Klohn Crippen Berger

Anglo American

Dawson South EA Amendment

Groundwater Impact Assessment Report

Final

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March 2024

25 March 2024

Anglo American
11/201 Charlotte St
Brisbane, QLD
4000

Katy Steele
Environmental Approvals Manager

Dear Ms. Steele:

Dawson South EA Amendment
Groundwater Impact Assessment Report
Final

KCB Australia Pty Ltd (KCB) is pleased to provide this final technical report on the groundwater impact assessment to support Anglo America's Dawson South Operation.

Yours truly,

KCB AUSTRALIA PTY LTD.

Brent Usher, PhD, RPGeo
Senior Hydrogeochemist, Principal
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AC:BU:JJ

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EXECUTIVE SUMMARY

KCB Australia Pty Ltd (KCB) was commissioned by Anglo American Steelmaking Coal (Anglo) to undertake an assessment of potential groundwater-related impacts as a result of proposed final landform changes to the Existing (already existing mine plan) open pit mining activities associated with Dawson South (the Project).

Description of the Project

The Dawson South mining area is located within the Mining Lease (ML) ML5657 and ML80160 boundary and is operated by Anglo Steelmaking Coal in accordance with the Dawson South Environmental Authority (EA) EPML00657413. Anglo commenced open cut mining in the Dawson South mining area in 2003. Coal is currently mined in three open cut pits (Pit 25, Pit 26 and Pit 27) located in the northern part of the Dawson South mining area. These pits are located along the strike of the coal seams. A fourth open cut pit (Pit 28) is existing mine plan in the southern part of the Dawson South mining area. The proposed Project involves:

i. Reconfiguration/relocation and extension of the existing mine plan Pit 28 final void; and
ii. Alterations to the existing final landform, including addition of a new final void in Pit 25.

The Project will use the same open cut mining methods currently used in the Dawson South mining area and will utilise the existing Dawson Mine infrastructure and mining equipment. Existing mining activities (that are existing mine plan) include several open pits including an existing mine plan final void in Pit 28.

Hydrogeology Context

The Project is located in the Dawson River catchment. Surface water flow across the Project area is from north to south, and south of the project the Dawson flows west to east. Local creeks drain toward the Dawson River.

Hydrostratigraphic units in the vicinity of the Project area include Quaternary alluvium, associated with surface water courses; Tertiary sediments; Tertiary basalt; the Triassic Rewan Group; and Permian coal measures. Saturated conditions are observed in the Rewan Group and Permian coal measures; while within the Project area, limited groundwater is observed within the Quaternary alluvium, Tertiary sediments and Tertiary basalt.

Groundwater use by third parties, within a 5 km radius of the Project area, has not been identified. All registered bores on the Department of Regional Development, Manufacturing and Water (DRDMW) groundwater bore database within a 5 km radius of the Project area are used for mine monitoring purposes and are screened across various hydrostratigraphic units.

Groundwater Dependent Ecosystem(GDE) mapping of the Fitzroy basin indicates that there is low confidence terrestrial GDEs located adjacent to the Dawson River which is within 5 km of the Project area.

Impact Assessment

A numerical groundwater model was developed for the Project area, and surrounds, to simulate the groundwater level drawdown associated with the proposed landform changes. The numerical groundwater model was constructed using data provided by Anglo and sourced from public

domain sources. Model calibration was completed using groundwater levels, recorded over time, from bores within and surrounding the study area. Prediction of groundwater level drawdown was conducted based on the Proposed open pit mining schedule provided by Anglo. The updated groundwater model was able to achieve a good calibration between the measured/observed water levels and the model-predicted water levels for the transient calibration period. The model calibration metrics are acceptable and within the requirements of the Australian Groundwater Modelling Guidelines. The transient hydrograph comparisons between simulated and measured water levels show that the model is able to match the general trends and responses observed in the data record, including the shallower hydrostratigraphic units which could be potentially impacted by mining activities. Results from the predictive simulation were used to consider potential drawdown impacts to the groundwater environment.

Potential operational impacts to water-dependent assets were considered based on groundwater levels and drawdown assessments (See Figure A below the text in this summary for reference). A summary of the potential impacts to water-dependent assets are:

- Modelling results show that the greatest dewatering occurs at the end of mining operations (largest absolute impact on the groundwater system). This period is when the actively mined coal seams would have resulted in the lowest groundwater elevations in the final active pit and coincides with the period when the cumulative dewatering impact from the interaction between the pits is at its highest. Since the groundwater system is very slowly recovering outside of the active mining area, the end of the mining period shows the greatest overall groundwater drawdown at Dawson South.
- Observed changes to the potential impact on the groundwater system from the Project arise after operations have ceased, as result of the presence of the additional pit lake in the final void of Pit 25 and due to the increased size of the post-mining void in Pit 28.
- No additional third-party groundwater users are impacted by the Project. While the Project does result in additional post-closure drawdown the area impacted after closure and distance from the mining voids is less than at the end of mining. The maximum extent of groundwater level drawdown occurs during the final operational stages of the existing mining activities. The impact of the Proposed change in landform after closure is not predicted to extend beyond the end of existing mining activities. Therefore, no impacts to third-party groundwater users are predicted as result of the Proposed Project.
- Following the cessation of mining, groundwater levels will be allowed to recover, which will ultimately result in the development of two post-closure voids located in the north (Pit 25) and south (Pit 28) of the Proposed Project landform. Post-closure equilibrated void levels and particle tracking indicate that the voids will remain groundwater sinks.
- It should be noted that for the Project landform equilibrated water level elevation in the Pit 28 void is higher than in the existing mine plan landform. As result, the groundwater impact from the Proposed Pit 28 void will be reduced compared to the existing case.
- Although the existing mine plan landform equilibrated void water levels lie at a lower elevation for Pit 25, in comparison to the recovered void in the Proposed landform, the overall zone of influence (extent) will be smaller after closure than at the end of operations (confirming that end of existing operations represents the period of greatest impact to groundwater, irrespective of the Project).

- The largest difference observed in terms of the impact on surface water resources will occur once the pit voids have equilibrated (reached steady state). The predictions indicate under conservative modelled scenario conditions across the entire Dawson South area, that surface water bodies (creeks and the Dawson River) will lose water to the groundwater environment but at a similar magnitude to the Existing mine plan.
- The Project-related groundwater level elevations across the study area, resulting from the Proposed post-closure landform, is not predicted to cause any additional appreciable impacts to the groundwater resource.

Conclusion

A groundwater impact assessment of the Project has been undertaken to consider potential impacts to groundwater resources and groundwater-dependent assets as a result of Proposed landform changes.

It is concluded that the Proposed development changes of the Project will not have any additional appreciable impact on water resources.

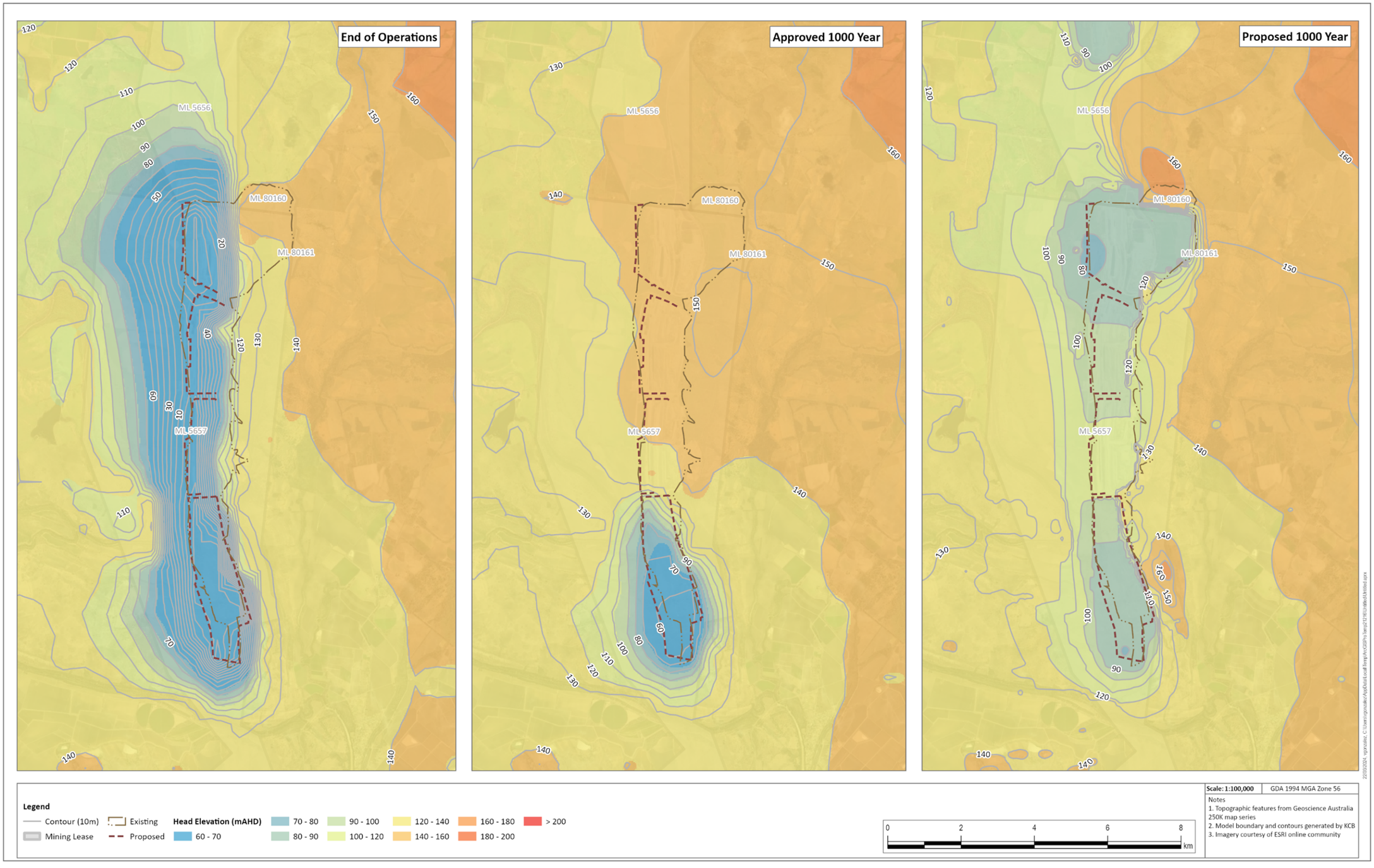

Figure A: Comparison of groundwater levels at the end of operations (left), and 1000 year after closure for the Existing Mine Plan (centre) and Proposed Mine Plan (right)

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1 INTRODUCTION

KCB Australia Pty Ltd (KCB) was commissioned by Anglo American Steelmaking Coal (Anglo) to undertake the groundwater impact assessment (GIA) to support the application for amendment of the Dawson South Environmental Authority (EA) EPML00657413, in accordance with the Environmental Protection Act 1994 (EP Act).

The objective of this report is to assess the potential impact on groundwater resources and groundwater-dependent assets under the *Environment Protection Act 1994* (EP Act) (State of Queensland 2021) as a result of the proposed activities associated with the Project and other relevant guidelines.

1.1 Project Background

The Dawson Mining Complex is located within Queensland's Bowen Basin, ~175 km southwest of Gladstone. Dawson South comprises the southern extent of the complex, ~8 km north of Theodore.

The mining complex extends over 50 km (north-south) and comprises three distinct operating areas; Dawson North, Dawson Central, and Dawson South. Mining activity in the complex targets the Permian Baralaba Coal Measures.

Production of a mixture of coking, soft coking, and thermal coal is processed at the site, then transported by rail to the Barney Point Terminal and RG Tanna Coal Terminal for export.

The Dawson South mining area is located within the Mining Lease (ML) 5657 and ML 80160 boundary and is operated by Anglo American Steelmaking Coal in accordance with the Dawson South Environmental Authority (EA) EPML00657413. Open cut mining in the Dawson South mining area commenced in 2003. Coal is currently mined in three open cut pits (Pit 25, Pit 26 and Pit 27) located in the northern part of the Dawson South mining area. These pits are located along the strike of the coal seams. A fourth open cut pit (Pit 28) is in the existing mine plan in the southern part of the Dawson South mining area. The Proposed Project involves:

i. Reconfiguration/relocation and extension of the existing mine plan Pit 28 final void; and
ii. Alterations to the existing mine plan final landform, including addition of a new final void in Pit 25.

The Project will use the same open cut mining methods currently used in the Dawson South mining area and will utilise the existing Dawson Mine infrastructure and mining equipment.

The Project location (centred at Dawson South) is presented in Figure 1.1. Dawson South comprises three existing open pits (Pits 25 – 27) which will be backfilled in the future, and one proposed open pit (Pit 28). The Project will require an amendment to the Dawson South EA in accordance with the Environmental Protection Act 1994 (EP Act).

The environmental impact assessment (undertaken by others) will support the EA amendment application for approval from the Queensland Department of Environment and Science and Innovation (DESI) under the EP Act.

Figure 1.1 Dawson South Location

1.2 Report Structure

This report is structured as follows:

Section 1: Introduction – provides an overview of the Proposed Project, report purpose and structure.

Section 2: Regulatory Framework Context – describes the regulatory setting, for both Queensland and Commonwealth legislation, relating to groundwater and the project.

Section 3: Detailed Description – describes project location, project approval status and Proposed Project components.

Section 4: Assessment Methodology – describes the assessment method including the collection of relevant data and numerical groundwater modelling.

Section 5: Existing Environment – describes the relevant land uses, local topography, drainage and climate.

Section 6: Conceptualisation Hydrogeological Model – details the regional and local hydrogeological characteristics.

Section 7: Numerical Groundwater Modelling – provides a summary of the numerical groundwater modelling approach, design, calibration process, predictions and uncertainty analysis.

Section 8: Impact Assessment – provides a detailed description and the predicted effects of the Proposed mining on the local groundwater regime. This section also presents an assessment of the potential impacts on groundwater users and the sensitive environmental features. A summary of the potential risks to water resources and water-related assets, and the application of management controls for risk reduction, is also provided in this section in the form of a Risk Assessment.

Appendix I: Groundwater Modelling Report

2 REGULATORY FRAMEWORK

This report has been prepared with consideration of key guidelines, policies and legislation from the State of Queensland. This section provides an overview of key legislation/policies relevant to this assessment. The reporting and assessment have considered the requirements of applicable Commonwealth legislation relating to impacts on groundwater resources from mining. In this regard consideration of aspects such as flow regimes, recharge rates, inter-aquifer interaction, changes to groundwater and surface water interactions and groundwater table changes have been considered. Changes to the hydrological/hydrogeological characteristics of the proposed activities have been assessed as part of this study for the identification of potential impacts.

2.1 Queensland Legislation

2.1.1 Queensland Mineral Resources Act 1989

The Queensland *Mineral Resources Act 1989* (MR Act) entitles the holder of a mining lease to take or interfere with underground water (i.e. groundwater) as part of existing mine plan mining operations. This entitlement is termed the mining lease holder's 'underground water rights'.

Groundwater that is taken or interfered with while exercising the underground water rights is termed 'associated water'. The holder of the mining lease is entitled to use associated water for any purpose. To exercise the underground water rights for existing mine plan mining operations on mining leases that were in existence when the legislation came into force (i.e. 6 December 2016), the lease holder must:

- Comply with the notification requirements under Section 334ZP(6) of the MR Act by notifying the administering authority for Chapter 3 of the Queensland Water Act 2000 (Water Act) of the exercise of its underground water rights. The administering authority for Chapter 3 of the Water Act is the Department of Environment and Science (DES); and
- Comply with its monitoring and reporting obligations under Section 334ZP(5) of the MR Act and Chapter 3 of the Water Act. Section 334ZP(5) of the MR Act requires that the volume of associated water taken is measured and reported. Obligations under Chapter 3 of the Water Act include undertaking baseline assessments of the groundwater regime and water supply bores, providing ongoing assessment and reporting of groundwater take and (where necessary) entering into make good agreements with owners of affected water supply bores.

Under the requirements of the MR Act, the proponent notified DES of its intention to continue to exercise its underground water rights as part of the existing existing mine plan Dawson South mining operations. Existing mine plan mining is referred to the "Existing" mine plan throughout this document.

2.1.2 Environmental Protection Act 1994

The Queensland *Environmental Protection Act 1994* (EP Act) was amended in December 2016 to align the EP Act with the requirements of Chapter 3 of the Water Act.

Section 227AA of the EP Act requires that an EA amendment application that involves a change to the exercise of underground water rights must be supported by the following information:

- A description of each aquifer and the movement of water within each aquifer affected by the proposed activities;
- A description of the impacts of the proposed activities on environmental values;
- A description of the effects of the proposed activities on groundwater quality; and
- A description of any strategies to manage or mitigate the impacts of the proposed activities.

The supporting information required under the EP Act and as instructed in *requirements for site-specific and amendment applications – underground water rights* (DES 2021) is provided in this report. The conceptual groundwater regime, including relevant aquifers and the movement of groundwater is discussed in Section 5. The predicted effects of the Project changes in groundwater levels and quality are discussed in Section 7 and Section 8. The predicted impacts of the Proposed Project on groundwater users and sensitive environmental features are also addressed in Section 8**.**

The proponent will not require a separate approval (e.g. an associated water licence under the parallel provisions of the Water Act) in order to exercise its water rights.

2.1.3 Trigger Thresholds

Under Section 362 of the Water Act 2000, a bore trigger threshold for a consolidated aquifer of 5 m applies (2 m for an unconsolidated aquifer). The 5 m threshold represents the maximum allowable groundwater level decline in a groundwater bore, due to tenure holders' activities, prior to triggering an investigation into the water level decline and an assessment to establish whether a bore has, or is likely to have, an impaired capacity because of a tenure holder exercising their underground water rights. The presence of Groundwater-Dependent Ecosystems that may be impacted further by the Proposed Project is also a consideration and 1 m or incremental 0.2 m additional drawdown impacts may play a role in defining additional impact from the Proposed Project.

2.1.4 Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The Environmental Protection (Water) Policy, the EPP (Water and Wetland biodiversity) provides a framework to protect and/or enhance the suitability of Queensland waters for various beneficial uses.

Groundwater resources within the Project area lie within the Dawson River catchment as listed in Schedule 1 of the EPP (Water and Wetland Biodiversity). The EPP states that the environmental values for groundwaters within the Lower Dawson River catchment may include aquatic ecosystems, irrigation, farm supply, stock water, aquaculture, primary recreation, drinking water and cultural and spiritual values.

2.1.4.1 Water Quality Objectives – Groundwater

The EPP provides water quality objectives (WQOs) to support and protect the various environmental values identified for waters within the Dawson River catchment. The groundwater WQOs for the Dawson River catchment are provided in the *Dawson River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Dawson River*

Sub-basin except the Callide Creek Catchment (DES 2011) according to their chemistry zone and depth category. Groundwater within the vicinity of the Dawson Mine (Northern area) is classified as 'shallow' and 'deep' under chemistry zone 34, a brackish (Na-Cl) type water. Groundwater within the Dawson Mine (southern area) within the project area is classified as 'shallow', under chemistry zone 21, an alluvial sequence with moderate salinity (Na-Mg-Ca, Cl) type water.

Section 6.8 presents the groundwater quality data relevant to the Project setting.

2.1.5 Water Resource and Resource Operations Plans

The water resource planning process under the Water Act provides a framework for the development of catchment-specific Water Plans. A Water Plan, along with Water Management Protocols, Resource Operations Licences and associated operations manuals, provides a management framework for water resources in a plan area, and includes outcomes, objectives and strategies for maintaining balanced and sustainable water use in that area.

The project area is outside of any groundwater management areas in the Water Plan (Fitzroy Basin) 2011. The Project site is located adjacent to, however, does not impact the Dawson Valley Water Management Area (Dawson H) under Schedule 3B of the Water Plan (Fitzroy Basin) 2011 area (Figure 3).

3 DETAIL OF PROJECT DESCRIPTION FOR GROUNDWATER

The Dawson mining complex lies over the Baralaba Coal Measures and coal resources are primarily produced from the Permian-age reserves contained in five major seams (Seams A to F). The mining complex extends over 25 mining leases and comprises three distinct operating areas; Dawson North (DN), Dawson Central (DC) and Dawson South (DS); which are aligned in a north south orientation along the strike of the coal seams and extend over a distance of approximately 50 km (JBT 2018).

Underground mining activities started in 1963 and ceased in 1994. The mine currently produces a mixture of coking, soft coking and thermal coal which is processed and then transported 150 km by rail to the Barney Point Terminal and RG Tanna Coal Terminal for export (JBT 2018).

Coal is currently mined in three open cut pits (Pit 25, Pit 26 and Pit 27) located in the northern part of the Dawson South mining area. These pits are located along the strike of the coal seams. A fourth open cut pit (Pit 28) is existing mine plan in the southern part of the Dawson South mining area.

The Project involves:

- Reconfiguration and extension of the existing mine plan Pit 28 final landform; and
- Alterations to the existing mine plan final landform, including addition of new final void in Pit 25 and relocation and enlargement of the existing mine plan Pit 28 final void.

The Project will use the same open cut mining methods currently used in the Dawson South mining area and will utilise the existing Dawson Mine infrastructure and mining equipment. Figure 1.1 shows infrastructure and layout of the Dawson South mining complex including Pits 25, 26, 27 and 28.

3.1 Project Setting

A summary of the regional project setting is provided below, with further details included in the remainder of the report:

- The target coal seam for the Project is within the Baralaba Coal Measures, of the Permo-Triassic Bowen Basin.
- The Project is located adjacent to the Dawson Valley Water Management Area which forms part of the larger Fitzroy Basin.
- Groundwater in the Project area comprises three systems: 1) shallow alluvial aquifers which generally follow water drainage systems and are thickest next to rivers and creeks; 2) a deeper low permeability system associated with the Triassic Rewan Formation which is recognised as an aquitard; and 3) The Baralaba Coal Measures which are recognised regionally as an interbedded aquitard (Section 6.5).

3.2 Project Approval Status

The Project's approval status within the legislative / regulatory framework is summarised by:

- Anglo is currently preparing to apply for an EA amendment for (ML) 5657 and ML 80160 under the Environmental Protection Act 1994 to authorise changes to mining landforms.
- An Environmental Assessment Report (EAR) is currently being prepared for the project. This will support the EA amendment application for the project approval from the Queensland Department of Environment and Science and Innovation (DESI) under the Environment Protection (EP) Act.
- The project must be supported by specific information on the take and/or interference with groundwater. Therefore, this Groundwater Impact Assessment Report has been prepared to support the EA amendment application.

3.3 Project Activities

The Project proposes to alter the final landform of Pit 25 to maintain a final void in the reconfigured Pit 25 final landform. Pit 28 will also undergo reconfiguration and extension of the final void.

The Project will continue to employ open cut methods which include dragline, truck and shovel methods. A summary of the Proposed mining activity is provided in the following section.

3.4 Mining Schedule

The Dawson mining complex consists of several mining areas spread over a strike-length of 50 km plus a coal handling and processing plant (CHPP) and train loading facilities. There are up to five separate coal mining horizons (seam groups) and associated splits are extracted in each mining area using shovel and truck operations for pre-strip and draglines for uncovering the lower coal seams (Anglo, 2022). The mined coal is transported via overland conveyor to the CHPP, where it is washed and then loaded into rail wagons and transported to the Port of Gladstone for export.

For Dawson South, the mining and extraction of coal occurs within existing surface rights areas from four pits (Pit 25, Pit 26 and Pit 27 and Pit 28) (see Table 3.1). The Proposed Project involves alterations to the final landform with a final void being maintained in Pit 25 as well as the reconfiguration and extension of the existing mine plan Pit 28 final void, with progressive rehabilitation conducted when Pits 26 and 27 are fully extracted. The approximate mine stages and timeframes are provided in Table 3.1.

Table 3.1 Mining activities and Timeframes

Mining Stage	Description	Timeframe
Pit 25	Recovering resource using extractive methods	2024-2030
Pit 26	Recovering resource using extractive methods	2024-2025
Pit 27	Recovering resource using extractive methods	2024-2027
Pit 28	Recovering resource using extractive methods	2027-2048

4 ASSESSMENT METHODOLOGY

4.1 Methodology and Data Sources

4.1.1 Assessment Area

The existing environment within the vicinity of the Project area was considered through a desktop assessment to establish the baseline groundwater conditions, environmental values and potential receptors.

The assessment area, for the purposes of this report, includes hydrogeological units underlying the Project within the Bowen Basin, Baralaba Coal Measures (Permian-aged strata). The Baralaba Coal Measures are overlain by the Rewan Formation (Triassic sedimentary rocks) which are in turn juxtaposed by Tertiary Sediments and Quaternary units (Alluvium deposits).

For the identification of groundwater receptors relevant to this Project, a nominal 5 km buffer around the Project area was established to capture potential adjacent groundwater receptors that may be impacted by the Proposed mining activity.

4.1.2 Database Searches and Government Mapping

A search of relevant Australian and Queensland databases was undertaken. The purpose of this search was to identify the presence of current and historical groundwater bores and collate drilling records and groundwater level, yield and quality data from relevant bores. The database search area included the Project area and its surrounds within a 5 km radius. The search radius was considered representative of the geological and hydrogeological setting of the area.

The following databases and mapping were searched:

- The Department of Regional Development, Manufacturing and Water (DRDMW) Groundwater Database of registered water bore data from private water bores and Queensland Government groundwater investigation and monitoring bores. Sourced data includes bore location, groundwater levels, construction details, stratigraphic logs, available hydrogeological testing and available groundwater quality.
- The Queensland Spatial Catalogue (QSpatial), via Queensland Globe. Records of petroleum and coal seam gas (CSG) exploration, production and monitoring wells are contained within this database.
- Queensland Spring Register, published by the Queensland Herbarium (Queensland Herbarium 2018).
- Potential Groundwater Dependent Ecosystem (GDE) mapping published by the DES (DES 2018).
- Bureau of Meteorology (BoM), National Atlas of Groundwater Dependent Ecosystems (GDEs).
- Groundwater monitoring network within the Project area of Dawson South, including groundwater level and quality data.

4.1.3 Literature Review and Previous Groundwater Studies

A number of relevant studies have been conducted at, and within the vicinity of, the Project. These studies have supported the conceptual hydrogeological understanding of the Project area, as summarised in Table 4.1.

Table 4.1 Summary of Previous Reports

Document Name	Year	Author
Assessment of Hydrogeological Environment and Pit Inflow Estimates - Dawson South Stage 2 Coal Project	2004	Parsons Brinckerhoff
Whole Of Mine Groundwater Regime and Monitoring Program Dawson (Moura) Mine	2004	AGE
Whole of Mine Groundwater Regime and Monitoring Program Dawson (Moura) Mine	2004	AGE
Dawson (Moura) mine whole of mine groundwater regime & monitoring program mine layout - infrastructure	2004	AGE
Dawson (Moura) mine whole of mine groundwater regime & monitoring program water levels of coal seam gas bores (august 2004)	2004	AGE
Dawson (Moura) mine whole of mine groundwater regime & monitoring program locations of NRM registered bores	2004	AGE
Dawson (Moura) mine whole of mine groundwater regime & monitoring program mine layout - infrastructure	2004	AGE
Dawson South EIS appendices 10-14	2006	Anglo Coal
Dawson South environmental impact statement and environmental management plan	2006	EH&S Systems Pty Ltd
Assessment Report under the EP Act 1994 on the EIS for the Dawson South Stage 2 Coal Project	2007	Queensland Government EPA
Groundwater impact assessment Dawson central coal mine water supply/dewatering of underground mines	2007	AGE
Groundwater Impact Assessment Dawson Central Coal Mine Water Supply/dewatering of underground mines	2007	AGE
Moura no. 1 underground mine water resource	2010	AGE
Re: Moura no. 1 underground mine water resource	2010	AGE
Groundwater assessment report - Dawson mine South ml 5657	2012	EGC Pty Ltd
Groundwater Interaction with Dawson Final Voids	2018	JBT
Groundwater interaction with Dawson final voids	2018	Hatch/JBT
Dawson Mining Complex Water balance update - 1427-01-H1	2019	WRM
Dawson mine 2c west pit lake desktop review	2020	Stantec
Dawson South EIS GW Update	2023	KCB
Dawson South Extension Field Investigation Report	2023	Hydrogeologist.com.au

4.1.4 Dawson Mine Groundwater Monitoring Network

Table 4.2 summarises the groundwater monitoring network for Dawson South. Additional detail on available groundwater level data and groundwater quality data are provided in Table 4.3 and Table 4.4 respectively[1].

[1] Only monitoring bores and vibrating wire piezometers with available data are included in the table.

Table 4.2 Groundwater Monitoring Network

ID	Easting[1]	Northing[1]	Type[2]	Drilled Date	Hydrostratigraphic Unit	Groundwater Level Data Available?	Groundwater Quality Data Available?
BH1	199360	7249750	MB	2011	Permian Coal Measures	Yes	Yes
BH2	199192	7249616	MB	2011	Permian Interburden (assumed)	Yes	Yes
BH3	199670	7246721	MB	2011	Permian Coal Measures	Yes	Yes
GW1	200118	7252308	MB	2005	Permian Coal Measures	Yes	Yes
GW1A	200121	7252326	MB		Permian Coal Measures	Yes	Yes
GW2	199819	7259768	MB	2005	Permian Coal Measures	Yes	Yes
GW2A	199933	7251406	MB	2005	Permian Coal Measures	Yes	Yes
GW2B	199933	7251406	MB	2005		No	No
GW3	200817	7249737	MB			Yes	Yes
GW4	199909	7249574	MB	2005	Permian Coal Measures	Yes	Yes
GW4A	199919	7249690	MB	2005	Fault	Yes	Yes
DSMB05	199958	7242428	MB	2022	Alluvium	Yes	Yes
DSMB06	199743	7243192	MB	2022	Alluvium	Yes	Yes
DSMB07	199158	7244361	MB	2022	Alluvium	Yes	Yes
DSMB08	200776	7241911	MB	2021	Permian Coal Measures	Yes	Yes
DSMB10	201663	7241544	MB	2021	Permian Coal Measures	Yes	No
DSMB13	197538	7246445	MB	2022	Alluvium	Yes	Yes
DSMB14	197363	7248966	MB			No	No
DSMB15	199710	7245593	MB	2021	Permian Coal Measures	Yes	No
DSMB16	198609	7247568	MB			No	No
DSVWP01-1	199569	7245792	VWP		Permian Coal Measures	No	No
DSVWP01-2	199569	7245792	VWP		Permian Coal Measures	No	No
DSVWP01-3	199569	7245792	VWP		Permian Coal Measures	No	No
DSVWP02-1	200389	7243371	VWP	2021	Permian Coal Measures	No	No
DSVWP02-2	200389	7243371	VWP	2021	Permian Coal Measures	No	No
DSVWP02-3	200389	7243371	VWP	2021	Permian Coal Measures	No	No
DSVWP03-1	201020	7240526	VWP	2021	Permian Coal Measures	No	No
DSVWP03-2	201020	7240526	VWP	2021	Permian Coal Measures	No	No
DSVWP03-3	201020	7240526	VWP	2021	Permian Coal Measures	No	No
DSVWP05-1	199740	7243193	VWP	2021	Rewan Group	No	No
DSVWP05-2	199740	7243193	VWP	2021	Rewan Group	No	No
DSVWP05-3	199740	7243193	VWP	2021	Rewan Group	No	No
DSVWP11-1	199785	7253142	VWP	2021	Permian Coal Measures	No	No
DSVWP11-2	199785	7253142	VWP	2021	Permian Coal Measures	No	No
DSVWP11-3	199785	7253142	VWP	2021	Permian Coal Measures	No	No
28588	201239	7251989	MB			Yes	No
28589	201259	7251989	MB			No	No
28624	201230	7249876	MB			Yes	No
28627	201087	7249788	MB			Yes	No
28639	201186	7252065	MB			Yes	No

Notes:
1 = Easting and Northing coordinates have been compiled from various sources and are in AGD66, Zone 56
2 = MB: monitoring bore; VWP: vibrating wire piezometer
Blank cell = information not available

Table 4.3 Available Groundwater Level Data

ID	Number of Groundwater Level Measurements Available														
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 to 2021	2022
BH1										1	4	2			
BH2										4	4	2			
BH3										1	4	2			
GW1	4	10		7	4	5	5	5	4	5	3	2			
GW1A										2					
GW2	4	10		7	4	5	6	3							
GW2A									3	5	4	1			
GW3	4	10		4											
GW4	1	10		7	5	5	6	5	4	6	3	2			
GW4A									3	6	4				
DSMB05															1*
DSMB06															1*
DSMB07															1*
DSMB08															1*
DSMB10															1*
DSMB13															1*
DSMB15															1*
28588		1													
28624		1													
28627		1													
28639		1													

Notes:
* = Water level measured following airlift development

Table 4.4 Available Groundwater Quality Data

ID	Number of Groundwater Quality Measurements Available														
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 to 2021	2022
BH1											3	2	1	1 (2018)	
BH2											3	2	1		
BH3											3	2	1		
GW1		1		7	5	4	5	7	3	1					
GW1A						1					2	2			
GW2		1		7	5	5	6	5			1				
GW2A				7	5	5	6	6	3	2	2	1			
GW3		1		4							1				
GW4		1		7	5	5	5	7	3	2	3	2			
GW4A				4		5	6	6	3	2	3				
DSMB05															1
DSMB06															1
DSMB07															1
DSMB08															1
DSMB13															1

4.2 Data Analysis and Conceptualisation

Information compiled as part of the review of relevant data sets and previously completed assessments (Section 4.1) was analysed in detail to develop a conceptual understanding of the hydrogeological system. This included the key geology, groundwater flow and groundwater quality characteristics. The conceptualised groundwater regime is discussed in Section 5. The collated local groundwater dataset is considered fit for purpose for this Project and data that was used to develop the conceptual understanding included:

- Geological data collected from the proponent's current Geological Model (Vulcan). The Geological model was informed by data compiled by the geological logs collected from drilling across the Dawson Mining Leases, regional geological mapping and mapped structural geology.
- Groundwater level data collected from nineteen (19) bores screening the Permian Coal Measures and the Alluvium from within the Project area and its surrounds. Fifteen bores were used to monitor and record water levels in the Permian coal measures. This includes manual and automated logger groundwater level data from the Dawson groundwater monitoring bores and surrounding mine monitoring bores.
- Eight (8) Monitoring bores have been installed to monitor the shallower hydrostratigraphy (i.e. alluvium, Tertiary sediments, Tertiary basalt), however, groundwater was only recorded in four of these bores and has not been observed in these bores since installation.
- Hydraulic testing results collected from eight (8) rising/falling head tests conducted on eight Dawson South groundwater monitoring bores screened across the Alluvium and Permian Coal Measures.
- Groundwater quality data collected from 15 bores including detailed field measurements and laboratory results for key hydrostratigraphic units within and surrounding the Project area.

4.2.1 Geology

The geological setting has been compiled based on the following data sources:

- Geological logs and data compiled from drilling across the Project site, Dawson North, Central and Southern Mining leases;
- Geological data from registered bores within the vicinity of the project site held on DNRME's groundwater database;
- Publicly available geological mapping and reports; and
- Regional geological mapping included in the Bowen Basin Supermodel (Esterle et al. 2002). The geological setting forms the basis for the conceptual hydrogeological model described in Section 7 and provides the structural framework for developing a MODFLOW numerical groundwater model.

4.2.2 Groundwater Levels and Flow

Spatially distributed groundwater level data were used to characterise groundwater flow directions, gradients and velocities. The groundwater monitoring network at Dawson South includes 25 monitoring bores and 15 VWPs, screened or installed in four hydrostratigraphic units (Alluvium, Rewan, Permian Coal Measures, and a Fault Zone) at varying depths (Table 4.1, Table 4.2, and Figure 4.1). Inferred groundwater levels from these data is provided on Figure 4.2.

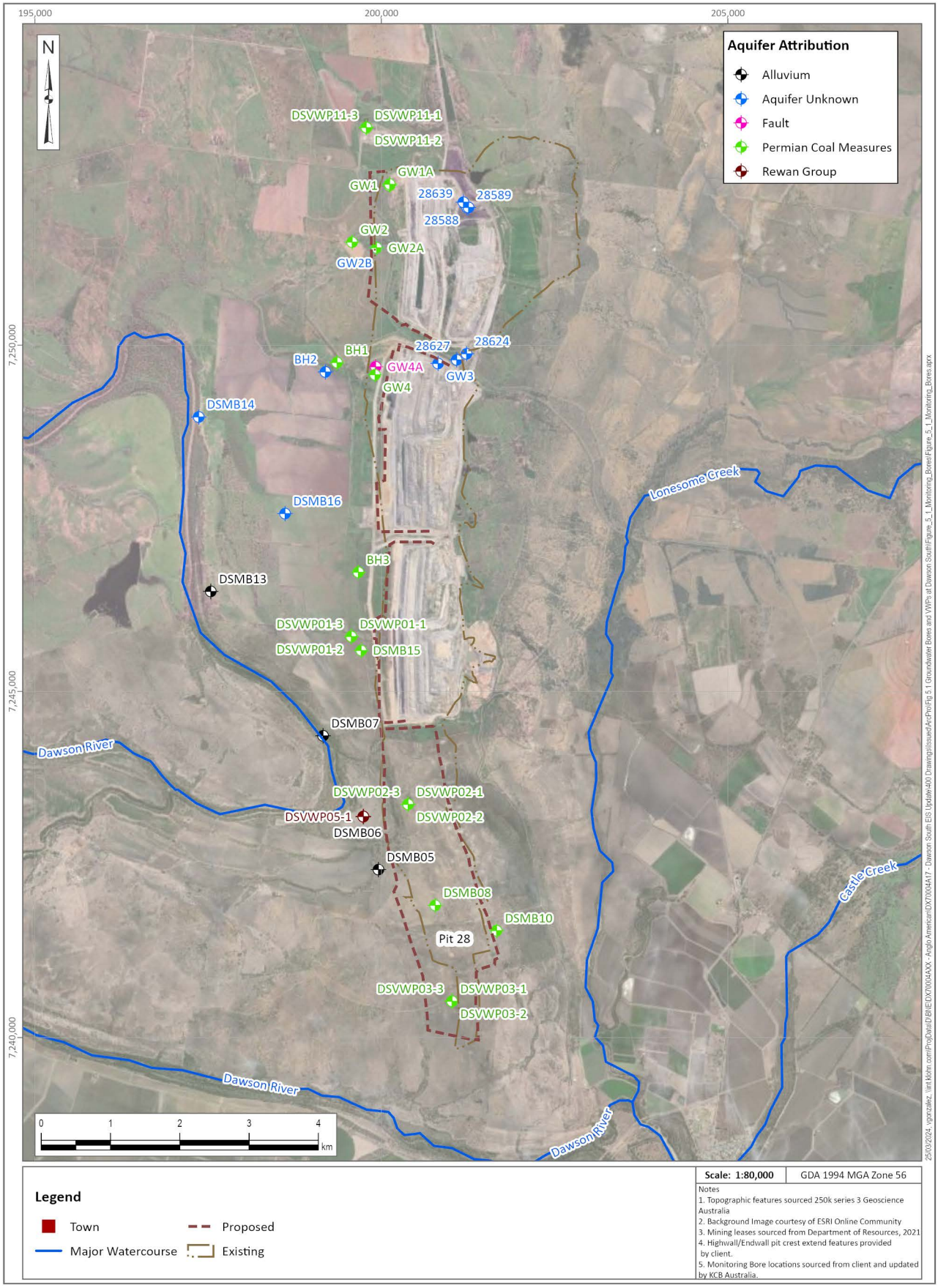

Figure 4.1 Dawson South Groundwater Monitoring Bore Network

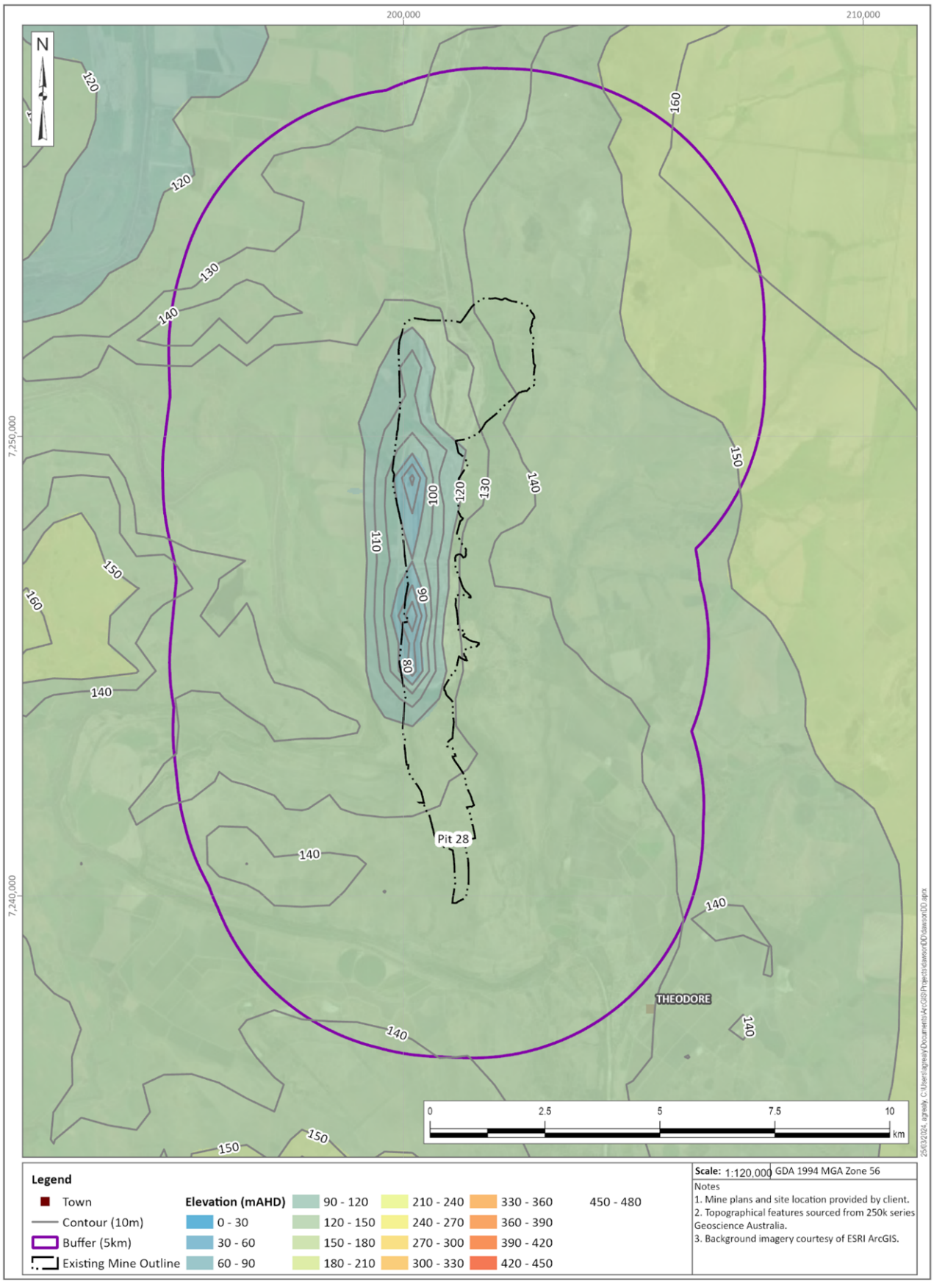

Figure 4.2 Dawson South Inferred Groundwater Levels

4.2.3 Groundwater Quality

Groundwater quality data provides useful information on the hydrogeological regime, as it is influenced by interaction with the aquifer matrix, and groundwater recharge/discharge processes.

Salinity is a key constraint to the usability of groundwater resources for productive applications such as potable supply, irrigation, stock watering and industrial applications. If groundwater with elevated salinity levels is used for incompatible purposes or applications it may result in impacts to agricultural productivity, health and the environment.

A categorisation scheme for salinity proposed by (FAO 2013) is presented in Table 4.5 and compared compiled results from laboratory analysis of groundwater samples collected from the current and historical Dawson groundwater monitoring bores. The dataset collected from these bores represents the most relevant and comprehensive, long-term record of groundwater quality within the vicinity of the Project. The groundwater monitoring bores on the Dawson Mine site indicate that the groundwater is moderately saline.

Table 4.5 Available Groundwater Quality Data

Salinity	Range (TDS md/L)	Groundwater salinity in Monitoring Bores (Average TDS (mg/L))
Fresh	<500	NIL
Brackish	500-1,500	
Moderately Saline	1,500-7,000	GW1, GW2, GW3, GW4, DSMB05, DSMB06, DSMB07, DSMB08, DSMB13
Saline	7,000-15,000	
Highly Saline	15,000-35,000	
Brine	>35,000	

4.3 Numerical Groundwater Modelling

A numerical groundwater model was developed from the conceptual groundwater regime and supported by the collated dataset. The numerical model was used to predict the effects of the Project on the groundwater regime during and post-mining. The modelling results were used to inform the assessment of the Project impacts on groundwater users and the surrounding environment, and the cumulative groundwater impacts of the Project. Numerical groundwater modelling was undertaken to represent the conceptual groundwater regime described in Section 6 and predict the effects of the Proposed Project activities on the groundwater regime (discussed in Section 8). A detailed description of the groundwater modelling methodology is provided in Appendix I.

5 EXISTING ENVIRONMENT

5.1 Topography and Drainage

The Dawson Mine Complex is located within the Dawson River Catchment (in the Fitzroy Basin), between the Dawson River to the west and the Malakoff Range (a prominent north south trending ridge) to the east. Westerly flowing creeks across the mine complex have been significantly altered by mining activities (AGE 2004).

Topography at the Dawson Mining Complex is generally flat to gently undulating, rising immediately east of the seam sub-crops with light brush and pasture covering the majority of the undisturbed watershed catchment. The Dawson Range (a northwest-southeast trending topographic high) is located to the west of Dawson River with elevations reaching 360 mAHD.

Topography and drainage across Dawson South are presented in Figure 5.1. Topography ranges from low-lying alluvial flood plains adjacent to the Dawson River, to undulating hills associated with the Malakoff Range. Kianga Creek, Castle Creek, and Lonesome Creek are located near the Project site, and all drain west into the Dawson River. Kianga Creek's course has been diverted due to mining activities further north of Dawson South (Figure 5.1).

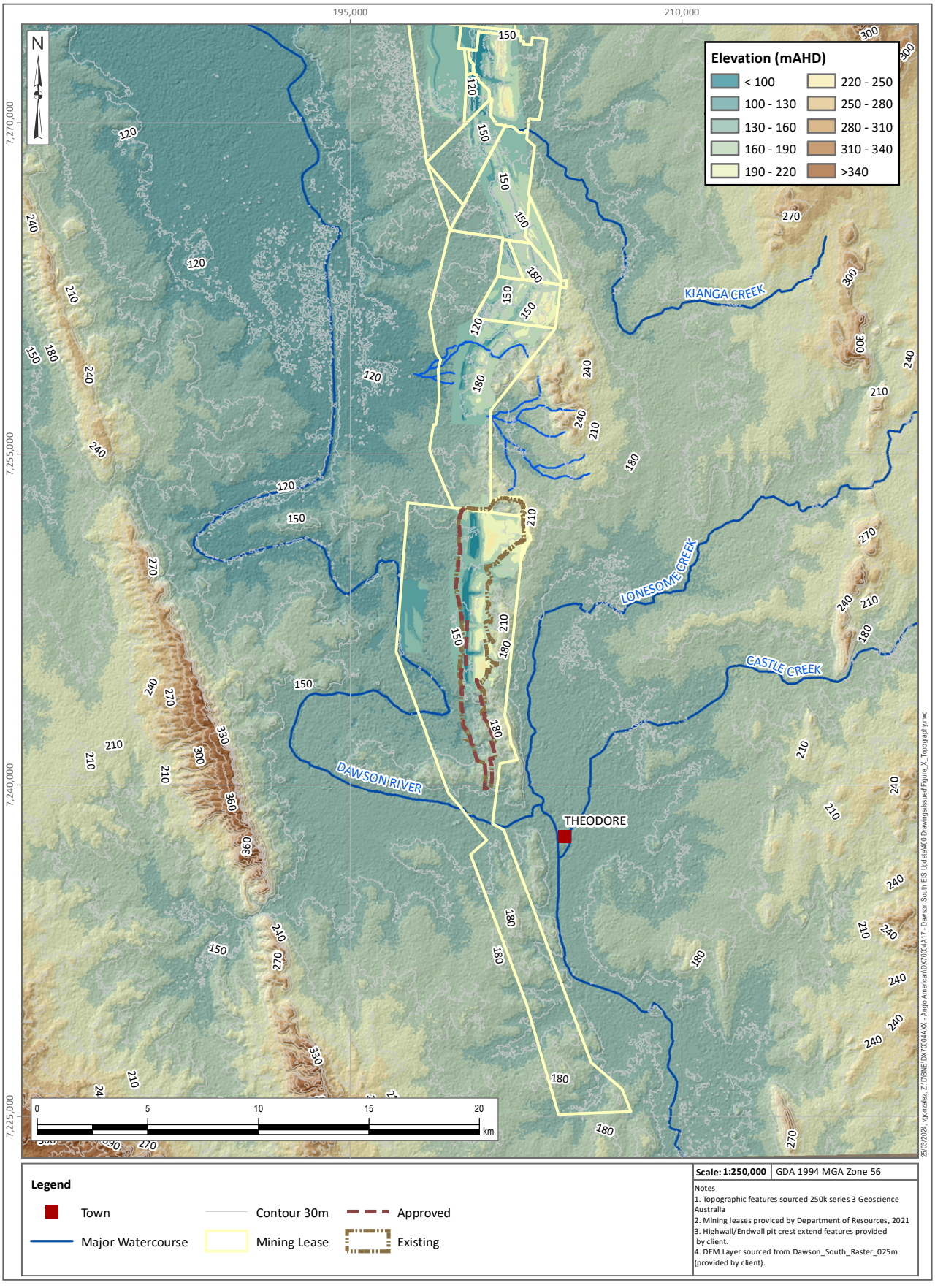

Figure 5.1 Regional Topography and Drainage at Dawson South

5.2 Climate

Dawson South mine is located in eastern Central Queensland which experiences a subtropical climate with moderately dry winters (modified Köppen classification system) (BOM. 2005). Climate summary statistics for the area including average annual rainfall and precipitation are presented in Table 5.1 rates are presented on Figure 5.2. Data from 1960 to present were analysed for this report.

Table 5.1 Climate Summary Statistics for Dawson South (SILO Grid lat, long: -24.85, 150.05), 1960 – 2024

Month	Mean Max. Temp	Mean Min. Temp	Mean Rainfall (mm)	Mean Evaporation (mm)
	1960-2024	*1960-2024*	*1960-2024*	*1960-2024*
January	33.8	20.6	85.1	231.1
February	33.4	20.6	90.4	187.8
March	31.9	18.6	54.9	187.8
April	29.3	14.7	34.6	146.0
May	25.6	10.7	33.9	109.0
June	22.6	7.5	28.1	84.3
July	22.3	6.0	28.0	92.2
August	24.3	7.1	23.8	123.0
September	27.7	10.7	28.9	164.4
October	30.5	14.6	61.0	206.2
November	32.1	17.5	75.4	219.3
December	33.4	19.5	87.6	237.1
Annual	-	-	**631.6**	**1988.3**

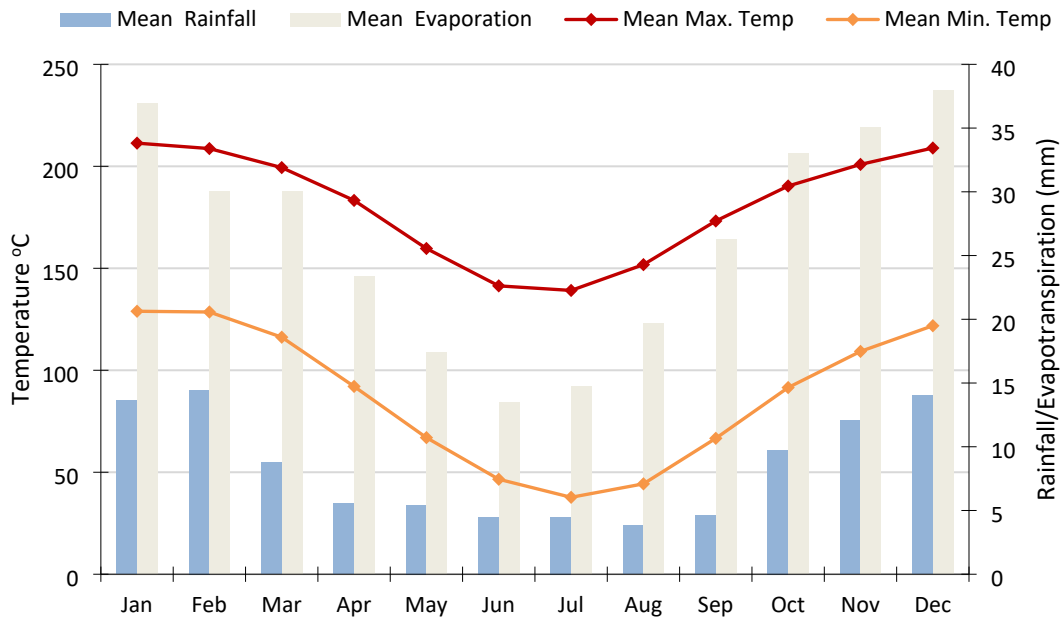

Figure 5.2 Average Monthly Climate at Dawson South (SILO Grid lat, long: -24.90, 150.03), 1960 – 2024

Maximum temperatures range between 33.8°C and 22.3°C during summer. Minimum temperatures range between 20.6°C and 6.0°C during winter. Daily evaporation rates are generally high and exceed rainfall throughout the year. Highest rainfall occurs December to February and lowest rainfall occurs April to September.

Synthetic rainfall data were used to analyse rainfall trends due to incomplete rainfall data for the Project area (State of Queensland 2024). SILO is an enhanced synthetic climate database that provides daily timeseries data for point locations and comprises observed weather station data augmented by interpolated estimates where observed data were absent.

Figure 5.3 presents daily rainfall between 1960 and 2024, alongside a cumulative rainfall departure (CRD) trend for the same period. CRD trends represent a running deviation of long-term actual rainfall against the overall average. This method provides season-scale identification of trends (wet / dry) and longer term (e.g., decadal) deviation from average conditions. CRDs are useful for correlating rainfall events with aquifer responses.

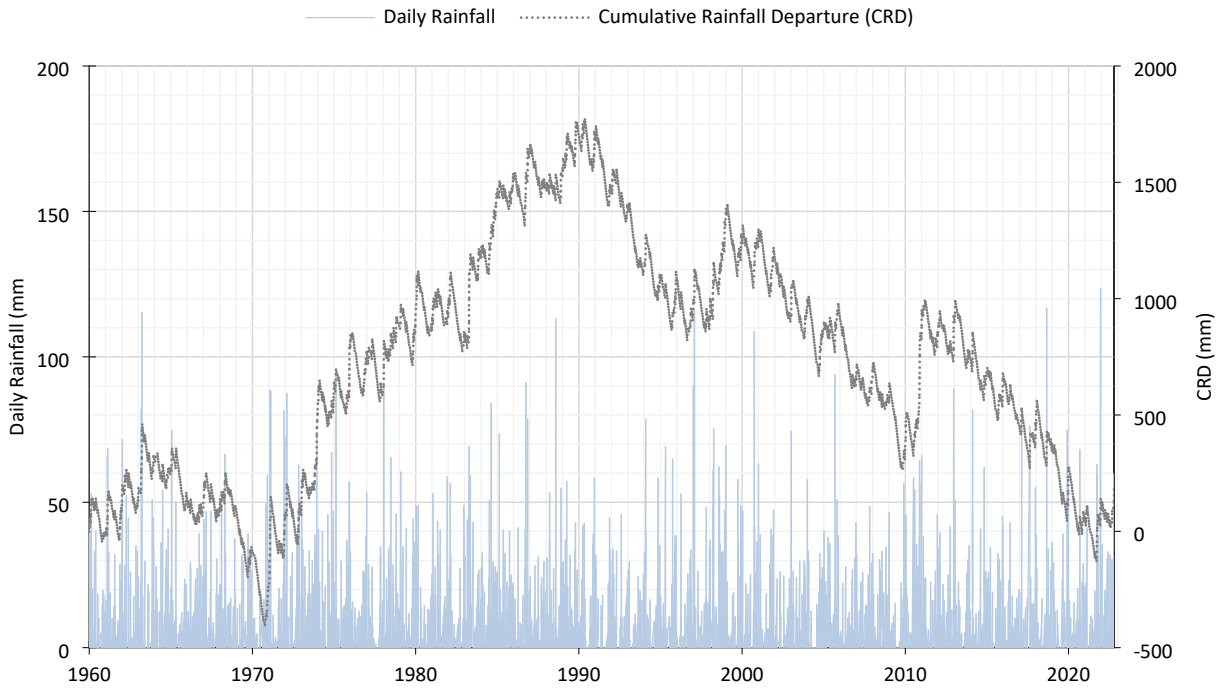

Figure 5.3 Historical Daily Rainfall and CRD Trend at Dawson South (SILO Grid lat, long: -24.90, 150.03), 1960 – 2024

Observations from the rainfall record and CRD trend include:

- The overall rainfall trend is characterised by wet / dry season cyclicity, with annual fluctuations of approximately 200 mm evident across the record.
- A period of increasing rainfall between 1971 and 1990 and an overall declining rainfall trend between ~2000 and 2024 (interrupted by the 2011 extreme wet season).
- High rainfall associated with the 2011 wet season is followed by a period of decline to below average rainfall conditions at present.