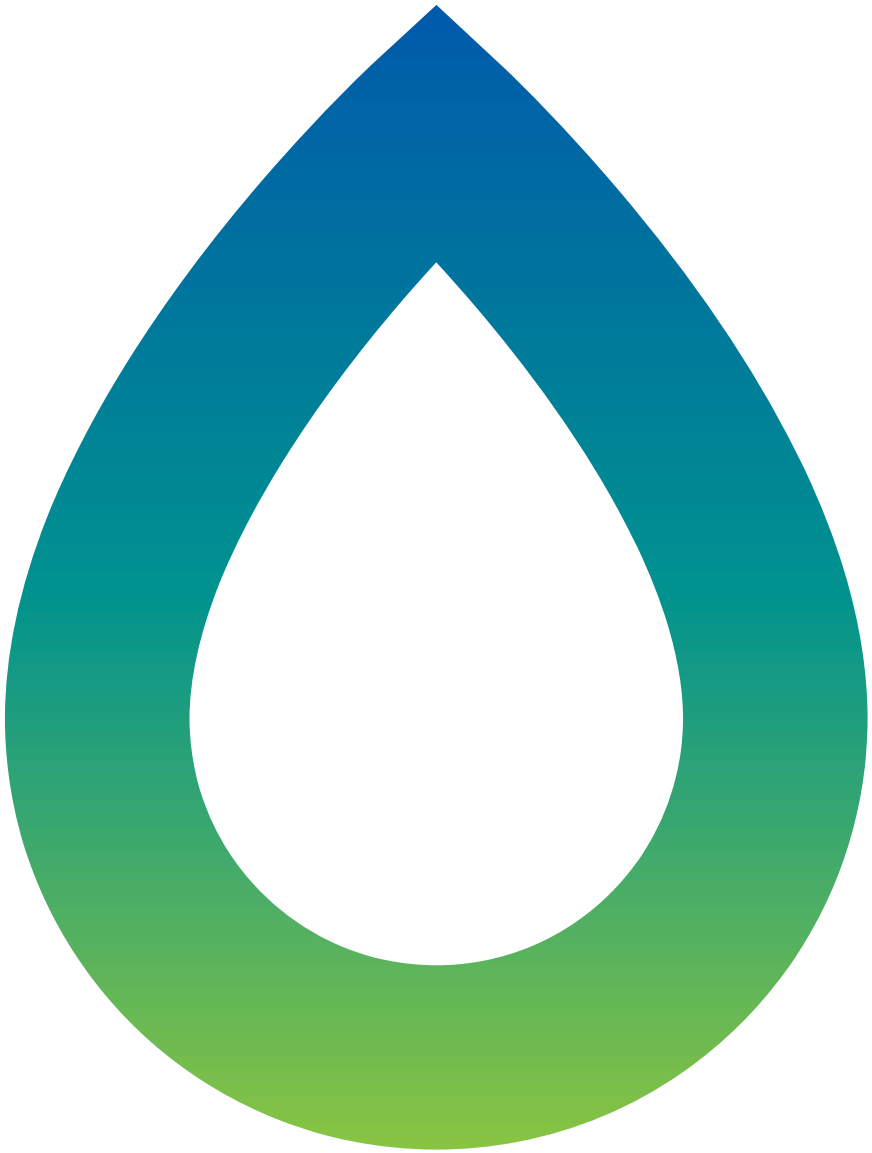
VULCAN SOUTH

Receiving Environment Monitoring Program

METServe

15 November 2024

1571-37-B4



DETAILS

Report Title	Vulcan South, Receiving Environment Monitoring Program
Client	METServe

THIS REVISION

Report Number	1571-37-B4
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Author	ZG/RN
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1 INTRODUCTION

The Vulcan South (referred to as 'the Project' and 'VS'), which is managed by Vitrinite Pty. Ltd., owner of Qld Coal Aust No.1 Pty. Ltd. and Queensland Coking Coal Pty. Ltd. (Vitrinite), is a proposed open pit and highwall mining operation located to the southeast of Moranbah, in Central Queensland. The Vulcan hard coking coal target has been defined and selected for open cut development via three separate open cut pits that form the primary mining focus of the Project. The Project is located immediately south and west of Vitrinite's initial mining project, and it lies to the immediate west of several established mining operations, including BHP's Peak Downs and Saraji mines. Vitrinite has a statutory obligation to manage water risks off the mining lease of the Project. This document provides an overview of the monitoring and assessment processes for the Receiving Environment Monitoring Program (REMP) for the Project.

1.1 CONTEXT

The Project is being undertaken on mining lease (ML) 700073 and operates under Environmental Authority number P-EA100265081 (the EA). Queensland Coking Coal Pty Ltd and QLD Coal Aust No. 1 Pty Ltd are the joint holders of the EA, and both companies are subsidiaries of Vitrinite Pty Ltd. In addition to Vitrinite's obligations under the Environmental Protection Act 1994, the EA stipulates that a Receiving Environment Management Program (REMP) must be developed, maintained, and implemented on the commencement of activities.

The area authorised for disturbance by the EA is shown in Figure 1.1**.**

1.2 AIMS AND OBJECTIVES

A REMP aims to monitor and assess the potential impacts of controlled or uncontrolled releases of wastewater and associated contaminants to the environment from a regulated activity. The process of designing a REMP is described in the Receiving Environment Monitoring Program Guideline – For use with Environmentally Relevant Activities under the Environmental Protection Act 1994- Version 3.01 (Queensland Department of Environment, Science and Innovation (DESI), 2024).

The EA provides direction on the requirements for the REMP and defines the receiving environment in Conditions F16, F17, F18, F19, F20 and F21, reproduced in Table 1.1 below. Condition F19 outlines the specific objectives and aims required for the REMP. Table 1.2 and Table 1.3 show the receiving environment surface water monitoring locations and water quality objectives respectively for the Project. The locations of Receiving Waters Quality Monitoring Locations are shown in Figure 1.1 below.

Table 1.1 REMP EA Conditions

Condition number	Condition
F16	**Receiving Environment Monitoring Program** On or before **1 August 2024**, a Receiving Environment Monitoring Program (REMP) Design Document must be: a) prepared in accordance with condition **F19**; and b) submitted to the administering authority
F17	For the purposes of the REMP, the only receiving environment is the waters detailed in **Table F2 – Surface waters monitoring locations**. The REMP must encompass any sensitive receiving waters or environmental values within the area of the site that will potentially be directly affected by releases of sediment water.

Condition number	Condition
F18	Any comments made by the administering authority on the REMP Design Document must be addressed to the reasonable satisfaction and within a timeframe specified by the administering authority.
F19	The REMP must at a minimum: a) address and comply with the latest version of the administering authority's guideline 'Receiving environment monitoring program guideline' (ESR/2016/2399); and b) identify, describe and monitor any adverse impacts to surface water environmental values, quality, and flows; and c) assess the long-term condition or state of surface waters and aquatic ecosystem health; and d) include monitoring from background reference sites (e.g., upstream sites) and downstream sites from the release (as a minimum, the locations specified in **Table F2 – Surface water monitoring locations;** e) identify and describe all environmental values of the receiving environment; and f) include monitoring and assessment of dissolved oxygen saturation, temperature and all water quality parameters listed in **Table F3 – Surface water quality objectives** against the surface water quality objectives in **Table F3 – Surface water quality objectives**. g) include an assessment of the potential impacts of the activity and propose appropriate mitigation measures; and h) assess the status of and any change to aquatic ecosystem health including aquatic flora and fauna within and immediately surrounding the project area; and i) assess the status of and any change to riparian vegetation health within and immediately surrounding the project area; and j) apply procedures and/or guidelines from ANZG 2018 and other relevant standards and guideline documents; and k) describe sampling and analysis methods and quality assurance and control; and l) incorporate stream flow and hydrological information in the interpretations of water quality and biological data.
F20	A REMP Annual Report must be prepared annually by **1 August** and submitted to the administering authority on request.
F21	The REMP Annual Report required by condition **F20** must: a) be prepared by an appropriately qualified person; and b) outline the findings of the REMP, including but not limited to: i. an assessment of long-term upstream water quality; and ii. an assessment of the long-term condition or state of surface waters, including sediment and aquatic ecosystem health; and iii. recommendations for further investigation or actions; and iv. recommendations for changes or improvements to the monitoring program; and v. potential changes to management of the authorised activity to minimise impacts; and vi. all monitoring results; and vii. a description of all conclusions formed.

Table 1.2 Surface waters monitoring locations (Table F2 of the EA)

Station ID	Previous Station ID	Catchment Area	Latitude (GDA2020)	Longitude (GDA2020)	Description
Upstream sites					
DL2_US	N/A	Boomerang Creek	22.290841264°S	148.154357187°E	Drainage line 2 upstream of the highwall mining area
DL3_ US	N/A	Boomerang Creek	22.305612596°S	148.192716185°E	Drainage line 3 upstream of the haul road
DL4_US	N/A	Boomerang Creek	22.323035473°S	148.200252458°E	Drainage line 4 at the upstream mining lease boundary
DL6_US	N/A	East Creek	22.339508200°S	148.207957289°E	Drainage line 6 at the upstream mining lease boundary
DL7_US	N/A	East Creek	22.347211456°S	148.209392813°E	Drainage line 7 at the upstream mining lease boundary
HCN_US	N/A	Hughes Creek	22.370485469°S	148.226638033°E	Hughes Creek north tributary approximately 5.5 km upstream of Saraji Road
HC_US	VSW5	Hughes Creek	22.395927439°S	148.224656137°E	Hughes Creek approximately 2.8 km upstream of Saraji Road
DL8_US	N/A	Hughes Creek	22.395784122°S	148.251629364°E	Drainage line 8 approximately 2.2 km upstream of Saraji Road
BC1_US	VSW6	Hughes Creek	22.411388907°S	148.269449617°E	Barrett Creek upstream of Saraji Road
Downstream sites					
DD1_US	VSW1	Boomerang Creek	22.276596290°S	148.174514955°E	Diversion bund
DD1_DS[1]	VSW2	Boomerang Creek	22.301050508°S	148.195240117°E	Drainage line 2, downstream of the confluence of existing diversion drain
DL2_DS	VSW11	Boomerang Creek	22.298264498°S	148.189625245°E	Drainage line 2 upstream of confluence of existing diversion drain
DL3_DS	VSW3	Hughes Creek	22.306311857°S	148.194663612°E	Minor drainage line, upstream of confluence of Drainage Line 2
DL4_DS	VESW4	Hughes Creek	22.321553686°S	148.200307744°E	Drainage line 4 upstream of the confluence of Boomerang Creek
DL6_DS	VSW9	East Creek	22.334779125°S	148.221868903°E	Drainage line 6, at the downstream mining lease boundary
DL7_DS[1]	VSW7	East Creek	22.343101091°S	148.231039608°E	Drainage line 7, at the downstream mining lease boundary
HC_DS[1]	VSW4	Hughes Creek	22.384885209°S	148.266275740°E	Hughes Creek at the downstream mining lease boundary
DL8_DS	VSW10	Hughes Creek	22.388240114°S	148.268093290°E	Drainage line 8 at the downstream mining lease boundary

[1] Remote water level logger location

Table 1.3 Surface water quality objectives (Table F3 of the EA)

Quality characteristic (units)	Sediment dam trigger value	Downstream monitoring point trigger value	Source	Frequency
pH	6.5-8.5	6.5-8.5	EPP WQO (aquatic ecosystems)	Monthly and Daily during release (the first sample must be taken within 2 hours of commencement of release)
Electrical Conductivity (µS/cm)	864*	Baseflow: 720 Medium flow: 500 High flow: 250	EPP WQO	
Turbidity (NTU)	60*	50	EPP WQO	
Total Suspended Solids (mg/L)	102^	85	EPP WQO	
Sulphate as SO_4 (mg/L)	37#	25	EPP WQO	
Ammonia (µg/L)	900	900	ANZG 2018	
Nitrate (µg/L)	1,100	1,100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for Total Nitrate	Monthly and Daily during release (the first sample must be taken within 2 hours of commencement of release)
Filtered metals and metalloids				
Aluminium (µg/L)	192*	160	Locally derived	Monthly and Commencement of release and thereafter weekly during release
Arsenic (µg/L)	16*	13	ANZG 2018	
Lead (µg/L)	4.1*	3.4	ANZG 2018	
Mercury (µg/L)	0.72*	0.6	EPP WQO (aquatic ecosystems)	
Molybdenum (µg/L)	40.8*	34	EPP WQO (aquatic ecosystems)	
Selenium (µg/L)	6*	5	ANZG 2018	

Notes:

All metals and metalloids must be measured as 'dissolved' (from analysis of a field filtered sample) and total (unfiltered). Limits for metals and metalloids apply to dissolved results.
*20% increase on trigger value
95th percentile site specific
^locally derived trigger values (80th percentile values of natural surface water monitoring)

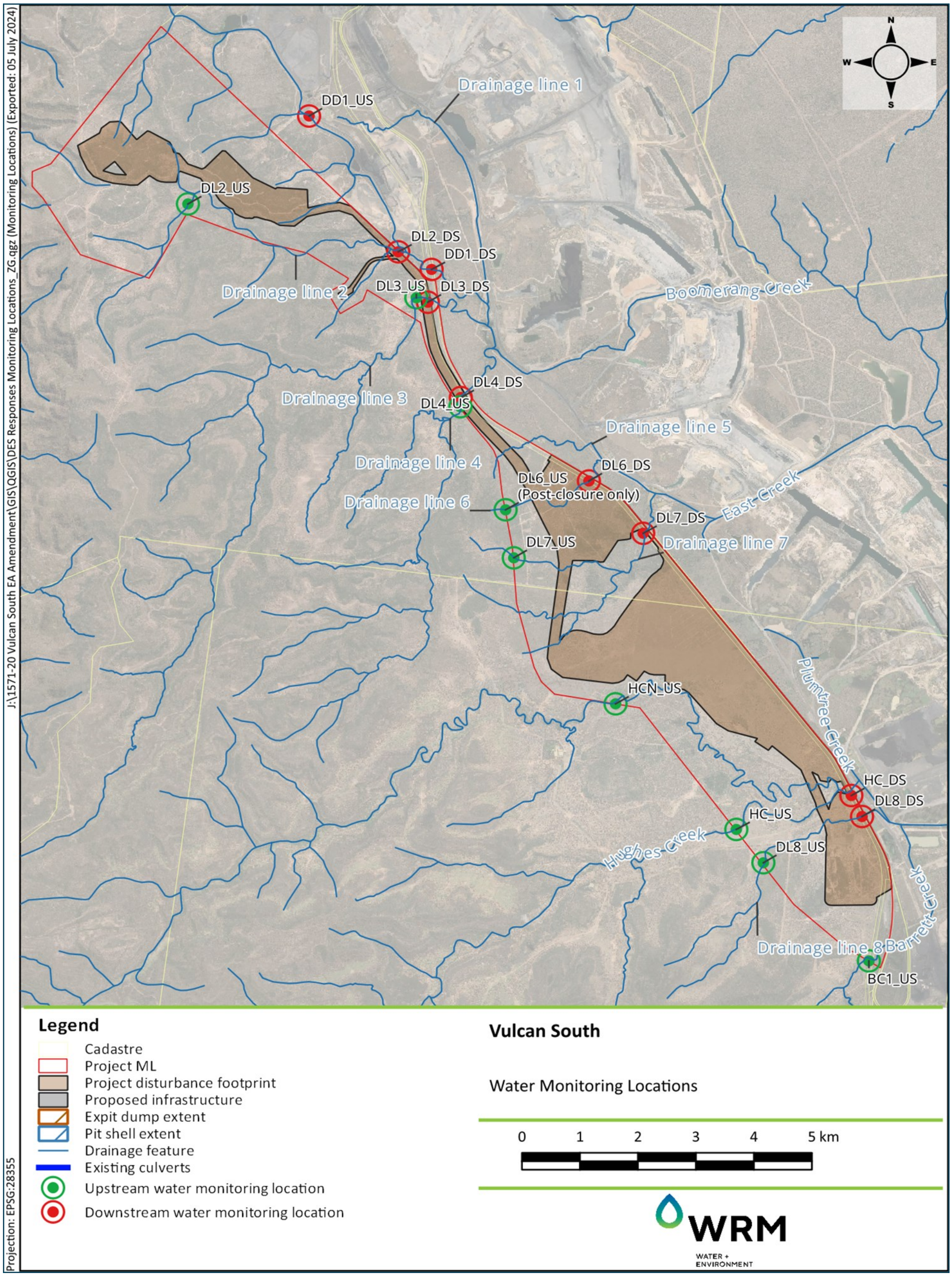

Figure 1.1 Water Quality Monitoring locations

2 DESCRIPTION OF ACTIVITY

2.1 LOCATION

VS is located to the southeast of Moranbah, in Central Queensland. It lies to the immediate west of several established mining operations, including BHP's Peak Downs and Saraji mines and falls within the jurisdiction of the Isaac Regional Council. The Project is located immediately south and west of Vitrinite's initial mining project.

2.2 RESOURCE TENURES

VS is located on ML700073 (see Figure 1.1). The Project ML covers an area of approximately 3,800 ha and is situated over multiple underlying prerequisite tenures (EPC 1732, 1233 and 1234). The ML overlies adjacent portions of existing Exploration Permit Coal (EPC) 1732, 1233 and 1234 tenements (held by Qld Coal Aust No.1 Pty Ltd and Queensland Coking Coal Pty Ltd). Both companies hold an equal 50 percent (%) share of the ML. Both companies are owned by Vitrinite. A list of the properties, tenure, usage, and landowners within the ML boundary are outlined in Table 2.1.

Table 2.1 Land Tenure and Real Property Descriptions for the Project

Lot/Plan	Tenure	Usage	Owner
2SP296877	Lands Lease	Pastoral	O'Sullivan
59SP235297	Lands Lease	Pastoral	O'Sullivan
Saraji Road	Road Licence	Road for public use	Isaac Regional Council
26/CNS125	Lands Lease	Norwich Park Branch Railway	Aurizon

The Project falls within the Isaac Regional Council local government area. The region has a distinct mining influence with multiple significant coal mining operations in the immediate vicinity of the Project. Most of the land within the ML has been previously disturbed by agriculture and mining related activities. There are a small number of rural or residential dwellings located within 5 km of the southern extent of the Project activities.

2.3 PROJECT ACTIVITY

The Jupiter hard coking coal target has been defined and selected for open cut development via three separate pits. VS will operate for approximately 9 years and will extract approximately 13.5 million tonnes (Mt) of Run of Mine (ROM) hard coking coal at a rate of up to 1.95 million tonnes per annum (Mtpa). VS will target the Alex and multiple Dysart Lower coal seams. Truck and shovel mining operations will be employed to develop the pits. The Project planned disturbance footprint is approximately 1,395 ha (see Figure 1.1).

The current mine plan proposes the Coal Handling and Preparation Plant (CHPP), rail loop, and train load-out facility (TLO) at a location between the northern and central pits. The CHPP will include dry tailings technology to maximise water recycling and produce a dry tailings waste product for permanent storage within active waste rock dumps. No wet tailings wastes are proposed and therefore no tailings dams are required. The VS Geochemistry Assessment has analysed waste rock and coal reject material geochemistry and has concluded that co-disposal of reject material with waste rock material would be advantageous from a geochemical perspective.. Ex-pit waste rock dumps will be established at each of the three pits prior to commencing in-pit dumping activities that

will continue for the life of the operation. Ancillary infrastructure, including a Run of Mine (ROM) pad, Mine Infrastructure Area (MIA), offices, roads, and surface water management infrastructure, will be established to support the operation.

Development of the VS pits will require the Saraji Road and existing services infrastructure to be realigned to the eastern boundary of the ML, adjacent to the existing rail easement, in several locations. The realignment will occur within the ML boundary.

In-pit dumping will fill most of the pit volumes during operations, with the remaining final voids to be backfilled upon cessation of mining, resulting in the establishment of low waste rock dump landforms over the former pit areas. Following backfill of the final voids, the remaining material stored in the initial out-of-pit waste rock dumps will be rehabilitated in-situ.

2.4 CONTAMINANTS OF POTENTIAL CONCERN

A geochemical assessment of the waste rock material (overburden and interburden) and potential coal reject materials has been undertaken (RGS Environmental 2022). This assessment included a series of geochemical tests on samples from the Jupiter pits area to assess the risk of potential oxidation of sulphides, acid and metalliferous drainage, potential presence and leaching of soluble metals/metalloids and other salinity/erosion issues. The following conclusions regarding the geochemical characterisation of the potential spoil were established:

- The overwhelming majority of the waste rock materials have low sulfide content, excess Acid Neutralising Capacity (ANC), and are classified as Non-Acid Forming (NAF) (Barren). These materials have a very low risk of acid generation and a high factor of safety with respect to potential for generation of acidity. assay of the multi-element concentration present in selected representative samples indicates that there are no elements (metals/metalloids) enriched in the sample materials compared to median crustal abundance in unmineralized soils.
- the initial static and kinetic test results indicate that surface runoff and seepage from the sample materials are likely to be pH neutral with moderate excess alkalinity, and low levels of salinity.
- the initial geochemistry results are consistent with the larger data set of results obtained from geochemical characterisation of 139 samples from 21 drill holes across the broader Jupiter and Vulcan areas in the VCM and VS; and
- the results represent an ‘assumed worst case’ scenario as the sample is pulverised (to minus 75 micrometres) prior to testing. Therefore, samples have a very high surface area compared to materials in the field. This process provides a greater potential for dissolution and reaction and represents an assumed initial ‘worst case’ scenario for geochemical testing of these materials.
- Coal reject materials have relatively low sulfide content and excess ANC. As a bulk mixed material, it is expected that coal reject will be classified as NAF and have a relatively low risk of generating acidic drainage. Co-disposal of reject materials in waste rock dumps is likely to have a beneficial impact on the quality of the reject leachate.

2.5 MINE WATER MANAGEMENT STRATEGY

The Surface Water Assessment completed by WRM Water and Environment (WRM, 2023) assessed sources of various contaminants, and measures to avoid or minimise impacts to water quality and aquatic ecosystems. The water management system for VS aims to protect the identified downstream environmental values and comprises the following key objectives:

- Separate diverted water from mine affected water to ensure that up-catchment water and mine affected water do not mix wherever practicable;
- Capture of mine affected runoff (e.g. mine industrial area, haul road/ROM pad runoff), storage and priority reuse as mine water supply;

- Divert up-catchment water runoff from upstream catchments around the active mining area;
- Limit external catchment runoff draining into the open cut pits;
- Manage sediment from disturbed catchment areas (e.g. the ex-pit waste rock dump, cleared/pre-strip areas) by using erosion and sediment control (ESC) measures prior to release offsite.
- Reuse onsite water (e.g. mine affected water) where possible to support mine operational water demands (and therefore limit mine affected water inventories under normal operating conditions); and
- Manage any mine affected water releases to the receiving environment to meet environmental release conditions (not currently proposed).

The VS water management system includes mine water drainage, mine water storages, sediment dams, pit water storages and flood protection work (i.e. the drainage diversion).

2.6 WATER MANAGEMENT INFRASTRUCTURE

A series of drains and bunds have been established to direct runoff to sediment control structures, with a mine water dam constructed to supply mine related water use. This includes the following:

- diverted water drains, bunds and drainage diversions to divert runoff from undisturbed catchments around areas disturbed by mining;
- flood protection levees along the southern side of the Vulcan North pit extent, along the western and southeastern sides of the Vulcan Main pit, and around the Vulcan South pit;
- sediment dams and drains to collect and treat runoff from waste rock emplacement areas; and
- mine-affected water drains and dams to store water pumped out of the open cut mining areas and to collect runoff from the infrastructure areas.

2.7 DISCHARGE WATER TO THE RECEIVING ENVIRONMENT

There are four pathways through which water from VS can enter the receiving environment:

- Dewatering and overflows from sediment dams;
- Overflows from mine affected water dams and the open cut pits;
- Runoff from diverted water catchments; and
- Runoff from rehabilitated catchments.

The release locations of planned sediment dams at VS to receiving waters are outlined in Table 2.2. Note that these locations will need to be confirmed following the construction of each structure.

Table 2.3 summarises the indicative schedule of the ESC structures and their respective upstream and downstream monitoring locations. Monitoring should commence at the upstream and downstream monitoring locations at least 2 months prior to any planned disturbance in the catchment. Note that this schedule is considered indicative only. ESC structures will be constructed prior to disturbance in the catchment.

Table 2.2 ESC structure monitoring locations (Table F1 of the EA)

ESC Structure	Location Latitude (GDA2020)	Location Longitude (GDA2020)	ESC structure water source location	Downstream monitoring point	Receiving waters description
SD9	-22.3432	148.2276	Vulcan North Out of Pit Dump	DL7_DS	Drainage Line 7
SD10	-22.3469	148.224	Vulcan North Out of Pit Dump	DL7_DS	Drainage Line 7
SD11	- 22.3379	148.2193	Vulcan North In Pit Dump	DL6_DS	Drainage Line 6
SD12	-22.3418	148.2297	Vulcan North In Pit Dump	DL7_DS	Drainage Line 7
SD13	-22.3353	148.2226	Vulcan North In Pit Dump	DL6_DS	Drainage Line 6
SD14	-22.3341	148.2203	Vulcan North In Pit Dump	DL6_DS	Drainage Line 6
SD15	-22.3315	148.2157	Vulcan North Out of Pit Dump	DL5_DS	Drainage Line 5
SD16	-22.3643	148.2365	Vulcan North Out of Pit Dump	HC_DS	Hughes Creek
SD17	-22.3578	148.2441	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD18	-22.3612	148.2469	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD19	-22.3737	148.2488	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD20	-22.3682	148.2532	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD21	-22.3738	148.2582	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD22	-22.3782	148.2617	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD23	-22.3784	148.257	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD24	-22.3852	148.2658	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD25	-22.3875	148.2673	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD26	-22.3888	148.2676	Vulcan Main In Pit Dump	HC_DS	Hughes Creek
SD27	-22.3914	148.2636	Vulcan South Out of Pit Dump	HC_DS	Hughes Creek
SD28	-22.4011	148.2697	Vulcan South Out of Pit Dump	DL8_DS	Barrett Creek
SD29	-22.3944	148.271	Vulcan South In Pit Dump	HC_DS	Hughes Creek
SD30	-22.3818	148.2641	Vulcan South In Pit Dump	HC_DS	Hughes Creek
HWD1	-22.2866	148.1497	Highwall Trial Area Bench	DL2_DS	Drainage Line 2

Table 2.3 ESC structure schedule

ESC Structure	Proposed operational years	Schedule of commencement of monitoring	Upstream monitoring point	Downstream monitoring point
SD9	2025 to 2026	Prior to construction in 2025	DL7_US	DL7_DS
SD10	2025 to 2026		DL7_US	DL7_DS
SD11	2025 to 2026		DL7_US/DL6_US*	DL6_DS
SD12	2025 to 2026		DL7_US	DL7_DS
SD13	2025 to 2026		DL7_US/DL6_US*	DL6_DS
SD14	2025 to 2026		DL7_US/DL6_US*	DL6_DS
SD15	2025 to 2026		DL7_US/DL6_US*	DL5_DS
SD16	2025 to 2032	Prior to construction in 2025	HCN_US, HC_US	HC_DS
SD17	2025 to 2032		HCN_US, HC_US	HC_DS
SD18	2025 to 2032		HCN_US, HC_US	HC_DS
SD19	2025 to 2032		HCN_US, HC_US	HC_DS
SD20	2025 to 2032		HCN_US, HC_US	HC_DS
SD21	2029 to 2032	Prior to construction in 2029	HCN_US, HC_US	HC_DS
SD22	2029 to 2032		HCN_US, HC_US	HC_DS
SD23	2029 to 2032		HCN_US, HC_US	HC_DS
SD24	2029 to 2032		DL8_US, HC_US	HC_DS
SD25	2029 to 2032		DL8_US, HC_US	HC_DS
SD26	2029 to 2032		DL8_US, HC_US	HC_DS
SD27	2029 to 2032		DL8_US, HC_US	HC_DS
SD28	2029 to 2032		DL8_US, BC1_US	DL8_DS
SD29	2029 to 2032		DL8_US, BC1_US	HC_DS
SD30	2029 to 2032		HCN_US, HC_US	HC_DS
HWD1	2025 to 2026	Prior to construction in 2025	DL2_US	DL2_DS

Note: *DL6_US can be used as an upstream monitoring site once the Drainage line 6 catchment is no longer diverted

3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 SURFACE WATER

VS is located within the Isaac River sub-basin of the greater Fitzroy Basin. Figure 3.1 shows the Upper Isaac River catchment to its confluence with Phillips Creek.

The Isaac River commences approximately 100 km to the north of VS within the Denham Range. It drains in a south westerly direction through the Carborough and Kerlong Ranges before turning in a south easterly direction near the Goonyella Riverside Mine. It drains approximately 30 km to the east of VS, and eventually flows to the Mackenzie River some 150 km to the southeast.

Three open water bodies are in the Isaac upper catchment including Lake Elphinstone, Teviot Creek Dam and Burton Gorge Dam (see Figure 3.1). Lake Elphinstone is a natural lake formed behind the Carborough Range whereas Teviot Creek Dam and Burton Gorge Dam are man-made structures that supply water to Burton and North Goonyella mines in the upper catchment.

Other than along the ranges, the majority of the Isaac River catchment has been cleared for agricultural use or for mining. There are several existing coal mines in the catchment, including Burton, North Goonyella, Goonyella Riverside, Broadmeadow, Broadlea North, Isaac Plains, Moranbah North, Millennium, Daunia, Poitrel, Grosvenor, Caval Ridge, Peak Downs, Saraji, Norwich Park and Lake Vermont mines.

Figure 3.2 shows the surrounding catchments of the Project area. The Project is located in the headwaters of the Boomerang, Hughes, Barrett and Harrow creek catchments:

- Headwater drainage features of Boomerang Creek, which is a watercourse and tributary of the Isaac River, drains the northern portion of the Project area.
- Hughes Creek is a watercourse and tributary of Boomerang Creek and drains the majority of the southern Project area.
- Barrett Creek, which is identified as a watercourse within the Project MLA and is and tributary of Hughes Creek, drains a small portion of the southern Project area.
- Headwater drainage features of Harrow Creek, which is a tributary of Cherwell Creek and the Isaac River, drains a small portion of the northern Project MLA area.

3.2 CURRENT LAND AND WATER USES

The predominant catchment land uses of Boomerang Creek include undeveloped areas with some stock grazing to the west of Saraji Road and stock grazing and coal mining to the east. Boomerang Creek, Hughes Creek and Barrett Creek flow into the existing BHP Billiton Mitsubishi Alliance (BMA) operations (Peak Downs and Saraji).

The existing BMA operations have diverted the original alignment of Boomerang Creek and its tributaries, as well as Harrow Creek to the north as shown in Figure 3.2 Additional diversions of Boomerang Creek and its floodplain are also planned for approved operations further to the east.

3.3 ENVIRONMENTAL PROTECTION (WATER AND WETLAND BIODIVERSITY) POLICY 2019

3.3.1 Environmental Values

The Queensland Water Quality Guidelines 2009 (QWQG, 2013) and Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water) establish environmental values (EVs) and water quality objectives (WQOs) for natural waters in Queensland. VS is located within the 'Isaac western

upland tributaries' area of the Isaac River sub-basin, shown in Figure 3.3. Under the EPP Water, the following EVs have been nominated for this area.

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock Water;
- Aquaculture;
- Human consumption;
- Primary recreation;
- Secondary recreation;
- Visual recreation;
- Drinking water;
- Industrial use; and
- Cultural and spiritual values.

3.3.2 Water Quality Objectives

Schedule 1 of the EPP Water shows that VS lies within the Isaac River Sub-basin (Figure 3.3), with the full list of relevant WQO's outlined in the Environmental Protection (Water) Policy 2009 Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part) document (Sept 2011).

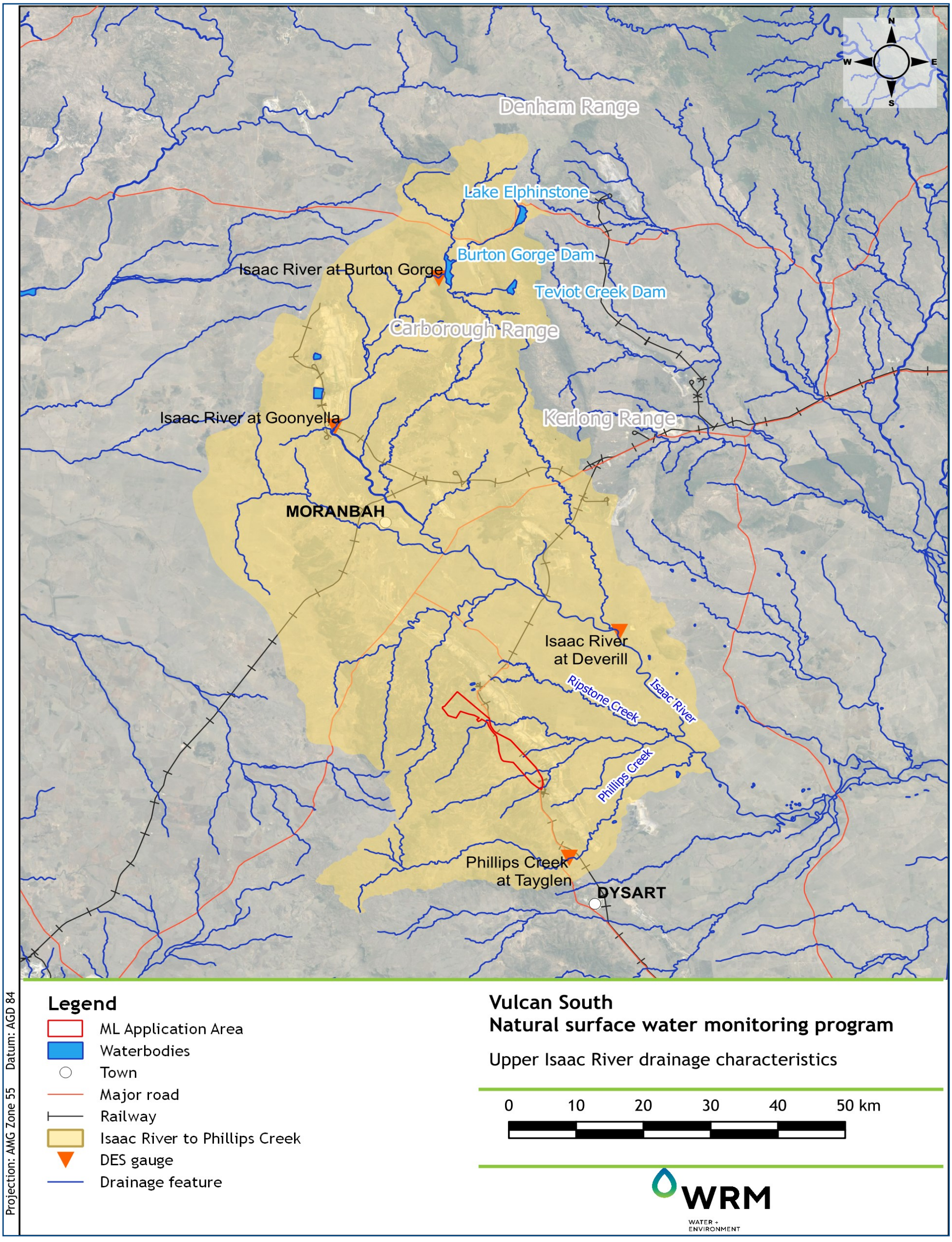

Figure 3.1 Upper Isaac River Drainage

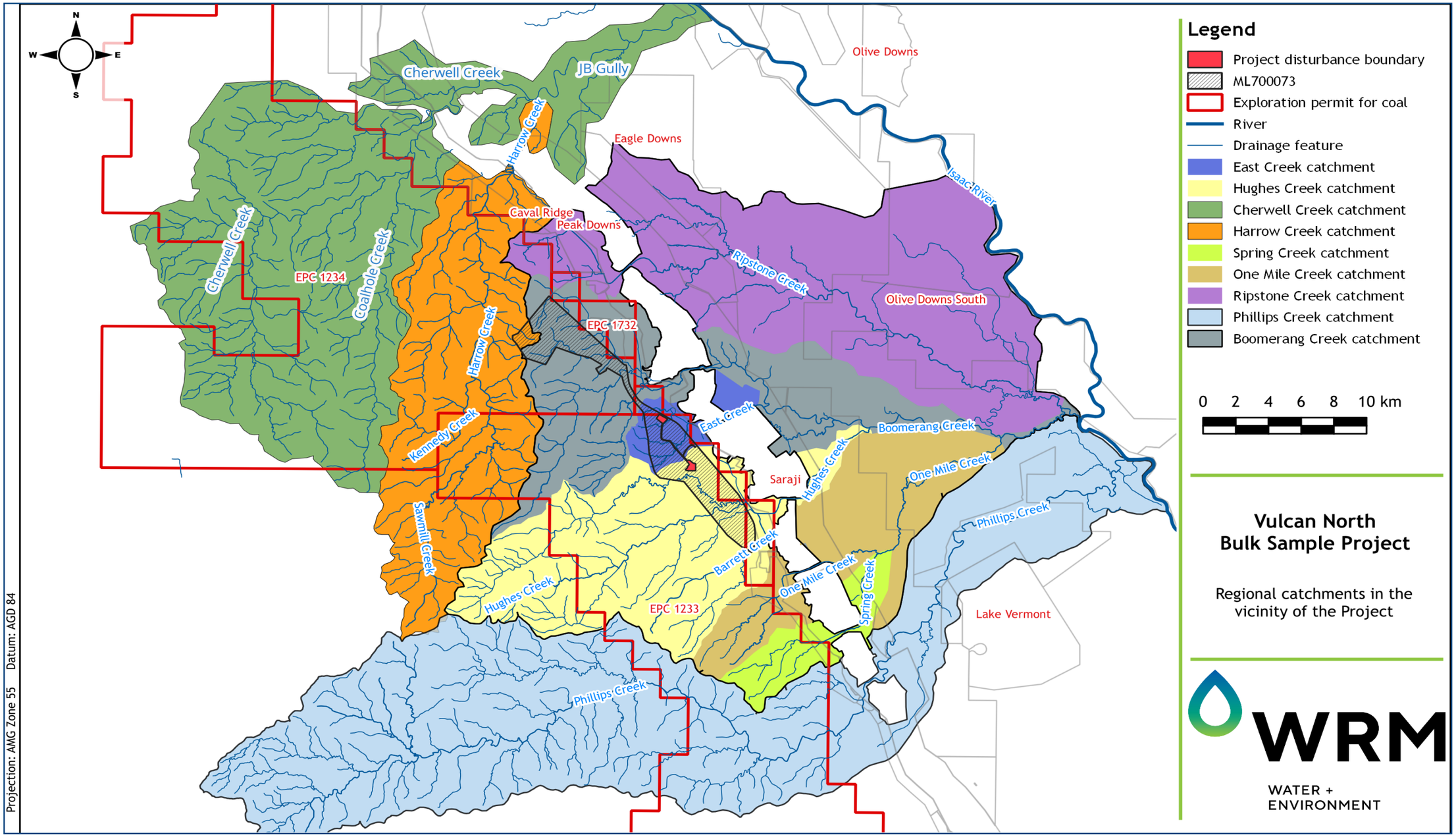

Figure 3.2 Reginal Catchment

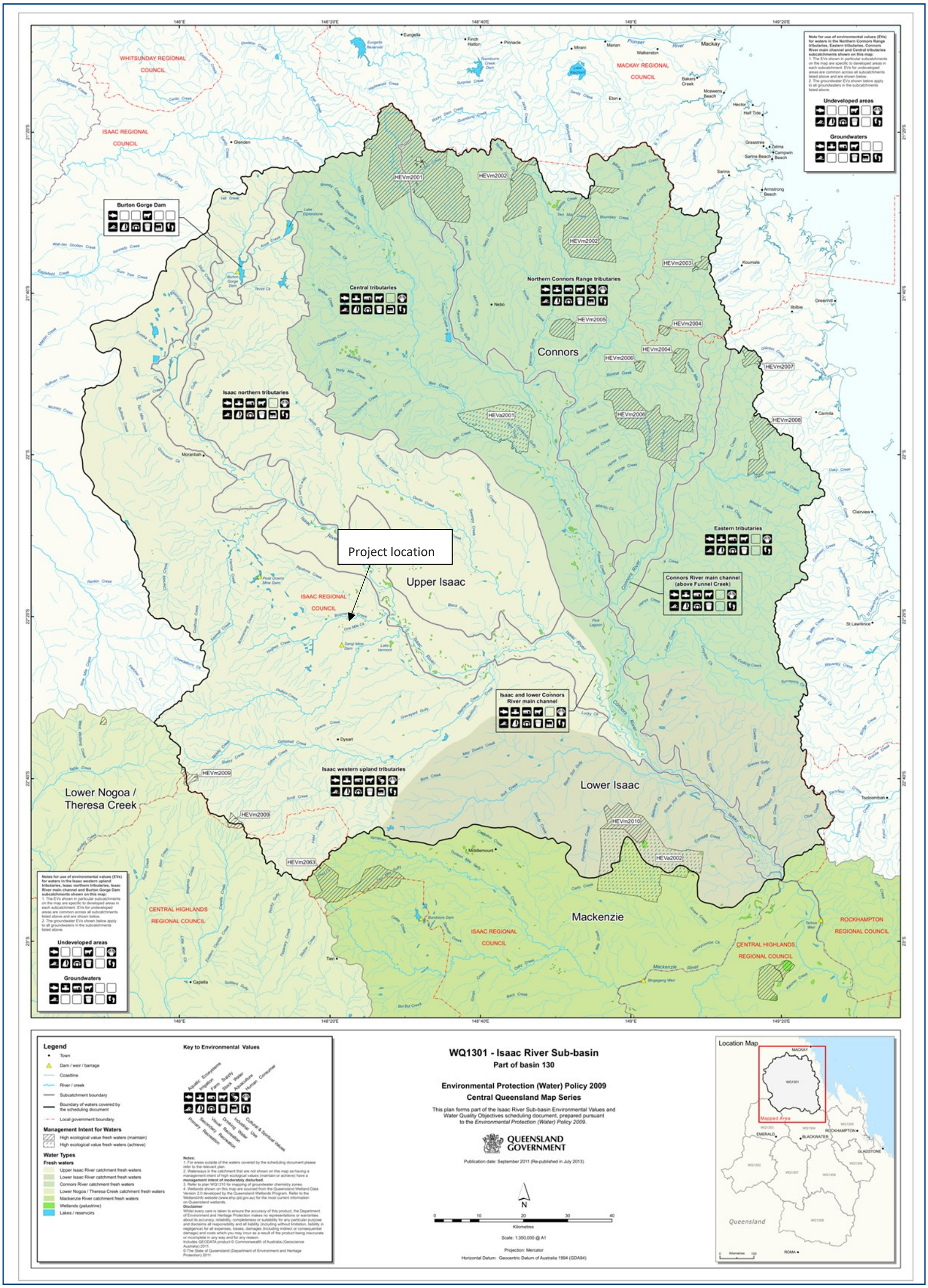

Figure 3.3 Isaac River sub basin EVs

4 SURFACE WATER AND MINE WATER RELEASE

There are four key mechanisms through which surface water and mine affected water can enter the receiving environment:

- Surface water dewatering and overflows from sediment dams;
- Mine water overflows from mine affected water dams and open pits;
- Surface water runoff from diverted water catchments; and
- Surface water runoff from rehabilitated catchments.

Sediment dam water and mine affected water overflows are classified as a point source. Runoff from rehabilitated catchments is likely to be classified as both a point and diffuse source of water to the receiving environment. When a sediment dam catchment is completely rehabilitated, and water quality monitoring of the runoff has established that it is consistent with natural background conditions, the sediment dam and associated drainage infrastructure will be decommissioned. Surface runoff and seepage from the rehabilitated catchment will be allowed to shed directly to the receiving environment.

Mine affected water dams at the project have been sized to limit the likelihood of releases of mine affected water. Hence, the risk of mine water overflows from the mine to the receiving environment is expected to be low.

5 RECEIVING ENVIRONMENT MONITORING PROGRAM

5.1 LOCATIONS

Monitoring for the REMP will be undertaken at nineteen locations within Hughes Creek and Barrett Creek and Boomerang Creeks as well as the diversion bund and Drainage Lines 2, 3, 4, 6, 7 and 8. These sites will include ten sites downstream of discharge points and nine sites upstream of discharge points.

The downstream sites represent 'test' sites due to water releases activities, while the upstream sites represent 'control' sites as they are located upstream of the VS discharge points and have not been previously affected by mine water discharges. Receiving surface waters monitoring locations have been nominated in the EA as noted in Table 1.2 (Table F2 of the EA) and depicted in Figure 1.1. Table 5.1 shows the downstream monitoring locations and their respective relevant upstream monitoring locations during Operations and Post-closure of the Project.

Releases to receiving waters will be monitored during release events from the mine. ESC structure (sediment dams) monitoring locations have been nominated in the EA as noted in Table 2.2 (Table F1 of the EA).

Table 5.1 Downstream monitoring locations and relevant upstream monitoring locations

Downstream monitoring location 'test' site	Upstream monitoring location 'control' site	
	Operations	Post-closure
DD1_DS	DD1_US* DL2_US	DD1_US* DL2_US
DL2_DS	DL2_US	DL2_US
DL3_DS	DL3_US	DL3_US
DL4_DS	DL4_US	DL4_US
DL6_DS	DL7_US[1]	DL6_US[1]
DL7_DS	DL7_US	DL7_US
HC_DS	HCN_US HC_US	HCN_US HC_US
DL8_DS	DL8_US	DL8_US

Note: *Water quality results indicate that the monitoring location is affected by the adjacent mine site tailings facility.
[1]DL7_US is the appropriate upstream monitoring location for DL6_DS during operations while Drainage line 6 is diverted. DL6_US is the appropriate monitoring location post-closure.

5.2 TIMING AND FREQUENCY

As per condition F12 of the EA, monitoring at locations specified in Table 1.2 (receiving surface waters) and Table 2.2 (ESC structures) must occur during natural flow events and release events (Table 2.2). Sampling frequency is required monthly per Table F3 of the EA monthly for all parameters and:

- For field parameters: within 2 hours of the commencement of release and thereafter daily during release; and
- For filtered metals and metalloids: commencement of release and thereafter weekly during release.

To ensure sample integrity (i.e. holding times met), grab samples will be collected daily, where safe to do so, and transferred to relevant Nata certified laboratory sample bottles.

5.3 INDICATORS

At each monitoring site for each sampling event, in-situ measurements of physio-chemical characteristics of the water column will be collected using a calibrated water quality instrument. Samples will also be collected for laboratory analysis for parameters described in Table 1.3 as well as filtered copper and dissolved organic carbon (DOC).

5.4 METHODOOGY

All in-situ water quality measurements will be performed in accordance with Queensland Monitoring and Sampling Manual (DES 2018) and Australian Standard AS/NZS 5667.1:1998 Water Quality Sampling. At each monitoring site for each sampling event, in-situ measurements of physio-chemical characteristics of the water column will be collected using a calibrated water quality instrument. Samples will also be collected for laboratory analysis for a range of parameters. Water samples from release points will be collected in a representative area of each site by hand or by a sampling pole with clamp if required for safety reasons.

5.4.1 Surface Water Monitoring

Monitoring of surface water quality both within and external to the mine site will form a key component of the surface water management system. Monitoring of upstream, onsite, and downstream water quality will assist in demonstrating that the site water management system is effective in meeting its objective of minimal impact on receiving water quality and will allow for early detection of any impacts and appropriate corrective action.

The surface water monitoring protocols will:

- ensure compliance with the EA.
- provide valuable information on the performance of the water management system; and
- facilitate adaptive management of water resources on the site

5.4.2 Stream Sediment Monitoring

Sediment sampling to measure metal concentrations is to be undertaken where appropriate. The Guideline for Receiving environment monitoring program (DESI, 2024) defines appropriate as:

1 where there is a risk of sediment contamination or history of water quality exceedances; and

2 where there are sediments present, not sand.

Stream sediment monitoring should be undertaken to demonstrate the suitability of release conditions, and sediment contaminants should initially be included within a REMP. Noting that sediment sampling can only occur at sites where suitable substrates exist (i.e. silty or muddy substrates, not sand). Given that the waterways surrounding VS have streambeds that are dry and dominated by sandy substrates, monitoring of the stream sediment is deemed to be unsuitable as part of this REMP.

5.4.3 Biological Monitoring

The habitat assessment results for representative sites within the region surrounding VS, as part of the Aquatic Ecology Study (FRC Environmental 2020) indicate that the specific waterways of VS are characterised by:

- well-defined channels with dry stream beds;
- substrate dominated by sand with some clay; and
- streambanks dominated by clay with some sand.

Waterways of VS have low to very low cover of aquatic habitat elements, and riparian vegetation condition was assessed as low to moderate in condition. Riverine bioassessment scores cannot be calculated for dry waterways; however, the score is likely to be calculated within the lower ranges during the rare times that hydrological habitat is present. This indicates that even during brief periods that water is present at these sites, the habitat features would not support diverse biological communities. Where biological monitoring is possible as part of the REMP program, macroinvertebrate indicators will be used. Limitations on the implementation of biological monitoring may occur where:

- there is no high flow event at monitoring locations to facilitate conditions appropriate for macroinvertebrate colonisation; or
- there is no habitat present for macroinvertebrate populations.

The WQOs for the central Queensland freshwaters are provided below in Table 5.2. Further, macroinvertebrate monitoring will be undertaken in accordance with the Aus Rivas methodology.

Table 5.2 Biological Indicators and Water Quality Objectives of the Central Queensland Freshwaters

Indicator	Score Description	WQO Range[1]
SIGNAL	1 (most tolerant of pollution) 10 (least tolerant of pollution)	3.33 – 3.85 (Composite) 3.31 – 4.2 (Edge)
% Tolerant Taxa (% of	0 – 100 %. Higher scores indicate streams containing taxa of higher pollution tolerance	25 – 50 (Composite) 44 – 56 (Edge)
PET taxa richness	Higher values indicate higher stream health	2 – 5 (Composite) 2 – 5 (Edge)
Taxa richness	Higher values generally indicate higher stream health	13 – 21 (Composite) 23 – 33 (Edge)
“composite” = All “Pool” or “Bed” habitat		

[1] Based on the Qld Guideline scores for slightly to moderately disturbed in the Freshwater Central Regions (QWQG 2013)

5.4.4 Streamflow

Stream flow gauging stations have been installed and are operated and maintained to record stream flows at the downstream monitoring locations specified in Table 1.2: Receiving Waters Quality Monitoring Locations.

5.4.5 Drainage line diversions

The drainage line diversions will be monitored regularly to collect data for use in evaluating their performance. The collection of monitoring data will help identify any issues with the construction of the diversion and assist with relinquishment of the diversion at mine closure. The monitoring plan will

be carried out for three reaches (upstream of diversion, the diversion and downstream of diversion) in three different stages as follows:

- Baseline monitoring will be conducted prior to the construction of the diversions to provide a reference data set for evaluation of monitoring data collected throughout the life of the monitoring program and will include:
    - site photography;
    - aerial photography;
    - survey;
    - vegetation characterisation and assessment; and
    - flow event monitoring
- During construction, monitoring will be conducted to ensure the diversion is constructed to the design specifications and will include:
    - execution database to record construction activities;
    - site photography; and
    - aerial photography.
- Operations monitoring will be conducted after construction works have been completed to maintain channel condition and to identify remedial works. The operations monitoring is a combination of visual assessments and survey data and will include:
    - survival of works;
    - site photography;
    - aerial photography;
    - visual assessment;
    - index of diversion condition (IDC);
    - site survey; and
    - flow events monitoring.

The intention is that the diversions will be stable and require minimal maintenance during mine operations. While erosion risks will require mitigation immediately post construction, it should ultimately achieve a state of dynamic equilibrium with the adjoining reaches such that ongoing management is not required post mining.

5.5 DATA INTERPRETATION AND REPORTING

5.5.1 Investigation Requirements

As per the EA condition F13, if a water quality characteristic measured at a downstream site specified in Table 1.2 (Table F2 of the EA) exceeds any water quality objective specified in Table 1.3 (Table F3 of the EA) the holder of this environmental authority must compare the following:

- The downstream results are to be compared to the applicable upstream results in the receiving waters and:
    a. If the quality measured at a downstream site is equal to or less than the quality measured at the applicable upstream site, no further action is required; or

b. If the quality measured at a downstream site is greater than the quality measured at the applicable upstream site, complete an investigation into the cause of the deterioration in water quality and the potential for environmental harm and submit a written report to the administering authority within twenty (20) business days outlining:

   i. details of the investigation carried out including any assumptions and limitations of the investigation; and

   ii. findings of the investigation including an explanation of the cause identified; and

   iii. recommendations of the investigation; and

   iv. actions taken to comply with the conditions of the environmental authority and to prevent environmental harm.

Per condition F5 of the EA, if monitoring of any ESC structure identifies an exceedance of any of the sediment dam trigger values identified in Table 1.3 (Table F3 of the EA), all water in the structure that has exceeded the trigger values will be transferred to a mine water dam.

Figure 5.1 shows a flow chart of the EA requirements for surface water investigations, notifications and actions for surface water investigation and notification requirements

5.5.2 Notification Requirements

If an exceedance in accordance with condition F13(b) occurs, the holder of the environmental authority must notify the administering authority within twenty-four (24) hours of receiving the monitoring result via WaTERS and pollution hotline.

5.5.3 Reporting

All surface water monitoring data must be submitted to the administering authority via WaTERS.

Figure 5.1 Surface water monitoring, investigation and management flowchart

5.6 QUALITY ASSURANCE AND QUALITY CONTROL

Sampling will be undertaken in accordance with AS5667 Water Quality Sampling and in accordance with the Queensland Monitoring and Sampling Manual (DES 2018).

5.6.1 Data Collection and Sampling

Samples will be collected and transported in appropriately pre-treated sample bottles supplied by a NATA accredited laboratory. Correct sample volumes for each parameter will be collected using the appropriate sampling bottle. Sample containers will be labelled with a waterproof xylene-free marker pen on the containers label and lid. The site number, name of the collector, time and date will be included on the label.

All storage containers will be chilled on ice (4°C) immediately following collection and during transport to the chosen laboratory (same day, otherwise transferred to refrigerator). The samples requiring freezing will be placed in the freezer at the completion of the day's sampling. Storage requirements and holding times are specified in the Monitoring and Sampling Manual 2018 (DES 2018).

Accurate chain of custody forms will be maintained for samples. The form will identify all samples numbers, the respective analyses and limits or reporting (LORs) required for analysis. All samples will be submitted to the analytical laboratory as a single batch to minimise the chance for misplaced or misdirected freight.

5.6.2 Laboratory Analysis

Analysis of samples will be completed by a NATA accredited laboratory. The laboratory practical quantitation limits (PQLs) should be sufficient to enable any exceedances of the QWQG (2013) and ANZG (2018) guideline limits to be detected (where available).

5.6.3 Data Interpretation

The annual and seasonal patterns in the flow in the receiving environment will be identified and discussed. Rainfall data from the closest BoM station will also be incorporated and discussed.

Water quality data collected during water quality sampling will be compared between sites (i.e. test sites compared to control sites) and to the water quality trigger values. In the event of an exceedance of a trigger value, the management actions and reporting outlines in Section 5.5 will be undertaken.

6 REFERENCES

Department of Environment and Science (2022).	Guideline: Receiving environment monitoring program, July2024, Version 2.01.
Department of Environment and Science (2018).	Monitoring and Sampling Manual, June 2018, Version 2.
FRC environmental (2020).	Vulcan Complex Project: Aquactic Ecology Study. Report prepared for Mining and Energy Technical Services Pty Ltd by FRC environmental Pty Ltd, Brisbane.
RGS (2022)	Geochem assessment of waste rock and coal reject, Vulcan Complex Project. Report prepared for Vitrinite Pty Ltd by RGS Environmental Pty Ltd, Brisbane.
WRM, 2023	Vulcan South Project Surface Water Assessment. Report prepared for Mining and Energy Technical Services Pty Ltd by WRM Water & Environment Pty Ltd, Brisbane
QWQG (2013)	Queensland Water Quality Guidelines 2009, Department of Environment and Heritage Protection, Version 3, ISBN 978-0-9806986-0-2, 2013
ANZG (2018)	Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

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