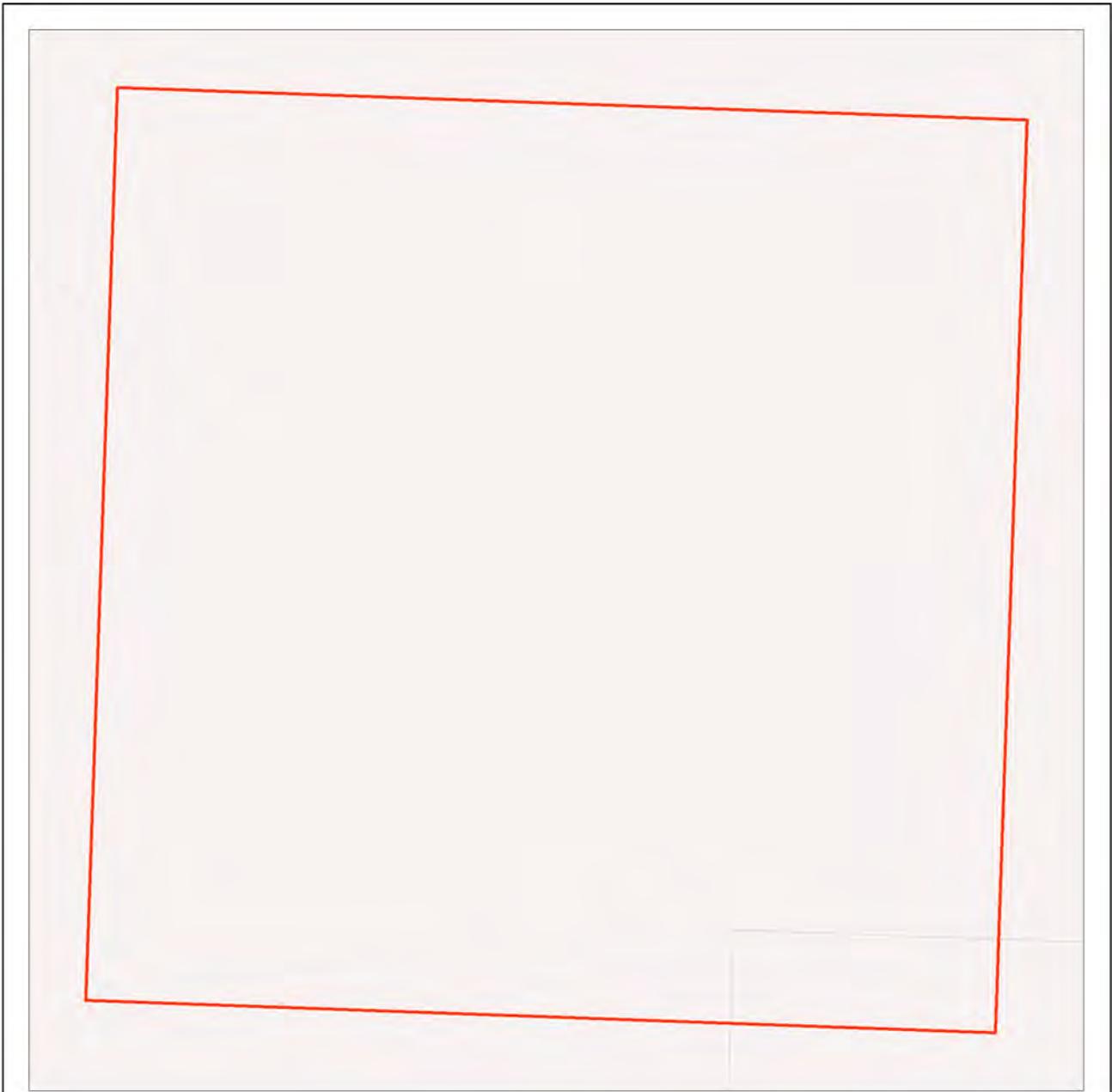
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



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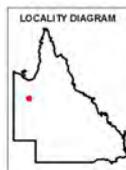
Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)



MSES - Wildlife habitat (sea turtle nesting areas)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)

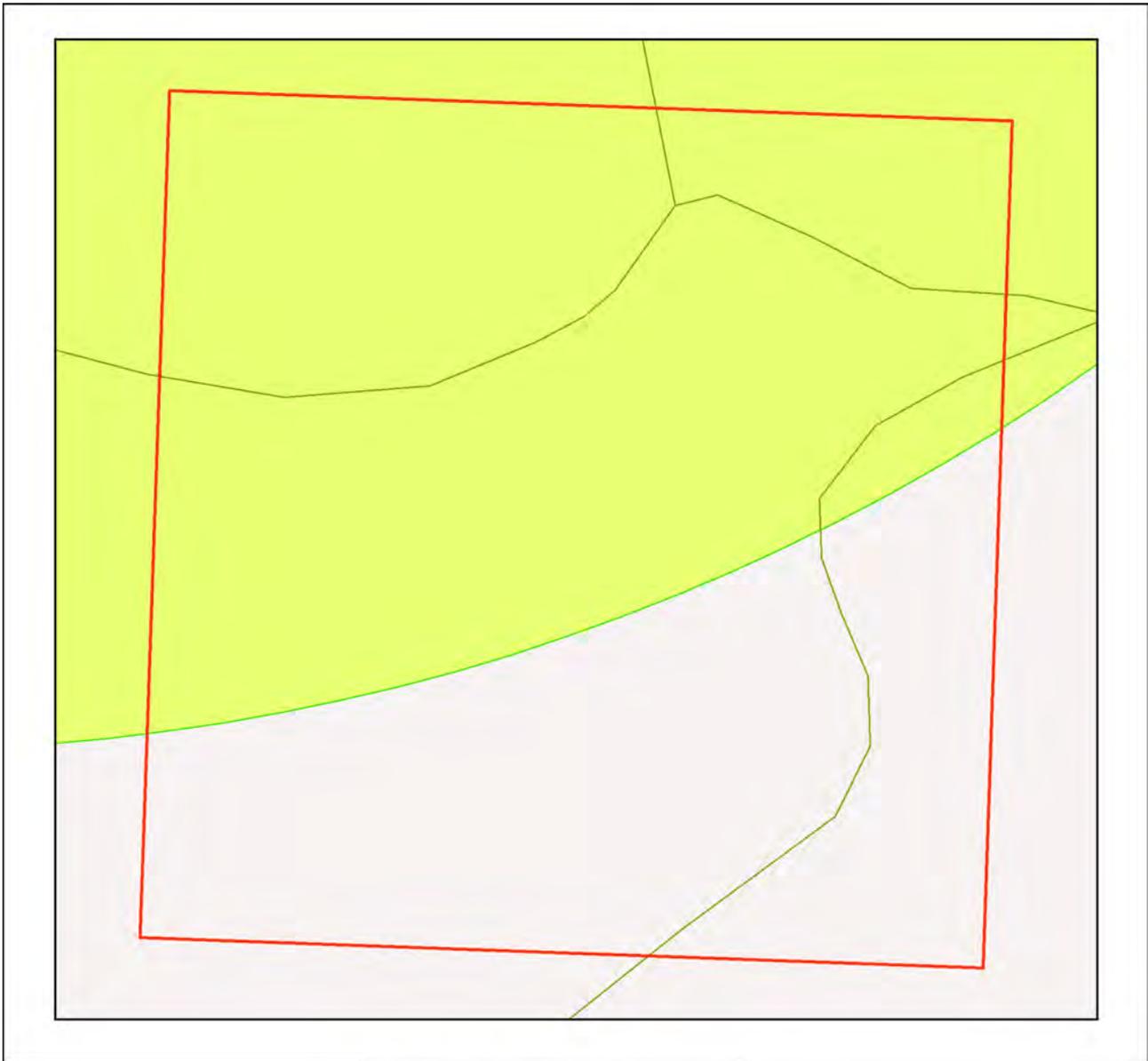


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MSES mapping of sea turtle nesting areas identifies beaches where the recorded number of turtle nests are over 1% of the turtle species or genetic stock. The linework is also deliberately extended along nearby rocky coastlines and headlands to recognise 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.



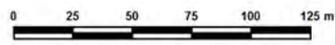
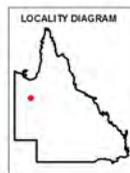
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

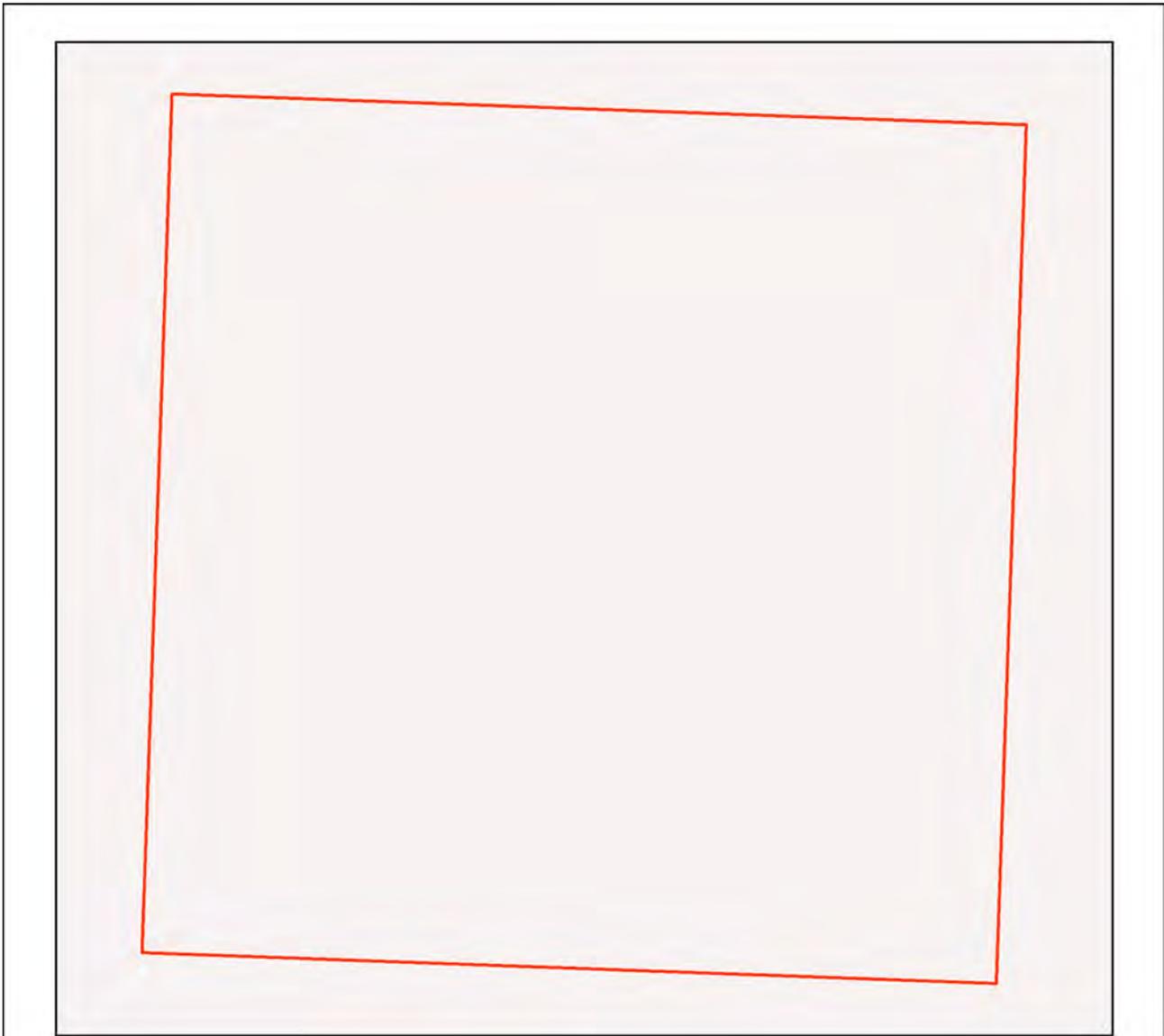
- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered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



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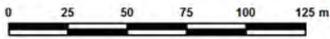
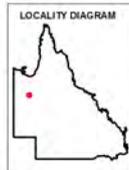
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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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). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" 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 - Sea Turtle Nesting Areas records
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 DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 2499

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 1994). 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 field survey may be required to validate values on the ground.

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

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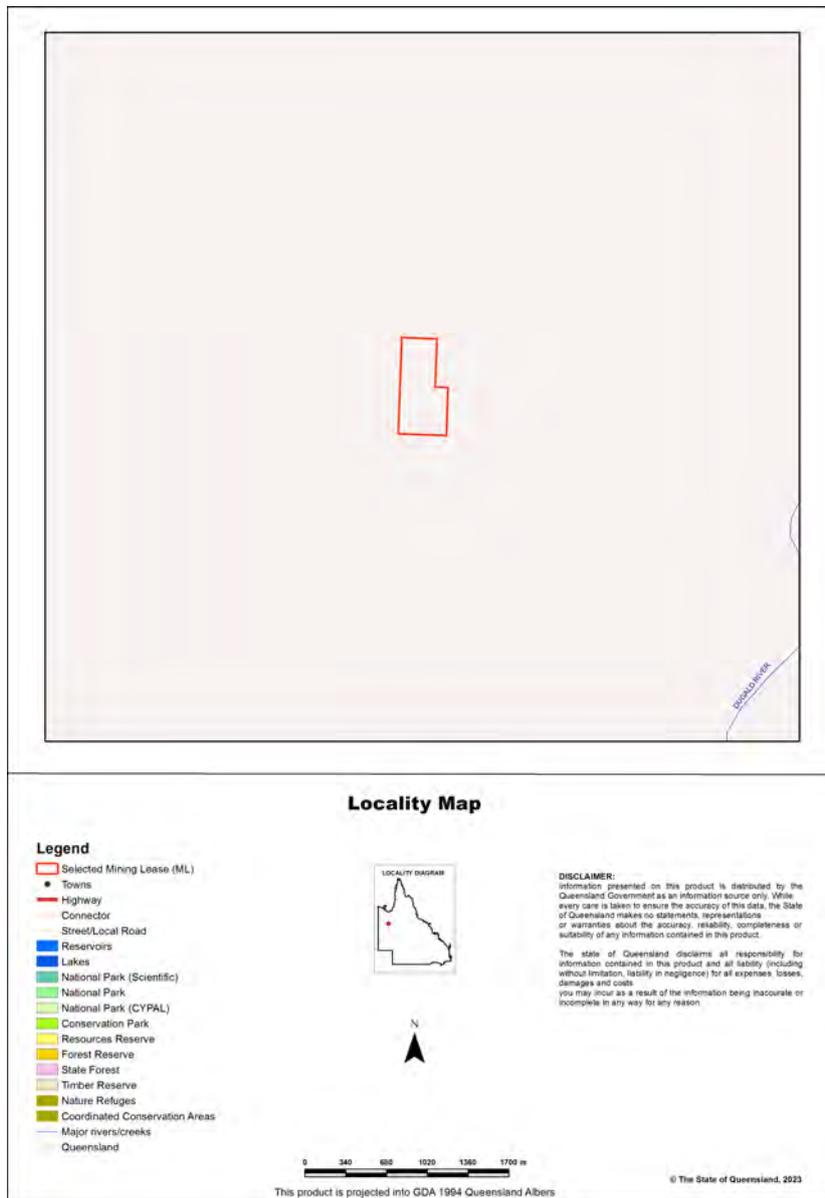
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Assessment Area Details

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 ml: 2499

Size (ha)	28.08
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders



Matters of State Environmental Significance (MSES)

MSES Categories

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'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.'

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- 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	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	9.1 ha	32.4%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
7d Sea turtle nesting areas	0.0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	9.3 ha	33.1%
8e Regulated Vegetation - intersecting a watercourse	0.8 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

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

Values are present

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>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarium casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	None
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Macadamia integrifolia</i>		V	None
<i>Macadamia ternifolia</i>		V	None
<i>Macadamia tetraphylla</i>		V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	E	None
<i>Taudactylus pleione</i>	Kroombit tinkerfrog	E	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

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		

Special least concern animal species records

(no results)

Shorebird habitat (critically endangered/angered/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**, **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)

Not applicable

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

Values are present

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

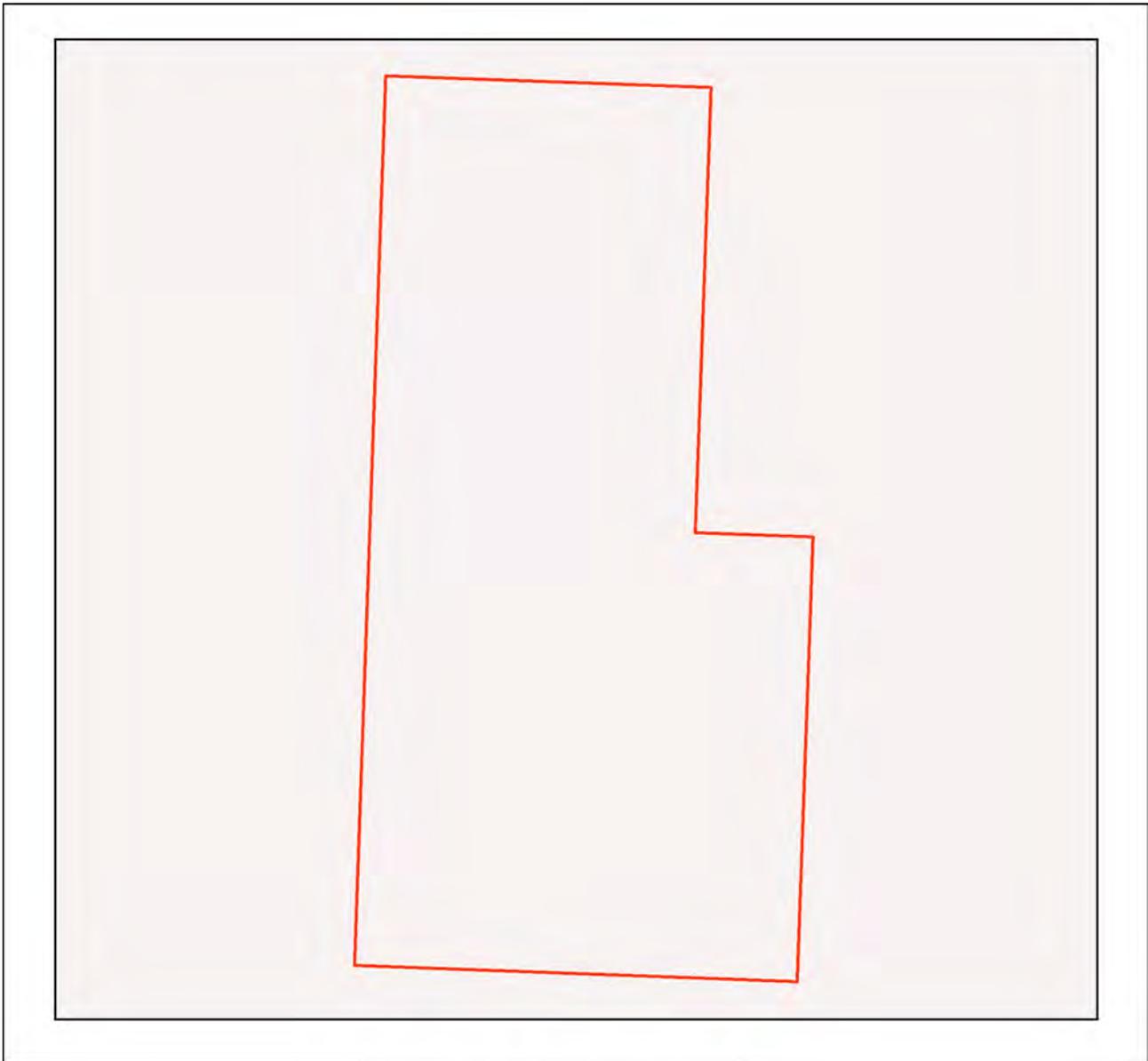
(no results)

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.

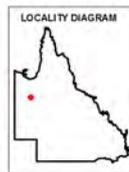
Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

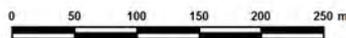
Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Protected area (estates, nature refuges, special wildlife reserves)
-  Declared fish habitat area (A and B areas)
-  Marine park (highly protected)



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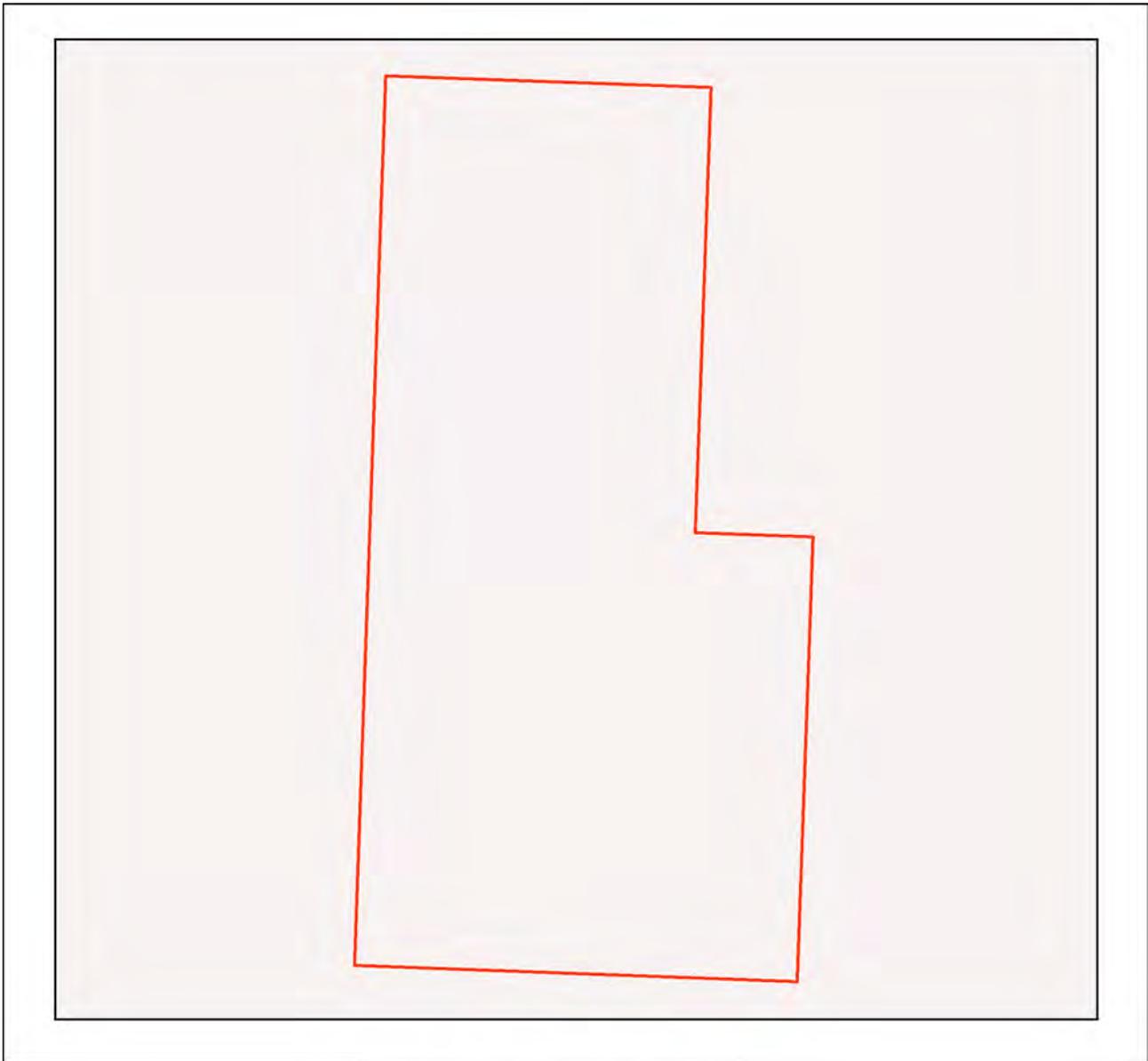
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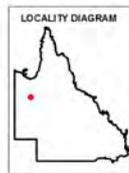
Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands



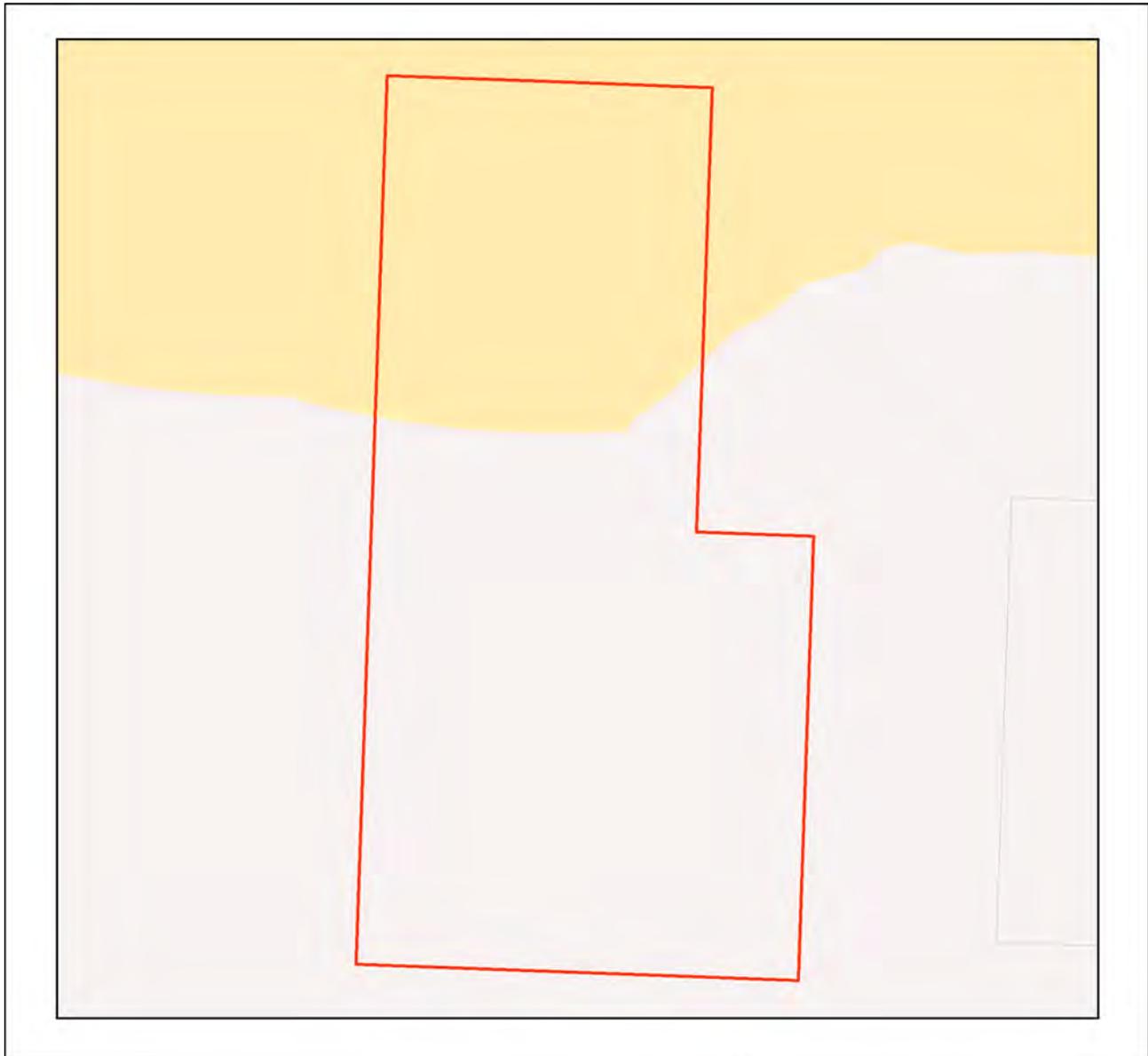
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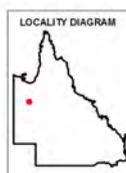
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



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

Area of Interest

- Selected Mining Lease (ML)
- ▲ Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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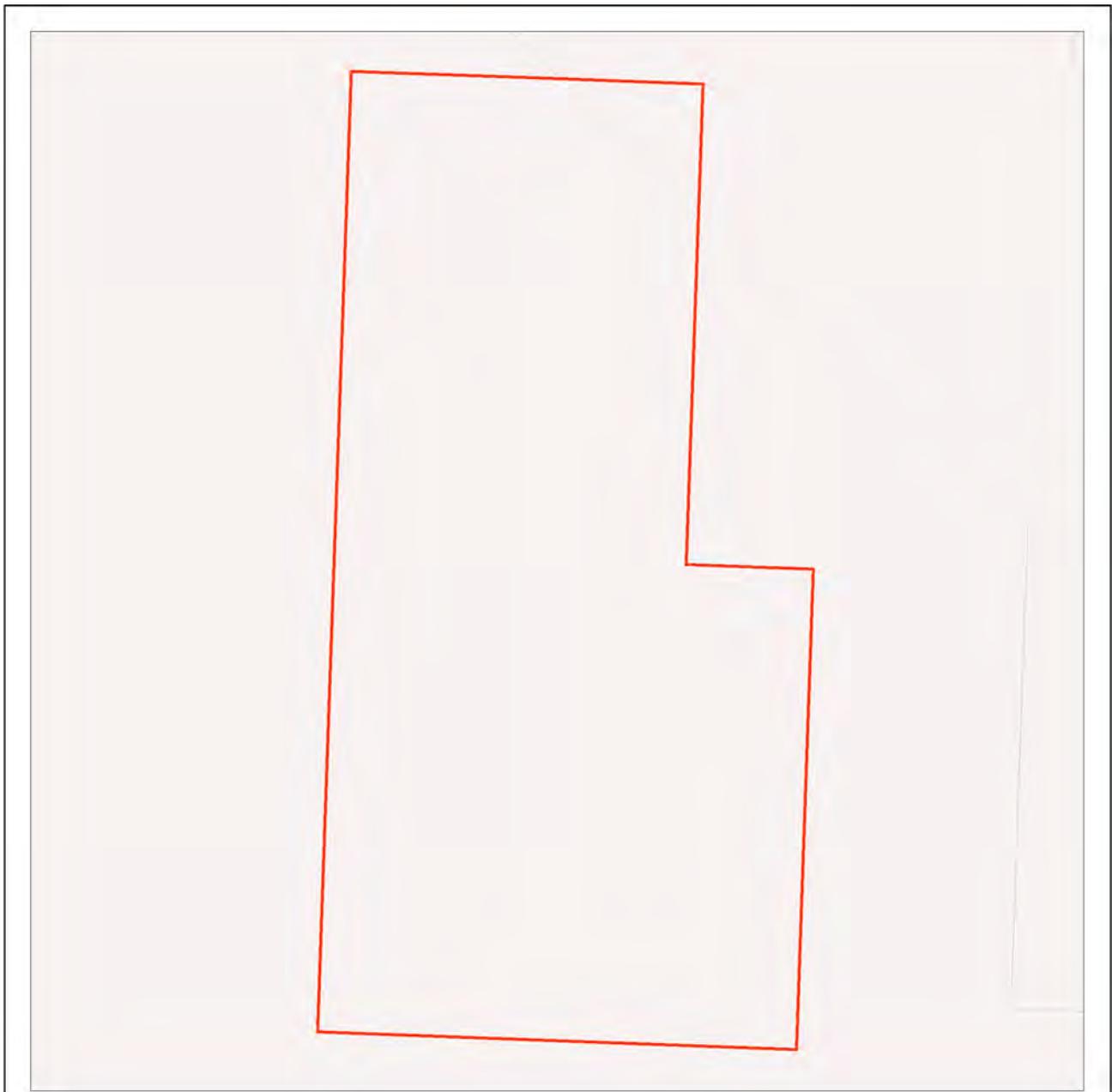
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Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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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>

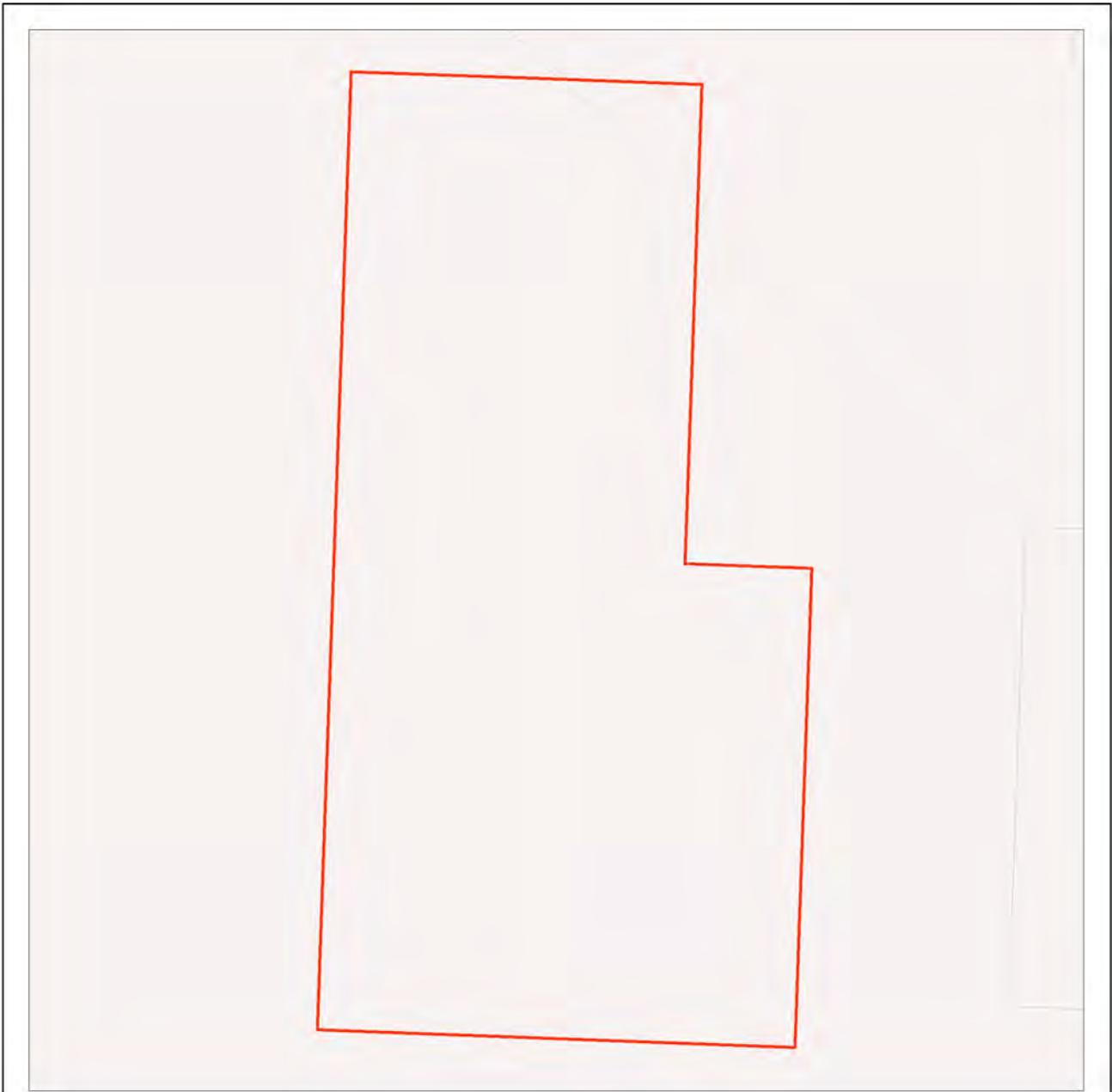
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



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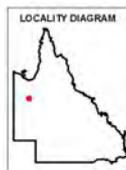
Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)



MSES - Wildlife habitat (sea turtle nesting areas)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)

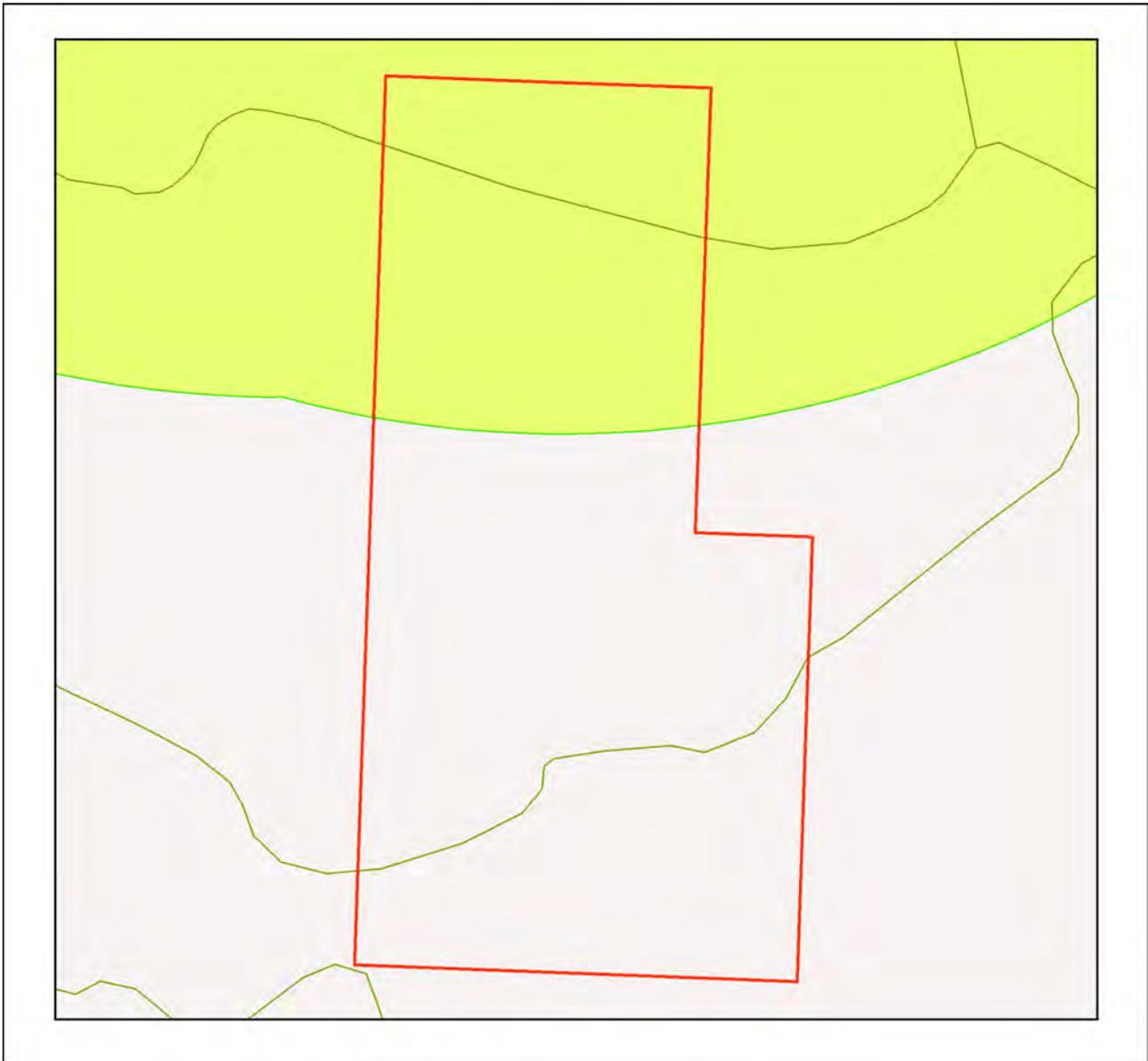


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MSES mapping of sea turtle nesting areas identifies beaches where the recorded number of turtle nests are over 1% of the turtle species or genetic stock. The linework is also deliberately extended along nearby rocky coastlines and headlands to recognise 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.



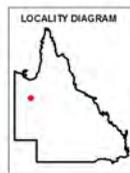
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- Selected Mining Lease (ML)
- 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)



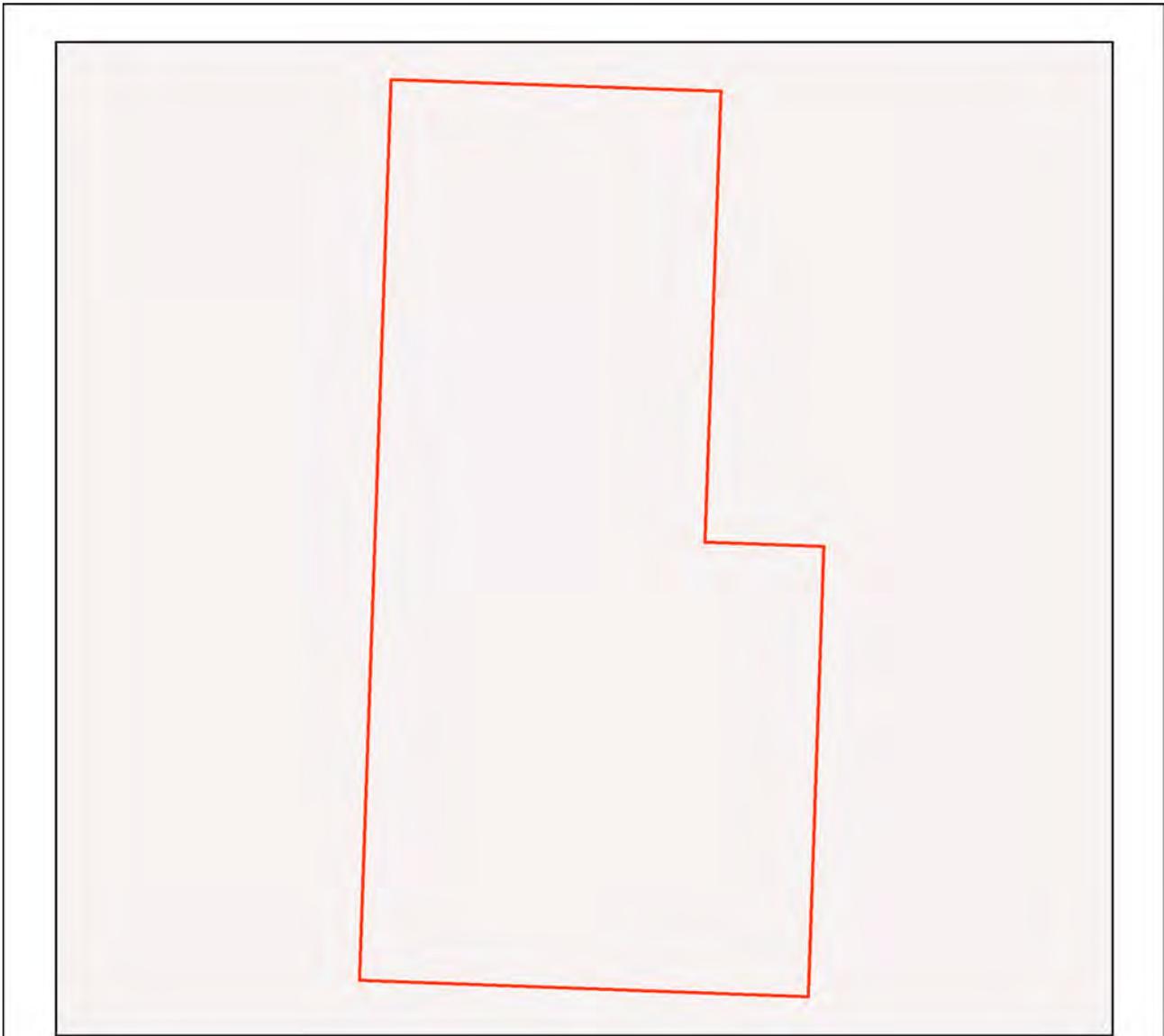
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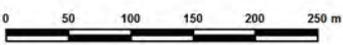
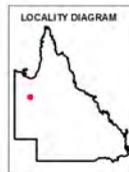
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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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). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support 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. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" 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 - Sea Turtle Nesting Areas records
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 DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



**APPENDIX C – ENVIRONMENTAL REPORTS – BIODIVERSITY AND
CONSERVATION VALUES – BIODIVERSITY PLANNING ASSESSMENTS AND
AQUATIC CONSERVATION ASSESSMENTS**



Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
ml: 2601

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 co-ordinates" option, the resulting assessment area encompasses an area extending from 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 1994). 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 field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: ml: 2601

Size (ha)	28.5
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Northwest Highlands v1.1
Aquatic Conservation Assessment(s) (riverine)	Eastern Gulf of Carpentaria v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Eastern Gulf of Carpentaria v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.8	2.82
Of concern	0.0	0.0
No concern at present	15.29	53.65

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	16.1	56.49
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
(No Records)	

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent

information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	28.5	100.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	16.1	56.49
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains an RE that is one of the largest of its type in the bioregion (D1) & Remnant has high connectivity or buffers an endangered RE or Sig. Wetland (G)	16.1	56.49

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa			16.1	56.5				
B1: Ecosystem Value (Bioregion)					16.1	56.5		
B2: Ecosystem Value (Subregion)					16.1	56.5		
C: Tract Size			16.1	56.5				
D1: Relative RE Size (Bioregion)	16.1	56.5						
D2: Relative RE Size (Subregion)	16.1	56.5						
F: Ecosystem Diversity			16.1	56.5				
G: Context and Connection	16.1	56.5						

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

(No Records)

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al.* 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to assess overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa								
Ia: Centres of Endemism								
Ib: Wildlife Refugia								
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								
Ih: Artificial Wetland								

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
li: Hollow Bearing Trees								
lj: Breeding or Roosting Site								
lk: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to lj cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

- Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;
- Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- Maintaining large scale seasonal/migratory species processes and movement of fauna;
- Maximising connectivity between large tracts/patches of remnant vegetation;
- Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

- Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);
- Follow major watershed/catchment and/or coastal boundaries;
- Incorporate major altitudinal/geological/climatic gradients;
- Include and maximise connectivity between large tracts/patches of remnant vegetation;
- Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

- Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	0.0	0.0
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

(No Records)

Expert panel decision descriptions:

(No Records)

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in Queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning processes

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at *Wetland Info*:

<http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	28.5	100.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					28.5	100.0		
2. Naturalness catchment					28.5	100.0		
3. Diversity and richness			28.5	100.0				
4. Threatened species and ecosystems	28.5	100.0						
5. Priority species and ecosystems			28.5	100.0				
6. Special features								
7. Connectivity								
8. Representativeness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
(No Records)								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, HerbreCs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		Low			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

*JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species.

**I - wetland indicator species; D - wetland dependent species.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Amytornis ballarae</i>	Kalkadoon grasswren	H	FA
<i>Artamus cinereus</i>	black-faced woodswallow	None	FA

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Barnardius zonarius macgillivrayi</i>	Cloncurry parrot	L	FA
<i>Ctenotus decaneurus</i>	ten-lined ctenotus	L	FA
<i>Ctenotus striaticeps</i>	stripe-headed finesnout ctenotus	L	FA
<i>Egernia hosmeri</i>	Hosmer's skink	DD	FA
<i>Gehyra robusta</i>	robust dtella	L	FA
<i>Heteromunia pectoralis</i>	pictorella mannikin	L	FA
<i>Neosilurus hyrtlil</i>	Hyrtl's catfish	L	FA
<i>Varanus mertensi</i>	Mertens' water monitor	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

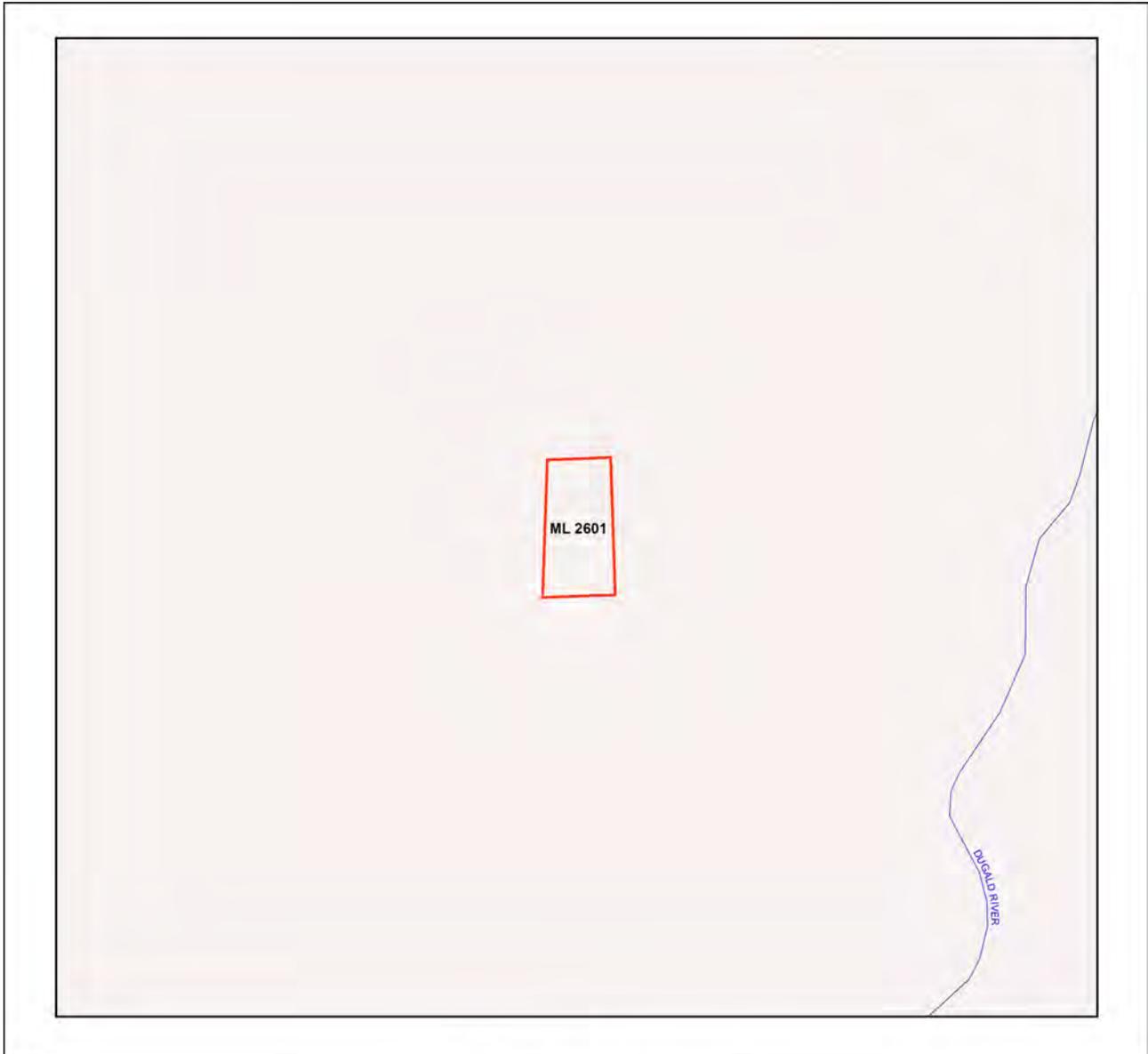
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

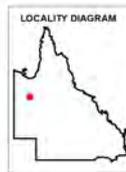
Map 1 - Locality Map



Locality Map

Legend

- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland

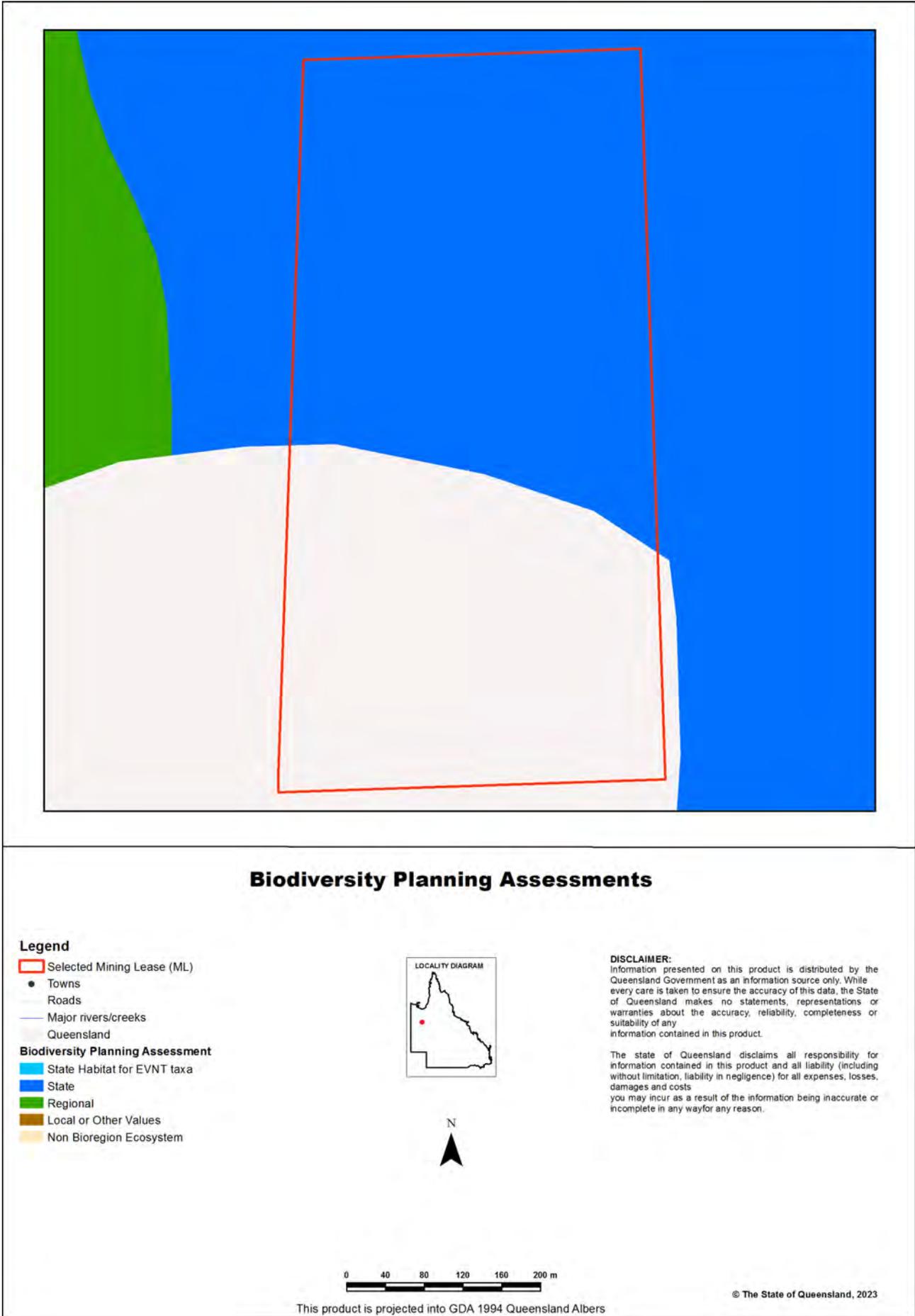


DISCLAIMER:

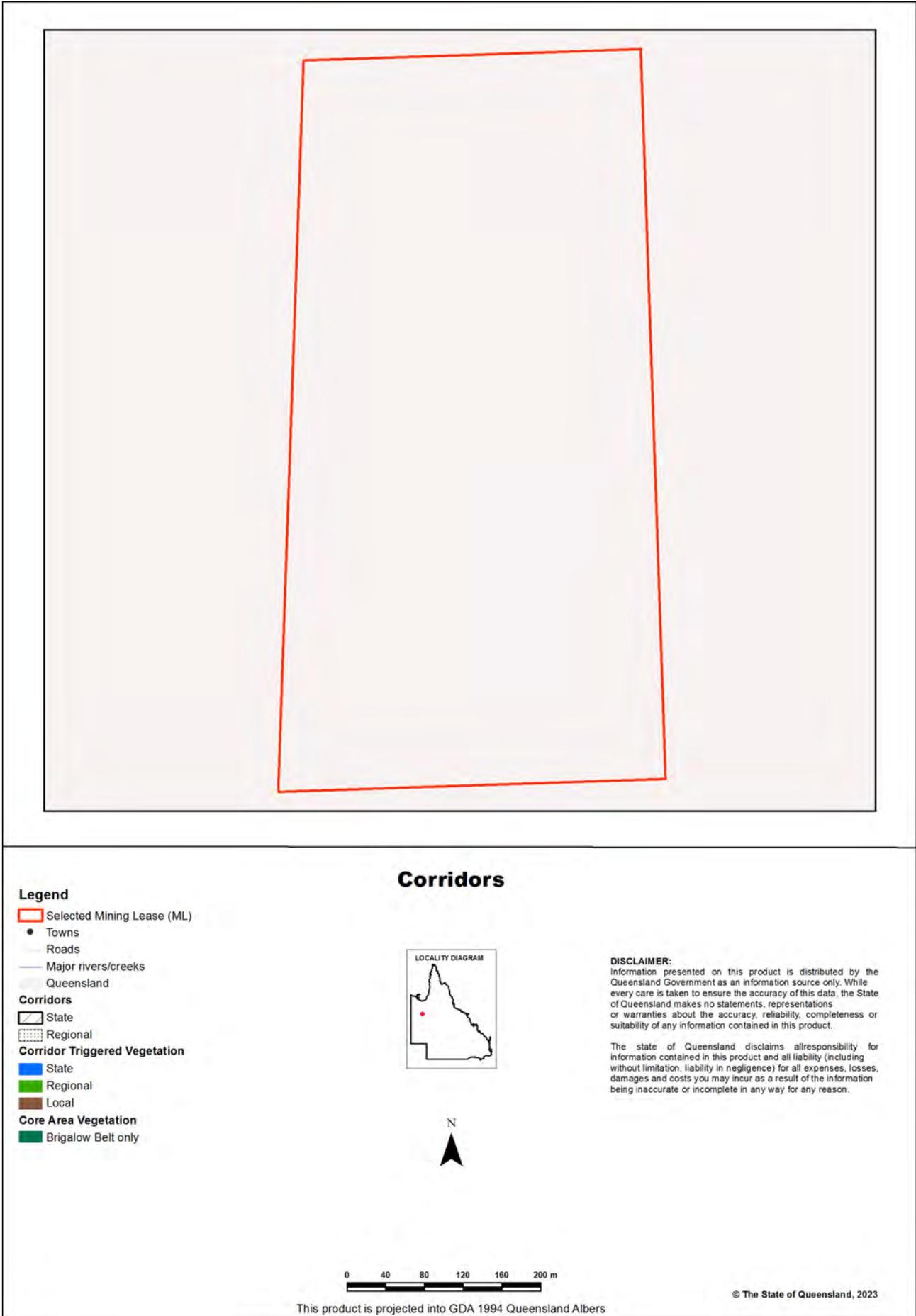
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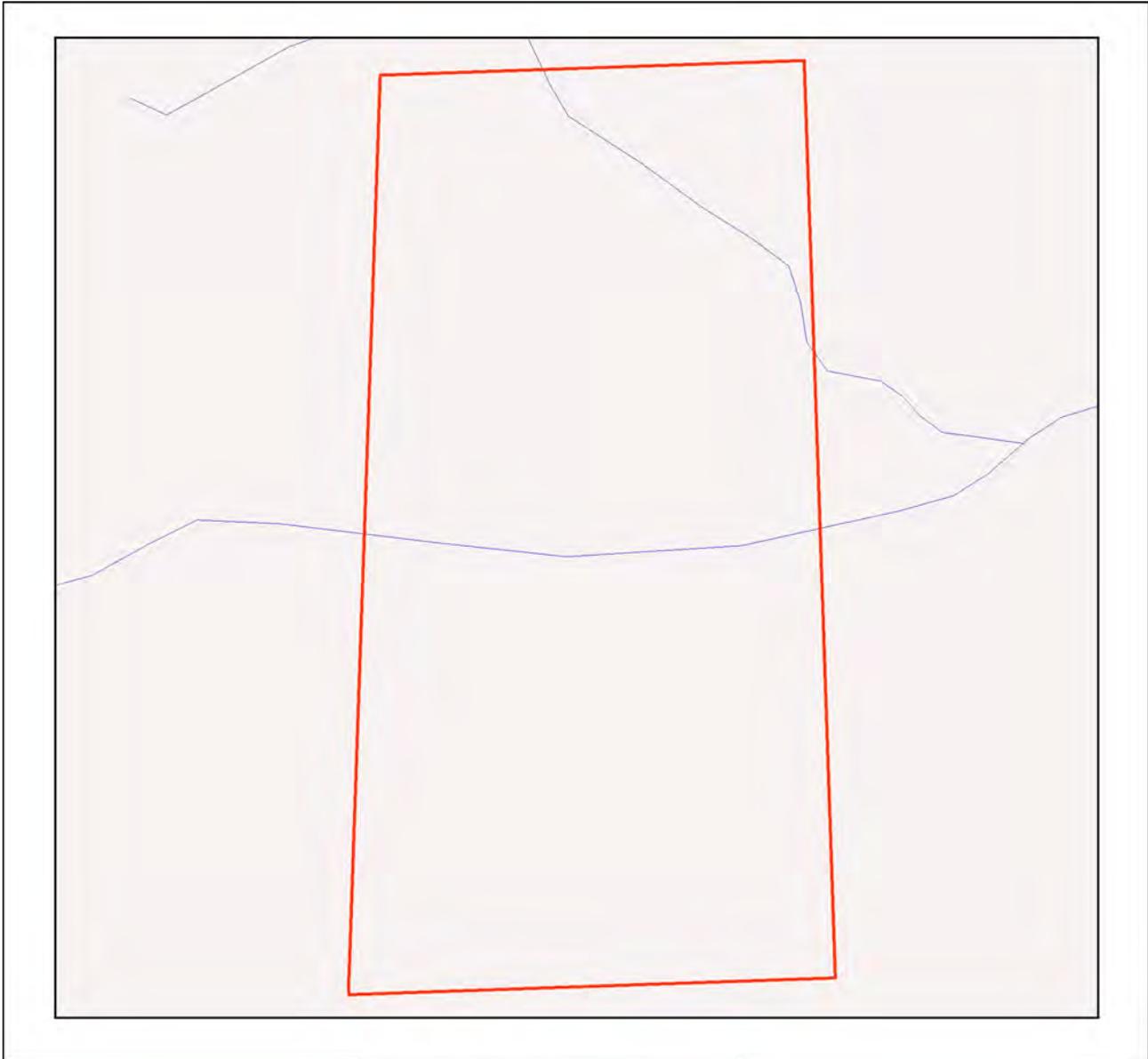
Map 2 - Biodiversity Planning Assessment (BPA)



Map 3 - Corridors



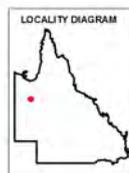
Map 4 - Wetlands and waterways



Wetlands and Waterways

Legend

- Selected Mining Lease (ML)
 - Towns
 - Roads
 - Springs
 - Rivers/Creeks
 - Directory of Important Wetlands
 - ▨ Ramsar Sites - QLD
 - Queensland
- Wetland Type**
- Marine Waterbodies
 - Estuarine Waterbodies
 - Riverine Waterbodies
 - Lacustrine Waterbodies
 - Palustrine Waterbodies
 - Marine RE
 - Estuarine RE
 - Riverine RE
 - Lacustrine RE
 - Palustrine RE
 - RE 51-80% wetland (mosaic units)
 - RE 1-50% wetland (mosaic units)



DISCLAIMER:

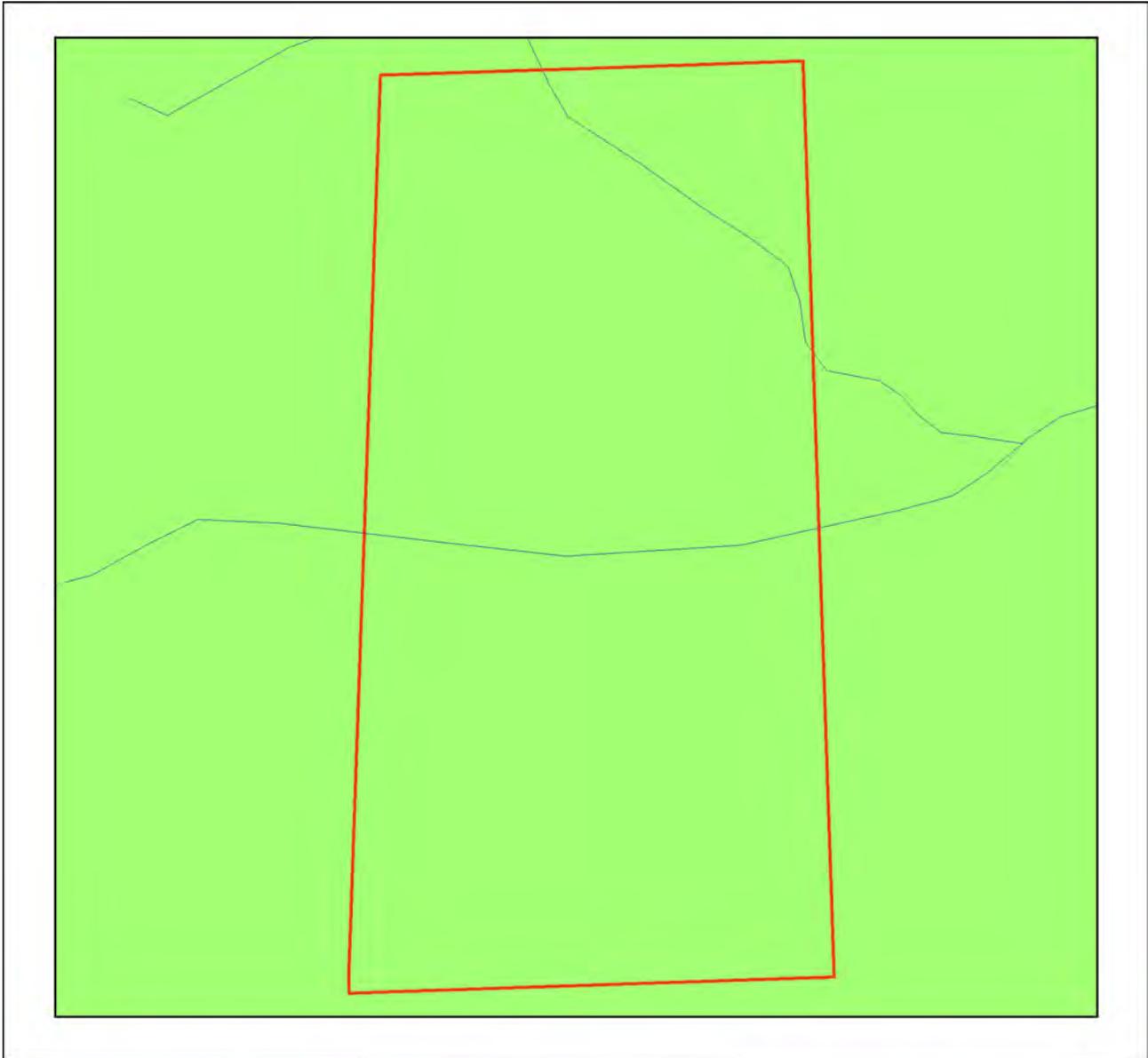
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Map 5 - Aquatic Conservation Assessment (ACA) - riverine



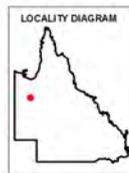
Aquatic Conservation Assessment (ACA) - riverine

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Riverine - Subcatchment Significance

- Very High
- High
- Medium
- Low
- Very Low



DISCLAIMER:

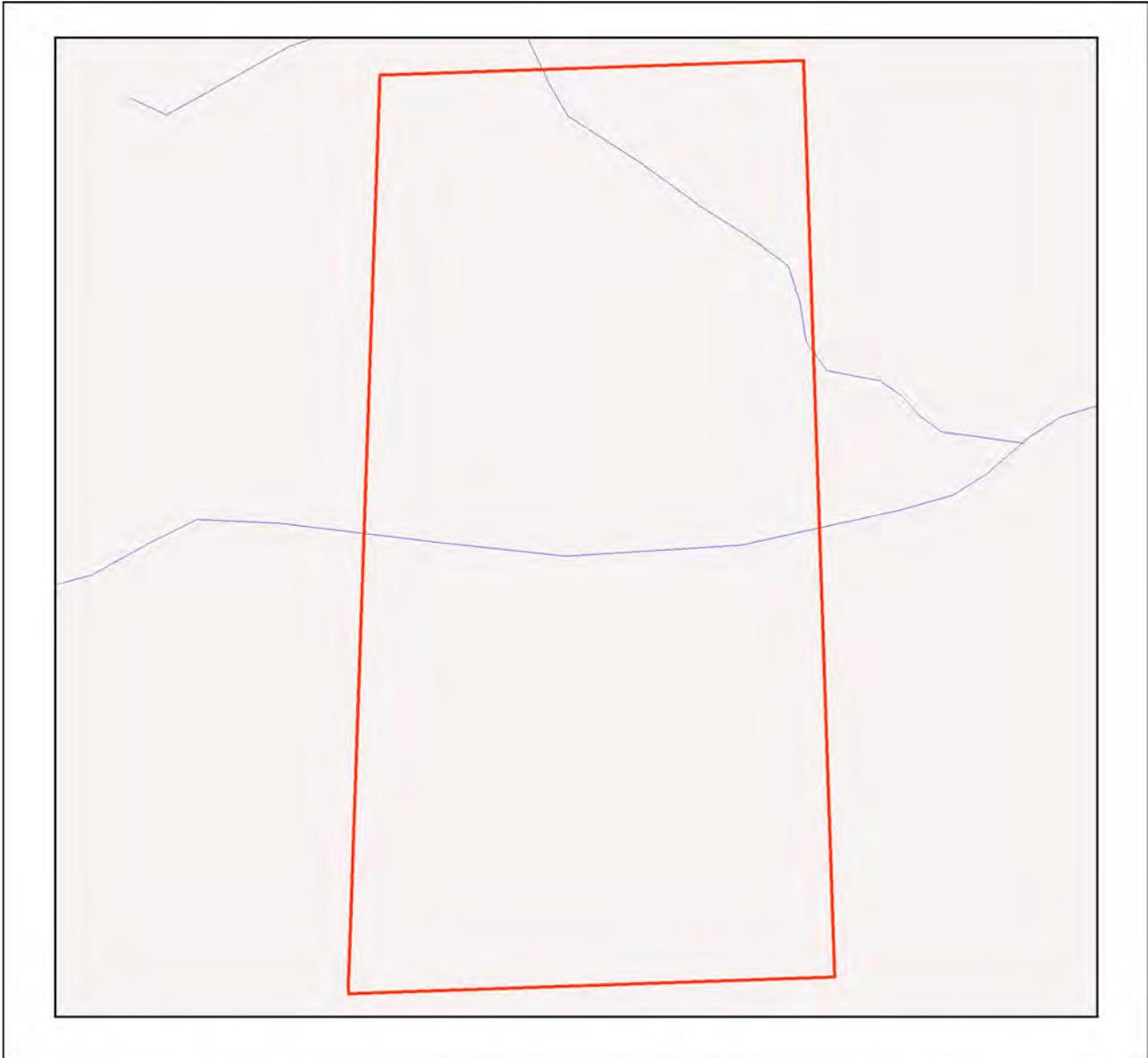
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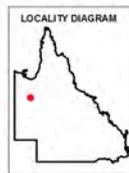
Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Rivers/Creeks
- Queensland
- ACA Non-riverine**
- Very High
- High
- Medium
- Low
- Very Low



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Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDBB Non-riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDBB Riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.

*These datasets are available at:

<http://dds.information.qld.gov.au/DDS>

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
ml: 2498

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 co-ordinates" option, the resulting assessment area encompasses an area extending from 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 1994). 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 field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: ml: 2498

Size (ha)	29.06
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Northwest Highlands v1.1
Aquatic Conservation Assessment(s) (riverine)	Eastern Gulf of Carpentaria v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Eastern Gulf of Carpentaria v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.4	1.37
Of concern	0.0	0.0
No concern at present	18.54	63.78

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	7.99	27.49
Regional	10.95	37.68
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
(No Records)	

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent

information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	29.06	100.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	7.99	27.49
Regional	10.95	37.68
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains an RE that is one of the largest of its type in the bioregion (D1) & Remnant has high connectivity or buffers an endangered RE or Sig. Wetland (G)	7.99	27.49
Regional	Remnant contains at least 1 Vulnerable or Near Threatened species (A)	10.95	37.68

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa			18.94	65.2				
B1: Ecosystem Value (Bioregion)					18.94	65.2		
B2: Ecosystem Value (Subregion)					18.94	65.2		
C: Tract Size			18.94	65.2				
D1: Relative RE Size (Bioregion)	7.99	27.5					10.95	37.7
D2: Relative RE Size (Subregion)	7.99	27.5					10.95	37.7
F: Ecosystem Diversity			7.99	27.5	10.95	37.7		
G: Context and Connection	18.94	65.2						

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

(No Records)

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al.* 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to assess overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa								
Ia: Centres of Endemism								
Ib: Wildlife Refugia								
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
lh: Artificial Wetland								
li: Hollow Bearing Trees								
lj: Breeding or Roosting Site								
lk: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

- Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;
- Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- Maintaining large scale seasonal/migratory species processes and movement of fauna;
- Maximising connectivity between large tracts/patches of remnant vegetation;
- Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

- Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);
- Follow major watershed/catchment and/or coastal boundaries;
- Incorporate major altitudinal/geological/climatic gradients;
- Include and maximise connectivity between large tracts/patches of remnant vegetation;
- Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

- Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	0.0	0.0
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

(No Records)

Expert panel decision descriptions:

(No Records)

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in Queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning processes

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at *Wetland Info*:

<http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	29.06	100.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					29.06	100.0		
2. Naturalness catchment					29.06	100.0		
3. Diversity and richness			29.06	100.0				
4. Threatened species and ecosystems	29.06	100.0						
5. Priority species and ecosystems			29.06	100.0				
6. Special features								
7. Connectivity								
8. Representativeness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
(No Records)								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, HerbreCs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		Low			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

*JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species.

**I - wetland indicator species; D - wetland dependent species.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Amytornis ballarae</i>	Kalkadoon grasswren	H	FA
<i>Artamus cinereus</i>	black-faced woodswallow	None	FA

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Barnardius zonarius macgillivrayi</i>	Cloncurry parrot	L	FA
<i>Ctenotus decaneurus</i>	ten-lined ctenotus	L	FA
<i>Ctenotus striaticeps</i>	stripe-headed finesnout ctenotus	L	FA
<i>Egernia hosmeri</i>	Hosmer's skink	DD	FA
<i>Gehyra robusta</i>	robust dtella	L	FA
<i>Heteromunia pectoralis</i>	pictorella mannikin	L	FA
<i>Neosilurus hyrtlil</i>	Hyrtl's catfish	L	FA
<i>Varanus mertensi</i>	Mertens' water monitor	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. Furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

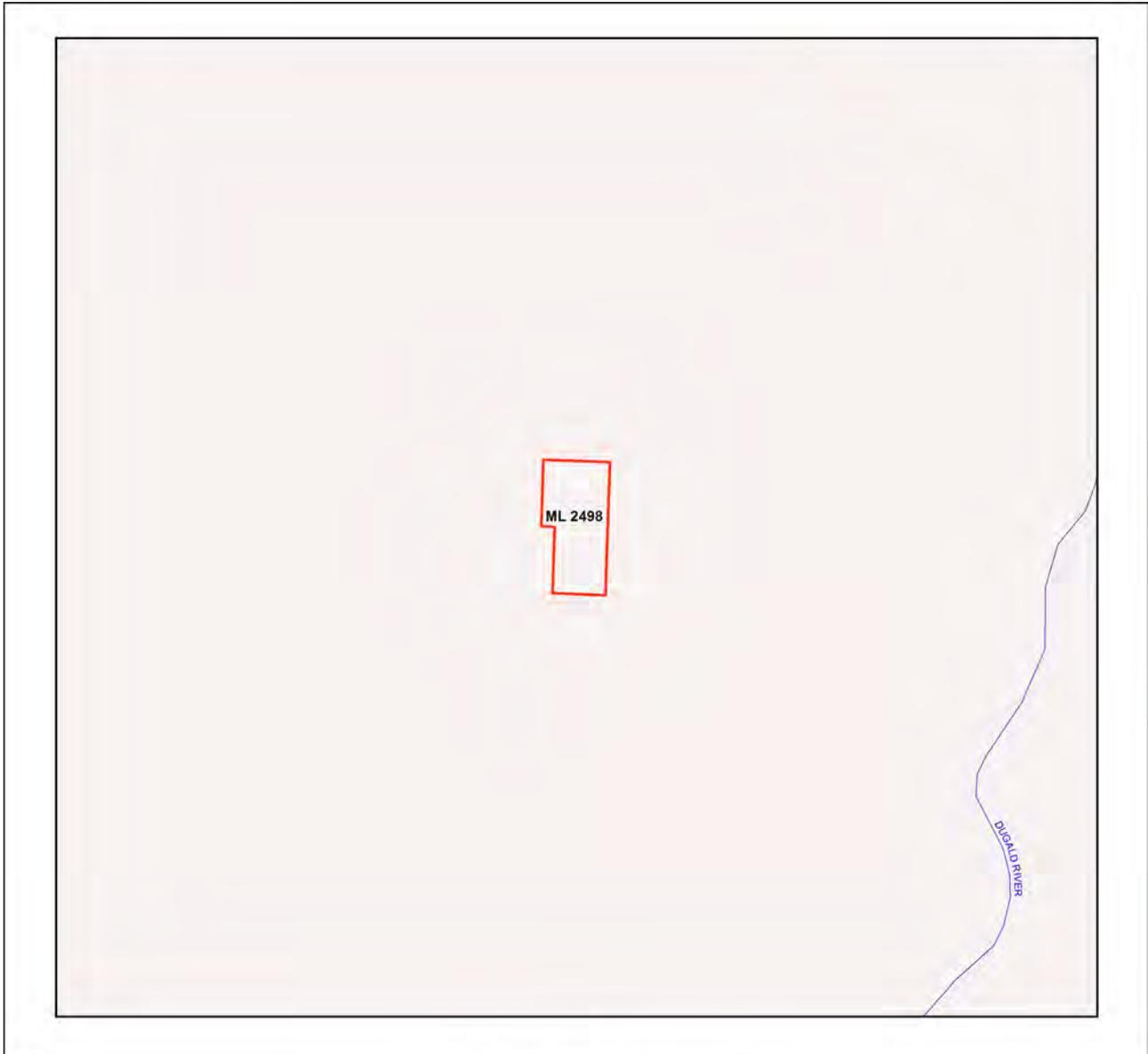
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

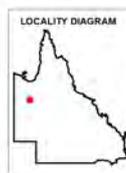
Map 1 - Locality Map



Locality Map

Legend

- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland

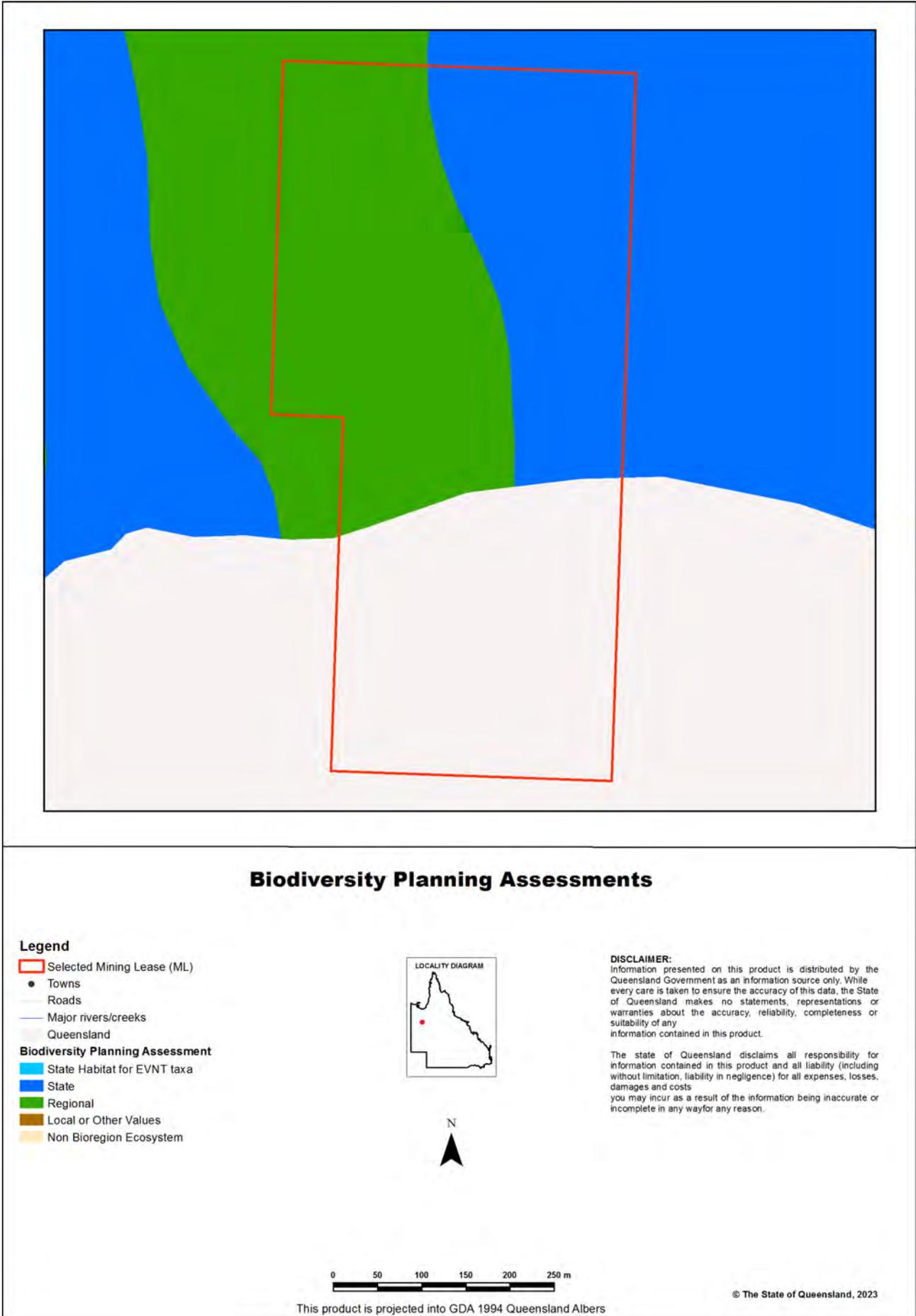


DISCLAIMER:

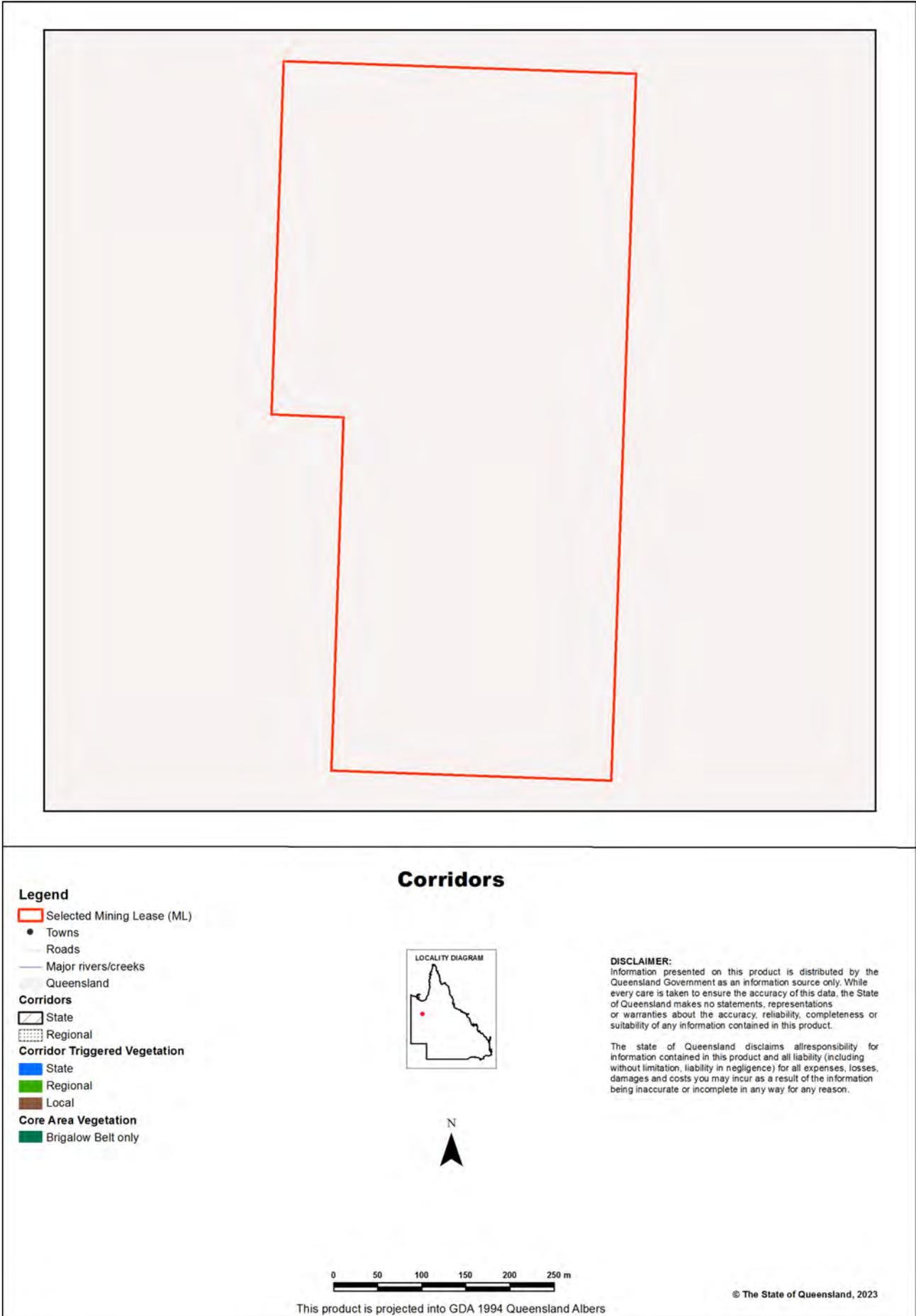
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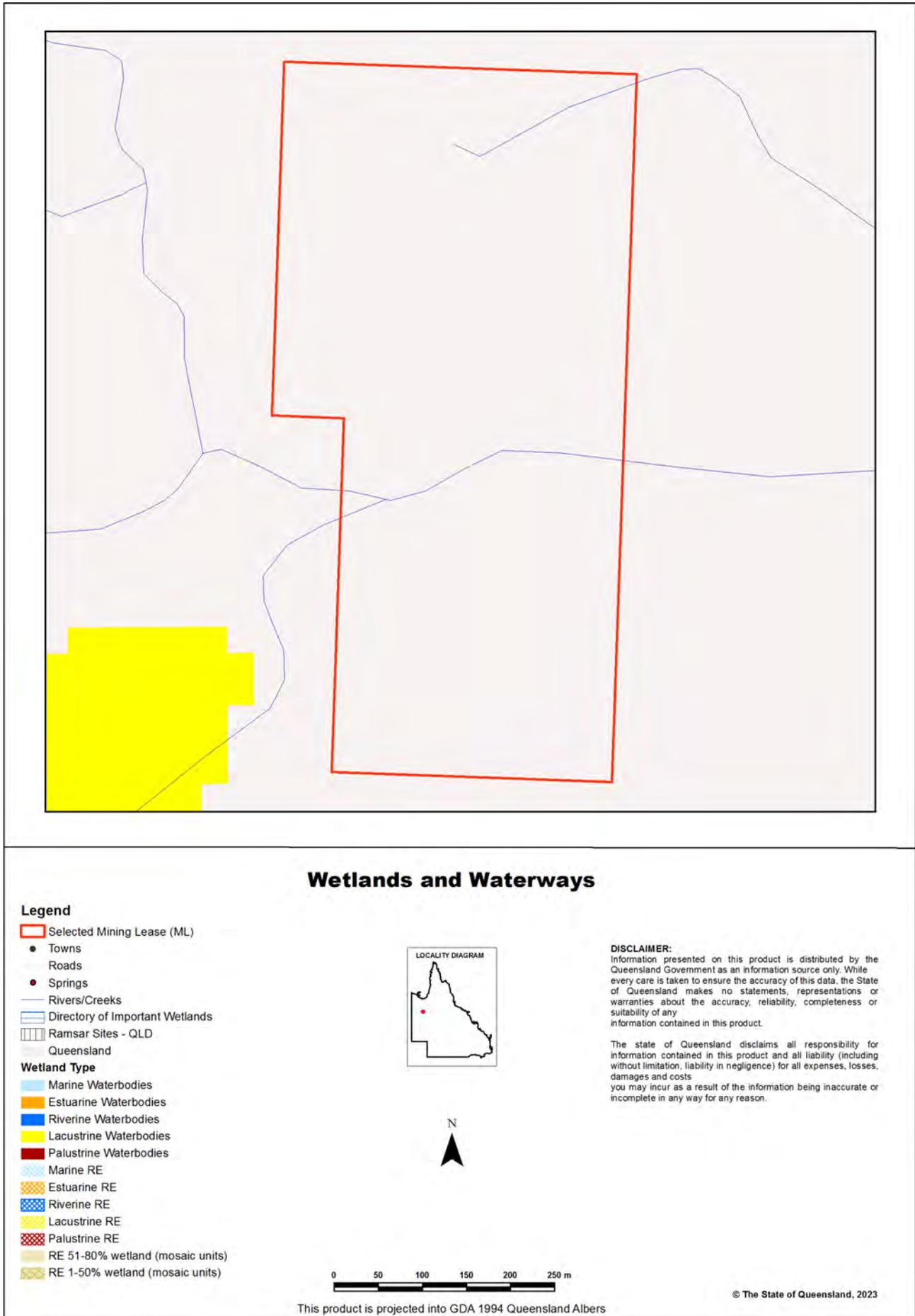
Map 2 - Biodiversity Planning Assessment (BPA)



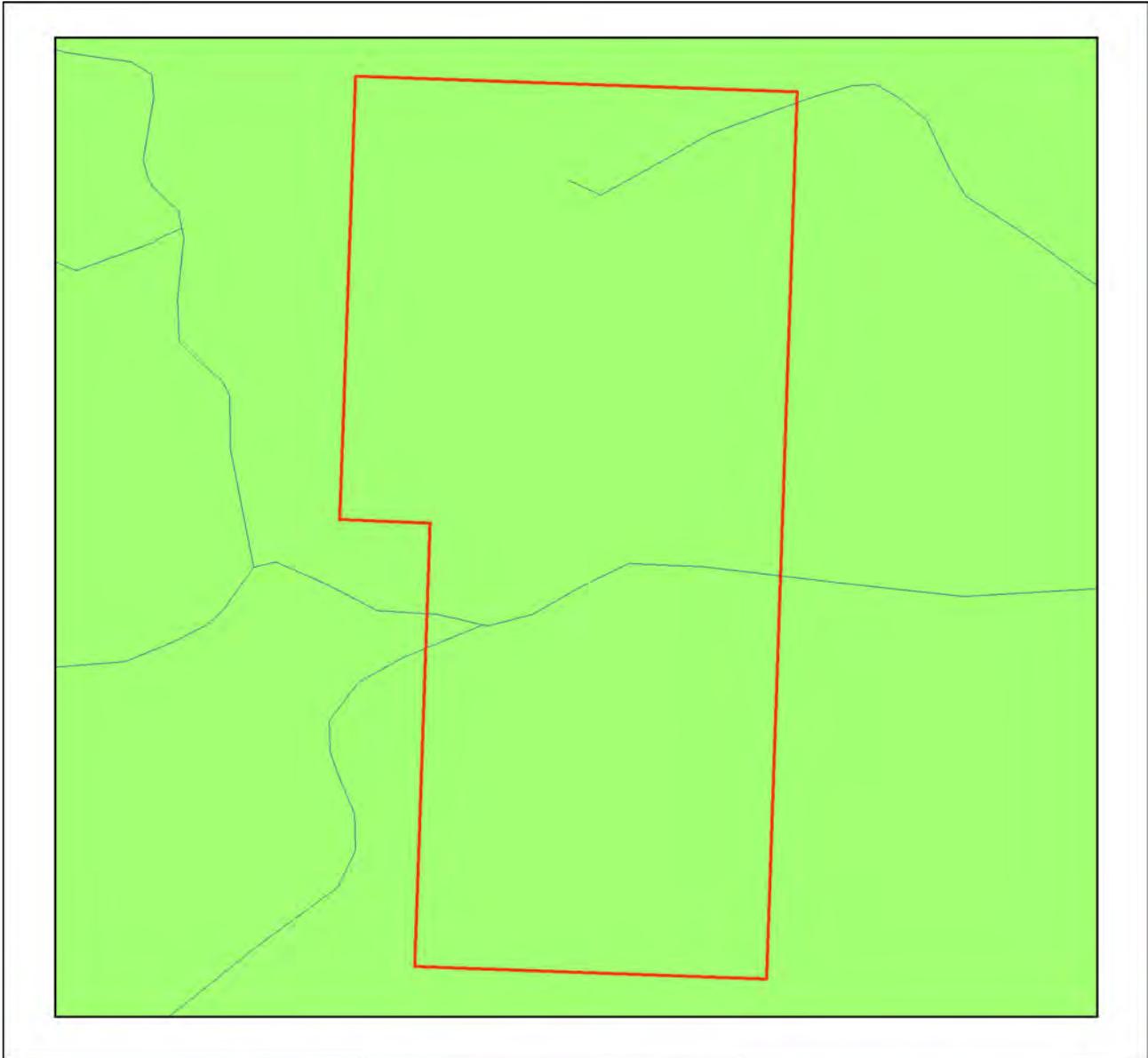
Map 3 - Corridors



Map 4 - Wetlands and waterways



Map 5 - Aquatic Conservation Assessment (ACA) - riverine



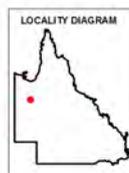
Aquatic Conservation Assessment (ACA) - riverine

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Riverine - Subcatchment Significance

- Very High
- High
- Medium
- Low
- Very Low



This product is projected into GDA 1994 Queensland Albers

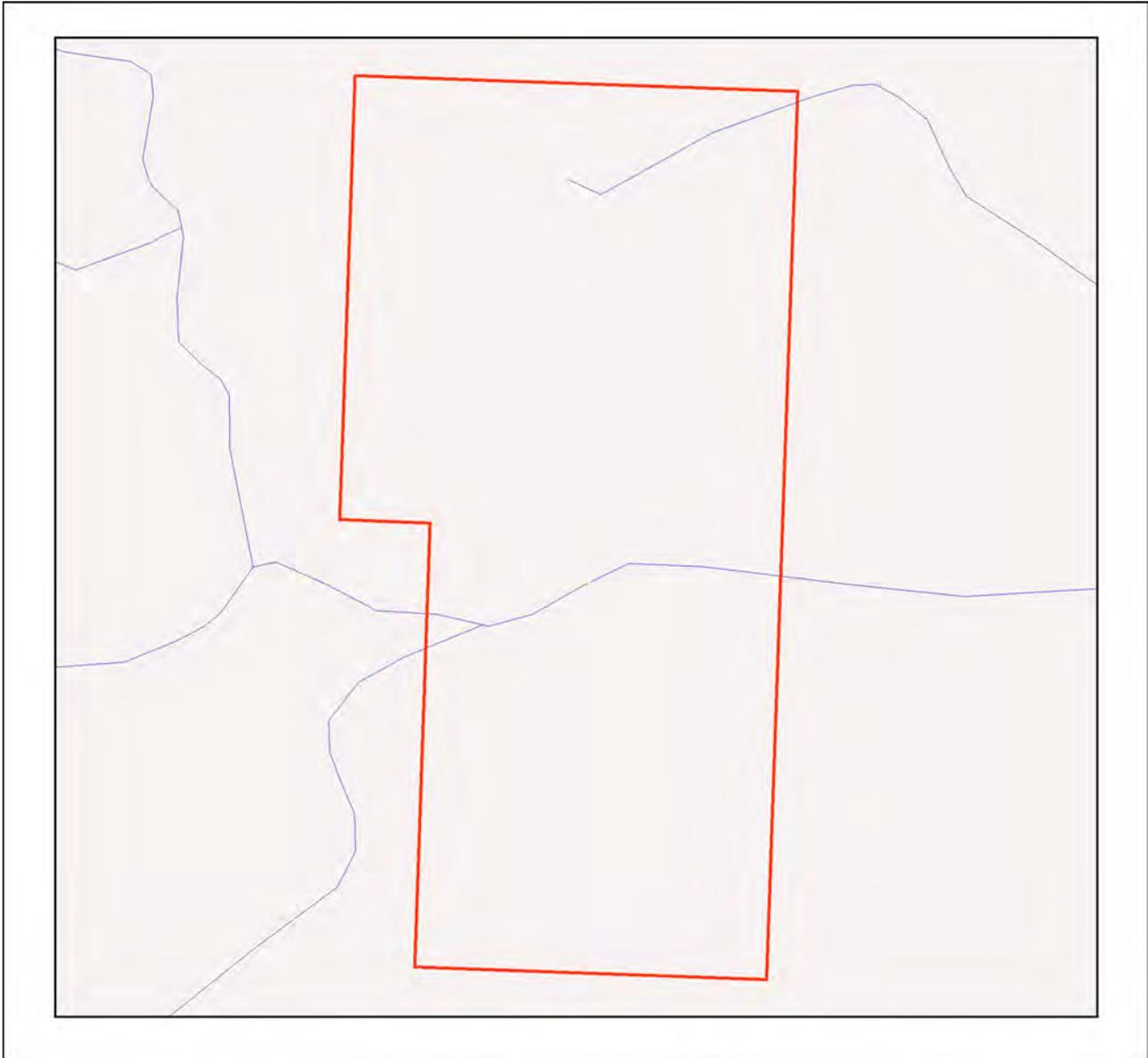
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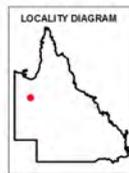
Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Rivers/Creeks
- Queensland
- ACA Non-riverine**
- Very High
- High
- Medium
- Low
- Very Low



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Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDBB Non-riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDBB Riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.

*These datasets are available at:

<http://dds.information.qld.gov.au/DDS>

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
ml: 2470

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 co-ordinates" option, the resulting assessment area encompasses an area extending from 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 1994). 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 field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: ml: 2470

Size (ha)	16.19
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Northwest Highlands v1.1
Aquatic Conservation Assessment(s) (riverine)	Eastern Gulf of Carpentaria v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Eastern Gulf of Carpentaria v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.22	1.37
Of concern	0.0	0.0
No concern at present	6.19	38.21

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	4.42	27.3
Regional	1.99	12.29
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
(No Records)	

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent

information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	16.19	100.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	4.42	27.3
Regional	1.99	12.29
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains an RE that is one of the largest of its type in the bioregion (D1) & Remnant has high connectivity or buffers an endangered RE or Sig. Wetland (G)	4.42	27.3
Regional	Remnant contains at least 1 Vulnerable or Near Threatened species (A)	1.99	12.29

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa			6.4	39.5				
B1: Ecosystem Value (Bioregion)					6.4	39.5		
B2: Ecosystem Value (Subregion)					6.4	39.5		
C: Tract Size			6.4	39.5				
D1: Relative RE Size (Bioregion)	4.42	27.3					1.98	12.2
D2: Relative RE Size (Subregion)	4.42	27.3					1.98	12.2
F: Ecosystem Diversity			4.42	27.3	1.98	12.2		
G: Context and Connection	6.4	39.5						

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

(No Records)

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al.* 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to assess overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa								
Ia: Centres of Endemism								
Ib: Wildlife Refugia								
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
lh: Artificial Wetland								
li: Hollow Bearing Trees								
lj: Breeding or Roosting Site								
lk: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

- Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;
- Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- Maintaining large scale seasonal/migratory species processes and movement of fauna;
- Maximising connectivity between large tracts/patches of remnant vegetation;
- Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

- Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);
- Follow major watershed/catchment and/or coastal boundaries;
- Incorporate major altitudinal/geological/climatic gradients;
- Include and maximise connectivity between large tracts/patches of remnant vegetation;
- Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

- Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	0.0	0.0
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

(No Records)

Expert panel decision descriptions:

(No Records)

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in Queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning processes

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at *Wetland Info*:

<http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	16.19	100.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					16.19	100.0		
2. Naturalness catchment					16.19	100.0		
3. Diversity and richness			16.19	100.0				
4. Threatened species and ecosystems	16.19	100.0						
5. Priority species and ecosystems			16.19	100.0				
6. Special features								
7. Connectivity								
8. Representativeness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
(No Records)								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, HerbreCs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		Low			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

*JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species.

**I - wetland indicator species; D - wetland dependent species.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Amytornis ballarae</i>	Kalkadoon grasswren	H	FA
<i>Artamus cinereus</i>	black-faced woodswallow	None	FA

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Barnardius zonarius macgillivrayi</i>	Cloncurry parrot	L	FA
<i>Ctenotus decaneurus</i>	ten-lined ctenotus	L	FA
<i>Ctenotus striaticeps</i>	stripe-headed finesnout ctenotus	L	FA
<i>Egernia hosmeri</i>	Hosmer's skink	DD	FA
<i>Gehyra robusta</i>	robust dtella	L	FA
<i>Heteromunia pectoralis</i>	pictorella mannikin	L	FA
<i>Neosilurus hyrtlil</i>	Hyrtl's catfish	L	FA
<i>Varanus mertensi</i>	Mertens' water monitor	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. Furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

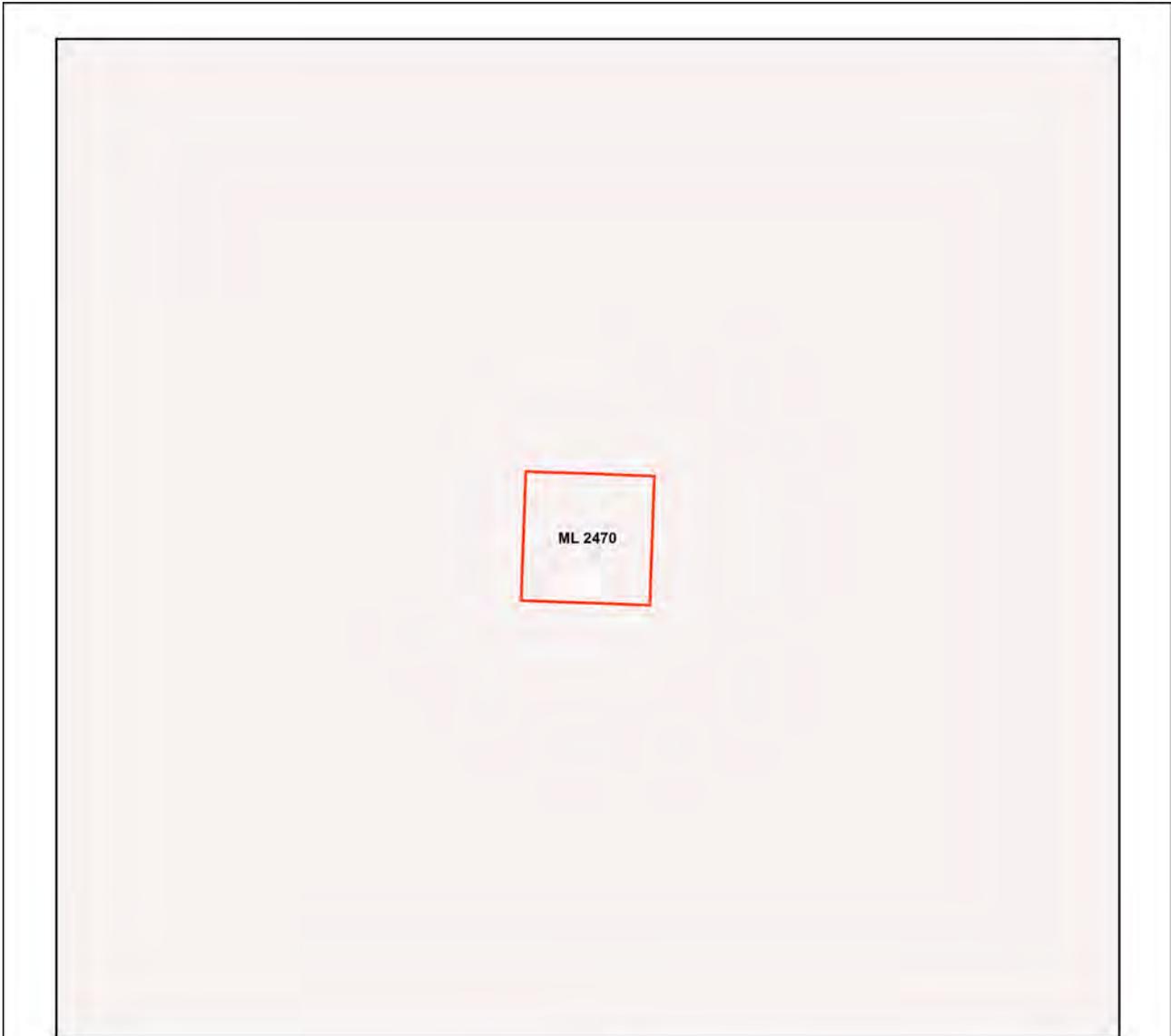
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Leiopotherapon unicolor</i>	Spangled Perch	Low	FA
<i>Varanus mertensi</i>	Mertens' Water Monitor	Low	FA

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

Map 1 - Locality Map



Locality Map

Legend

- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



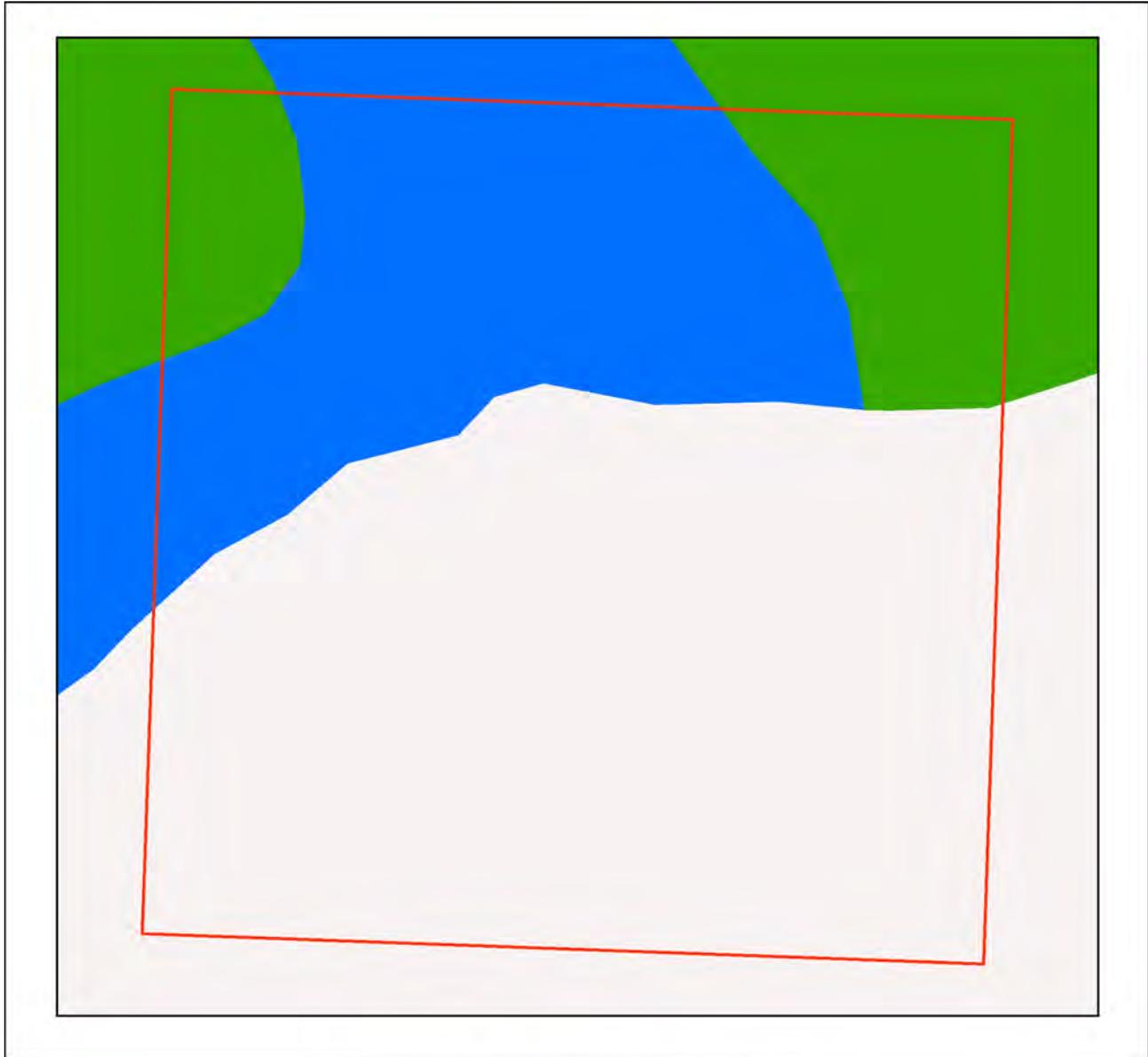
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Map 2 - Biodiversity Planning Assessment (BPA)



Biodiversity Planning Assessments

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Major rivers/creeks
- Queensland

Biodiversity Planning Assessment

- State Habitat for EVNT tax
- State
- Regional
- Local or Other Values
- Non Bioregion Ecosystem



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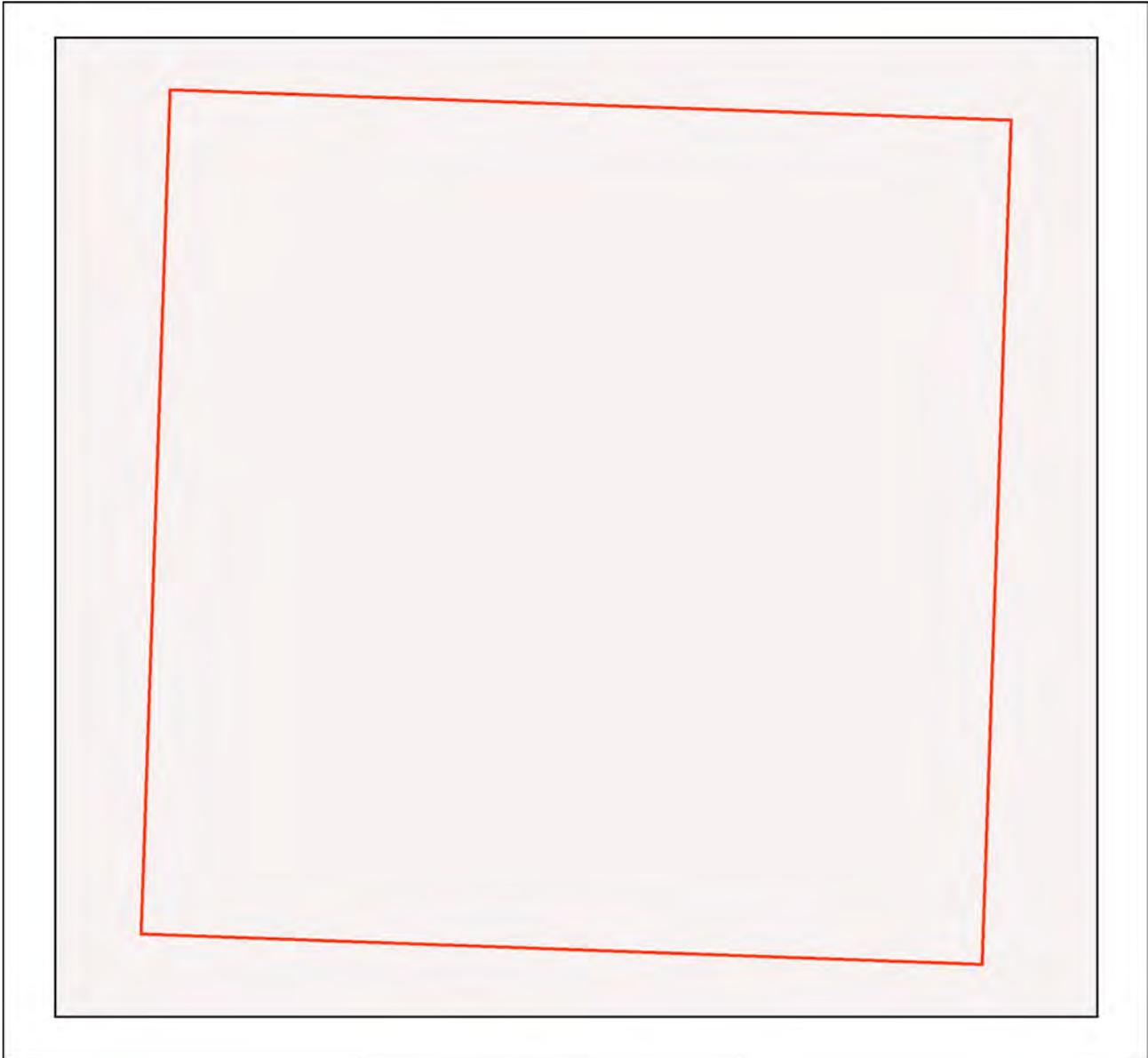
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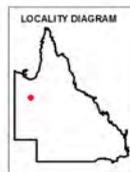
Map 3 - Corridors



Corridors

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Major rivers/creeks
- Queensland
- Corridors**
- State
- Regional
- Corridor Triggered Vegetation**
- State
- Regional
- Local
- Core Area Vegetation**
- Brigalow Belt only



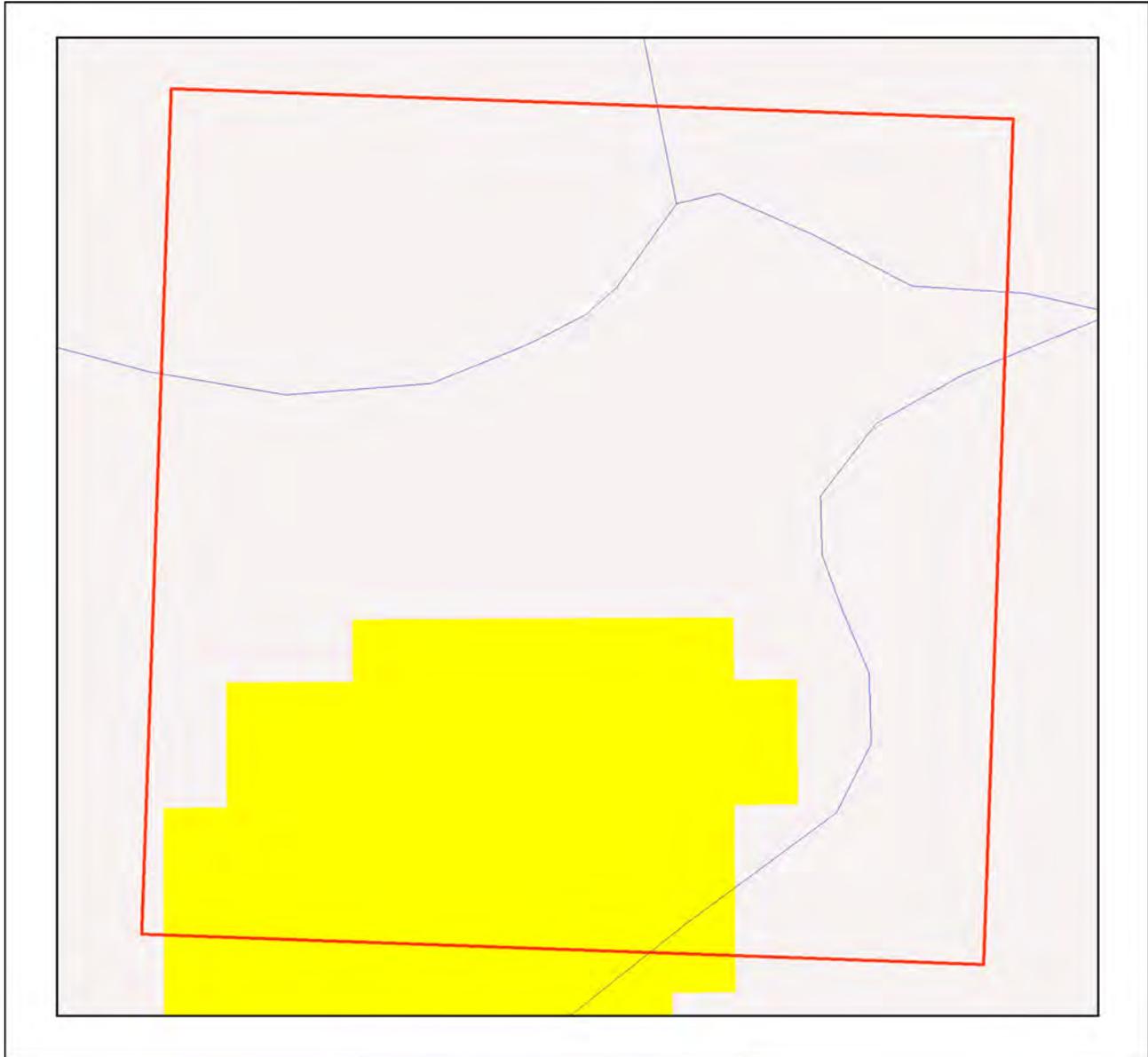
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Map 4 - Wetlands and waterways



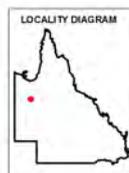
Wetlands and Waterways

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Springs
- Rivers/Creeks
- Directory of Important Wetlands
- ▨ Ramsar Sites - QLD
- Queensland

Wetland Type

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



This product is projected into GDA 1994 Queensland Albers

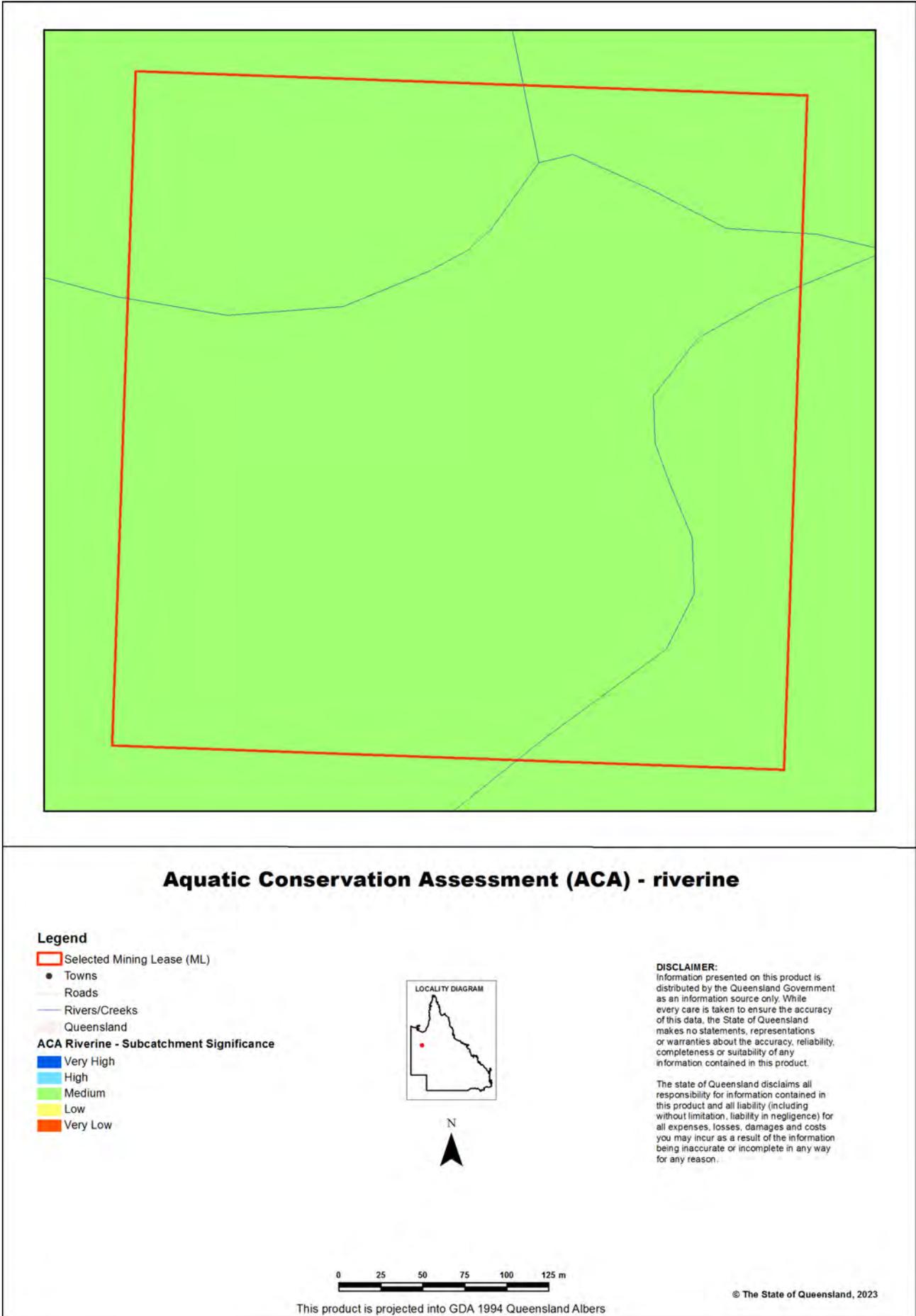
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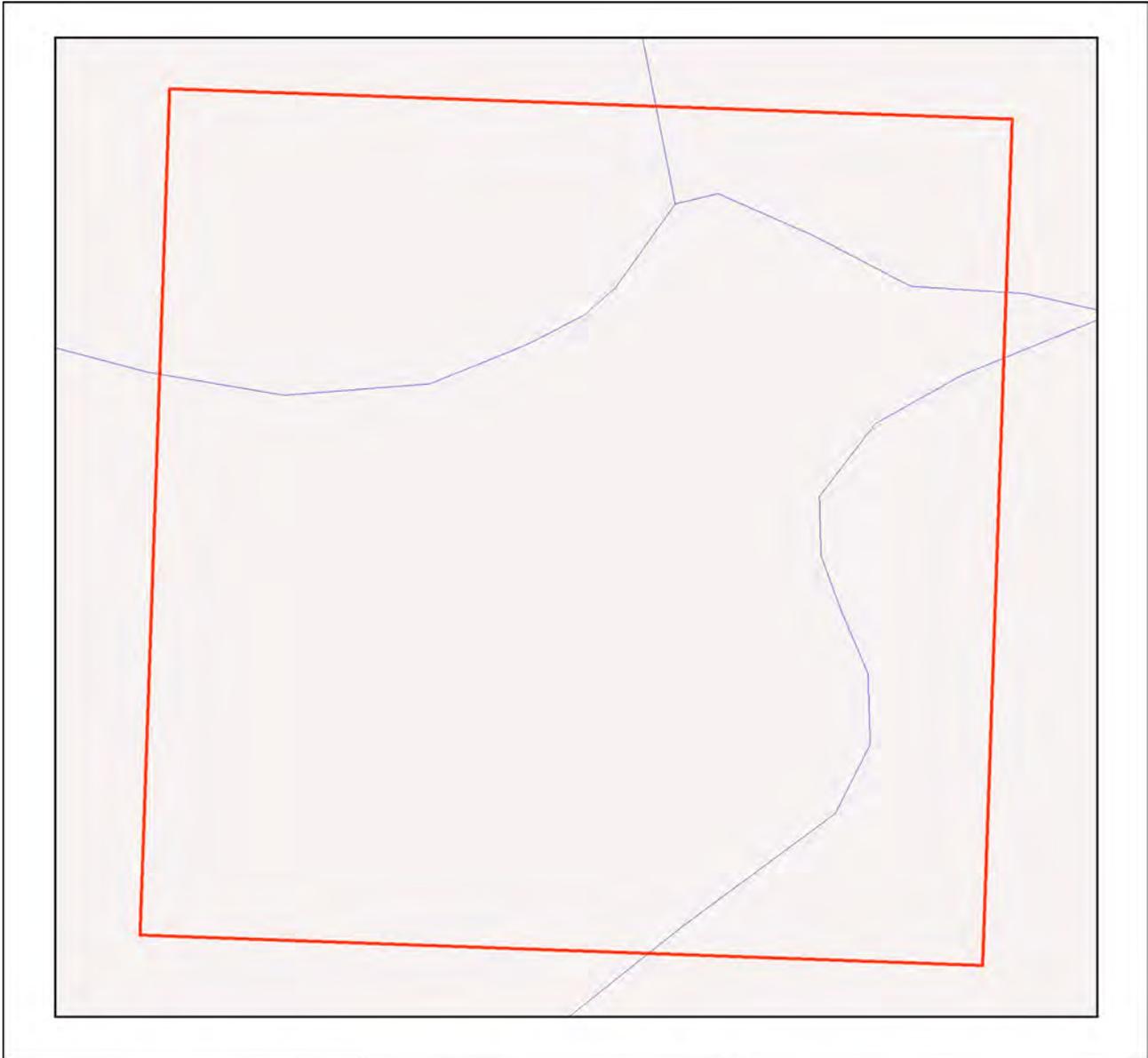
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Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- Selected Mining Lease (ML)
- Towns
- Roads
- Rivers/Creeks
- Queensland
- ACA Non-riverine**
- Very High
- High
- Medium
- Low
- Very Low



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Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDBB Non-riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDBB Riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.

*These datasets are available at:

<http://dds.information.qld.gov.au/DDS>

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
ml: 2499

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 co-ordinates" option, the resulting assessment area encompasses an area extending from 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 1994). 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 field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: ml: 2499

Size (ha)	28.08
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Northwest Highlands v1.1
Aquatic Conservation Assessment(s) (riverine)	Eastern Gulf of Carpentaria v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Eastern Gulf of Carpentaria v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.12	0.43
Of concern	0.0	0.0
No concern at present	13.07	46.53

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	2.43	8.65
Regional	10.76	38.32
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
(No Records)	

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent

information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	28.08	100.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	0.0	0.0
State	2.43	8.65
Regional	10.76	38.32
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains an RE that is one of the largest of its type in the bioregion (D1) & Remnant has high connectivity or buffers an endangered RE or Sig. Wetland (G)	2.43	8.65
Regional	Remnant contains at least 1 Vulnerable or Near Threatened species (A)	10.76	38.32

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa			13.19	47.0				
B1: Ecosystem Value (Bioregion)					13.19	47.0		
B2: Ecosystem Value (Subregion)					13.19	47.0		
C: Tract Size			13.19	47.0				
D1: Relative RE Size (Bioregion)	2.43	8.7					10.76	38.3
D2: Relative RE Size (Subregion)	2.43	8.7					10.76	38.3
F: Ecosystem Diversity			2.43	8.7	10.76	38.3		
G: Context and Connection	13.19	47.0						

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

(No Records)

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al.* 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to assess overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa								
Ia: Centres of Endemism								
Ib: Wildlife Refugia								
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
lh: Artificial Wetland								
li: Hollow Bearing Trees								
lj: Breeding or Roosting Site								
lk: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

- Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;
- Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- Maintaining large scale seasonal/migratory species processes and movement of fauna;
- Maximising connectivity between large tracts/patches of remnant vegetation;
- Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

- Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);
- Follow major watershed/catchment and/or coastal boundaries;
- Incorporate major altitudinal/geological/climatic gradients;
- Include and maximise connectivity between large tracts/patches of remnant vegetation;
- Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

- Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	0.0	0.0
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

(No Records)

Expert panel decision descriptions:

(No Records)

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in Queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning processes

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at *Wetland Info*:

<http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca>

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

<http://qspatial.information.qld.gov.au/geoportal/>

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	28.08	100.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					28.08	100.0		
2. Naturalness catchment					28.08	100.0		
3. Diversity and richness			28.08	100.0				
4. Threatened species and ecosystems	28.08	100.0						
5. Priority species and ecosystems			28.08	100.0				
6. Special features								
7. Connectivity								
8. Representativeness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
(No Records)								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, HerbreCs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
<i>Petrogale purpureicollis</i>	purple-necked rock-wallaby	V		Low			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

*JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species.

**I - wetland indicator species; D - wetland dependent species.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Amytornis ballarae</i>	Kalkadoon grasswren	H	FA
<i>Barnardius zonarius macgillivrayi</i>	Cloncurry parrot	L	FA
<i>Ctenotus decaneurus</i>	ten-lined ctenotus	L	FA

Species	Common name	Back on Track rank	Identified flora/fauna
<i>Ctenotus striaticeps</i>	stripe-headed finesnout ctenotus	L	FA
<i>Cyperus cunninghamii</i> subsp. <i>cheradicus</i>	None	None	FL
<i>Egernia hosmeri</i>	Hosmer's skink	DD	FA
<i>Neosilurus hyrtlii</i>	Hyrtl's catfish	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. Furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

(no results)

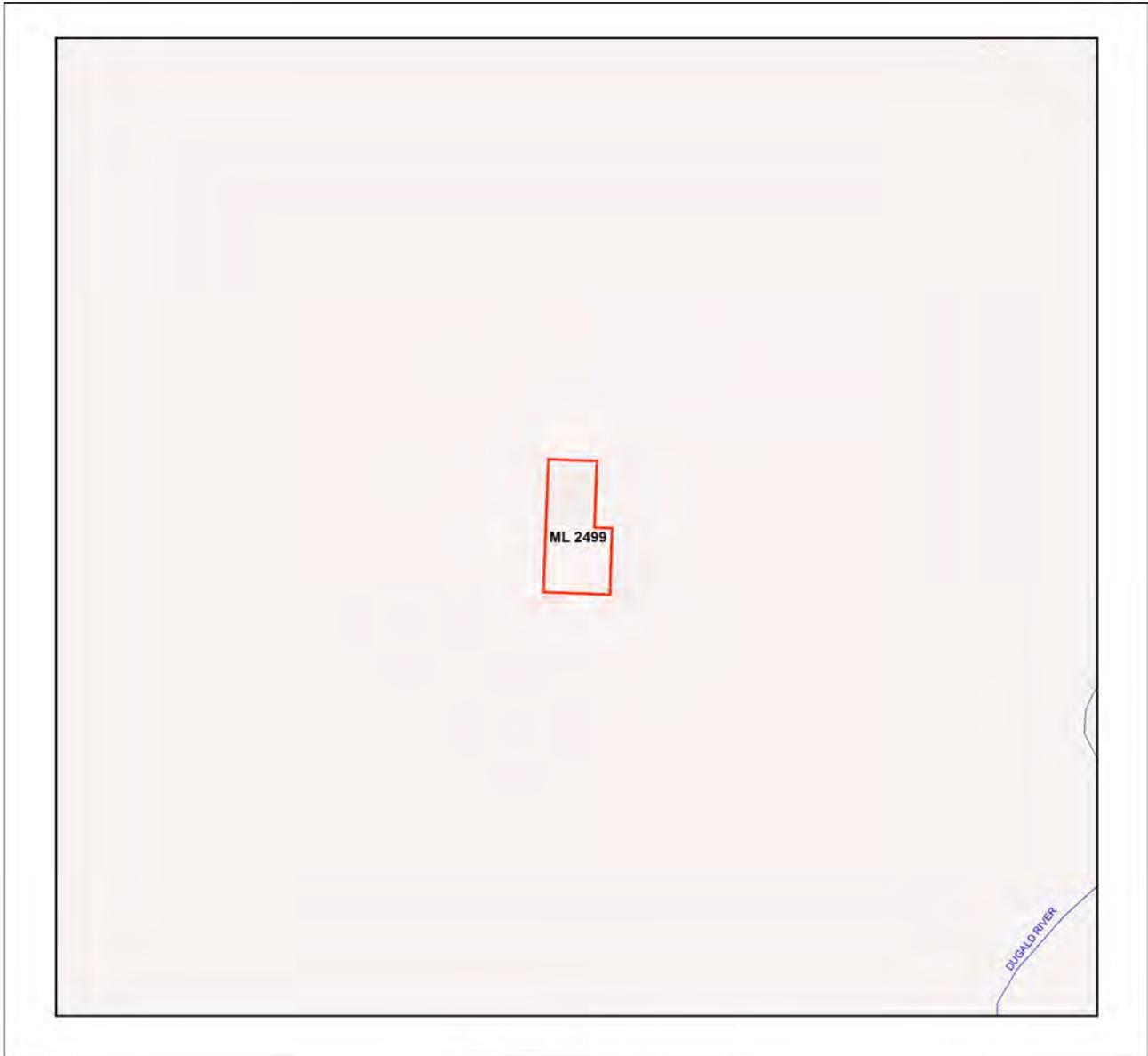
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

(no results)

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

Map 1 - Locality Map



Locality Map

Legend

- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland

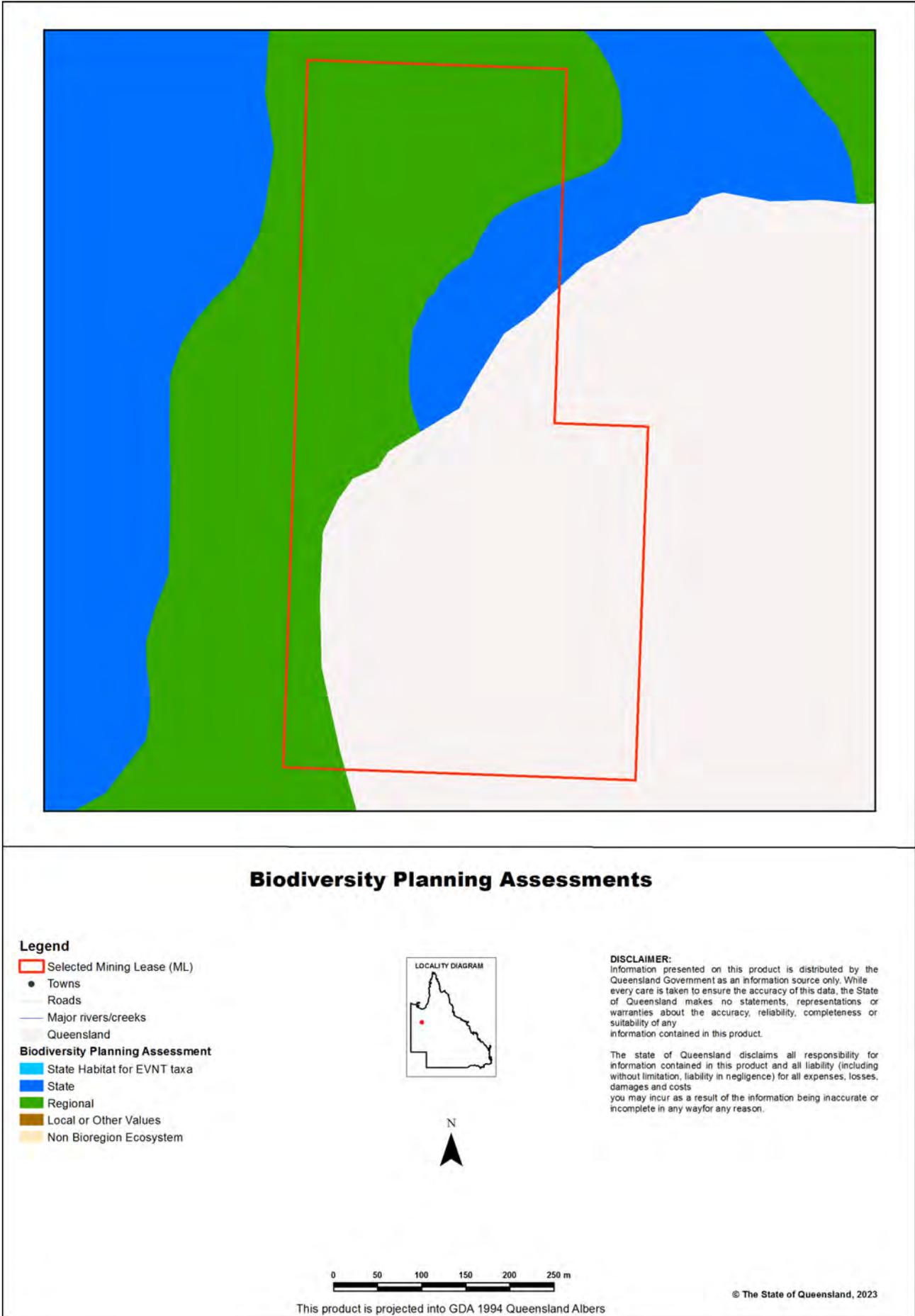


DISCLAIMER:

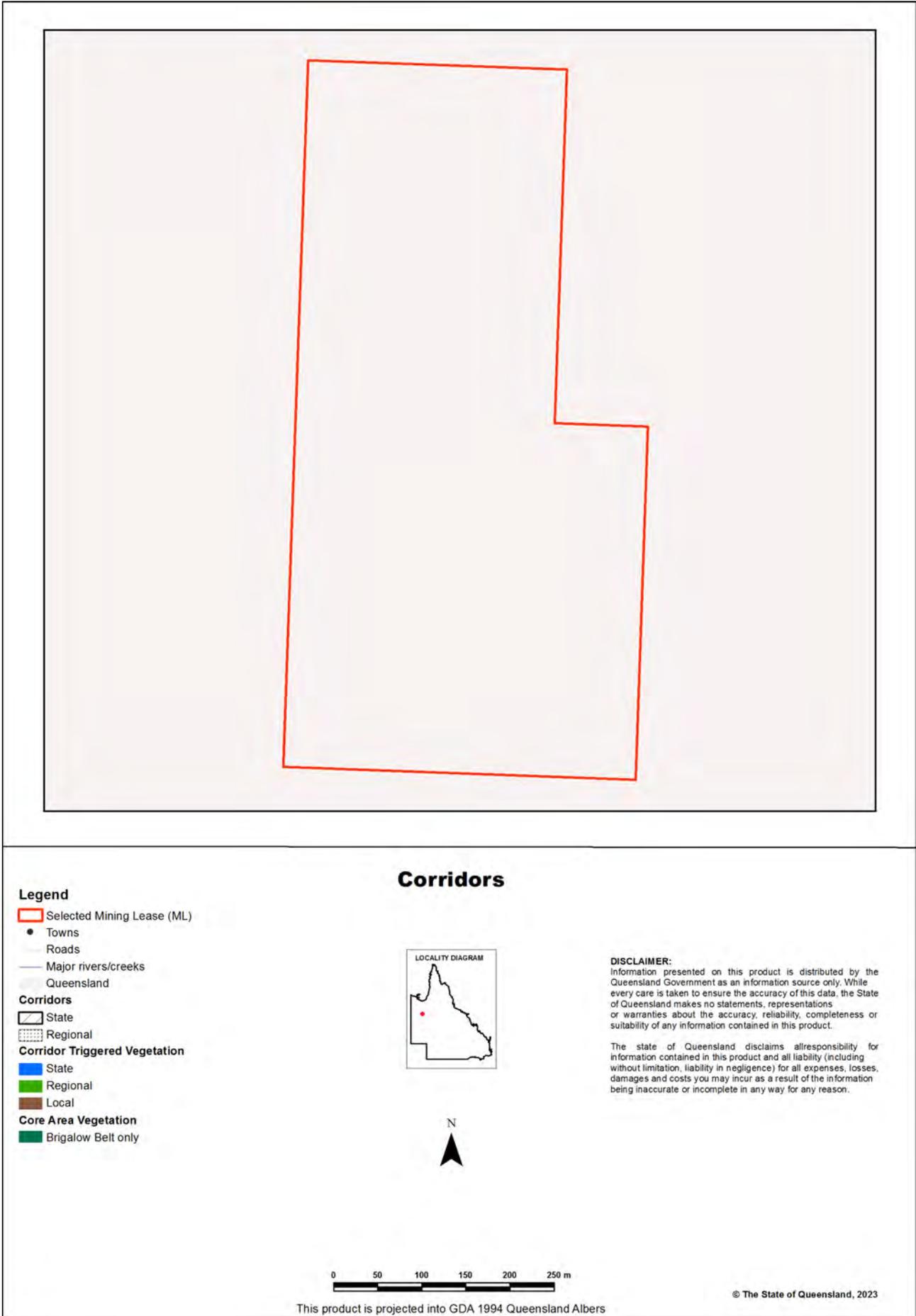
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

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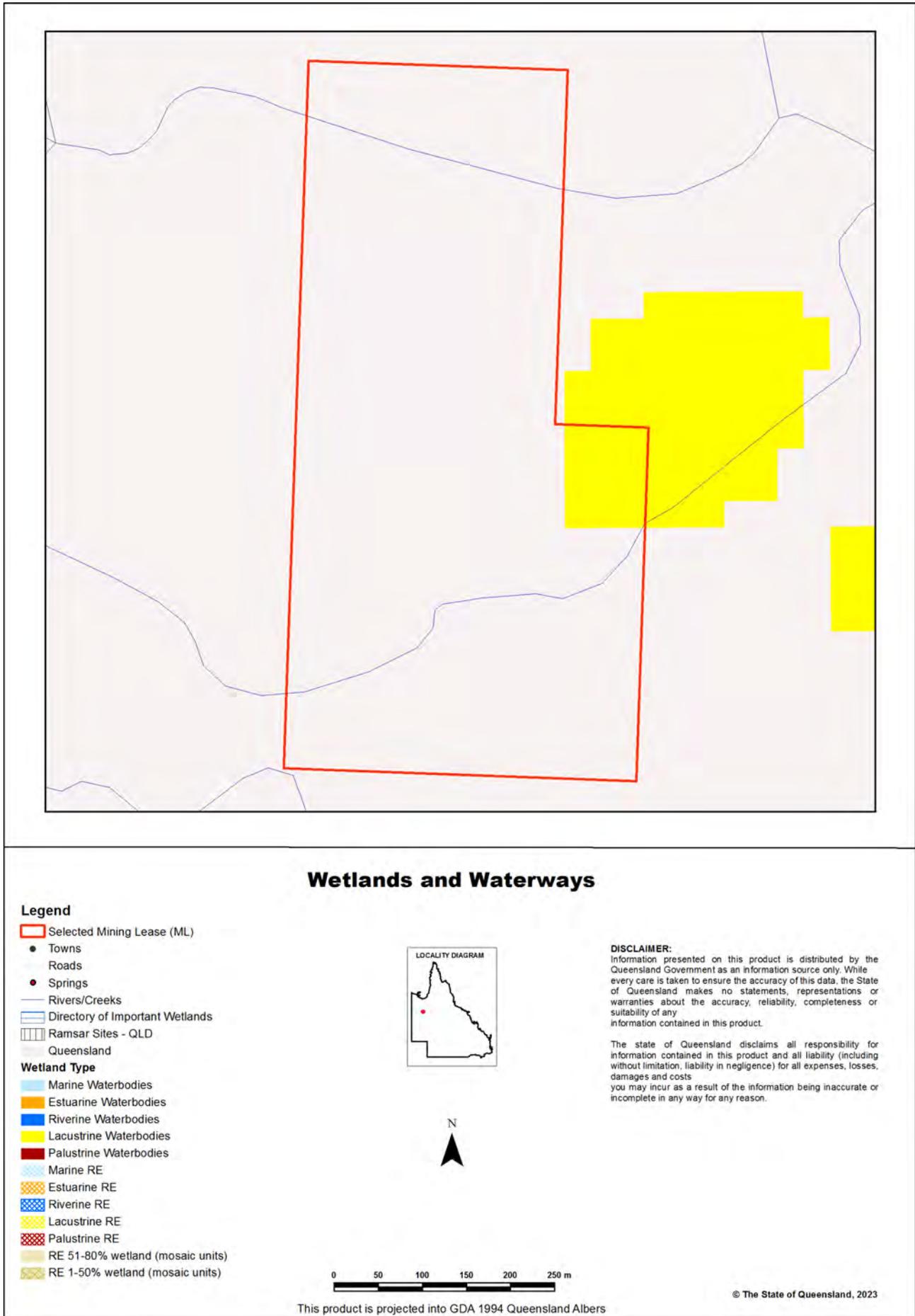
Map 2 - Biodiversity Planning Assessment (BPA)



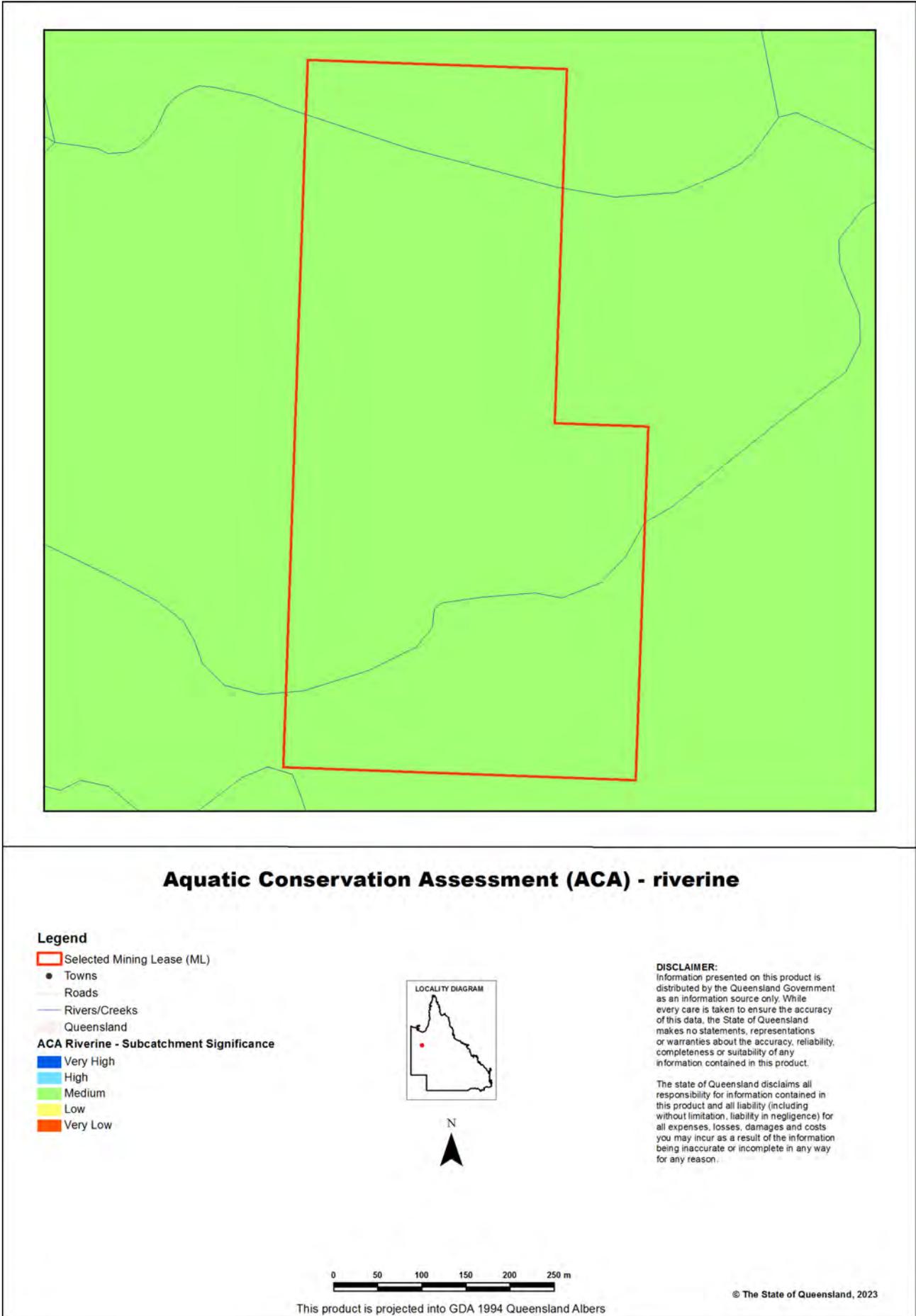
Map 3 - Corridors



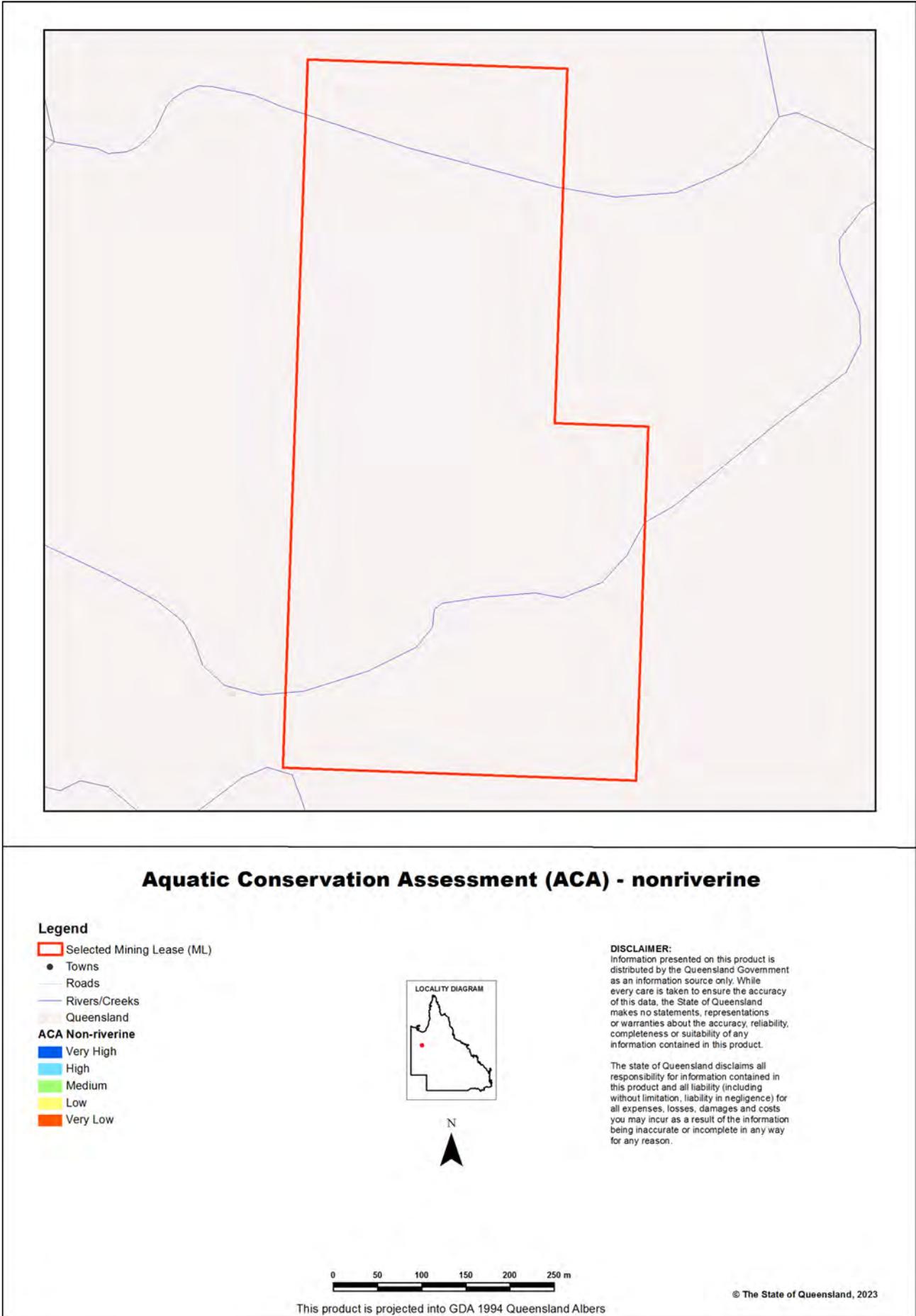
Map 4 - Wetlands and waterways



Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



References

Clayton, P.D., Fielder, D.F., Howell, S. and Hill, C.J. (2006) *Aquatic biodiversity assessment and mapping method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment*. Published by the Environmental Protection Agency, Brisbane. ISBN 1-90928-07-3. Available at

<http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca/>

Environment and Heritage Protection 2014, *Biodiversity Assessment and Mapping Methodology*. Version 2.2. Department of Environment and Heritage Protection, Brisbane.

Morton, S. R., Short, J. and Barker, R. D. with an Appendix by G.F. Griffin and G. Pearce (1995). *Refugia for Biological Diversity in Arid and Semi-arid Australia*. *Biodiversity Series*, Paper No. 4, Biodiversity Unit, Environment Australia.

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDBB Non-riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDBB Riverine ACA v2.1 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecks, Corveg, the QLD Museum, as well as other incidental sources.

*These datasets are available at:

<http://dds.information.qld.gov.au/DDS>

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



**APPENDIX D – ENVIRONMENTAL REPORTS – REGIONAL ECOSYSTEMS –
BIODIVERSITY STATUS**



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 2601

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 input coordinates.

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 1994). 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 matters of interest have been identified within the site.

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

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website <https://www.resources.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: ml: 2601

Size (ha)	28.5
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.8	2.82
Of concern	0.0	0.0
No concern at present	15.29	53.65
Total remnant vegetation	16.1	56.48

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2022) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

<https://www.resources.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
1.11.2a	Eucalyptus leucophloia low open woodland	No concern at present	11.27	39.53
1.3.7b	Eucalyptus camaldulensis woodland on channels and levees	Endangered	0.8	2.82
1.5.13	Eucalyptus pruinosa low open woodland on older alluvial and residual soils	No concern at present	4.02	14.12
non-remnant	None	None	12.41	43.54

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
1.11.2a	Pre-clearing 1245000 ha; Remnant 2021 1239000 ha	19a	Not a Wetland	Low
1.3.7b	Pre-clearing 163000 ha; Remnant 2021 162000 ha	16a	Riverine	Medium
1.5.13	Pre-clearing 320000 ha; Remnant 2021 319000 ha	19c	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
1.11.2a	1.11.2: Potential habitat for NCA listed species: Eucalyptus nudicaulis, Ipomoea antonschmidii, Solanum carduiforme, Trachymene glandulosa.
1.3.7b	1.3.7: Important seasonal water bird habitat; regional corridor for fauna.
1.5.13	None
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	12.41	43.54
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	0.8	2.82
19a	Low open woodlands dominated by Eucalyptus leucophloia (snappy gum) with Triodia spp. dominated ground layer, mainly on hills and ranges.	11.27	39.53
19c	Low open woodlands dominated by Eucalyptus pruinosa low open woodlands on sandplains, outwash areas and lateritised surfaces.	4.02	14.12

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2022 (PDF)* section 3.3 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

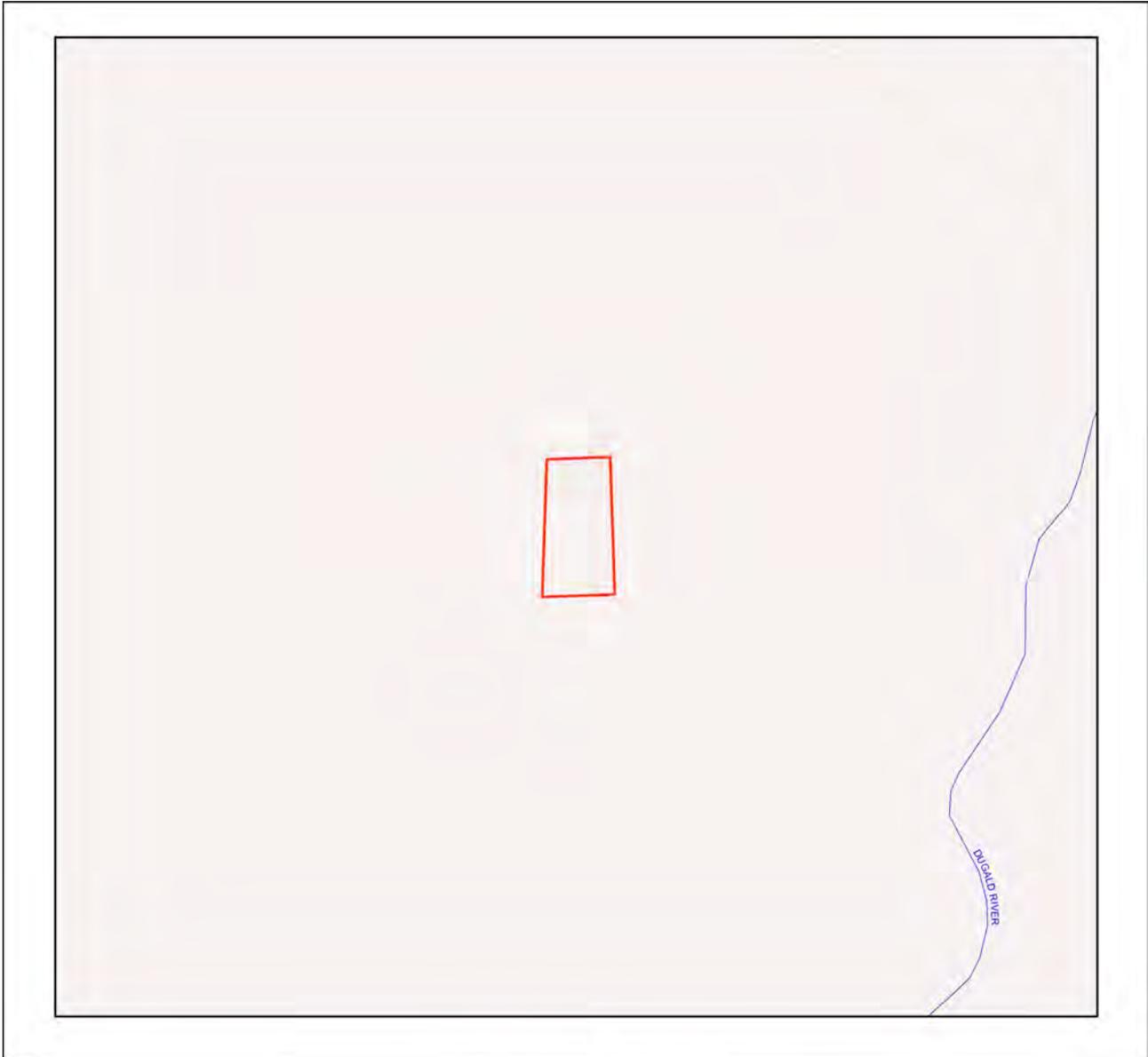
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
1.11.2a	Available	Not currently available
1.3.7b	Available	Not currently available
1.5.13	Available	Not currently available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



Locality Map

Legend

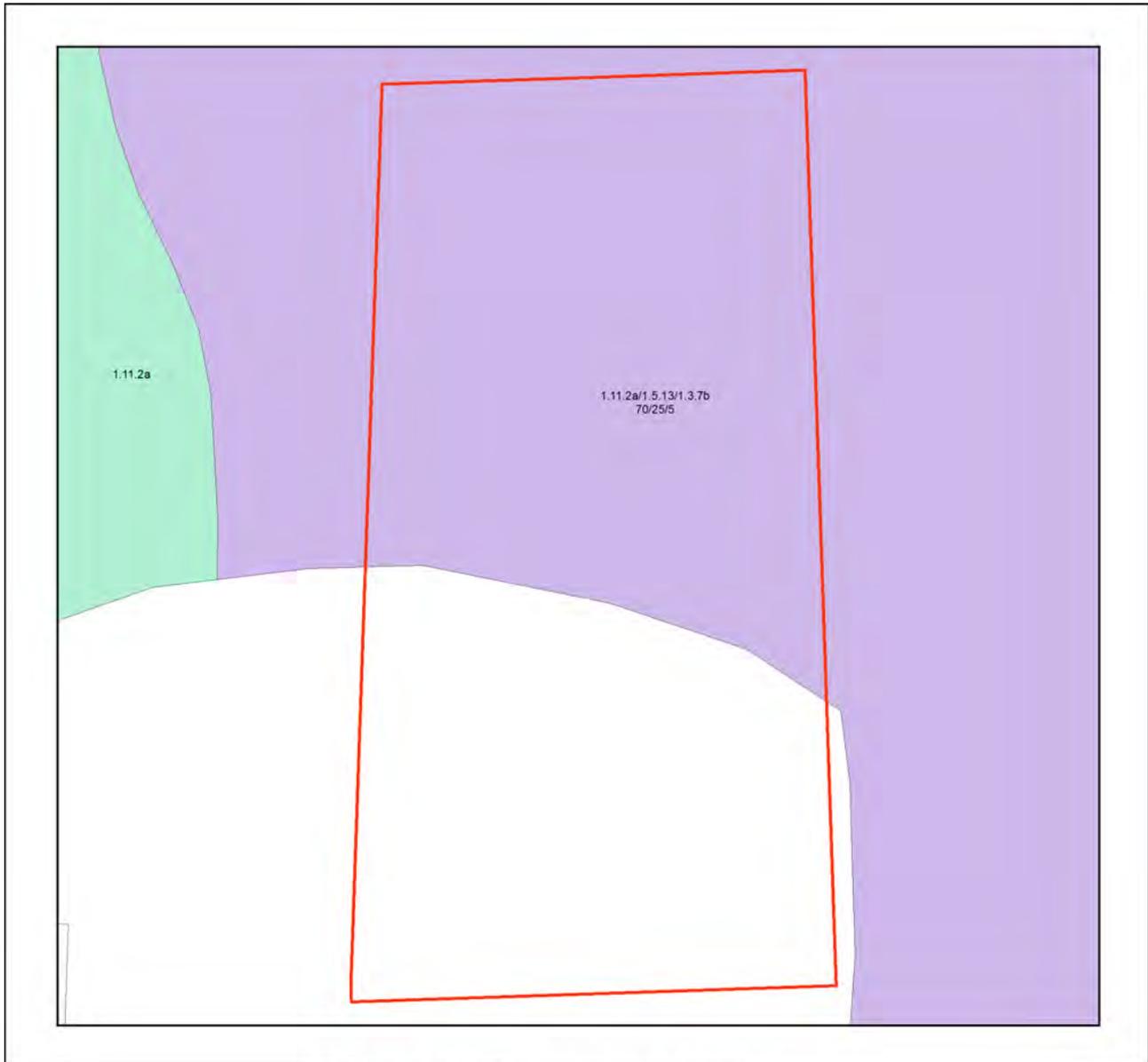
- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



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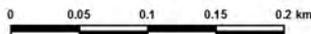
Map 2 - Remnant 2021 regional ecosystems



Remnant 2021 Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

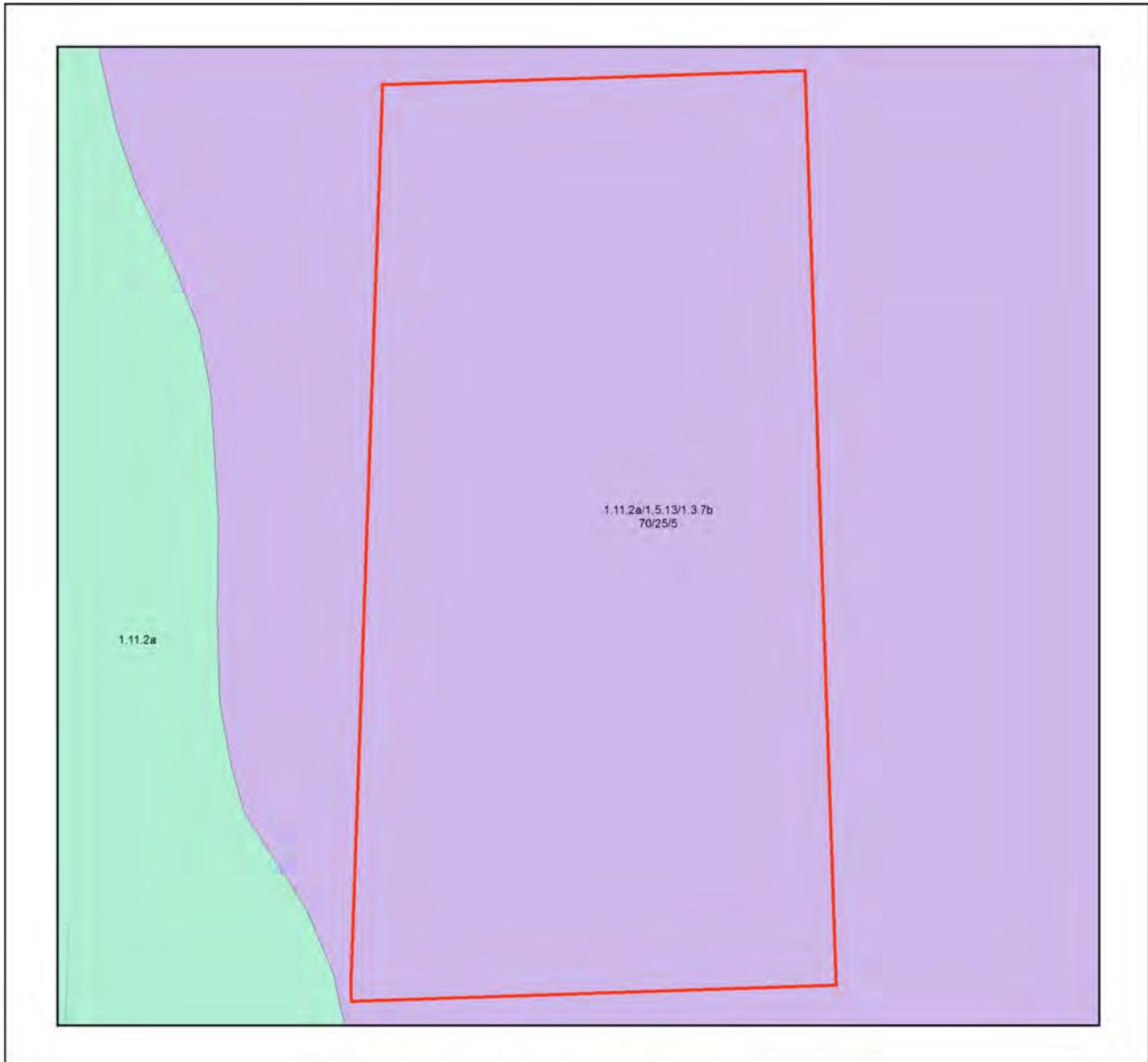
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. Non-remnant vegetation includes regrowth and disturbed native vegetation.

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Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

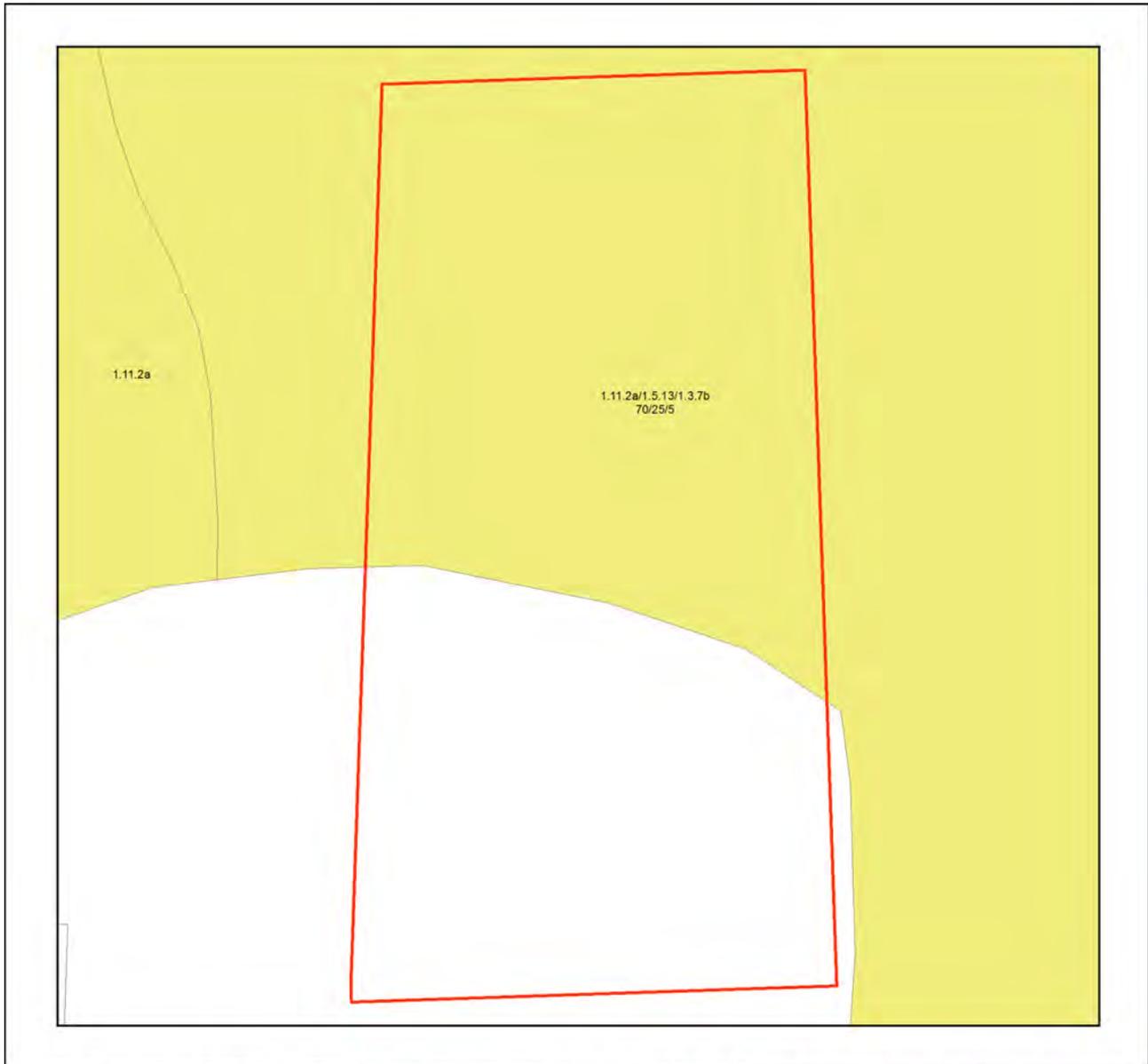
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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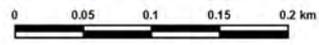
Map 4 - Remnant 2021 regional ecosystems by BVG (5M)



Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

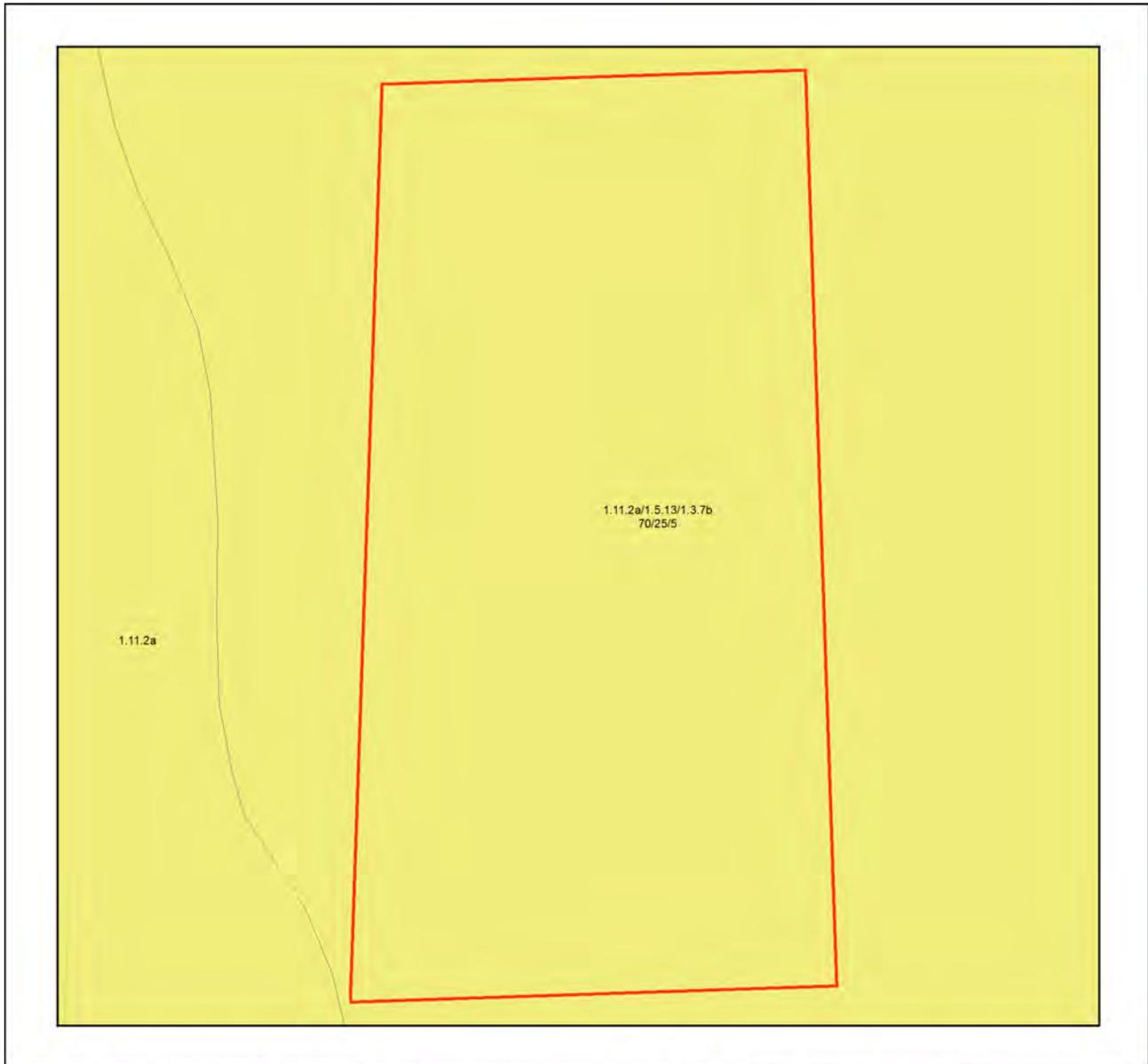
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

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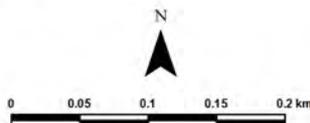
Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

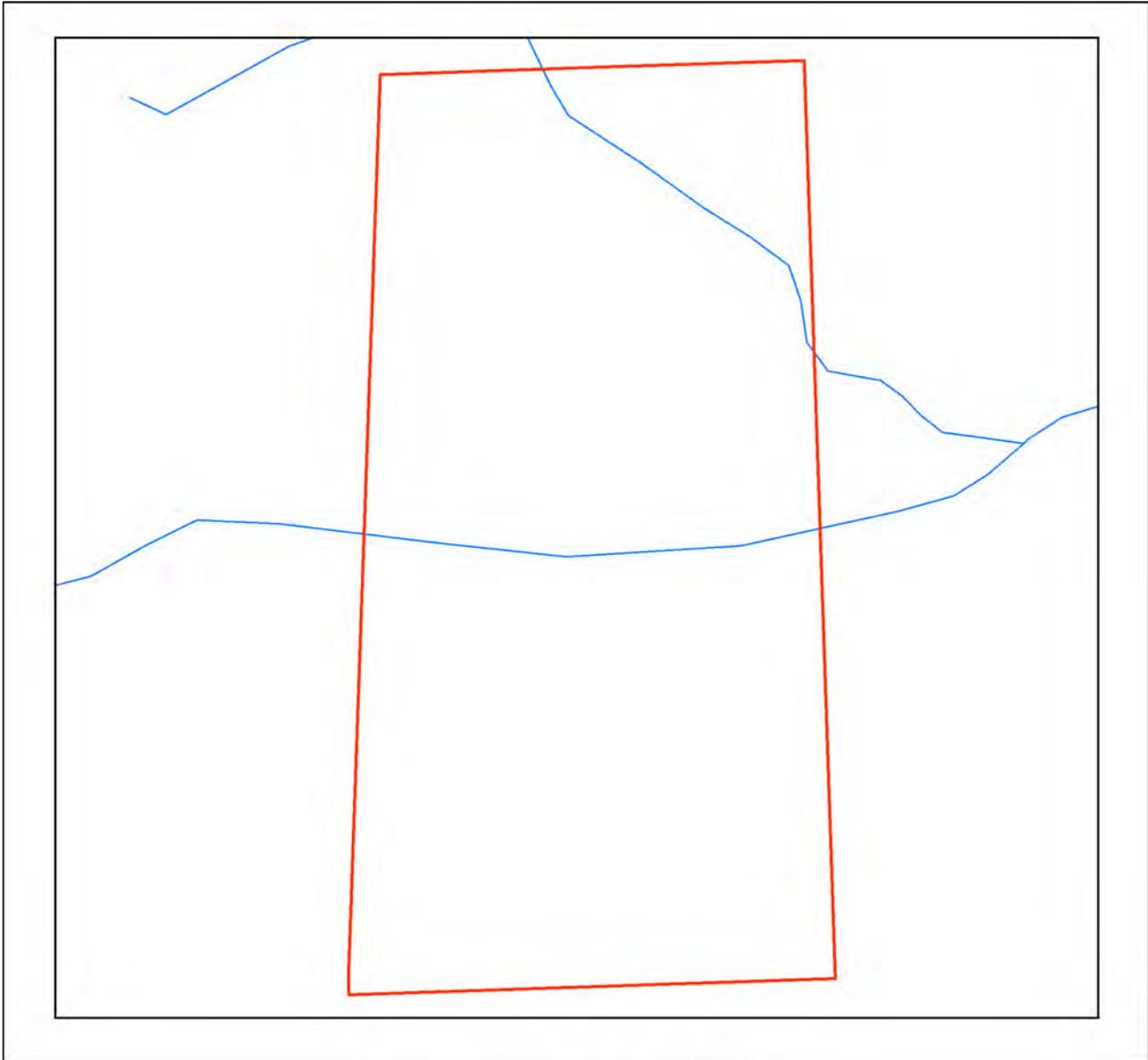
Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem line work reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of line work is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community - the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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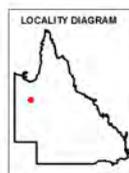
Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- Selected Mining Lease (ML)
- Towns
- Queensland Wetland Data**
- Riverine Drainage Lines
- ▲ Springs
- Wetland System - Water Bodies**
- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Wetland System - Regional Ecosystems**
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coast which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpreting data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

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This product is projected into GDA 1994 Queensland Albers

Links and Other Information Sources

The Department of Environment and Science's Website -

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

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<https://qldglobe.information.qld.gov.au/>

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science.

<https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086>

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appelman, C.N. (2022). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

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

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 2498

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 input coordinates.

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 1994). 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 matters of interest have been identified within the site.

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

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website <https://www.resources.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: ml: 2498

Size (ha)	29.06
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.4	1.37
Of concern	0.0	0.0
No concern at present	18.54	63.78
Total remnant vegetation	18.93	65.16

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2022) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

<https://www.resources.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
1.11.2a	Eucalyptus leucophloia low open woodland	No concern at present	16.54	56.91
1.3.7b	Eucalyptus camaldulensis woodland on channels and levees	Endangered	0.4	1.37
1.5.13	Eucalyptus pruinosa low open woodland on older alluvial and residual soils	No concern at present	2.0	6.87
non-remnant	None	None	10.13	34.84

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
1.11.2a	Pre-clearing 1245000 ha; Remnant 2021 1239000 ha	19a	Not a Wetland	Low
1.3.7b	Pre-clearing 163000 ha; Remnant 2021 162000 ha	16a	Riverine	Medium
1.5.13	Pre-clearing 320000 ha; Remnant 2021 319000 ha	19c	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
1.11.2a	1.11.2: Potential habitat for NCA listed species: Eucalyptus nudicaulis, Ipomoea antonschmidii, Solanum carduiforme, Trachymene glandulosa.
1.3.7b	1.3.7: Important seasonal water bird habitat; regional corridor for fauna.
1.5.13	None
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	10.13	34.84
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	0.4	1.37
19a	Low open woodlands dominated by Eucalyptus leucophloia (snappy gum) with Triodia spp. dominated ground layer, mainly on hills and ranges.	16.54	56.91
19c	Low open woodlands dominated by Eucalyptus pruinosa low open woodlands on sandplains, outwash areas and lateritised surfaces.	2.0	6.87

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2022 (PDF)* section 3.3 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

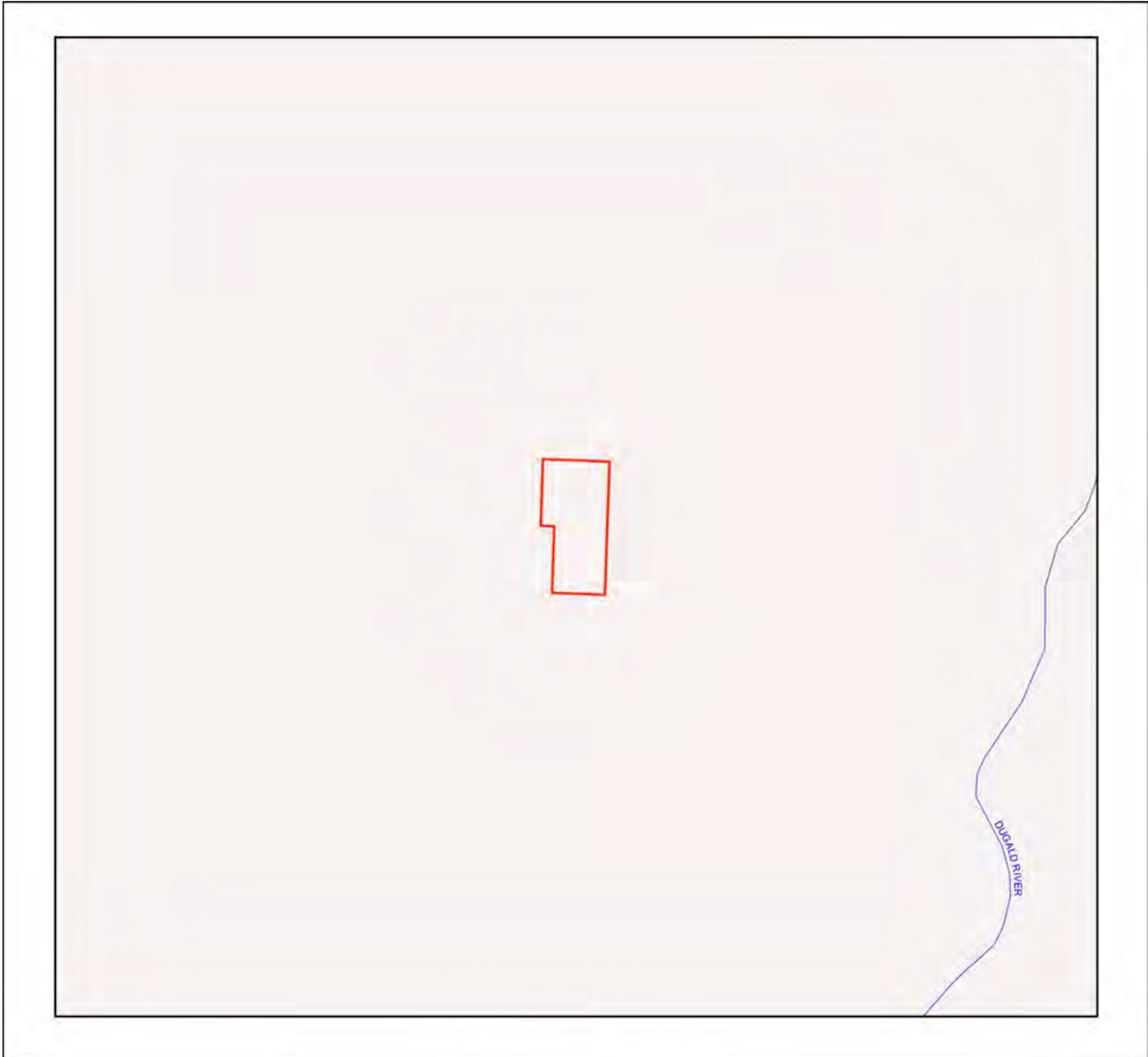
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
1.11.2a	Available	Not currently available
1.3.7b	Available	Not currently available
1.5.13	Available	Not currently available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



Locality Map

Legend

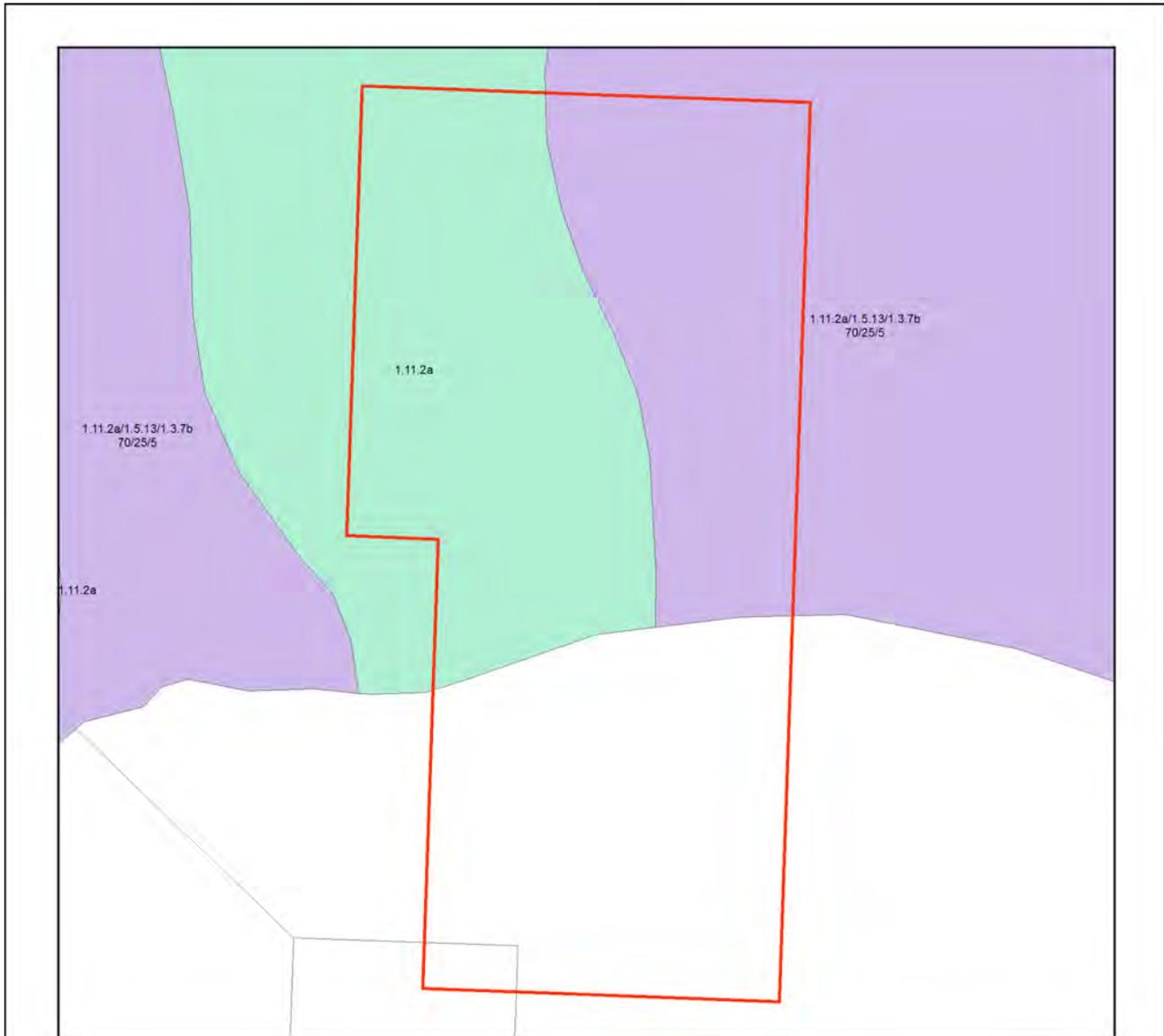
- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



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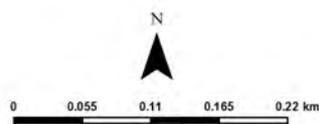
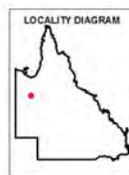
Map 2 - Remnant 2021 regional ecosystems



Remnant 2021 Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

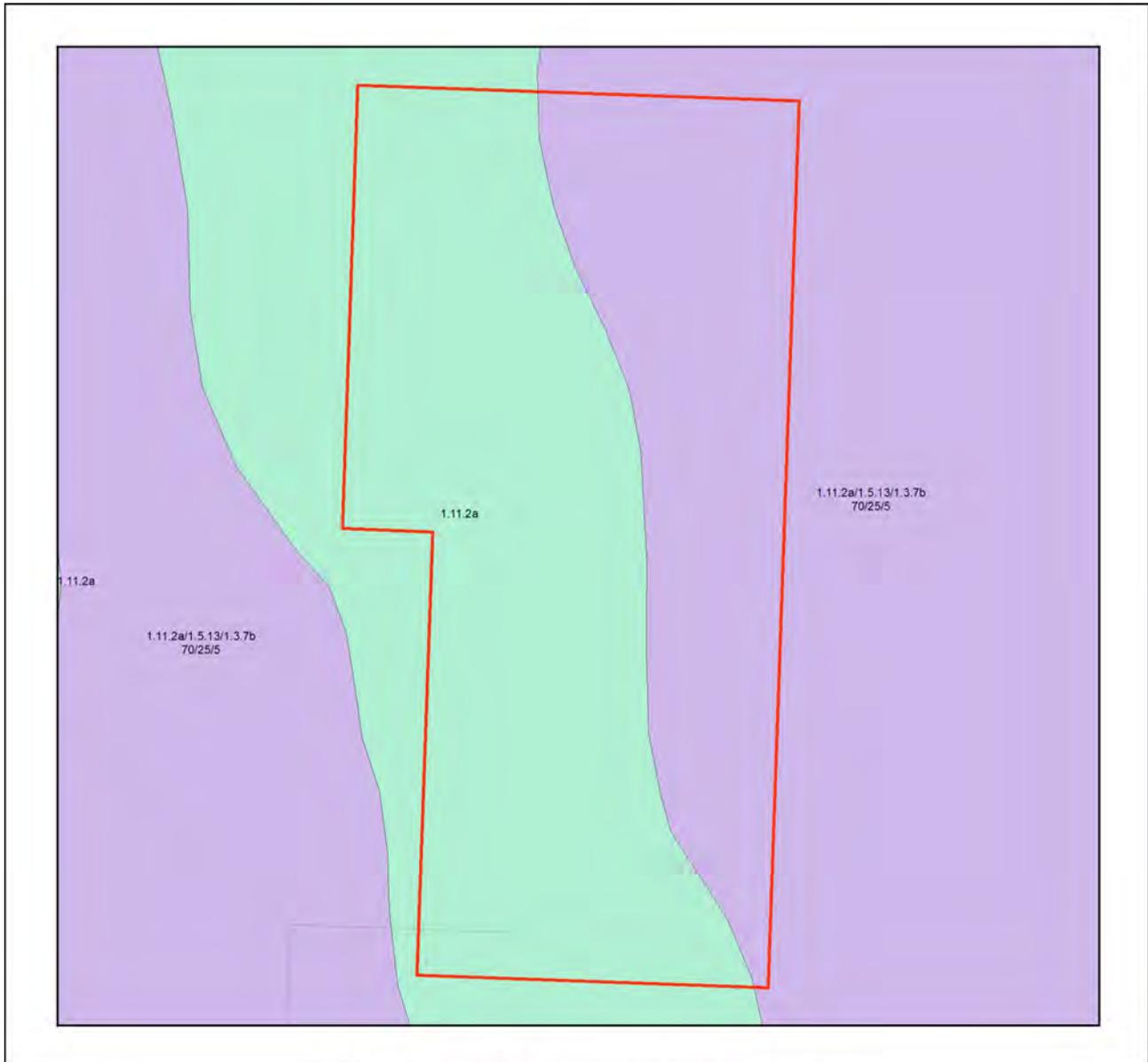
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. Non-remnant vegetation includes regrowth and disturbed native vegetation.

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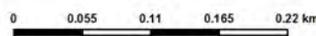
Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

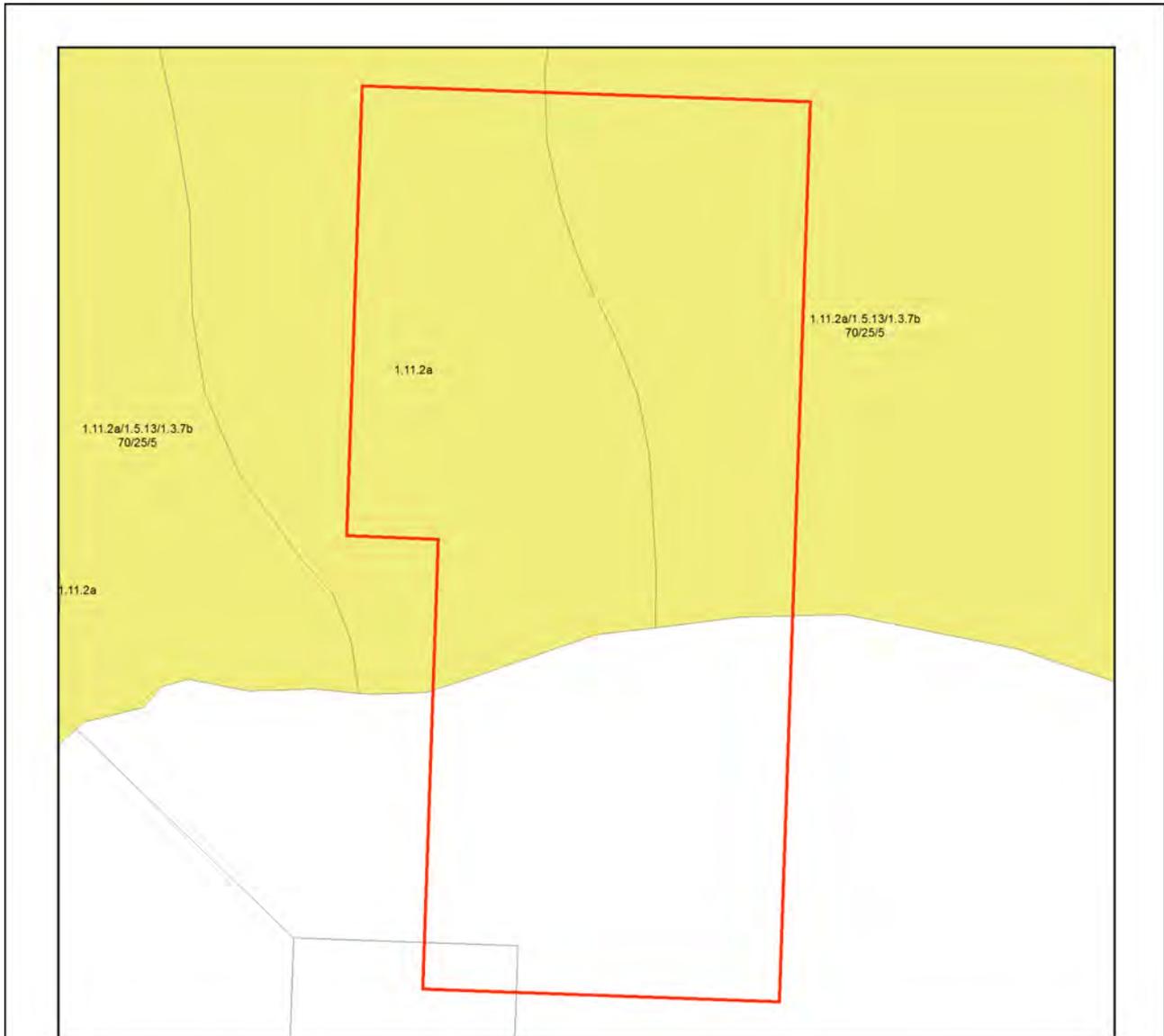
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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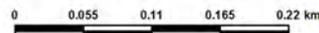
Map 4 - Remnant 2021 regional ecosystems by BVG (5M)



Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

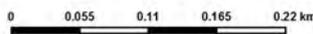
Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

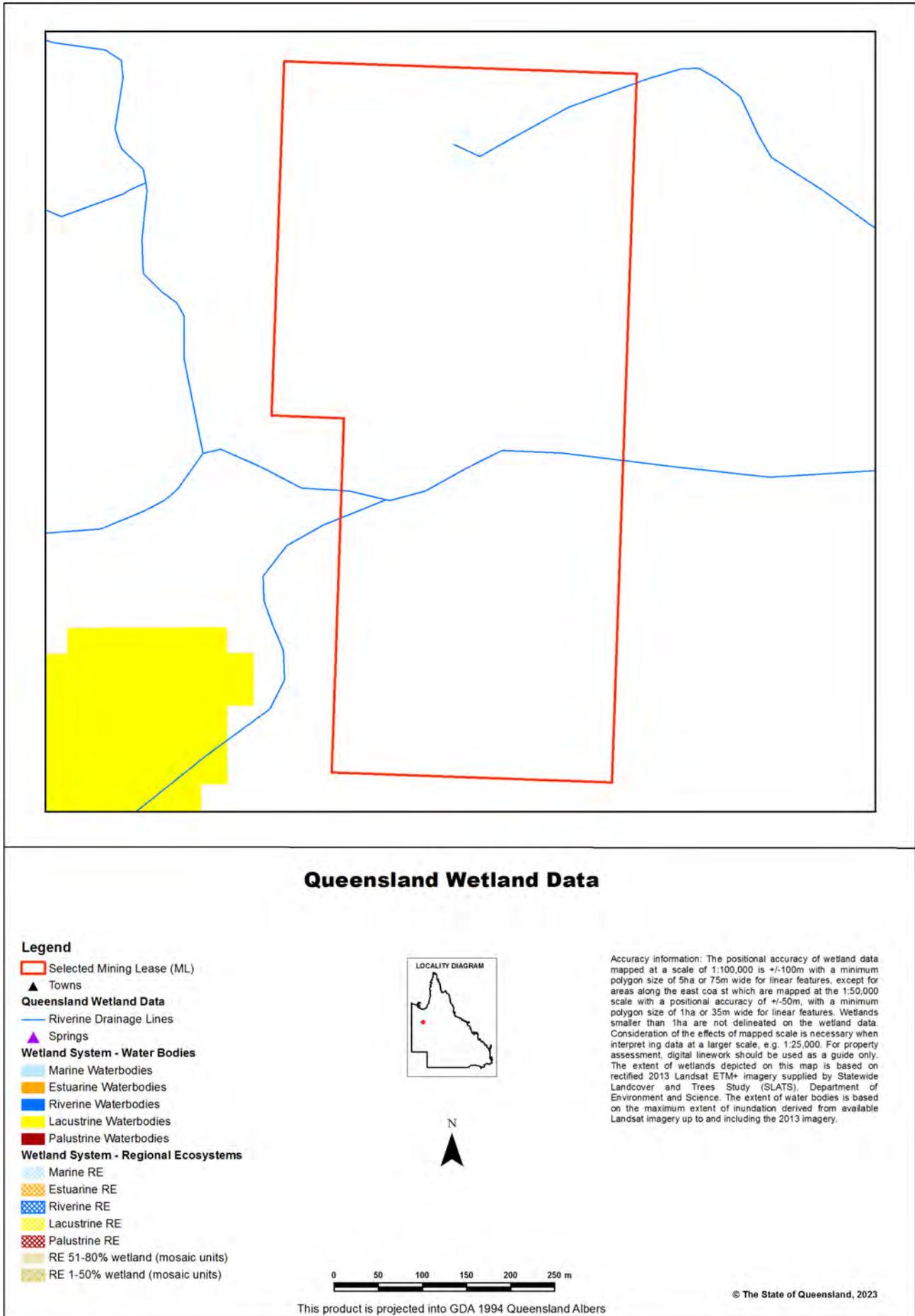
Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community - the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of Environment and Science's Website -

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

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<https://qldglobe.information.qld.gov.au/>

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science.

<https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086>

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appelman, C.N. (2022). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

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

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 2499

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 input coordinates.

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 1994). 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 matters of interest have been identified within the site.

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

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website <https://www.resources.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: ml: 2499

Size (ha)	28.08
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.12	0.43
Of concern	0.0	0.0
No concern at present	13.07	46.53
Total remnant vegetation	13.19	46.96

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2022) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

<https://www.resources.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
1.11.2a	Eucalyptus leucophloia low open woodland	No concern at present	12.46	44.37
1.3.7b	Eucalyptus camaldulensis woodland on channels and levees	Endangered	0.12	0.43
1.5.13	Eucalyptus pruinosa low open woodland on older alluvial and residual soils	No concern at present	0.61	2.16
non-remnant	None	None	14.89	53.02

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
1.11.2a	Pre-clearing 1245000 ha; Remnant 2021 1239000 ha	19a	Not a Wetland	Low
1.3.7b	Pre-clearing 163000 ha; Remnant 2021 162000 ha	16a	Riverine	Medium
1.5.13	Pre-clearing 320000 ha; Remnant 2021 319000 ha	19c	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
1.11.2a	1.11.2: Potential habitat for NCA listed species: Eucalyptus nudicaulis, Ipomoea antonschmidii, Solanum carduiforme, Trachymene glandulosa.
1.3.7b	1.3.7: Important seasonal water bird habitat; regional corridor for fauna.
1.5.13	None
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	14.89	53.02
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	0.12	0.43
19a	Low open woodlands dominated by Eucalyptus leucophloia (snappy gum) with Triodia spp. dominated ground layer, mainly on hills and ranges.	12.46	44.37
19c	Low open woodlands dominated by Eucalyptus pruinosa low open woodlands on sandplains, outwash areas and lateritised surfaces.	0.61	2.16

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2022 (PDF)* section 3.3 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

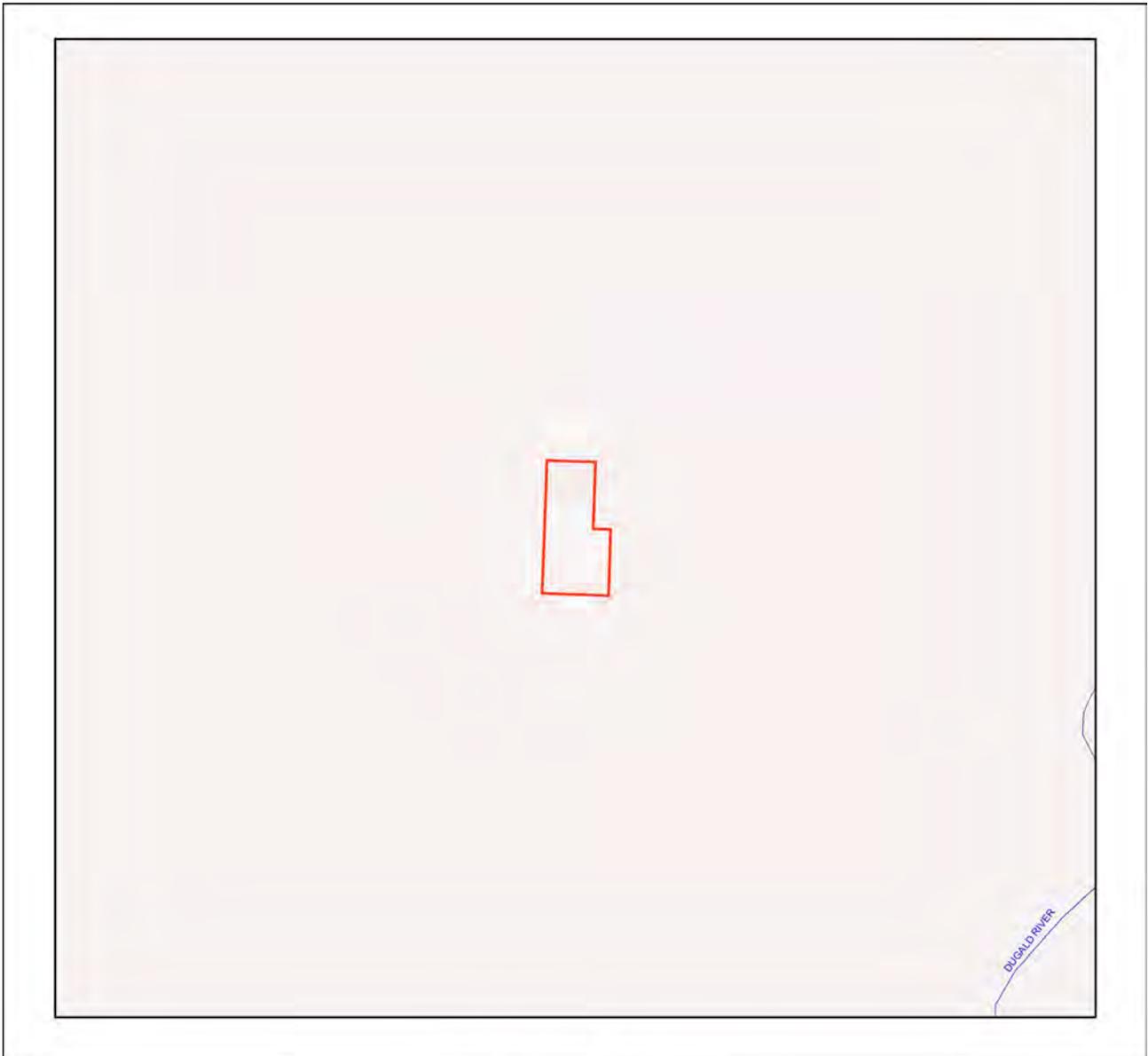
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
1.11.2a	Available	Not currently available
1.3.7b	Available	Not currently available
1.5.13	Available	Not currently available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



Locality Map

Legend

- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



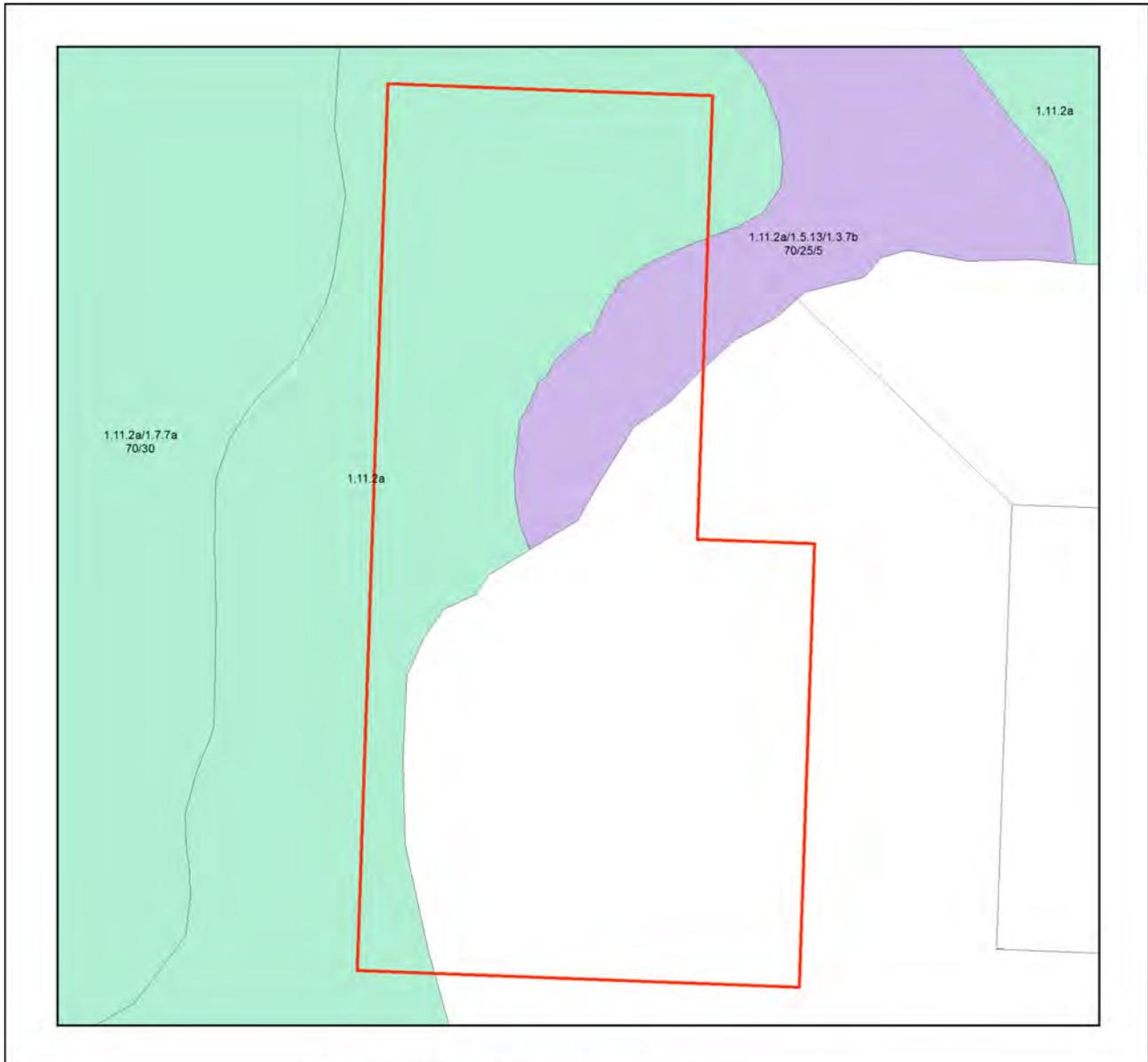
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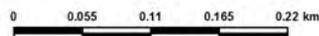
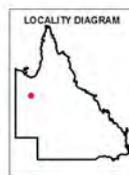
Map 2 - Remnant 2021 regional ecosystems



Remnant 2021 Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. Non-remnant vegetation includes regrowth and disturbed native vegetation.

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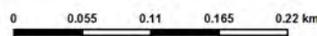
Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

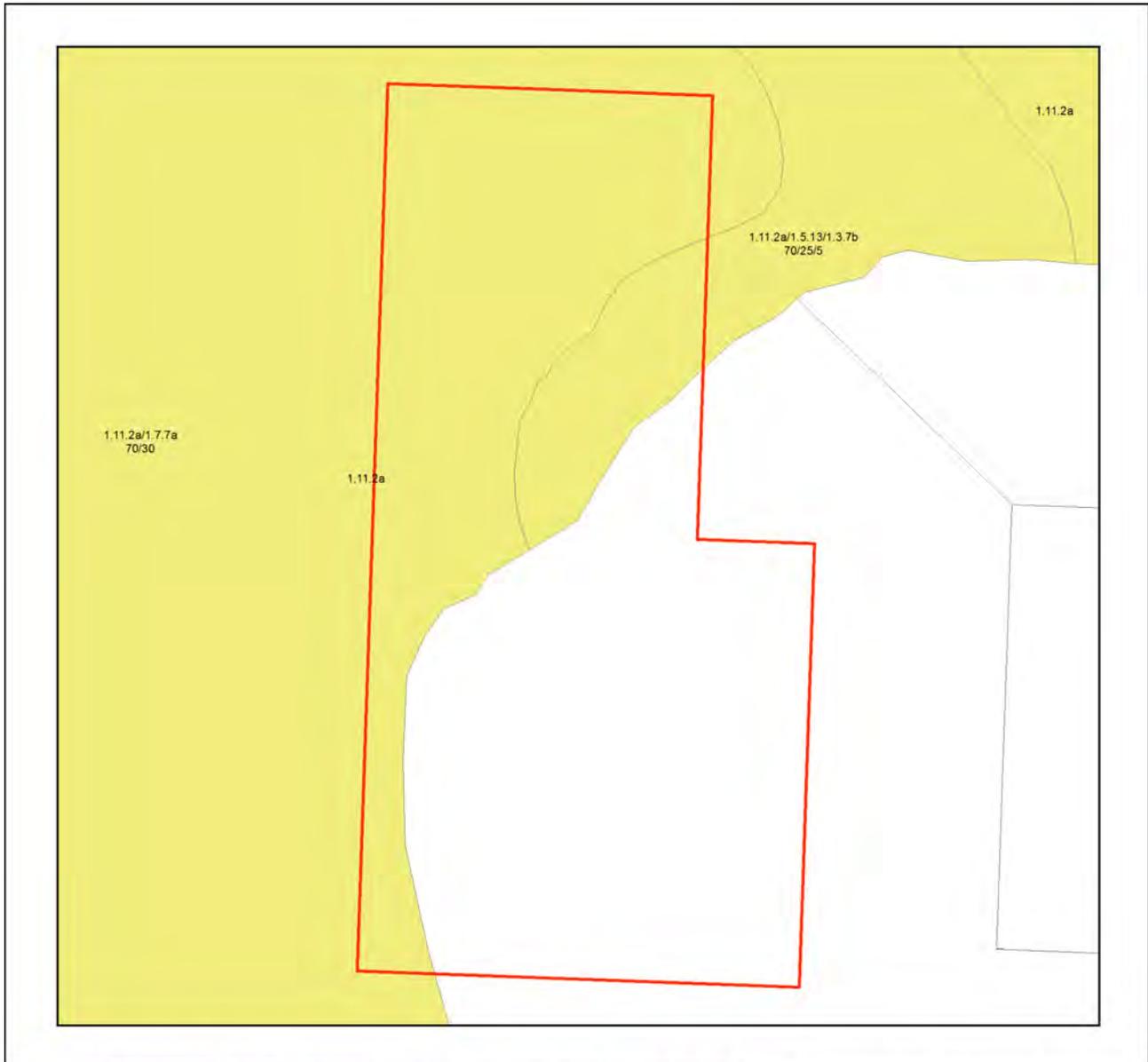
The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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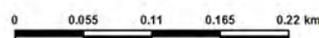
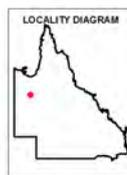
Map 4 - Remnant 2021 regional ecosystems by BVG (5M)



Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

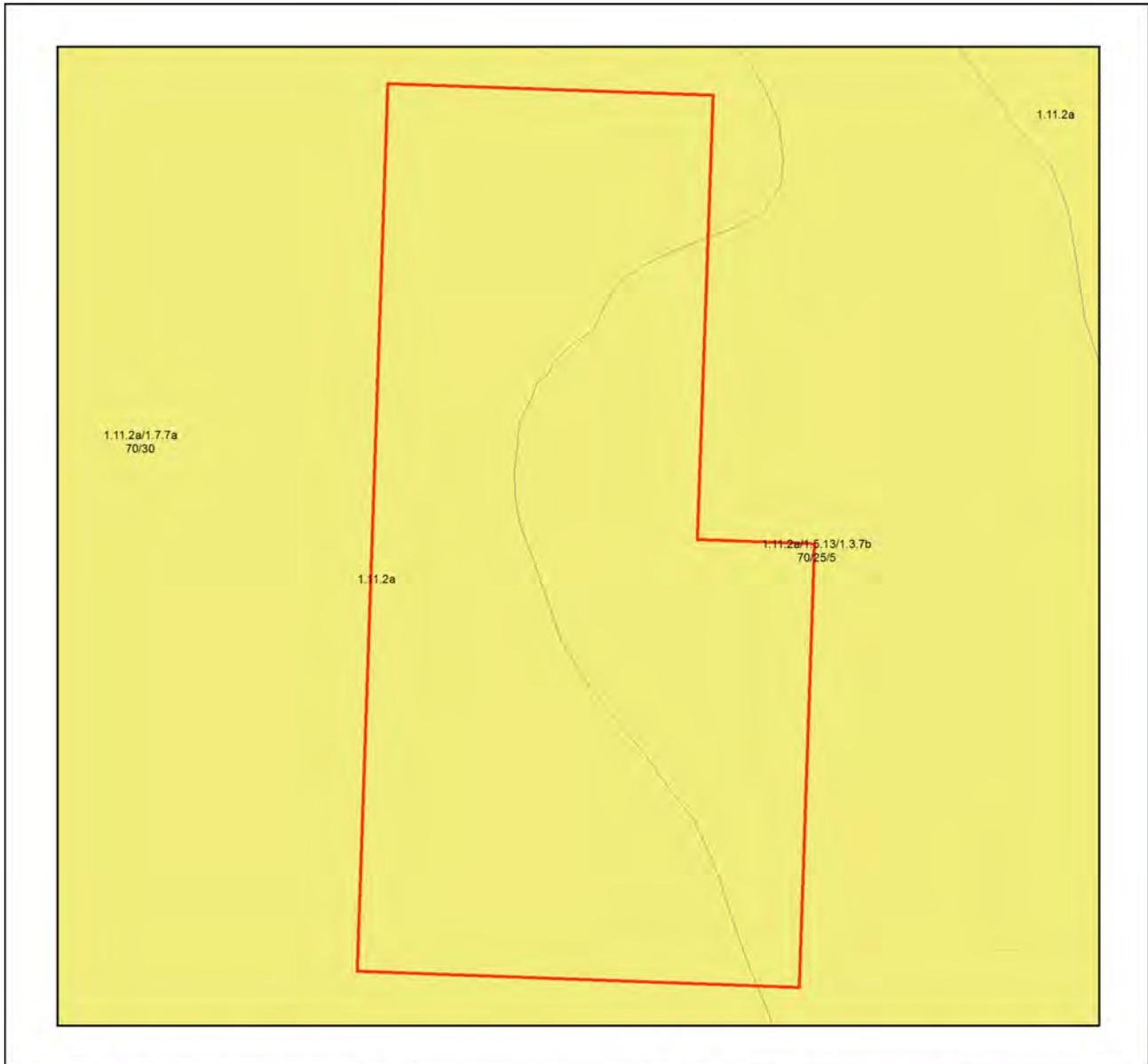
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

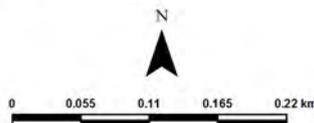
Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

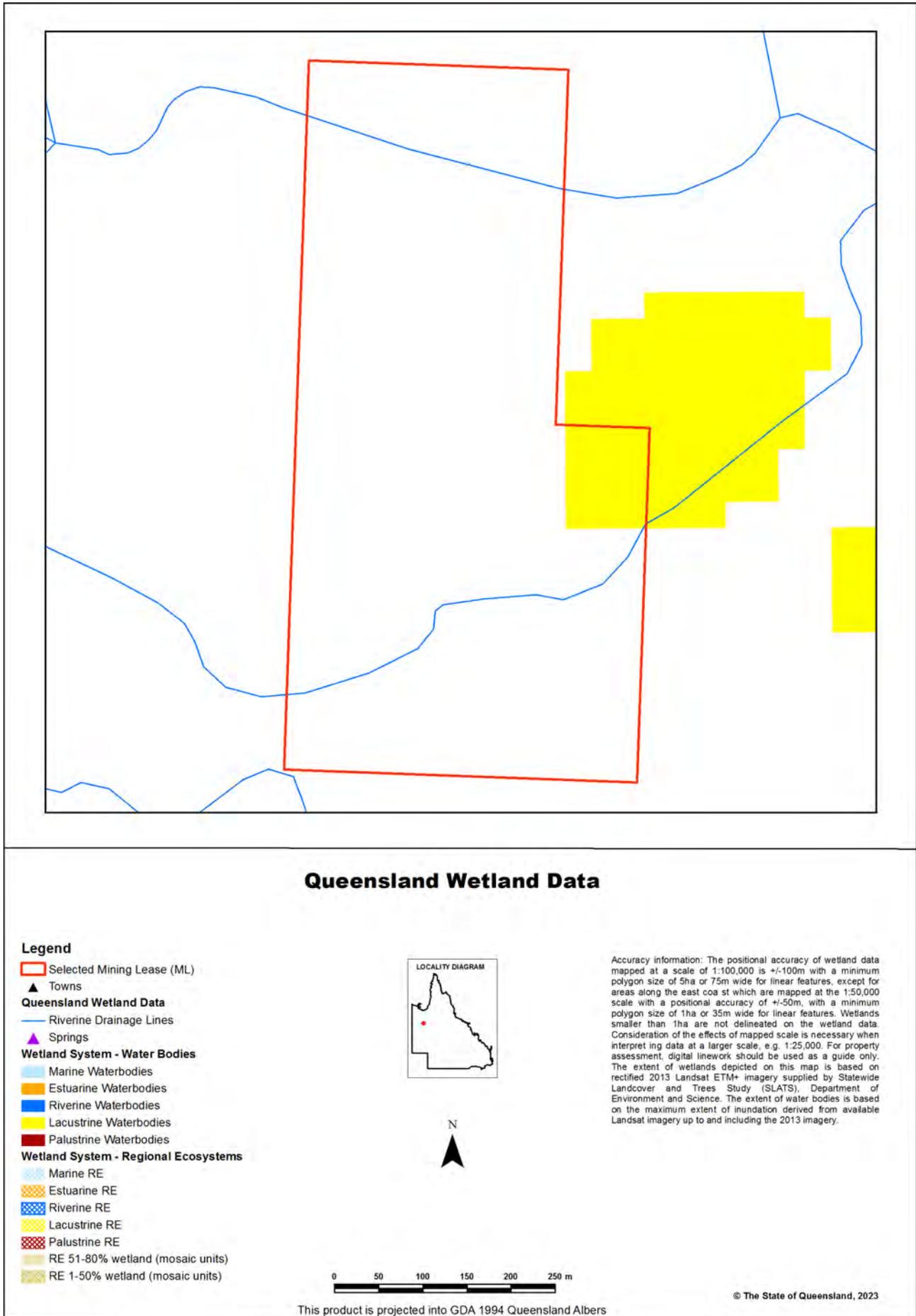
Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of Environment and Science's Website -

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

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<https://qldglobe.information.qld.gov.au/>

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science.

<https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086>

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appelman, C.N. (2022). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

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

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 2470

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 input coordinates.

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 1994). 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 matters of interest have been identified within the site.

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

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website <https://www.resources.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: ml: 2470

Size (ha)	16.19
Local Government(s)	Cloncurry Shire
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Flinders

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.22	1.37
Of concern	0.0	0.0
No concern at present	6.19	38.21
Total remnant vegetation	6.41	39.58

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2022) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

<https://www.resources.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
1.11.2a	Eucalyptus leucophloia low open woodland	No concern at present	5.08	31.39
1.3.7b	Eucalyptus camaldulensis woodland on channels and levees	Endangered	0.22	1.37
1.5.13	Eucalyptus pruinosa low open woodland on older alluvial and residual soils	No concern at present	1.11	6.83
non-remnant	None	None	9.78	60.4

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
1.11.2a	Pre-clearing 1245000 ha; Remnant 2021 1239000 ha	19a	Not a Wetland	Low
1.3.7b	Pre-clearing 163000 ha; Remnant 2021 162000 ha	16a	Riverine	Medium
1.5.13	Pre-clearing 320000 ha; Remnant 2021 319000 ha	19c	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
1.11.2a	1.11.2: Potential habitat for NCA listed species: Eucalyptus nudicaulis, Ipomoea antonschmidii, Solanum carduiforme, Trachymene glandulosa.
1.3.7b	1.3.7: Important seasonal water bird habitat; regional corridor for fauna.
1.5.13	None
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	9.78	60.4
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	0.22	1.37
19a	Low open woodlands dominated by Eucalyptus leucophloia (snappy gum) with Triodia spp. dominated ground layer, mainly on hills and ranges.	5.08	31.39
19c	Low open woodlands dominated by Eucalyptus pruinosa low open woodlands on sandplains, outwash areas and lateritised surfaces.	1.11	6.83

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2022 (PDF)* section 3.3 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

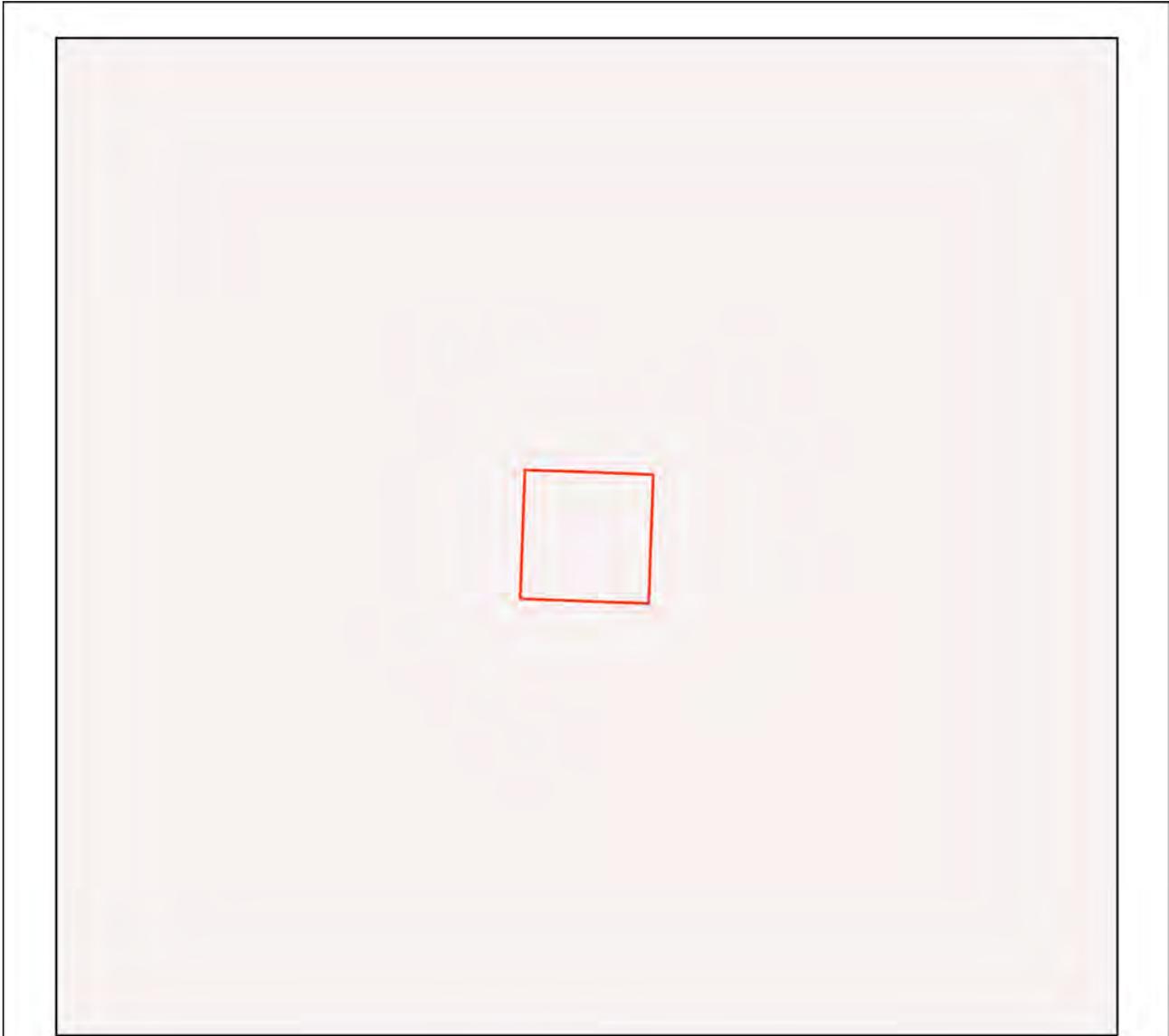
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
1.11.2a	Available	Not currently available
1.3.7b	Available	Not currently available
1.5.13	Available	Not currently available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



Locality Map

Legend

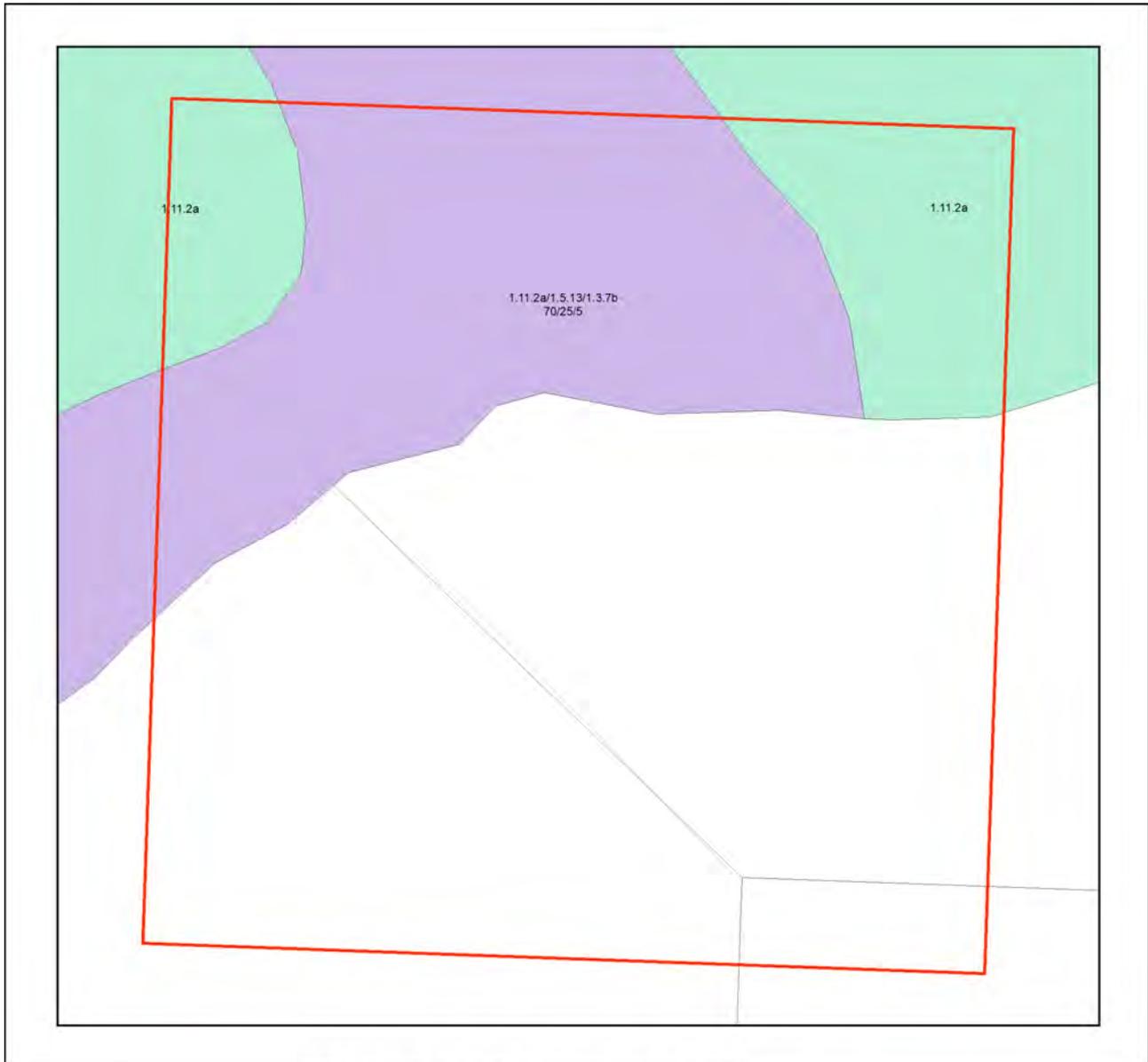
- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



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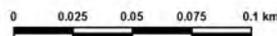
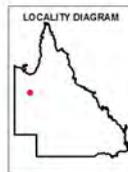
Map 2 - Remnant 2021 regional ecosystems



Remnant 2021 Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

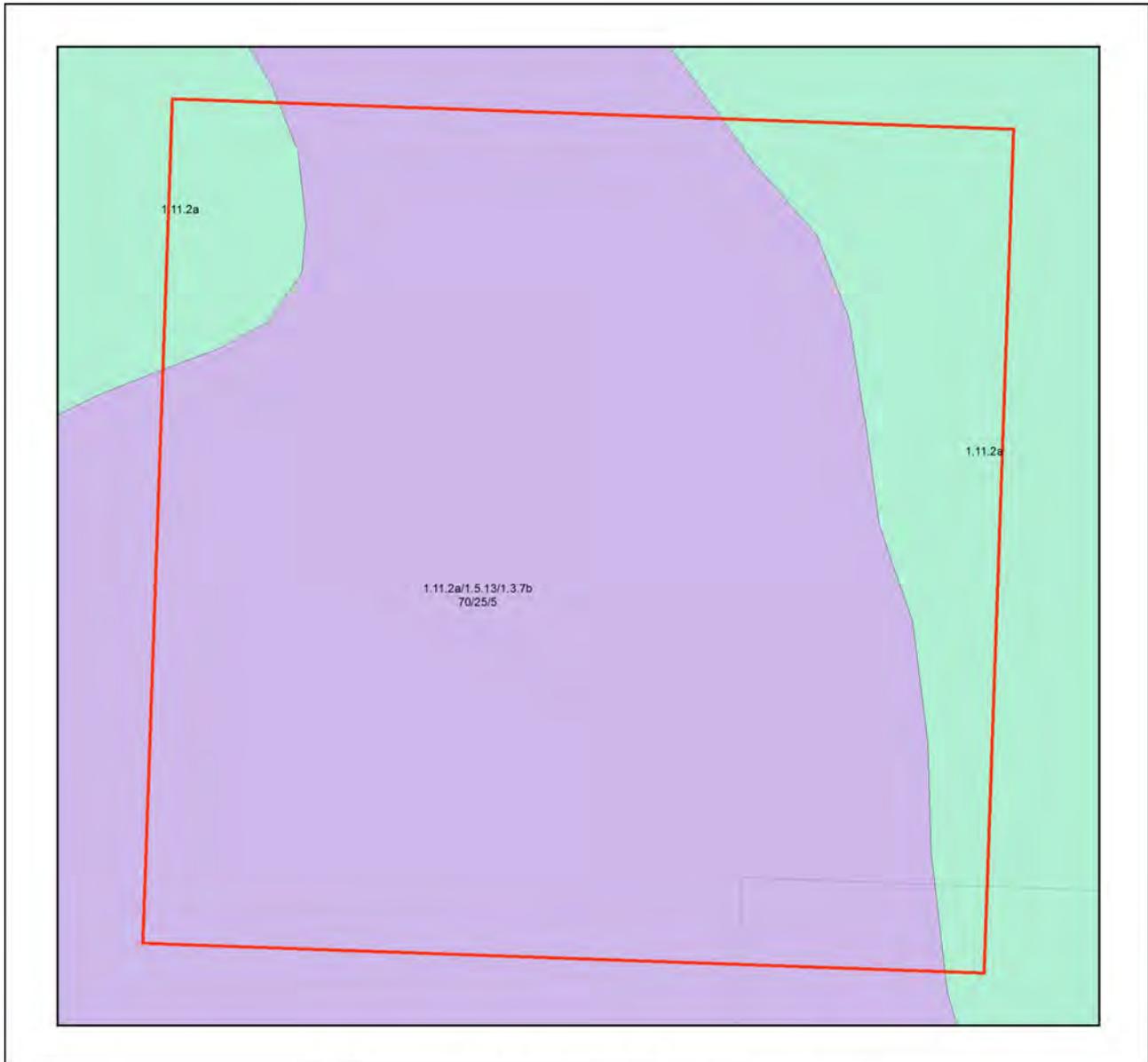
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. Non-remnant vegetation includes regrowth and disturbed native vegetation.

This product is projected into GDA 1994 Queensland Albers

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Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries



Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

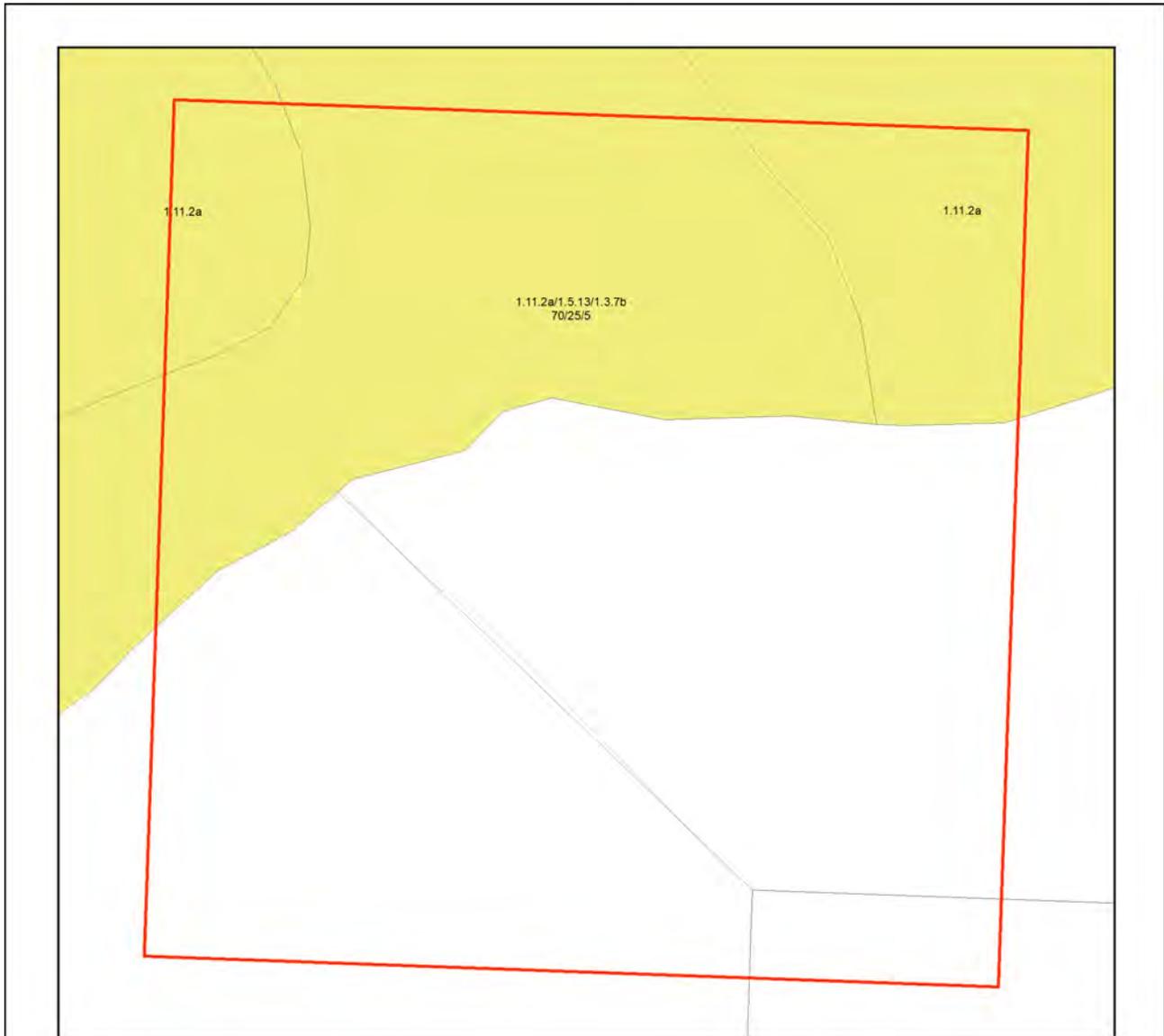
The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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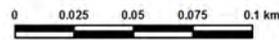
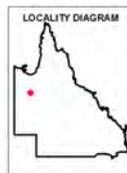
Map 4 - Remnant 2021 regional ecosystems by BVG (5M)



Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Non-remnant vegetation includes regrowth and disturbed native vegetation.

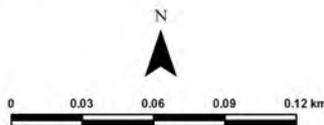
Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups BVG5M Description (BVG1M codes)

- Selected Mining Lease (ML)
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
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- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

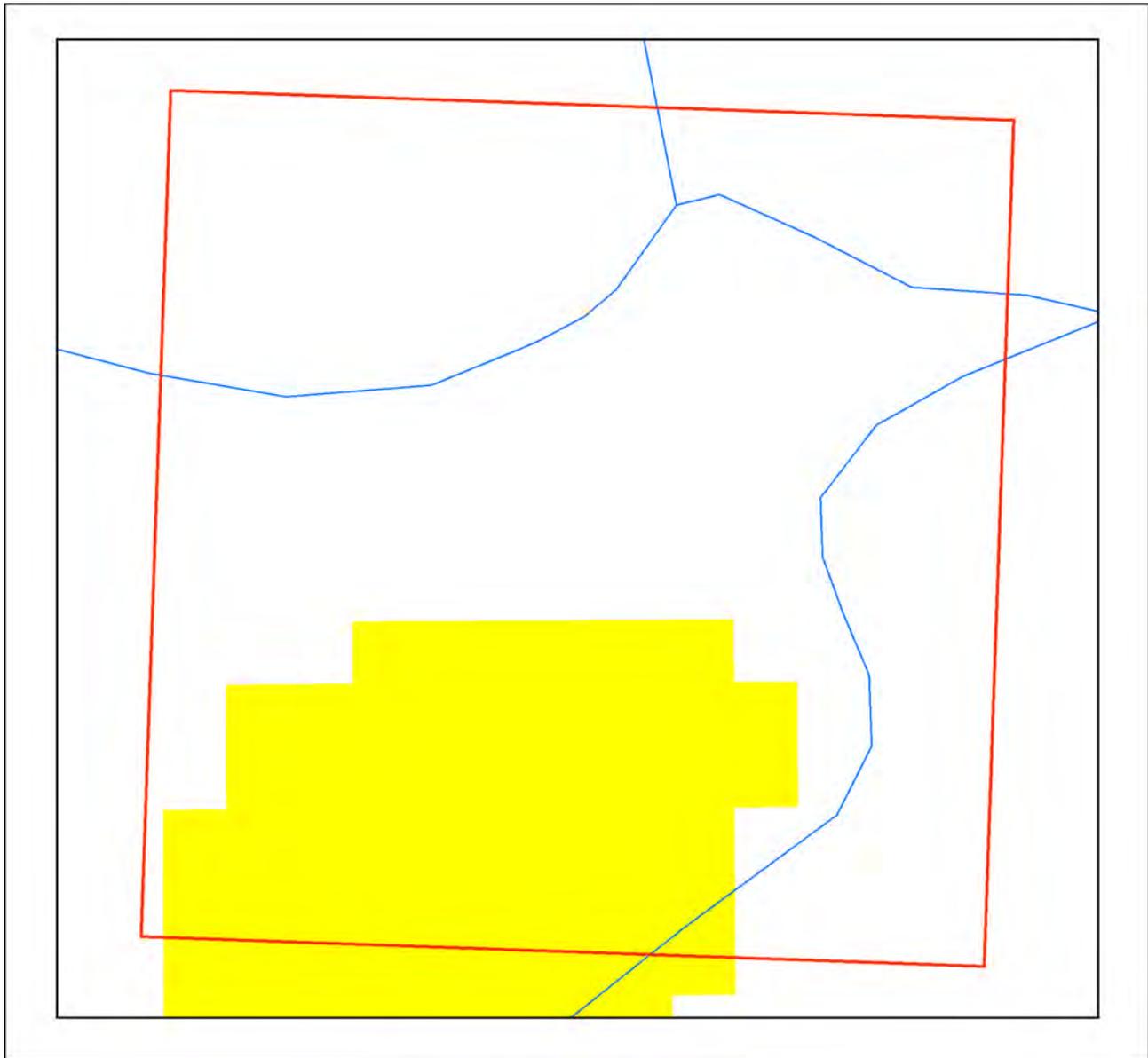
Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem line work reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of line work is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework". Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM Imagery, geology, soils, land systems data, field survey and historical records.

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Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- Selected Mining Lease (ML)
- Towns
- Queensland Wetland Data**
- Riverine Drainage Lines
- ▲ Springs
- Wetland System - Water Bodies**
- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Wetland System - Regional Ecosystems**
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coast which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpreting data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

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This product is projected into GDA 1994 Queensland Albers

Links and Other Information Sources

The Department of Environment and Science's Website -

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

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<https://qldglobe.information.qld.gov.au/>

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science.

<https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086>

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appelman, C.N. (2022). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

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

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>



APPENDIX E – FORM OF CERTIFICATION

Certification Form – Consequence Category Assessment

Dugald River Mine – PAF Stage 2 Dam

Name and address of Registered Professional Engineer providing certification:

Craig Noske
Senior Principal Engineer, ATC Williams Pty. Ltd. (RPEQ 21885)
222 Beach Road, Mordialloc, Victoria, 3195

Statement of relevant experience:

I hereby state that I am a Registered Professional Engineer of Queensland and meet the requirements of the definition of ‘suitably qualified and experienced person’.

Statement of certification:

All relevant material relied upon by me, including subsidiary certifications of specialist components, where required by the environmental authority, is provided in the report “*Dugald River Mine – PAF Stage 2 Dam - Consequence Category Assessment*”; Reference 108003.63.12.R01-Rev0”, dated 25 July 2023, to which this certificate is appended.

I hereby certify that the “*Dugald River Mine – PAF Stage 2 Dam - Consequence Category Assessment*”:

1. Identifies which regulated structure(s) is the subject of the certification;
2. Identifies the relevant environmental authority condition which is the subject of the certification;
3. Identifies, where appropriate, what is not included in the certification—including information about any limitations, restrictions or exclusions that apply to the certification; and
4. Has identified that the PAF Stage 2 Dam has a consequence category of ‘Significant’ based on a ‘failure to contain – dam break’ scenario, and is therefore considered to be a regulated structure.

I, Craig Noske, declare that the information provided as part of this certification is true to the best of my knowledge. I acknowledge that it is an offence under Section 480 of the *Environmental Protection Act 1994* to give the administering authority a document containing information that I know is false, misleading or incomplete in a material particular.

Signed:  (RPEQ 21885)

Date: 25th July 2023

APPENDIX D: Review of the Saturday Bore as a groundwater monitoring bore in the Environmental Authority (Rob Lait & Associates, 2023)



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RL/rl: (Dugald River Project Saturday Bore)
Project No. 116
June 2023

DUGALD RIVER MINING PROJECT

**REVIEW OF SATURDAY BORE AS A GROUNDWATER MONITORING
BORE IN THE ENVIRONMENTAL AUTHORITY**

MMG LIMITED

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1.0 INTRODUCTION

One of the groundwater monitoring bores that is currently in the Environmental Authority (EA) for the Dugald River mine site (Saturday Bore) has collapsed and is no longer serviceable for obtaining groundwater levels or groundwater quality parameters.

Rob Lait and Associates Pty Ltd (RLA) was requested by MMG Limited to provide comment on the requirement for Saturday Bore to be renewed and maintained in the Environmental Authority.

2.0 DUGALD RIVER MINE GROUNDWATER MONITORING BORE SUITE

Following a groundwater census of the area in March 2008 a suite of six groundwater monitoring bores was installed at the Dugald River Project late in 2008 to complement the data from the private bores in the area and previously drilled exploration bores.

The 2008 groundwater monitoring bores complemented the limited historical groundwater monitoring data that existed at the time. Since 2008 a further nine groundwater monitoring bores have been installed at Dugald River Mine.

The dedicated groundwater monitoring bores installed since 2008 have been constructed according to the Minimum Construction Standards for Water Bores In Australia¹.

The locations of the dedicated groundwater monitoring bores within the Dugald River project leases are shown in Figure 1.

RLA considers that the 15 dedicated groundwater monitoring bores within the Dugald River Mine leases comprehensively monitor groundwater conditions at the site.

¹ Australian Government, National Water Commission, National Uniform Drillers Licensing Committee. February 2012. MINIMUM CONSTRUCTION REQUIREMENTS FOR WATER BORES IN AUSTRALIA Third edition

Mining Leases, Groundwater Monitoring Bores and Saturda...

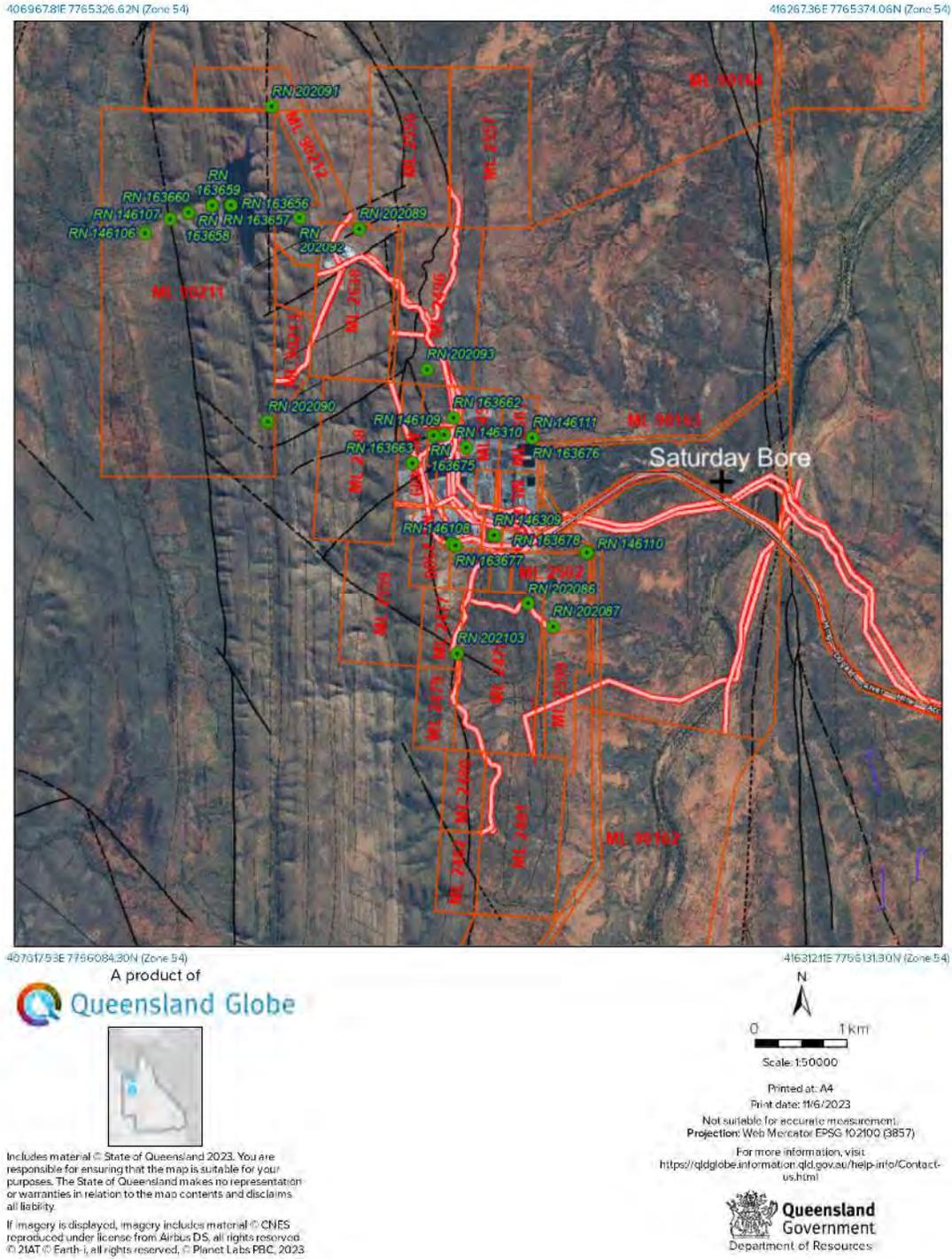


Figure 1: Location of Saturday Bore and Dugald River Mine Features

3.0 SATURDAY BORE AS PART OF THE EA

3.1 History of Saturday Bore

CRA² reported on groundwater in a 1989 exploration drilling program at Dugald River. Groundwater was intersected in broken vuggy ground at the calc-silicate/ black slate boundary and there were reports of loss of drilling fluids in deeper sections. This essentially indicates that, while fractures and void spaces exist at depth, these void spaces are not filled with significant volumes of groundwater.

The first dedicated groundwater exploration program commenced in 1990 with 15 groundwater locations being assessed. Groundwater yield, depth and quality were recorded³. The bores drilled during that investigation have several names. Saturday Bore (also known as SB1) was the most successful of the bores drilled during the 1990 program. As a result, it was used as a groundwater supply for drilling exploration activities. No drilling and construction details are available for Saturday Bore other than the fact that it was originally 36m deep and lined with 125mm internal diameter PVC casing.

Mackie Martin & Associates⁴ analysed the results of a formal pumping test on Saturday Bore. The pumping test showed that dewatering of the aquifer was occurring after approximately 400 minutes, indicating that the volume of water in storage would be limited and not able to satisfy long term demand for any industrial purposes.

CRA Exploration Pty. Ltd⁵ (CRA) suggested that Saturday Bore was located in a zone of structural weakness which would most likely be fed by the Dugald River.

3.2 Original Intention

In 2008 Saturday Bore was considered valuable from a historical perspective and potentially for assessing impacts of mining and processing and it was included in the groundwater monitoring bore suite until more comprehensive groundwater data could be obtained for assessing the impacts of Dugald River Mine.

3.3 Saturday Bore Construction

Saturday Bore was not constructed according to the Minimum Construction Requirements for Water Bores in Australia as no such requirements existed when it was installed. No construction details for Saturday Bore exist but it is likely that the borehole annulus around the casing was filled with gravel from total depth (36m) to ground surface. No grout envelope exists at the surface and the bore is therefore vulnerable to direct contamination from any source.

² CRA Exploration Pty. Ltd. Dugald River Lead Zinc Project, Report on the 1989 Diamond Drill Program (DD89DR90 to DD89DR178), including geological interpretation and geochemical results. Sheppard W.A. and Hawkes N. April 1990 Volume 1.

³ CRA Exploration Pty. Ltd., Note from Steve Allnutt, Dugald Camp to Ian Bell MINENCO Pty. Ltd. 19th August 1990.

⁴ Fax from Mackie Martin & Associates to Steve Allnutt CRA 11th August 1990.

⁵ CRA Exploration Pty. Ltd. Note to Locon Wall, AGC Woodward Clyde, from Steve Allnutt, 19th March 1991. Re: Groundwater in the Dugald River Project Environs.

3.4 Hydrogeological Sequence

Saturday Bore is constructed within the Roseby Schist which consists of calcareous and scapolitic metasediments of mixed greenschist to amphibolite metamorphic grade. This is the same geological formation and lithologies that monitoring bores MB2 and MB4 are constructed in (RN 146111 and RN 146110 respectively – Figure 1).

There is very little primary porosity within the Roseby Schist and water-bearing sequences only occur within fractures. The effective porosity of the Roseby Schist is assumed to be 1%.

Groundwater occurs in fractures, joints, solution channels and along bedding planes (secondary porosity).

Figure 1 also shows that there is no structural connection (faulting) between Saturday Bore and the Dugald River mine.

Groundwater monitoring data collected by MMG since 2008 indicate that there is little, if any, significant hydraulic connectivity in the 1.8km between MB2 / MB4 and Saturday Bore.

3.5 Groundwater Levels

Figure 2 shows the comparison of groundwater elevations from monitoring carried out since 2013. Groundwater level behaviour in both bores is broadly similar. Therefore, MB2 is considered to adequately inform on aquifer conditions in the eastern portion of the Dugald River leases. Saturday Bore is surplus to requirement for groundwater levels.

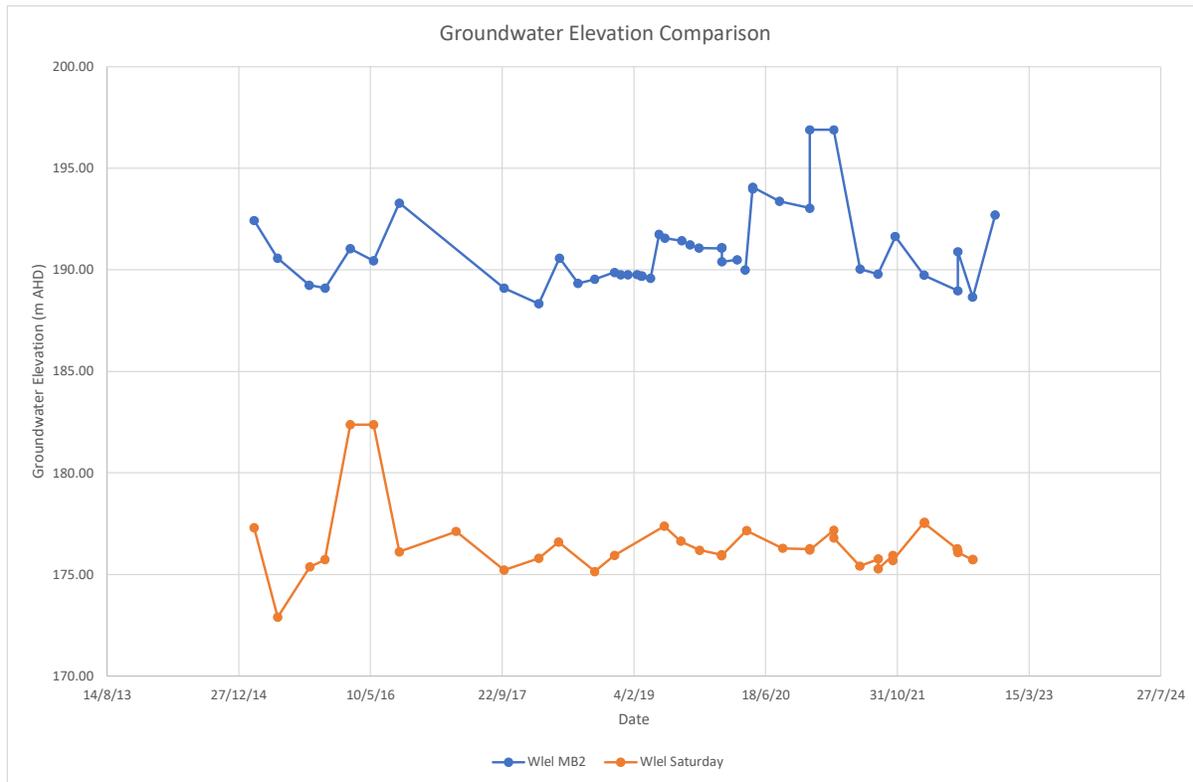


Figure 2: Groundwater Elevation Comparison MB2 and Saturday Bore

3.6 Groundwater Flow

Figure 2 shows that the groundwater elevation in MB2 is between 10 and 15m higher than that in Saturday Bore. Therefore, if hydraulic connectivity existed between MB2 and Saturday Bore, groundwater flow would be from west to east.

The hydraulic conductivity (or permeability) of the Roseby Schist sequence in the 2008 groundwater monitoring bores was measured by a program of falling head permeability tests in 2010. Table 1 shows the results obtained from that program.

TABLE 1: AQUIFER HYDRAULIC CONDUCTIVITY OF THE ROSEBY SCHIST				
Bore Identifier	Aquifer Transmissivity	Aquifer Permeability	Aquifer Permeability	Aquifer Permeability
	m²/day	m/day	m/s	cm/s
MB1	5.88 x 10 ⁻⁴	7.53E-06	8.71E-11	8.71E-09
MB2	3.18 x 10 ¹	4.08E-01	4.72E-06	4.72E-04
MB3	2.29 x 10 ¹	2.60E-01	3.01E-06	3.01E-04
MB4	4.06 x 10 ⁰	7.52E-02	8.70E-07	8.70E-05
MB5	7.19 x 10 ⁰	9.21E-02	1.07E-06	1.07E-04
MB6	1.73 x 10 ⁻¹	2.23E-03	2.58E-08	2.58E-06

In general, the hydraulic conductivity of the Roseby Schist is very low. The groundwater gradient in the Roseby Schist to the east of the Dugald River mine leases (calculated from the MB2 and Saturday Bore measurements) is 0.009 which is typical of a low bulk permeability aquifer sequence. Assuming an effective porosity of 1% the groundwater flow velocity from MB2 to Saturday Bore is of the order of 0.2m/day. Therefore, groundwater would take 23.6 years to travel from MB2 to Saturday Bore if the hydraulic conductivity remained everywhere consistent. It is doubtful that this is the case and significant groundwater flow from west to east appears to not be occurring.

3.7 Groundwater Quality

Table 2 shows the comparison of groundwater quality between MB2 and Saturday Bore.

Notably the electrical conductivity, and the concentrations of copper, manganese, iron and nickel are higher in the groundwater from Saturday Bore than in the groundwater from MB2.

It is reasonable to contend that the groundwater quality in Saturday Bore is poorer than the groundwater quality from MB2.

It is therefore assessed that the groundwater from the Dugald River leases is having no impact of the groundwater quality at Saturday Bore. This suggests that there is very little, if any hydraulic connection between the two features.

TABLE 2: GROUNDWATER QUALITY COMPARISON MB2 AND SATURDAY BORE						
Analyte	Units	MB2		Saturday		Comparison
		No of Results	Result	No of Results	Result	
Electrical Conductivity (Lab)	µS/cm	102	1,040	23	1,700	SB higher
pH (Lab)	pH unit	107	7.53	23	7.53	same
Total Dissolved Solids	mg/L	140	662	25	1,010	SB higher
Suspended Solids	mg/L	130	2.5	24	2.5	same
Turbidity	NTU	38	0.2	14	1.6	SB higher
Sulfate as SO ₄ - Turbidimetric (filtered)	mg/L	139	139	24	134.5	lower
Sulphur as S (filtered)	mg/L	7	110	1	47	lower
Bicarbonate as CaCO ₃	mg/L	112	330.5	22	553	SB higher
Chloride	mg/L	139	51	24	165.5	SB higher
Fluoride	mg/L	138	1.4	24	1.7	SB higher
Calcium (filtered)	mg/L	133	95	24	77	lower
Magnesium (filtered)	mg/L	133	42	24	53.5	SB higher
Potassium (filtered)	mg/L	133	5	24	4	lower
Sodium (filtered)	mg/L	133	76	24	232	SB higher
Total Hardness as CaCO ₃	mg/L	7	460	1	410	lower
Total Hardness as CaCO ₃ (filtered)	mg/L	117	412	23	412	lower
Carbonate Alkalinity as CaCO ₃	mg/L	112	0.5	22	0.5	lower
Hydroxide Alkalinity as CaCO ₃	mg/L	112	0.5	22	0.5	lower
Total Alkalinity as CaCO ₃	mg/L	112	331.5	22	553	SB higher
Aluminium	mg/L	132	0.005	24	0.005	same
Aluminium (filtered)	mg/L	134	0.005	24	0.005	same
Arsenic	mg/L	137	0.0005	24	0.0005	same
Arsenic (filtered)	mg/L	139	0.0005	24	0.0005	same
Cadmium	mg/L	137	0.00005	24	0.00005	same
Cadmium (filtered)	mg/L	138	0.00005	24	0.00005	same
Copper	mg/L	137	0.012	24	0.0005	lower
Copper (filtered)	mg/L	139	0.003	24	0.0005	lower
Iron	mg/L	12	0.025	6	0.125	SB higher
Iron (filtered)	mg/L	12	0.025	6	0.055	SB higher
Lead	mg/L	137	0.0005	24	0.0005	same
Lead (filtered)	mg/L	139	0.0005	24	0.0005	same
Manganese	mg/L	136	0.0355	24	0.589	SB higher
Manganese (filtered)	mg/L	136	0.031	24	0.566	SB higher
Nickel	mg/L	137	0.0005	24	0.00075	SB higher
Nickel (filtered)	mg/L	139	0.0005	24	0.0005	same
Zinc	mg/L	137	0.0025	24	0.0025	same

TABLE 2: GROUNDWATER QUALITY COMPARISON MB2 AND SATURDAY BORE						
Analyte	Units	MB2		Saturday		Comparison
		No of Results	Result	No of Results	Result	
Zinc (filtered)	mg/L	139	0.0025	24	0.0025	same

4.0 CONCLUSIONS

This review has reached the following conclusions:

1. Saturday Bore was not constructed according to the Minimum Construction Requirements for Water Bores in Australia as no such requirements existed when it was installed. No construction details for Saturday Bore exist other than the fact that it was originally 36m deep and lined with 125mm internal diameter PVC casing. It is likely that the borehole annulus around the casing was filled with gravel from total depth (36m) to ground surface. No grout envelope exists at the surface and the bore is therefore vulnerable to direct contamination from any source.
2. Fifteen dedicated groundwater monitoring bores installed since 2008 have been constructed within the Dugald River Mine leases according to the Minimum Construction Standards for Water Bores In Australia⁶ since 2008. This suite of bores comprehensively monitors groundwater conditions at the site.
3. MB2 adequately informs on aquifer conditions in the eastern portion of the Dugald River leases. Saturday Bore is surplus to requirement for groundwater levels.
4. Saturday Bore is constructed within the Roseby Schist which consists of calcareous and scapolitic metasediments of mixed greenschist to amphibolite metamorphic grade. This is the same geological formation and lithologies that monitoring bores MB2 and MB4 are constructed in (RN 146111 and RN 146110 respectively).
5. There is very little primary porosity within the Roseby Schist and water-bearing sequences only occur within fractures. The effective porosity of the Roseby Schist is assumed to be 1%. Groundwater occurs in fractures, joints, solution channels and along bedding planes (secondary porosity).
6. There is no structural connection (faulting) between Saturday Bore and the Dugald River mine.
7. There is little, if any, significant hydraulic connectivity in the 1.8km between MB4 / MB4 and Saturday Bore. the groundwater elevation in MB2 is between 10 and 15m higher than that in Saturday Bore.
8. If hydraulic connectivity existed between MB2 and Saturday Bore, groundwater flow would be from west to east. Groundwater monitoring data suggest that there is very little, if any hydraulic connection between the two features and there is no evidence to suggest that significant west to east groundwater flow is occurring.

⁶ Australian Government, National Water Commission, National Uniform Drillers Licensing Committee. February 2012. MINIMUM CONSTRUCTION REQUIREMENTS FOR WATER BORES IN AUSTRALIA Third edition

9. The groundwater quality in Saturday Bore is poorer than the groundwater quality from MB2.
10. It is assessed that the groundwater from the Dugald River leases is having no impact of the groundwater quality at Saturday Bore.
11. Both MB2 and MB4 monitor the same hydrogeological regime as Saturday Bore and there would be no reduction in the mechanism for assessment of the hydrogeological regime to the east of the Dugald River mine processing plant if Saturday Bore was to be removed from the EA,.
12. Even if Saturday Bore was serviceable RLA considers it to be superfluous. Removal of Saturday Bore from the EA will not diminish the effectiveness of groundwater monitoring at the Dugald River site.

5.0 RECOMMENDATION

It is recommended that Saturday Bore should be removed from the Dugald River Mine Environmental Authority groundwater monitoring bore suite.



ROB LAIT
Principal Hydrogeologist
Rob Lait and Associates Pty Ltd

APPENDIX E: Erosion and Sediment Control Plan (WTS, 2023)



EROSION AND SEDIMENT CONTROL PLAN

DUGALD RIVER MINE

MMG DUGALD RIVER PTY LTD

JUNE 2023



**WULGURU TECHNICAL
SERVICES**

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1. Introduction

MMG Dugald River Pty Ltd (MMG) operate the Dugald River Mine (DRM), a Zinc mining operation situated 62km north west of Cloncurry, northwest Queensland. Zinc is mined at DRM via underground diamond drilling techniques, processed at the DRM process plant and exported as concentrate via the Port of Townsville.

DRM operates in accordance with Environmental Authority (EA) EPML00731213. EA EPML00731213 Condition C33 specifies that an Erosion and Sediment Control Plan (ESCP) must be prepared by an appropriately qualified person and implemented for all stages of the mining activity. The ESCP must be prepared to provide the following functions (EA Condition C33):

- a. Prevent or minimise the contamination of receiving waters and stormwater;
- b. Divert uncontaminated stormwater run-off around areas disturbed by the mining activity or where contaminants or wastes are stored or handled;
- c. Collect treat reuse and/or release contaminated stormwater runoff, incident rainfall and leachate in accordance with conditions of the environmental authority;
- d. Minimise the size of areas or cover areas where contaminants or wastes are stored or handled;
- e. Erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent the contamination of any waters;
- f. Provide procedures to ensure that erosion and sediment control structures are maintained, and adequate storage is available in sediment dams in accordance with design criteria; and
- g. Provide training of staff that will be responsible for maintenance and operation of sediment and erosion control structures.

This ESCP has been prepared by Wulguru Technical Services (WTS) on behalf of MMG to achieve compliance with EA Conditions C32, C33 and C34.

1.1. Purpose

The purpose of this document is to prepare an ESCP which achieves the requirements of EA EPML00731213 Condition C32, C33 and C34. This ESCP has been prepared by suitably qualified persons who hold qualifications in erosion and sediment control practices and/or are qualified as a Registered Professional Engineer in Queensland (RPEQ). Requirements of the ESCP are detailed in

Table 1. MMG ESCP Requirements

	Description	Where Addressed in ESCP
	EA EPML00731213 Condition C33 specifies that an Erosion and Sediment Control Plan (ESCP) must be prepared by an appropriately qualified person and implemented for all stages of the mining activity. The ESCP must be prepared to provide the following functions (EA Condition C33):	
a.	Prevent or minimise the contamination of receiving waters and stormwater;	Section 2.1.3, 2.1.4, 2.2.1
b.	Divert uncontaminated stormwater run-off around areas disturbed by the mining activity or where contaminants or wastes are stored or handled;	2.2
c.	Collect treat reuse and/or release contaminated stormwater runoff, incident rainfall and leachate in accordance with conditions of the environmental authority;	2.2.2
d.	Minimise the size of areas or cover areas where contaminants or wastes are stored or handled;	2.1.4
e.	Erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent the contamination of any waters;	2.3.2
f.	Provide procedures to ensure that erosion and sediment control structures are maintained, and adequate storage is available in sediment dams in accordance with design criteria; and	3.1
g.	Provide training of staff that will be responsible for maintenance and operation of sediment and erosion control structures.	3, 3.1

1.2. DRM Climate and Erosion Risk

DRM is situated within the northwest highlands biogeographic region. The region is characterised by distinctive wet and dry seasons with hot conditions and periods of rainfall between November to April, and relatively dry & mild conditions between May to October. The average rainfall for the Cloncurry region is 483.1 mm.

The International Erosion Control Association's (IECA) Best Practice Erosion and Sediment Control Guidelines (IECA 2008) sets erosion hazard based on average rainfalls for regions around Australia (Table 2). DRM monthly erosion risk is detailed in Table 3.

Table 2. Erosion Risk Rating Based on Average Monthly Rainfall Depth (IECA,2008)

Erosion Risk Rating	Average Monthly Rainfall Depth (mm)
Very Low	0 – 30
Low	30 – 45
Moderate	45 – 100
High	100 – 225
Extreme	>225

Table 3. Monthly Average Rainfall and Erosion Risk

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mm	122.8	113.7	67.3	17.7	13.5	12.0	7.4	3.9	7.0	16.1	31.5	69.1
Risk	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

H – High

M - Moderate

L – Low

VL – Very Low

1.3. DRM Project Soils

Soil investigations were conducted at DRM as a part of the Environmental Impact Assessment (AARC, 2010). The investigations determined 6 soil types across DRM. Soil types and descriptions are detailed in Table 4.

Table 4. Soil Types (AARC, 2010)

SMU	Description
Red Plain	Rudosol – Red sandy loam to sandy clay loam, neutral to slightly acidic, weak to moderate structure, shallow (0.5m) k factor – 0.045, occurs on flat plain areas
Miners	Rudosol – dark yellowish brown, sandy clay loam, slightly alkaline, weak structure, shallow (20cm), K Factor – 0.045, occurs on moderate slopes of 10 - 20°
Knapdale	Tenosol – Brown, sandy clay loam, neutral to slightly acid, weak structure, shallow (20cm) K Factor – 0.045, occurs on slopes of 30-40°
Dale	Rudosol – Brown, sandy loam, slightly acid (increasing pH with depth), weak to moderate structure, moderate depth (50 – 70cm), K Factor – 0.030, occurs in depressions.
Prospectors	Rudosol – Dark yellowish brow, clay loam, slightly acidic, weak structure, shallow (<20cm) depth. K Factor 0.030 occurs at the toe of the Knapdale ranges.
Pocket	Calcarosol – Grey, c lay loam, alkaline, weak structure, shallow (<20cm). Situated on slopes <5°



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Figure 1. Soil Management Units

Legend

- Mine Lease
- Mine Features
- ESRI Satellite

Soil Management Unit

- Dale
- Knapdale
- Miners
- Pocket
- Prospectors
- Red Plain

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2. Erosion and Sediment Control Implementation

2.1. General Erosion and Sediment Control Principles

2.1.1. ESC Purpose

ESC measures are designed to control/manage erosion and sediment that may result from mining and other related activities. General ESC principles include:

- Implementing ESCs prior to land disturbance;
- Minimising all disturbed areas and stabilisation as much as possible by conducting progressive rehabilitation/stabilisation as soon as practical;
- Maintaining vegetative buffer zones where possible;
- Regular maintenance of ESCs; and
- Revegetation of final landforms as soon as possible.

2.1.2. ESC Installation

ESCs fall into three groups:

1. **Type 1:** Sediment trap designed to collect particles <0.045mm. Includes Sediment Basins and other filtration systems used in de-watering operations (IECA, 2008).
2. **Type 2:** Sediment containment systems designed to capture sediment to between 0.045 and 0.14mm. Includes Rock Filter Dams, Sediment Weirs and Filter Ponds (IECA, 2008).
3. **Type 3:** Sediment containment systems primarily designed to trap sediment particles <0.14mm. Includes sediment fences, buffer zones and some stormwater inlet protection systems (IECA, 2008).

The determination of the ESC to be implemented primarily depends on the area of disturbance and the estimated soil loss rate (t/ha/year) and erosion hazard (See Appendix C).

2.1.3. Disturbance Minimisation

It is recommended the following disturbance minimisation methods be implemented at DRM:

- Limiting land clearing to the area specifically required for mining and construction activities.
- Land disturbances are to be carried out 50m from a watercourse.
- Survey of areas to be disturbed are required to be conducted prior to disturbance to ensure areas are not over cleared.
- Limiting the amount of access points to a working area.
- Minimising the of areas where contaminates or waste area stored or handled.

2.1.4. Management of Runoff

It is recommended that runoff from disturbed areas of DRM be managed using the following management principles:

1. **Diversion of clean water** – Clean water diversion bunds/drains installed and maintained around disturbed areas. Clean water diversions (including roofing) direct clean waters away from DRM activities to ensure that waters do not become contaminated and in turn, impact the receiving environment.
2. **Capture & treatment of runoff** – Sediment basins installed and maintained within the disturbance areas. Waters are conveyed towards sediment basins and containment dams. Where sediment basins reach capacity, they may be discharged to the receiving environment where they meet the criteria of EA EPML00731213 Schedule C Table 2. Where waters do not meet the requirements of Schedule C Table 2, additional treatment of waters may be required to ensure discharge compliance (Flocculation, dilution etc.).

2.2. Site Specific Control Measures

2.2.1. Operational Areas

Operational areas include areas of the MLs which are required for the mining, processing of ore, and tailing storage facility (TSF) (process plant, waste rock dumps, TSF etc.). These operation areas have existing containment dams and sediment basins, which have previously been sized and designed by RPEQs, and have since been constructed. These water storages are currently managed under the DRM EA and as a certified regulated structure where required. This section provides detail of operational ESC features. ESC designs are included in Appendix A. There are no changes to existing designed structures as a part of this ESCP.

The main objective of structures installed within operational areas of DRM is to control/manage stormwater runoff, manage sediment loss, minimise the risk of erosion throughout all phases of the mine and contain potential contaminants produced by mining/processing activities. Structures used within operational areas to manage sediment loss and erosion include:

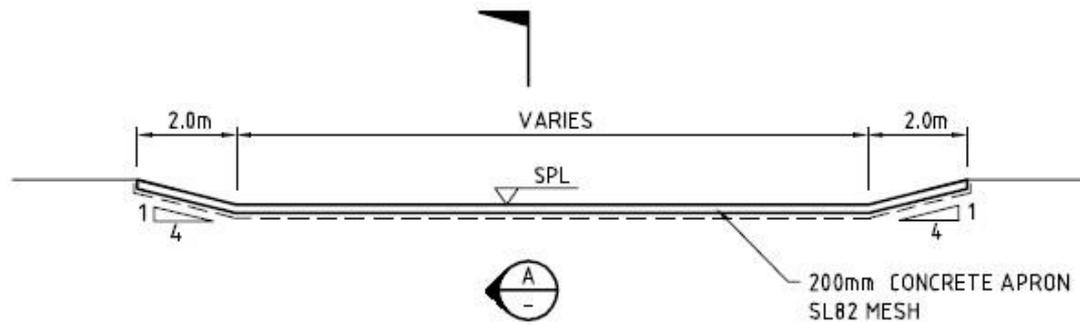
- water culverts;
- water inlet channels;
- Sediment basins; and
- Containment Dams

2.2.1.1. Culverts

Culverts have been installed within operational area catchments to concentrate flow and direct runoff towards storages. The culverts are often installed at the low point of each operational subcatchment which then direct runoff into storage inlet channels.

2.2.1.2. Inlet Channels

Inlet channels have been constructed to convey concentrated runoff from culverts towards storages. Structures with inlet channels include the process plant containment pond, process plant runoff dam, and ROM runoff dam. Inlets are constructed as concrete aprons with low batter angles. Waters conveyed by culverts flow over the inlet channels and into storages. A typical concrete inlet design is detailed in Figure 2.



TYPICAL SECTION CONCRETE SPILLWAY *

SCALE 1:100

* CONCRETE SPILLWAY ONLY IF HDPE LINER IS PROVIDED

Figure 2. Typical Concrete Inlet

2.2.2. Sediment Control

2.2.2.1. Sediment Basins

Sediment basins are utilised to reduce the sediment discharged into waterways as a result of runoff from disturbed areas. These sediment basins are considered to be Type D or Type F basins under the IECA ESC best practice guidelines.

Treatment of sediment basins is primarily via natural sediment drop out within the water column. However, where dispersive soils exist, flocculation may be required to assist in the drop out of finer particles. Retained dirty runoff is able to be treated and discharged where the quality of discharge meets the requirements of EPML00731213 Table 2.

2.2.2.2. Containment Dams

Containment Dams have been constructed to manage stormwater from catchments with a potential for contaminants. Each containment dam has been constructed taking into consideration the types of contaminants most likely to be captured and the size of the catchment.

2.2.2.3. Spillway Design

Sediment basins and containment dams have spillways designed and approved for discharge during wet weather events. Spillways at DRM are constructed out of 50-150 mm diameter rip rap material to a depth of 300 mm. Discharged either flows into the receiving environment directly via the spillway or via an outflow channel.

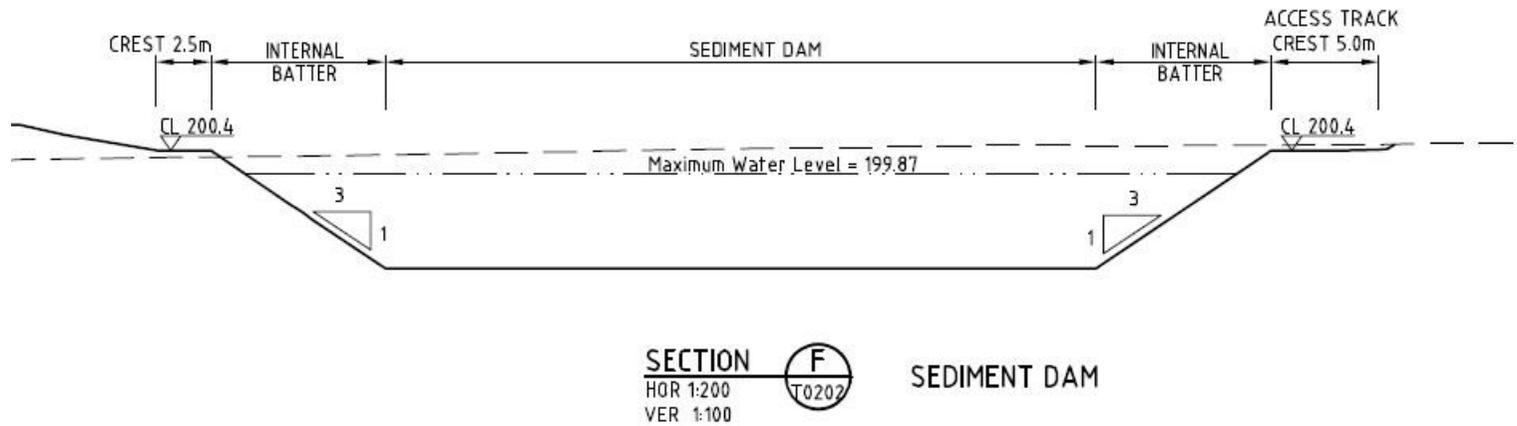


Figure 3. Typical Sediment Basin Design

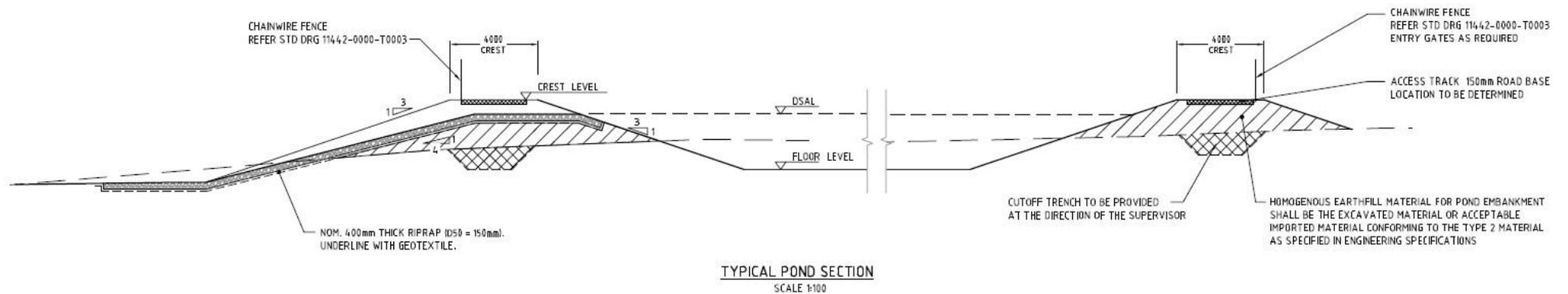


Figure 4. Typical Runoff Dam Design

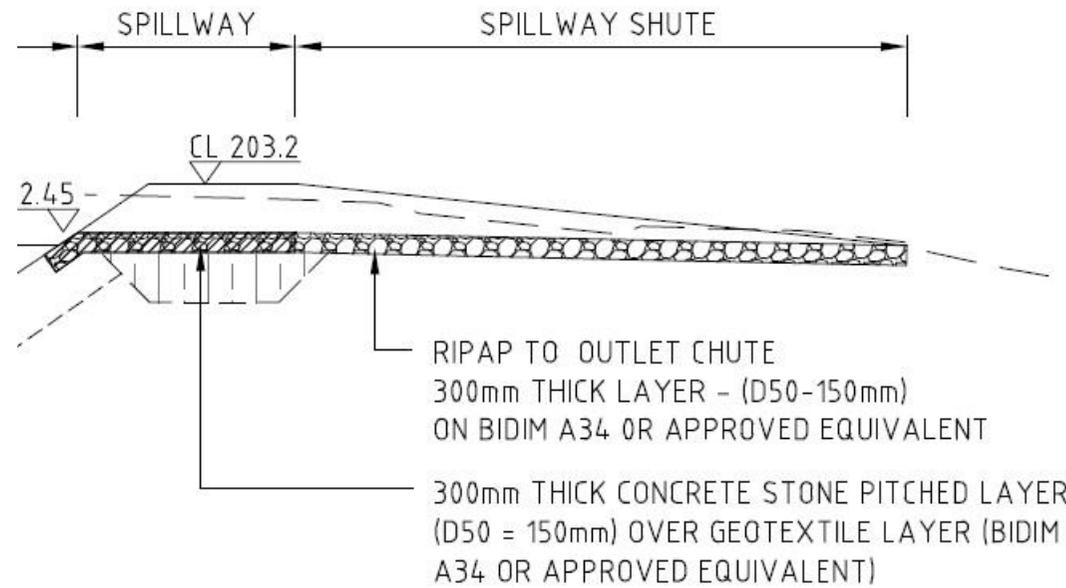


Figure 5. Typical Spillway Design

2.2.2.4. Type 3 Controls

Type 3 ESCs are considered temporary and usually implemented during initial disturbance, focussing on capturing particle size fractions > 0.14mm (IECA, 2008). These measures may be installed during earthworks to prevent sediment laden water from entering clean water catchments.

Type 3 ESCs which may be used within DRM operational areas include:

- Sediment fences;
- Coir logs;
- Rock check dams;
- Buffer Zones; and
- Berms.

2.3. Non-Operational Areas

Non-operational areas are domains of DRM which are not a direct part of the mining or process activities and include areas such as exploration pads, tracks, laydowns, workers accommodation and wind farm pads. This section details the calculations used to assess erosion risk, the types of ESCs required and ESC details for non-operational areas of DRM. Detailed designs have been prepared by Civil IQ Pty Ltd (Civil IQ) and are included in Appendix B.

2.3.1. ESC Controls Requirements

The type of control to be installed is dependent on soil loss (t/ha/year) over the catchment. Soil loss within a catchment is calculated using the Revised Universal Soil Loss Equation (RUSLE) as follows:

$$A = R \times K \times LS \times P \times C$$

Where:

A = Computed soil loss (t/ha/year)

R = Rainfall erosivity factor

K = Soil erodibility factor

LS = Slope length/gradient factor

P = Erosion control practice factor

C = Ground cover and management factor

RUSLE calculations determine the soil loss (t/ha/year) and erosion hazards for each of the Subcatchments at DRM. The soil loss rate determines the type of ESCs required to be installed.

Sediment control type standards and corresponding soil loss rates are detailed in Figure 6.

Table B1 – Sediment control standard (default) based on soil loss rate

Catchment Area (m ²) ^[1]	Soil loss (t/ha/yr) ^[2]			Soil loss (t/ha/month) ^[2]		
	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
250	N/A	N/A	[4]	N/A	N/A	[4]
1000	N/A	N/A	All cases	N/A	N/A	All cases
2500	N/A	> 75	75	N/A	> 6.25	6.25
>2500	> 150	150	75	> 12.5	12.5	6.25
> 10,000	> 75	N/A	75	> 6.25	N/A	6.25

Notes:

- [1] Area is defined by the catchment area draining to a given site discharge. Sub-dividing a given drainage catchment shall not reduce its 'effective area' if runoff from these sub-areas ultimately discharges from the site at the same general location. The 'area' does not include any 'clean' water catchment that bypasses the sediment trap. The catchment area shall be defined by the 'worst case' scenario, i.e. the largest effective area that exists at any instance during the soil disturbance.
- [2] Soil loss defines the maximum allowable soil loss rate (based on RUSLE analysis) from a given catchment area. A slope length of 80 m should be adopted within the RUSLE analysis unless permanent drainage or landscape features reduce this length.
- [3] RUSLE analysis on a monthly basis shall only apply in circumstances where the timing of the soil disturbance is/shall be regulated by enforceable development approval conditions. When conducting monthly RUSLE calculations, use the worst-case monthly R-Factor during the nominated period of disturbance.
- [4] Refer to the relevant regulatory authority for assessment procedures. The default standard is a Type 3 sediment trap.
- [5] Exceptions to the use of *Sediment Basins* shall apply in circumstances where it can be demonstrated that the construction and/or operation of a *Sediment Basin* is not practical, such as in many forms of linear construction where the available work space or Right of Way does not provide sufficient land area. In these instances, the focus must be erosion control using techniques to achieve an equivalent outcome. The 'intent' shall always be to take all reasonable and practicable measures to prevent or minimise potential environmental harm.

Figure 6. Sediment Control Standard based on Soil Loss Rates

Soil loss and erosion hazard have been calculated using the RUSLE calculation above for the 24 sub-catchments identified outside of DRM operational areas. Soil loss calculations are detailed in Appendix C.

2.3.2. Drainage Controls

2.3.2.1. Clean Water Diversions

It is recommended that clean water diversions are constructed on the upstream perimeter of disturbance to convey clean water runoff away from disturbed areas and reduce the catchment of runoff requiring retention and treatment. Clean water diversions may consist of a bund which will concentrate flow along the tow of the bund away from disturbance areas or catch drains can be installed upslope of the disturbance area. Where subsoils are sodic, catch drains are not recommended and bunds are preferred to be installed to limit the risk of dispersive material being exposed to runoff.

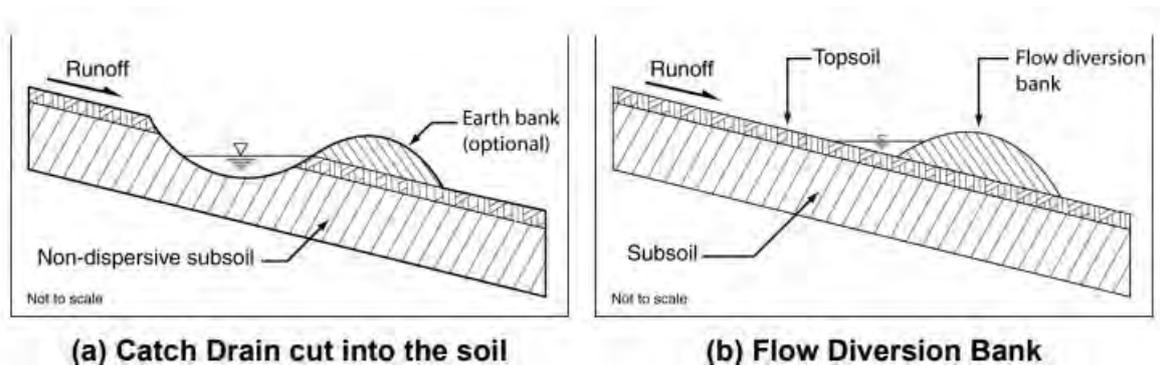


Figure 7. Diversion Bank Options (IECA,2008)

2.3.2.2. Cross Bank Drainage

Cross bank drains may be installed on unsealed tracks to divert water to roadside table drains. Cross bank drains divert waters off the road or access track at designated intervals. Cross bank drains are recommended to be installed at a height that adequately diverts runoff while also being wide enough to allow for comfortable vehicle passage. IECA Best practice in ESC guideline (2008) outlines that Cross-bank drains are to be sized dependant on Erosion Risk (Table 5).

Table 5 Cross Bank Drain Spacing (IECA,2008)

Road Grade	Horizontal Spacing (m)
1%	100
2%	60
3%	50
5%	40
10%	30
>14%	20

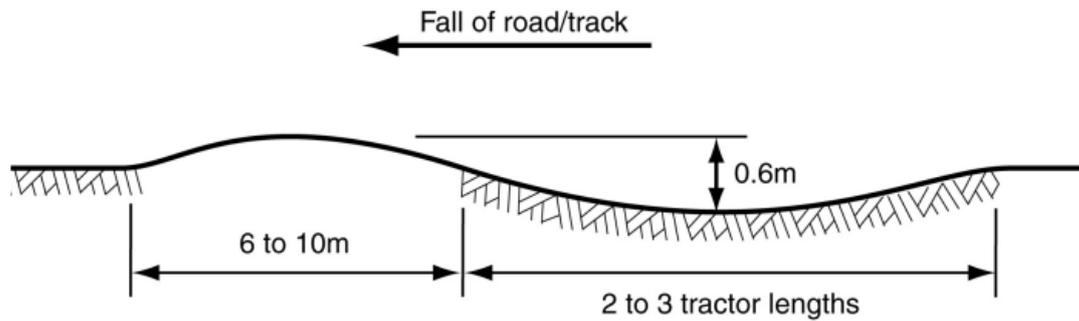


Figure 8. Typical Cross Bank Drain Design

The following is to be considered when installing cross bank drains as cross bank drainage features:

- Material used in construction must be cohesive and material such as sands and bull dust should be avoided.
- Direction of should ensure discharge does not impact lower portions of roads/tracks.
- Should be positioned away from intersections.
- Should not be > 4H:1V.

2.3.2.3. Table Drains

It is recommended that table drains be installed parallel to roads and tracks and convey waters downstream to Mitre drains for disposal. These drains are designed to have sufficient capacity to convey waters without eroding. The type of drain (parabolic vs “v” shape) is dependent on the substrate in which the drain is being installed however, parabolic drains are preferred. Typical drain design is displayed in Figure 9.

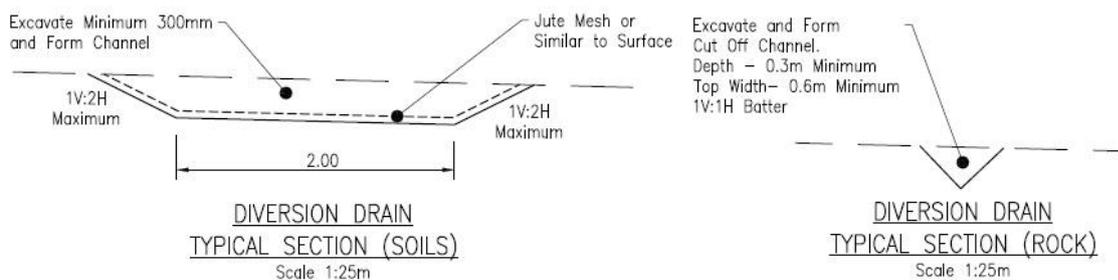


Figure 9. Typical Diversion Drain Designs (Civil IQ, 2022)

2.3.2.4. Mitre Drains

Mitre drains are open channels built parallel to roads and tracks which direct runoff from cross bank drains for disposal. Mitre drains convey waters to an energy dissipater at the mitre drain outlet which will allow waters to discharge as sheet flow into the receiving environment. The spacing of Mitre drains is dependent on the spacing of cross bank drains however, standard spacing for Mitre drains are detailed in Table 6.

Table 6. Mitre Drain Spacings Along Roadside Table Drains (IECA,2008)

Road Grade	Horizontal Spacing (m)
<1%	>150
2%	100
5%	60
10%	40
>10%	15

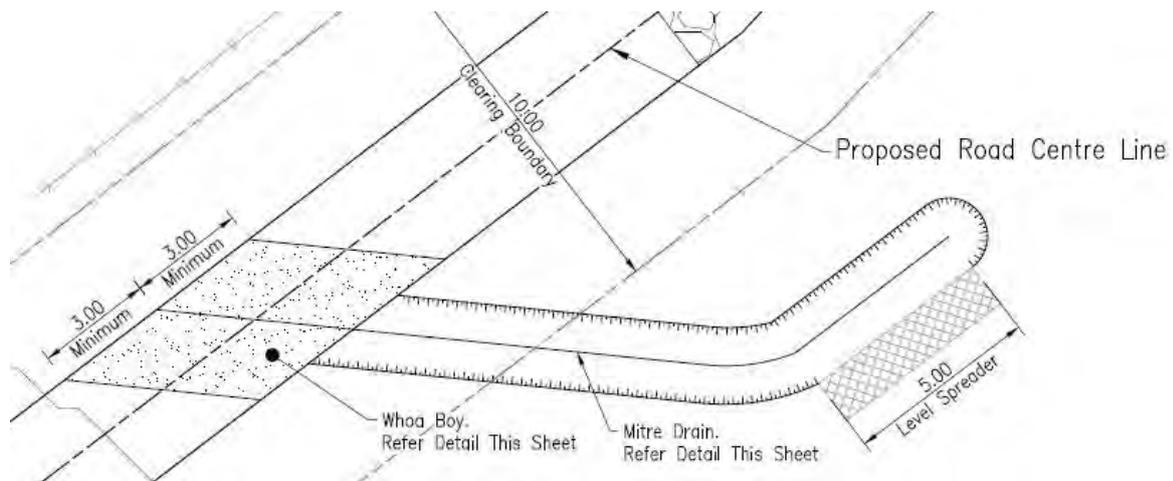


Figure 10. Typical Cross Bank & Mitre Drain Design (Civil IQ, 2022)

2.3.2.5. Waterway Crossings

Waterway crossings are required at DRM where access tracks cross watercourses. Waterway crossings will be installed as “dry” and “wet” waterway crossings as per the schematics below. The following is to be considered when installing waterway crossings:

- Soil is not stockpile in watercourses.
- Disturbance of stream bed is to be minimised as much as practical.
- Disturbance of the stream bed is kept to a minimum.

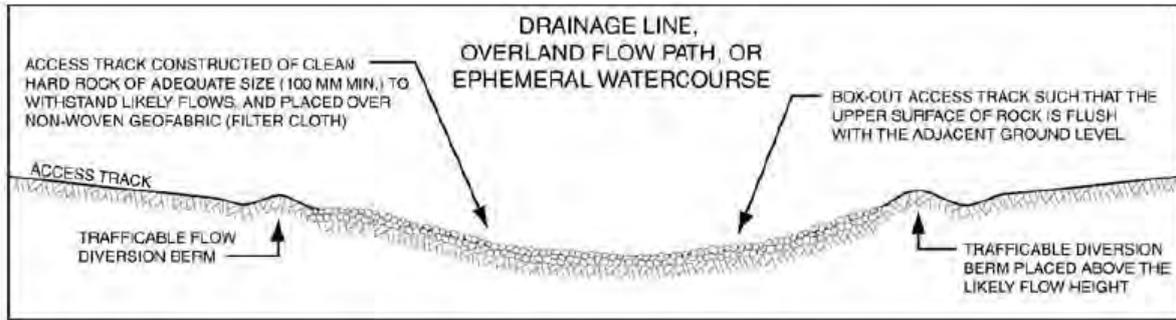


Figure 16. Typical profile of a bedlevel vehicle crossing for a 'dry' drainage line (IECA, 2015).

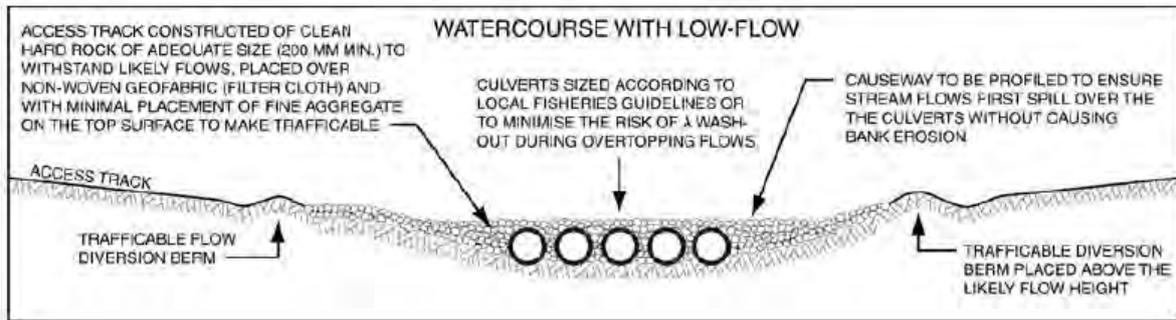


FIGURE 11. BED LEVEL CROSSING OPTIONS (LANDLOCH, 2018)

2.3.3. Sediment Controls

2.3.3.1. Sediment Basins

Sediment basins have been designed for non-operational areas of DRM (Appendix E). Sediment basins have been designed for IFD: 2-year, 6-hour storm. Typical Sediment Basin design is included in Figure 12. Sediment Basin sizings detailed in Appendix D.

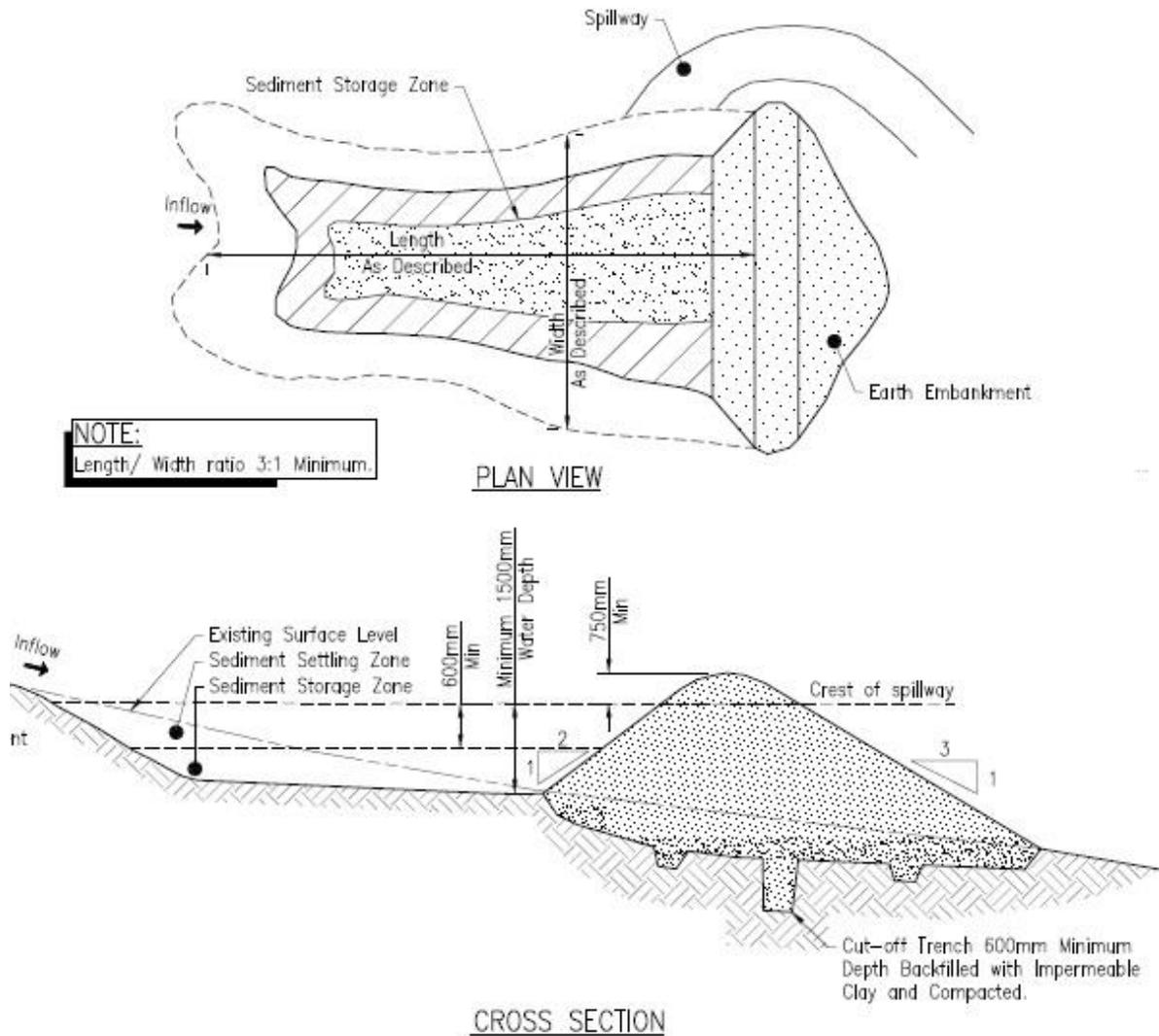


Figure 12. Typical Sediment Basin Design (Civil IQ, 2022)

2.3.4. Sediment Weir

Where soil loss calculations have determined that type 2 ESCs are required, sediment weirs should be installed. Sediment Weirs are self-supporting vertical rock weirs constructed from riprap, with a filter medium placed upstream of the weir. Sediment weirs can be installed at the low point of the catchment. Dirty runoff flows through the outer geotextile fabric and aggregate into the sump where sediment will drop from suspension. When waters within the sump exceed the natural elevation of the lower wall, runoff will continue to flow through the geotextile fabric and aggregate, and into the receiving environment. A weir may be installed on the outfall wall of the sediment weir when flows exceed capacity. Typical Sediment Weir design is below.

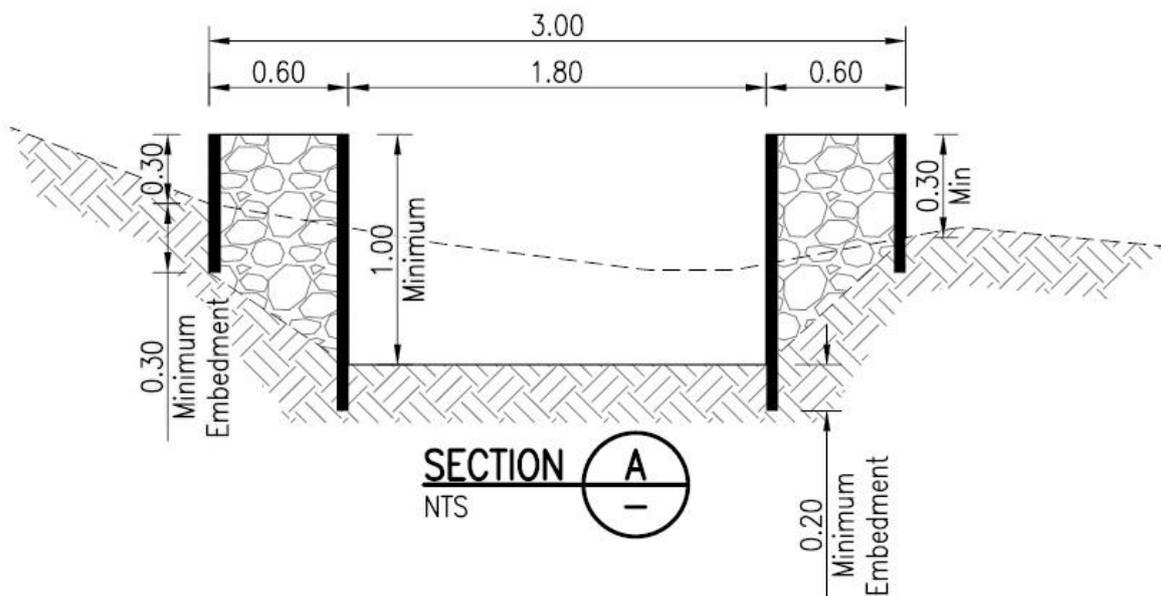


Figure 13. Typical Sediment Weir

2.3.4.1. Level Spreader

Where there is a low to very low erosion risk within a sub-catchment, level spreaders may to be installed. Level spreaders convert concentrated flow to sheet flow to avoid high velocity waters entering the environment and causing erosion and sediment loss. Level spreaders can be installed at the outfall of a subcatchment. The slope of the landform must be <1% and the landform receiving discharged runoff must be stable and non-sodic. Typical Level spreader design is displayed in Figure 14.

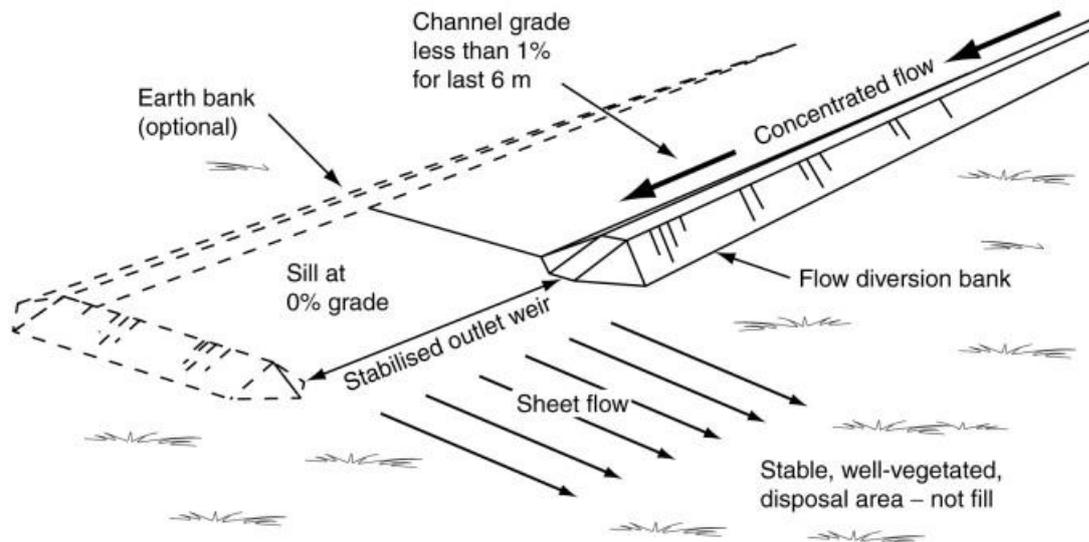


Figure 14. Typical Level Spreader

2.3.5. Type 3 ESCs

Type 3 ESCs should be implemented where there is a low to very low erosion hazard. Type 3 controls at DRM may be constructed as sediment fences. Sediment fences are constructed using geotextile filter fabric with steel pickets to be spaced no more than 2.5 metres apart. Sediment fences are to be installed on the downstream of the areas disturbed and are to be installed parallel to the landform contours, with the upslope catchment is to grade of no more than 1V: 2H. Sediment fences should not be installed in high velocity flows and where upstream catchments exceed 0.6 hectares. Where practicable, catchment areas are to be reduced by constructing fences with returns at 20 metres to create smaller catchments.

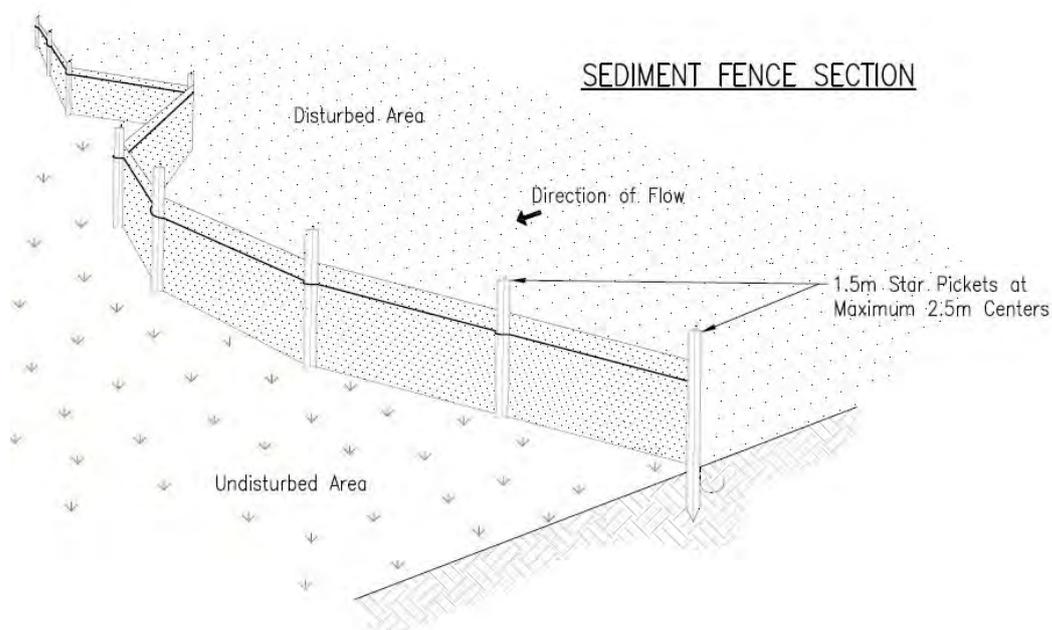


Figure 15. Typical Sed Fence Design

3. ESC Management

3.1. Inspections

Inspections of erosion and sediment control structures is designed to assess the condition and performance of the structures. Inspections are carried out in accordance with applicable site inspection procedures to review any maintenance requirements and assess storage availability.

3.2. Staff Training

Training in ESC is recommended to be completed by the DRM environmental team and other personnel who are conducting works under a DRM LDP. Basic ESC training for these workers is aimed at ensuring that these workers understand the importance of ESC and the types of ESCs to be implemented within their work areas. Training will include:

- Land disturbance processes;
- ESC used at DRM; and
- Erosion hazards of their work areas.

4. References

BUCHANAN S, 2018. Erosion and Sediment Control Strategy. Landloch Pty Ltd. Toowoomba

BUREAU OF METEOROLOGY. 2021a. Climate statistics for Australian locations - Cloncurry Airport (029141) [Online]. Available: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=029141 [Accessed 01/012/2022].

ECA 2008, Best Practice Erosion and Sediment Control. Book 1. International Erosion Control Association (Australasia), Picton NSW

ECA 2008, Best Practice Erosion and Sediment Control. Book 2. International Erosion Control Association (Australasia), Picton NSW

ECA 2008, Best Practice Erosion and Sediment Control. Book 3. International Erosion Control Association (Australasia), Picton NSW

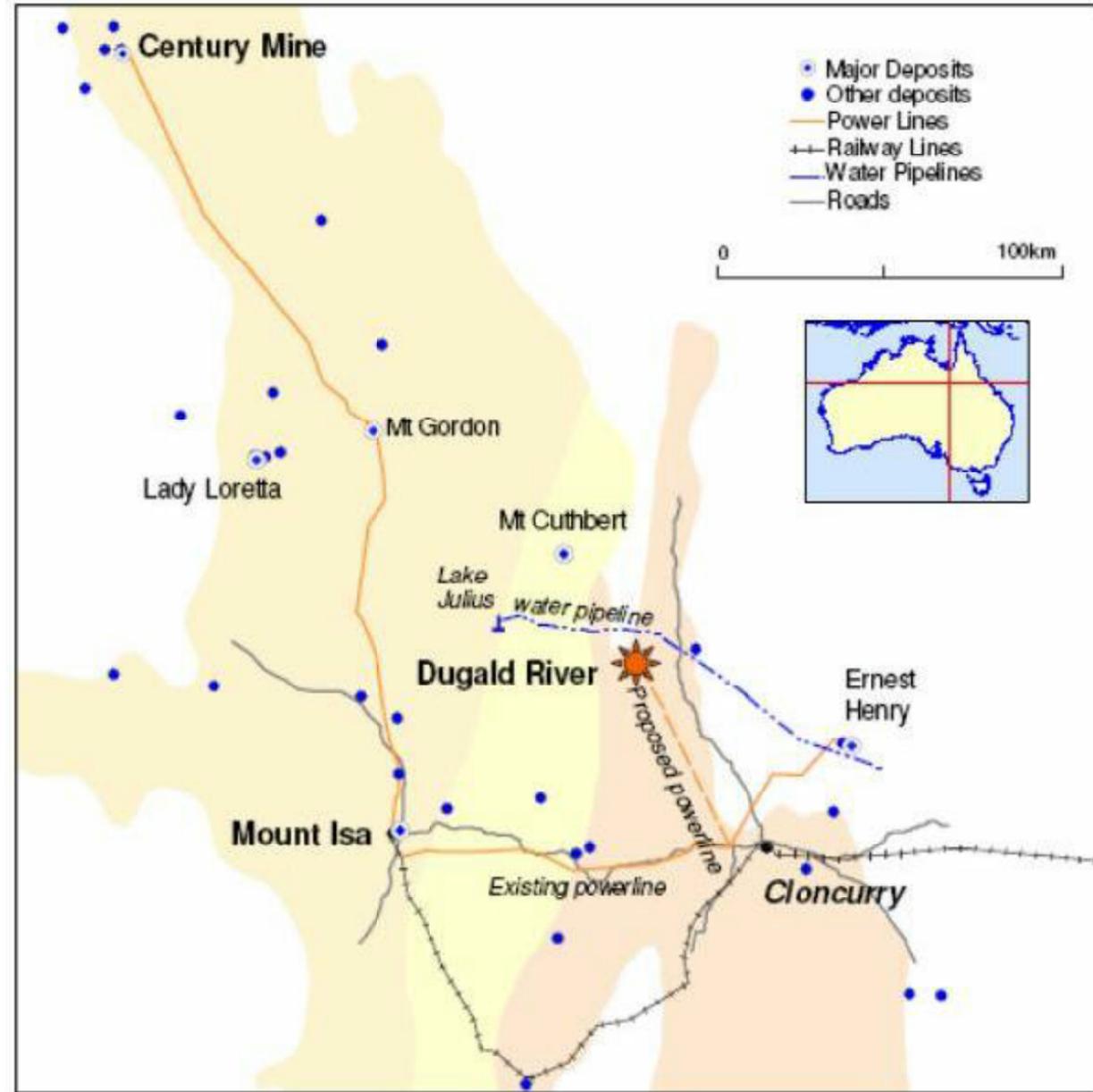
GLENCORE – ULAN COAL 2021. Erosion and Sediment Control Plan

Appendix A – Operational Area ESCP Plans



MMG DUGALD RIVER DUGALD RIVER PROJECT

ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL



LOCALITY PLAN
SCALE: NTS

DRAWING LIST

MMG DRAWING #	ATCW DRAWING #	DRAWING TITLE
0016-DWG-2160-C-0067	108003.26-000	DRAWING LIST
0016-DWG-2160-C-0068	108003.26-001	SITE PLAN
0016-DWG-2160-C-0069	108003.26-002	SED DAM C - GENERAL LAYOUT
0016-DWG-2160-C-0070	108003.26-003	SED DAM C - SEDIMENT COLLECTION DRAINS AND 'CLEAN WATER' DIVERSION CHANNEL LONG SECTIONS
0016-DWG-2160-C-0071	108003.26-004	SED DAM C - SEDIMENT COLLECTION DRAINS AND 'CLEAN WATER' DIVERSION CHANNEL SECTIONS AND DETAILS
0016-DWG-2160-C-0072	108003.26-005	SED DAM C - DETAIL PLAN AND SECTIONS
0016-DWG-2160-C-0073	108003.26-006	SED DAM C - SECTIONS AND DETAILS (SHEET 1 OF 2)
0016-DWG-2160-C-0074	108003.26-007	SED DAM C - SECTIONS AND DETAILS (SHEET 2 OF 2)
0016-DWG-2160-C-0075	108003.26-008	SED DAM D - GENERAL LAYOUT, DETAIL PLAN AND SECTIONS
0016-DWG-2160-C-0076	108003.26-009	SED DAM D - SEDIMENT COLLECTION DRAIN LONG SECTIONS AND DETAILS
0016-DWG-2160-C-0077	108003.26-010	SED DAM D - SECTIONS AND DETAILS

GENERAL CONSTRUCTION NOTES

1. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE WORK METHOD.
2. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
3. ALL COORDINATES ARE IN METRES TO MAP GRID OF AUSTRALIA (MGA).
4. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
5. DIMENSIONS AND LOCATIONS OF EXISTING STRUCTURES SHALL BE CONFIRMED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
6. LOCATION AND DEPTH OF ALL SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF WORKS.
7. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.
8. SECTION REFERENCING RELATES TO THE MMG DRAWING NUMBERS.

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD	SCALE NTS
1	ISSUED FOR CONSTRUCTION	05.10.16	LL	AVK	MD	SCALE NTS
						JOB No. 108003.26
						DATE 08.07.16
						DESIGN AVK
						DRAWN HR
						CHECKED AVK
						APPROVED MD

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GROUNDED IN DESIGN

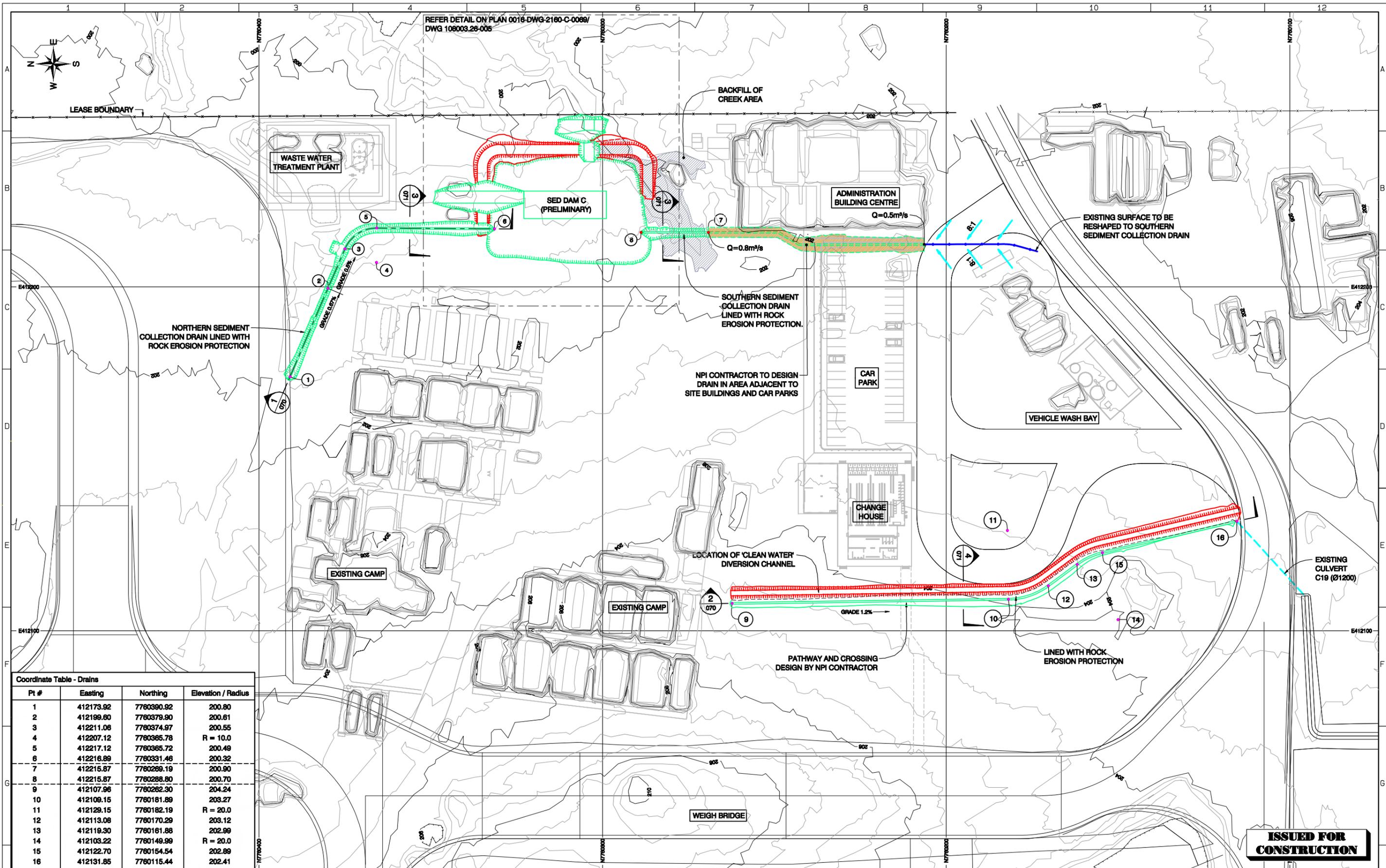
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MMG DUGALD RIVER DUGALD RIVER PROJECT		108003.26-000
ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL DRAWING LIST		MMG DWG NO. 0016-DWG-2160-C-0067
REV. 1	SHT SIZE A3	
SHEET 1 OF 1		



Coordinate Table - Drains

Pt #	Easting	Northing	Elevation / Radius
1	412173.92	7760390.92	200.80
2	412199.60	7760379.90	200.61
3	412211.08	7760374.97	200.55
4	412207.12	7760365.76	R = 10.0
5	412217.12	7760365.72	200.49
6	412216.89	7760331.46	200.32
7	412215.87	7760289.19	200.90
8	412215.87	7760288.80	200.70
9	412107.96	7760282.30	204.24
10	412109.15	7760181.89	203.27
11	412129.15	7760182.19	R = 20.0
12	412113.08	7760170.29	203.12
13	412119.30	7760161.88	202.99
14	412103.22	7760149.99	R = 20.0
15	412122.70	7760154.54	202.89
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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
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 APPROVED MD

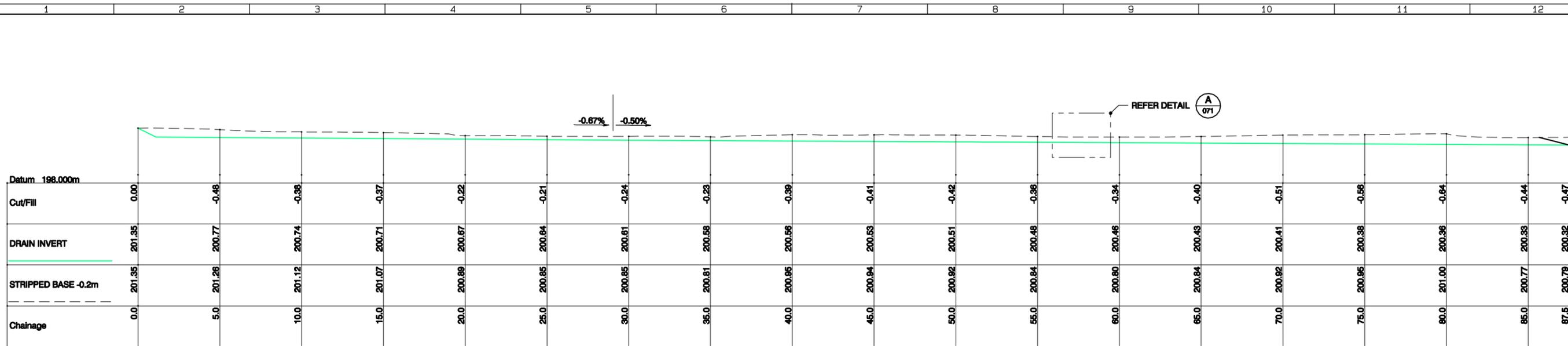
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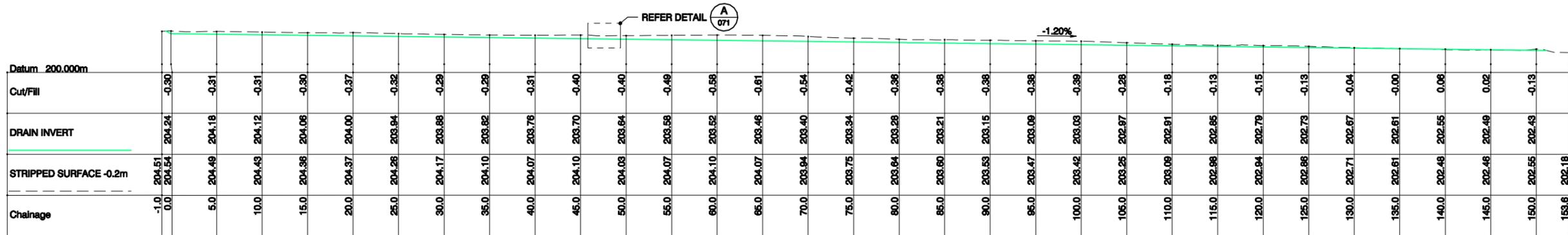
**MMG DUGALD RIVER
 DUGALD RIVER PROJECT**

ADMINISTRATION AREA
 SEDIMENTATION AND EROSION CONTROL
 SED DAM C
 GENERAL LAYOUT

108003.26-002
 MMG DWG NO.
 0016-DWG-2160-C-0069
 REV. 1 SHT SIZE A3
 SHEET 1 OF 1



LONG SECTION 1
088
NORTHERN SEDIMENT COLLECTION DRAIN
 SCALE 1:280



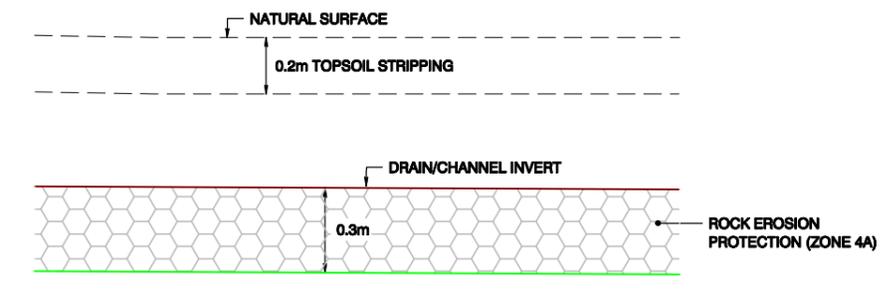
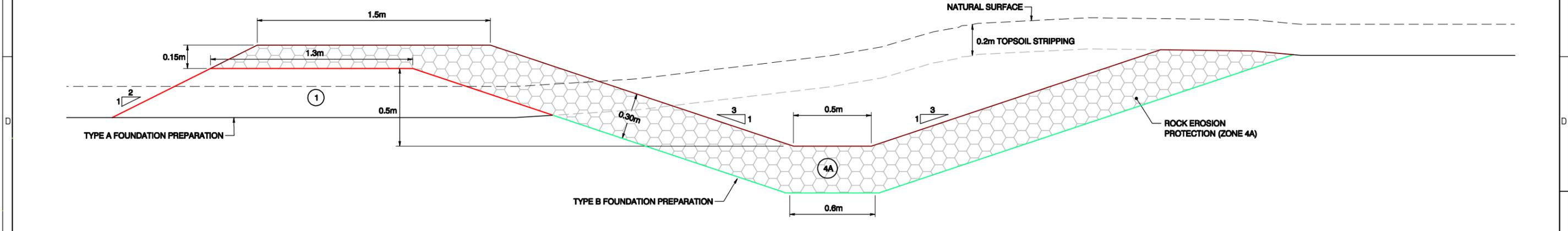
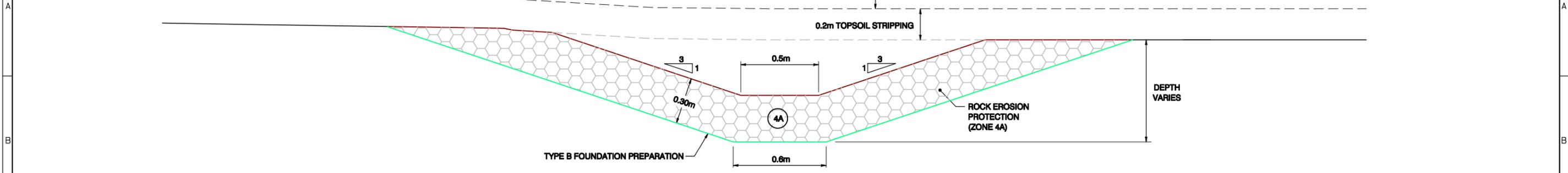
LONG SECTION 2
088
'CLEAN WATER' DIVERSION CHANNEL
 SCALE 1:500

ISSUED FOR CONSTRUCTION

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MMG DUGALD RIVER DUGALD RIVER PROJECT		108003.26-003
ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL SED DAM C SEDIMENT COLLECTION DRAINS AND 'CLEAN WATER' DIVERSION CHANNEL LONG SECTIONS		MMG DWG NO. 0016-DWG-2160-C-0070
REV. 1	SHT SIZE A3	SHEET 1 OF 1

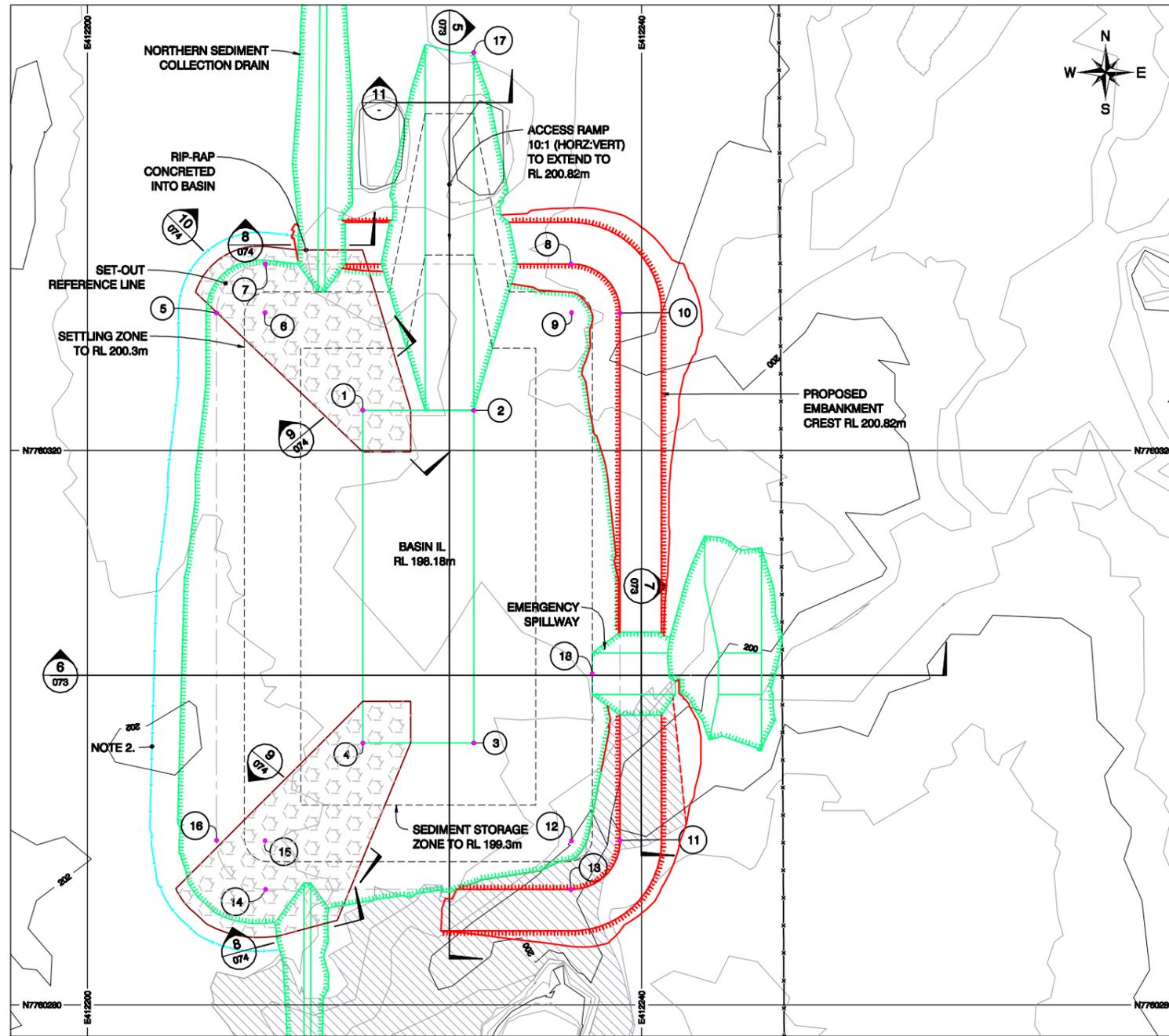


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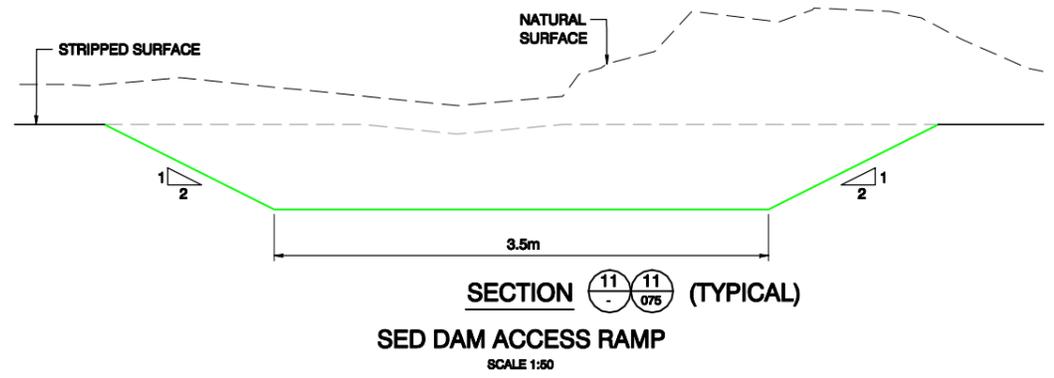
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DRAWN	DR	CHECKED	AVK	APPROVED	MD
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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD

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ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL SED DAM C SEDIMENT COLLECTION DRAINS AND 'CLEAN WATER' DIVERSION CHANNEL SECTIONS AND DETAILS		MMG DWG NO. 0016-DWG-2160-C-0071
REV. 1	SHT SIZE A3	SHEET 1 OF 1



DETAIL PLAN
SED DAM C
SCALE 1:400



- NOTES:**
1. FINAL SURFACE TO BE TRIMMED AND ROLLED WITH A 10 TONNE SMOOTH DRUM ROLLER TO PRESENT A SMOOTH HARD WEARING SURFACE.
 2. CONSTRUCTION OF 300mm DEEP SWALE DRAINS (3:1 SIDE SLOPES) WITH LOCAL RESHAPING OF GROUND SURFACE TO DIRECT WATER TO INLET DRAINS.

ISSUED FOR CONSTRUCTION

Coordinate Table - Sedimentation Dam C, Ramp & Spillway							
Pt #	Easting	Northing	Elevation / Radius	Pt #	Easting	Northing	Elevation / Radius
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2	412227.878	7760322.895	198.820	12	412234.938	7760291.835	R = 3.5m
3	412227.878	7760298.895	198.820	13	412234.898	7760288.335	200.820
4	412219.878	7760298.895	198.820	14	412212.857	7760288.335	200.820
5	412209.317	7760329.916	200.820	15	412212.818	7760291.835	R = 3.5m
6	412212.817	7760329.955	R = 3.5m	16	412209.318	7760291.874	200.820
7	412212.856	7760333.455	200.820	17	412227.878	7760348.710	200.760
8	412234.898	7760333.455	200.820	18	412236.438	7760303.894	200.320
9	412234.938	7760329.955	R = 3.5m				
10	412238.438	7760329.916	200.820				

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
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SCALE AS SHOWN

JOB No. 108003.26
DATE 08.07.16
DESIGN AVK
DRAWN HR
CHECKED AVK
APPROVED MD

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melbourne@atcwilliams.com.au

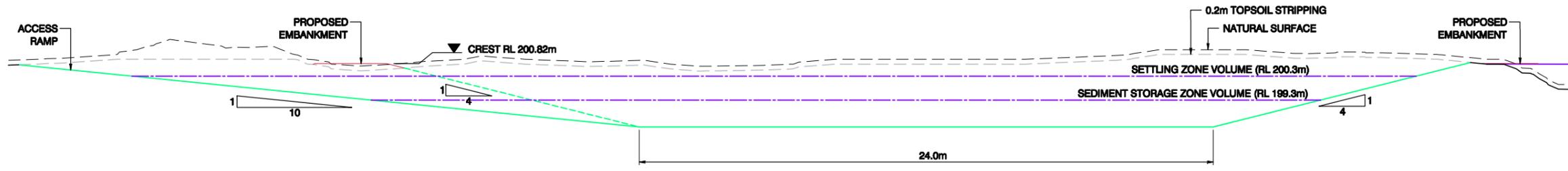
**MMG DUGALD RIVER
DUGALD RIVER PROJECT**

108003.26-005

ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL
SED DAM C
DETAIL PLAN & SECTIONS

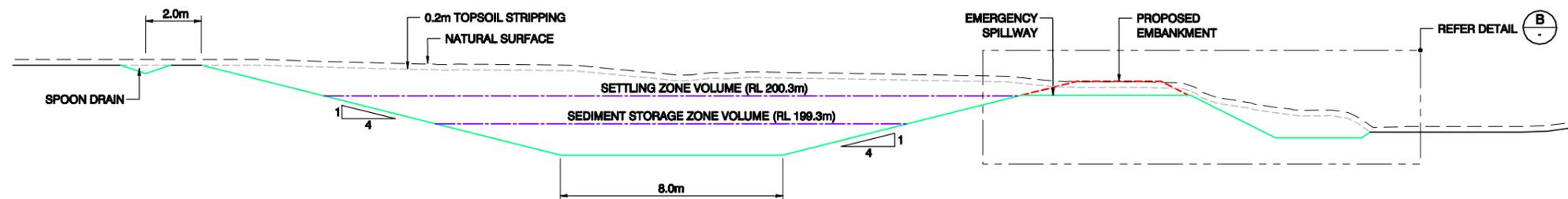
MMG DWG NO.
0016-DWG-2160-C-0072

REV. 1 SHT SIZE A3
SHEET 1 OF 1

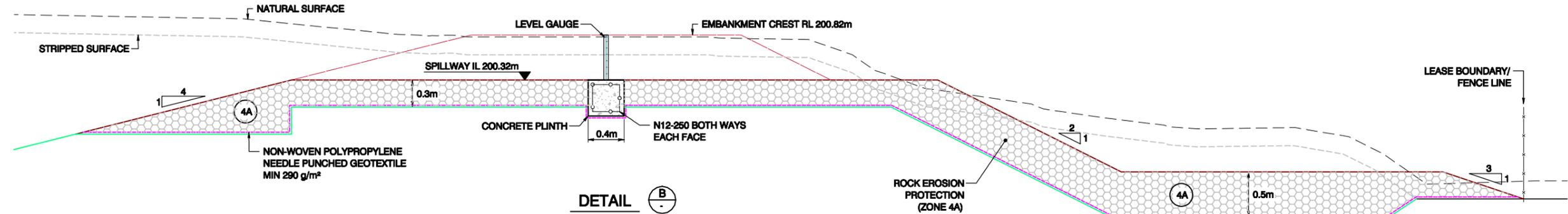


SECTION 5
SED DAM C (SHOWING ACCESS RAMP)
 SCALE 1:200

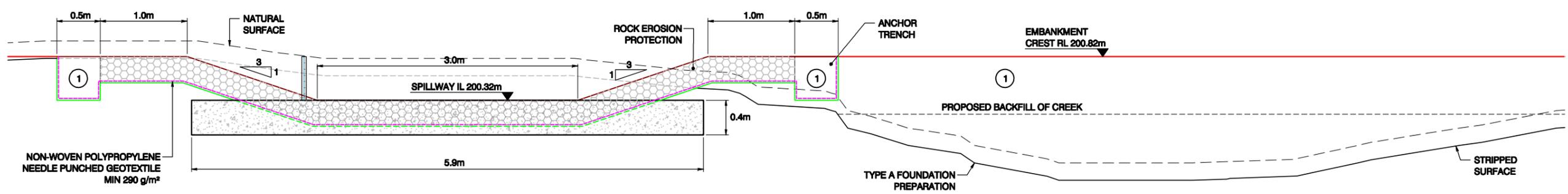
NOTE:
 FINAL SURFACE TO BE TRIMMED AND ROLLED WITH A 10 TONNE SMOOTH DRUM ROLLER TO PRESENT A SMOOTH HARD WEARING SURFACE



SECTION 6
SED DAM C (THROUGH CONTROLLED RELEASE OUTLET)
 SCALE 1:200



DETAIL B
SED DAM C (THROUGH SPILLWAY AND OUTLET CHANNEL)
 SCALE 1:50



SECTION 7
SED DAM C SPILLWAY
 SCALE 1:50

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
1	ISSUED FOR CONSTRUCTION	05.10.16	LL	AVK	MD

SCALE AS SHOWN

JOB No. 108003.26
 DATE 10.07.16
 DESIGN AVK
 DRAWN DR
 CHECKED AVK
 APPROVED MD

ATC Williams
 GROUNDED IN DESIGN

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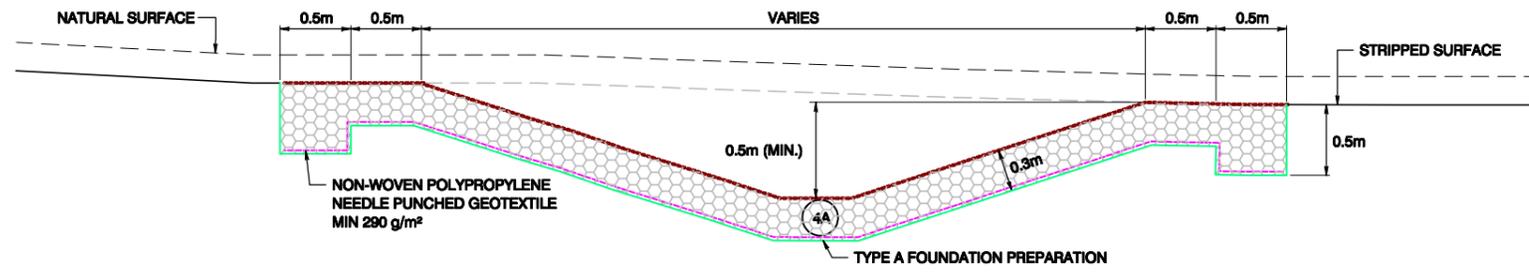
**MMG DUGALD RIVER
 DUGALD RIVER PROJECT**

108003.26-006

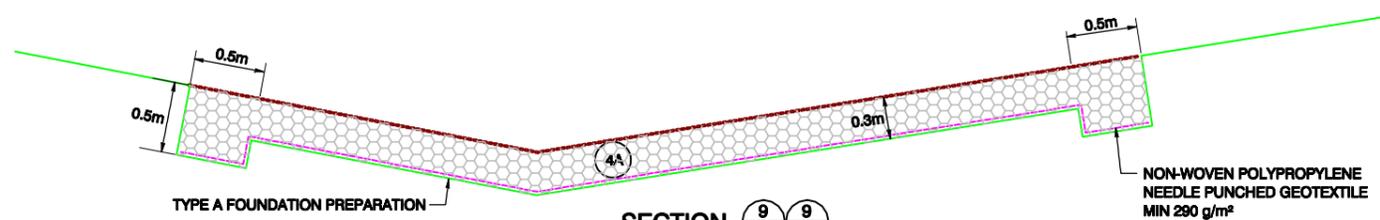
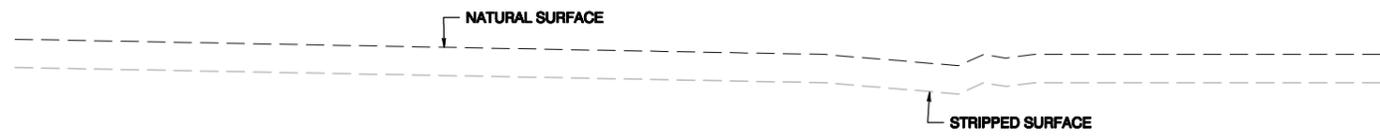
ADMINISTRATION AREA SEDIMENTATION AND EROSION CONTROL
 SED DAM C
 SECTIONS & DETAILS (SHEET 1 OF 2)

MMG DWG NO.
 0016-DWG-2160-C-0073

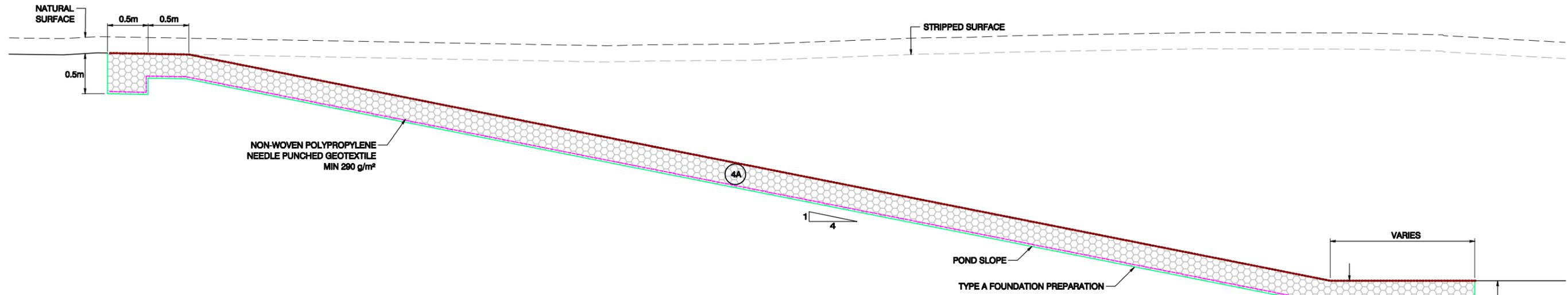
REV. 1 SHT SIZE A3
 SHEET 1 OF 1



SECTION $\frac{8}{072}$ $\frac{8}{075}$
SED DAM C & D INLET DRAINS
 SCALE 1:50



SECTION $\frac{9}{072}$ $\frac{9}{075}$
SED DAM C & D INLET AREA SURFACE TREATMENT
 SCALE 1:50



SECTION $\frac{10}{072}$ $\frac{10}{075}$
SED DAM C & D INLET AREA SURFACE TREATMENT
 SCALE 1:50

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
1	ISSUED FOR CONSTRUCTION	05.10.16	LL	AVK	MD

SCALE AS SHOWN

JOB No. 108003.26
 DATE 08.07.16
 DESIGN AVK
 DRAWN HR
 CHECKED AVK
 APPROVED MD

ATC Williams
 GROUNDED IN DESIGN

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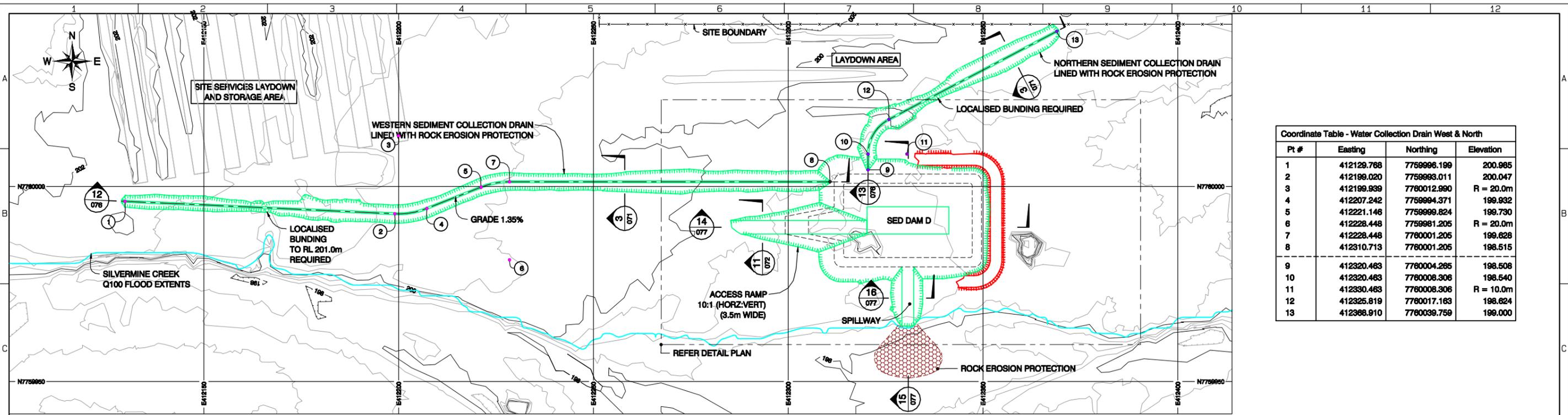
**MMG DUGALD RIVER
 DUGALD RIVER PROJECT**

108003.26-007

ADMINISTRATION AREA
 SEDIMENTATION AND EROSION CONTROL
 SED DAM C
 SECTIONS AND DETAILS (SHEET 2 OF 2)

MMG DWG NO.
 0016-DWG-2160-C-0074

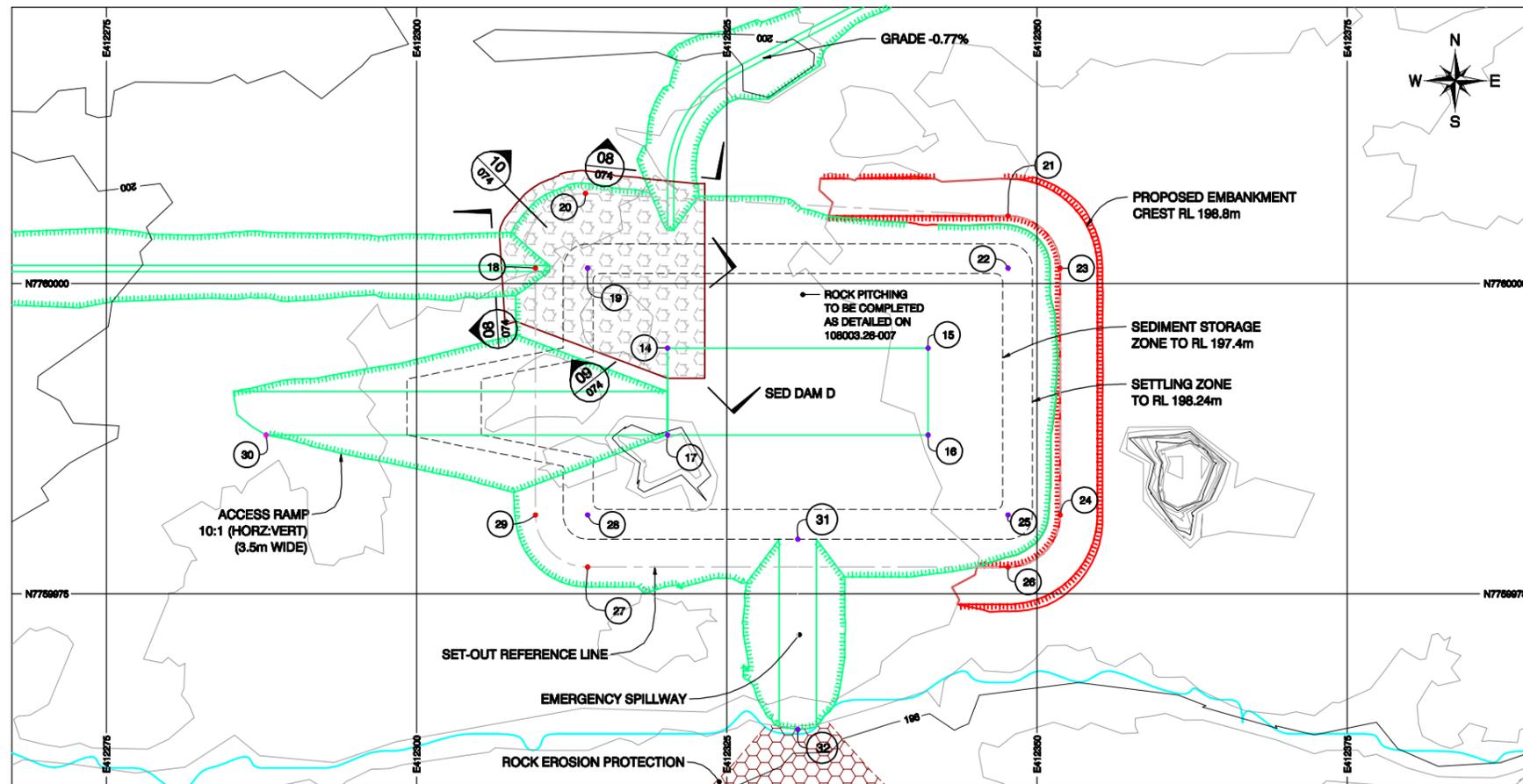
REV. B SHT SIZE A3
 SHEET 1 OF 1



Coordinate Table - Water Collection Drain West & North			
Pt #	Easting	Northing	Elevation
1	412129.768	7759996.199	200.985
2	412199.020	7759993.011	200.047
3	412199.939	7760012.990	R = 20.0m
4	412207.242	7759994.371	199.932
5	412221.146	7759999.824	199.730
6	412228.448	7759981.205	R = 20.0m
7	412228.448	7760001.205	199.628
8	412310.713	7760001.205	198.515
9	412320.463	7760004.285	198.508
10	412320.463	7760008.306	198.540
11	412330.463	7760008.306	R = 10.0m
12	412325.819	7760017.163	198.624
13	412368.910	7760039.759	199.000

LAYOUT - SEDIMENT DAM D

SCALE 1:1000



DETAIL PLAN - SEDIMENT DAM D

SCALE 1:500

Coordinate Table - Sedimentation Dam D, Ramp & Spillway			
Pt #	Easting	Northing	Elevation / Radius
14	412320.213	7759994.792	198.140
15	412341.213	7759994.792	198.140
16	412341.213	7759987.792	198.140
17	412320.203	7759987.795	198.140
18	412309.573	7760001.232	198.800
19	412313.773	7760001.232	R = 4.2m
20	412313.598	7760007.253	198.800
21	412347.653	7760005.432	198.800
22	412347.653	7760001.232	R = 4.2m
23	412351.853	7760001.232	198.800
24	412351.853	7759981.352	198.800
25	412347.653	7759981.352	R = 4.2m
26	412347.653	7759977.152	198.800
27	412313.773	7759977.152	198.800
28	412313.773	7759981.352	R = 4.2m
29	412309.573	7759981.352	198.800
30	412287.859	7759987.792	199.377
31	412330.713	7759979.392	198.240
32	412330.713	7759984.067	198.240

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
1	ISSUED FOR CONSTRUCTION	05.10.16	LL	AVK	MD

SCALE AS SHOWN

JOB No. 108003.26

DATE 08.07.16

DESIGN AVK

DRAWN HR

CHECKED AVK

APPROVED MD

ATC Williams
GROUNDED IN DESIGN

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MMG DUGALD RIVER
DUGALD RIVER PROJECT

108003.26-008

ADMINISTRATION AREA
SEDIMENTATION AND EROSION CONTROL
SED DAM D

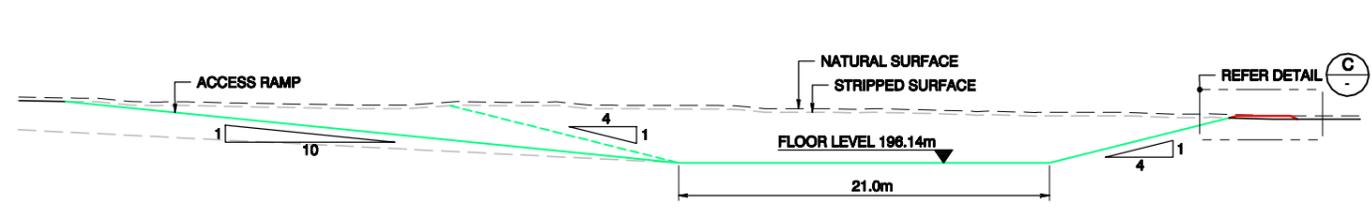
MMG DWG NO.
0016-DWG-2160-C-0075

REV. 1 SHT SIZE A3

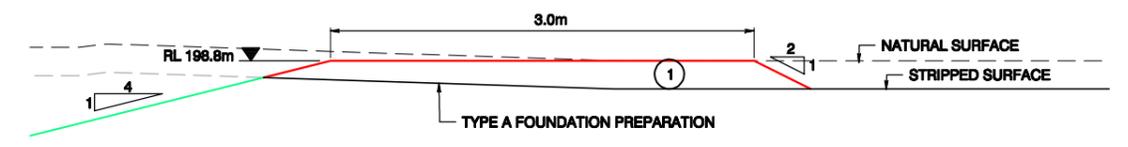
GENERAL LAYOUT AND DETAIL PLAN

SHEET 1 OF 1

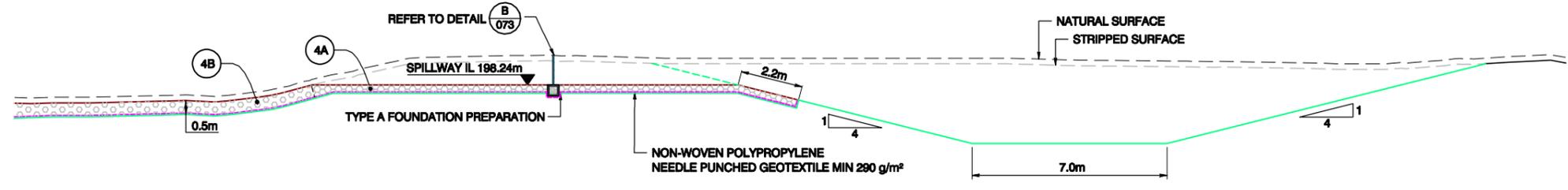
NOTE:
FINAL SURFACE TO BE TRIMMED AND ROLLED
WITH A 10 TONNE SMOOTH DRUM ROLLER TO
PRESENT A SMOOTH HARD WEARING SURFACE



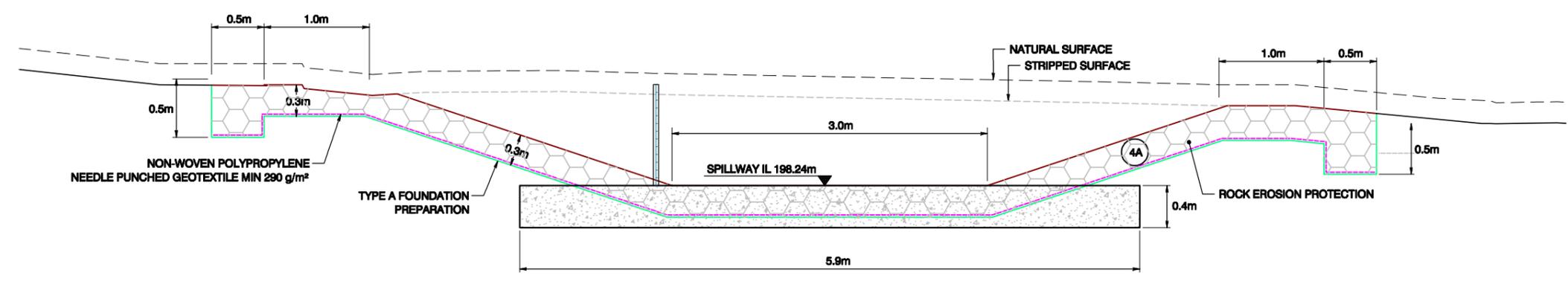
SECTION 14
SED DAM D (THROUGH RAMP)
SCALE 1:400



DETAIL C
SED DAM D (THROUGH EMBANKMENT)
SCALE 1:50



SECTION 15
SED DAM D (THROUGH SPILLWAY)
SCALE 1:200



SECTION 16
SED DAM D SPILLWAY
SCALE 1:50

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
1	ISSUED FOR CONSTRUCTION	05.10.16	HR	AVK	MD

SCALE AS SHOWN

JOB No. 108003.26
DATE 08.07.16
DESIGN AVK
DRAWN HR
CHECKED AVK
APPROVED MD

ATC Williams
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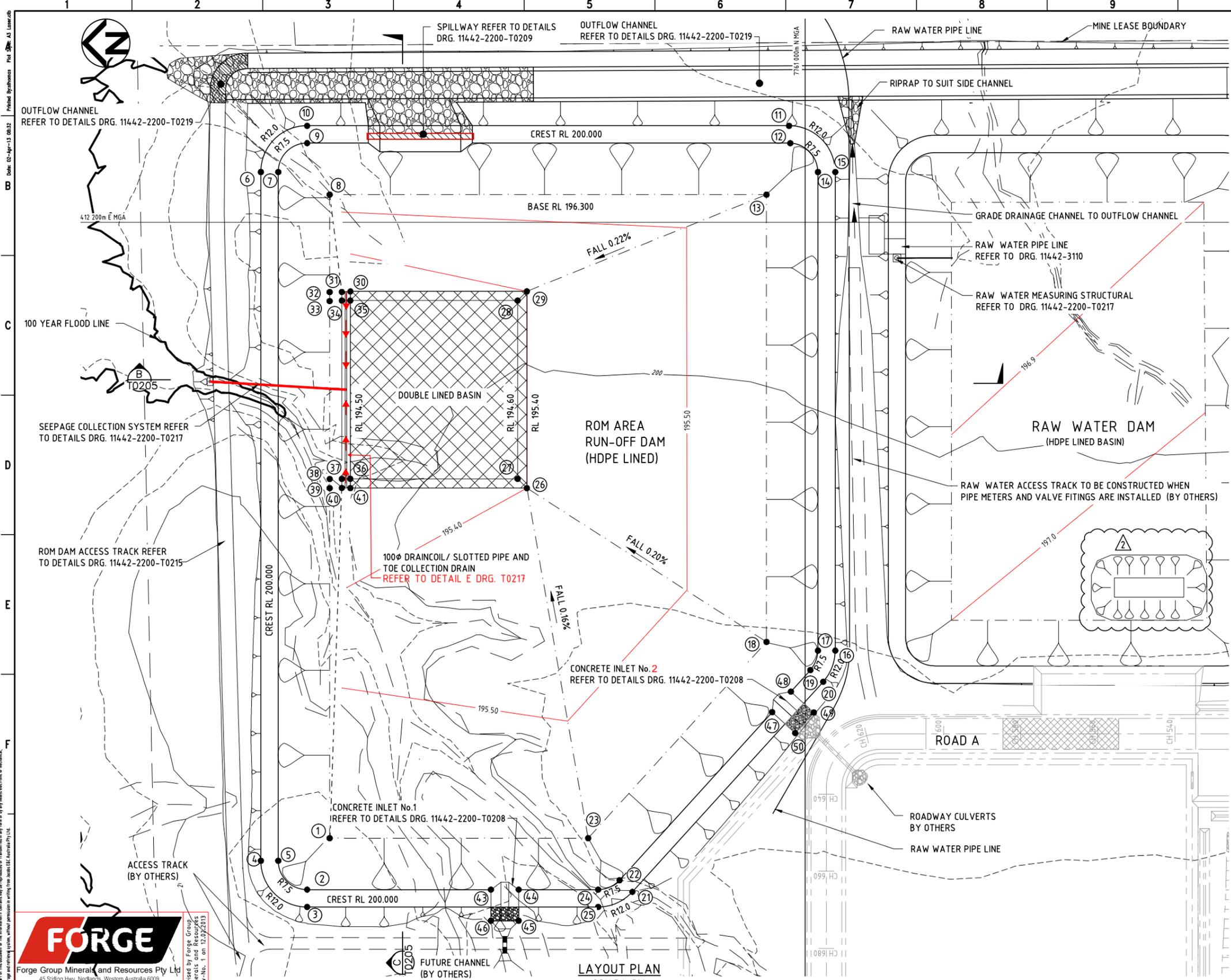
**MMG DUGALD RIVER
DUGALD RIVER PROJECT**

108003.26-010

ADMINISTRATION AREA
SEDIMENTATION AND EROSION CONTROL
SED DAM D
SECTIONS & DETAILS

MMG DWG NO.
0016-DWG-2160-C-0077

REV. 1 SHT SIZE A3
SHEET 1 OF 1



ROM PAD RUN OFF DAM SETOUT			
No.	EASTING	NORTHING	LEVEL
1	412040.445	7761123.328	195.550
2	412027.095	7761129.178	200.000
3	412022.595	7761129.178	200.000
4	412034.595	7761141.178	200.000
5	412034.473	7761136.677	200.000
6	412213.048	7761141.178	200.000
7	412213.048	7761136.678	200.000
8	412207.198	7761123.328	195.550
9	412220.548	7761129.178	200.000
10	412225.048	7761129.178	200.000
11	412225.048	7761004.180	200.000
12	412220.548	7761004.180	200.000
13	412207.198	7761010.030	195.550
14	412213.048	7760996.680	200.000
15	412213.048	7760992.180	200.000
16	412089.039	7760992.180	200.000
17	412089.039	7760996.680	200.000
18	412091.301	7761010.030	195.550
19	412083.992	7760998.631	200.000
20	412080.965	7760995.302	200.000
21	412026.522	7761044.815	200.000
22	412029.549	7761048.145	200.000
23	412040.445	7761056.280	195.550
24	412027.095	7761053.693	200.000
25	412022.595	7761053.693	200.000
26	412131.153	7761072.178	195.400

DOUBLE BASIN AND COLLECTION SYSTEM			
27	412133.553	7761074.578	194.600
28	412179.753	7761074.578	194.600
29	412182.153	7761072.178	195.400
30	412182.153	7761117.978	195.300
31	412182.016	7761120.178	195.300
32	412182.028	7761123.328	195.550
33	412179.722	7761123.334	195.550
34	412179.753	7761120.181	194.500
35	412179.753	7761117.978	194.500
36	412133.553	7761117.978	194.500
37	412133.553	7761120.176	194.500
38	412133.532	7761123.324	195.550
39	412131.185	7761123.328	195.550
40	412131.206	7761120.178	195.300
41	412131.153	7761117.978	195.300
42	412066.308	7761123.325	195.550
43	412027.095	7761081.504	200.000

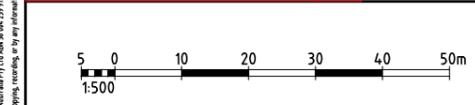
CONCRETE INLET SPILLWAY			
44	412027.095	7761074.304	200.000
45	412019.045	7761074.304	200.000
46	412019.045	7761081.504	200.000
47	412073.093	7761008.544	200.000
48	412078.420	7761003.699	200.000
49	412073.004	7760997.744	200.000
50	412067.677	7761002.588	200.000

- LEGEND**
- 300mm RIPRAP ON bidMIN A34
 - EXTENT OF DOUBLE LINER BASIN
 - 100 YEAR FLOOD LEVEL
 - TOE COLLECTION DRAIN AND PIPE
 - PROPOSED DESIGN CONTOURS
 - EXISTING CONTOURS
 - DRAINAGE PIPE LINES (BY OTHERS)

NOTE:
1. FOR GENERAL NOTES REFER DRG No. 11442-2200-T0200

ISSUED FOR CONSTRUCTION

FORGE
Forge Group Minerals and Resources Pty Ltd
45 Stirling Hwy, Nedlands, Western Australia 6009
Ph 61 (8) 6222 6400 Fax 61 (8) 6222 6499 Info@forgegroup.com.au



DRAWING No.	REFERENCE DRAWING TITLE	REVISION DESCRIPTION	REV.	BY	CHECKED	APPROVED	PROJ. ENGR.	DATE
		ATCW REVISION (IN RED)	3	CN	MD			24.07.13
		SUMP BATTER/LOCATION/EXTENTS MODIFIED	2	MK	DS	AN	AN	02.04.13
		SUMP ADDED	1	MK	SRT	AN	AN	22.03.13
		ISSUED FOR CONSTRUCTION	0	DM	SU	AY	BH	28/09/12

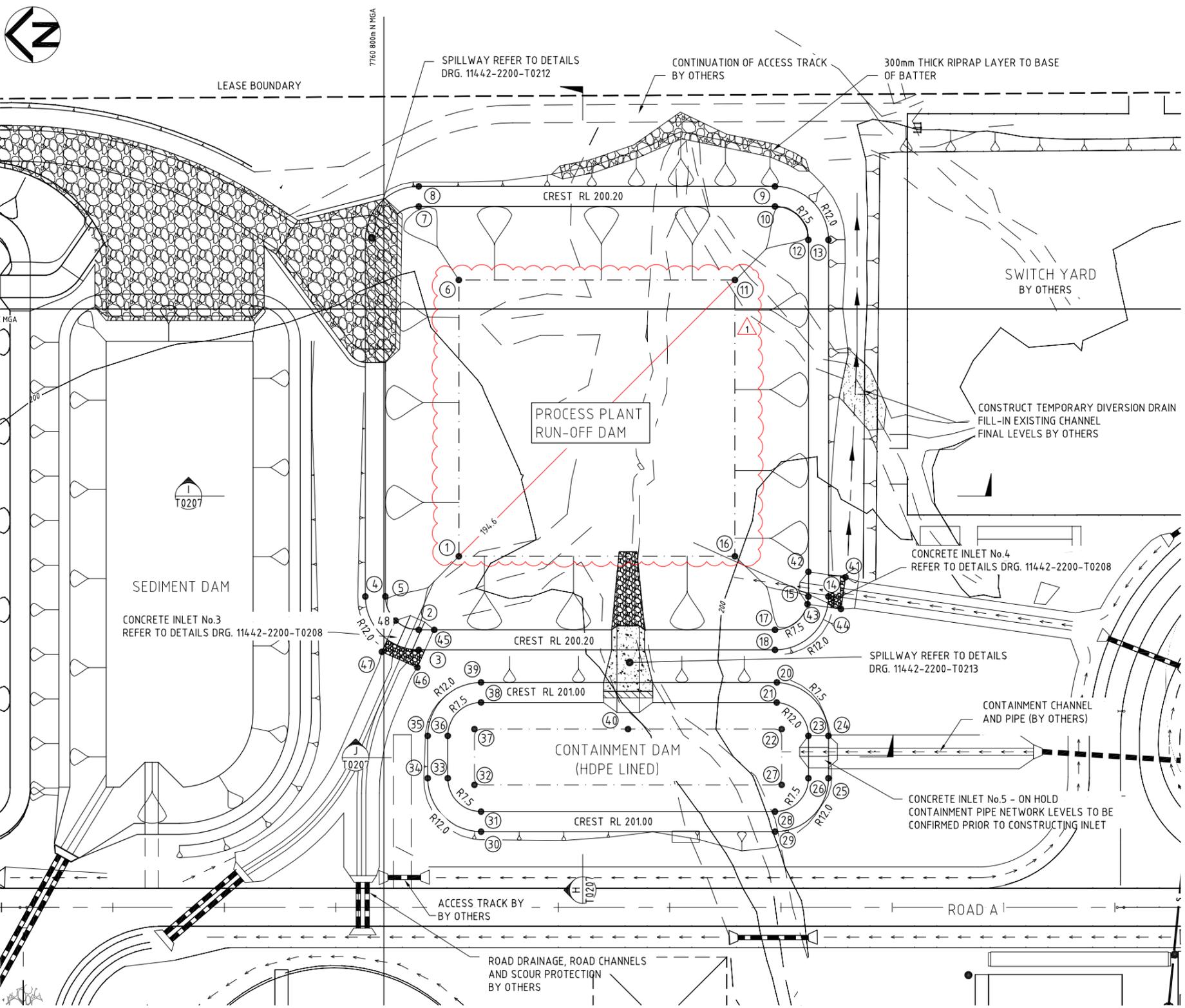
APPROVED	BY	DATE	CLIENT
CLIENT APPROVED			
ISS'D FOR CONSTR.			
SCALE	1:500		
STATUS	ISSUED FOR CONSTRUCTION		

JACOBS CLIENT No. DUG-DWG-2200-EC-0211 REV. 3
DRG. No. 11442-2200-T0201 REV. 3

DUGALD RIVER PROJECT
EARTHWORKS - PROCESS PLANT AREA
PROCESS PLANT DAMS - ROM AREA RUN-OFF DAM LAYOUT

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PROCESS DAM SETOUT			
No.	EASTING	NORTHING	LEVEL
1	412144.550	7760783.200	194.600
2	412128.050	7760792.200	199.554
3	412123.550	7760792.200	199.880
4	412135.550	7760804.200	200.200
5	412135.550	7760799.700	200.200
6	412206.550	7760783.200	194.500
7	412223.050	7760792.200	200.200
8	412227.550	7760792.200	200.200
9	412227.550	7760712.200	200.200
10	412223.050	7760712.200	200.200
11	412206.550	7760721.200	194.600
12	412215.550	7760704.700	200.200
13	412215.550	7760700.200	200.200
14	412135.550	7760700.200	199.618
15	412135.560	7760704.711	199.768
16	412144.550	7760721.200	194.700
17	412128.050	7760712.211	200.200
18	412123.550	7760712.200	200.200

CONTAINMENT DAM SETOUT			
No.	EASTING	NORTHING	LEVEL
20	412116.270	7760712.200	201.000
21	412111.770	7760712.200	201.000
22	412104.999	7760711.497	198.800
23	412104.270	7760704.700	201.000
24	412104.270	7760700.200	201.000
25	412094.770	7760700.200	201.000
26	412094.770	7760704.700	201.000
27	412094.037	7760711.464	198.800
28	412087.270	7760712.200	201.000
29	412082.770	7760712.200	201.000
30	412082.770	7760778.195	201.000
31	412087.270	7760778.195	201.000
32	412094.023	7760778.919	198.800
33	412094.770	7760785.695	201.000
34	412094.770	7760790.195	201.000
35	412104.270	7760790.195	201.000
36	412104.270	7760785.695	201.000
37	412105.011	7760778.929	198.800
38	412111.770	7760778.195	201.000
39	412116.270	7760778.195	201.000
40	412105.020	7760745.130	198.700

CONCRETE INLETS SETOUT			
No.	EASTING	NORTHING	LEVEL
41	412139.871	7760696.363	200.200
42	412141.067	7760704.700	200.200
43	412133.822	7760704.902	200.200
44	412132.744	7760697.385	200.200
45	412128.050	7760788.812	200.200
46	412119.634	7760792.511	200.200
47	412123.135	7760800.475	200.200
48	412130.141	7760797.396	200.200

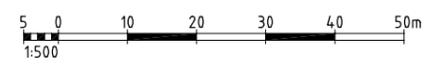
- LEGEND**
- 300mm RIPRAP ON BIDMIN A34
 - 100 YEAR FLOOD LEVEL
 - TOE COLLECTION DRAIN AND PIPE
 - PROPOSED DESIGN CONTOURS
 - EXISTING CONTOURS
 - DRAINAGE PIPE LINES (BY OTHERS)

NOTE:
1. FOR GENERAL NOTES REFER DRG No. 11442-2200-T0200

ISSUED FOR CONSTRUCTION

NOTE: PROCESS PLANT RUNOFF DAM INVERT LEVEL REVISED BY HYDER AS INSTRUCTED BY MMG

LAYOUT PLAN
SCALE 1:500

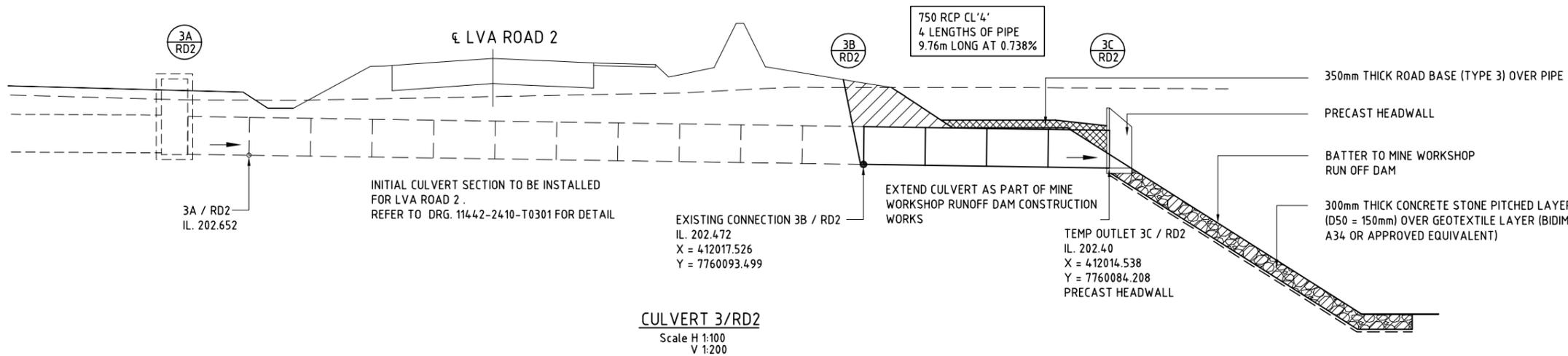


REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE
1	GBM	FP	FP	FP	26/10/12
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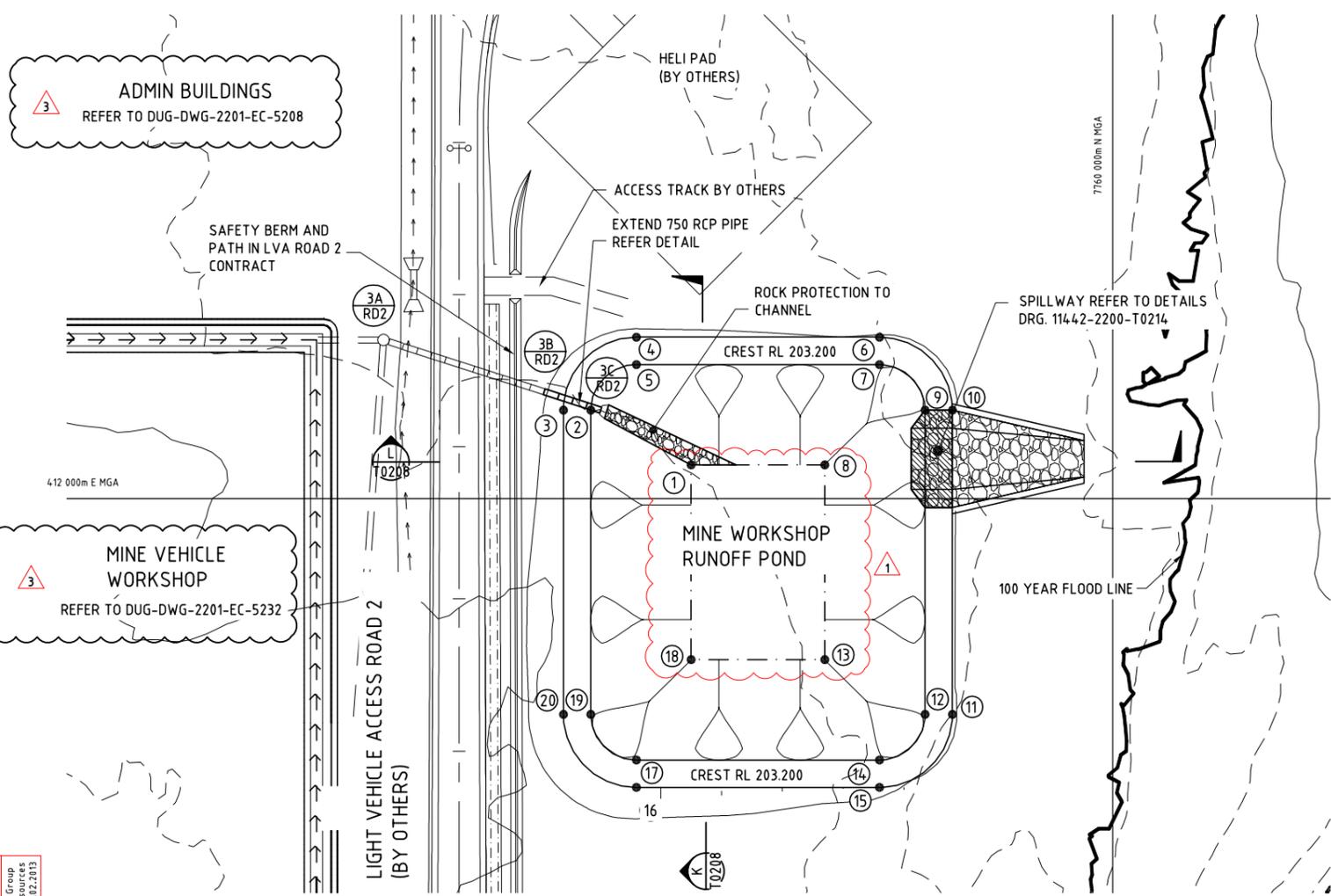
APPROVED	BY	DATE	CLIENT
ISS'D FOR CONSTR.			
SCALE	1:500		
STATUS	ISSUED FOR CONSTRUCTION		

JACOBS CLIENT No. DUG-DWG-2200-EC-0213 REV. 1
 DRG. No. 11442-2200-T0203 REV. 1
 DUGALD RIVER PROJECT
 EARTHWORKS - PROCESS PLANT AREA
 PROCESS DAMS - PROCESS PLANT RUN-OFF AND CONTAINMENT DAM LAYOUT

File: I:\A050515\EC-CAD\10-FIN-DWG-2200-EC-0213_Rev1.dwg



CULVERT 3/RD2
Scale H 1:100
V 1:200



NOTE: MINE WORKSHOP RUNOFF DAM INVERT LEVEL
REVISED BY HYDER AS INSTRUCTED BY MMG

LAYOUT PLAN
SCALE 1 : 500

MINE WORKSHOP DAM SETOUT			
No.	EASTING	NORTHING	LEVEL
1	412005.520	7760069.350	197.700
2	412014.520	7760085.850	203.200
3	412014.520	7760090.350	203.200
4	412026.520	7760078.350	203.200
5	412022.020	7760078.350	203.200
6	412026.520	7760038.350	203.200
7	412022.020	7760038.350	203.200
8	412005.520	7760047.350	197.600
9	412014.520	7760050.850	203.200
10	412014.509	7760026.350	203.200
11	411964.520	7760026.350	203.200
12	411964.520	7760030.850	203.200
13	411973.520	7760047.350	197.700
14	411957.020	7760038.350	203.200
15	411952.520	7760038.350	203.200
16	411952.520	7760078.350	203.200
17	411957.020	7760078.350	203.200
18	411973.520	7760069.350	197.800
19	411964.520	7760085.850	203.200
20	411964.520	7760090.350	203.200

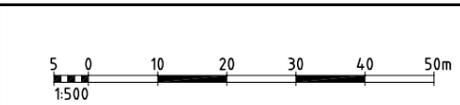
LEGEND	
300mm RIPRAP ON BIDMIN A34	
100 YEAR FLOOD LEVEL	
TOE COLLECTION DRAIN AND PIPE	
PROPOSED DESIGN CONTOURS	
EXISTING CONTOURS	
DRAINAGE PIPE LINES (BY OTHERS)	

NOTE:
1. FOR GENERAL NOTES REFER DRG No. 114.42-2200-T0204

ISSUED FOR CONSTRUCTION

FORGE
Forge Group Minerals and Resources Pty Ltd
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Revised by Forge Group Minerals and Resources
Rev-No. 1 on 12.02.2013



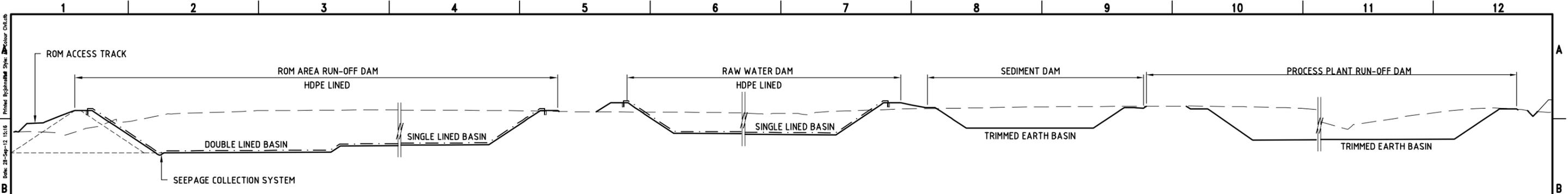
REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE	REVISION DESCRIPTION
3	MK	MK	AN	GR	20.03.2013	ADD REV 1 AND REV 2 ON TO ONE DRAWING.
2	DS	MK	AN	GR	12/03/13	DRAWING REFERENCE NUMBERS ADDED
1	GBM	FP	FP	FP	26/10/12	RUN-OFF POND SETOUT POINTS CHANGES - BY HYDER
0	DM	SU	AY	BH	28/09/12	ISSUED FOR CONSTRUCTION

APPROVED	BY	DATE	CLIENT
CLIENT APPROVED			
ISS'D FOR CONSTR.			
SCALE			
1:500			
STATUS			
ISSUED FOR CONSTRUCTION			

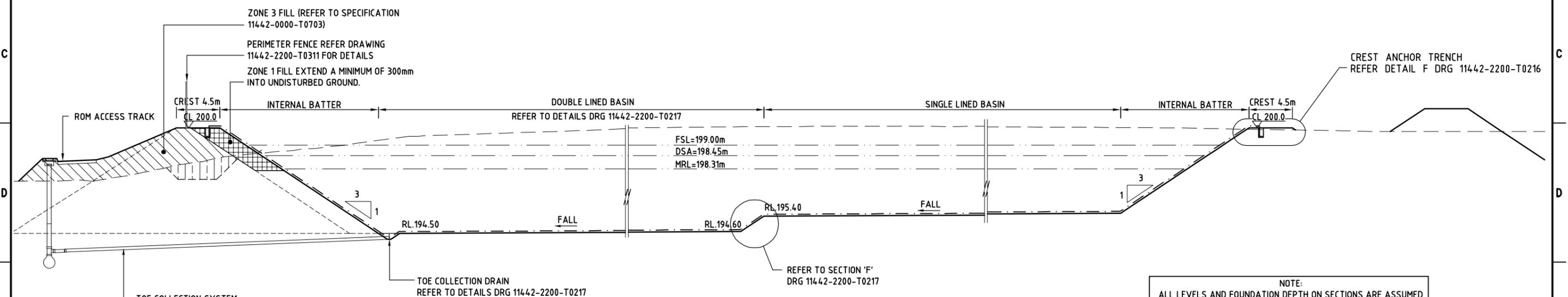
JACOBS CLIENT No. DUG-DWG-2200-EC-0214 REV. 3
DRG. No. 114.42-2200-T0204 REV. 3

DUGALD RIVER PROJECT
EARTHWORKS - PROCESS PLANT AREA
PROCESS DAMS - MINE WORKSHOP RUN-OFF DAM LAYOUT

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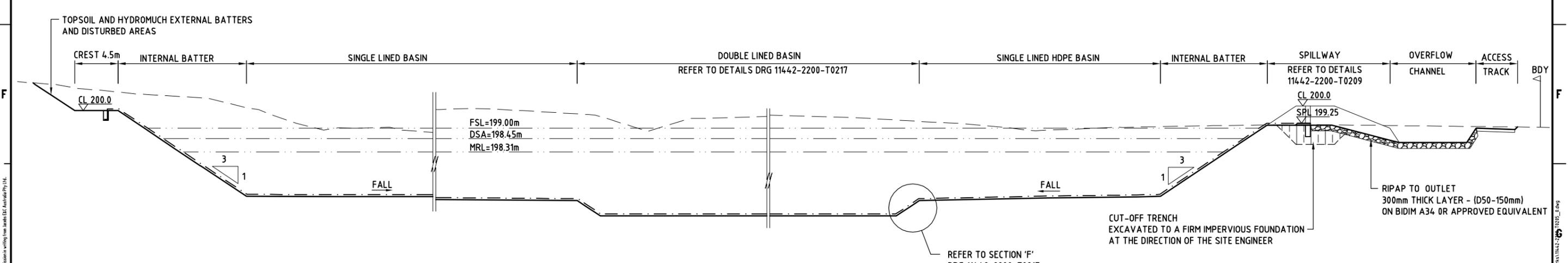


SECTION A
 SECTION ALL DAMS
 HOR 1:500
 VER 1:250



SECTION B
 ROM AREA RUN-OFF DAM
 HOR 1:200
 VER 1:100

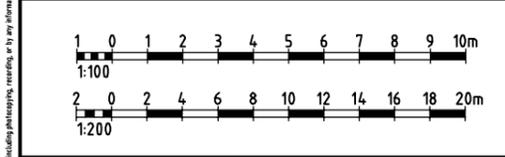
NOTE:
 ALL LEVELS AND FOUNDATION DEPTH ON SECTIONS ARE ASSUMED TO BE SUITABLE GROUND CONDITIONS. SITE GEOTECHNICAL ENGINEER TO TO CONFIRM PRIOR TO CONSTRUCTION.



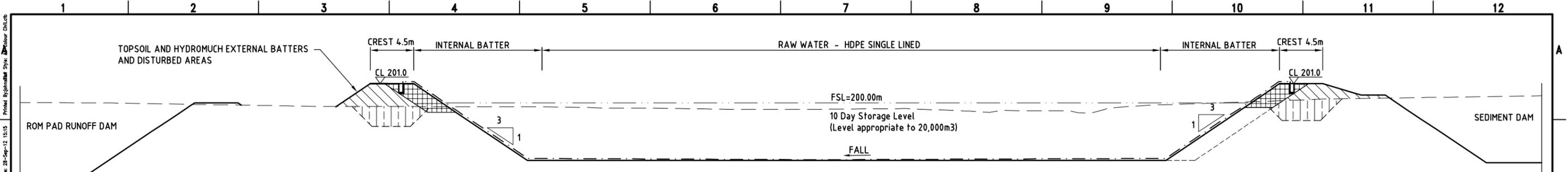
SECTION C
 ROM AREA RUNOFF DAM
 HOR 1:200
 VER 1:100

NOTE:
 DSA - DESIGN STORAGE LEVEL
 MRL - MANDATORY REPORTING LEVEL
 FSL - FULL SUPPLY LEVEL
 CL - CREST LEVEL
 SPL - SPILLWAY LEVEL

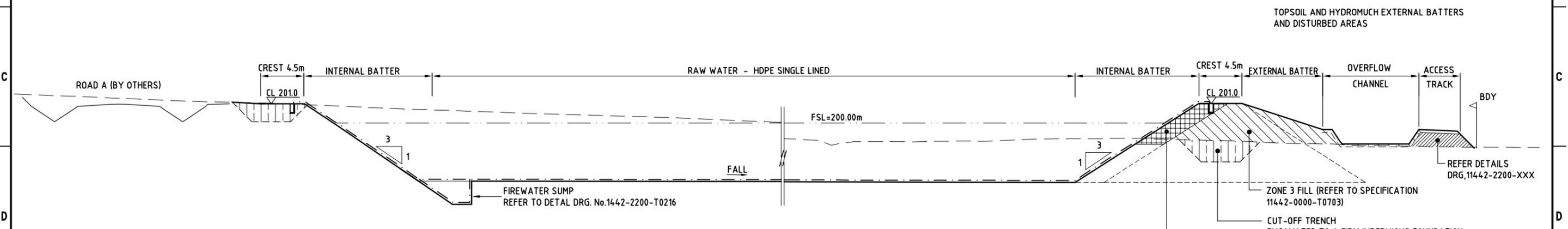
ISSUED FOR CONSTRUCTION



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CLIENT APPROVED							DRG. No. 11442-2200-T0205	REV. 0
ISS'D FOR CONSTR.								
SCALE		AS SHOWN					DO NOT SCALE THIS DRAWING. USE WRITTEN DIMENSIONS ONLY.	
STATUS		ISSUED FOR CONSTRUCTION			DUGALD RIVER PROJECT EARTHWORKS - PROCESS PLANT AREA PROCESS DAM SECTIONS SHEET 1 OF 4			
DRAWING No.	REFERENCE DRAWING TITLE	ISSUED FOR CONSTRUCTION	0	DM	SU	AY	BH	28/09/12
		REVISION DESCRIPTION	REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE

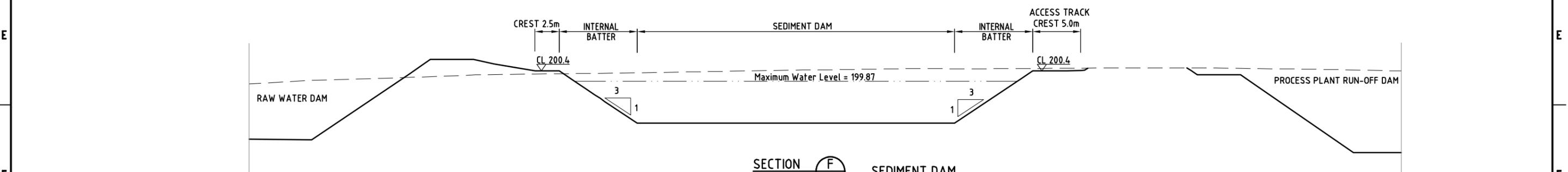


SECTION **D** RAW WATER DAM
 HOR 1:200
 VER 1:100

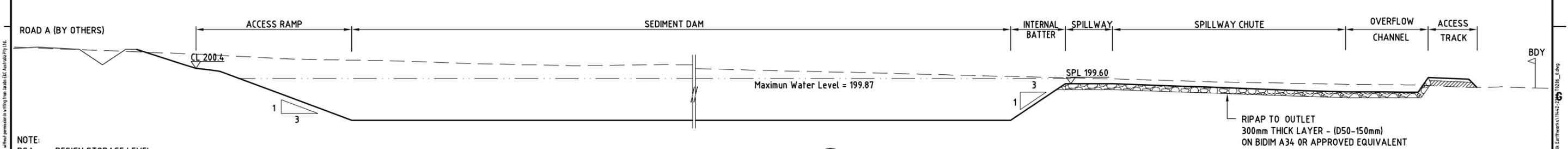


SECTION **E** RAW WATER DAM
 HOR 1:200
 VER 1:100

NOTE:
 ALL LEVELS AND FOUNDATION DEPTH ON SECTIONS ARE ASSUMED TO BE SUITABLE GROUND CONDITIONS. SITE GEOTECHNICAL ENGINEER TO TO CONFIRM PRIOR TO CONSTRUCTION.

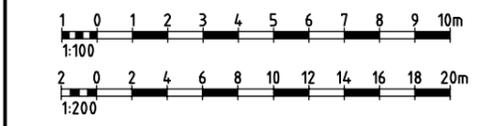


SECTION **F** SEDIMENT DAM
 HOR 1:200
 VER 1:100



SECTION **G** SEDIMENT DAM
 HOR 1:200
 VER 1:100

- NOTE:
- DSA - DESIGN STORAGE LEVEL
- MRL - MANDATORY REPORTING LEVEL
- FSL - FULL SUPPLY LEVEL
- CL - CREST LEVEL
- SPL - SPILLWAY LEVEL

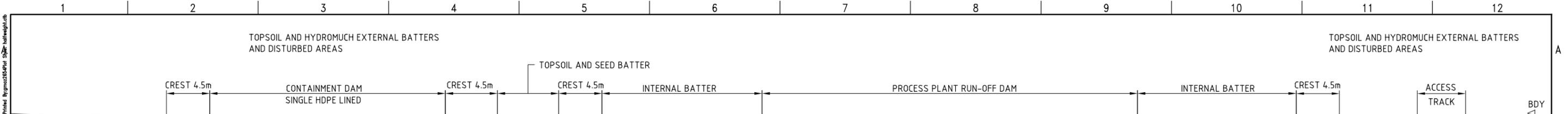


ISSUED FOR CONSTRUCTION

APPROVED BY DATE CLIENT				CLIENT No. DUG-DWG-2200-EC-0228	REV. 0		
CLIENT APPROVED				DRG. No. 11442-2200-T0206	REV. 0		
ISS'D FOR CONSTR.		AS SHOWN		DUGALD RIVER PROJECT			
SCALE		DO NOT SCALE THIS DRAWING. USE WRITTEN DIMENSIONS ONLY.		EARTHWORKS - PROCESS PLANT AREA			
STATUS		ISSUED FOR CONSTRUCTION		PROCESS DAM SECTIONS SHEET 2 OF 4			
ISSUED FOR CONSTRUCTION		0	DM	SU	AY	BH	28/09/12
REVISION DESCRIPTION	REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE	

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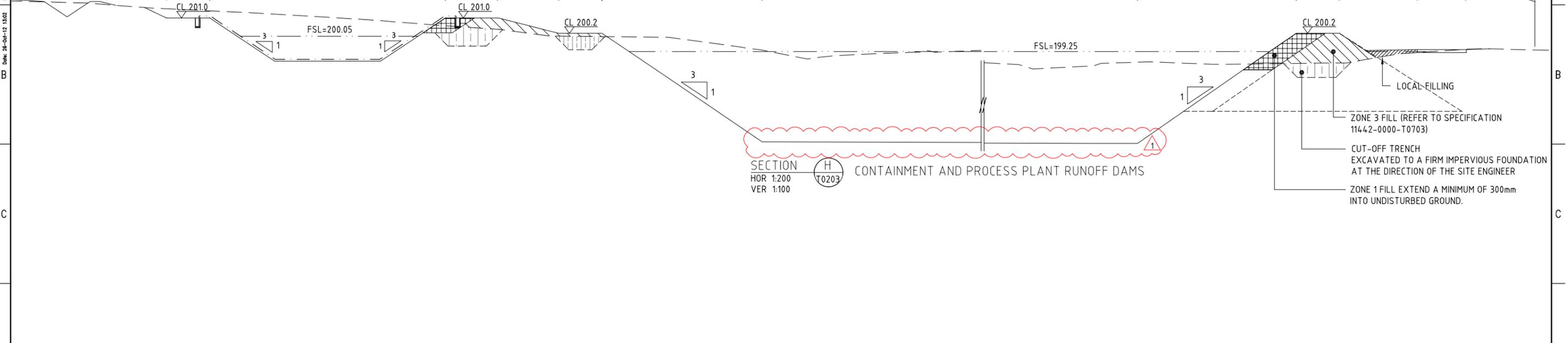
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SECTION H
HOR 1:200
VER 1:100

CONTAINMENT AND PROCESS PLANT RUNOFF DAMS

LOCAL-FILLING
ZONE 3 FILL (REFER TO SPECIFICATION 11442-0000-T0703)
CUT-OFF TRENCH EXCAVATED TO A FIRM IMPERVIOUS FOUNDATION AT THE DIRECTION OF THE SITE ENGINEER
ZONE 1 FILL EXTEND A MINIMUM OF 300mm INTO UNDISTURBED GROUND.

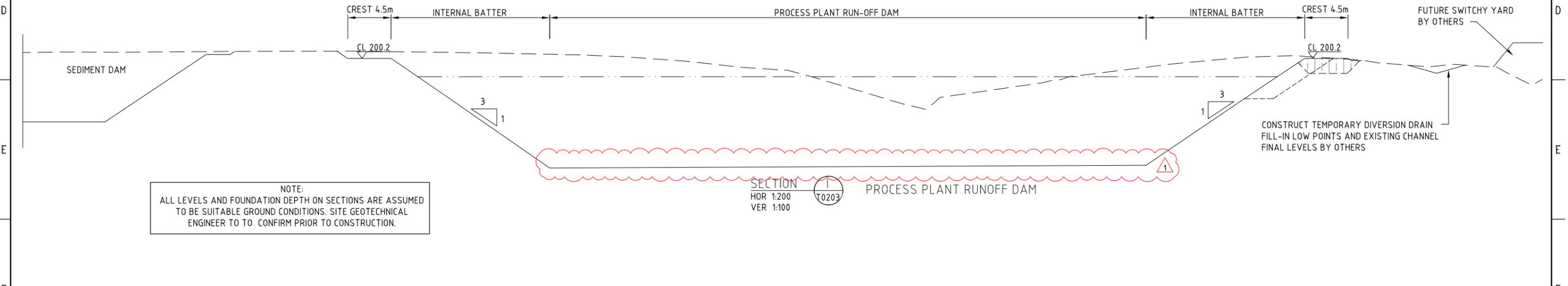


SECTION I
HOR 1:200
VER 1:100

PROCESS PLANT RUNOFF DAM

NOTE:
ALL LEVELS AND FOUNDATION DEPTH ON SECTIONS ARE ASSUMED TO BE SUITABLE GROUND CONDITIONS. SITE GEOTECHNICAL ENGINEER TO TO CONFIRM PRIOR TO CONSTRUCTION.

CONSTRUCT TEMPORARY DIVERSION DRAIN
FILL-IN LOW POINTS AND EXISTING CHANNEL
FINAL LEVELS BY OTHERS

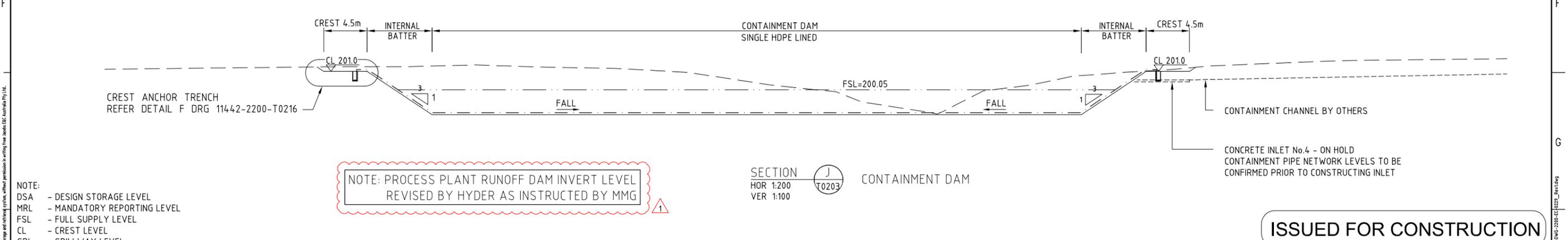


SECTION J
HOR 1:200
VER 1:100

CONTAINMENT DAM

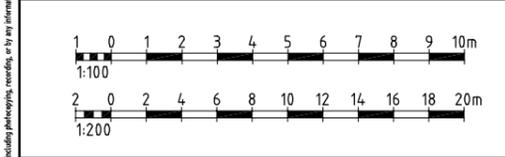
NOTE: PROCESS PLANT RUNOFF DAM INVERT LEVEL REVISED BY HYDER AS INSTRUCTED BY MMG

CONCRETE INLET No.4 - ON HOLD
CONTAINMENT PIPE NETWORK LEVELS TO BE CONFIRMED PRIOR TO CONSTRUCTING INLET



NOTE:
DSA - DESIGN STORAGE LEVEL
MRL - MANDATORY REPORTING LEVEL
FSL - FULL SUPPLY LEVEL
CL - CREST LEVEL
SPL - SPILLWAY LEVEL

ISSUED FOR CONSTRUCTION



DRAWING No.	REFERENCE DRAWING TITLE	REVISION DESCRIPTION	REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE
		RUN-OFF DAM DEPTH INCREASED - BY HYDER	1	GBM	FP	FP	FP	26/10/12
		ISSUED FOR CONSTRUCTION	0	DM	SU	AY	BH	28/09/12

APPROVED	BY	DATE	CLIENT
CLIENT APPROVED			
ISS'D FOR CONSTR.			
SCALE	AS SHOWN		
STATUS	ISSUED FOR CONSTRUCTION		

APPROVED	BY	DATE	CLIENT
CLIENT APPROVED			
ISS'D FOR CONSTR.			
SCALE	AS SHOWN		
STATUS	ISSUED FOR CONSTRUCTION		

APPROVED	BY	DATE	CLIENT
CLIENT APPROVED			
ISS'D FOR CONSTR.			
SCALE	AS SHOWN		
STATUS	ISSUED FOR CONSTRUCTION		

JACOBS CLIENT No. DUG-DWG-2200-EC-0229
DRG. No. 11442-2200-T0207

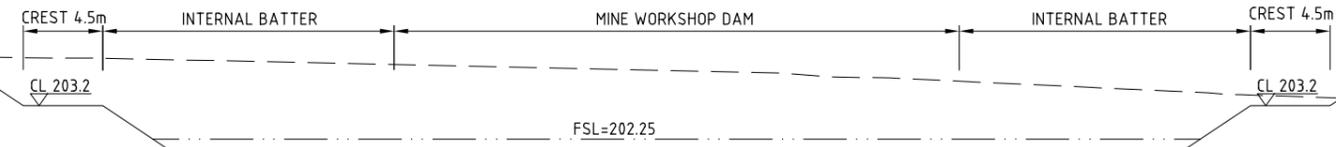
DUGALD RIVER PROJECT
EARTHWORKS - PROCESS PLANT AREA
PROCESS DAM SECTIONS SHEET 3 OF 4

Printed: 26-Oct-12 13:52 Date: 26-Oct-12 13:52

A B C D E F G A1

Printed: By: gmac2654/Plat_S/Plat_halfwidth.dwg
 Date: 28-09-12 15:00
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 File: F:\A08554\EC-COIN-COIN-FIN\006-2200-2200-EC-0230-1.dwg

TOPSOIL AND HYDROMUCH EXTERNAL BATTERS AND DISTURBED AREAS

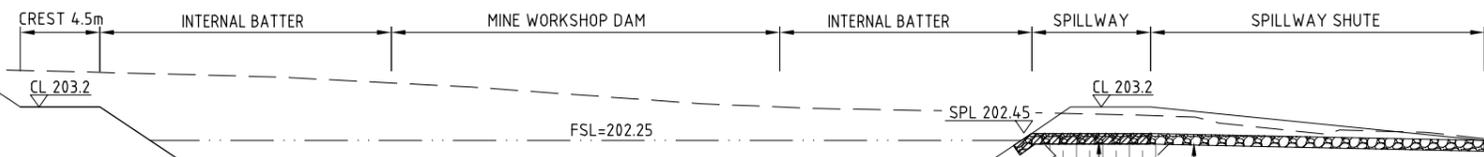


CLAY LINING PROVISIONAL TO BE INSTRUCTED FOLLOWING EXCAVATION AND INSPECTION BY THE ENGINEER

SECTION K T0204 MINE WORKSHOP DAM
Scale 1:100

NOTE:
ALL LEVELS AND FOUNDATION DEPTH ON SECTIONS ARE ASSUMED TO BE SUITABLE GROUND CONDITIONS. SITE GEOTECHNICAL ENGINEER TO TO CONFIRM PRIOR TO CONSTRUCTION.

LVS ROAD 2



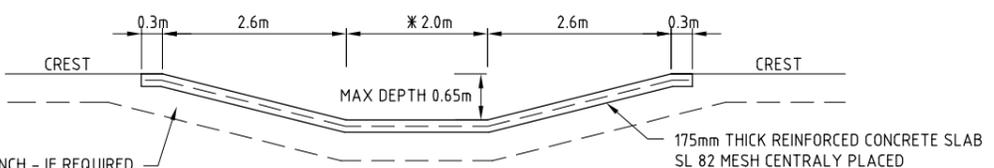
SECTION L T0204 MINE WORKSHOP DAM
Scale 1:100

NOTE: MINE WORKSHOP RUNOFF DAM INVERT LEVEL REVISED BY HYDER AS INSTRUCTED BY MMG

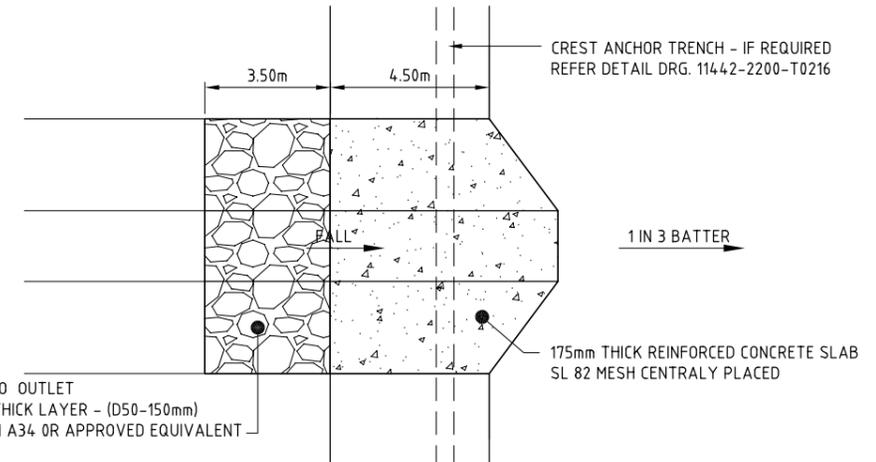
NOTE:
DSA - DESIGN STORAGE LEVEL
MRL - MANDATORY REPORTING LEVEL
FSL - FULL SUPPLY LEVEL
CL - CREST LEVEL
SPL - SPILLWAY LEVEL

NOTE
1. ADJOINING DRAINAGE CHANNELS BY OTHERS.
2. CHANNEL ENTERING DAMS MAY NEED TO BE TEMPORARY BLOCK-OFF OF DRAINAGE FLOWS MAY NEED TO BE DIVERTED DURING CONSTRUCTION.

* INLET CONCRETE SLAB PROCESS DAM 'A' = 3.5m WIDE BASE
ALL OTHER INLET CONCRET SLABS TO BE 2.0m WIDE BASE

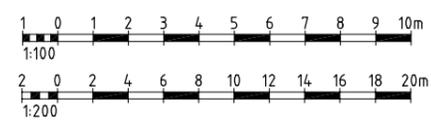


TYPICAL SECTION - CONCRETE INLET
Scale 1:25



LAYOUT - CONCRETE INLET
Scale 1:100

ISSUED FOR CONSTRUCTION

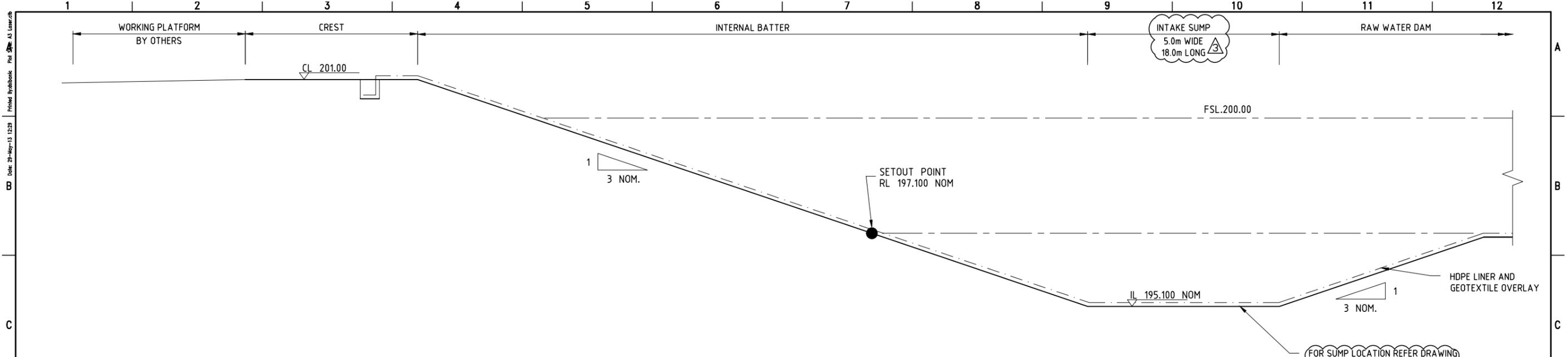


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				RUN-OFF POND DEPTHS CHANGED - BY HYDER		1		GBM		FP		FP		FP		26/10/12								MMG	
				ISSUED FOR CONSTRUCTION		0		DM		SU		AY		BH		28/09/12								JACOBS	
																								CLIENT No. DUG-DWG-2200-EC-0230 REV. 1	
																								DRG. No. 11442-2200-T0208 REV. 1	
																								DUGALD RIVER PROJECT EARTHWORKS - PROCESS PLANT AREA PROCESS DAM SECTIONS SHEET 4 OF 4	

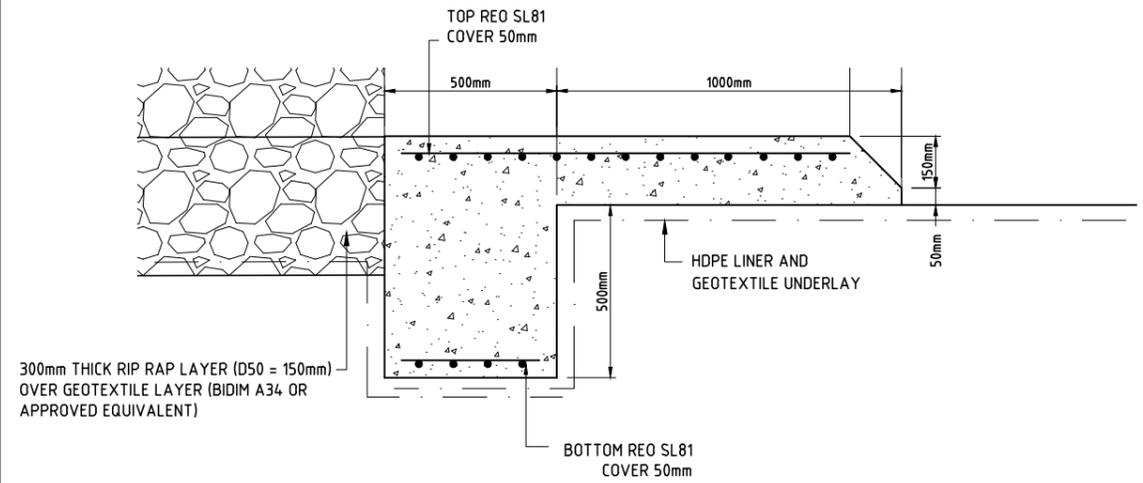
ISSUED FOR CONSTRUCTION

DUGALD RIVER PROJECT
EARTHWORKS - PROCESS PLANT AREA
PROCESS DAM SECTIONS SHEET 4 OF 4

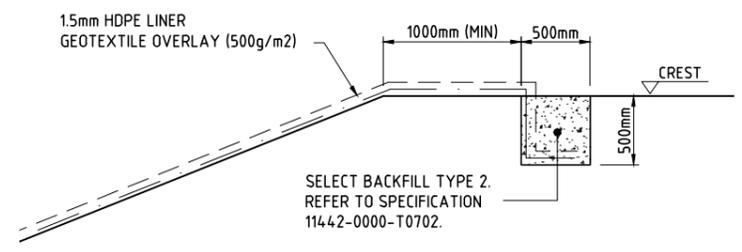
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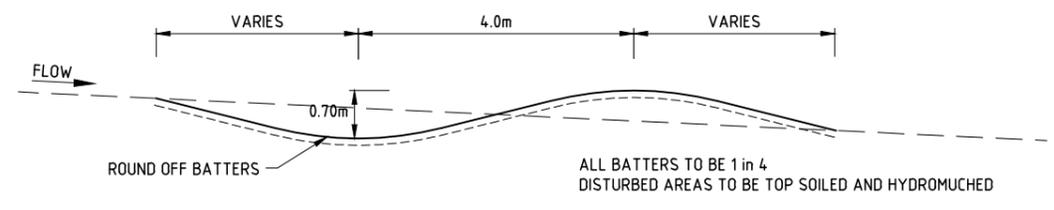
RAW WATER DAM SUMP - SECTION
SCALE 1:50



DETAIL A - CONCRETE ANCHOR TRENCH AT SPILLWAY
SCALE 1:10

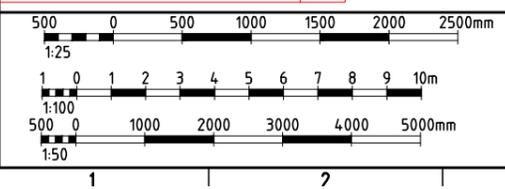


RAW WATER DAM - CREST ANCHOR TRENCH DETAIL FOR HDPE LINER
SCALE 1:25



TEMPORARY CLEAN WATER DIVERSION CHANNEL - SECTION
SCALE 1:20

FORGE
Forge Group Minerals and Resources Pty Ltd
45 Stirling Hwy, Nedlands, Western Australia 6009
Ph 61 (8) 6222 6400 Fax 61 (8) 6222 6499 Info@forgegroup.com.au
Revised by Forge Group Minerals and Resources Rev-No. 1 on 12.02.2013



REV.	BY	CHECKED	APPROVED	PROJ. ENG.	DATE	REVISION DESCRIPTION
3	DS	MK	AN	AN	29.05.13	ANNOTATION ADDED
2	MK	DS	AN	AN	02.04.13	SUMP SECTION MODIFIED
1	MK	SRT	AN	AN	22.03.13	RAW WATER DAM SUMP UPDATED
0	DM	AB	AY	BH	28/09/12	ISSUED FOR CONSTRUCTION

APPROVED	BY	DATE	CLIENT
AS SHOWN			

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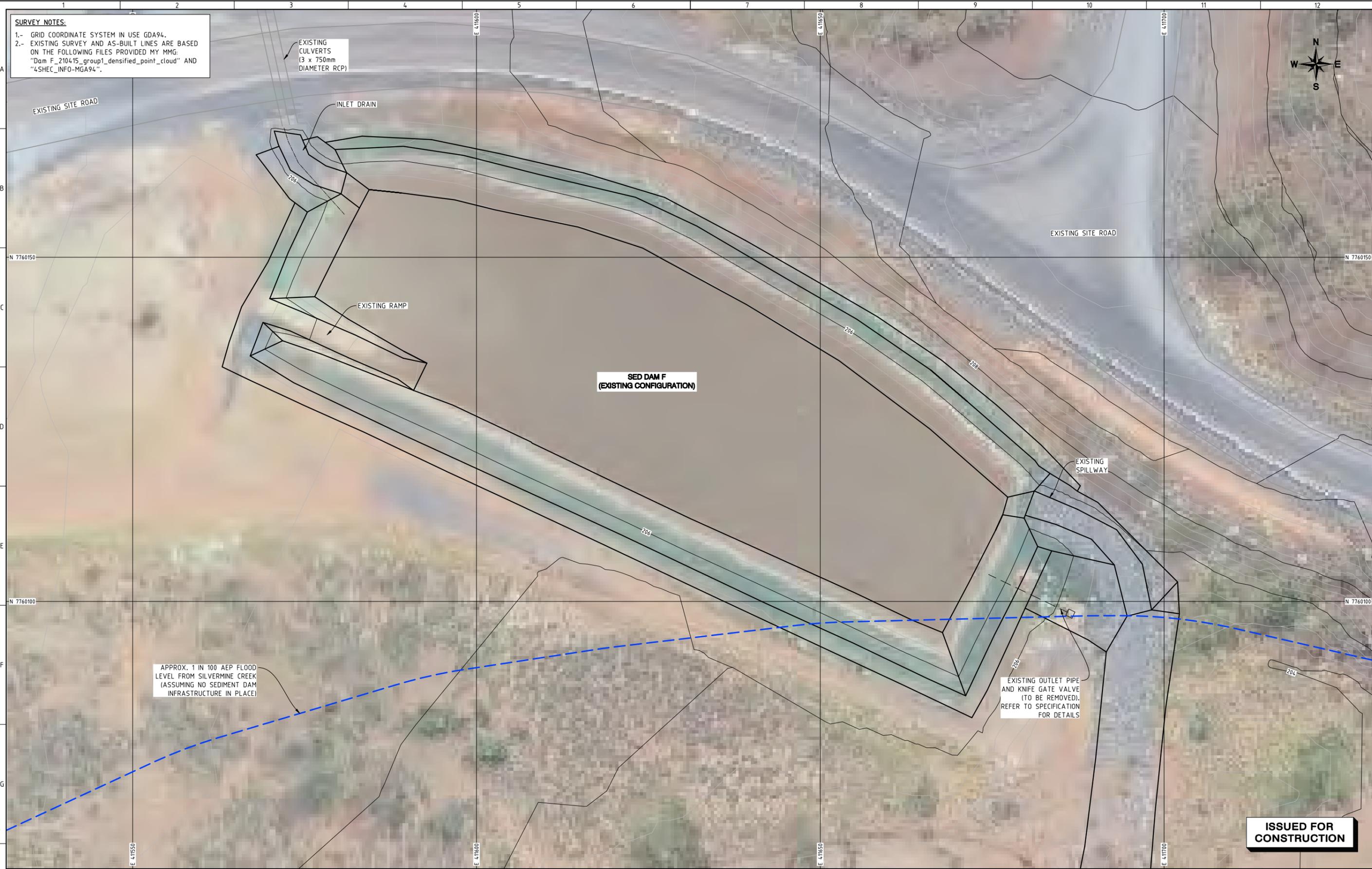
JACOBS CLIENT No. DUG-DWG-2200-EC-0231
REV. 3
DRG. No. 11442-2200-T0216
REV. 3

DUGALD RIVER PROJECT
EARTHWORKS - PROCESS PLANT AREA
PROCESS DAMS - TYPICAL DETAILS AND SECTIONS

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Fig. 11: Transfer to Doc Central\3377 Dugald River\2200-EC-0231-01.dwg

SURVEY NOTES:
 1.- GRID COORDINATE SYSTEM IN USE GDA94.
 2.- EXISTING SURVEY AND AS-BUILT LINES ARE BASED ON THE FOLLOWING FILES PROVIDED BY MMG: "Dam F_210415_group1_densified_point_cloud" AND "4SHEC_INFO-MGA94".



APPROX. 1 IN 100 AEP FLOOD LEVEL FROM SILVERMINE CREEK (ASSUMING NO SEDIMENT DAM INFRASTRUCTURE IN PLACE)

EXISTING OUTLET PIPE AND KNIFE GATE VALVE (TO BE REMOVED). REFER TO SPECIFICATION FOR DETAILS

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
0	ISSUED FOR CONSTRUCTION	27.08.21	HR	DMR	NB

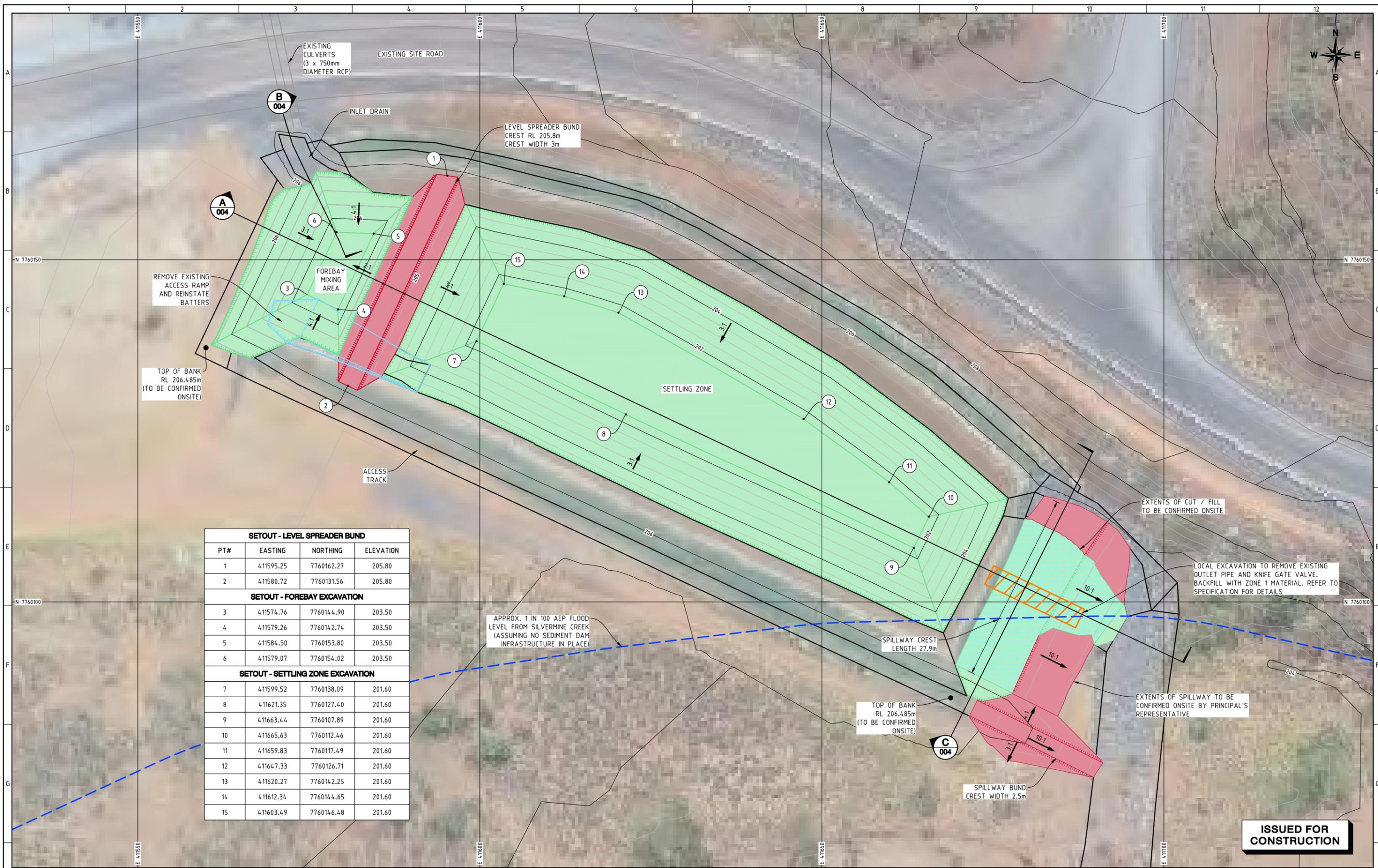
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 JOB No. 108003.50
 DATE 25.08.21
 DESIGN DMR
 DRAWN HR
 CHECKED DMR
 APPROVED NB

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 www.atcwilliams.com.au
 Melbourne T +61 3 8587 0900
 melbourne@atcwilliams.com.au

**MMG DUGALD RIVER
 SEDIMENT DAM F UPGRADE**

EXISTING CONDITIONS

DWG. No.	108003.50-001
SHEET SIZE	A3 Rev. 0
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SHEET 1 OF 1	



SETOUT - LEVEL SPREADER BUND			
PT#	EASTING	NORTHING	ELEVATION
1	411595.25	7760162.27	205.80
2	411580.72	7760131.56	205.80
SETOUT - FOREBAY EXCAVATION			
3	411574.76	7760144.90	203.50
4	411579.26	7760142.74	203.50
5	411584.50	7760153.80	203.50
6	411579.07	7760154.02	203.50
SETOUT - SETTLING ZONE EXCAVATION			
7	411599.52	7760138.09	201.60
8	411621.35	7760127.40	201.60
9	411663.44	7760107.89	201.60
10	411665.63	7760112.46	201.60
11	411659.83	7760117.49	201.60
12	411647.33	7760126.71	201.60
13	411620.27	7760142.25	201.60
14	411612.34	7760144.65	201.60
15	411603.49	7760146.48	201.60

APPROX. 1 IN 100 AEP FLOOD LEVEL FROM SILVERMINE CREEK (ASSUMING NO SEDIMENT DAM INFRASTRUCTURE IN PLACE)

SPILLWAY CREST LENGTH 27.9m

TOP OF BANK RL 206.485m (TO BE CONFIRMED ONSITE)

SPILLWAY BUND CREST WIDTH 2.5m

EXTENTS OF CUT / FILL TO BE CONFIRMED ONSITE

LOCAL EXCAVATION TO REMOVE EXISTING OUTLET PIPE AND KNIFE GATE VALVE. BACKFILL WITH ZONE 1 MATERIAL. REFER TO SPECIFICATION FOR DETAILS

EXTENTS OF SPILLWAY TO BE CONFIRMED ONSITE BY PRINCIPAL'S REPRESENTATIVE

ISSUED FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
0	ISSUED FOR CONSTRUCTION	27.08.21	HR	DMR	NB

SCALE: 1:500
 JOB No. 108003.50
 DATE 25.08.21
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 DRAWN HR
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**MMG DUGALD RIVER
 SEDIMENT DAM F UPGRADE**

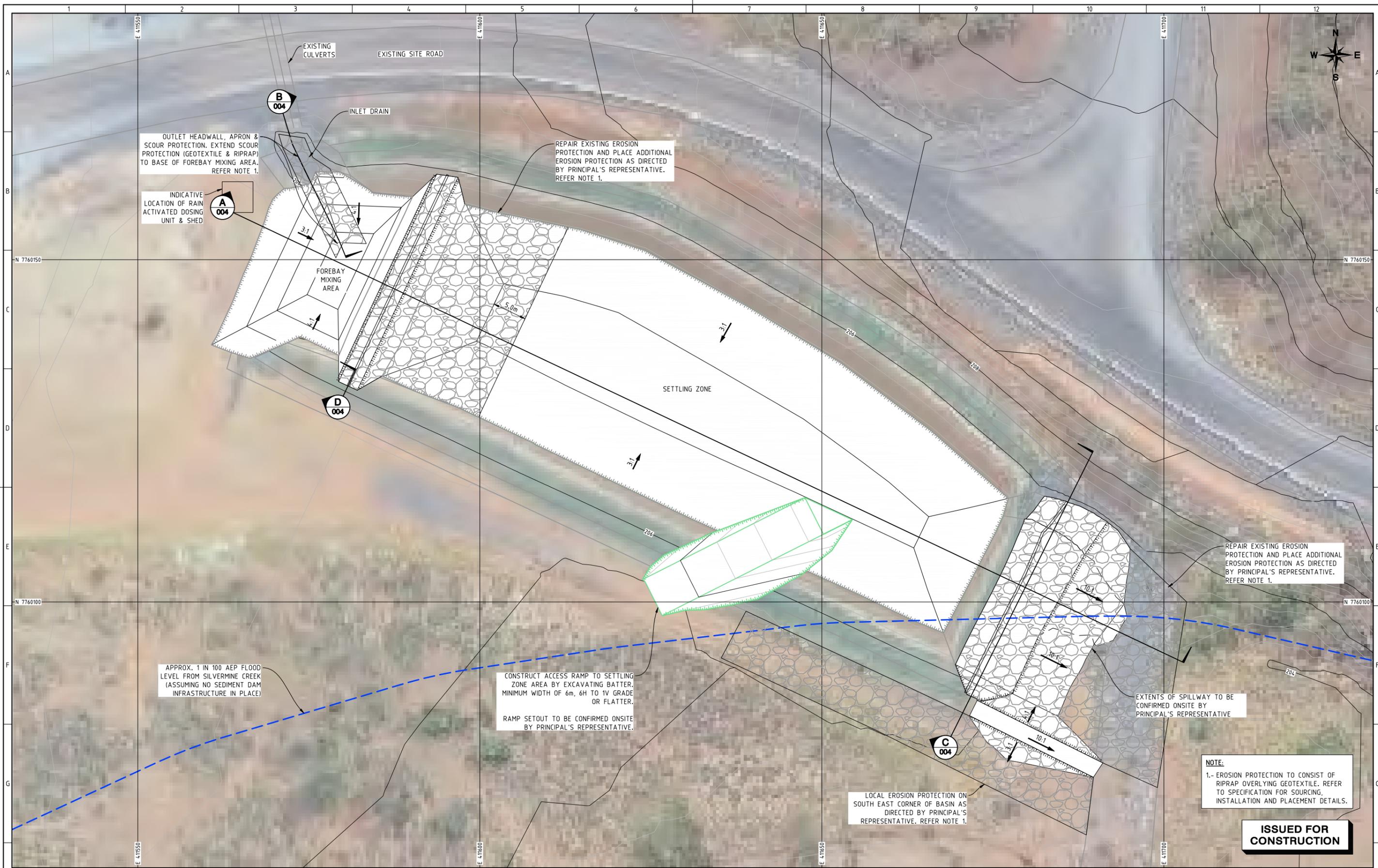
LAYOUT PLAN

DWG. No. 108003.50-002

SHEET SIZE A3 Rev. 0

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SHEET 1 OF 1



NOTE:
1.- EROSION PROTECTION TO CONSIST OF RIPRAP OVERLYING GEOTEXTILE. REFER TO SPECIFICATION FOR SOURCING, INSTALLATION AND PLACEMENT DETAILS.

ISSUED FOR CONSTRUCTION

0	ISSUED FOR CONSTRUCTION	27.08.21	CV	DMR	NB	APPROVED	NB
No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D		

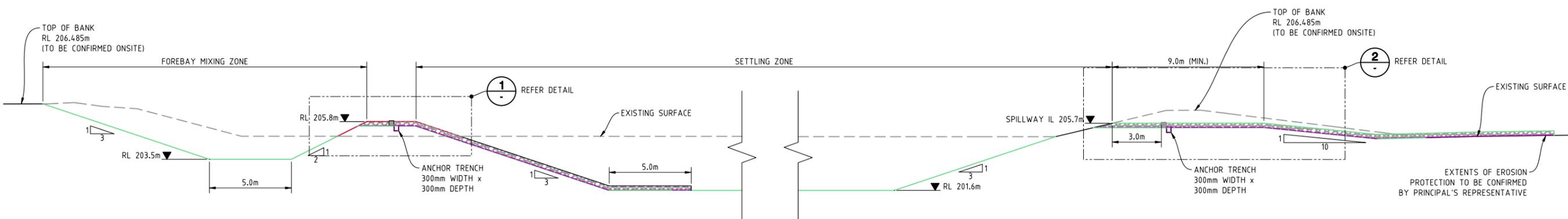
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 DATE 25.08.21
 DESIGN DMR
 DRAWN CV
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 APPROVED NB

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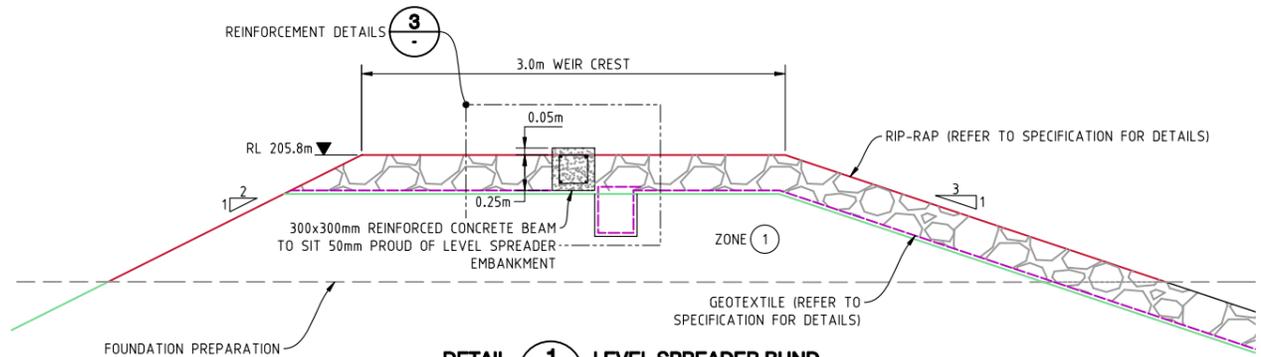
**MMG DUGALD RIVER
 SEDIMENT DAM F UPGRADE**

**EROSION PROTECTION EXTENTS
 & ACCESS RAMPS**

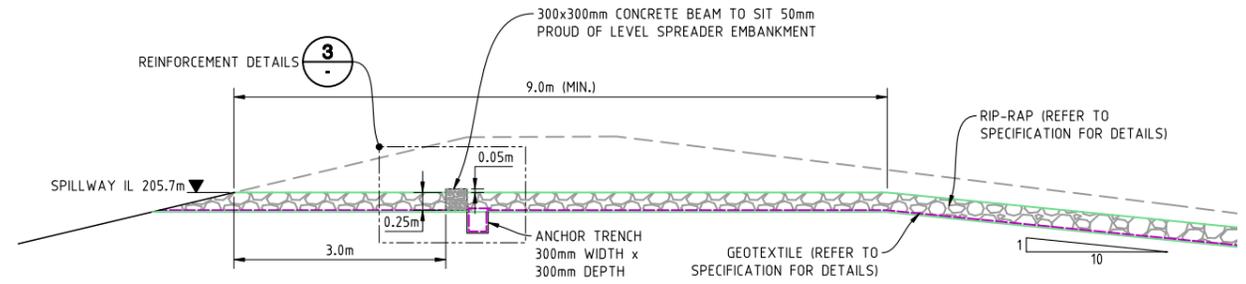
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SHEET 1 OF 1	



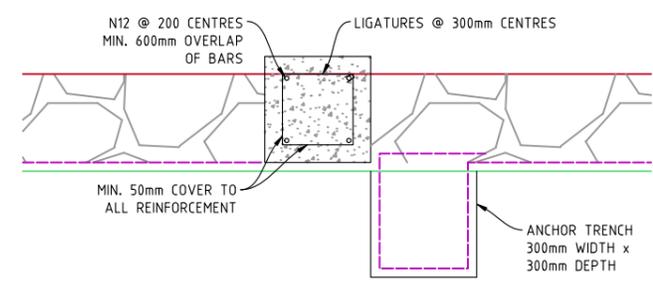
SECTION A SEDIMENT BASIN
SCALE 1:250 002



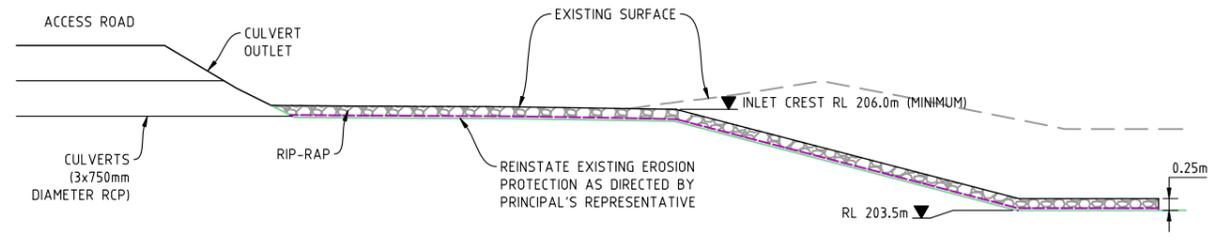
DETAIL 1 LEVEL SPREADER BUND
SCALE 1:50



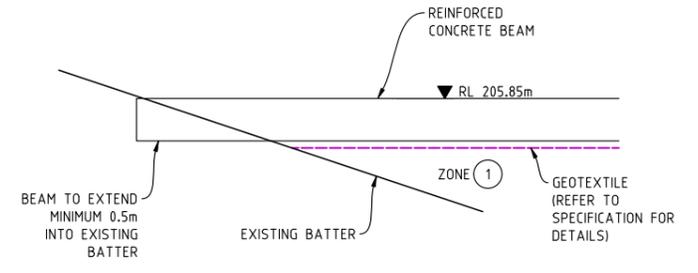
DETAIL 2 SPILLWAY
SCALE 1:100



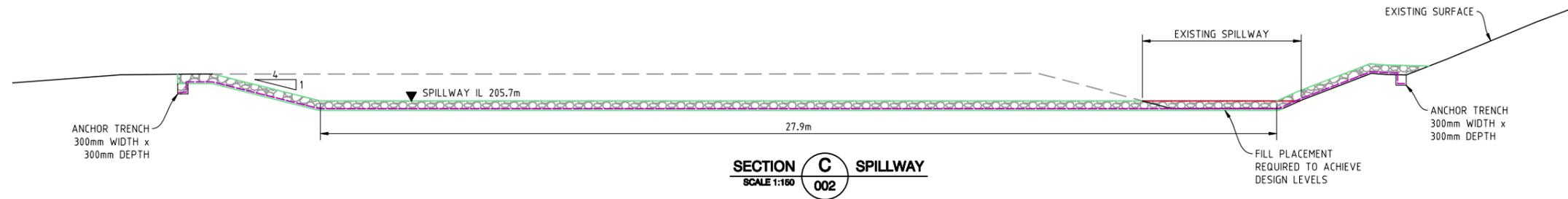
DETAIL 3 REINFORCEMENT
SCALE 1:20



SECTION B INLET DRAIN
SCALE 1:150 002



SECTION D CONCRETE BEAM
SCALE 1:50 003



SECTION C SPILLWAY
SCALE 1:150 002

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No.	DESCRIPTION	DATE	DRAWN	CHECKD	APPRD
0	ISSUED FOR CONSTRUCTION	27.08.21	HR	DMR	NB

SCALE: AS SHOWN
 JOB No. 108003.50
 DATE 25.08.21
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 TAILINGS . WATER . WASTE .

**MMG DUGALD RIVER
 SEDIMENT DAM F UPGRADE**

SECTIONS & DETAILS

DWG. No. 108003.50-004

SHEET SIZE A3 Rev. 0

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SHEET 1 OF 1

Appendix B – ESCP Plan Reference



APPENDIX A REFERENCE DOCUMENTS

Item	Title/Description	Author/Publisher	Version/Date
1	Bridge and Culvert Construction	IECA Book 4 – Design Fact Sheets	2010
2	Catch Drains Part-1 General	IECA Book 4 – Design Fact Sheets	2010
3	Catch Drains Part-2 Earth	IECA Book 4 – Design Fact Sheets	2010
4	Catch Drains Part-2 Grass	IECA Book 4 – Design Fact Sheets	2010
5	Check Dam Sediment Traps	IECA Book 4 – Design Fact Sheets	2010
6	Construction Access Roads	IECA Book 4 – Design Fact Sheets	2010
7	Construction Exits Part-3 – Vibration Grids	IECA Book 4 – Design Fact Sheets	2010
8	Construction Exits Part-4 – Wash Bays	IECA Book 4 – Design Fact Sheets	2010
9	Diversion Channels	IECA Book 4 – Design Fact Sheets	2010
10	Dust Control	IECA Book 4 – Design Fact Sheets	2010
11	Excavated Sediment Traps	IECA Book 4 – Design Fact Sheets	2010
12	Filter Fence	IECA Book 4 – Design Fact Sheets	2010
13	Flow Diversion Bank Part-1 General	IECA Book 4 – Design Fact Sheets	2010
14	Flow Diversion Bank Part-1 Grass	IECA Book 4 – Design Fact Sheets	2010
15	Flow Diversion Bank Part-2 Earth	IECA Book 4 – Design Fact Sheets	2010
16	Installation of Services	IECA Book 4 – Design Fact Sheets	2010
17	Level Spreaders	IECA Book 4 – Design Fact Sheets	2010
18	Mulch Filter Berms	IECA Book 4 – Design Fact Sheets	2010
19	Pipe & Culvert Inlet Sediment Traps	IECA Book 4 – Design Fact Sheets	2010
20	Sediment Basin Overview	IECA Book 4 – Design Fact Sheets	2010
21	Sediment Basin Spillways	IECA Book 4 – Design Fact Sheets	2010
22	Sediment Fence	IECA Book 4 – Design Fact Sheets	2010
23	Sediment Weirs	IECA Book 4 – Design Fact Sheets	2010
24	Site Management	IECA Book 4 – Design Fact Sheets	2010
25	Soil Management	IECA Book 4 – Design Fact Sheets	2010
26	Stockpile Management	IECA Book 4 – Design Fact Sheets	2010
27	Temporary Culvert Crossings	IECA Book 4 – Design Fact Sheets	2010
28	Vegetation Management	IECA Book 4 – Design Fact Sheets	2010

Appendix C – Non-Operational Area Soil Loss Calculations



Sub-Catchment	Area (Ha)	Slope (%)	Length (m)	K Factor	Ls	C Factor	Soil Loss Rate (t/ha/yr)	Soil Erosion Hazard	Soil Loss Class
WTG-1A	0.22	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-1B	0.21	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-1C	0.14	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-2A	0.40	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-2B	0.16	1	80.0	0.030	0.19	1.00	19	Very Low	1
WTG-3A	0.33	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-3B	0.25	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-4A	0.35	17	30.0	0.030	2.67	1.00	273	Moderate	3 to 4
WTG-4B	0.30	17	30.0	0.030	2.67	1.00	273	Moderate	3 to 4
WTG-5A	0.34	12	60.0	0.030	3.02	1.00	309	Moderate	3 to 4
WTG-5B	0.31	12	60.0	0.030	3.02	1.00	309	Moderate	3 to 4
WTG-6A	0.38	5	80.0	0.030	1.19	1.00	122	Very Low	1
WTG-6B	0.24	5	80.0	0.030	1.19	1.00	122	Very Low	1
WTG-7A	0.34	10	60.0	0.030	2.31	1.00	236	Moderate	3 to 4
WTG-7B	0.31	7	60.0	0.030	1.24	1.00	127	Very Low	1
WTG-8A	0.65	8	60.0	0.030	1.70	1.00	174	Low	2
WTG-9A	0.47	1	80.0	0.030	0.19	1.00	19	Very Low	1
VIL-W01	0.35	5	80.0	0.030	1.19	1.00	122	Very Low	1
VIL-W02	0.33	5	80.0	0.030	1.19	1.00	122	Very Low	1
VIL-N01	0.51	15	80.0	0.030	4.61	1.00	472	Moderate	3 to 4
VIL-N02	3.96	2.5	80.0	0.030	0.65	1.00	67	Very Low	1
VIL-N03	1.58	15	80.0	0.030	4.61	1.00	472	Moderate	3 to 4
THE-01	1.95	1	80.0	0.045	0.19	1.00	29	Very Low	1
BESS-01	0.42	1	80.0	0.045	0.19	1.00	29	Very Low	1
SS-01	0.47	1	80.0	0.045	0.19	1.00	29	Very Low	1

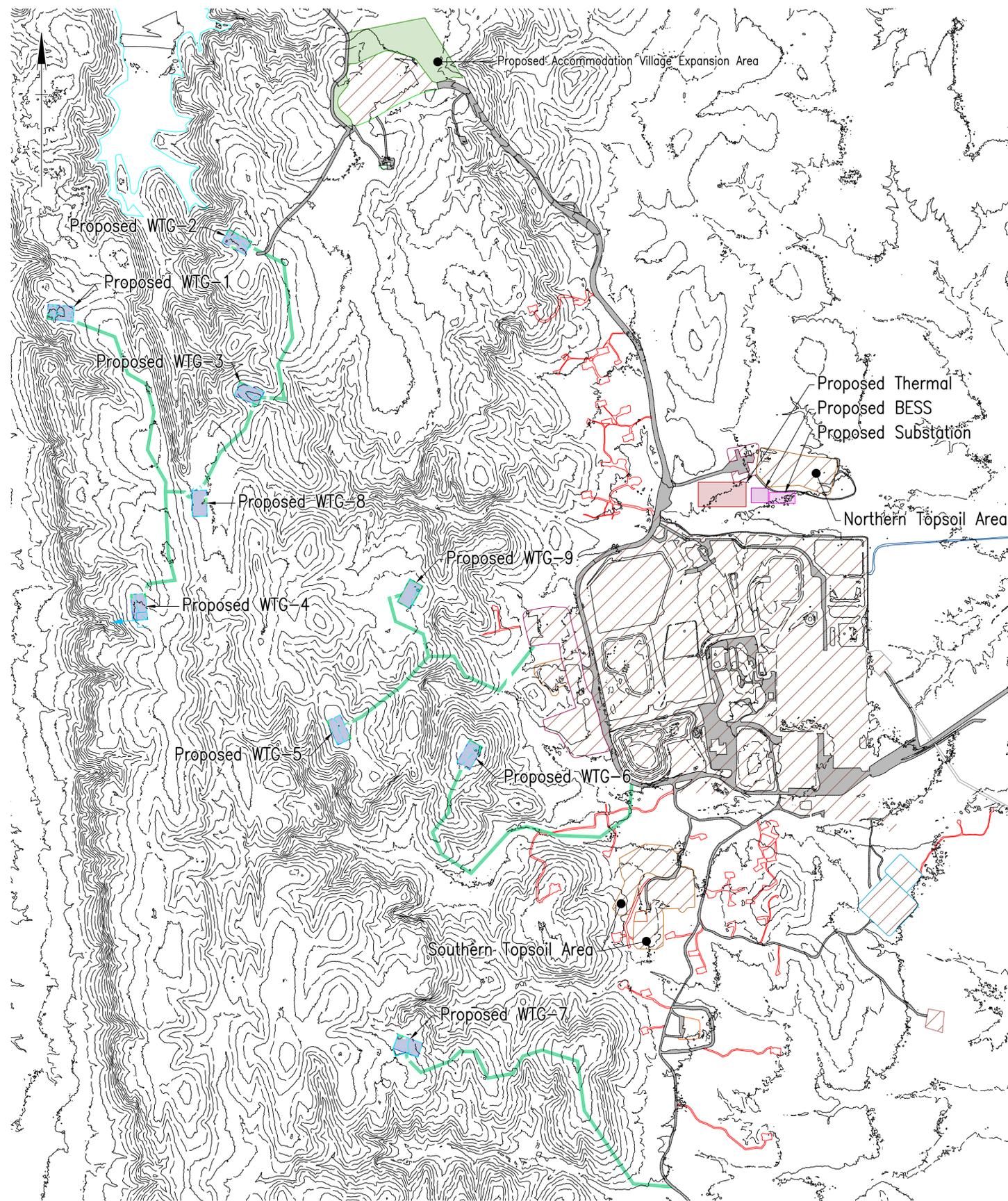
Sub-Catchment	Area (Ha)	Slope (%)	Length (m)	K Factor	Ls	C Factor	Soil Loss Rate (t/ha/yr)	Soil Erosion Hazard	Soil Loss Class
STA-01	1.40	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-02	2.26	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-03	1.87	3.5	80.0	0.045	0.91	1.00	140	Very Low	1
STA-04	1.30	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-05	1.31	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
NTA-01	1.08	1.5	80.0	0.045	0.41	1.00	63	Very Low	1
NTA-02	0.24	1.5	80.0	0.045	0.41	1.00	63	Very Low	1

Appendix D – Non-operational Sediment Basin Sizing



Sub-catchment ID	Disturbed Area (ha)	Design rainfall depth (mm of storm)	Design rainfall depth (percentile)	X-day, Y-percentile rainfall event	Rainfall R-factor (if available)	IFD: 2-year, 6-hour storm (t/ha/yr)	oil loss rate (t/ha/yr)	Length (m)	Width (m)	Ratio	Area (m ²)	Depth of sediment zone	Depth of settling zone	Internal batter slope	Check basin storage (soil volume /m ²)	Check basin settling	Check sediment basin total	Weir height (m)	Freeboard (m)	Check total depth (m)
WTG-2A	0.4	5	80	23.8	2624	11	261	15	5	3	75	0.4	0.9	2	33	65	98	0.3	0.3	1.9
WTG-3A	0.3	5	80	23.8	2624	11	261	15	5	3	75	0.4	0.7	2	27	54	80	0.3	0.3	1.7
WTG-4A	0.4	5	80	23.8	2624	11	273	15	5	3	75	0.4	0.8	2	29	58	87	0.3	0.3	1.8
WTG-4B	0.3	5	80	23.8	2624	11	273	15	5	3	75	0.3	0.7	2	25	49	74	0.3	0.3	1.6
WTG-5A	0.3	5	80	23.8	2624	11	309	15	5	3	75	0.4	0.7	2	28	56	84	0.3	0.3	1.7
WTG-5B	0.3	5	80	23.8	2624	11	309	15	5	3	75	0.3	0.7	2	25	51	76	0.3	0.3	1.6
WTG-7A	0.4	5	80	23.8	2624	11	236	15	5	3	75	0.5	0.9	2	34	68	102	0.3	0.3	2
WTG-8A	0.7	5	80	23.8	2624	11	174	20	7	3	133	0.4	0.8	2	54	107	161	0.9	0.3	2.4
VIL-N01	0.5	5	80	23.8	2624	11	472	18	6	3	108	0.4	0.8	2	42	84	126	0.3	0.3	1.8
VIL-N03	1.6	5	80	23.8	2624	11	472	30	10	3	300	0.4	0.9	2	130	259	389	0.3	0.3	1.9
STA-01	1.4	5	80	23.8	2624	11	100	27	9	3	243	0.5	0.9	2	115	230	345	0.3	0.3	2
STA-02	2.3	5	80	23.8	2624	11	100	35	12	3	408	0.5	0.9	2	186	371	557	0.3	0.3	2
STA-03	1.9	5	80	23.8	2624	11	140	35	12	3	408	0.4	0.8	2	154	307	461	0.3	0.3	1.7
STA-04	1.3	5	80	23.8	2624	11	100	30	10	3	300	0.4	0.7	2	107	213	320	0.3	0.3	1.7
STA-05	1.3	5	80	23.8	2624	11	100	30	10	3	300	0.4	0.7	2	107	213	320	0.3	0.3	1.7

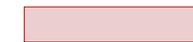
Appendix E - Non-operational Area ESCP Plans



EXISTING FEATURES LEGEND:

-  Existing Surface Contour
-  Existing Roadways
-  Existing Mine Infrastructure
-  Existing Investigation Drill Pads and Tracks
-  Existing Powerline Corridor

PROPOSED FEATURES LEGEND:

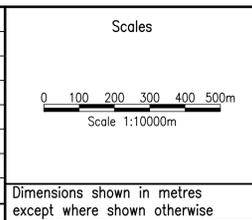
-  Investigation Tracks
-  Borrow Pits and Stockpiles
-  Wind Turbine Hard Stand – WTG (107x61m)
-  Thermal
-  BESS
-  Substation
-  Accommodation Village Expansion Area

DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	DATE	REVISION
WTS-001-SKC000	PROPOSED AREAS OF INTEREST	01/12/22	A
WTS-001-SKC005	TYPICAL ROAD DETAILS SHEET 1 OF 2	01/12/22	A
WTS-001-SKC006	TYPICAL ROAD DETAILS SHEET 2 OF 2	01/12/22	A
WTS-001-SKC007	EROSION AND SEDIMENT CONTROL DETAILS SHEET 1 OF 2	01/12/22	A
WTS-001-SKC008	EROSION AND SEDIMENT CONTROL DETAILS SHEET 2 OF 2	01/12/22	A
WTS-001-SKC010	WIND TURBINE LOCATION KEY PLAN	01/12/22	A
WTS-001-SKC011	WTG-1 FOOTPRINT	01/12/22	A
WTS-001-SKC012	WTG-2 FOOTPRINT	01/12/22	A
WTS-001-SKC013	WTG-3 FOOTPRINT	01/12/22	A
WTS-001-SKC014	WTG-4 FOOTPRINT	01/12/22	A
WTS-001-SKC015	WTG-5 FOOTPRINT	01/12/22	A
WTS-001-SKC016	WTG-6 FOOTPRINT	01/12/22	A
WTS-001-SKC017	WTG-7 FOOTPRINT	01/12/22	A
WTS-001-SKC018	WTG-8 FOOTPRINT	01/12/22	A
WTS-001-SKC019	WTG-9 FOOTPRINT	01/12/22	A
WTS-001-SKC020	ACCOMMODATION VILLAGE EXPANSION OVERVIEW	01/12/22	A
WTS-001-SKC021	ACCOMMODATION VILLAGE EXPANSION DETAILS	01/12/22	A
WTS-001-SKC030	PROPOSED THERMAL, BESS AND SUBSTATION INFRASTRUCTURE	01/12/22	A
WTS-001-SKC031	PROPOSED THERMAL INFRASTRUCTURE	01/12/22	A
WTS-001-SKC032	PROSED BESS/SUBSTATION INFRASTRUCTURE	01/12/22	A
WTS-001-SKC040	DRILL PAD LOCATION KEY PLAN	01/12/22	A
WTS-001-SKC041	TYPICAL EXISTING DRILL PAD	01/12/22	A
WTS-001-SKC050	TOPSOIL AREAS KEY PLAN	01/12/22	A
WTS-001-SKC051	SOUTHERN TOPSOIL AREA SHEET 1 OF 2	01/12/22	A
WTS-001-SKC052	SOUTHERN TOPSOIL AREA SHEET 2 OF 2	01/12/22	A
WTS-001-SKC053	NORTHERN TOPSOIL AREA	01/12/22	A

Last Modified: 1: - Dec 01, 2022 - 1:27pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22



Client

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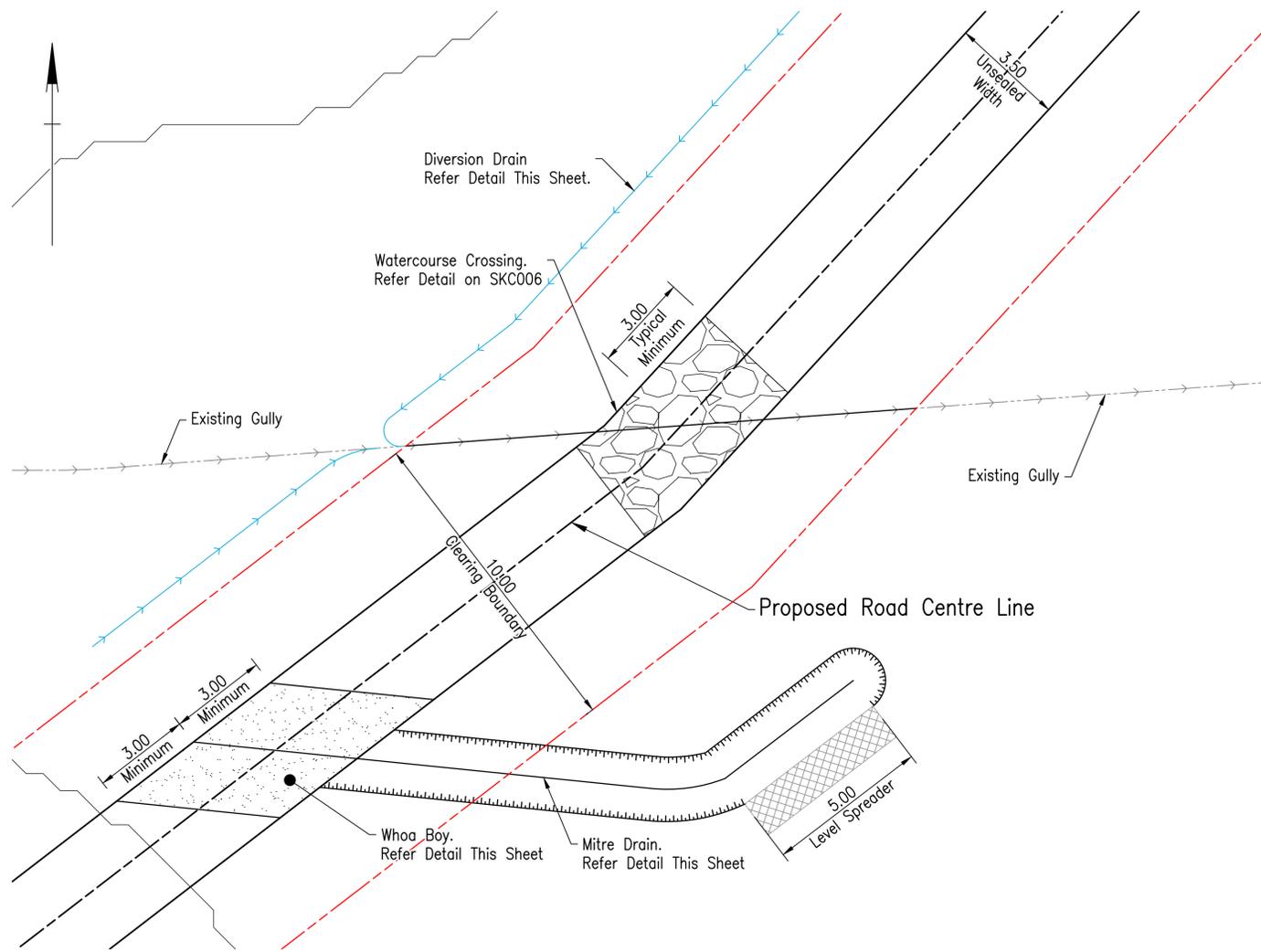
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Title

**DUGALD RIVER MINE
EROSION AND SEDIMENT CONTROL
PROPOSED AREAS**

ENGINEERING CERTIFICATION (RPEQ)				
ENG. AREA	NAME	SIGNATURE	NO.	DATE
Drawn M.SMITH				
Designed M.HAUSFELD				

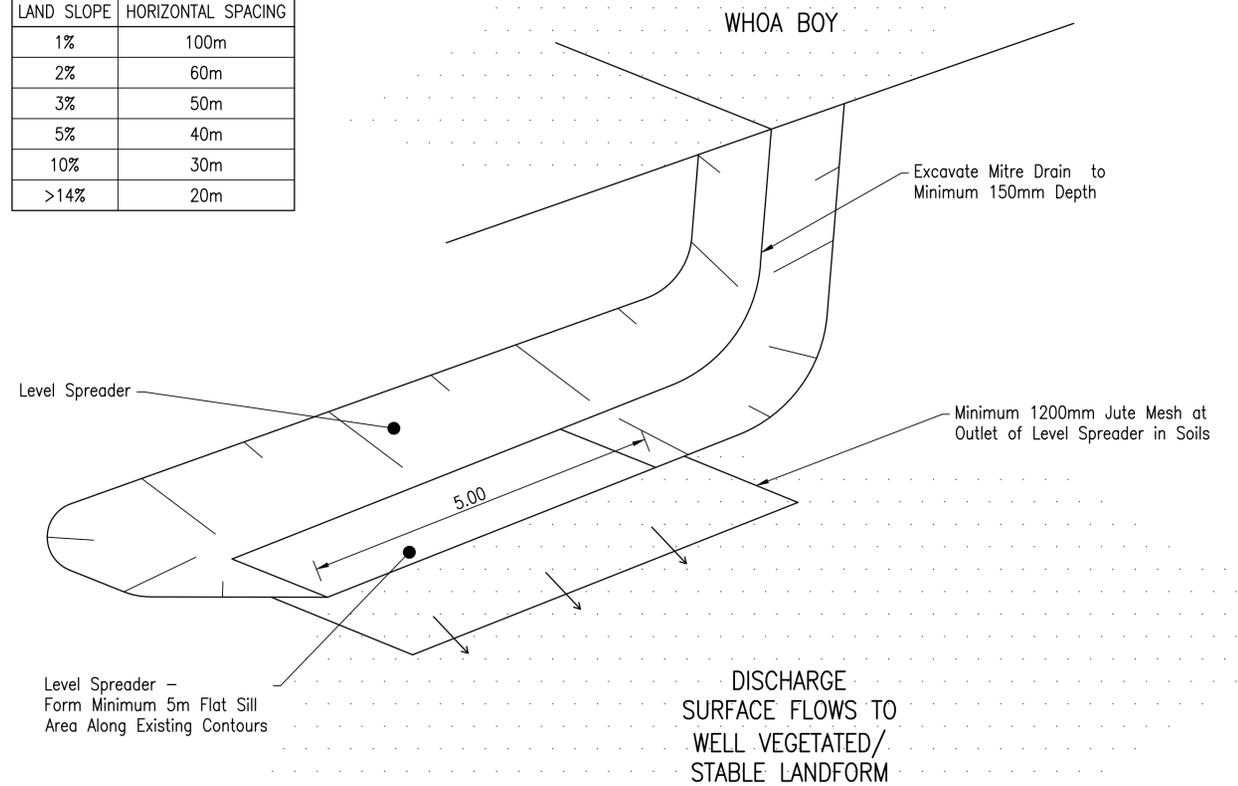
Job No.	WTS-002
Drawing No.	SKC000
Revision	A
Series Number	1 OF 1



WHAO BOY LAYOUT PLAN
Scale 1:100m

TYPICAL WHOA BOY SPACING

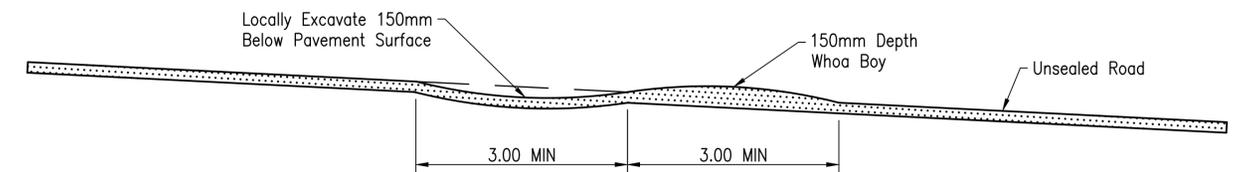
LAND SLOPE	HORIZONTAL SPACING
1%	100m
2%	60m
3%	50m
5%	40m
10%	30m
>14%	20m



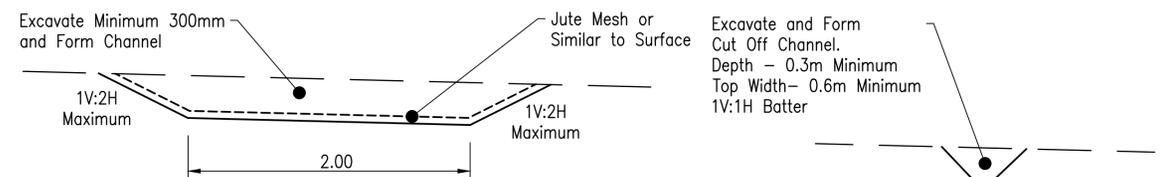
MITRE DRAIN/ LEVEL SPREADER TYPICAL PLAN
Scale 1:50m

ROAD EROSION AND SEDIMENT CONTROL NOTES:

- All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
- Works for Access Roads shall be Undertaken in the Following Sequence:
 - Install Stabilised Site Access
 - Install Cut Off Channels to Divert External Catchment Flows to all Low Points, Gullies and Watercourses
 - Construct Rock Rip Rap Crossings at Low Points, Gullies and Watercourses
 - Construct Whoa Boys and Associated Mitre Drains and Level Spreaders at Required Spacings
- Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
- The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
- Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
- Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
- All Trees to be Retained Unless Approved for Removal by the Superintendent.
- Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
- All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
- The Contractor Shall Maintain a Log Book Detailing:
 - Records of All Rainfall
 - Condition of Erosion and Sediment Control Measures
 - Any Additional Remedial Works Required
- The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.



WHAO BOYS/ CROSS BANKS TYPICAL SECTION
Scale 1:50m



DIVERSION DRAIN TYPICAL SECTION (SOILS)
Scale 1:25m

DIVERSION DRAIN TYPICAL SECTION (ROCK)
Scale 1:25m

Last Modified: 1- Dec 01, 2022 - 2:31pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales

0 0.25 0.5 0.75 1.0 1.25m
Scale 1:25m

0 0.5 1.0 1.5 2.0 2.5m
Scale 1:50m

0 1 2 3 4 5.0m
Scale 1:100m

Dimensions shown in metres except where shown otherwise

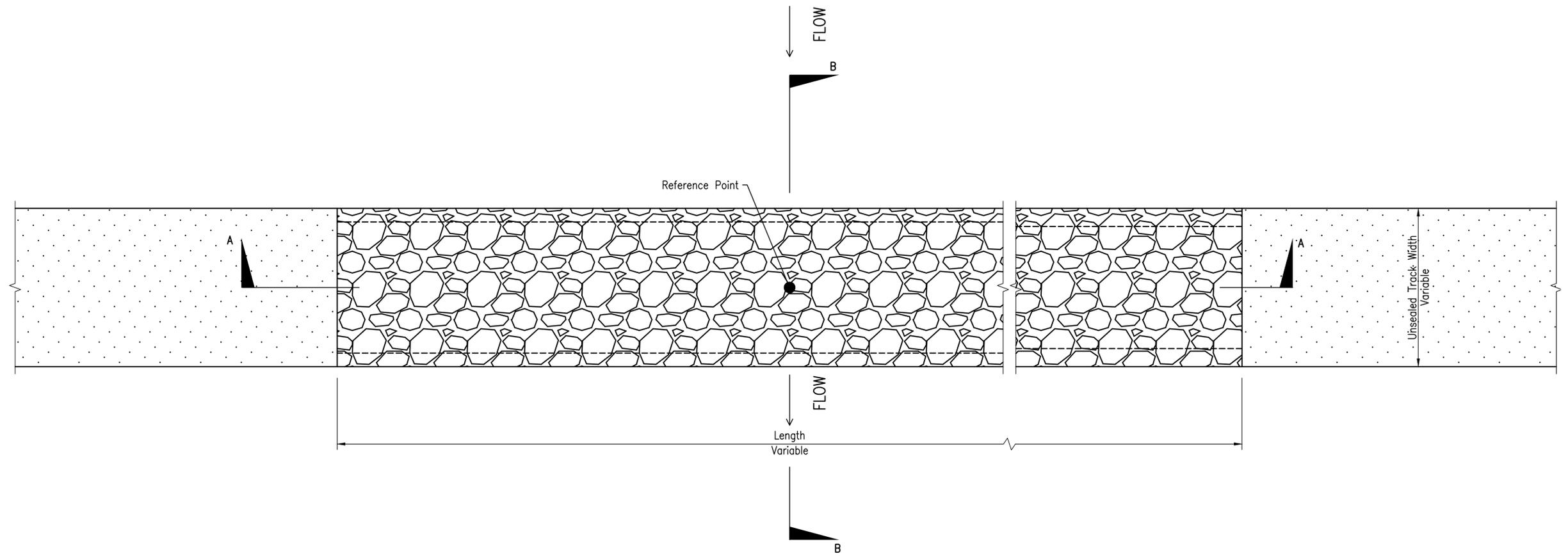


Client

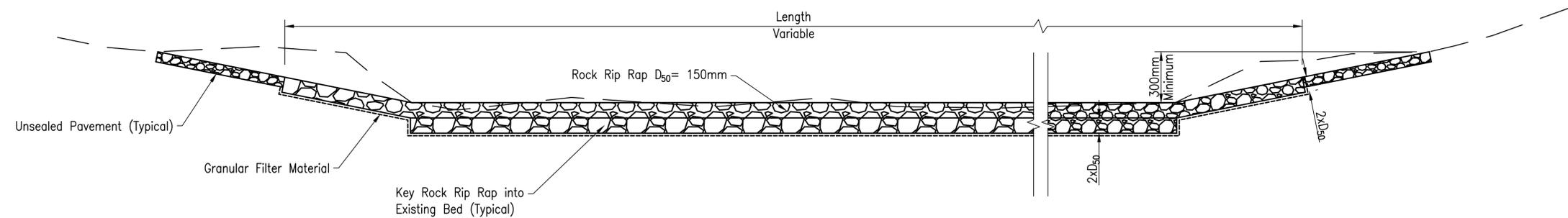
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Title					
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL TYPICAL ROAD DETAILS SHEET 1 OF 2					
Drawn	ENGINEERING CERTIFICATION (RPEQ)				
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO.	DATE
Designed	M.HAUSFELD				

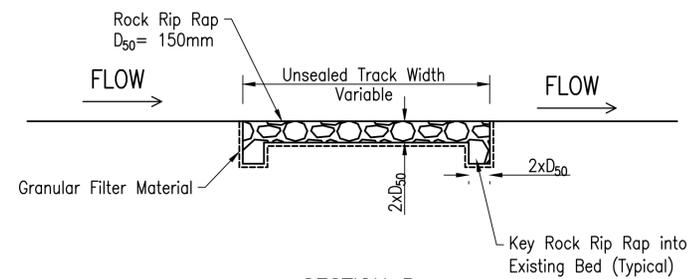
Job No.	WTS-002
Drawing No.	SKC005
Revision	A
Series Number	1 OF 2



PLAN
 AT GRADE WATERCOURSE/ CREEK/ GULLY CROSSINGS
 Scale 1:50m



SECTION A
 Scale 1:50m



SECTION B
 Scale 1:50m

Last Modified: 1: Dec 01, 2022 - 1:27pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales	
Scale 1:50m	



Client

WULGURU TECHNICAL SERVICES

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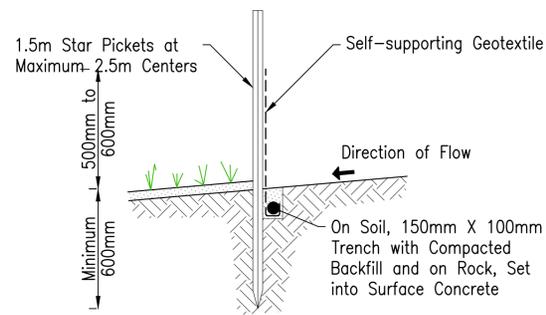
Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL TYPICAL ROAD DETAILS SHEET 2 OF 2				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC006
Revision	A
Series Number	2 OF 2

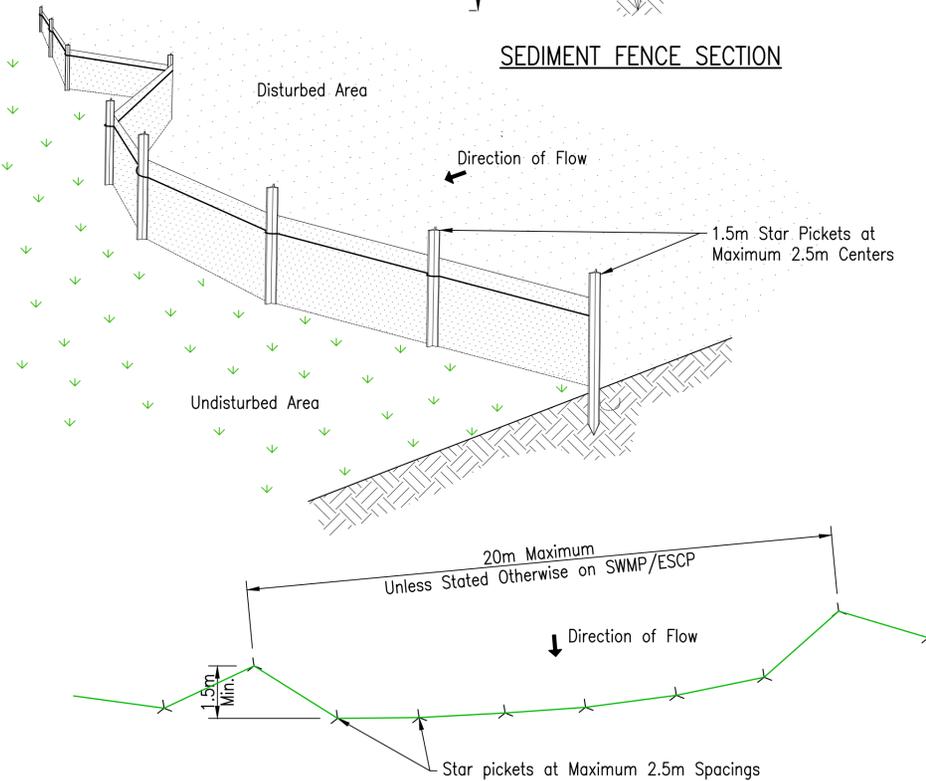
EROSION AND SEDIMENT CONTROL NOTES:

- All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
- Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
 - Install Stabilised Site Access
 - Construct Clean Water Diversion Channels and Level Spreaders where External Catchments Discharge to the Site
 - Construct Dirty Water Channels/ Bunds
 - Construct Sediment Basins and Sediment Weirs
 - Install all Sediment Fencing
 - Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - Rehabilitate the Site
 - Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent

This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
- Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
- The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
- Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
- Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
- All Trees to be Retained Unless Approved for Removal by the Superintendent.
- Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
- All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
- The Contractor Shall Maintain a Log Book Detailing:
 - Records of All Rainfall
 - Condition of Erosion and Sediment Control Measures
 - Any Additional Remedial Works Required
- The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.



SEDIMENT FENCE SECTION

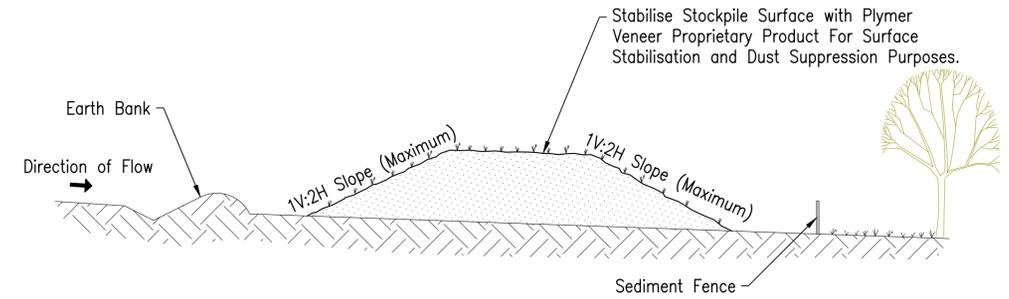


SEDIMENT FENCE PLAN

SEDIMENT FENCE CONSTRUCTION NOTES:

- Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
- Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
- Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
- Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
- Join sections of fabric at a support post with a 150-mm overlap.
- Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

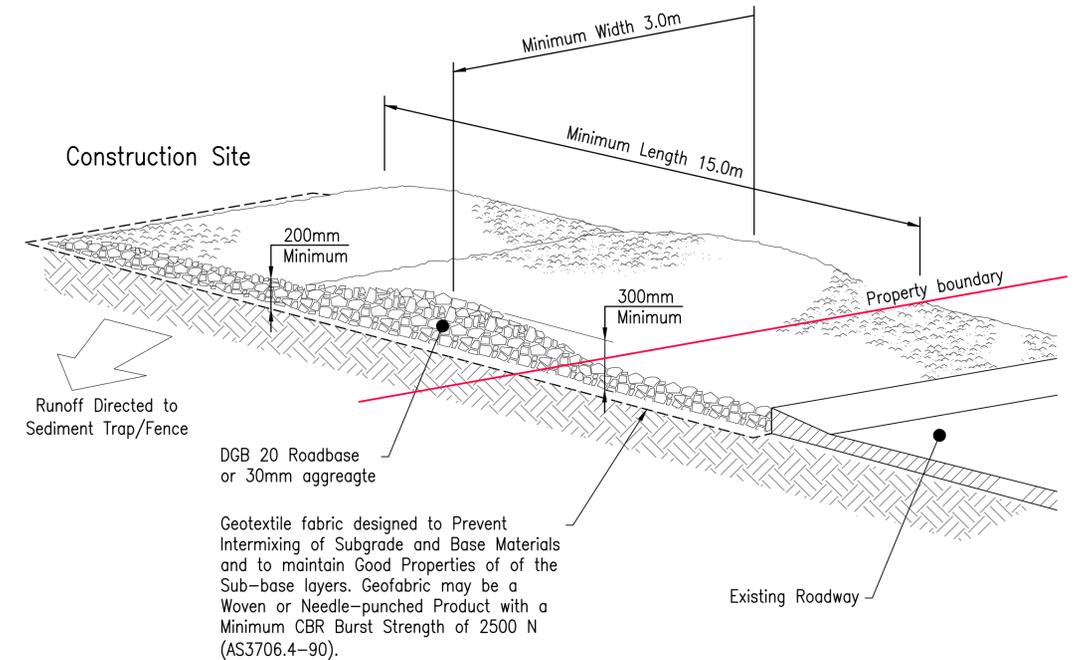
SEDIMENT FENCE DETAIL
N.T.S



STOCKPILES CONSTRUCTION NOTES:

- Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
- Construct on the contour as low, flat, elongated mounds.
- Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
- Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
- Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES DETAIL
N.T.S



STABILISED SITE ACCESS CONSTRUCTION NOTES:

- Strip the topsoil, Level the Site and Compact the Subgrade.
- Cover the Area with Woven or Needle-punched Geotextile.
- Construct at 200mm Thick Pad over the Geotextile using available Road base or 30mm Aggregate.
- Ensure the Structure is a Minimum of 15.0m Long or to Building Alignment and at least 3.0m Wide.
- Where a Sediment Fence Joins onto the Stabilised Access, Construct a hump in the Stabilised Access to Divert Water to the Sediment Fence.

STABILISED SITE ACCESS DETAIL
N.T.S

Last Modified :- Dec 01, 2022 - 1:27pm

Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales

Dimensions shown in metres except where shown otherwise

Client

Title

DUGALD RIVER MINE
EROSION AND SEDIMENT CONTROL
EROSION AND SEDIMENT CONTROL DETAILS SHEET 1 OF 2

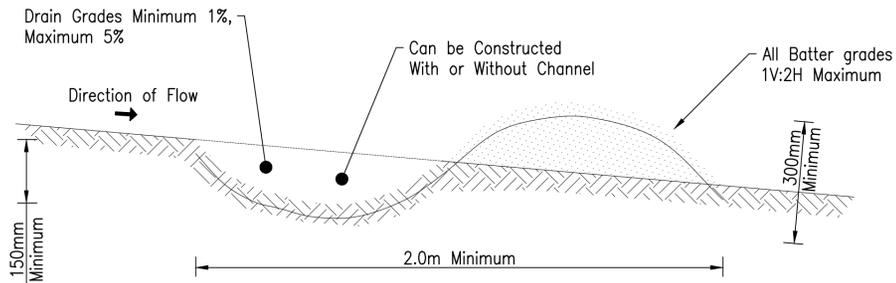
Drawn
M.SMITH

Designed
M.HAUSFELD

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ENGINEERING CERTIFICATION (RPEQ)				
ENG. AREA	NAME	SIGNATURE	NO.	DATE

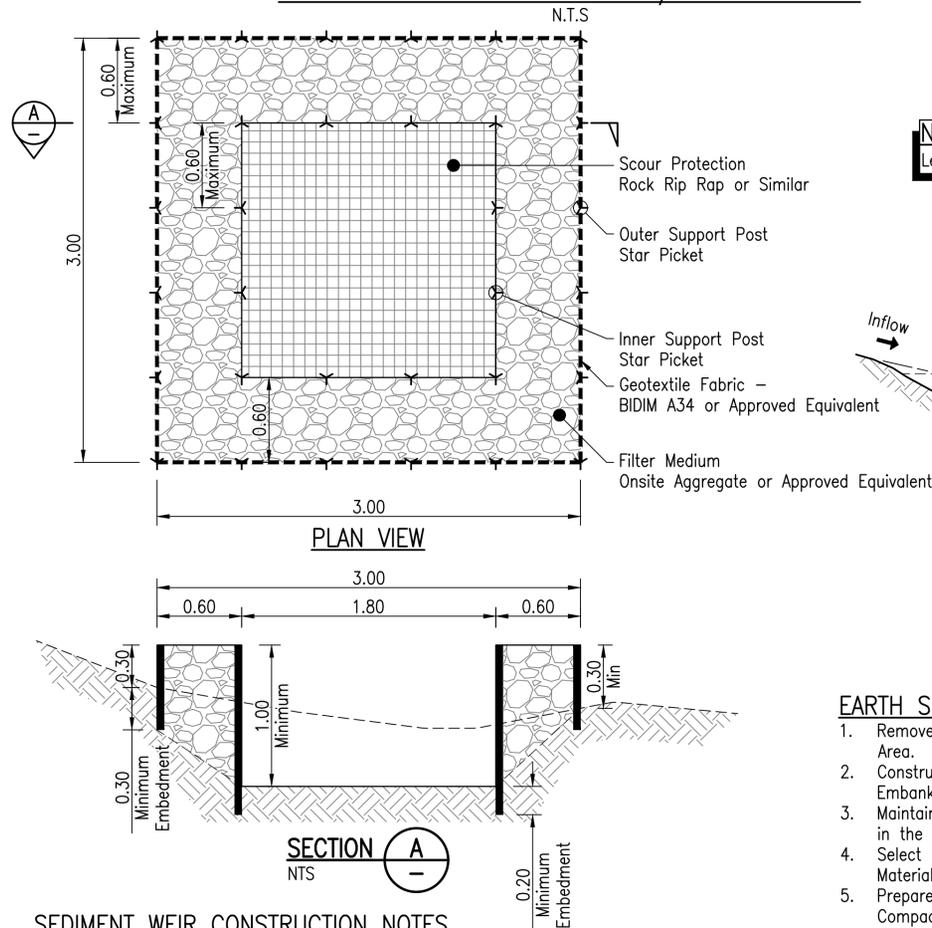
Job No.	WTS-002
Drawing No.	SKC007
Revision	A
Series Number	1 OF 2



DIRTY WATER CATCHMENT CHANNEL/ BUNDING CONSTRUCTION NOTES:

1. Build with Gradients Between 1% and 5%.
2. Avoid removing trees and Shrubs if Possible – Work around them.
3. Ensure the Structures are Free of Projections or other Irregularities that Could Impede Water Flow.
4. Build the Drains with Circular, Parabolic or Trapezoidal Cross Sections, not V Shaped.
5. Ensure Banks are Properly Compacted to Prevent Failure.
6. Complete Permanent or Temporary Stabilisation Within 10 Days of Construction.

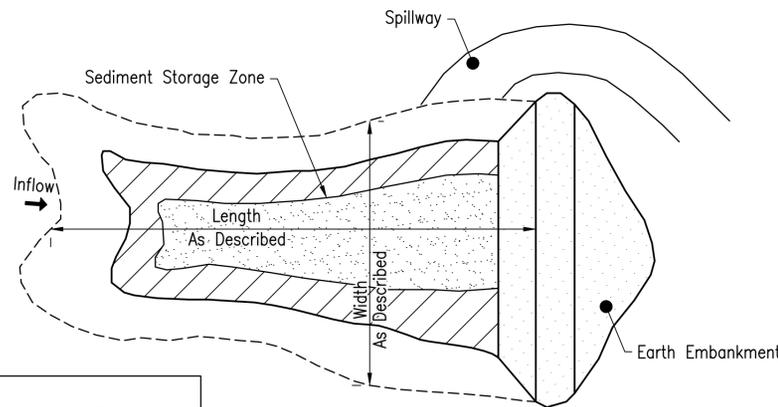
DIRTY WATER CATCHMENT CHANNEL/ BUNDING DETAIL



SEDIMENT WEIR CONSTRUCTION NOTES

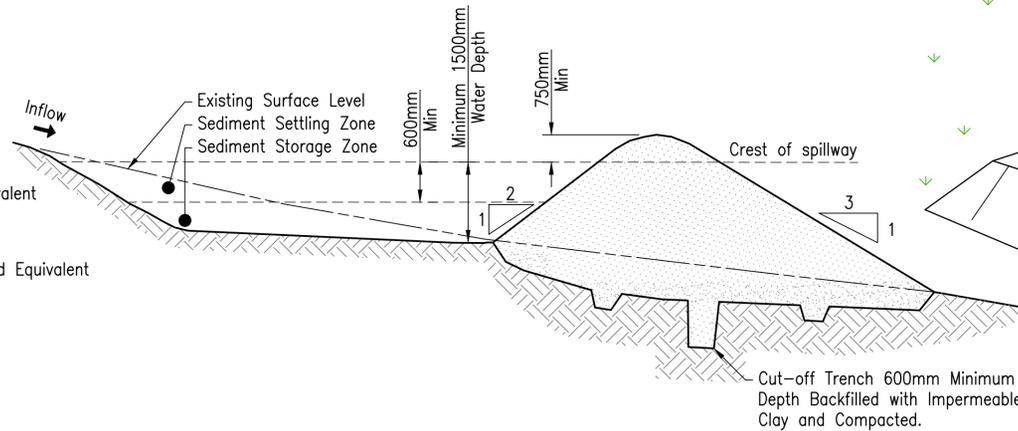
1. Remove all Vegetation and Topsoil in Footprint.
2. Excavate to Depths and Widths Required.
3. Form Sediment Weir Utilising Star Pickets, Aggregate and Geotextile.
4. Rehabilitate Following Decommissioning.

SEDIMENT WEIR DETAIL
N.T.S



PLAN VIEW

NOTE:
Length/ Width ratio 3:1 Minimum.

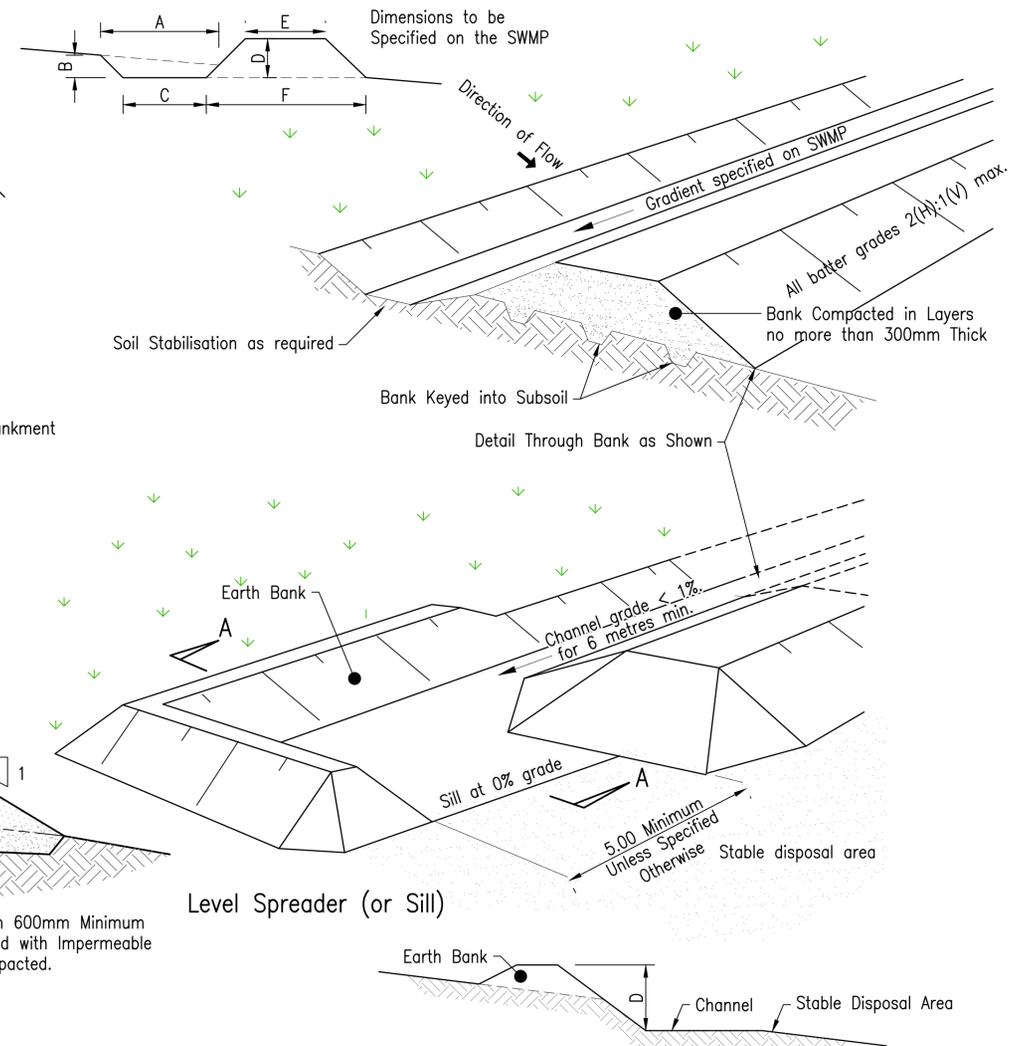


CROSS SECTION

EARTH SEDIMENT BASIN CONSTRUCTION NOTES

1. Remove all Vegetation and Topsoil from Under the Dam Wall and From Within the Storage Area.
2. Construct a Cut-off Trench 500mm Deep and 1,200mm Wide Along the Centreline of the Embankment Extending to a Point on the Gully Wall Level with the Riser Crest.
3. Maintain the Trench Free of Water and Recompact the Materials with Equipment as Specified in the SWMP to 95% Standard Proctor Density.
4. Select Fill Following the SWMP that is Free of Roots, Wood, Rock, Large Stone or Foreign Material.
5. Prepare the Site Under the Embankment by Ripping to at least 100mm to help bond Compacted Fill to the Existing Substrate.
6. Spread the Fill in 100mm to 150mm Layers and Compact it at Optimum Moisture Content Following the SWMP.
7. Construct the Emergency Spillway.
8. Rehabilitate the Structure Following the SWMP.

EARTH SEDIMENT BASIN DETAIL
N.T.S



Level Spreader (or Sill)

SECTION AA

CONSTRUCTION NOTES

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible – work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

CHANNEL/ BUNDING DETAIL (LARGE)
N.T.S

Last Modified :- Dec 01, 2022 - 2:30pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Dimensions shown in metres except where shown otherwise

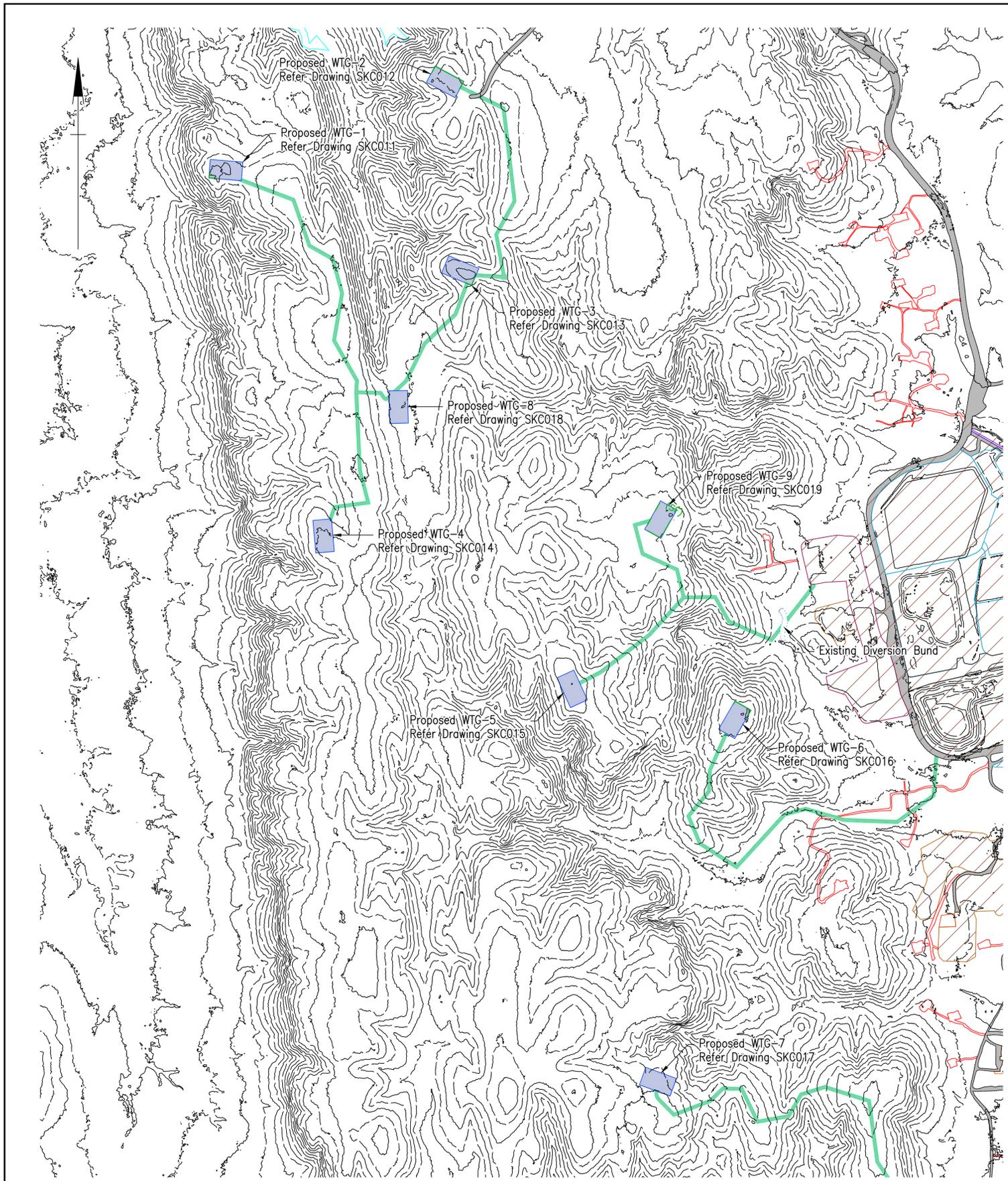
Scales

Client

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Title					
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL EROSION AND SEDIMENT CONTROL DETAILS SHEET 2 OF 2					
Drawn					
M.SMITH	ENGINEERING CERTIFICATION (RPEQ)				
	ENG. AREA	NAME	SIGNATURE	NO.	DATE
Designed					
M.HAUSFELD					

Job No.	WTS-002
Drawing No.	SKC008
Revision	A
Series Number	2 OF 2



FEATURES LEGEND:

- 210m Major Existing Surface Contour
- Minor Existing Surface Contour
- Existing Roadways
- Existing Mine Infrastructure
- Existing Drill Pads
- Existing Powerline Corridor
- Proposed Investigation Tracks
- Proposed Wind Turbine Hard Stand

EROSION CONTROL LEGEND:

- Proposed Sediment Fence
- Proposed Clean Water Diversion Channels (Direction Shown)
- Proposed Dirty Water Catchment Channel/Bunding (Direction Shown)
- Proposed Dirty Water Catchment Area
- Proposed Whoa boys and Turnouts
- Proposed Rock Scour Protection
- Proposed Sediment Basin Extents
- Proposed Sediment Weir
- Proposed Level Spreader
- Existing Overland Flow (Clean)
- Existing Overland Flow (Dirty)

EROSION AND SEDIMENT CONTROL NOTES:

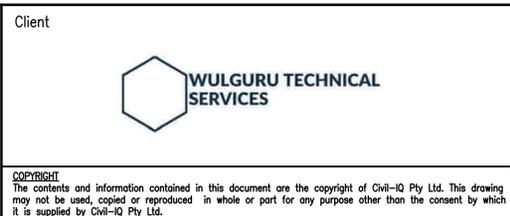
1. All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
2. Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
 - 2.1. Install Stabilised Site Access
 - 2.2. Construct Clean Water Diversion Channels and Level Spreaders where External Catchments Discharge to the Site
 - 2.3. Construct Dirty Water Channels/ Bunds
 - 2.4. Construct Sediment Basins and Sediment Weirs
 - 2.5. Install all Sediment Fencing
 - 2.6. Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - 2.7. Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - 2.8. Rehabilitate the Site
 - 2.9. Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent

This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
3. Works for Access Roads shall be Undertaken in the Following Sequence:
 - 3.1. Install Stabilised Site Access
 - 3.2. Install Cut Off Channels to Divert External Catchment Flows to all Low Points, Gullies and Watercourses
 - 3.3. Construct Rock Rip Rap Crossings at Low Points, Gullies and Watercourses
 - 3.4. Construct Woah Boys and Associated Mitre Drains and Level Spreaders at Required Spacings
4. Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
5. The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
6. Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
7. Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
8. All Trees to be Retained Unless Approved for Removal by the Superintendent.
9. Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
10. All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
11. The Contractor Shall Maintain a Log Book Detailing:
 - 11.1. Records of All Rainfall
 - 11.2. Condition of Erosion and Sediment Control Measures
 - 11.3. Any Additional Remedial Works Required
12. The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.

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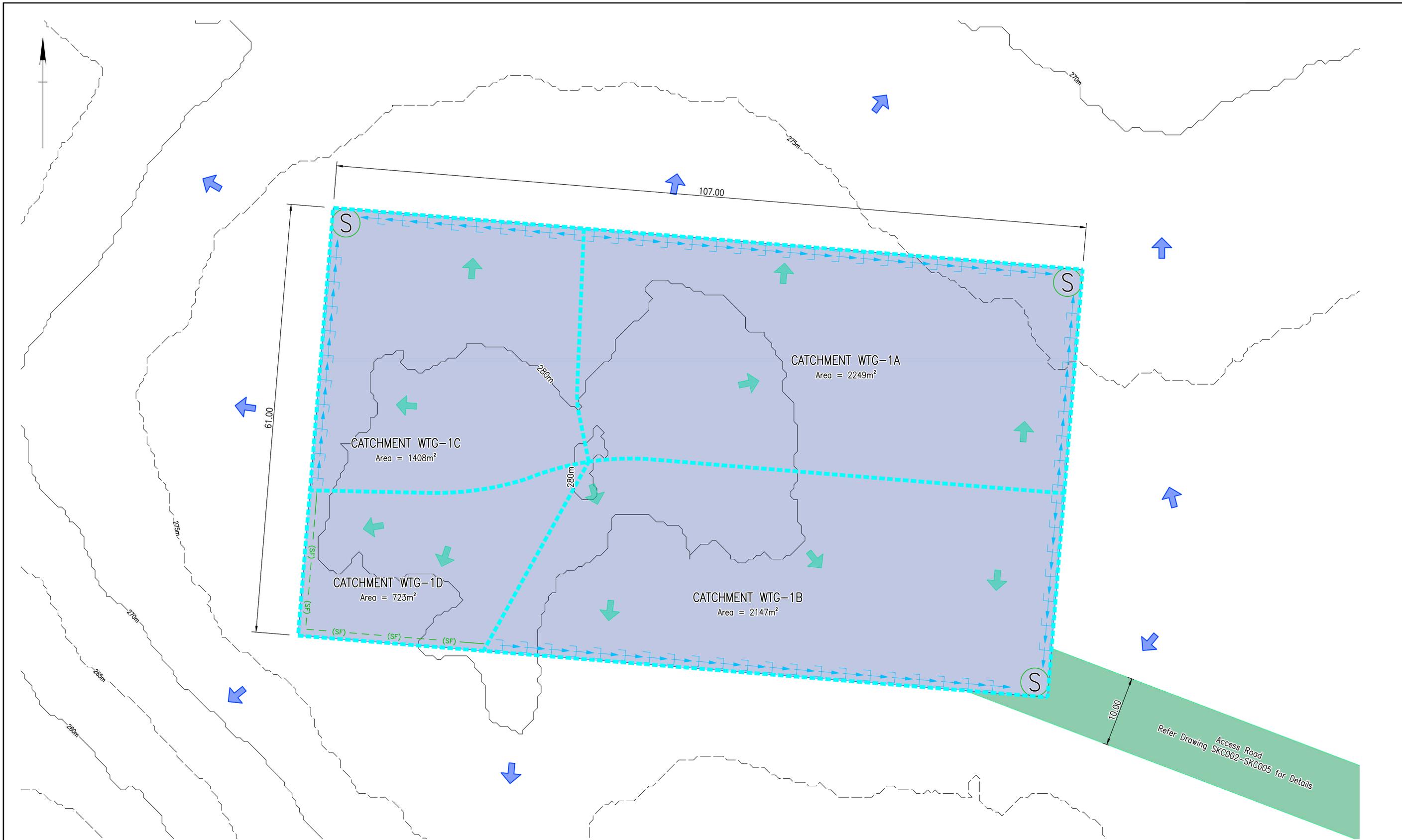
A		DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description		Certification	Date

Scales
N.T.S
Dimensions shown in metres except where shown otherwise



Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WIND TURBINE LOCATION KEY PLAN				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed	M.HAUSFELD			

Job No.	WTS-002
Drawing No.	SKC010
Revision	A
Series Number	1 OF 10



WTG-1 PLAN
Scale 1:250m

Last Modified: 1: Dec 01, 2022 - 1:28pm

Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales	
Scale 1:250m	



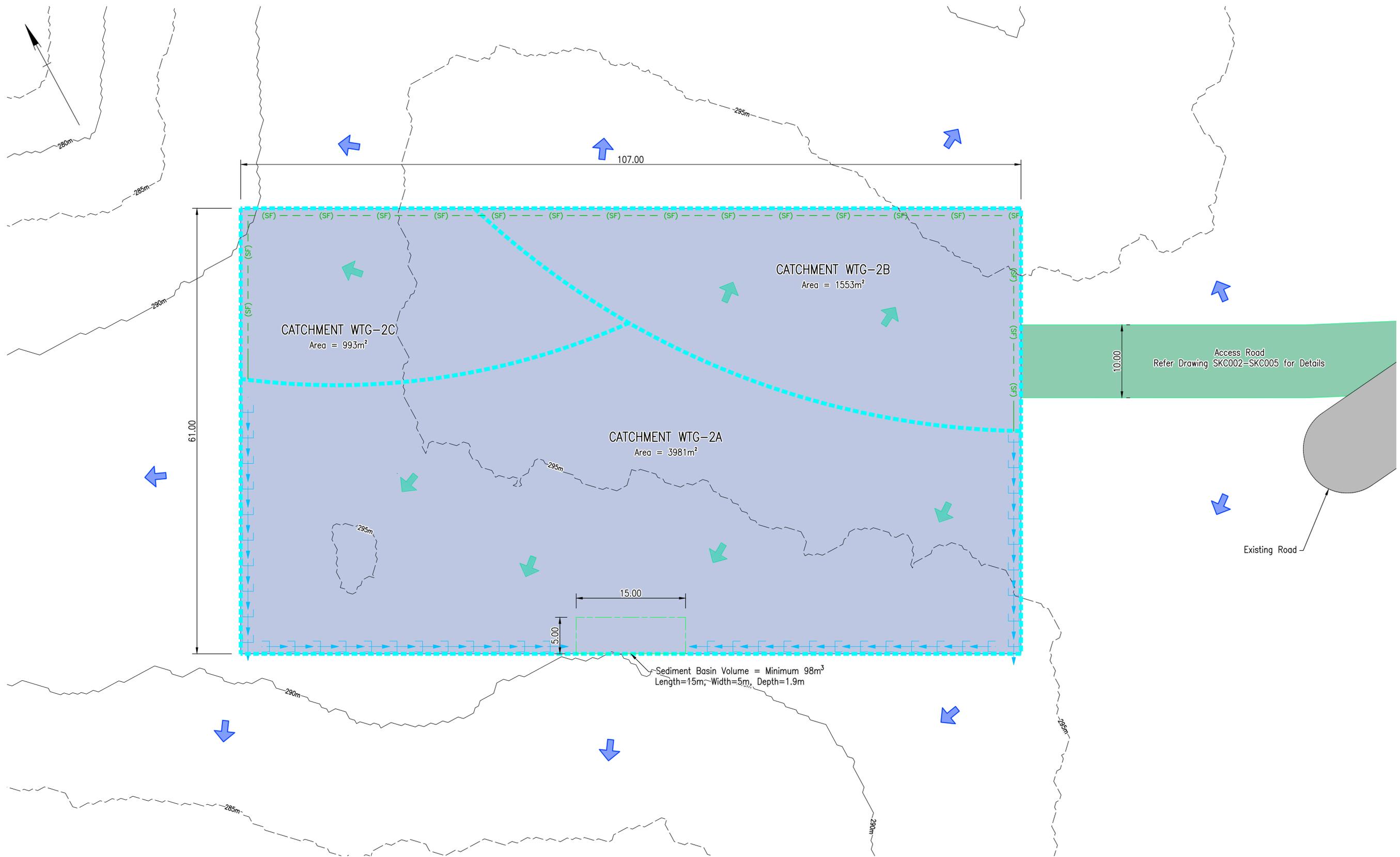
Client

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Title		ENGINEERING CERTIFICATION (RPEQ)			
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-1 FOOTPRINT		ENG. AREA	NAME	SIGNATURE	NO.
Drawn	M.SMITH	DATE			
Designed	M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC011
Revision	A
Series Number	2 OF 10



WTG-2 PLAN
Scale 1:250m

Last Modified: 1: Dec 01, 2022 - 1:29pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales	
Scale 1:250m	



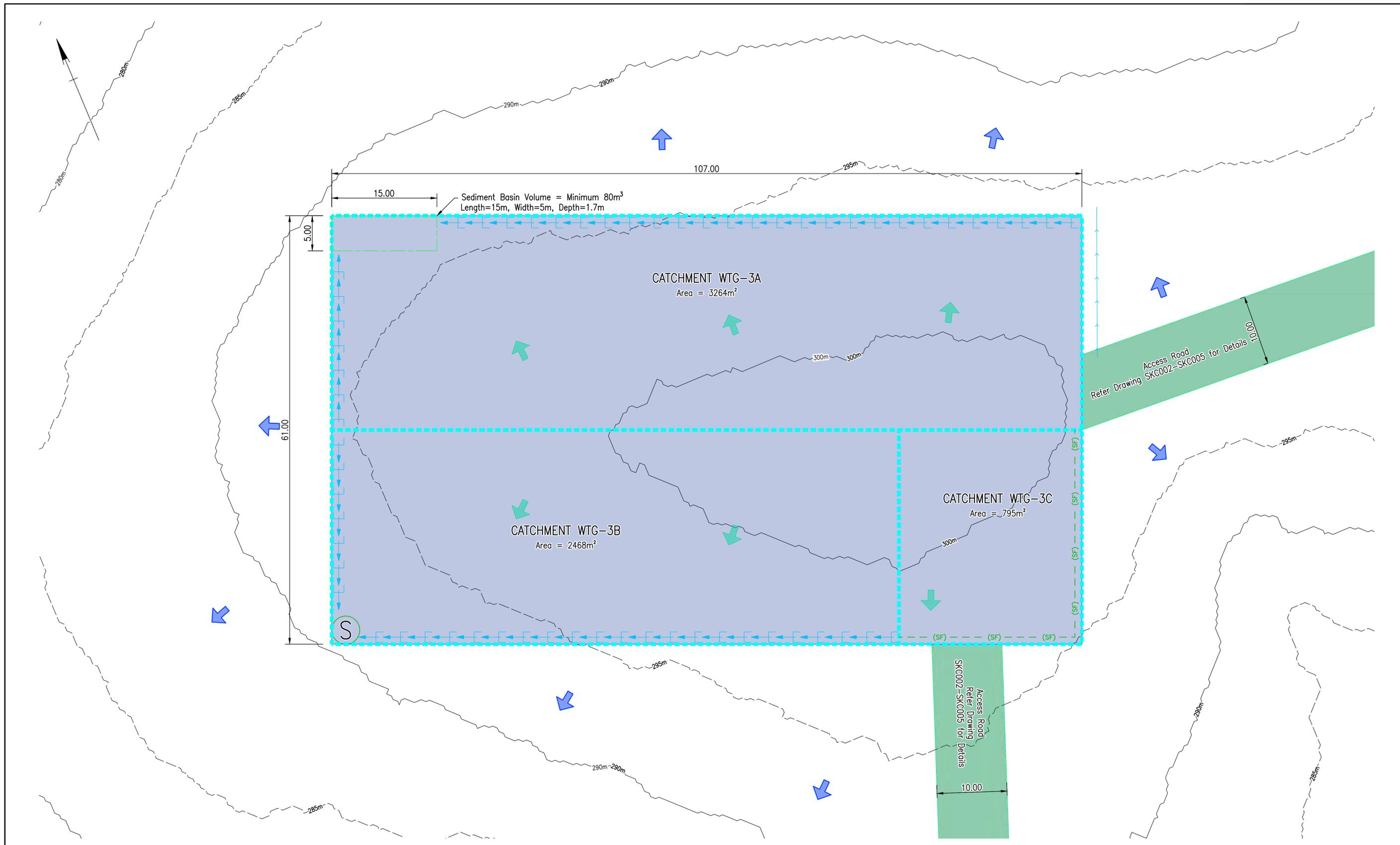
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-2 FOOTPRINT				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC012
Revision	A
Series Number	3 OF 10



WTG-3 PLAN
Scale 1:250m

Last Modified :- Dec 01, 2022 - 1:29pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales	
Scale 1:250m	



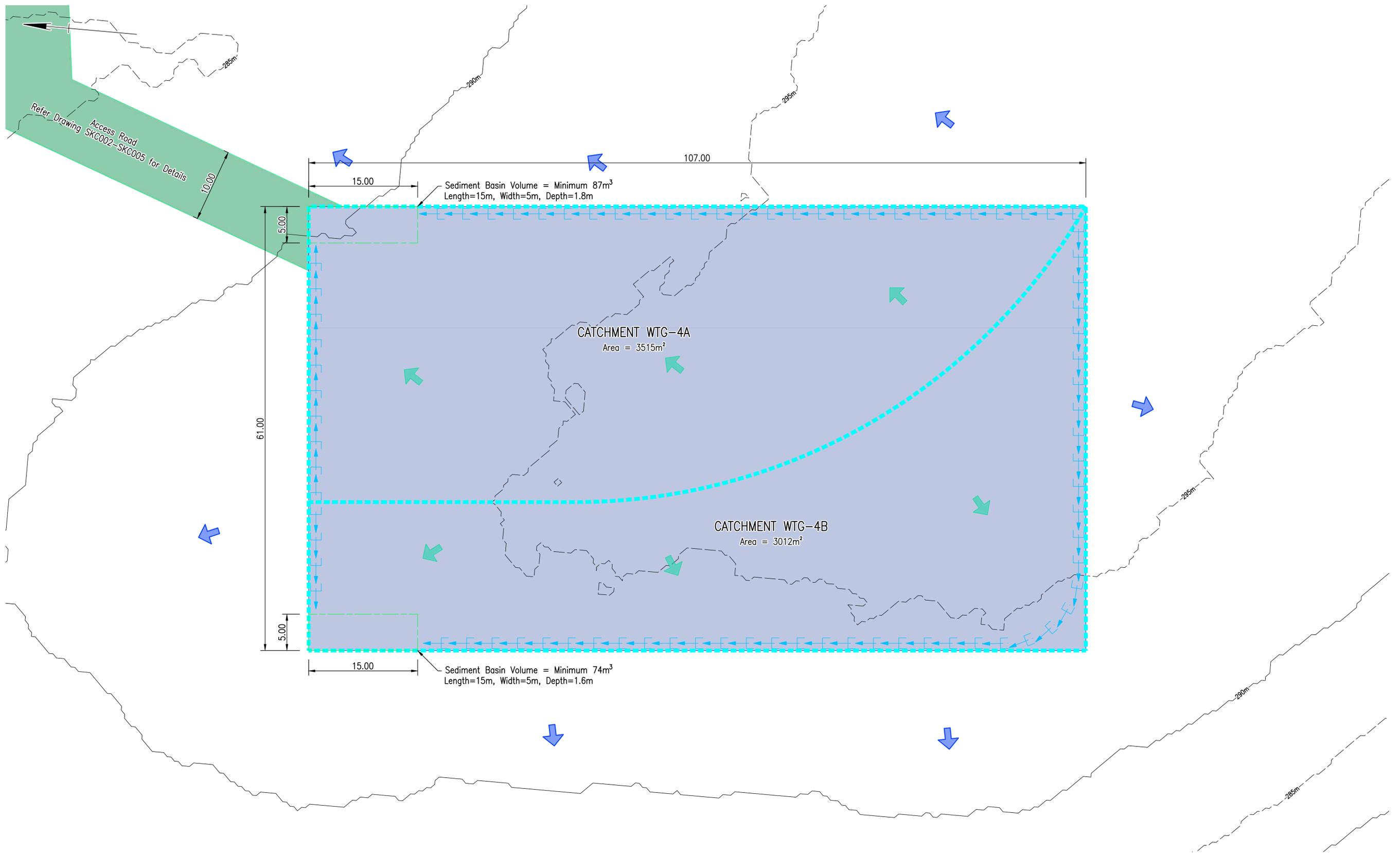
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-3 FOOTPRINT				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC013
Revision	A
Series Number	4 OF 10



WTG-4 PLAN
Scale 1:250m

Last Modified :- Dec 01, 2022 - 1:30pm

Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales	
Scale 1:250m	



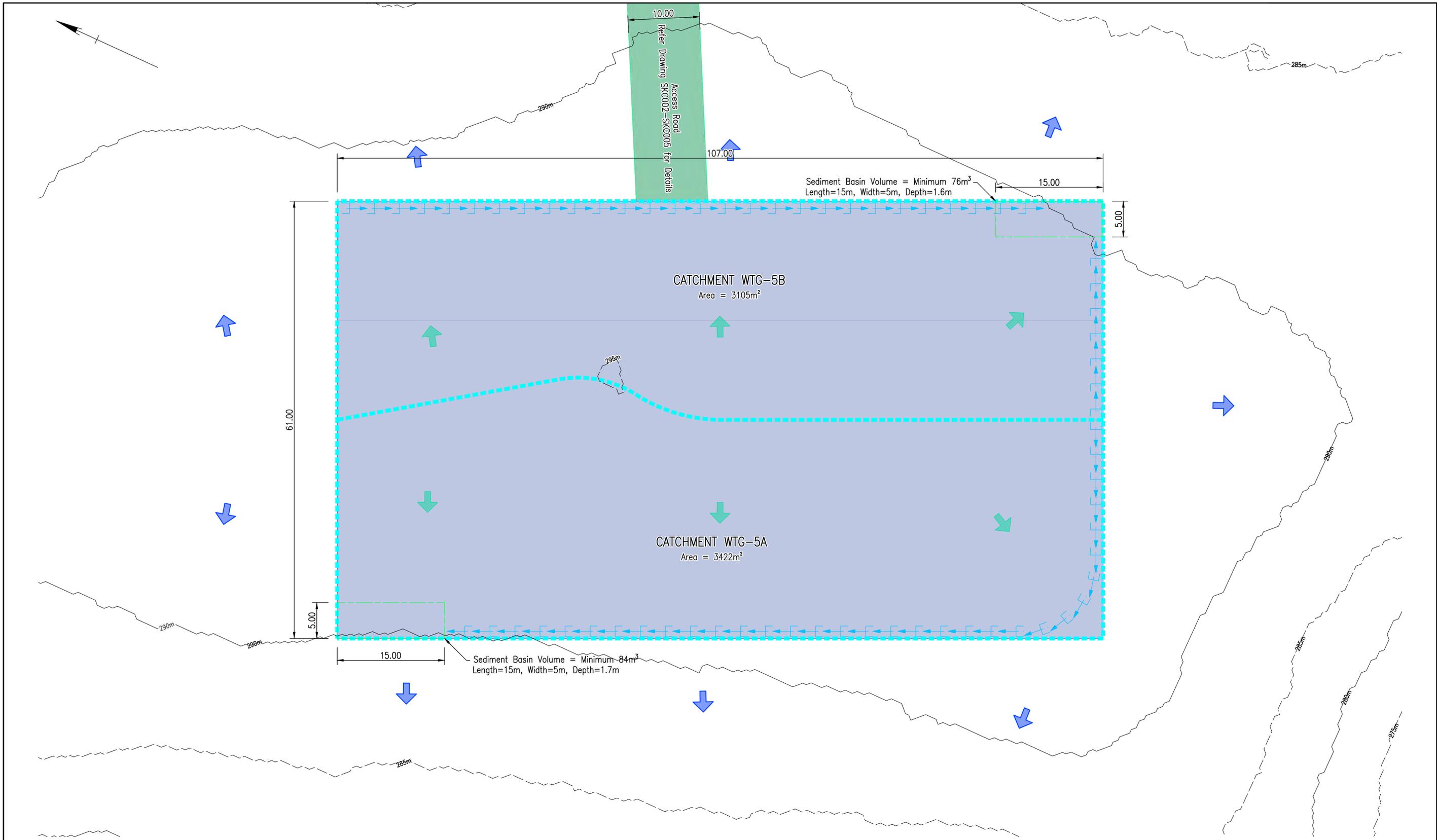
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Title		ENGINEERING CERTIFICATION (RPEQ)			
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-4 FOOTPRINT		ENG. AREA	NAME	SIGNATURE	NO.
Drawn	M.SMITH	DATE			
Designed	M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC014
Revision	A
Series Number	5 OF 10



WTG-5 PLAN
Scale 1:250m

Last Modified: 1: - Dec 01, 2022 - 1:30pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales

Scale 1:250m

Dimensions shown in metres
except where shown otherwise



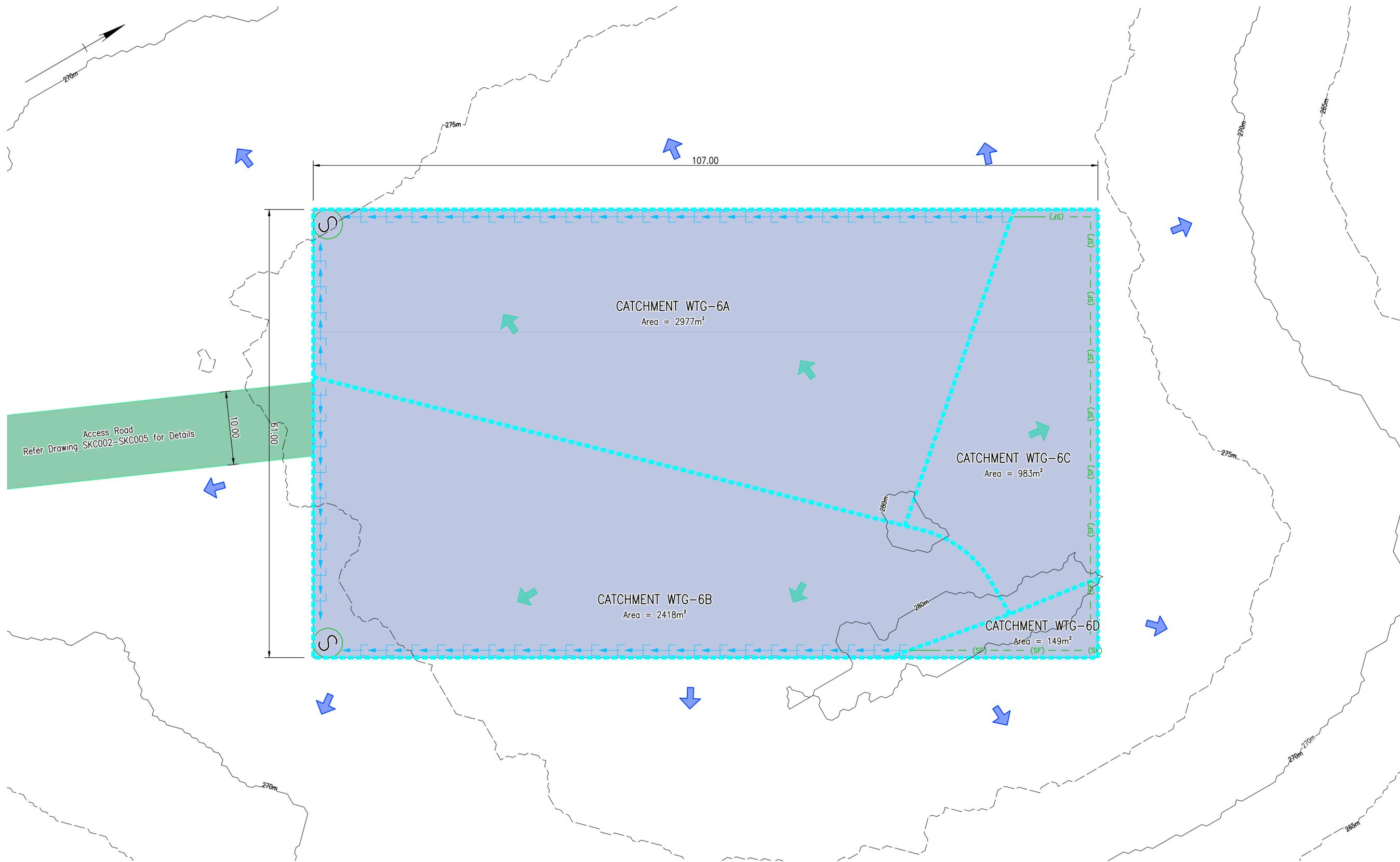
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Title		DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-5 FOOTPRINT			
Drawn	M.SMITH	ENGINEERING CERTIFICATION (RPEQ)			
Designed	M.HAUSFELD	ENG. AREA	NAME	SIGNATURE	NO. DATE

Job No.	WTS-002
Drawing No.	SKC015
Revision	A
Series Number	6 OF 10



WTG-6 PLAN
Scale 1:250m

Last Modified: 1: Dec 01, 2022 - 1:31pm

Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales

Scale 1:250m

Dimensions shown in metres except where shown otherwise



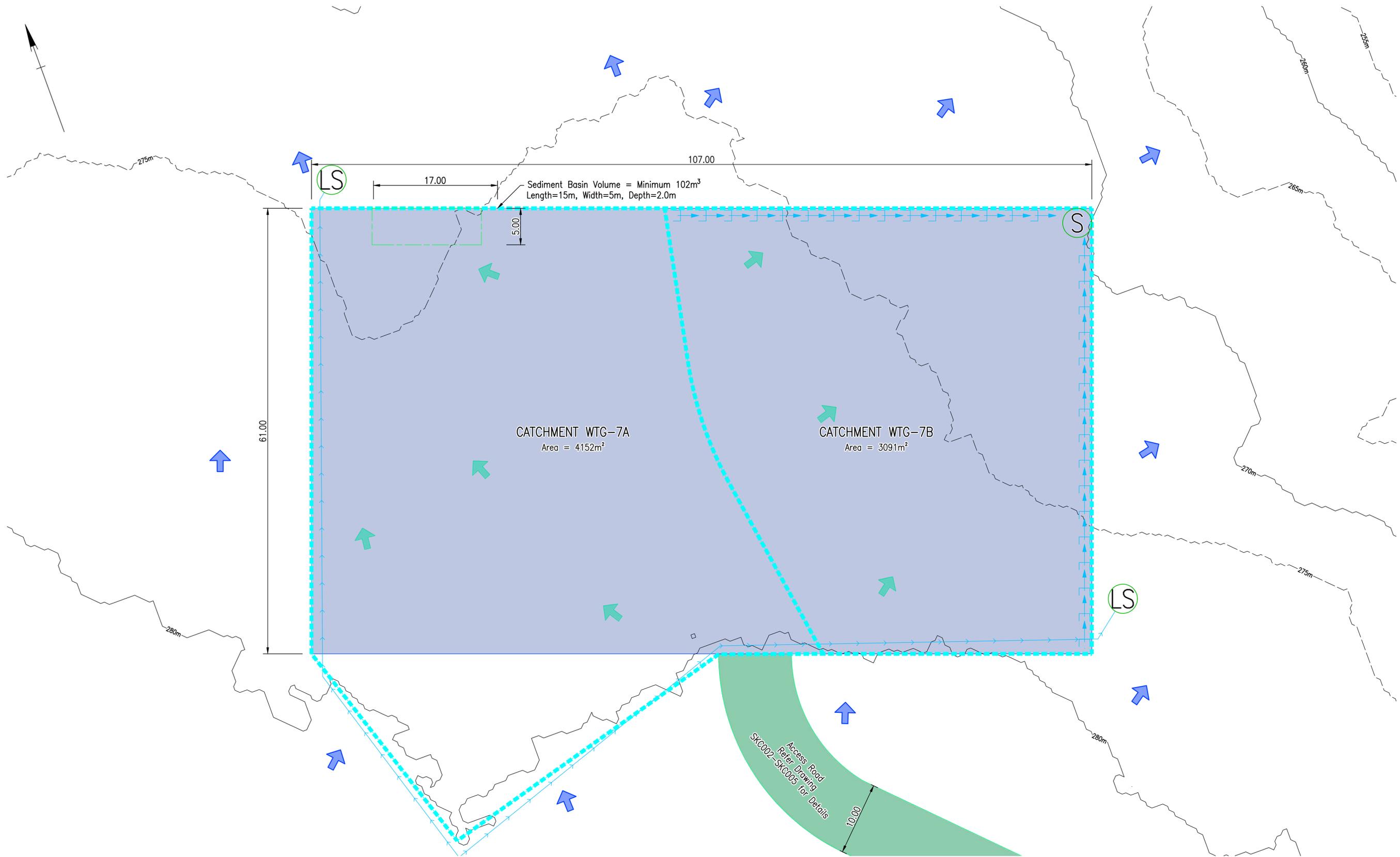
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-6 FOOTPRINT				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC016
Revision	A
Series Number	7 OF 10



WTG-7 PLAN
Scale 1:250m

Last Modified: 1: Dec 01, 2022 - 2:32pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales	
Scale 1:250m	



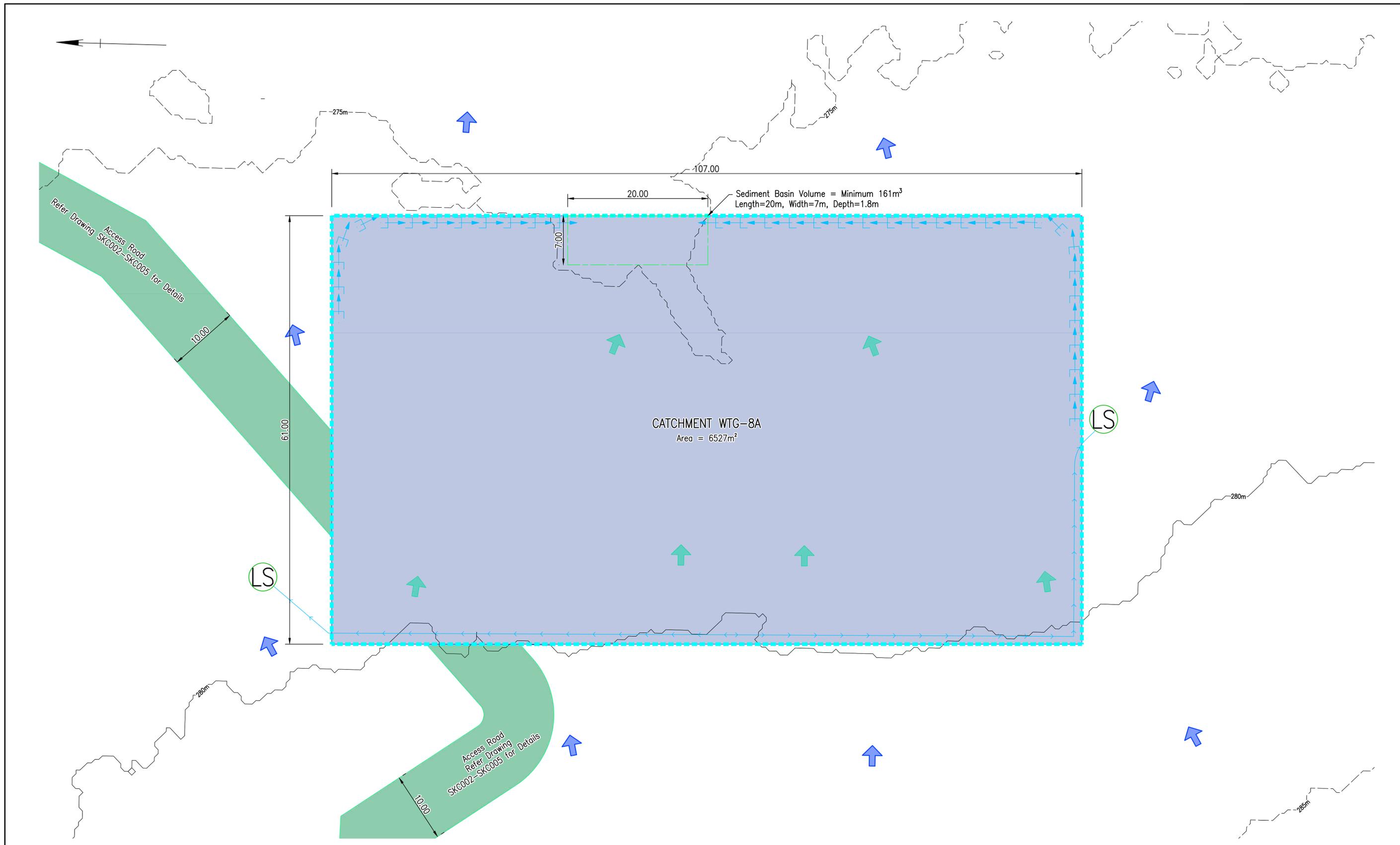
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Title		ENGINEERING CERTIFICATION (RPEQ)			
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-7 FOOTPRINT		ENG. AREA	NAME	SIGNATURE	NO.
Drawn	M.SMITH	DATE			
Designed	M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC017
Revision	A
Series Number	8 OF 10



WTG-8 PLAN
Scale 1:250m

Last Modified: 1: - Dec 01, 2022 - 1:32pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales	
Scale 1:250m	



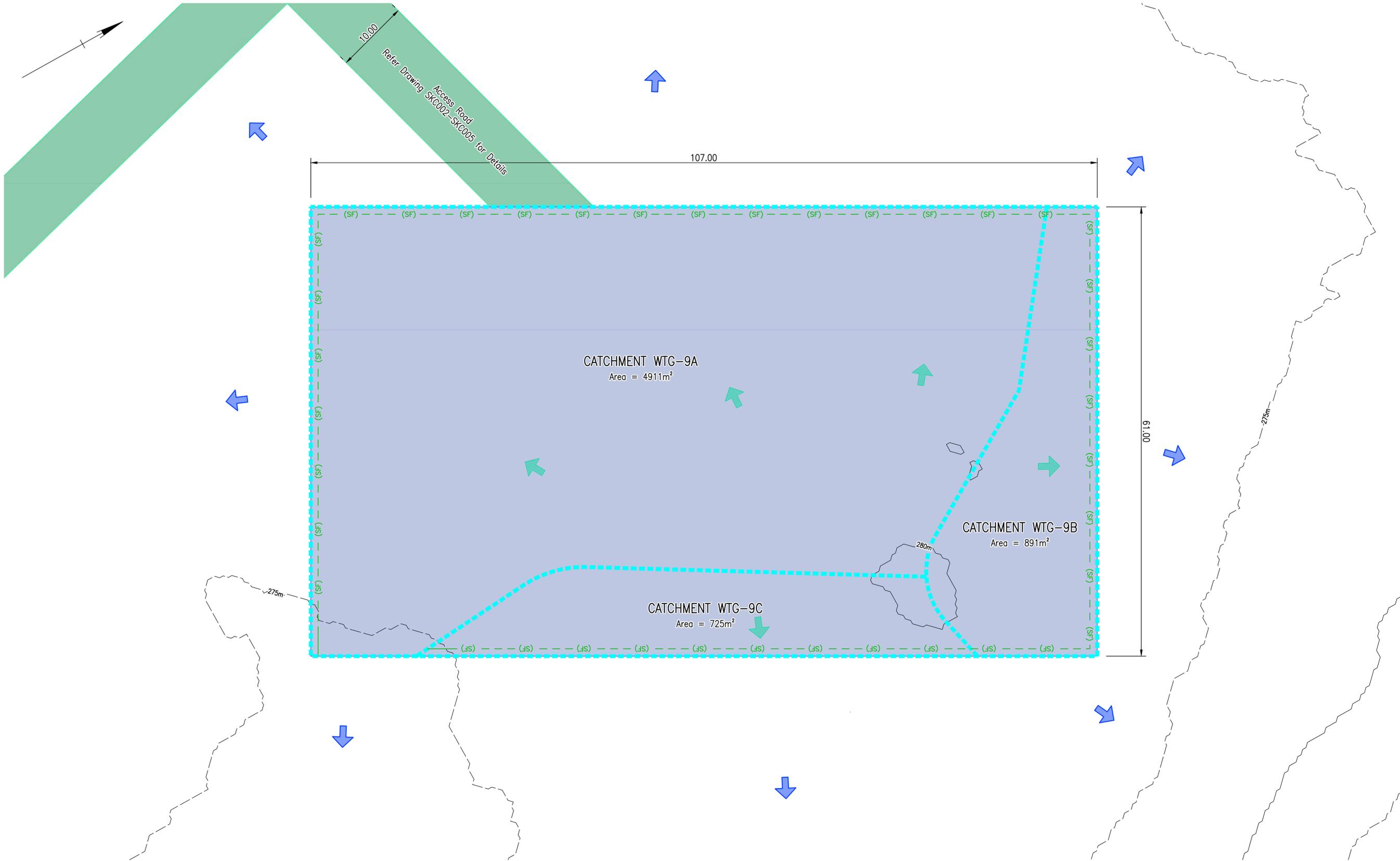
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-8 FOOTPRINT				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC018
Revision	A
Series Number	9 OF 10



WTG-9 PLAN
Scale 1:250m

Last Modified :- Dec 01, 2022 - 1:32pm

Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

Scales	
Scale 1:250m	



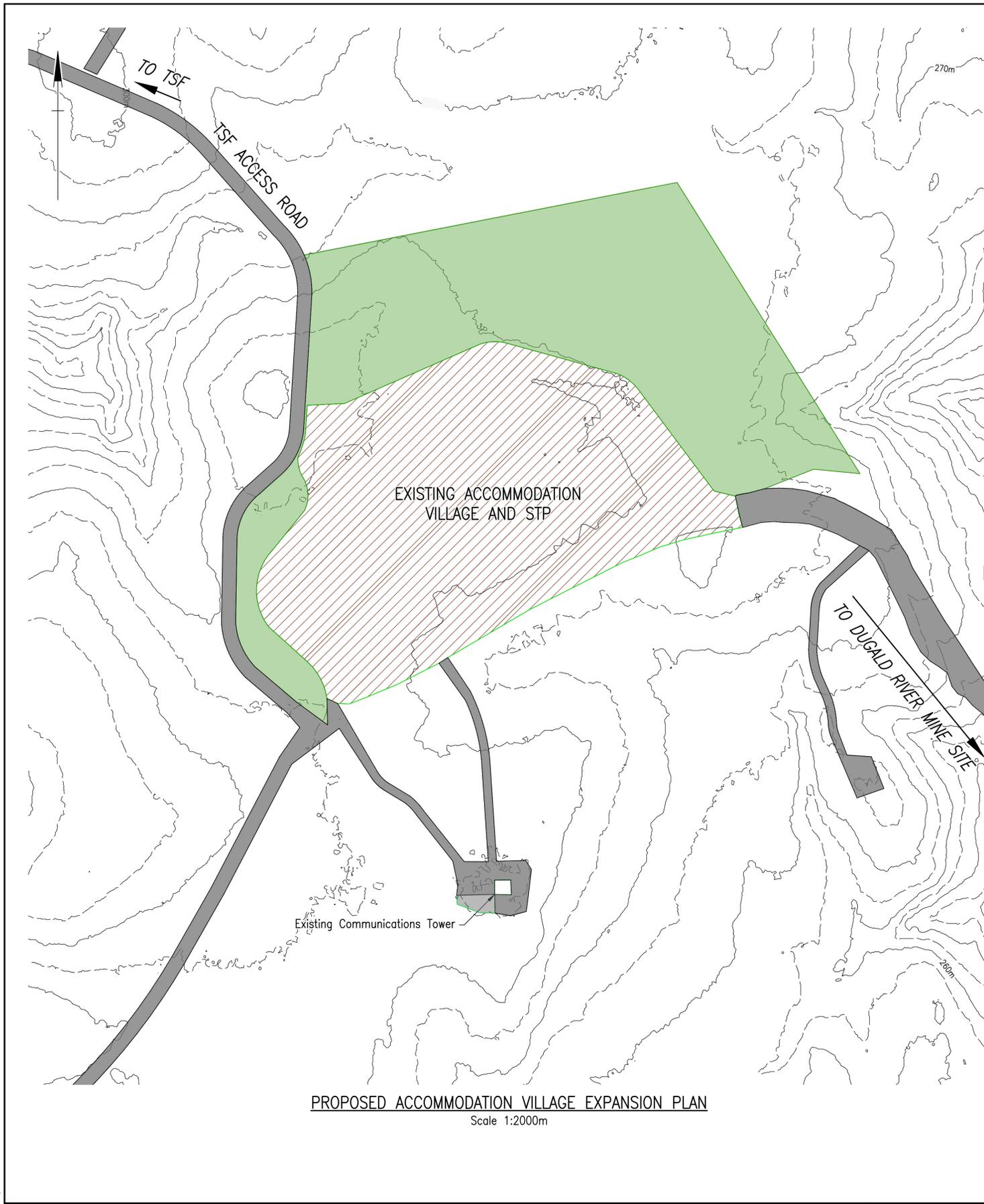
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Title		ENGINEERING CERTIFICATION (RPEQ)			
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL WTG-9 FOOTPRINT		ENG. AREA	NAME	SIGNATURE	NO.
		DATE			
Drawn	M.SMITH				
Designed	M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC019
Revision	A
Series Number	10 OF 10



FEATURES LEGEND:

- Existing Surface Contour
- Existing Roadways
- Existing Village Accommodation Area
- Proposed Village Expansion Area

EROSION CONTROL LEGEND:

- Proposed Sediment Fence
- Proposed Clean Water Diversion Channels (Direction Shown)
- Proposed Dirty Water Catchment Area
- Proposed Dirty Water Catchment Channel/Bunding (Direction Shown)
- Proposed Whoa boys and Turnouts
- Proposed Sediment Basin Extents
- Proposed Sediment Weir
- Proposed Level Spreader
- Existing Overland Flow (Clean)
- Existing Overland Flow (Dirty)

EROSION AND SEDIMENT CONTROL NOTES:

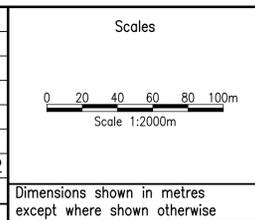
1. All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
2. Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
 - 2.1. Install Stabilised Site Access
 - 2.2. Construct Clean Water Diversion Channels and Level Spreaders where External Catchments Discharge to the Site
 - 2.3. Construct Dirty Water Channels/ Bunds
 - 2.4. Construct Sediment Basins and Sediment Weirs
 - 2.5. Install all Sediment Fencing
 - 2.6. Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - 2.7. Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - 2.8. Rehabilitate the Site
 - 2.9. Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent

This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
3. Works for Access Roads shall be Undertaken in the Following Sequence:
 - 3.1. Install Stabilised Site Access
 - 3.2. Install Cut Off Channels to Divert External Catchment Flows to all Low Points, Gullies and Watercourses
 - 3.3. Construct Rock Rip Rap Crossings at Low Points, Gullies and Watercourses
 - 3.4. Construct Whoa Boys and Associated Mitre Drains and Level Spreaders at Required Spacings
4. Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
5. The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
6. Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
7. Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
8. All Trees to be Retained Unless Approved for Removal by the Superintendent.
9. Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
10. All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
11. The Contractor Shall Maintain a Log Book Detailing:
 - 11.1. Records of All Rainfall
 - 11.2. Condition of Erosion and Sediment Control Measures
 - 11.3. Any Additional Remedial Works Required
12. The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.

PROPOSED ACCOMMODATION VILLAGE EXPANSION PLAN
Scale 1:2000m

Last Modified: 1: Dec 01, 2022 - 1:45pm

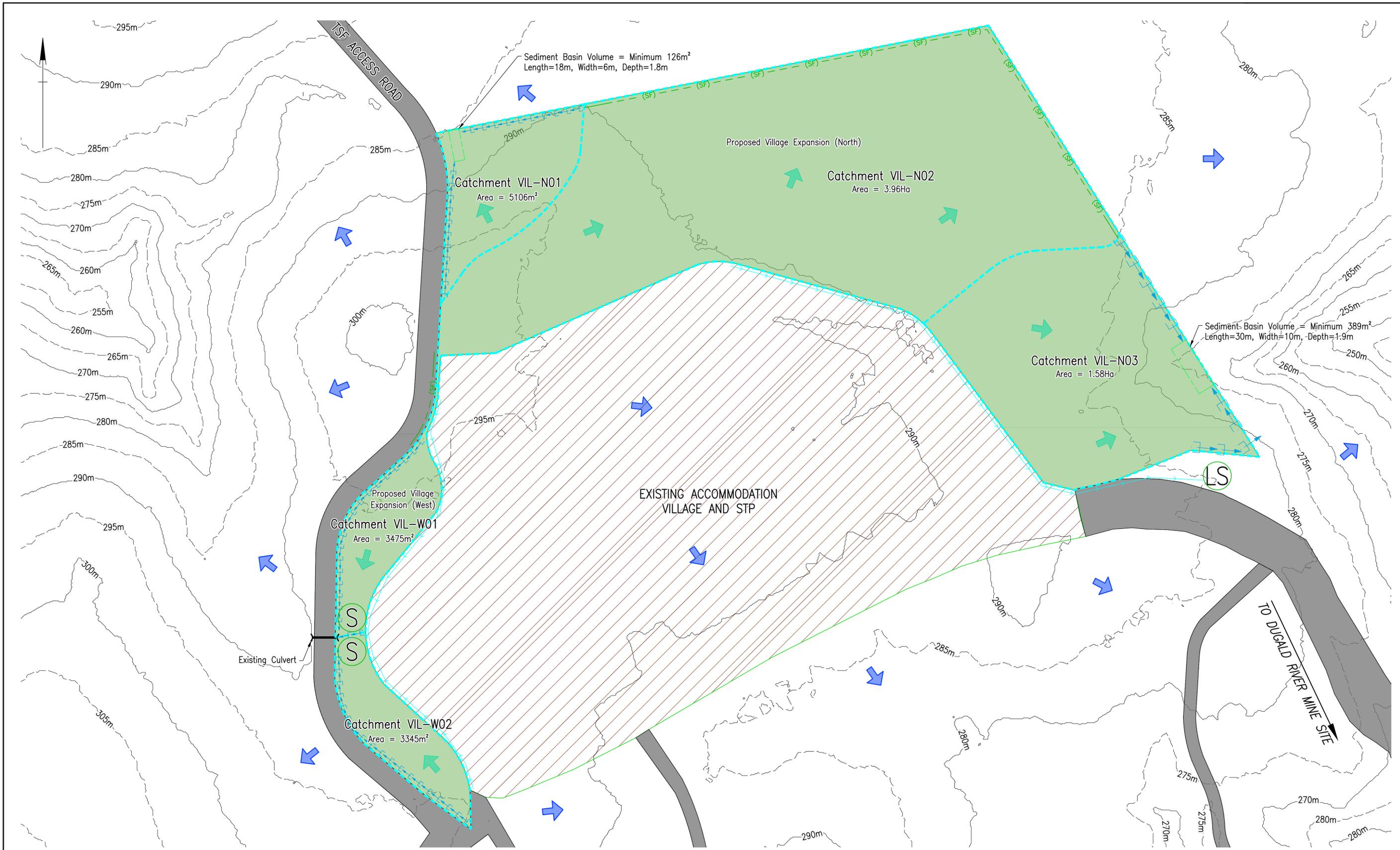
Rev	Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22



Client

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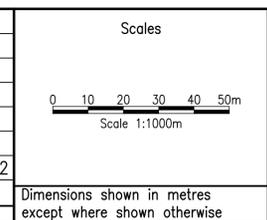
Title					Job No.	WTS-002
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL ACCOMMODATION VILLAGE EXPANSION OVERVIEW					Drawing No.	SKC020
					Revision	A
Drawn	ENGINEERING CERTIFICATION (RPEQ)				Series Number	1 OF 2
M.HAUSFELD	ENG. AREA	NAME	SIGNATURE	NO.		
Designed						
M.SMITH						



PROPOSED ACCOMMODATION VILLAGE EXPANSION PLAN
Scale 1:1000m

Last Modified :- Dec 01, 2022 - 2:30pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22



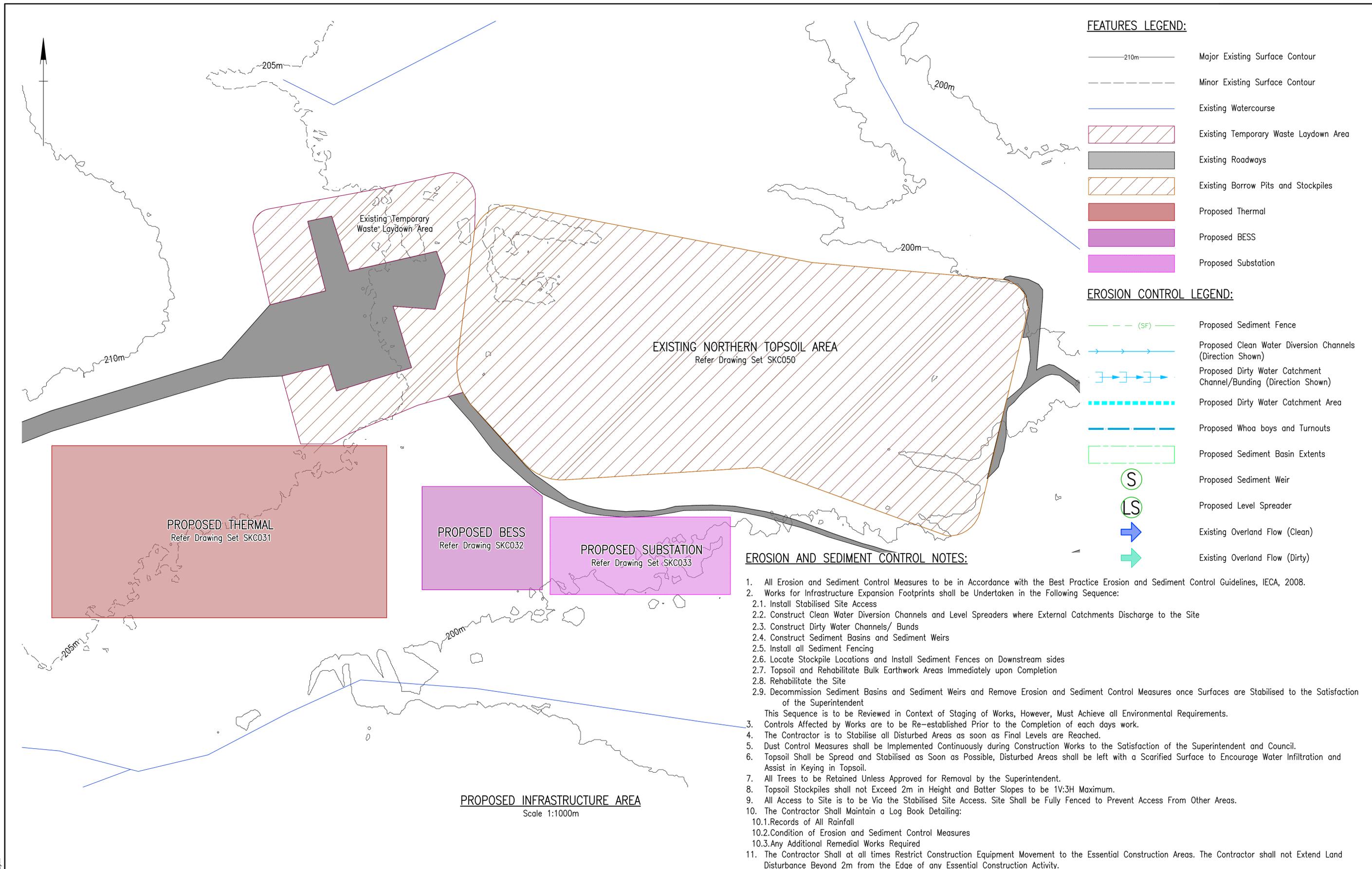
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Title		ENGINEERING CERTIFICATION (RPEQ)			
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL ACCOMMODATION VILLAGE EXPANSION DETAILS		ENG. AREA	NAME	SIGNATURE	NO.
					DATE
Drawn	M.SMITH				
Designed	M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC021
Revision	A
Series Number	2 OF 2



- FEATURES LEGEND:**
- 210m Major Existing Surface Contour
 - Minor Existing Surface Contour
 - Existing Watercourse
 - Existing Temporary Waste Laydown Area
 - Existing Roadways
 - Existing Borrow Pits and Stockpiles
 - Proposed Thermal
 - Proposed BESS
 - Proposed Substation

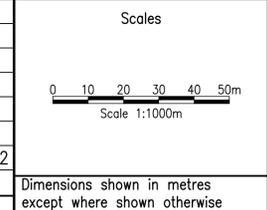
- EROSION CONTROL LEGEND:**
- Proposed Sediment Fence
 - Proposed Clean Water Diversion Channels (Direction Shown)
 - Proposed Dirty Water Catchment Channel/Bunding (Direction Shown)
 - Proposed Dirty Water Catchment Area
 - Proposed Whoa boys and Turnouts
 - Proposed Sediment Basin Extents
 - Proposed Sediment Weir
 - Proposed Level Spreader
 - Existing Overland Flow (Clean)
 - Existing Overland Flow (Dirty)

EROSION AND SEDIMENT CONTROL NOTES:

1. All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
2. Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
 - 2.1. Install Stabilised Site Access
 - 2.2. Construct Clean Water Diversion Channels and Level Spreaders where External Catchments Discharge to the Site
 - 2.3. Construct Dirty Water Channels/ Bunds
 - 2.4. Construct Sediment Basins and Sediment Weirs
 - 2.5. Install all Sediment Fencing
 - 2.6. Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - 2.7. Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - 2.8. Rehabilitate the Site
 - 2.9. Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent
3. This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
4. Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
5. The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
6. Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
7. Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
8. All Trees to be Retained Unless Approved for Removal by the Superintendent.
9. Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
10. All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
- 10.1. Records of All Rainfall
- 10.2. Condition of Erosion and Sediment Control Measures
- 10.3. Any Additional Remedial Works Required
11. The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.

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Rev	Revision Description	Certification	Date
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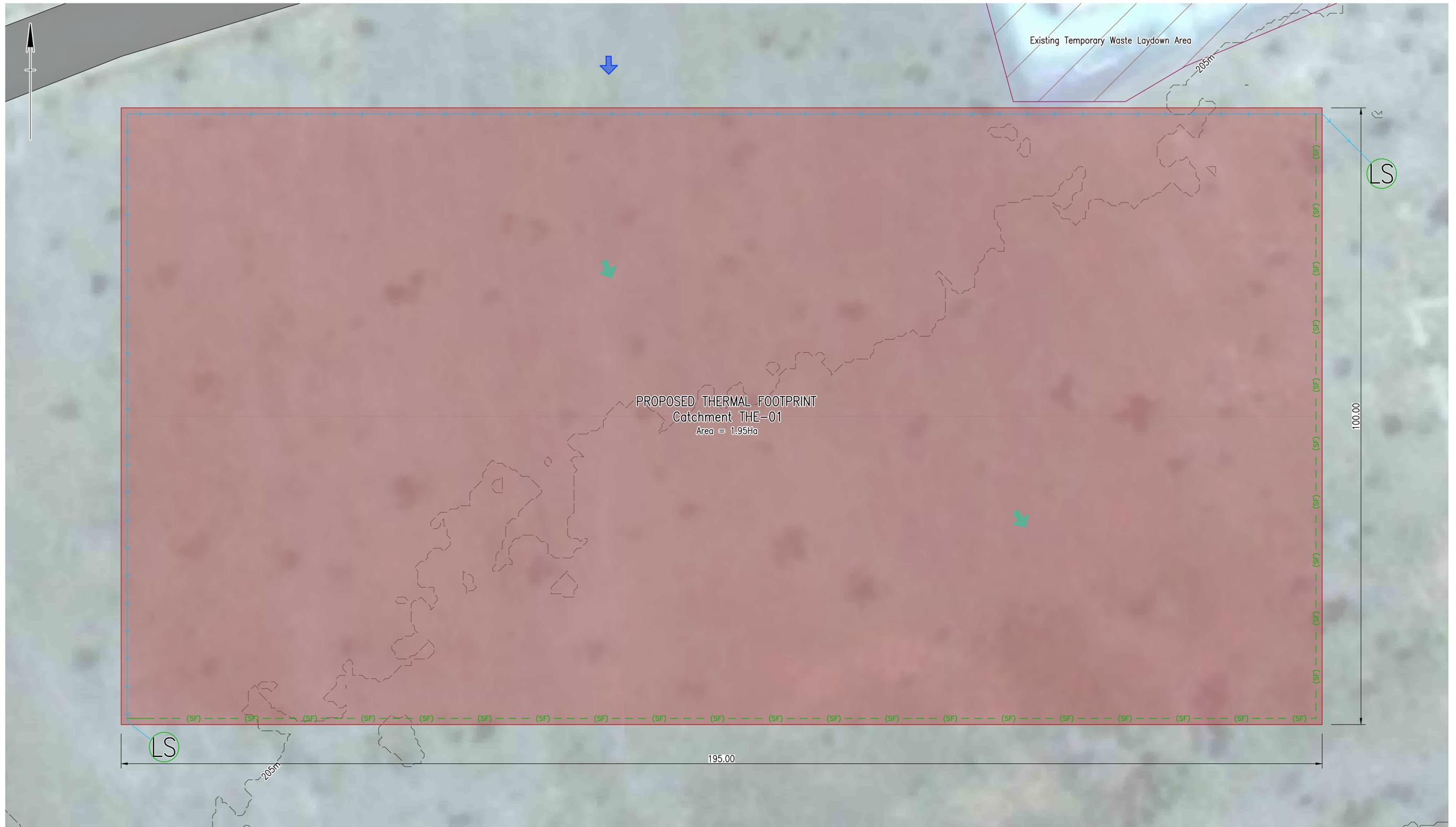
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL PROPOSED THERMAL, BESS AND SUBSTATION INFRASTRUCTURE				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed	M.HAUSFELD			

Job No.	WTS-002
Drawing No.	SKC030
Revision	A
Series Number	1 OF 3



PROPOSED WINDFARM THERMAL FOOTPRINT
Scale 1::300m

Last Modified :- Dec 01, 2022 - 1:34pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales
Scale 1:300m
Dimensions shown in metres except where shown otherwise



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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL PROPOSED THERMAL INFRASTRUCTURE				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

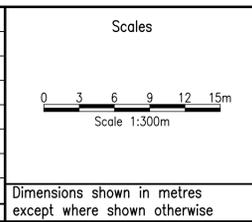
Job No.	WTS-002
Drawing No.	SKC031
Revision	A
Series Number	2 OF 3



PROPOSED BESS AND SUBSTATION FOOTPRINT
Scale 1:300m

Last Modified: 1: Dec 01, 2022 - 1:35pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date



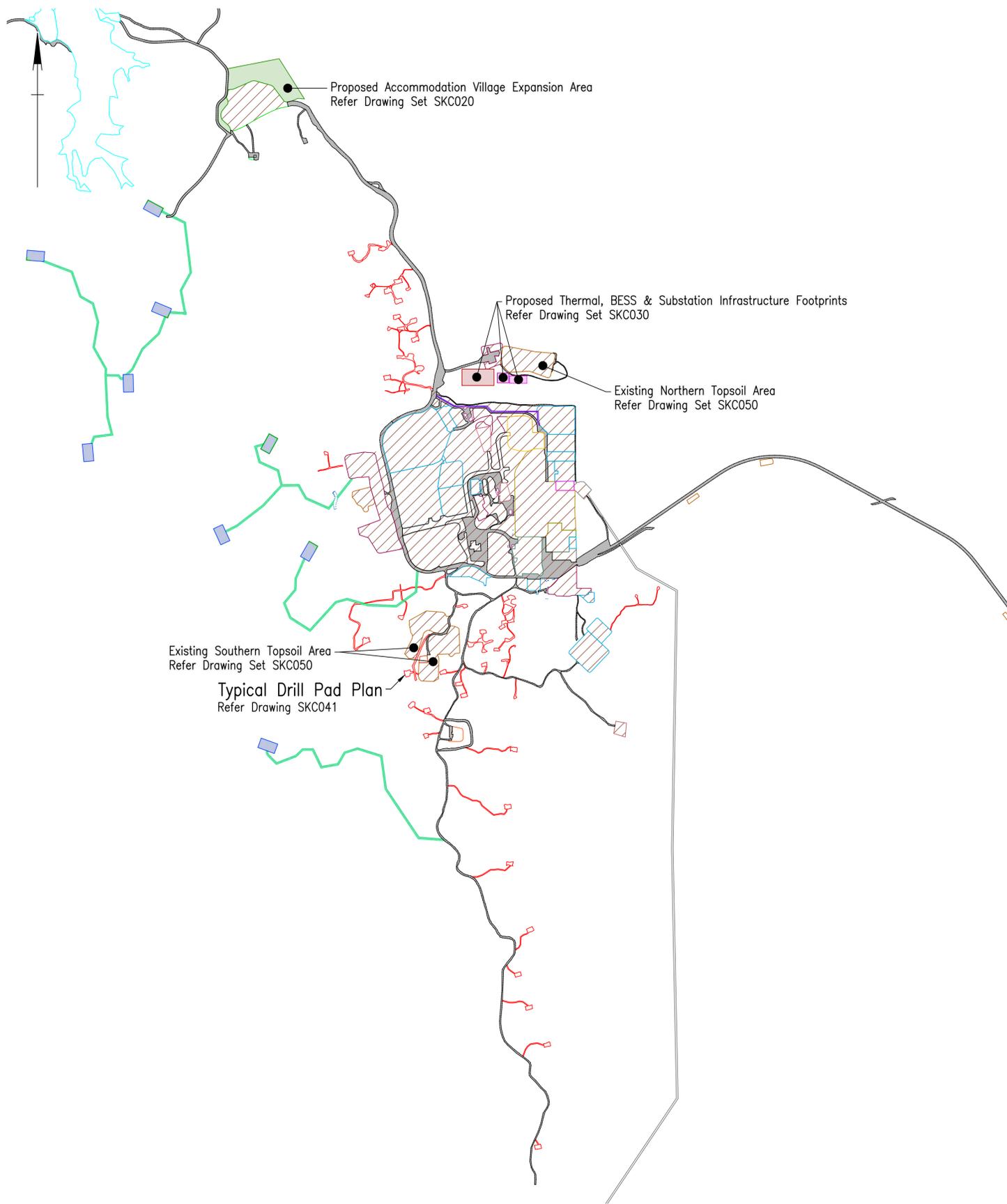
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DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL PROPOSED BESS/SUBSTATION INFRASTRUCTURE				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

Job No.	WTS-002
Drawing No.	SKC032
Revision	A
Series Number	3 OF 3



FEATURES LEGEND:

- 210m Major Existing Surface Contour
- Minor Existing Surface Contour
- Existing Mine Infrastructure
- Haulroads
- Existing Investigation Drill Pads and Tracks
- Existing Powerline Corridor
- Proposed Investigation Tracks
- Proposed Wind Turbine Hard Stand

EROSION CONTROL LEGEND:

- Proposed Sediment Fence
- Proposed Clean Water Diversion Channels (Direction Shown)
- Proposed Dirty Water Catchment Channel/Bunding (Direction Shown)
- Proposed Dirty Water Catchment Area
- Proposed Whoa boys and Turnouts
- Proposed Sediment Basin Extents
- Proposed Sediment Weir
- Proposed Level Spreader
- Existing Overland Flow (Clean)
- Existing Overland Flow (Dirty)

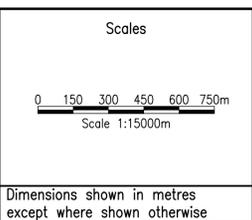
EROSION AND SEDIMENT CONTROL NOTES:

1. All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
2. Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
 - 2.1. Install Stabilised Site Access
 - 2.2. Construct Clean Water Diversion Channels and Level Spreaders where External Catchments Discharge to the Site
 - 2.3. Construct Dirty Water Channels/ Bunds
 - 2.4. Construct Sediment Basins and Sediment Weirs
 - 2.5. Install all Sediment Fencing
 - 2.6. Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - 2.7. Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - 2.8. Rehabilitate the Site
 - 2.9. Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent

This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
3. Works for Access Roads shall be Undertaken in the Following Sequence:
 - 3.1. Install Stabilised Site Access
 - 3.2. Install Cut Off Channels to Divert External Catchment Flows to all Low Points, Gullies and Watercourses
 - 3.3. Construct Rock Rip Rap Crossings at Low Points, Gullies and Watercourses
 - 3.4. Construct Woah Boys and Associated Mitre Drains and Level Spreaders at Required Spacings
4. Controls Affected by Works are to be Re-established Prior to the Completion of each days work.
5. The Contractor is to Stabilise all Disturbed Areas as soon as Final Levels are Reached.
6. Dust Control Measures shall be Implemented Continuously during Construction Works to the Satisfaction of the Superintendent and Council.
7. Topsoil Shall be Spread and Stabilised as Soon as Possible, Disturbed Areas shall be left with a Scarified Surface to Encourage Water Infiltration and Assist in Keying in Topsoil.
8. All Trees to be Retained Unless Approved for Removal by the Superintendent.
9. Topsoil Stockpiles shall not Exceed 2m in Height and Batter Slopes to be 1V:3H Maximum.
10. All Access to Site is to be Via the Stabilised Site Access. Site Shall be Fully Fenced to Prevent Access From Other Areas.
11. The Contractor Shall Maintain a Log Book Detailing:
 - 11.1. Records of All Rainfall
 - 11.2. Condition of Erosion and Sediment Control Measures
 - 11.3. Any Additional Remedial Works Required
12. The Contractor Shall at all times Restrict Construction Equipment Movement to the Essential Construction Areas. The Contractor shall not Extend Land Disturbance Beyond 2m from the Edge of any Essential Construction Activity.

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Title					Job No.	WTS-002
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL INVESTIGATION DRILL PAD AND TRACKS LOCATION KEY PLAN					Drawing No.	SKC040
Drawn	ENGINEERING CERTIFICATION (RPEQ)				Revision	A
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO.	DATE	
Designed					Series Number	1 OF 3
M.HAUSFELD						



EXISTING INVESTIGATION DRILL PAD AND TRACKS FOOTPRINT
Scale 1:250m

Last Modified: 1- Dec 01, 2022 - 1:35pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date

Scales	
Scale 1:250m	
Dimensions shown in metres except where shown otherwise	



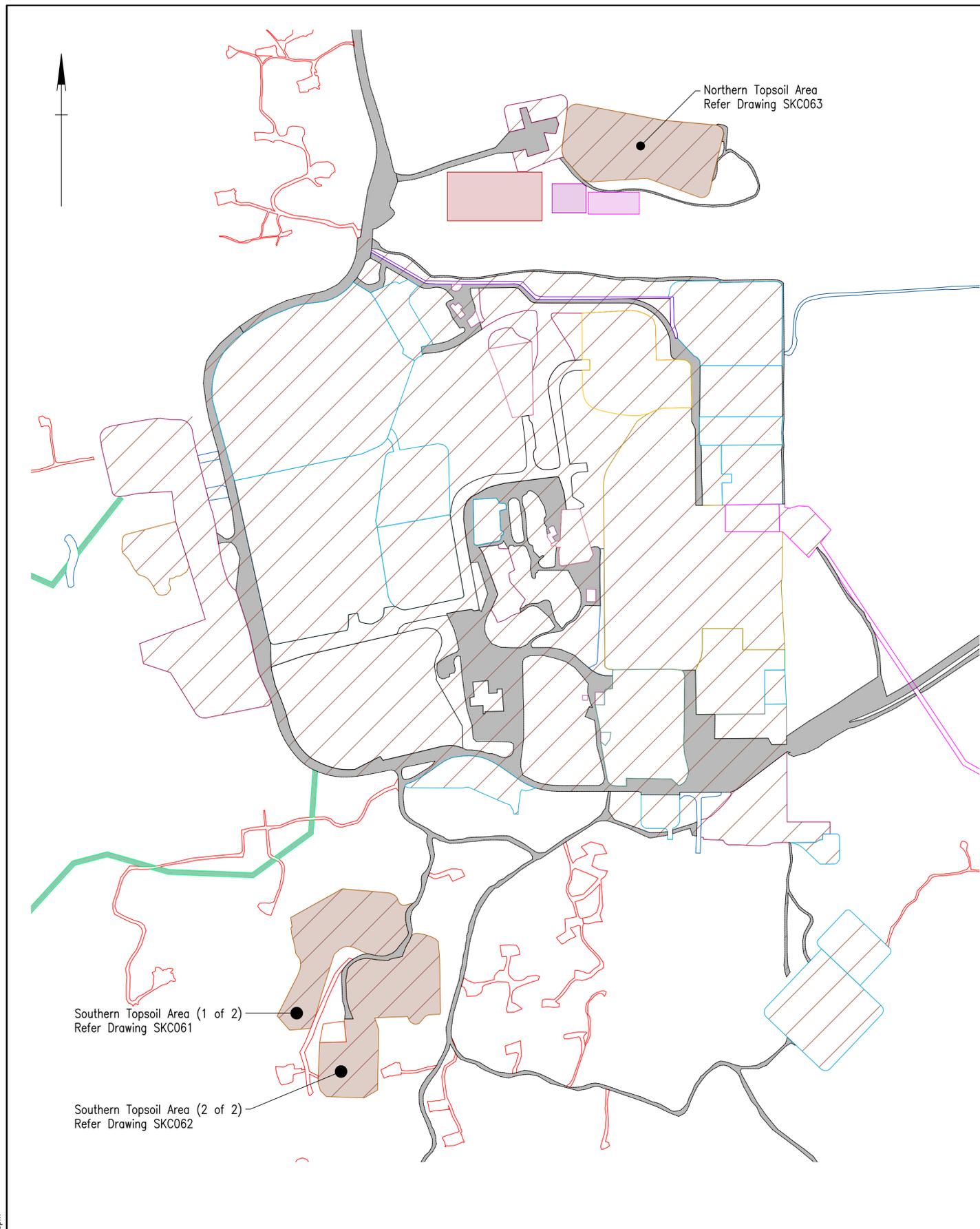
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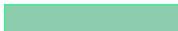
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL TYPICAL EXISTING INVESTIGATION DRILL PAD AND TRACKS				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

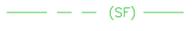
Job No.	WTS-002
Drawing No.	SKC041
Revision	A
Series Number	2 OF 3



FEATURES LEGEND:

-  Existing Roadways
-  Existing Mine Infrastructure
-  Existing Topsoil Area
-  Existing Drill Pads
-  Existing Powerline Corridor
-  Proposed Investigation Tracks (Drawing Set SKC000)
-  Thermal Location (Drawing Set SKC040)
-  Bess Location (Drawing Set SKC040)
-  Substation Location (Drawing Set SKC040)

EROSION CONTROL DEVICES LEGEND:

-  Proposed Sediment Fence
-  Proposed Clean Water Diversion Channels (Direction Shown)
-  Proposed Dirty Water Catchment Channel/Bunding (Direction Shown)
-  Proposed Dirty Water Catchment Area
-  Proposed Whoa boys and Turnouts
-  Proposed Sediment Basin Extents
-  Proposed Sediment Weir
-  Proposed Level Spreader
-  Existing Overland Flow (Clean)
-  Existing Overland Flow (Dirty)

EROSION AND SEDIMENT CONTROL NOTES:

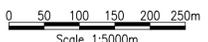
1. All Erosion and Sediment Control Measures to be in Accordance with the Best Practice Erosion and Sediment Control Guidelines, IECA, 2008.
2. Works for Infrastructure Expansion Footprints shall be Undertaken in the Following Sequence:
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 - 2.5. Install all Sediment Fencing
 - 2.6. Locate Stockpile Locations and Install Sediment Fences on Downstream sides
 - 2.7. Topsoil and Rehabilitate Bulk Earthwork Areas Immediately upon Completion
 - 2.8. Rehabilitate the Site
 - 2.9. Decommission Sediment Basins and Sediment Weirs and Remove Erosion and Sediment Control Measures once Surfaces are Stabilised to the Satisfaction of the Superintendent

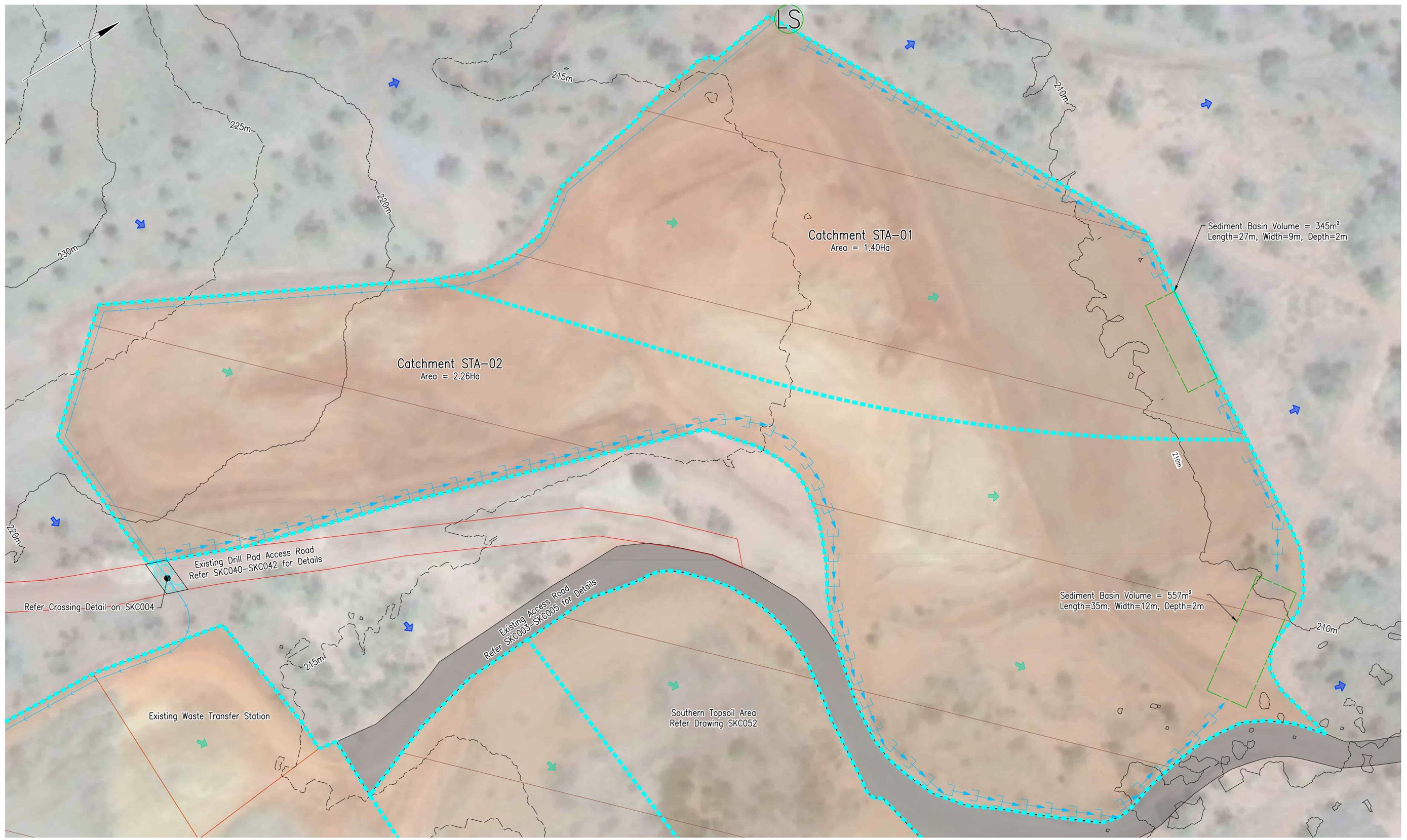
This Sequence is to be Reviewed in Context of Staging of Works, However, Must Achieve all Environmental Requirements.
3. Works for Access Roads shall be Undertaken in the Following Sequence:
 - 3.1. Install Stabilised Site Access
 - 3.2. Install Cut Off Channels to Divert External Catchment Flows to all Low Points, Gullies and Watercourses
 - 3.3. Construct Rock Rip Rap Crossings at Low Points, Gullies and Watercourses
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Southern Topsoil Area (1 of 2)
Refer Drawing SKC061

Southern Topsoil Area (2 of 2)
Refer Drawing SKC062

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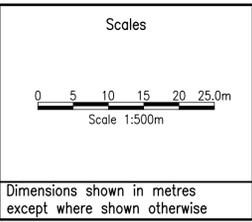
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		 Scale 1:5000m				DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL TOPSOIL AREAS KEY PLAN				Drawing No.	SKC050	
A		DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22	Drawn M.SMITH				ENGINEERING CERTIFICATION (RPEQ)			
Rev		Revision Description	Certification	Date	ENG. AREA M.HAUSFELD		NAME	SIGNATURE	NO.	DATE	Revision	A
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SOUTHERN TOPSOIL AREA PLAN
Scale 1:500m

Last Modified: 1: Dec 01, 2022 - 1:37pm

Rev	Revision Description	Certification	Date
A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22

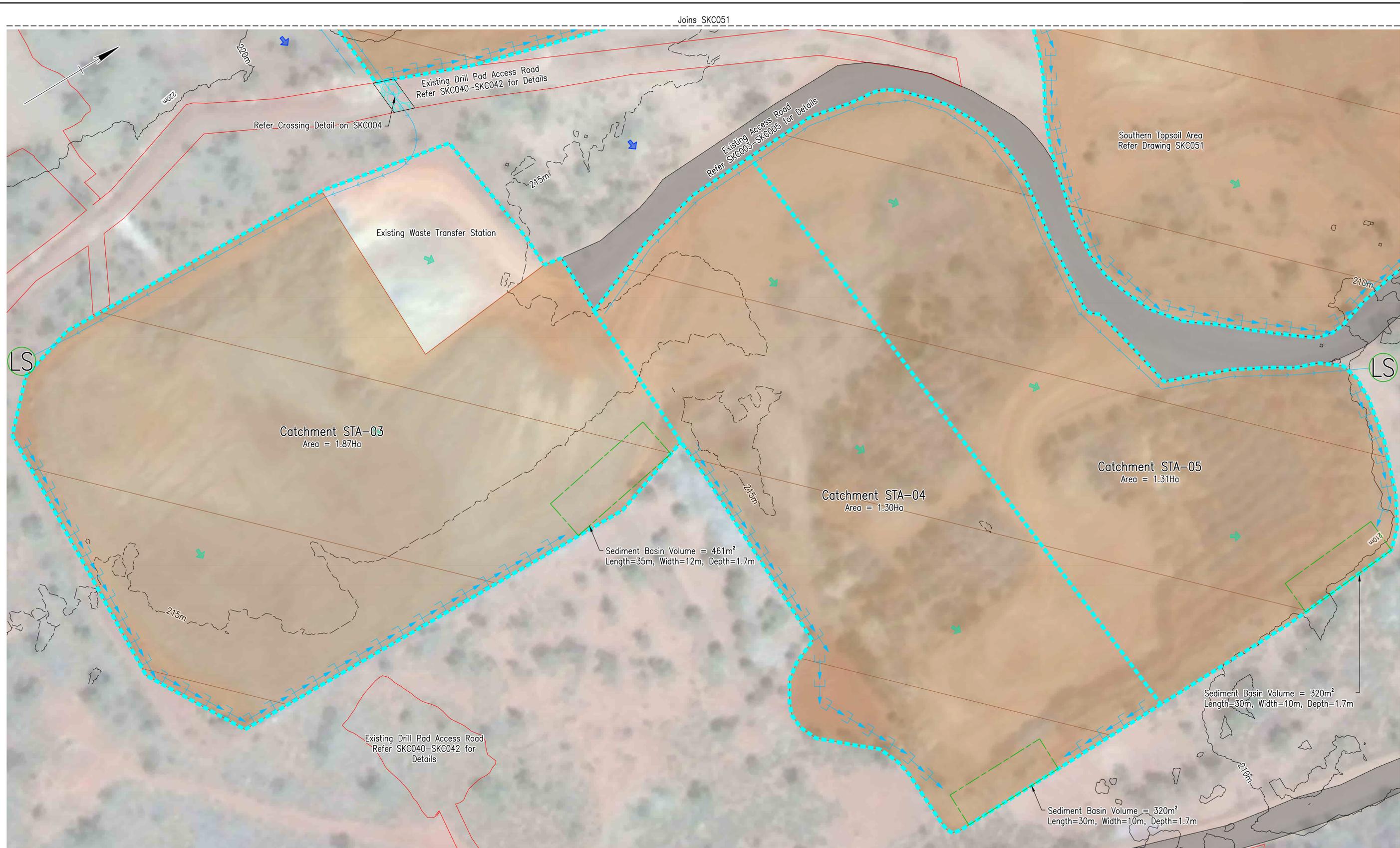


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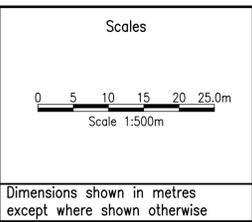
Title					Job No.	
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL SOUTHERN TOPSOIL AREA SHEET 1 OF 2					WTS-002	
					Drawing No.	
ENGINEERING CERTIFICATION (RPEQ)					Revision	
Drawn	ENG. AREA	NAME	SIGNATURE	NO.	DATE	A
M.SMITH						
Designed	Series Number					2 OF 4
M.HAUSFELD						



SOUTHERN TOPSOIL AREA PLAN
Scale 1:500m

Last Modified: 1- Dec 01, 2022 - 1:38pm

A	DRAFT FOR CLIENT REVIEW	M.HAUSFELD	01/12/22
Rev	Revision Description	Certification	Date



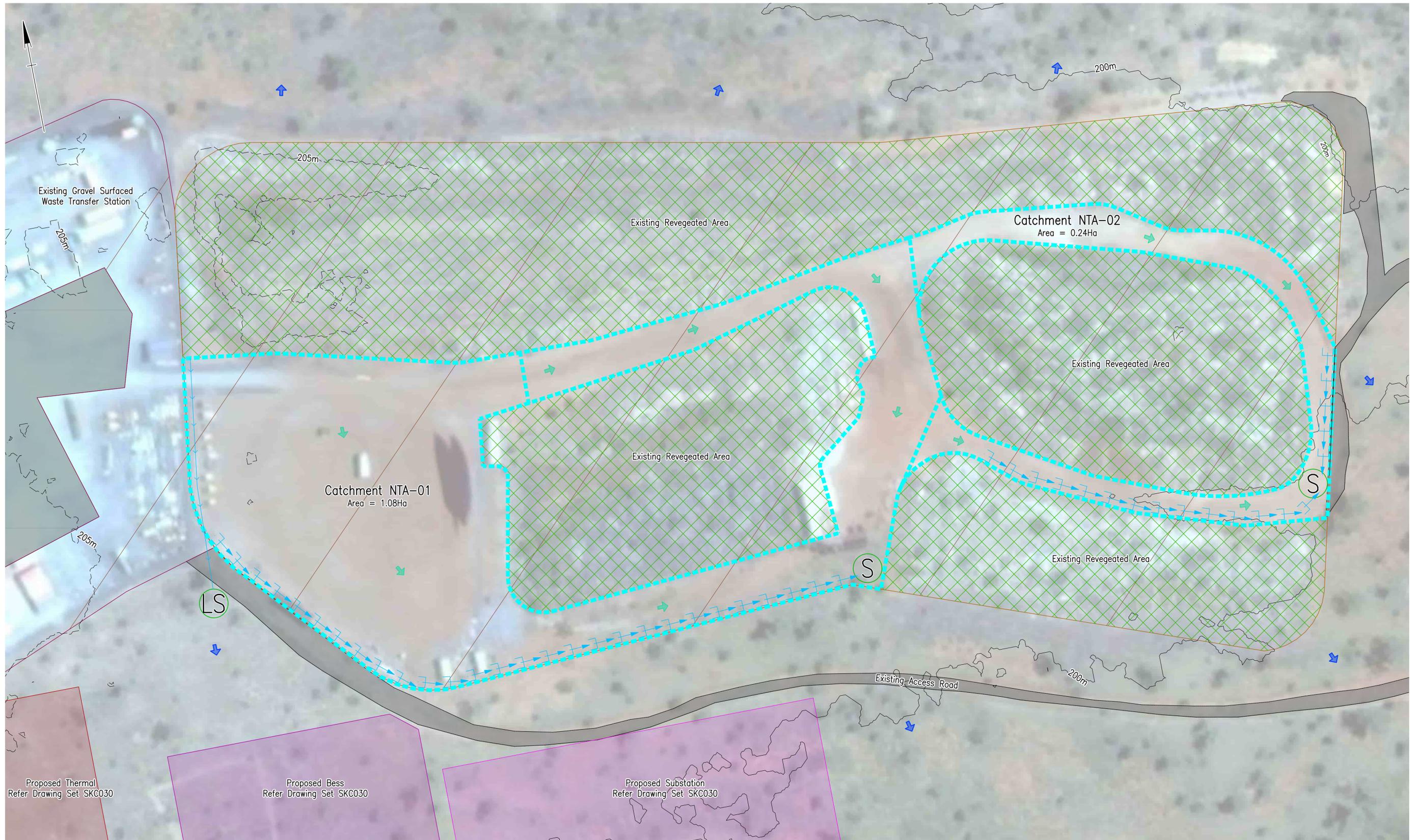
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Title				
DUGALD RIVER MINE EROSION AND SEDIMENT CONTROL SOUTHERN TOPSOIL AREA SHEET 2 OF 2				
Drawn	ENGINEERING CERTIFICATION (RPEQ)			
M.SMITH	ENG. AREA	NAME	SIGNATURE	NO. DATE
Designed				
M.HAUSFELD				

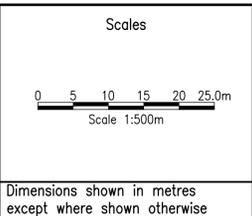
Job No.	WTS-002
Drawing No.	SKC052
Revision	A
Series Number	3 OF 4



BORROW PIT AND STOCKPILE B PLAN
Scale 1:500m

Last Modified :- Dec 01, 2022 - 1:38pm

Rev	Revision Description	Certification	Date
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M.SMITH					
Designed					
M.HAUSFELD					

Job No.	WTS-002
Drawing No.	SKC053
Revision	A
Series Number	4 OF 4

Appendix F– ESCP Calculations



Rainfall Factor

Determined from E3.2 in IECA guidelines

$$R = 164.74 \times 1.1177^S \times S^{0.6444}$$

S = 2 year 6 hour storm

S = 11

R = 2624.422

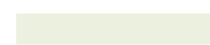
R
P (default)
C (default)

2624.42	RUSLE = K x R x P x C x LS
1.3	
1.00	

From Table 3.1 - Soil Loss Classes (IECA 2008)

Soil Loss Class	Soil Loss Rate	Erosion Risk
	(t/ha/yr)	
1	0 to 150	Very Low
2	151 to 225	Low
3 to 4	226 to 500	Moderate
5 to 6	501 to 1500	High
7	above 1500	Extremely High

Catchment ID	Catchment Size	Slope	Length	K Factor	Ls	C Factor	Soil Loss Rate	Soil Erosion Hazard	Soil Loss Class
	Area (ha)						%		
WTG-1A	0.22	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-1B	0.21	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-1C	0.14	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-2A	0.40	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-2B	0.16	1	80.0	0.030	0.19	1.00	19	Very Low	1
WTG-3A	0.33	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-3B	0.25	20	40.0	0.030	4.32	1.00	442	Moderate	3 to 4
WTG-4A	0.35	17	30.0	0.030	2.67	1.00	273	Moderate	3 to 4
WTG-4B	0.30	17	30.0	0.030	2.67	1.00	273	Moderate	3 to 4
WTG-5A	0.34	12	60.0	0.030	3.02	1.00	309	Moderate	3 to 4
WTG-5B	0.31	12	60.0	0.030	3.02	1.00	309	Moderate	3 to 4
WTG-6A	0.30	5	80.0	0.030	1.19	1.00	122	Very Low	1
WTG-6B	0.24	5	80.0	0.030	1.19	1.00	122	Very Low	1
WTG-7A	0.42	10	60.0	0.030	2.31	1.00	236	Moderate	3 to 4
WTG-7B	0.31	7	60.0	0.030	1.24	1.00	127	Very Low	1
WTG-8A	0.65	8	60.0	0.030	1.70	1.00	174	Low	2
WTG-9A	0.49	1	80.0	0.030	0.19	1.00	19	Very Low	1
VIL-W01	0.35	5	80.0	0.030	1.19	1.00	122	Very Low	1
VIL-W02	0.33	5	80.0	0.030	1.19	1.00	122	Very Low	1
VIL-N01	0.51	15	80.0	0.030	4.61	1.00	472	Moderate	3 to 4
VIL-N02	3.96	2.5	80.0	0.030	0.65	1.00	67	Very Low	1
VIL-N03	1.58	15	80.0	0.030	4.61	1.00	472	Moderate	3 to 4
THE-01	1.95	1	80.0	0.045	0.19	1.00	29	Very Low	1
BESS-01	0.42	1	80.0	0.045	0.19	1.00	29	Very Low	1
SS-01	0.47	1	80.0	0.045	0.19	1.00	29	Very Low	1
STA-01	1.40	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-02	2.26	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-03	1.87	3.5	80.0	0.045	0.91	1.00	140	Very Low	1
STA-04	1.30	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
STA-05	1.31	2.5	80.0	0.045	0.65	1.00	100	Very Low	1
NTA-01	1.08	1.5	80.0	0.045	0.41	1.00	63	Very Low	1
NTA-02	0.24	1.5	80.0	0.045	0.41	1.00	63	Very Low	1



From Table 4.4.7 (IECA 2008) - Best practice land clearing and rehabilitation requirements

Erosion Risk Rating	Soil Loss Rate (t/ha/yr)	Advanced land clearing allowed (wks work)	Max No. Of Days for stabilisation	Minimum Cover (%)	Stage constructoin of Batters > 6H to 1V	Stabilisation of stockpiles
Very Low	0 to 150	8	30	60		
Low	151 to 225	8	30	70		
Moderate	226 to 500	6	20	70	Yes	
High	501 to 1500	4	10	75	Yes	Yes
Very High	above 1500	2	5	80	Yes	Yes

All cases - All practical steps must be taken to apply Erosion and Sedimentation Controls and stabilise works prior to anticipated rainfall

From Table B1 Appendix B (IECA 2018) - Sediment control standard (default) based on soil loss rate

Area Limit (m ²)	Soil Loss Rate (t/ha/yr)			Soil Loss Rate (t/ha/month)		
	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
250	N/A	N/A	All	N/A	N/A	All
1000	N/A	N/A	All	N/A	N/A	All
2500	N/A	>75	75	N/A	>6.25	6.25
>2500	>150	150	75	>12.5	12.5	6.25
>10000	>75	N/A	75	>6.25	N/A	6.25

From Table 4.5.2 (IECA 2008) - Sediment control based on erosivity and rainfall

Area Limit (m ²)	Soil Loss Rate (t/ha/yr)			Soil Loss Rate (t/ha/month)		
	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
250	N/A	N/A	All	N/A	N/A	All
1000	N/A	N/A	All	N/A	N/A	All
2500	N/A	>60	60	N/A	>30	30
>2500	>100	100	60	>45	45	30

1. Sediment Basins

Site Name: Dugald Mine Site Expansion

Site Location: Cloncurry, QLD

Precinct/Stage: WTG Areas

Date: 29/11/2022

Other Details: SHEET 1

Site area	Sub-catchment or Name of Structure						
	WTG-2A	WTG-3A	WTG-4A	WTG-4B	WTG-5A	WTG-5B	WTG-7A
Total catchment area (ha)	0.40	0.33	0.35	0.30	0.34	0.31	0.42
Disturbed catchment area (ha)	0.4	0.3	0.4	0.3	0.3	0.3	0.4

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D	D	D	D	D	D	D
% sand (fraction 0.02 to 2.00 mm)							
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							
% of whole soil dispersible	0	0	0	0	0	0	0
Soil Texture Group	D	D	D	D	D	D	D

Rainfall data

Design rainfall depth (no of days)	5	5	5	5	5	5	5
Design rainfall depth (percentile)	80	80	80	80	80	80	80
x-day, y-percentile rainfall event (mm)	23.8	23.8	23.8	23.8	23.8	23.8	23.8
Rainfall R-factor (if known)	2624	2624	2624	2624	2624	2624	2624
IFD: 2-year, 6-hour storm (if known)	11	11	11	11	11	11	11

RUSLE Factors

Rainfall erosivity (R-factor)	2624	2624	2624	2624	2624	2624	2624
Soil erodibility (K-factor)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Slope length (m)	20	20	30	30	60	60	60
Slope gradient (%)	20.0	20.0	17.0	17.0	12.0	12.0	10.0
Length/gradient (LS-factor)	2.6	2.6	2.7	2.7	3.0	3.0	2.3
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Ground cover (C-factor)	1	1	1	1	1	1	1

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Put an X here to use 50% of water zone							
Storage (soil) zone design (months)	2	2	2	2	2	2	2
Cv (Volumetric runoff coefficient)	0.69	0.69	0.69	0.69	0.69	0.69	0.69

Calculations and Type D/F Sediment Basin Volumes

Soil loss rate (t/ha/yr)	261	261	273	273	309	309	236
Soil loss class	3	3	3	3	3	3	3
Soil loss (m ³ /ha/yr)	201	201	210	210	238	238	182
Basin storage (soil) volume (m ³)	33	27	29	25	28	25	34
Basin settling (water) volume (m ³)	65	54	58	49	56	51	68
Sediment basin total volume (m ³)	98	80	87	74	84	76	102

Typical Sizing

Length	15	15	15	15	15	15	15
Width	5	5	5	5	5	5	5
Ratio	3	3	3	3	3	3	3
Area	75	75	75	75	75	75	75
Depth of sediment zone	0.4	0.4	0.4	0.3	0.4	0.3	0.5
Depth of settling zone	0.9	0.7	0.8	0.7	0.7	0.7	0.9
Internal batter slope	2	2	2	2	2	2	2
Check basin storage (soil) volume (m ³)	33	27	29	25	28	25	34
Check basin settling (water) volume (m ³)	65	54	58	49	56	51	68
Check sediment basin total volume (m ³)	98	80	87	74	84	76	102
Weir height (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Freeboard (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Check total depth (m)	1.9	1.7	1.8	1.6	1.7	1.6	2.0

1. Sediment Basins

Site Name: Dugald Mine Site
 Exoansion
 Site Location: Cloncurry, QLD
 Precinct/Stage: WTG Areas
 Date: 29/11/2022
 Other Details: SHEET 2

Site area	Sub-catchment or Name of Structure							
	WTG-8A	VIL-N01	VIL-N03	STA-01	STA-02	STA-03	STA-04	STA-05
Total catchment area (ha)	0.65	0.51	1.58	1.40	2.26	1.87	1.30	1.30
Disturbed catchment area (ha)	0.7	0.5	1.6	1.4	2.3	1.9	1.3	1.3

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D	D	D	D	D	D	D	D
% sand (fraction 0.02 to 2.00 mm)								
% silt (fraction 0.002 to 0.02 mm)								
% clay (fraction finer than 0.002 mm)								
Dispersion percentage								
% of whole soil dispersible	0	0	0	0	0	0	0	0
Soil Texture Group	D	D	D	D	D	D	D	D

Rainfall data

Design rainfall depth (no of days)	5	5	5	5	5	5	5	5
Design rainfall depth (percentile)	80	80	80	80	80	80	80	80
x-day, y-percentile rainfall event (mm)	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
Rainfall R-factor (if known)	2624	2624	2624	2624	2624	2624	2624	2624
IFD: 2-year, 6-hour storm (if known)	11	11	11	11	11	11	11	11

RUSLE Factors

Rainfall erosivity (R-factor)	2624	2624	2624	2624	2624	2624	2624	2624
Soil erodibility (K-factor)	0.03	0.03	0.03	0.045	0.045	0.045	0.045	0.045
Slope length (m)	60	80	80	80	80	80	80	80
Slope gradient (%)	8.0	15.0	15.0	2.5	2.5	3.5	2.5	2.5
Length/gradient (LS-factor)	1.7	4.6	4.6	0.7	0.7	0.9	0.7	0.7
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Ground cover (C-factor)	1	1	1	1	1	1	1	1

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Put an X here to use 50% of water zone								
Storage (soil) zone design (months)	2	2	2	2	2	2	2	2
Cv (Volumetric runoff coefficient)	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69

Calculations and Type D/F Sediment Basin Volumes

Soil loss rate (t/ha/yr)	174	472	472	100	100	140	100	100
Soil loss class	2	3	3	1	1	1	1	1
Soil loss (m ³ /ha/yr)	134	363	363	77	77	107	77	77
Basin storage (soil) volume (m ³)	54	42	130	115	186	154	107	107
Basin settling (water) volume (m ³)	107	84	259	230	371	307	213	213
Sediment basin total volume (m ³)	161	126	389	345	557	461	320	320

Typical Sizing

Length	20	18	30	27	35	35	30	30
Width	7	6	10	9	12	12	10	10
Ratio	3	3	3	3	3	3	3	3
Area	133	108	300	243	408	408	300	300
Depth of sediment zone	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4
Depth of settling zone	0.8	0.8	0.9	0.9	0.9	0.8	0.7	0.7
Internal batter slope	2	2	2	2	2	2	2	2
Check basin storage (soil) volume (m ³)	54	42	130	115	186	154	107	107
Check basin settling (water) volume (m ³)	107	84	259	230	371	307	213	213
Check sediment basin total volume (m ³)	161	126	389	345	557	461	320	320
Weir height (m)	0.9	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Freeboard (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Check total depth (m)	2.4	1.8	1.9	2.0	2.0	1.7	1.7	1.7

APPENDIX F: Data Summary